SEABROOK STATION

ENVIRONMENTAL REPORT

VOLUME III

PUBLIC SERVICE COMPANY OF
NEW HAMPSHIRE

SEABROOK STATION

Environmental Report
Construction Permit Stage

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK, NEW HAMPSHIRE

III

June 1973

ENVIRONMENTAL REPORT

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BOTANICAL SURVEY OF SEABROOK NUCLEAR PROJECT SITE

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June 9, 1972.

This survey was carried out between June 3 and June 8, 1972. During this time all or parts of three days were spent in studying the plants and types of vegetation in the field, taking notes on plant communities present and preparing the basic list. The remaining hours were spent as follows:

1. Correlation of vegetational types as observed in the field with patterns on the aerial photograph supplied for our use.
2. Preparation of a generalized vegetational map of the principal types of forest vegetation.
3. Preparation of as complete a list as possible of all native species of vascular plants observed in the area with emphasis on distributional features and abundance.

For purposes of convenience during the field survey and the preparation of the list, the extensive salt marsh areas were excluded. The M. S. thesis of George Vagenas (UNH, 1969) can be referred to in connection with the characteristics of the Seabrook salt marsh vegetation. Also the extensive dump area in sector 3 was avoided in the study as well as fields and farm land. In fact, only the native plants and relatively undisturbed types of vegetation are included in this report.

Except for the above-mentioned salt marsh study by Vagenas, there is no scientific work that relates directly to the native plants of the area included in this survey. The information submitted here all had to be obtained from current field work. The survey deals therefore essentially only with forested tracts within the circle that are marked on the accompanying map. After a brief reconaissance it was decided to subdivide this forested area into six sectors:

Sector 1: The area including "The Rocks."

Sector 2: The forested area between "The Rocks" and the railroad line and lying within the circle.

Sector 3: The cleared area embracing the dump and the wooded area west of the railroad, lying within the circle and south of Brown's River.

Sector 4: Hunt's Island at the extreme eastern edge of the area included in the study.

Sector 5: A tract of forest south of Hunt's Island Creek and separated from Sector 2 by Farm Brook and lying at the extreme southern edge of the area within the circle.

Sector 6: A tract of forest lying both east and west of the railroad north of Brown's River and unlike the other forested tracts lying in the township of Hampton Falls.

It was possible to make a rather thorough canvass of sectors 1, 4, 5 and 6 either because the areas are limited in size or because the vegetation is relatively homogeneous; sector 2 by contrast is more heterogeneous but does not lend itself easily to further subdivision of forest types. Sector 3 includes a great deal of disturbed land including the recently expanded dump, fields and openings gradually changing over to forest and considerable land still in field. For this reason less time was devoted to surveying sector 3 than any other although it was possible to note the principal species of trees in the area and their relative abundance.

It should be noted that the areas are not exactly and, in some instances, hardly at all correlated with forest types. In fact, on the enclosed vegetational map several characteristic types of vegetation may be found on one area as in sector 2.

In an area so affected by man and so recently grown up to forest from an earlier state of clearing, the vegetation is very diverse in character. No bit of forest quite matches any other even on the same type of topography.

Probably such ever-present differences can best be explained by accidents of migration during the colonizing of the area by the present forest. However there are some relatively distinct groupings of species that suggest strong ecological relationships and these we will now characterize. In general these can be recognized by the grain and depth of shading of the forested areas on the aerial photograph (1-400) taken on April 28, 1969 when the coniferous trees possessed their winter needles but before many of the hardwoods had burst into leaf. On the basis then of our field observations and the identification of certain forest communities on the ground followed by pinpointing the same areas on the photograph, it is possible to map the vegetation in a general way. Six major types of forest vegetation were recognized in the field survey, several of which are readily recognizable on the photograph and can therefore be satisfactorily marked on the accompanying map. We recognize the following forest communities:

1. Hardwood - (Red Cedar) (edge of marsh).
2. Upland Oak - Hickory (rocky woods often adjacent to marsh).
3. Swamp Hardwoods (in poorly drained hollows or flat woods).
4. Upland Hardwood - White Pine, Hemlock - Beech (old age forest in sites protected from coastal storms, salt spray and the like.
5. Hemlock ravine along intermittent brook in sector 2.
6. Old field pine with often temporary hardwood species such as poplars, birches and Red Maple.

Within the circle of our coverage there has been some fairly recent cutting resulting in the removal of some big White Pines in sector 5. In fact, White Pines would be a more important component of much of the hardwood-dominated forest if there had not been selective removal of them by cutting through the years. In all probability, however, White Pine was never dominant in areas immediately adjoining the salt marshes where oaks, hickories and a great variety of shrub species become very common.

We will now characterize the aforementioned forest communities in greater detail:

1. Hardwood - (Red Cedar)

   On ledges adjoining the salt marsh, Red and White Oaks, Shagbark and Pignut-Hickories, Red Maple, Red Cedar, Black Oak, Basswood, and Pitch Pine tend to be the most abundant trees while, on moister shores, Red Maple and oaks, including Swamp White Oak, become more common. Shrub species tend to be less specialized and several kinds of Shadbush occur widely on rocky or wetter marsh edges. Sassafras is abundant on some rocky shores and nearly absent from wet sites. Bayberry, Catbrier and Sumac are common as well as Poison Ivy. On moister shores we find an abundance of Arrow-wood, Smooth Alder, Shadbush and Chokeberry species.

2. Upland Oak - Hickory

   Areas dominated by Red, White and Black Oak and both Shagbark and Pignut Hickory with occasional Black Birch, Black Cherry and Red Maple. Catbrier, Huckleberry, species of Low Blueberry, Gray Dogwood, Poison Ivy, Chokeberry, Bayberry and Shadbush species are common.

3. Swamp Hardwoods

   Dominated by Red Maple and often with abundant Red and White Oak and occasional Tupelo. Shrubs present include Shadbush, Winterberry, Sweet Pepperbush, abundant Highbush Blueberry, occasional Maleberry and tangles of Catbrier. Herbaceous plants often include Cinnamon Fern, Hay-scented Fern, Lady-Fern and Shield Ferns often in great abundance.

4. Upland Hardwood - Evergreen

   This represents an older type of forest in an ecological sense having acquired both Hemlocks and Beech trees in addition to early arrivals such as White Pine, aspens and Gray and White Birches. The groundcover species often include an abundance of Starflower, Canada Mayflower, Partridge-berry and Wild Sarsaparilla with frequent Lady's-slipper orchids and Wild Cucumber-root.

5. Hemlock Ravine

   A very specialized vegetational type with Hemlocks abundant and White Pine common. Along the moist banks of the stream grow luxuriant Shield Ferns, False Hellebore and Jack-in-the-Pulpits.

6. Old Field Pine

   This type of forest has grown up recently on land formerly cleared for field or pasture. White Pine is the principal species but often intermixed with many broad-leaved species but rarely with either Beech or Hemlock. Shrub species are usually not very abundant except for those which persist from the pasture shrub stage. Thus Highbush Blueberry may be common as well as various other species that previously thrived when the area was open.

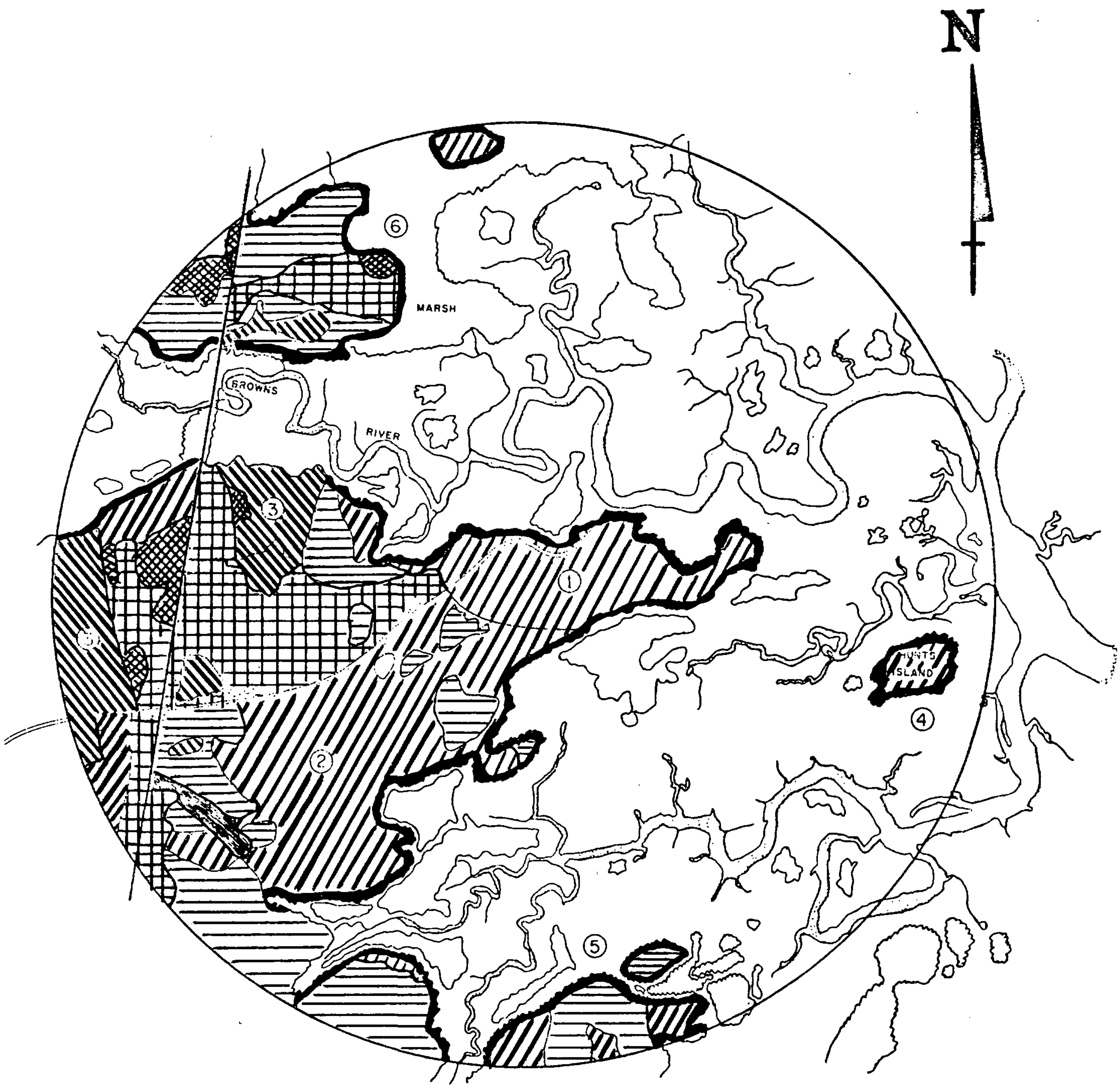
The indigenous flora of the area involved in our study is quite large and diverse. Certain highly salt-intolerant species such as Sugar Maple are absent but others such as Hemlocks are present in some quantity suggesting the possibility that other factors operate to exclude some fairly common species from this coastal area and also suggesting that salt at the present time may not be a limiting factor above the reaches of tides.

We found several rare species of vascular plants in the course of our work which had not hitherto been discovered in coastal New Hampshire. Indeed one such species with the scientific name Triosteum aurantiacum (Wild Coffee) grows on ledges at the southern side of "The Rocks." Our record of this of June 3, 1972 is the first for New Hampshire. In Maine there are three or four known widely separated localities for it. It is an unusual and rare wildflower in most of New England and should if possible be protected. On Hunt's Island we found a few plants of Early Meadow-rue (Thalictrum dioicum), a spring wildflower that becomes more common in the rich woods of western New England, of very restricted occurrence in eastern New England and, except for this record, absent from coastal areas. South of the dump in sector 2 there is a well developed Hemlock forest occupying a ravine containing a slowly flowing brook. Any considerable deposit of sodium chloride would without doubt destroy this stand as well as the big Hemlocks in sector 5. The Clubmosses, Lady's-slippers and Jack-in-the-pulpits of these older growth forests would disappear with much salt pollution.

Because of our very extensive field coverage of the area, the list of vascular plants is certainly complete for the spring and early summer season. However other species without doubt will appear during summer and early fall that are not obvious at present. These would not be dominant species and would probably be in such groups as Carex (sedge), the grass family, fall -asters and goldenrods. Diligent field work in late summer and fall might add 25 or more species but would not affect the list much from the standpoint of overall forest composition and occurrence of interesting rare species.

BOTANICAL COMMUNITIES

SEABROOK NUCLEAR PROJECT SITE



Key To Types of Vegetation

- Hardwood (Red Cedar)
- Upland Oak Hickory
- Swamp Hardwoods
- Upland Hardwood-Evergreen
- Hemlock Ravine
- Old Field Pine
- Fields, Disturbed Areas

REPORT ON THE LATE SUMMER FLORISTIC SURVEY OF THE SEABROOK SITE*

This is a continuation of the survey begun in mid-June of 1972 and involving the same area. New species which we have recorded recently have been added to the previous list so that the accompanying compilation submitted at this time should supersede the earlier one. A total of 106 new species of native plants has been added. Again all species recorded are native in the region and all introduced foreign weeds have been excluded. Also all strictly salt-marsh plants have been omitted.

It was expected that the June list would be incomplete and, as anticipated most of the species reported here as new were not evident in late spring. Visits to some new places yielded some new species not seen before. There is little likelihood, however, that future visits to the area would disclose many new plants since the area has now been thoroughly canvassed with many separate visits and most habitats explored at least twice. This, then, is for all practical purposes a complete list of the native vascular plants of the area. The number of new species is surprisingly large. We had thought that, by mid-summer, there might be at least 50 kinds which were not recognizable in mid-June but were hardly prepared for 106. It does show the wisdom in continuing the survey through the summer.

From the standpoint of protecting interesting species, the following information is supplied. [redacted]

*This August survey was carried out between the dates of August 14 and 18, 1972

[redacted]

The plants at this season are a bit nondescript, somewhat resembling Milkweed plants with large, opposite leaves. It is of further interest that there are three other unusual species near the Wild Coffee, namely a Bush-Clover (Lespedeza), Venus's Looking-Glass (Specularia) and Wild Licorice (Galium circaezans). Any herbicide that may have been used along the telephone line right-of-way presumably has not injured these herbaceous plants. The control here of trees and shrubs is perhaps advantageous to the continuation of these rare plants.

Most of the interesting species that we have noted are on islands, headlands and in the "hemlock ravine." Hopefully special attention will be given to the preservation of these areas.

The work has proved stimulating, the area being a fairly rich and diverse one. It is particularly gratifying to know that the Public Service Company of New Hampshire has shown interest in taking the plants of the area into consideration in its planning thus far.

Sincerely,

Albion R. Hodgdon

Albion R. Hodgdon

TREES

SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
		SECTORS				
Pinus rigida	Pitch Pine		r	o	o	
Pinus Strobus	White Pine	o	c	o	o	o
Tsuga canadensis	Hemlock		c		o	
Juniperus virginiana	Red Cedar	c		c	c	c
Populus grandidentata	Large-toothed Aspen	r				o
Populus tremuloides	Quaking Aspen	r	o	o	o	o
Carya cordiformis	Bitternut Hickory	r				
Carya glabra	Pignut Hickory	c	o	r	r	
Carya ovata	Shagbark Hickory	a	a	a	o	c
Ostrya virginiana	Hop Hornbeam		r			
Betula lenta	Black Birch	c	c		a	o
Betula papyrifera	White Birch	o	o			o
Betula populifolia	Gray Birch	c	c	o	o	o
Fagus grandifolia	Beech	r	o		c	
Quercus alba	White Oak	c	c	c	c	c
Quercus bicolor	Swamp White Oak	o	o			o
Quercus rubra	Red Oak	a	a	a	a	c
Quercus velutina	Black Oak	c	c	o	o	c
Celtis occidentalis	Hackberry			r		
Ulmus americana	Elm	r	o	r		
Sassafras albidum	Sassafras	o	o	o	c	
Prunus pensylvanica	Pin Cherry	o	o	o	o	o
Prunus serotina	Black Cherry	o	o	o	o	a
Acer rubrum	Red Maple	a	a		a	a
Tilia americana	Basswood	o	o	o	o	
Nyssa sylvatica	Tupelo	o	o		o	o

KEY TO RELATIVE ABUNDANCE

a = abundant

c = common

o = occasional

r = rare

SHRUBS		SECTORS				
SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Smilax rotundifolia	Catbrier	a	a	c	a	a
Salix Bebbiana	Long-beaked Willow		r			r
Salix discolor	Pussy-Willow		r	r		o
Salix humilis	Gray-Willow		r			
Salix rigida	Willow					r
Myrica pensylvanica	Bayberry	c	c	c	c	c
Comptonia peregrina	Sweet Fern		o			c
Alnus rugosa	Speckled Alder					o
Alnus serrulata	Smooth Alder	o	o			o
Corylus cornuta	Beaked Hazelnut	r	r			o
Ribes hirtellum	Smooth Currant	r		r		
Hamamelis virginiana	Witch-hazel	o	o		c	
Amelanchier arborea	Shadbush	c	c		c	
Amelanchier canadensis	Shadbush	c	c	c	c	c
Amelanchier laevis	Shadbush					c
Anelanchier stolonifera	Shadbush	c	c	c		c
Crataegus chrysocarpa	Hawthorn				r	
Prunus maritima	Beach-Plum				o	
Prunus nigra	Canada Plum		r			
Prunus virginiana	Chokecherry	c	c	c		
Pyrus floribunda	Purple Chokeberry	c	c	c	c	o
Pyrus melanocarpa	Black Chokeberry	c	c	c	c	c
Rosa carolina	Pasture Rose			r		
Rosa palustrus	Marsh Rose				r	
Rosa virginiana	Common Wild Rose	c	c	c	c	c
Spiraea latifolia	Meadowsweet	c	c	c	c	c
Rhus copallina	Dwarf Sumac		o		o	o
Rhus typhina	Staghorn Sumac	c	c	c		c
Toxicodendron radicans	Poison Ivy	a	a	a	a	a
Toxicodendron vernix	Poison Sumac		r			
Ilex laevigata	Smooth Winterberry	r	o			o
Ilex verticillata	Winterberry	c		c	c	o
Celastrus scandens	Bittersweet	r		o		
Vitis labrusca	Fox-Grape	o	o			o

S H R U B S

S E C T O R S

SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Vitis riparia	River-bank-Grape			o		
Parthenocissus inserta	Woodbine	c	c	c	c	c
Cornus racemosa	Gray Dogwood		o	o	r	
Clethra alnifolia	Sweet Pepperbush	o	c		c	o
Gaylussacia baccata	Black Huckleberry	a	a	c	c	o
Kalmia angustifolia	Sheep Laurel	o	o		o	c
Lyonia ligustrina	Maleberry				r	o
Vaccinium angustifolium var. laevifolium	Lowbush Blueberry	c	c	a	c	c
Vaccinium corymbosum	Highbush Blueberry	c	c	c	c	c
Vaccinium vacillans	Low Blueberry	a	a	c	c	o
Cephalanthus occidentalis	Buttonbush		o			
Diervilla Lonicera	Bush Honeysuckle		o	o	o	
Viburnum acerifolium	Maple-leaved Viburnum		o			
Viburnum cassinoides	Witherod		o		r	o
Viburnum recognitum	Arrow-wood	c	c	c	c	c
Sambucus canadensis	Black Elderberry	r	o	r		r

HERBACEOUS PLANTS

SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
		SECTORS				
Equisetum arvense	Horsetail	r	o			o
Equisetum sylvaticum	Wood-Horsetail		o			
Lycopodium clavatum	Running Clubmoss		o			
Lycopodium complanatum var. flabelliforme	Clubmoss		o			
Lycopodium obscurum	Clubmoss		o			o
Botrychium virginianum	Grape-Fern		r			
Osmunda cinnamomea	Cinnamon Fern	o	c	o	c	a
Osmunda Claytoniana	Interrupted Fern	r				o
Osmunda regalis	Royal Fern		o			o
Athyrium filix-femina	Lady-Fern		o			c
Dennstaedtia punctilobula	Hay-scented Fern		o		o	c
Dryopteris cristata and hybrids	Crested Shield-Fern		r			o
Dryopteris marginalis	Marginal Shield-Fern		o			
Dryopteris spinulosa	Shield-Fern		o			
Dryopteris spinulosa var. intermedia	Shield-Fern		o			o
Onoclea sensibilis	Sensitive Fern	o				o
Polypodium virginianum	Rock Fern	r				
Polystichum acrostichoides	Christmas Fern		r			
Pteridium aquilinum var. latiusculum	Bracken	o		o	o	o
Thelypteris noveboracensis	New York Fern		o			o
Thelypteris palustris	Marsh Fern	o	c	o	o	o
Thelypteris polypodioides	Long Beech-Fern		o			
Typha angustifolia	Cat-tail	o				
Typha latifolia	Cat-tail		o			
Andropogon scoparius	Broom-sedge		c	r		o
Agrostis scabra	Hairgrass	o				o
Calamagrostis canadensis	Bluejoint Grass		c	c	c	
Deschampsia flexuosa	Hairgrass	o	c	c	c	
Elymus virginicus	Wild Rye	c		c	c	
Festuca rubra	Fescue-Grass			c		
Glyceria melicaria	Manna-Grass		c			
Glyceria striata	Manna-Grass			o		

HERBACEOUS PLANTS		SECTORS				
SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Hierochloe odorata	Sweet Grass			o		
Muhlenbergia mexicana	Grass			r		
Muhlenbergia sp.	Grass	o				
Panicum clandestinum	Panic Grass					o
Panicum depauperatum var. psilophyllum	Panic Grass					o
Panicum lanuginosum var. implicatum	Panic Grass				o	o
Panicum virgatum	Switch-Grass	o	o	c	c	c
Spartina pectinata	Fresh-Water Cord-Grass				c	o
Torreyochloa Fernaldii	Manna-Grass	r				
Bulbostylis capillaris	Sedge					c
Carex annectens	Sedge			r		
Carex communis	Sedge		o			
Carex crinita	Sedge		o			
Carex debilis	Sedge		c	o		o
Carex Emmonsii	Sedge		o			o
Carex lurida	Sedge		o			o
Carex normalis	Sedge		r			
Carex pallescens	Sedge	r				
Carex pensylvanica	Sedge	c	c	c		c
Carex scabrata	Sedge		r			
Carex scoparia	Sedge		c			o
Carex spicata	Sedge	r				
Carex stipata	Sedge		o			
Carex Swanii	Sedge	o	c			c
Carex tribuloides	Sedge	o				
Carex vestita	Sedge	o	r	r		r
Cyperus filiculmis	Sedge		r			c
Cyperus strigosus	Sedge					r
Eleocharis tenuis	Sedge					c
Scirpus atrovirens var. Georgianus	Sedge	o	o			o
Scirpus cyperinus	Wool-Sedge					r
Scirpus pedicellatus	Wool-Sedge					r

HERBACEOUS PLANTS		SECTORS				
SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Rhynchospora capitellata	Beak-Rush					o
Acorus Calamus	Sweetflag		r			
Arisaema Stewardsonii	Jack-in-the-Pulpit		o			
Arisaema triphyllum	Jack-in-the-Pulpit		o			
Symplocarpus foetidus	Skunk-cabbage		o			
Juncus articulatus	Rush		r			o
Juncus brevicaudatus	Rush					o
Juncus bufonius	Toad-Rush	o	o			
Juncus effusus	Soft-Rush		o	r		o
Juncus Greenei	Rush		c			
Juncus marginatus	Rush		o			
Juncus tenüis	Rush	c				c
Luzula multiflora	Wood-Rush	o				o
Lilium philadelphicum	Wood-Lily		r	r		r
Maianthemum canadense	Canada Mayflower	c	c	o	c	a
Medeola virginica	Wild Cucumber-root	o	c		o	r
Polygonatum pubescens	Solomon's-seal		r			
Smilacina racemosa	False Solomon's-seal		o	o		
Smilacina stellata	False Solomon's-seal	o	o	c		o
Smilax herbacea	Carrion-Flower	o	o	r	o	o
Uvularia sessilifolia	Bellwort	o	o		o	o
Veratrum viride	False Hellebore		o			
Iris versicolor	Blue Flag	o				o
Sisyrinchium montanum	Blue-eyed Grass	o				
Cypripedium acaule	Pink Lady's-slipper		o	o	o	o
Pilea pumila	Richweed	o	o			
Urtica gracilis	Nettle	r				
Commandra umbellata	Bastard-toadflax	o	o	o	o	
Polygonum arifolium	Halberd-leaved Tearthumb		r			
Polygonum Hydropiper	Water-pepper	o				
Polygonum sagittatum	Arrowleaf-Tearthumb	r				
Polygonum scandens	Climbing False Buckwheat			r		
Phytolacca americana	Pokeweed	r				
Arenaria lateriflora	Arenaria	o	c	c	o	o
Silene antirrhina	Sleepy Catchfly	r				

HERBACEOUS PLANTS		SECTORS				
SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Anemone cylindrica	Thimbleweed			O		
Anemone quinquefolia	Wood-anemone	O	O	C	C	O
Aquilegia canadensis	Columbine	O				
Clematis virginiana	Virgin's Bower					O
Coptis groenlandica	Gold-thread					O
Ranunculus abortivus	Early Buttercup	O	O	O		
Thalictrum dioicum	Early Meadow-rue			r		
Thalictrum polygamum	Meadow-rue	O	O			O
Arabis sp.	Rock-Cress			r		
Chrysoplenium americanum	Water-mat		C			
Agrimonia gryposepala	Agrimonia	r				O
Fragaria virginiana	Wild Strawberry	O	O	O	O	O
Geum canadense	Canadian Avens	r				
Potentilla canadensis	Cinquefoil	O	C			O
Potentilla simplex	Cinquefoil	r	O			C
Rubus allegheniensis	High Blackberry	O	O		O	O
Rubus Enslenii	Dewberry	O	O	O		
Rubus flagellaris	Dewberry	C	C			C
Rubus hispidus	Trailing Blackberry	O	O		O	a
Rubus idaeus			~~O~~	~~O~~	~~O~~	
var. strigosus	Raspberry		O	O	O	
Rubus occidentalis	Black Raspberry	O	O			
Rubus pubescens	Dwarf Raspberry		r			
Rubus recurvicaulis	Blackberry	C		O		O
Sanguisorba canadensis	Burnet	O			C	C
Amphicarpa bracteata	Hog-peanut		O			
Apios americana	Ground-nut	O	a			a
Desmodium canadense	Tick-trefoil	r				O
Lespedeza intermedia	Bush-Clover	r				
Oxalis stricta	Wood-Sorrel	O				O
Geranium maculatum	Wild Geranium	O	O	O		O
Polygala sanguinea	Milkwort	r				O
Impatiens capensis	Jewel-weed	O	C			O
Hypericum canadense	St. John's-wort		O			O
Hypericum ellipticum	St. John's-wort		O			

H E R B A C E O U S   P L A N T S

SCIENTIFIC NAME	COMMON NAME	SECTORS 1	2	4	5	6
Hypericum gentianoides	Orange-Grass					c
Hypericum punctatum	St. John's-wort		r			
Hypericum virginicum	Marsh-St. John's-wort					o
Helianthemum Bicknellii	Frostweed		o			
Helianthemum canadense	Frostweed	o				o
Lechea intermedia	Pinweed	o				o
Viola cucullata	Blue Violet		o			
Viola lanceolata	Narrow-leaved White Violet					o
Viola pallens	Common White Violet		o			
Viola papilionacea	Blue Violet	o				o
Viola primulifolia	White Violet		r			
Viola septentrionalis	Blue Violet	r				
Lythrum Hyssopifolia	Loosestrife	r				
Epilobium glandulosum var. adenocaulon	Willow-herb	o	o	r		
Oenothera biennis	Evening-Primrose	o		r		o
Aralia hispida	Bristly Sarsaparilla	o			o	o
Aralia nudicaulis	Wild Sarsaparilla	o	c	o	c	c
Panax trifolius	Dwarf Ginseng	r				
Hydrocotyle americana	Water-Pennywort	r	c			o
Sanicula marilandica	Black Snakeroot		r			
Cornus canadensis	Bunchberry		o		o	o
Monotropa uniflora	Indian-pipe		o		o	r
Pyrola rotundifolia	Shin-leaf					o
Epigaea repens	Trailing Arbutus		r			
Gaultheria procumbens	Checkerberry		o		o	o
Lysimachia lanceolata	Loosestrife					o
Lysimachia quadrifolia	Loosestrife	c	c	o	c	c
Lysimachia terrestris	Loosestrife					
Trientalis borealis	Star-flower	c	o		c	c
Apocynum androsimaefolium	Dogbane		o	r	r	o
Asclepias syriaca	Milkweed	o	o			o
Cuscuta Gronovii	Dodder	o	c	c	c	
Convolvulus sepium	Wild Morning-glory	c	c	c	c	c

HERBACEOUS PLANTS

SCIENTIFIC NAME	COMMON NAME	SECTORS 1	2	4	5	6
Verbena hastata	Blue Vervain	r				o
Verbena urticaefolia	Vervain	o	o			o
Lycopus americanus	Bugle-weed	r				o
Lycopus uniflorus	Bugle-weed	o	c			c
Lycopus virginicus	Bugle-weed	r				
Mentha arvensis	Mint		o			
Prunella vulgaris	Heal-all	o				
Scutellaria lateriflora	Mad-dog Skullcap		c			
Teucrium canadense	American Germander	c	o	c	c	o
Trichostema dichotomum	Bluecurls	r				a
Chelone glabra	Turtle-head	r	o			
Gerardia tenuifolia	Gerardia					r
Gratiola neglecta	Hedge-hyssop	o				
Linaria canadensis	Old-field-Toadflax	o	o	o		
Melampyrum lineare	Cow-wheat		c			
Plantago Rugelii	Plantain	r				c
Galium aparine	Cleavers	r				
Galium circaezans	Wild Licorice	r				
Galium Claytoni	Bedstraw	o				
Galium triflorum	Sweet-scented Bedstraw		o			
Houstonia caerulea	Bluet	o				o
Mitchella repens	Partridgeberry		o		o	
Triosteum aurantiacum	Wild Coffee	r		r		
Lobelia inflata	Indian-tobacco		o			o
Specularia perfoliata	Venus's Looking-glass	r				
Ambrosia artemisiifolia	Ragweed	o	o	o	o	c
Antennaria plantaginifolia	Ladies'-tobacco	o	o			
Aster acuminatus	Boreal Fall Aster					c
Aster cordifolius	Heart-leaved Aster	o	o		o	o
Aster divaricatus	Aster		o			
Aster dumosus	Aster		r			
Aster ericoides	Aster					o
Aster foliaceous	Aster	o	o			o
Aster lateriflorus	Aster	c	a			
Aster linariifolius	Narrow-leaved Aster					c

H E R B A C E O U S	P L A N T S	S E C T O R S				
SCIENTIFIC NAME	COMMON NAME	1	2	4	5	6
Aster macrophyllus	Big-leaved Aster	o	o	o		
Aster novi-belgii	New York Aster	o	o			c
Aster puniceus	Aster		r			
Aster umbellatus	Willow-leaved Aster	c	c		o	
Aster vimineus	Aster		o			o
Erechtites hieracifolia	Fireweed	o		o	c	a
Erigeron annuus	Daisy-Fleabane					o
Erigeron canadensis	Horse-weed	r				o
Erigeron strigosus	Fleabane					o
Eupatorium dubium	Joe-Pye-weed	r	o			o
Eupatorium fistulosum	Joe-Pye-weed		o			
Eupatorium perfoliatum	Thoroughwort		r			o
Helianthus divaricatus	Sunflower	r				
Lactuca canadensis	Wild Lettuce	r				c
Prenanthes altissima	Rattlesnake-root		r			
Prenanthes trifoliolata	Gall-of-the-earth	o	c			o
Senecio aureus	Golden Ragwort		r			
Solidago X asperula (hybrid)	Goldenrod			r		
Solidago bicolor	White Goldenrod	c	c	o		
Solidago canadensis	Goldenrod	o	o			o
Solidago gigantea	Goldenrod	o				o
Solidago graminifolia	Goldenrod	o	o			o
Solidago juncea	Goldenrod	c	c	o		o
Solidago nemoralis	Goldenrod		o			o
Solidago puberula	Goldenrod		o			
Solidago rugosa	Goldenrod	o	o	c	o	o
Solidago ulmifolia	Goldenrod		r			
Xanthium sp.	Cocklebur			r		

APPENDIX B

APPENDIX B

A Survey of the Mammals of the Proposed Nuclear Project Site, Seabrook, New Hampshire

Edward N. Francq
(University of New Hampshire)
6 June 1972

From May 23 until June 3, 1972, an inventory was prepared of the mammals of the proposed nuclear site in Seabrook, New Hampshire. Information on the occurrence of species and their relative abundance was collected in four ways: 1) observation, 2) trapping, 3) interviews, and 4) by surveying the literature.

METHODS

Several species were observed directly. Others were identified through various signs noted during field surveys. These signs included animal remains, tracks, dens and nests, and scats (droppings). Small species of mammals were collected by use of Sherman Live traps and by snap traps. Generally 30 traps were set at ten or twenty foot intervals in a particular habitat. They were baited with peanut butter and/or bird seed and left for a three night period. Traps were checked and rebaited each day. These traps are suitable only for mice and similarly sized mammals and are not sufficient size to collect game or furbearers.

Eight sites were selected for trapping and the locations of the trap lines were indicated by number on a large scale photograph of the area for reference. A brief description of each site follows:

Site 1. The margin of Spartina salt marsh and the adjacent brush.

Site 2. A mixed stand of maple and oak with other scattered hard woods, sparce undergrowth including Smilax greenbrier.

Site 3. Along an old stone wall on south margin of power line clearing. Vegetation mostly grasses but mixed hardwoods and some conifers on opposite side of stone wall.

Site 4. Moist area of beech, maple, and scattered hemlock. Relatively little undergrowth.

Site 5. Along stream bank of mixed hardwoods and scattered conifers. A nearby culvert carries water underneath railroad tracks from an open area beyond.

Site 6. Area of mixed brush and small hardwoods adjacent to railroad tracks to the west and Spartina marsh grass to the east. Considerable open water to the north.

Site 7. A pure two species stand of clover and grass, clearly sown for hay. Surrounded by mixed hardwoods and brush.

Site 8. Stand of mixed white pine and scattered hemlock. Little brush but scattered rotting logs. Ground mostly covered with pine needles and therefore little herbaceous undergrowth.

Four residents of Rock Road, the main access into the area, were interviewed. These people, one of whom is in general charge of the Seabrook dump, have been residents of the immediate area for most of their 60 or more years and therefore have special knowledge of some of the larger and more conspicuous species of mammals present. In addition, several people who frequently came to the area to dig for clams, or to shoot rats or woodchucks were spoken with briefly concerning their knowledge of mammals of the area.

The available literature dealing with mammals of the general region was surveyed, and the accompanying bibliography compiled. There has been no general survey of mammals dealing solely with the coastal area near

Seabrook and therefore works of larger scope have been listed with brief comments. These tend to be out of date in many cases and are of value primarily in revealing what mammals might be expected to be in the area through virtue of Seabrook being within the broad area of the species' distribution. This allows a judgement of the occurrence and numbers present of a species based on experience.

Species Accounts

The common and scientific names are given for each species dealt with, along with an idea of the certainty of occurrence, the relative abundance and other pertinent information. The letters following the abundance indicate the occurrence of the species in the areas dealt with in the literature listed in the bibliography. The following system is used: G-Goodwin (1935), B-Cronan and Brooks (1962), J-Jackson (1922), M-Manville (1942), and C-Carpenter and Siegler (no date).

North American Opossum (Didelphis virginiana) Probable, scarce. G,B
Opossums have been slowly establishing themselves in New Hampshire in recent years. I collected one in Hampton in 1968.

Masked Shrew (Sorex cinereus) Probable, scarce. G,B,M,C
Numerous around Durham and might be expected around grassy areas, stone walls and less frequently the woods of the Seabrook area.

Smoky Shrew (Sorex fumeus) Possible, scarce. G,B,C
More in wooded areas than previous species and usually less abundant.

Short-tailed Shrew (Blarina brevicauda) Certain, abundant. G,B,M,C
One of our most common mammals, found in a variety of habitats. Three were trapped at site No. 7.

Star-nosed Mole (Condylura cristata) Certain, infrequent. G,B.M,C
Reported by residents. Frequents moister areas.

Little Brown Bat (Myotis lucifugus) Certain, common. G,B,M,C
Our most common bat, widely occurring throughout the state.

Big Brown Bat (Eptesicus fuscus) Certain, common. G,B,C
Our second most common bat, widely distributed.

Keen's Bat (Myotis keenii) Possible, scarce. G,B,C

Indian Bat (Myotis sodalis) Possible, scarce. G,B,C

Small-footed bat (Myotis subulatus) Possible, scarce. G,B,M

Silver-haired bat (Lasinonycteris noctivagans) Possible, scarce. G,B,M,C

Eastern Pipistrelle (Pipistrellus subflavus) Possible, scarce. G,B,C

Red bat (Lasiurus borealis) Possible, scarce. G,B,M,C

Hoary Bat (Lasiurus cinereus) Possible, scarce. G,B,C
These bats may occur sporadically or in migration. The Myotis bats sometimes occur in mixed colonies. None of the last seven species occur in large numbers in our area.

New England Cottontail (Sylvilagus transitionalis) Certain, common. G,B,J,C
I saw one and those interviewed had seen many.

Eastern chipmunk (Tamias striatus) Certain, common. G,B,J,M,C
Commonly seen.

Woodchuck (Marmota monax) Certain, common. G,B,J,M,C
Commonly seen by residents. I saw several probable burrows, particularly near open areas.

Gray Squirrel (Sciurus carolinensis) Certain, common. G,B,J,M,C
I saw several squirrels, several nests, and residents commonly see them.

Red Squirrel (Tamiascirurus hudsonius) Certain, common. G,B,J,M,C
Commonly reported, many tracks seen along streams, numerous nests.

Southern Flying Squirrel (Glaucomys volans) Probable, common. G,B,J,C

Northern Flying Squirrel (Glaucomys sabrinus) Probable , common. G,B,J,M,C
Seabrook is within the range for both flying squirrels. They are seldom observed but the residents have seen them in years past, in one case when a dead tree was cut down. Both species have been taken in Durham.

Beaver (Castor canadensis) Unlikely, scarce. G,B,J,M,C
While Seabrook is well within the range of the beaver, I saw no sign which is usually conspicuous, and the residents had no knowledge of them. It is possible that beaver occasionally pass through the area.

White-footed Mouse (Peromyscus leucopus) Certain, abundant. G,B,C
Probably our most common wild mammal. Nine of these were trapped at trapping sites 2,3,6, and 8. These are usually associated with hardwood forests and sometimes enter buildings especially in winter.

Red-backed Vole (Clethrionomys gapperi) Probable, infrequent. G,B,M,C
None of these were trapped but diggings in the pine-hemlock woods suggest their presence. They are not uncommon in our area in conifer woods but don't usually occur in great abundance.

Meadow Vole (Microtus pennsylvanicus) Certain, abundance varies. G,B,M,C
These mice undergo fluctuations in population densities and vary over periods of three to four years from being scarce to abundant. They are restricted to grassy areas and although none were trapped, runway systems and grass clippings indicate their presence.

Pine Vole (Microtus pinetorum) Probable, uncommon. G,B,C
Pine voles usually occur in semi-open woodlands but reach their highest densities in orchards. None were collected but their almost entirely subterranean habitats makes it unlikely to catch them with the methods used.

Muskrat (Ondatra zibethicus) Certain, common. G,B,M,C
Well known by residents, tracks were seen, and the habitat is suitable to support a high number.

Black Rat (Rattus rattus) Possible, uncommon. G,B,C
None have been collected from this area but they sometimes occur near human habitation, particularly along the coasts.

Norway Rat (Rattus norvegicus) Certain, abundant. G,B,M,C
Abundant throughout the area, particularly around dumps such as the one at Seabrook.

House Mouse (Mus musculus) Certain, abundant. G,B,M,C
Found in almost every farm building and many houses, particularly where food is not properly stored. Commonly found in coastal areas and around dumps. None were taken in this survey.

Meadow Jumping Mouse (Zapus hudsonius) Certain, abundant. G,B,M,C
Five of these were trapped at sites 5 and 6. The open woodland, and grass woodland edges provide favorable habitat.

Porcupine (Erethizon dorsatum) Possible, scarce. G,B,J,M,C
No evidence of these was seen and the residents did not know of their occurrence. Since porcupines are common in wooded parts of the state generally, they are listed here as possible.

Red Fox (Vulpes fulva) Certain, abundant, G,B,J,M,C
Several old dens possibly used by foxes were seen, and one active den was located. Several scats were found, and one pup eviscerated, probably by a dog or another fox was found. Residents often see red fox.

Gray Fox (Urocyon cinereoargenteus) Possible, scarce. G,B,C
While not uncommon further inland, it prefers more heavily wooded areas than the red fox. No definite records from the site are known.

Raccoon (Procyon lotor) Certain, abundant. G,B,J,M,C
Often seen by residents, and known to be common around dumps and in habitats afforded by the area.

Fisher (Martes pennanti) Possible, scarce. G,B,J,M,C
Certainly absent from southern New Hampshire for many years but recent records in Rockingham County make it possible that occasionally fisher may occur in the area. Usually, however, they prefer more heavily wooded areas than the nuclear site affords.

Short-tailed Weasel (Mustela erminea) Certain, common. G,B,J,M,C
Common through the area generally, though no direct evidence was found in this inventory.

Long-tailed Weasel (Mustela frenata) Probable, common. G,B,J,M,C
Although not usually as abundant as the short-tailed weasel, it is commonly found in the area generally.

Mink (Mustela vison) Certain, common. G,B,J,M,C
Well known by residents. Listed as common along the coastal regions by Carpenter and Siegler.

Striped Skunk (Mephitis mephitis) Certain, common. G,B,J,M,C
Well known by residents. Common in the area and numerous around dumps.

River Otter (Lutra canadensis) Possible, scarce. G,B,J,M,C
Known by residents and listed as uncommon through waterways of New Hampshire by Carpenter and Siegler. Likely they occur some years and not others.

Bobcat (Lynx rufus) Possible, scarce. G,B,J,M,C
Common through most of wooded New Hampshire inland according to Carpenter and Siegler. Occasionally there may be an occurrence in the Seabrook area.

Harbor Seal (Phoca vitulina) Certain (off the coast), common. G,B,J,M,C
Harbor seals probably do not get into the area proper, but are common particularly during winter off the adjacent coast.

White-tailed Deer (Odocoileus virginiana) Certain, common. G,B,J,M,C
Tracks were seen and deer are well known to the residents. Large bits of fur were found near the fox den probably resulting from carrion feeding.

Whales, porposises and seals.
A number of whales, porpoises and seals other than the harbor seal mentioned above, move along the coast of New Hampshire. These are included in the accompanying list of the "Mammals of New Hampshire".

BIBLIOGRAPHY OF WORKS DEALING WITH MAMMALS
IN AND AROUND THE SEA COAST AREA
of
NEW HAMPSHIRE

CARPENTER, R.G. AND H.R. SEIGLER. no date. A list of New Hampshire Mammals and their distribution. New Hampshire Fish and Game Dept. Concord. A very sketchy account and in need of revision and expansion.

COULTER, M.W. and C.E. Faulkner 1958. Common Small Mammals of Maine: their life histories and control. Me. Ext. Serv. Bull. 475, 40 pp. (Not generally available.)

CRONAN, J.M. and A. Brooks 1962. The Mammals of Rhode Island. Wildlife pamphlet, Vol. 6. Rhode Island Department of Agriculture and Conservation 133 pp. A general account of Rhode Island mammals.

FRANCQ, E.N. 1969. Key to land mammals of New Hampshire. University of New Hampshire Bookstore. 19 pp. mimeographed. Only for identification of mammals occurring throughout New Hampshire.

GOODWIN, G.G. 1935. The mammals of Connecticut. State Geological and Natural History Survey Bull. 53. Hartford. 221 pp. Out of print.

GRAYCE, R.L. 1957. Check List of New England mammals. Bull. Mass Aud. Soc. (Not generally available).

HAMILTON, W.J., Jr. 1953. The mammals of eastern United States. Comstock Publ. Co. Ithaca, New York 432 pp. A general account of descriptions and distributions.

JACKSON, C.F. 1922. Notes on New Hampshire mammals. Jour. Mamm. 3:13-15. A very sketchy and out of date account. Excludes the Old World rodents, jumping mice, bats, shrews and moles.

MANVILLE, R.H. 1942. Notes on the mammals of Mount Desert Island, Maine Jour. Mamm., 23:391-398. Probably the most detailed account dealing with a coastal area in Northern New England.

PETERSON, R.L. 1966. The mammals of Eastern Canada. Oxford Press, N.Y. 465 pp. A general account of descriptions and distributions.

SILVER, H. 1957. A history of New Hampshire game and furbearers. Survey Rept. No. 6. New Hampshire Fish and Game Dept. Concord. 466 pp. A very interesting account dealing with certain species throughout the state.

Mammals of New Hampshire

I. Order Marsupiala
- A. Fam: Didelphidae
  1. Didelphis virginiana - N. American opossum

II. Order Insectivora
- A. Fam: Soricidae
  1. Sorex cinereus - Masked shrew
  2. Sorex palustris - Water shrew
  3. Sorex fumeus - Smoky shrew
  4. Sorex dispar - Long-tailed shrew
  5. Microsorex hoyi - Pigmy shrew
  6. Blarina brevicauda - Short-tailed shrew
- B. Fam: Talpidae
  1. Parascalops breweri - Hairy-tailed mole
  2. Condylura cristata - Star-nosed mole

III. Order Chiroptera
- A. Fam: Vespertilionidae
  1. Myotis lucifugus - Little Brown Myotis
  2. Myotis keenii - Keen's Myotis
  3. Myotis sodalis - Indiana Myotis
  4. Myotis subulatus - Small-footed Myotis
  5. Lasionycteris noctivagans - Silver-haired Bat
  6. Pipistrellus subflavus - Eastern Pipistrelle
  7. Eptesicus fuscus - Big Brown Bat
  8. Lasiurus borealis - Red Bat
  9. Lasiurus cinereus - Hoary Bat

IV. Order Lagomorpha
- A. Fam: Leporidae
  1. Sylvilagus transitionalis - New England Cottontail
  2. Lepus americanus - Snowshoe Rabbit

V. Order Rodentia
- A. Fam: Sciuridae
  1. Tamias striatus - Eastern Chipmunk
  2. Marmota monax - Woodchuck
  3. Sciurus carolinensis - Gray squirrel
  4. Tamiasciurus hudsonicus - Red squirrel
  5. Glaucomys volans- Southern Flying Squirrel
  6. " sabrinus - Northern Flying Squirrel
- B. Fam: Castoridae
  1. Castor canadensis - Beaver

C. Fam: Cricetidae

1. Peromyscus maniculatus - Deer Mouse
2. " leucopus - White-footed Mouse
3. Clethrionomys gapperi - Red-backed Vole
4. Microtus pennsylvanicus - Meadow Vole
5. " chrotorrhinus - Rock Vole
6. " (Pitymys) pinetorum - Pine Vole
7. Ondatra zibethicus - Muskrat
8. Synaptomys cooperi - Southern Bog Lemming
9. " borealis - Northern Bog Lemming

D. Fam: Muridae

1. Rattus rattus - Black Rat
2. Rattus norvegicus - Norway Rat
3. Mus musculus - House Mouse

E. Fam: Zapodidae

1. Zapus hudsonius - Meadow Jumping Mouse
2. Napaeozapus insignis - Woodland Jumping Mouse

F. Fam. Erethizontidae

1. Erethizon dorsatum - Porcupine

VI. Order Cetacea

A. Fam: Ziphiidae - beaked whales

1. Mesoplodon densirostris - Atlantic Beaked Whale
2. " mirus - True's Beaked Whale
3. Hyperodon ampullatus - Bottle-nosed Whale

B. Fam: Physeteridae - Sperm Whale

1. Physeter catodon - Sperm Whale

C. Fam: Kogiidae

1. Kogia breviceps - Pygmy Sperm Whale

D. Fam: Monodontidae

1. Delphinapterus leucas - White Whale

E. Fam: Delphinidae

1. Stenella styx - Gray's porpoise
2. Lagenorhyncus acutus - Atlantic White-sided Dolphin
3. Grampus orca - Atlantic Killer Whale
4. Globicephala melaena - Atlantic Blackfish
5. Phocoena phocoena - Atlantic Harbor Porpoise

F. Fam: Balaenopteridae

1. Balaenoptera physalis - Fin-backed Whale
2. " borealis - Sei Whale
3. " acutorostrata - Little Piked Whale
4. Sibbaldus musculus - Blue Whale
5. Megaptera novaeangliae - Hump-backed Whale

G. Fam: Balaenidae
   1. Eubalaena glacialis - Atlantic Right Whale

VII. Order Carnivora
   A. Fam: Canidae
      1. Canis latrans - Coyote
      2. Vulpes fulva - Red Fox
      3. Urocyon cinereoargenteus - Gray Fox
   B. Fam: Ursidae
      1. Ursus americanus - Black Bear
   C. Fam: Procyonidae
      1. Procyon lotor - Raccoon
   D. Fam: Mustelidae
      1. Martes americana - Marten
      2. Martes pennanti - Fisher
      3. Mustela erminea - Ermine
      4. " frenata - Long-tailed weasel
      5. " vison - Mink
      6. Gulo luscus - Wolverine
      7. Mephitis mephitis - Striped Skunk
      8. Lutra canadensis - River Otter
   E. Fam: Felidae
      1. Lynx canadensis - Lynx
      2. " rufus - Bobcat

VIII. Order Pinnipedia
   A. Fam: Phocidae - Earless Seals
      1. Phoca vitulina - Harbor Seal
      2. Phoca groenlandica - Harp Seal
      3. Halichoerus grypus - Gray Seal
      4. Cystophora cristata - Hooded Seal

IX. Order Artiodactyla
   A. Fam: Cervidae
      1. Alces americana - Moose
      2. Odocoileus virginiana - White-tailed Deer

RESUME

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Western Hills High School, Cincinnati, Ohio; Diploma, June 1952.
University of Maryland, College Park; B.S. (General Biology), June 1956.
University of Idaho, Moscow; M.S. (Zoology), June 1962.
Thesis: An ecologic study of the mammals of the Palouse Range, Idaho.
The Pennsylvania State University, University Park; 1962-65, Ph.D. (Zoology), March 1967.
Thesis: Feigned death in the opossum, Didelphis marsupialis.

Military Service: September 1956 - December 1959. Major duties: Air Intelligence Officer in Air Anti-submarine Squadron. Released from active duty with rank of Lieutenant (junior grade). Have maintained reserve affiliation and currently hold rank of Commander.

Pertinent Employment Experience:

Laboratory Assistant, USDA Plant Industry Station, Beltsville, Maryland. Part time while in school, 1954-55.
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Principle Research Interests:

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Courses Assisted in as Graduate Student:

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Courses Taught Since Being at University of New Hampshire:

Animal behavior, mammalogy, general ecology, human anatomy and physiology, seminars and special problems in ecology, animal behavior, and vertebrate zoology.

Professional Societies:

Animal Behavior Society, American Society of Mammalogists, AAAS, Phi Sigma, Sigma Xi, American Museum of Natural History

Graduate Research Under My Direction (all Ph.D. work in Zoology)

Pawling, R. S. Some aspects of the preparation for hibernation in the woodland jumping mouse, _Napaeozapus insignis_. Ph.D. 1970.

Yelle, R. T. Comparative ecology and behavioral interactions of _Peromyscus maniculatus_ and _P. leucopus_ in New Hampshire. Research completed and thesis preparation in progress.

Hubbard, D. H. Predator-prey interactions between the shrew, _Blarina brevicauda_ and the vole, _Microtus pennsylvanicus_. Research nearly completed.

Bibliography:

Larrison, E. J. and E. N. Francq, 1961. The mice, rats, miscellaneous rodents and rabbits of Idaho. J. Idaho Acad. Sci. 2:26-64.

Larrison, E. J. and E. N. Francq, 1962. The insectivorous and carnivorous mammals of Idaho. J. Idaho Acad. Sci. 3:13-65.

Larrison, E. J. and E. N. Francq, 1962. Field guide to the birds of Washington State. Seattle Audobon Society. 220 p.

Francq, E. N. 1967. Feigned death in the opossum, Didelphis marsupialis. Ph.D. Dissertation, The Pennsylvania State University. Diss. Abstr. 28:6.

Francq, E. N. 1968. Review of "The adaptable black bear" by J. R. Matson. Quart. Rev. Biol. 43:471.

Francq, E. N. 1969. Behavioral aspects of feigned death in the opossum, Didelphis marsupialis. Amer. Midland Nat. 81:556-568.

Francq, E. N. 1969. Key to land mammals of New Hampshire. Univ. N. H. Bookstore. 19 p. (Mimeographed).

Francq, E. N. 1970. Electrocardiograms of the opossum, Didelphis marsupialis during feigned death. J. Mammal. 51:395.

References:

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APPENDIX C

APPENDIX C

Inventory of Birds of Seabrook - Hampton Falls Nuclear Power Plant Site

by Professor Roger W. Lawrence

The literature of the birds of the New Hampshire Coastal area provides records of the observations of birds and the seasonal frequency of the species associated with the site of the proposed nuclear power plant. Studies of the specific region of the site have not previously been made, most studies being for a more extended area. This survey will be directed to the birds on the site.

From the literature, the records of birds listed as occurring in Seabrook and Hampton Falls have been singled out. The numbers and date of occurrence of each report has been entered in block form on a graph for each species. The dates have been grouped for convenience in groups of three (eg., the first, second, and third of a month in one block) and the numbers have been grouped into five classes (less then 5; 5 to 24, 25 to 99; 100 to 499; 500 or over). Therefore, the block graph is not directly arithmetic but exponential. From the literature relatively few observations credited to the two towns of study have been published in the last decade. Many other observations taken in Seabrook or Hampton Falls have not been graphed on the report since they were listed in the literature grouped with other coastal towns and therefore could not be separated. Obviously, the records of the past decade are not representative of the true picture of birds in the two towns and consequently at the site. A more extensive search of the literature for the records or birds of the entire group of coastal towns (Seabrook, Hampton Falls, Hampton, North Hampton, Rye, and New Castle) provided a broader set of records. From these more extensive records it was necessary to interpret the meaningful portions which pertain to the site. The interpretation, in the author's judgement, represents the most likely of birds at the site. This is based on ten years of personal field work on the N.H. coast, discussions with other birdwatchers, and partial corroboration by a brief period of field work on the site itself. The author's interpretation of the most possible maximum numbers and the dates at which these occur has been graphed over the blocks of known occurrences by a line. Under unusual conditions the actual numbers may exceed those graphed, but under normal conditions the numbers will be smaller rising only at times to the maxima. At no time would all species be at their greatest numbers so that the total number of birds at the site would be less then the graphs might indicate. It is of importance, however, that at some time these birds will be present as indicated and it is these periods that are important in evaluating the impact of any change in the environment.

From the field studies a list of birds found to occur at the site has been drawn up. The period of the study unfortunately, comes shortly after the spring migrations and before the breeding and nesting season when most passerine birds will be singing. The brevity of the study has been complemented by some previous field experience in the site area by the author and on the coastal area in similar habitats. During the study period in the field from May 23 to June 7, 1972, a total of forty-two species were noted at the site. Twenty-six species were found in the wooded area, and twenty-one species found in the marsh. Several species were found in both habitats. A list of the species is included with the highest number seen on any one date along with the evaluated status of each species to the site. Further work would probably reveal some of the more elusive residents.

The area of the proposed plant site is not different in its content of birds from similar sites or habitats along the N.H. coast. There are no unusual species which are located only in this area, no colonies or large numbers of nesting birds. There are periods during the year when large numbers of migratory birds occur in the area or when large numbers of winter visitants may be present, but this is similar to the remainder of the N.H. coastal region. In general, it may be stated that this area is not of unusual importance for its avifauna. It should be noted, however, that the Seabrook area of the marsh is the most frequent location for unusual visitants as the Little Blue Heron and the Yellow Crowned Night Heron, many of which are seen in the proximal marsh or on the marsh of the area of the proposed site. Such birds would be displaced by alterations to this habitat.

The nesting birds of the wooded portion of the site are not in great numbers. During the study, some common species were notably absent from this area in which they could be normally expected. The most prominent nesting birds are the grackles which range in the wooded areas all along the coast in similar numbers. The Redwinged Blackbird which was seen on the marsh and in the small cattail swamp is an abundant bird of this entire region. Similarly, the Refous-Sided Towhee and Yellowthroats occupy many other similar habitats in fairly high numbers and their displacement would not be dramatic.

A study of the list of birds of the site reveals no species whose displacement from this area would seriously impair the status of the species. As with all encroachments on any natural habitat, there is a loss of territory for some species. This is true with less studied encroachments by private enterprises and will also occur in this proposed alteration of the environment. With all considerations of the bird life, it is the author's opinion that given the necessity for establishing the plant in this location, the trauma produced will not dislocate or extirpate any great numbers of birds or any important species.

Relative Abundance Of Birds In The Seabrook-Hampton Falls Area In The Proposed Nuclear Plant Site (From Lawrence, 1972).

The following terms are used to indicate abundance:

ABUNDANT - in large numbers in the particular habitat
(C) COMMON - not in large numbers, but always to be seen
(M) MODERATELY COMMON - in small numbers or not always seen
(U) UNCOMMON - very small numbers, easily missed by experienced observer
(R) RARE - likely of regular occurrence in suitable habitat, but always a surprise even to an experienced observer in any one year
(CA) CASUAL - out of normal range, occurring only every few years
(A) ACCIDENTAL - far from normal range, not to be expected.

Loons and Grebes - COMMON migrants in fall and spring and MODERATELY COMMON resident in winter. Mostly confined to the ocean but RARE on the marsh in bad weather, so generally not present at site.

Cormorants - COMMON TO MODERATELY COMMON on the coast at all seasons. The Greater Cormorant is found in winter and the Double-crested Cormorant in summer with both species found for a short period in fall and spring during migration. Occurs uncommonly in the marsh in the large pools but generally distant from the site.

Herons, Ibises, and Egrets - MODERATELY COMMON in the marsh during spring, summer and fall. The Green Heron and Black-crowned Herons are RESIDENTS during summer and some indications were found of the meeting of both species in the study site. Great Blue Herons feed on the nearby marsh but are not believed to nest on or near the site. Other herons occur casually or rarely. Glossy Ibises are of accidental occurrence. Snowy Egrets are common and feed on the marsh in the site area. Common Egrets are RARE but may occur in the site area.

Geese and Ducks - COMMON during spring at fall during migration and in winter. Canada Geese and most ducks feed in the area of the marsh and are to be found in the site area in small numbers. Black Ducks become ABUNDANT during the winter in the marsh and can be expected in large numbers also at the study site. Geese and other species of ducks are found only in small numbers at migratory seasons. Infrequently, during periods of harsh weather, ocean ducks such as Scoters, Old Squaws and Eiders may be forced onto the marsh for short periods, but are not of regular occurrence even when abundant on the ocean.

Hawks and Eagles - UNCOMMON fall and spring migrants. The coastal area does not seem to be a main pathway for the buteonine hawks, but the falcons and accipters occur over the marsh and woods during migration and MODERATELY COMMON. No evidence of any nesting in the study site.

Grouse and Pheasants - RARE to CASUAL probably in the study site in some years, since grouse have been observed in the woods within several miles of the site in late summer. No evidence of pheasant but may occur in their local movements.

Rails - No evidence of their occurrence in the site area or even in the two townships about the site. However, the marsh is of a suitable nature for them to be RARE migrants.

Shorebirds - ABUNDANT during the fall and spring migration in the marsh pools. A few species MODERATELY COMMON in winter and summer.

Most shorebirds feed in the Hampton-Seabrook Estuary on the sand flats and in the pools, the largest number found at low tide nearer the ocean. During high tides the shorebirds are forced to withdraw to the pools away from the ocean onto the marsh when they may be found in large numbers at the appropriate season. Killdeers were the only species found on the site with possible nesting, based on their territorial behavior. It is quite likely that several pairs nest yearly in the site area.

Gallinules and Coot - No evidence of these birds in the past decade on the study site, but they are RARE spring and fall migrants and summer residents in nearby areas of the marsh and on small ponds.

Gulls and Terns - Gulls are ABUNDANT throughout the year on the areas of and near the study site. They are drawn to this region by the nearby waste disposal plant. Herring Gulls rest on the marsh on the site. On May 29, 1972, six hundred gulls were resting on the marsh with about a hundred more feeding at the waste disposal plant. It can be expected that in winter when food is less plentiful that the number of gulls at the site area increases. There is no evidence of nesting and it is not likely to occur. Terns are MODERATELY COMMON during the summer flying over the marsh and setting on the marsh grass hummocks about the pools. Some possibly nest but only an occasional part. No colony exists on the marsh close to the site. Some small colonies are found several miles away. A few species of non-resident gulls and terns occur RARELY during migration individually or in very small groups.

Pigeons and Doves - No evidence of their occurrence in this area, but they may RARELY pass through the area in extremely small numbers.

Cuckoos - Both species are RARE in spring, summer, and fall in all of the coastal region. Since they have been recorded in Seabrook and Hampton Falls, they can be expected in the woods of the site but no evidence of any has been noted in this study.

Owls - RARE occurrence in this region at all times of the year. In migration very few may pass through the wooded area. During years of Snowy Owl invasions this species may be found regularly but in small numbers on the marsh and in the vicinity of the site. However, it has never been recorded at the site.

Goatsuckers - The Whip-poor-will is an UNCOMMON summer resident in the site woods. The Common Nighthawk is a RARE migrant over the coastal marshes in spring and uncommon in the fall.

Swifts - An UNCOMMON to RARE migrant over the site. No resident population.

Hummingbirds - At least a MODERATELY COMMON to UNCOMMON spring migrant. Its presence in late May could indicate a migrant, but it possibly could nest in small numbers in the woods.

Kingfisher - A MODERATELY COMMON summer resident and RARE to CASUAL winter resident in the nearby marsh. Not observed during the study so likely not nesting nearby or on the site where it may feed rarely.

Woodpeckers - RARE to UNCOMMON summer resident at the site and nearby woods. The Yellow-shafted Flicker is the most likely resident with fewer Downy and Hairy Woodpeckers. During migration some Yellow-bellied Sapsuckers are to be expected in the woods.

Flycatchers - COMMON summer residents and COMMON spring and fall migrants. Includes several species in the woods and some on the marsh feeding on insects.

Larks - The Horned Lark is an UNCOMMON year-round resident on the marsh but in migration may become COMMON. It undoubtedly occurs on the marsh within the site boundary but due to its very active habit does not remain constantly. At the site it can be considered UNCOMMON.

Swallows - ABUNDANT to COMMON during spring and fall migration over the entire marsh including the site. COMMON in summer feeding on the marsh but no evidence that they are residents.

Jays and Crows - The Blue Jay is a COMMON summer resident and an ABUNDANT spring and fall migrant at the site. The Common Crow is a COMMON to MODERATELY COMMON year-round resident, feeding daily on the marsh.

Chickadees and Titmouse - No evidence of the occurrence of the Titmouse at any season, but a possible erratic during the winter at the site. Chickadees are uncommon summer residents in the woods of the site.

Nuthatches - No evidence of any resident birds. Very likely MODERATELY COMMON to UNCOMMON migrants.

Creepers - The Brown Creeper is a MODERATELY COMMON summer resident and migrant in the wooded area of the site.

Wrens - Several species are COMMON spring to UNCOMMON fall migrants at the site. The marsh area of the site and surrounding nearby region is not of the habitat to support a population of Marsh Wrens. Probably House Wrens are summer residents in some years, since it is found in nearby residential shrubby areas.

Mimids - The Catbird and Brown Thrasher are both COMMON summer residents at the site. Also the two species especially the Catbird are probably COMMON migrants in spring and fall. The Mockingbird occurs in the site towns but is not recorded from the site.

Thrushes - COMMON spring and fall migrants. Robins are MODERATELY COMMON residents in the woods, feeding at the edge in the marsh.

Kinglets - UNCOMMON spring and fall migrants in all wooded areas of the coast.

Gnatcatchers - The Blue-gray Gnatcatcher is a RARE spring and fall migrant in coastal area. It very likely occurs in the site woods during those periods.

Pipits - The American Pipit is a RARE migrant in spring and fall on the marsh and probably occurs on the site.

Waxwings - RARE at the site and surrounding areas, but probably UNCOMMON in the spring migration.

Shrikes - Both species RARE. The Northern Shrike occurs in winter, the Loggerhead Shrike spring and fall.

Starling - ABUNDANT permanent resident on the marshes with large concentrations in winter roosts in Seabrook. Found feeding on the marsh daily in small to large flocks. 25,000 or more of this species observed in one day on the coast.

Vireos - COMMON to MODERATELY COMMON migrant and summer residents. The Red-eyed Vireo is a COMMON summer resident at the site woods and the Solitary Vireo may in some years be a site summer resident. Several other species, Philadelphia and Warbling are only migrants.

Warblers - COMMON to MODERATELY COMMON summer residents, and COMMON migrant in coastal woodlands. The site has all the qualities for the passage of migrants. One observer has noted warbler migrants flying to the site region in the presence of an easterly wind. The migrants include more than twenty five species in loose flocks up to several hundred individuals. The summer residents are of five species, of which the Yellowthroat is the most common. A few pairs of Black and White, Ovenbird, Redstart, and Nashville Warblers are also found in the site woods.

House Sparrow - Generally ABSENT from the site and marsh. May be present erratically in local dispersals.

Bobolink - An UNCOMMON spring and fall migrant. The marsh is unsuitable for nesting sites at this point.

Meadowlarks - UNCOMMON migrant and RARE to CASUAL winter resident on the marsh. Not likely to be present on site or nearby.

Blackbirds - ABUNDANT spring and fall migrants occurring in flocks of thousands of birds, mostly COMMON Grackle. COMMON summer resident in the woods. Both the Common Grackle and Redwinged Blackbird nest on the site and feed during summer on the marsh.

Orioles - MODERATELY COMMON migrant and summer resident on the site. At least one pair of Baltimore Orioles nesting in woods.

Tanagers - No evidence of any residents on the site. An UNCOMMON to RARE migrant.

Grosbeaks - The Rose-breasted Grosbeak is an UNCOMMON migrant with no evidence of any residents. Evening Grosbeaks varying yearly from RARE to COMMON but not of regular occurrence at any season or year.

Buntings - No evidence of any occurrence at the site, but probably an UNCOMMON migrant.

Finches - Only the American Goldfinch is of regular occurrence at the site being COMMON in migration and a MODERATELY COMMON resident. The Redpolls and Pine Siskin are not recorded in this site but as in other parts of the coast probably occurs as a common winter resident in years of abundance in the southern part of the state.

Crossbills - No record of occurrence. On the coast in some years can be ABSENT or MODERATELY COMMON. Due to the scarcity of conifers, they are not likely to be found at the site.

Towhee - The Rufous-sided Towhee is a COMMON summer resident. It is estimated that several pairs are found in each area of the site woods during the summer months. Also COMMON as a migrant.

Sparrows - This large group of about fifteen species is ABSENT at the site in summer except for the Song Sparrow which is a common resident. The many species are, however, from COMMON to ABUNDANT during spring and fall migration especially Fox, White-throated, and Song Sparrows with fewer of the other species.

Longspurs - Lapland Longspurs are RARE to UNCOMMON winter residents or visitants on the marsh with Horned Larks and Snow Buntings. They can therefore, occur on the site in the marsh.

Buntings - The Snow Buntings are an UNCOMMON to MODERATELY COMMON winter residents or visitants and probably occur in the marsh on the site.

Table 6

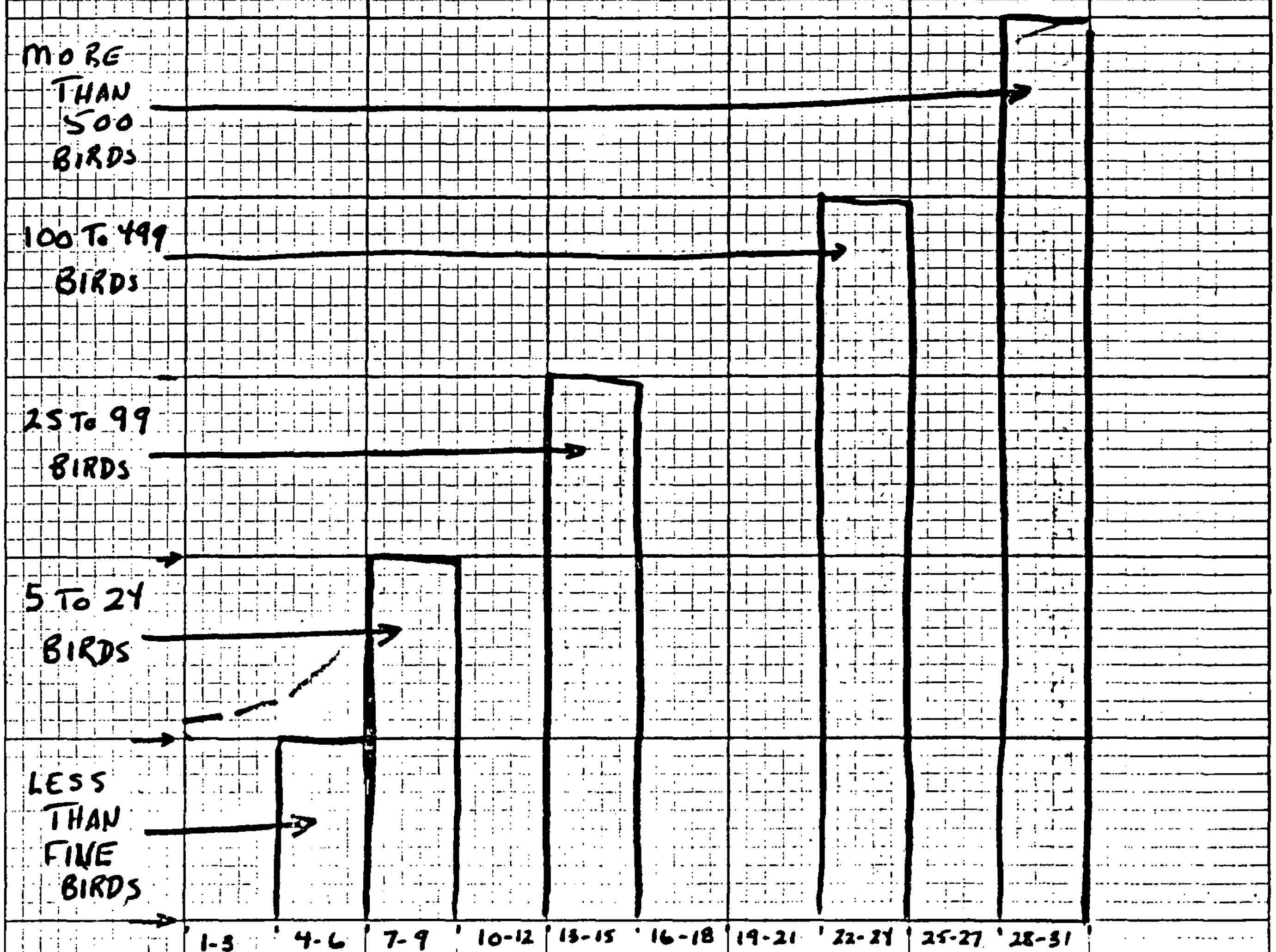
Survey of Birds Seen on the Seabrook Nuclear Site between May 29 and June 7, 1972 (from Lawrence, 1972).

	Woods	Marsh	Flying Over	Highest Number	Status in the Site
Great Blue Heron		x		3	Feeding in marsh pools
Green Heron	x	x		7	2 pairs at least nesting in woods, others feeding in pools.
Snowy Egret		x		7	Feeding in marsh pools
Black-crowned Night Heron		x		1	Immature bird of the year in pool - injured wing
Black Duck		x		5	In grass and marsh pools
Killdeer		x		2	Pair at same location each time - Likely nesting at edge of marsh.
Black-bellied Plover		x		7	Transients, gone at last field trip.
Greater Yellowlegs		x		2	Transients, lingering individuals - Non-breeders
Semipalmated Sand-piper		x		3	Transients, observed flying over marsh.
Great Black-backed Gull		x		1	With Herring Gulls near waste disposals site
Herring Gull		x	x	600	on marsh near waste disposal site.
Common Tern		x	x	2	Flying and settling on marsh at edge of site.
Whip-poor-will	x			1	Seen by 2 observers
Ruby-throated Hummingbird	x			2	Feeding on flowers in woods and flying - Probably residents.
Eastern Kingbird		x		2	Perched and feeding on insects in marsh.
Great Crested Flycatcher	x			1	Calling from trees in woods - Probably resident.
Eastern Phoebe	x			2	At edge of east part of woods - Residents.
Eastern Wood Pewee	x			1	Calling in woods - Resident.
Tree Swallow			x	3	Flying over marsh - Feeding but not likely resident
Barn Swallow		x	x	5	Flying over marsh - Feeding but not likely resident

Blue Jay	x			4	In woods-Probably residents
Common Crow		x	x	8	Eating in marsh and flying over.
Black-capped Chickadee	x			2	In woods on south side-Probably residents.
Brown Creeper	x			1	Singing in woods-Probably resident
Catbird	x			2	In woods over marsh-Probably resident.
Brown Thrasher	x	x		1	Seen on each visit in woods-Probably resident.
Robin	x	x		3	In woods and edge of marsh Residents.
Starling	x	x	x	25+	In woods and marsh - feeding - Resident.
Red-eyed Vireo	x			3	Actively singing in woods Residents.
Black & White Warbler	x			2	In woods - Residents.
Nashville Warbler	x			1	Singing male - Either migrant or resident.
Ovenbird	x			2	Singing in woods - Resident
Yellowthroat	x			7	The most common warbler - Resident.
American Redstart	x			1	Female in woods in wet area-Probably resident.
Redwinged Blackbird		x		15+	In woods and marsh - Resident in Cattail near woods.
Baltimore Oriole	x			2	Both singing males - Residents.
Common Grackle	x	x	x	30+	In woods and marsh - Residents.
Brown-headed Cowbird	x	x		1	Male in woods - Probably resident
American Goldfinch	x		x	3	Flying over woods-Probably resident.
Rufous-sided Towhee	x			13	In woods-At least 5 pairs residents.
White-throated Sparrow	x			1	In woods-Transient-Not seen at last visit.
Song Sparrow	x			2	Singing males in woods-Residents.

KEY TO GRAPHS OF RELATIVE FREQUENCY AND OCCURENCE OF BIRDS

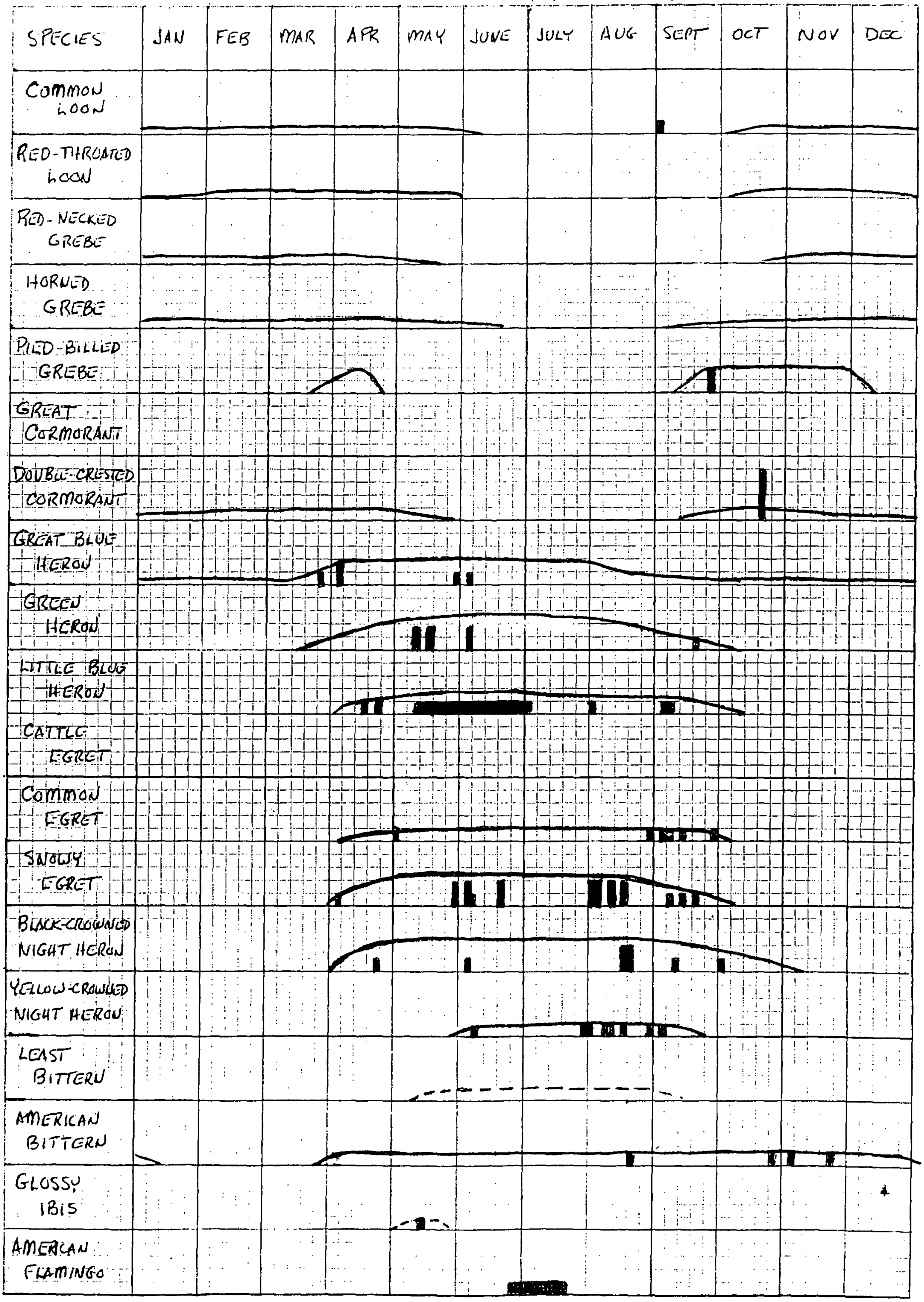
JAN

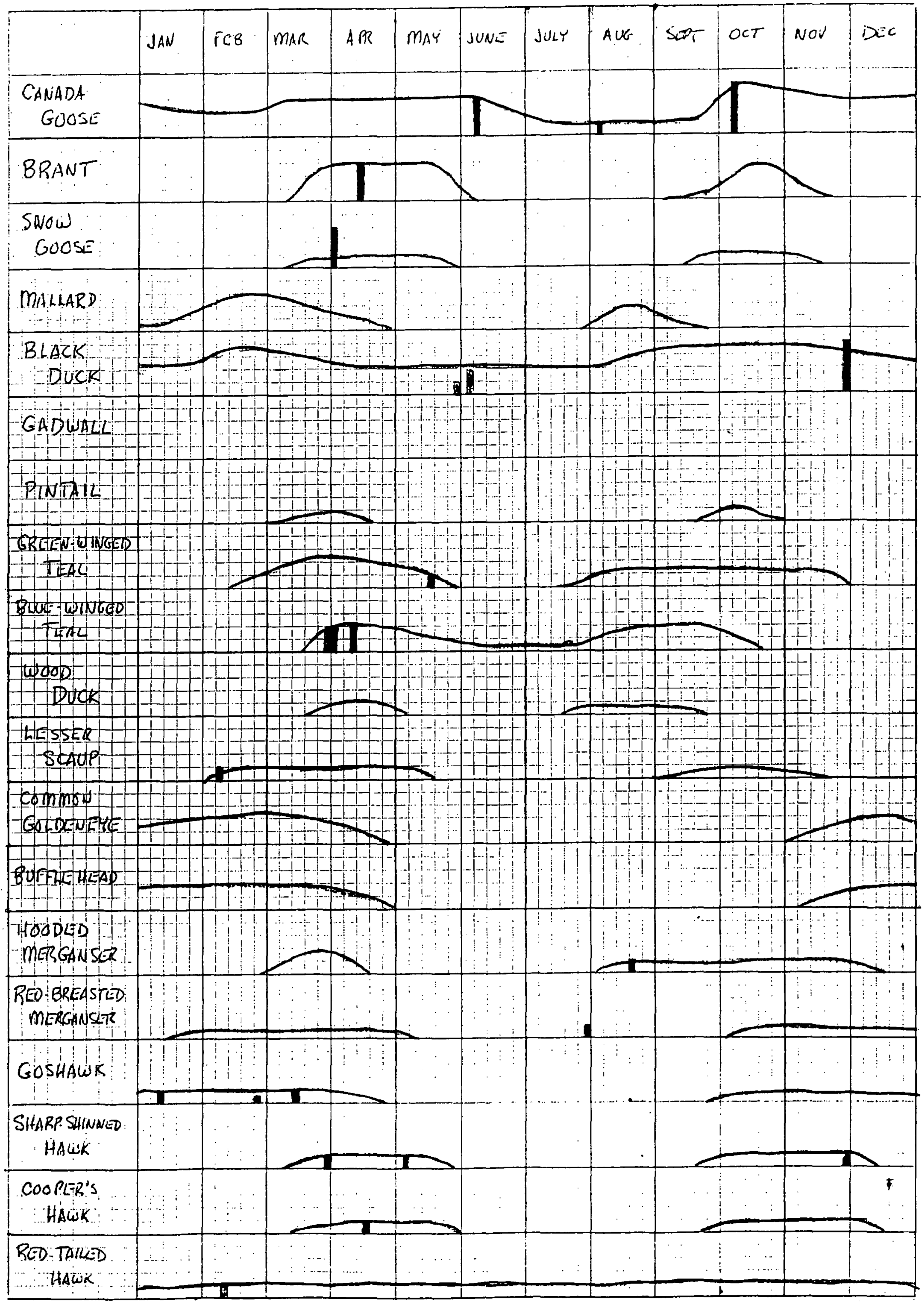


— — — = PROBABLE BUT UNCERTAIN OCCURENCE (DATA INADEQUATE)

——— = MOST LIKELY MAXIMUM FOR THAT PERIOD ON THE SITE

HAMPTON FALLS – SEABROOK AREA (LINE GRAPH refers to Proposed Nuclear Plant Site)





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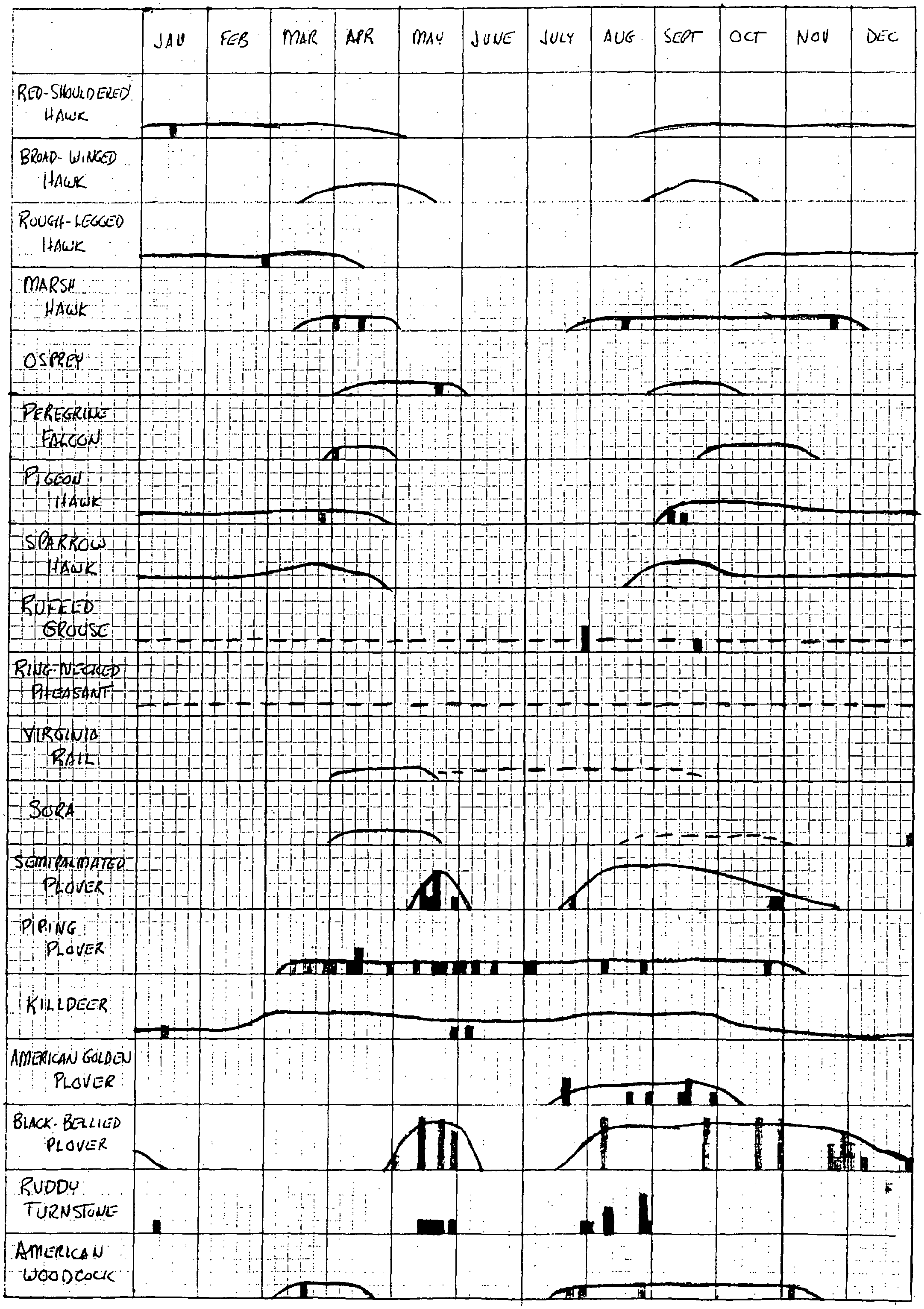
SNOW GOOSE
MALLARD
BLACK DUCK
GADWALL
PINTAIL
GREEN-WINGED TEAL
BLUE-WINGED TEAL
WOOD DUCK
LESSER SCAUP
COMMON GOLDENEYE
BUFFLEHEAD
HOODED MERGANSER
RED-BREASTED MERGANSER
GOSHAWK
SHARP-SHINNED HAWK
COOPER'S HAWK
RED-TAILED HAWK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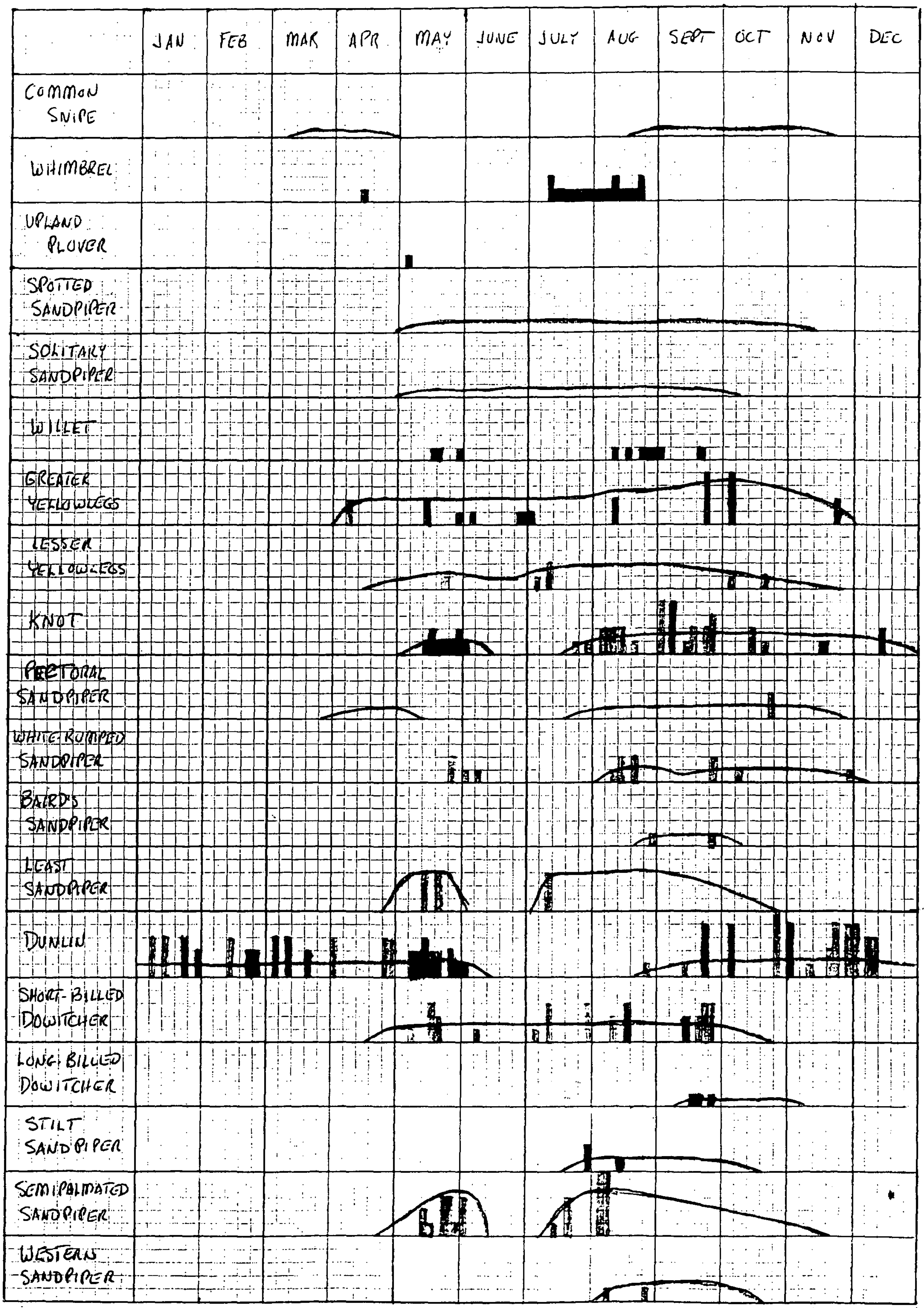
SPARROW HAWK
RUFFED GROUSE
RING-NECKED PHEASANT
VIRGINIA RAIL
SORA
SEMIPALMATED PLOVER
PIPING PLOVER
KILLDEER
AMERICAN GOLDEN PLOVER
BLACK-BELLIED PLOVER
RUDDY TURNSTONE
AMERICAN WOODCOCK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GREATER YELLOWLEGS
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PECTORAL SANDPIPER
WHITE-RUMPED SANDPIPER
BAIRD'S SANDPIPER
LEAST SANDPIPER
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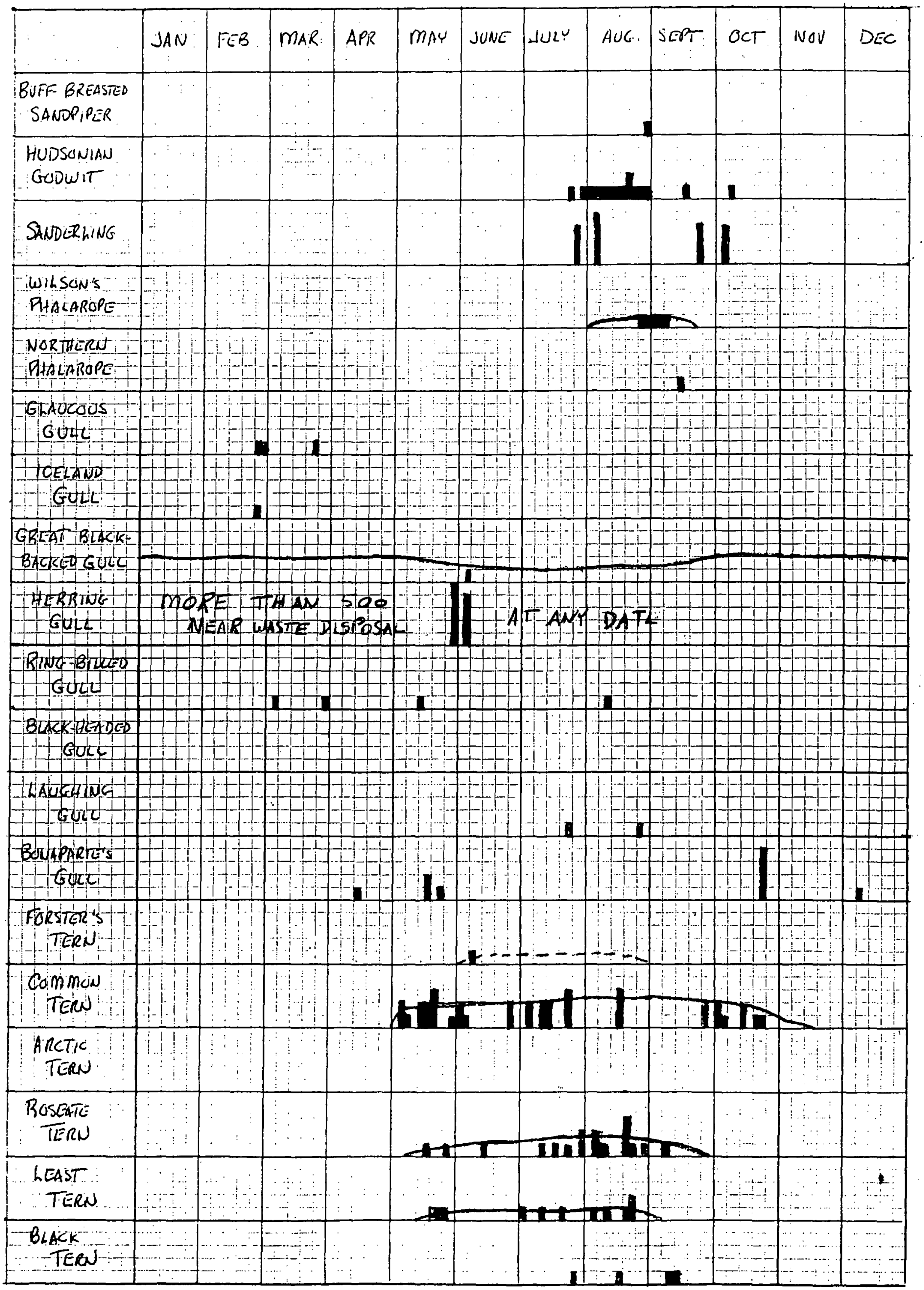
STILT SANDPIPER
SEMIPALMATED SANDPIPER
WESTERN SANDPIPER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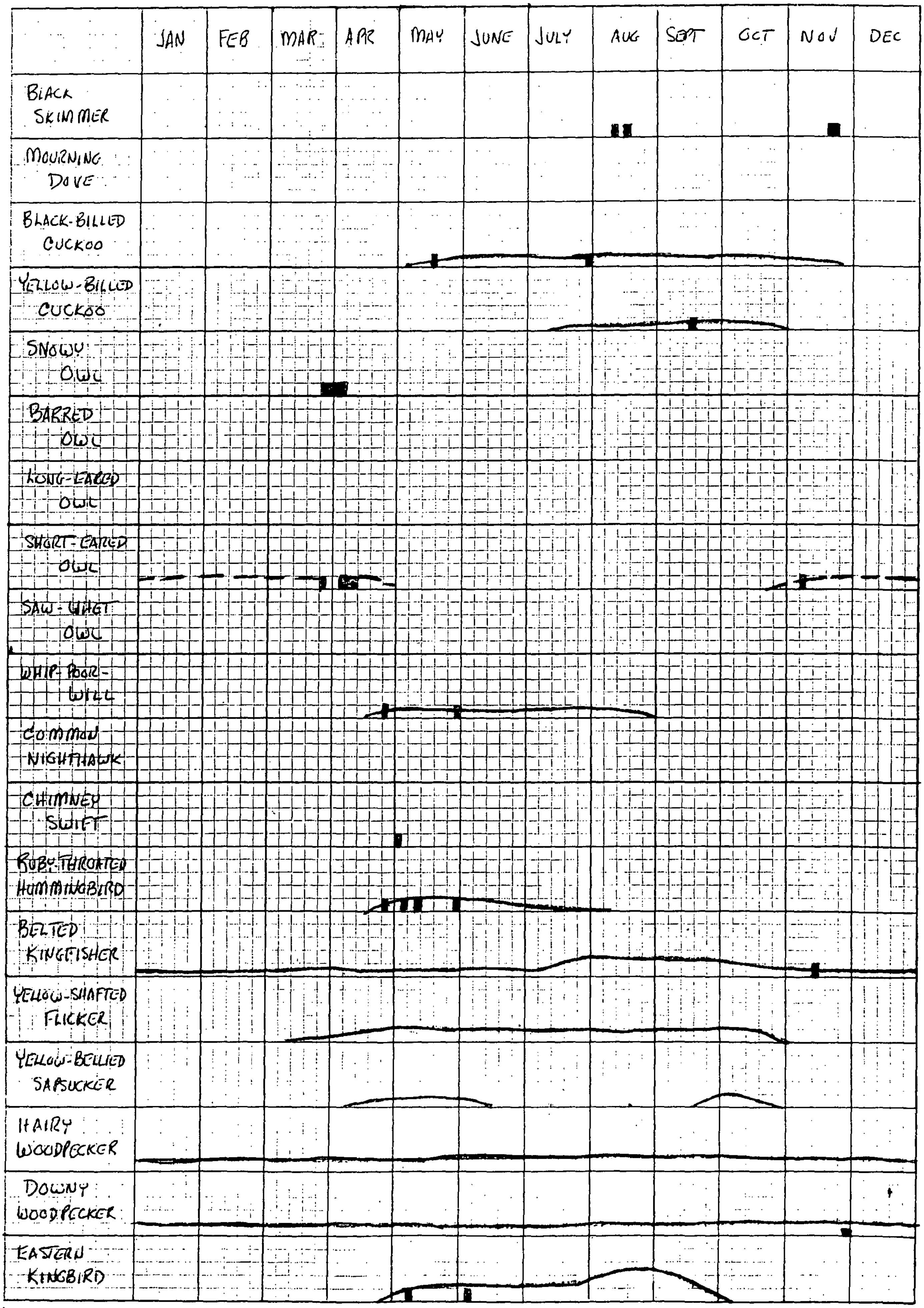
NORTHERN PHALAROPE
GLAUCOUS GULL
ICELAND GULL
GREAT BLACK-BACKED GULL
HERRING GULL
MORE THAN 500 NEAR WASTE DISPOSAL
AT ANY DATE
RING-BILLED GULL
BLACK-HEADED GULL
LAUGHING GULL
BONAPARTE'S GULL
FORSTER'S TERN
COMMON TERN
ARCTIC TERN
ROSEATE TERN
LEAST TERN
BLACK TERN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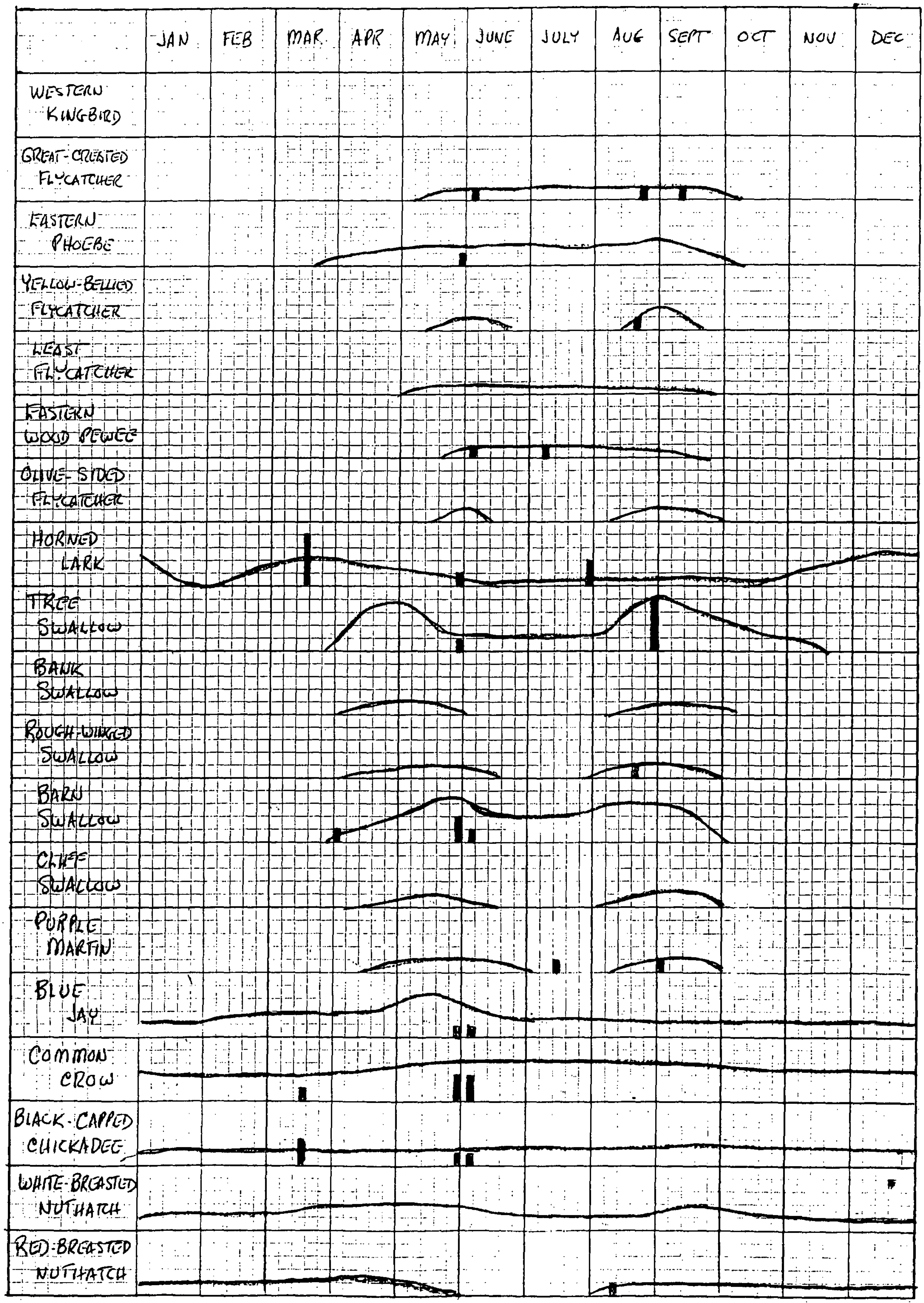
LONG-EARED OWL
SHORT-EARED OWL
SAW-WHET OWL
WHIP-POOR-WILL
COMMON NIGHTHAWK
CHIMNEY SWIFT
RUBY-THROATED HUMMINGBIRD
BELTED KINGFISHER
YELLOW-SHAFTED FLICKER
YELLOW-BELLIED SAPSUCKER
HAIRY WOODPECKER
DOWNY WOODPECKER
EASTERN KINGBIRD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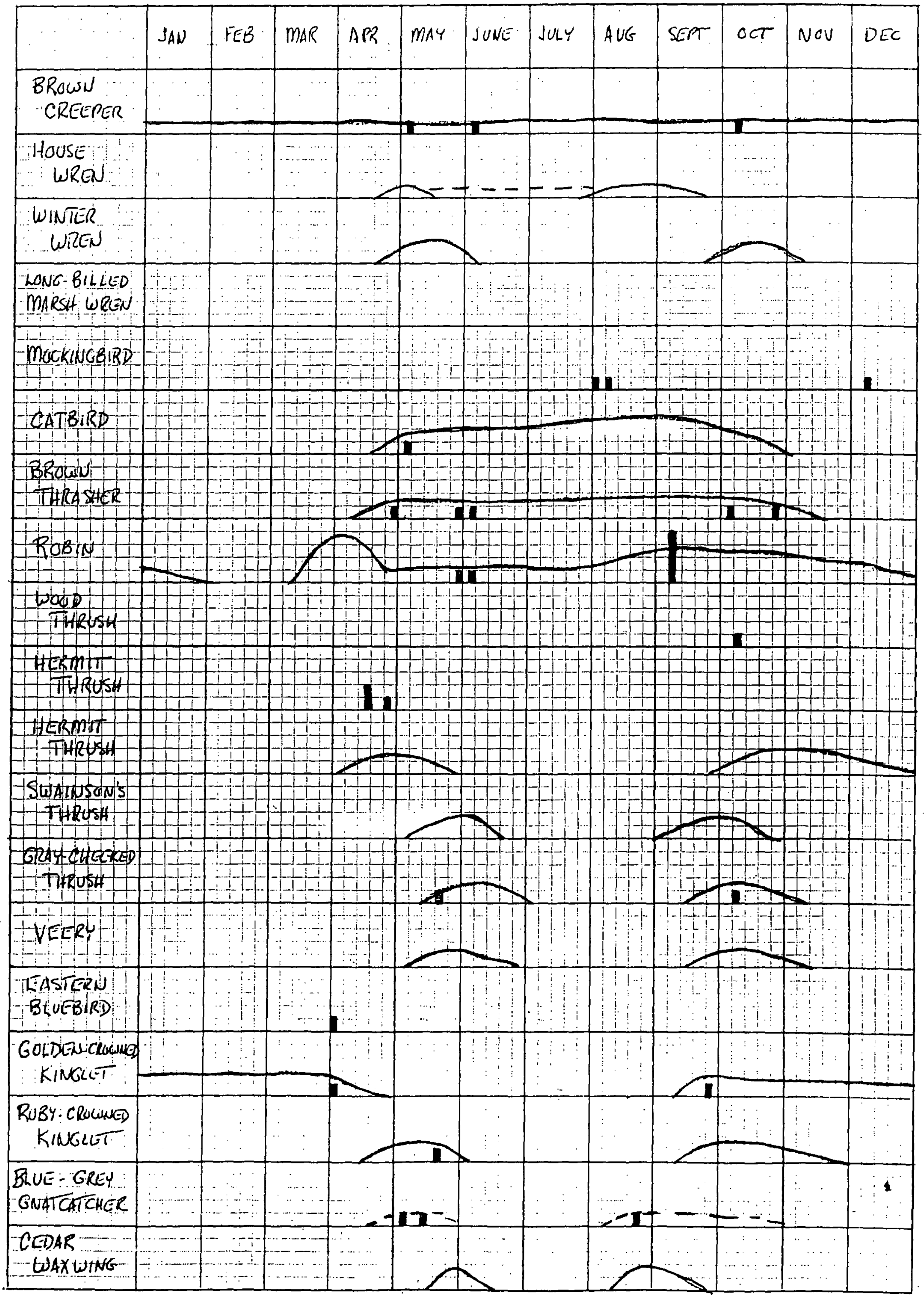
EASTERN PHOEBE
YELLOW-BELLIED FLYCATCHER
LEAST FLYCATCHER
EASTERN WOOD PEWEE
OLIVE-SIDED FLYCATCHER
HORNED LARK
TREE SWALLOW
BANK SWALLOW
ROUGH-WINGED SWALLOW
BARN SWALLOW
CLIFF SWALLOW
PURPLE MARTIN
BLUE JAY
COMMON CROW
BLACK-CAPPED CHICKADEE
WHITE-BREASTED NUTHATCH
RED-BREASTED NUTHATCH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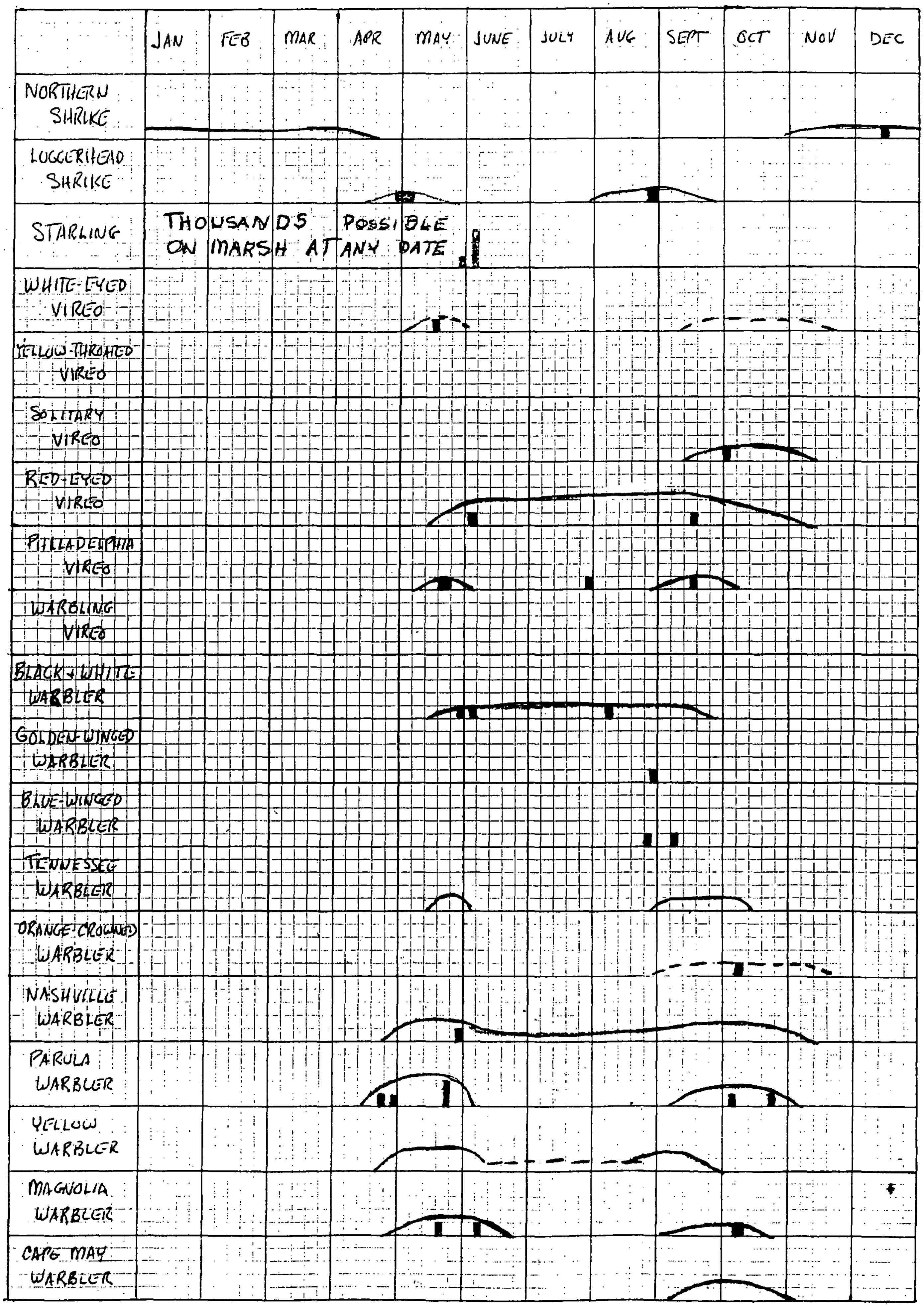
LONG-BILLED MARSH WREN
MOCKINGBIRD
CATBIRD
BROWN THRASHER
ROBIN
WOOD THRUSH
HERMIT THRUSH
HERMIT THRUSH
SWAINSON'S THRUSH
GRAY-CHEEKED THRUSH
VEERY
EASTERN BLUEBIRD
GOLDEN-CROWNED KINGLET
RUBY-CROWNED KINGLET
BLUE-GREY GNATCATCHER
CEDAR WAXWING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NORTHERN SHRIKE
LOGGERHEAD SHRIKE
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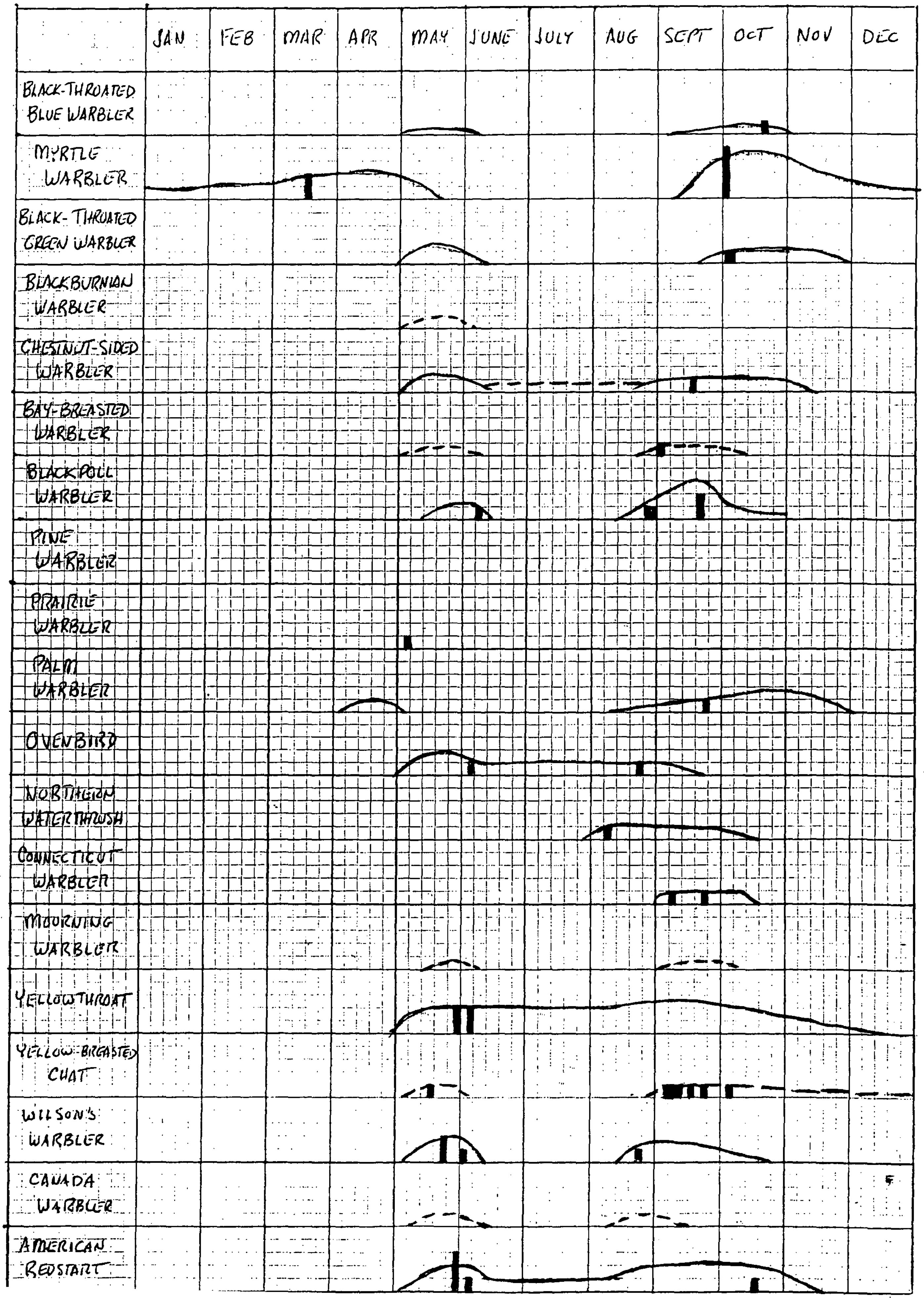
THOUSANDS POSSIBLE ON MARSH AT ANY DATE
WHITE-EYED VIREO
YELLOW-THROATED VIREO
SOLITARY VIREO
RED-EYED VIREO
PHILADELPHIA VIREO
WARBLING VIREO
BLACK + WHITE WARBLER
GOLDEN-WINGED WARBLER
BLUE-WINGED WARBLER
TENNESSEE WARBLER
ORANGE-CROWNED WARBLER
NASHVILLE WARBLER
PARULA WARBLER
YELLOW WARBLER
MAGNOLIA WARBLER
CAPE MAY WARBLER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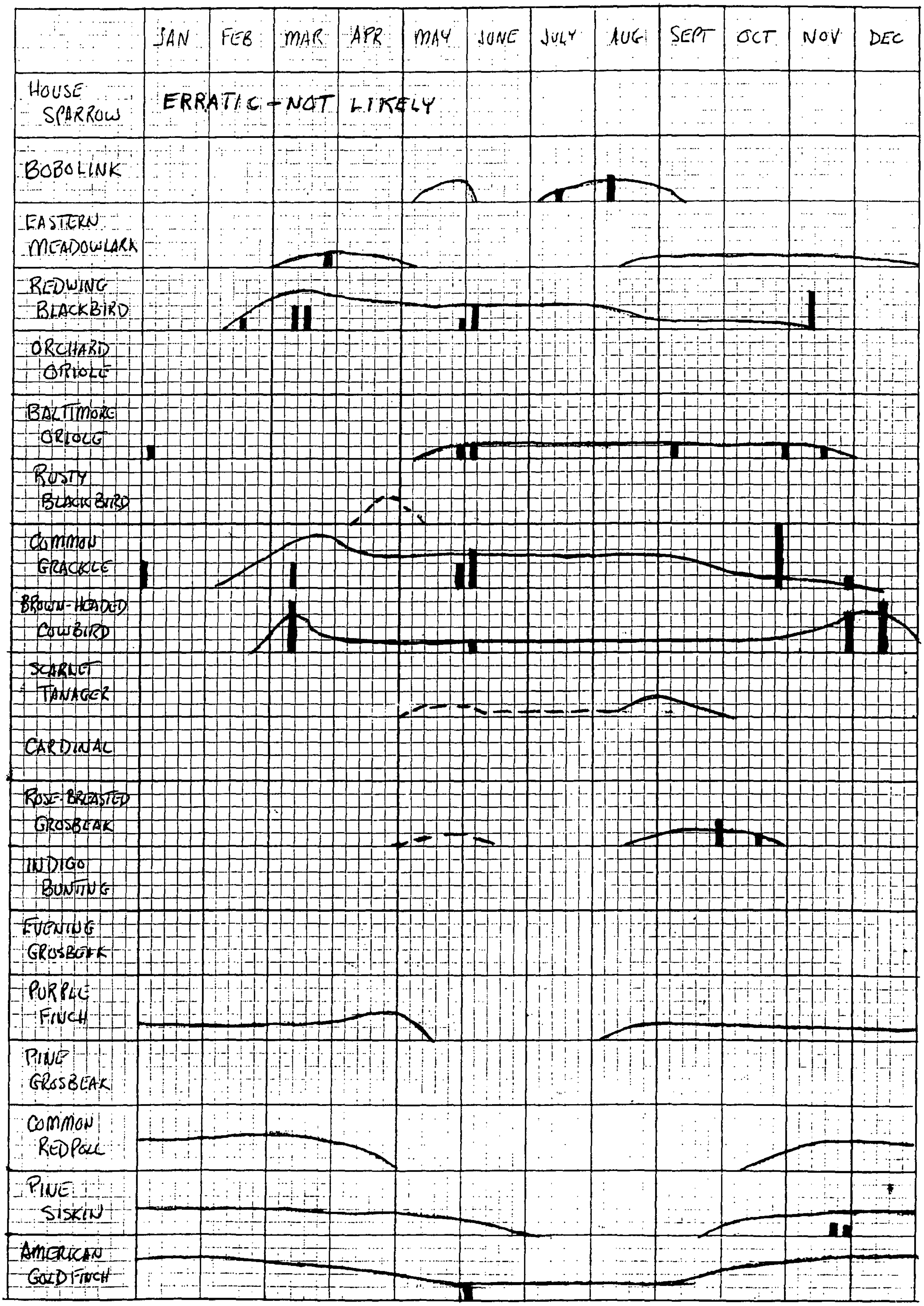
BLACK-THROATED BLUE WARBLER
MYRTLE WARBLER
BLACK-THROATED GREEN WARBLER
BLACKBURNIAN WARBLER
CHESTNUT-SIDED WARBLER
BAY-BREASTED WARBLER
BLACKPOLL WARBLER
PINE WARBLER
PRAIRIE WARBLER
PALM WARBLER
OVENBIRD
NORTHERN WATERTHRUSH
CONNECTICUT WARBLER
MOURNING WARBLER
YELLOWTHROAT
YELLOW-BREASTED CHAT
WILSON'S WARBLER
CANADA WARBLER
AMERICAN REDSTART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HOUSE SPARROW
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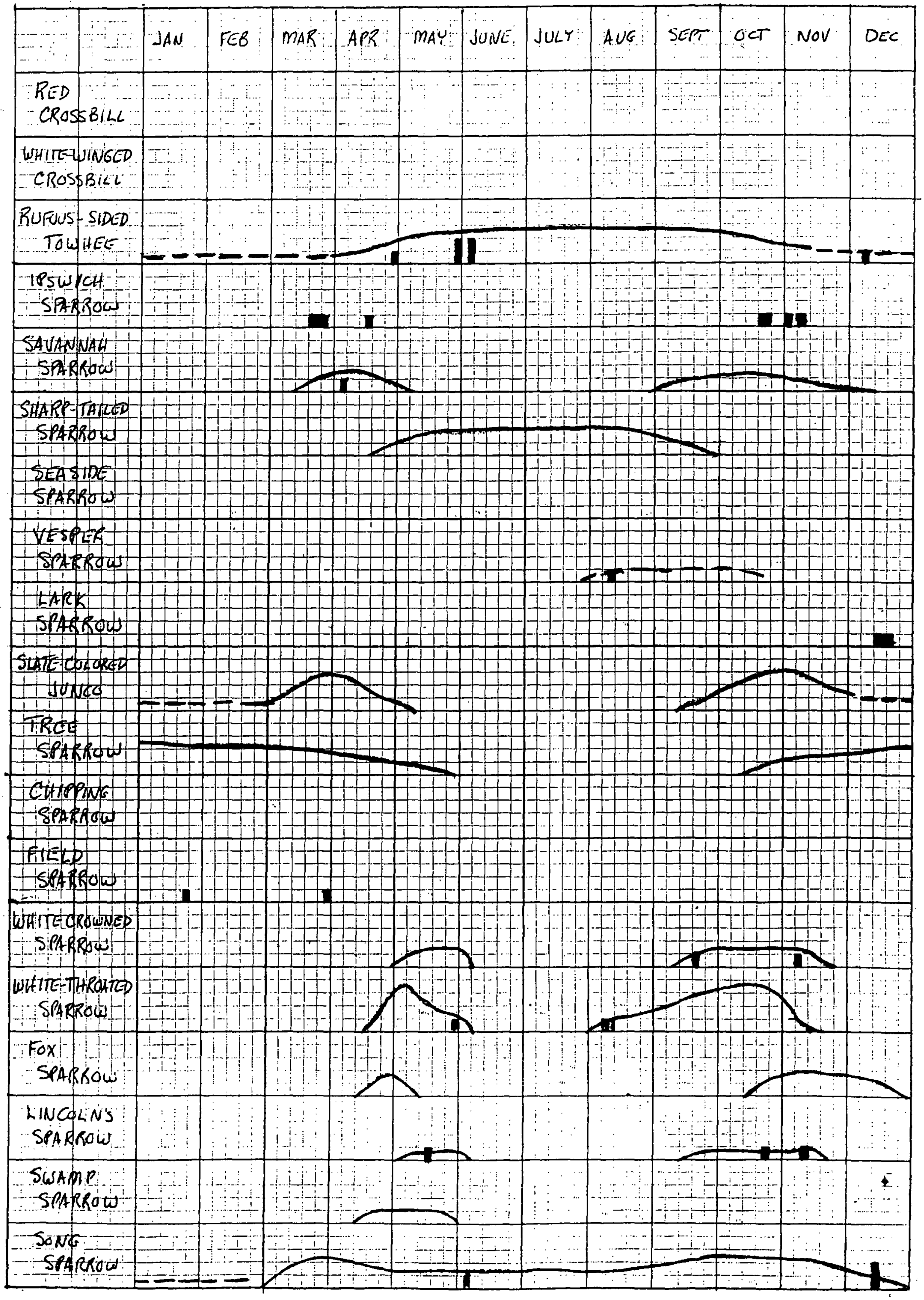
BOBOLINK
EASTERN MEADOWLARK
REDWING BLACKBIRD
ORCHARD ORIOLE
BALTIMORE ORIOLE
RUSTY BLACKBIRD
COMMON GRACKLE
BROWN-HEADED COWBIRD
SCARLET TANAGER
CARDINAL
ROSE-BREASTED GROSBEAK
INDIGO BUNTING
EVENING GROSBEAK
PURPLE FINCH
PINE GROSBEAK
COMMON REDPOLL
PINE SISKIN
AMERICAN GOLDFINCH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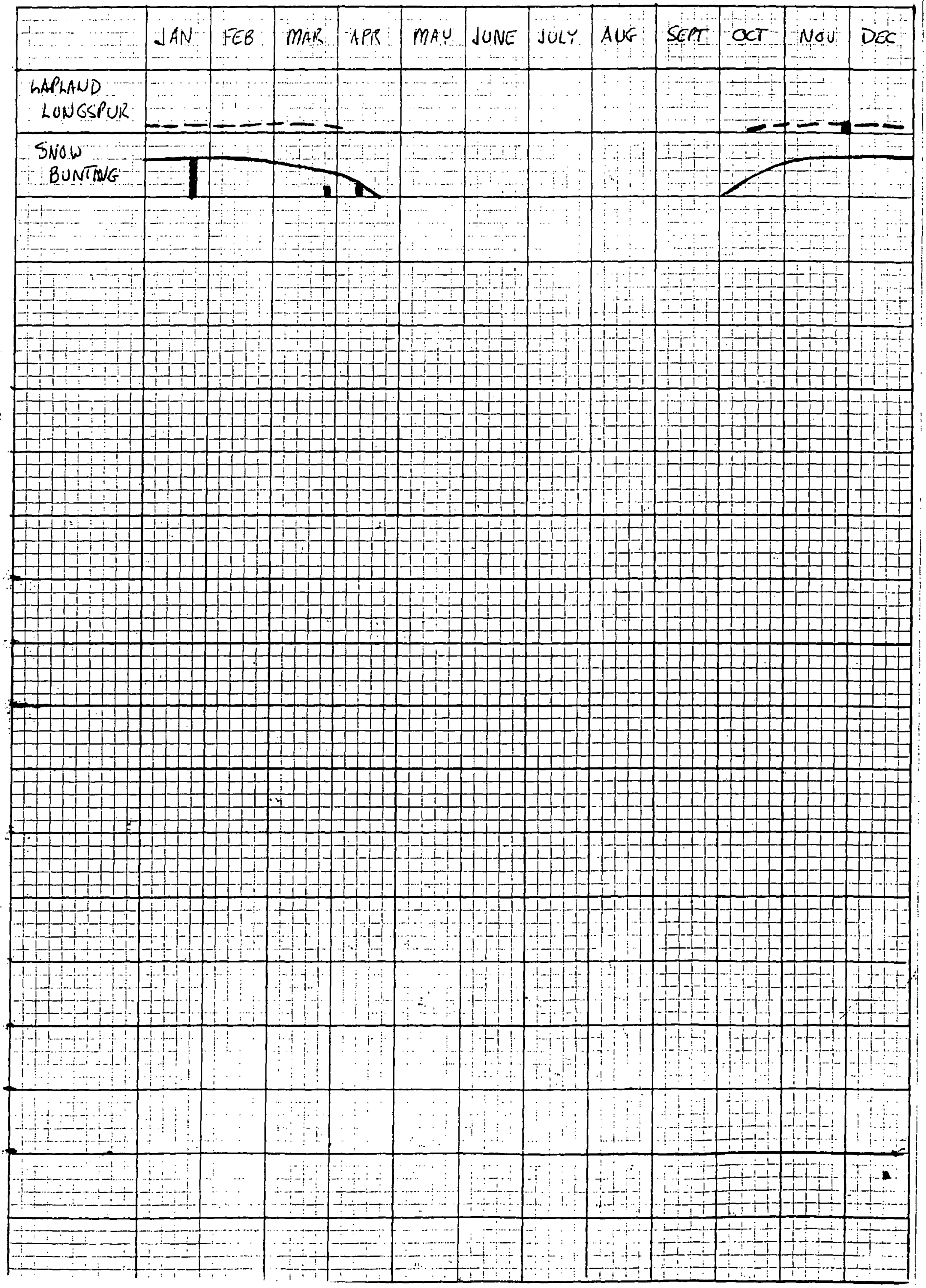
WHITE-WINGED CROSSBILL
RUFOUS-SIDED TOWHEE
IPSWICH SPARROW
SAVANNAH SPARROW
SHARP-TAILED SPARROW
SEASIDE SPARROW
VESPER SPARROW
LARK SPARROW
SLATE-COLORED JUNCO
TREE SPARROW
CHIPPING SPARROW
FIELD SPARROW
WHITE-CROWNED SPARROW
WHITE-THROATED SPARROW
FOX SPARROW
LINCOLN'S SPARROW
SWAMP SPARROW
SONG SPARROW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DEC
LAPLAND LONGSPUR
SNOW BUNTING

VITA

Education:

A.B. - 1948, St. Anselm's College, Manchester, N.H.

M.S. - 1950, Catholic University of New Hampshire

Graduate Studies 1952-55, University of Notre Dame.
Summers 1951 and 1953, University of Michigan, Biol. Station
Summer 1955 Duke University Marine Station
Summer 1962 University of New Hampshire
Summer 1969 Arizona State University Desert Institute

Employment (Professional):

Game Technician - N.H. Fish and Game Dept.

Pollution Biologist - N.H. Water Pollution Comm., Summer of 1959 and 1960

Prof. of Biology - St. Anselm College 1955 to date.

Ecologist - Normandeau Associates, Summers of 1968 and 1970.

Ornithological Affiliations:

Audubon Society of N.H. Member of Executive Board for 5 years.

Northeastern Bird Banding Assn. Member for 7 years, member of Council for 6 years.

Eastern Bird Banding Assn. Member for 5 years.

Curator of Museum - St. Anselm's College (includes bird skin preparation and collection).

U.S. Dept of Interior - Bird Banding Bureau
Holder of Bird Banding Permit #9327
Banding operations in N.H. 1965-1972

Manchester Institute of Arts and Sciences

Taught 2 sessions of Bird Watching 1969-1970.

Active Contributor to Bird Observation records in:

N.H. Audubon Quarterly
American birds (Formerly Audubon Full Notes)
New England Birds

BIBLIOGRAPHY

NEW HAMPSHIRE AUDUBON QUARTERLY 1961-71.

(Contains records of birds observed by birdwatchers. The records are of the highlights, high numbers, early and late dates, and exceptional birds seen in N.H.)

RICHARDS, Tudor, 1958. A List of the Birds of New Hampshire.

FOWLER, Susan, 1967. Hampton Salt Marsh Birds. N.H. Adu. Quat. 20(4): 129-135.

LAWRENCE, Roger (Unpublished Personal Records of N.H. Birds).

APPENDIX D

APPENDIX D

CHECK LIST OF NEW HAMPSHIRE REPTILES*

SNAKES

Black Snake (*Coluber c. constrictor*)

DeKay's Snake (*Storeria dekayi*)

Garter Snake, Eastern (*Thamnophis s. sirtalis*)

Green Snake, Smooth (*Opheodrys vernalis*)

Red-bellied Snake (*Storeria occipitomaculata*)

Ribbon Snake (*Thamnophis s. sauritus*)

Ring-necked Snake, Eastern (*Diadophis punctatus edwardsii*)

Spotted Adder, or House Snake (*Lampropeltis t. triangulum*)

Spreading Adder, or Hog-nosed Snake (*Heterodon contortrix*)

Rattlesnake, Northern Timber (*Crotalus h. horridus*)

Water Snake, Common or Banded (*Natrix s. sipedon*)

TURTLES

Blanding's Turtle (*Emys blandingii*)

Box Turtle (*Terrapene c. carolina*)

Musk Turtle (*Sternotherus odoratus*)

Painted Turtle, Eastern (*Chrysemys p. picta*)

Snapping Turtle (*Chelydra serpentina*)

Spotted Turtle (*Clemmys guttata*)

Wood Turtle (*Clemmys insculpta*)

*From N.H. Fish and Game Department Survey Report No. 4, Biological Survey of the Connecticut Watershed.

APPENDIX E

APPENDIX E

CHECK LIST OF NEW HAMPSHIRE AMPHIBIA*

SALAMANDERS

Dusky Salamander (Desmognathus fuscus fuscus)

Four-Toed Salamander (Hemidatylium scutatum)

Jefferson's Salamander (Ambystoma jeffersonianum)

Marbled Salamander (Ambystoma opacum)

Purple Salamander, Eastern (Gyrinophilus porphyriticus porphyriticus)

Red-Backed Salamander (Red-backed phase) (Plethodon cinereus)
Gray-Backed Salamander (Dusky phase)

Red-Spotted Newt (Aquatic Stage) (Triturus viridescens viridescens)
Red Eft (Terrestrial Stage)

Spotted Salamander (Ambystoma maculatum)

Two-Lined Salamander (Eurycea bislineata bislineata)

TOADS and FROGS

American Toad (Bufo americanus americanus)

Bullfrog (Rana catesbeiana)

Fowler's Toad (Bufo fowleri)

Green Frog (Rana clamitans)

Leopard Frog (Rana pipiens)

Mink Frog (Rana septentrionalis)

Pickerel Frog (Rana palustris)

Spring Peeper (Hyla crucifer crucifer)

Tree Toad, Common (Hyla versicolor versicolor)

Wood Frog, Eastern (Rana sylvatica sylvatica)

*From N. H. Fish and Game Department Survey Report No. 4
Biological Survey of the Connecticut Watershed

APPENDIX F

"APPENDIX F"

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK NUCLEAR PLANT

CONDENSING WATER STUDY

MAIN
CHAS. T. MAIN, INC.
ENGINEERS
April, 1972

TABLE OF CONTENTS

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EXHIBITS (Cont'd.)

DRAWINGS

I. SUMMARY

A. PURPOSE

The purpose of this study is to determine the feasibility, relative cost and other economic factors of the various methods of condensing turbine exhaust steam in two 1150 MW nuclear turbine-generator units served by light water reactors.

B. SCOPE

The scope of the study embraced all types of condenser cooling which were considered feasible for two 1150 MW nuclear units. These types of cooling were:

1. Once-through open cycles using ocean water discharged back into the ocean. Variations in this type of cooling included temperature rises of 45°F and alternately 15°F, and various arrangements of intake structure location.

2. Closed cycle cooling towers using evaporative cooling of condensing water. Both the natural draft and mechanical draft towers were included in the study.

3. Closed cycle condensing water canal using power spray modules to cool the condensing water by evaporative cooling of the sprayed water.

4. Closed cycle dry cooling towers which cool the condensing water by recirculation through finned-tubed heat exchangers over which air is blown by mechanical draft fans.

The study consisted of the preparation of conceptual design drawings of each of the various plans; investment estimates of all plans, both at the present 1972 price level and at the estimated price level expected to prevail at the actual time of construction; economic evaluations of each plan which embrace all costs to own and operate and including:

1. Fixed charges on investment.

2. Fuel cost resulting from turbine exhaust pressure variations.

3. Pumping, spray and fan power cost.

4. Other operating and maintenance cost.

5. Generating capability penalties resulting from relative turbine back pressure and pump spray and fan power.

Optimization studies were made to determine the most economical design features of each plan, such as, condenser temperature rise; pipe size; cooling tower cooling range and cooled water temperature approach to a selected design ambient web bulb temperature; number and arrangement of spray cooling modules; and condenser surface, tube size and length, etc.

C. RESULTS

The economic evaluation of the various plans are shown on Exhibit I at the 1972 price level and Exhibit II escalated for plant operation of Unit I in 1979 and Unit 2 in 1980. A summary of this differential evaluation is shown below:

	Differential Evaluated Costs in $1,000	
	1972 Price Level	Escalated for 1979-80 Operation
Once-Through Open Systems		
Intake on Ocean Shore		
15° Temperature Rise		
Pipe Inlet to Intake	56,711	77,416
Channel Inlet to Intake	58,737	80,728
45° Temperature Rise		
Pipe Inlet to Intake	16,687	22,695
Channel Inlet to Intake	25,620	35,376
Inland Intake Near Plant		
15°F Temperature Rise		
Pipe Inlet to Intake	74,248	102,230
Channel Inlet to Intake	29,943	41,383

	Differential Evaluated Costs in $1,000	
	1972 Price Level	Escalated for 1979-80 Operation
45°F Temperature Rise		
Pipe Inlet to Intake	28,838	32,720
Channel Inlet to Intake	Base	Base
Storage Reservoir System for Low-Tide Operations		
15°F Temperature Rise	44,139	60,091
45°F Temperature Rise	7,768	10,220
Closed Systems		
Wet Cooling Towers		
Natural Draft Towers	27,936	34,756
Mechanical Draft Towers	17,698	21,907
Power Spray Modules	16,685	18,668
Dry Cooling Towers	97,267	126,545

The most economical plan is a once-through open system with intake near the plant, 45°F Temperature rise, with an open channel inlet to the intake structure and with pipe discharge of condensing water to the ocean approximately 4000 feet off-shore into water approximately 40 feet deep. This plan is shown on Drawing AB-2. The channel is dredged to a depth of -24.5 feet all the way from the intake to the ocean.

The next most economical plan is similar to the base plan described above, but utilizing a storage reservoir of 45 acres west of the railroad to supply water to the condensing water pumps during each low cycle of the tide when the water falls to mean sea level. During rising tides above mean sea level the storage reservoir would be refilled by separate pumps located near the intake structure. In this plan, no inlet channel dredging is required, except near the intake structures in order to obtain a suitable water flow when the tide is at mean sea level or higher.

The next most economical plans, at approximately the same cost level, are:

a. Once-through open system with intake on ocean shore -- 45° Temp. Rise, and

b. Closed system with loop canal and power spray modules.

These latter plans range in evaluated cost approximately $17,000,000 above the most economical plan. These plans are shown on Drawings AA-1, and B-1 respectively.

II. DISCUSSION

A. PLANS STUDIED

As indicated in Section I.B. Scope, this study embraced all types of condenser cooling which were considered feasible for two 1150 MW nuclear units. Prime consideration of the study was preservation of the integrity of the existing wet lands. The plans studied are enumerated in Section I.B. and Exhibit III shows the technical data for each plan. Drawing 2316-13-E1 shows the one-line electrical system for all plans. Below is a discussion of each:

1. Once-Through Open Systems - Ocean Front Intake

   Several variations of this plan were investigated. Included were:

   (a) Ocean front intake and subaqueous pipelines from approximately 25 feet of water below mean sea level to the intake.

   (b) Ocean front intake and subaqueous ocean discharge with protected open channel from approximately 25 feet of water below mean sea level to the intake.

These plans are shown on Drawings 2316-13-AA1, AA2, AA3, AA6, AA7 and AA8. Drawings AA1 and AA2 show alternate routing of the intake line from the pump structure to the plant while AA7 and AA8 show the alternate intake arrangements.

For each of these plans the pipes and other facilities were sized for a 15°F and 45°F temperature rise.

The plant site is situated approximately two miles west of the shore line at Hampton Beach and requires buried pipelines for intake and discharge lines. The line will be buried for its entire length under a minimum of four feet of earth cover. Installation of the pipe will be accomplished underwater with the exception of a small section crossing Route 1A where it will be necessary to cofferdam the excavation in order to keep the highway open to traffic. Installation will be accomplished as follows:

1. A trench will be dredged in two stages. The first stage will be to remove the upper topsoil and it will be stockpiled along one side of the excavated trench in the form of a dike which will protect the excavation from disturbance from this side. The second stage will complete the excavation with this material stockpiled in the form of a dike on the other side of the trench.

2. A pipeline fabricating area will be set up at the plant end of the trench to fabricate the individual lengths of pipe into long sections by joining them together at the fabrication area. The pipe will then be floated out and sunk and joined to the previous prefabricated section underwater utilizing divers and waterbound equipment.

3. Back filling will be accomplished by replacing the lower material from the stock pile dike up to the previous bottom of the topsoil. The remainder of the back filling will be from the topsoil dike and the finished grade over the pipe will be brought back to its original condition. Excess excavated material will be removed from the site and the area will be completely returned to its original condition.

4. During the dredging operating for the pipe line trenches particular care will be exercised to assure that muddying or silting of the water will be limited to the immediate vicinity of the actual excavation and deposition. However, in no case will turbidity beyond a 100 yard radius of the source of work exceed 50 Jackson units above the existing natural background turbidity. If the turbidity reaches a level beyond the above criteria, baffled or diked areas will be provided at the sources of turbidity such as to control release of turbid water to that degree which does not exceed the limits above specified.

A recirculation pipe line has been included from the discharge lines to the intake structure for the purpose of cleaning the intake waterway and submerged structures and intake pipeline to the condenser of shell and other marine growth.

The intake structure is of the compartment type of reinforced concrete provided with traveling screens, trash racks, stop logs and provisions for two sets of fine screens per chamber. The intake structures are shown on Drawings 2316-13-AA4 and AA-5. In all plans the velocity of water approach to the intake facility is less than 1.0 foot per second.

In all the once-through operating systems studies, two (2) large diameter buried pipes were used for discharge of the heated circulating water to the ocean. The discharge lines extend approximately 15,000 feet from the power plant to the point of discharge out in the ocean. The point of discharge is under approximately 40 foot depth of water. The subaqueous discharge will utilize the theory of buoyand jet discharge for maximum dilution of heated water within the smallest possible area. Further discussion of the buoyant jet can be found in Alden Research Laboratories report:

Buoyant Jet Discharge Model
Seabrook Nuclear Station – Unit No. 1
Public Service Company of New Hampshire

Report
for

Ebasco Services Incorporated
August, 1969

2. Once-Through Open Systems – Plant Site Intake

Variations of this plan which were studied included:

(a) Pipe suction from the ocean.

(b) Open channel from the ocean.

(c) Storage reservoir for low tide operation.

These plans are shown on drawings 2316-13-AB1, AB2 and AB3.

For each of these plans the pipes and other facilities were sized for a 15°F and a 45°F temperature rise.

(a) Pipe Suction from Ocean

An inland pump station with buried intake pipe consists of approximately 10,200 feet of gravity flow intake pipe laid from approximately 25 foot depth of water in the ocean to a pump intake structure located near the plant site. The buried pipe draws ocean water to the intake forebay by gravity flow. Cooling water is pumped from here to the condenser and is discharged through subequeous line as described for ocean front intake. The intake structure forebay is designed for overflow in the event of pump failure and consequent pipeline surge.

(b) Channel Suction from Hampton Harbor

An inland pump station with an intake channel consists of dredging a channel approximately twenty five feet deep into a pump intake structure located near the power plant site. This channel is used to draw ocean water to the intake and is pumped through buried pipelines to circulate cooling water to the condenser and discharge this heated water to the ocean as previously described.

(c) Storage Reservoir for Low Tide Operation

An inland pump station located and sized approximately as shown on Drawing No. 2316-13-AB3 with a nominal intake channel is provided to circulate water through the power plant directly from the tidal basin and to pump water (above 0.0 msl) into a storage reservoir during high tide conditions. During low tide conditions the stored water will flow by gravity back into the intake and forebay and will be pumped through the power plant for condenser cooling. The circulating water pumps will operate continuously while the reservoir pumps will operate only during high tide conditions. A forebay structure is provided at the intake to maintain pump submergence during pumping of reservoir flow during low tide condition and into which water from the tidal basin flows directly during high tide conditions.

Water is pumped from the intake circulating water pumps through the condenser out the subaqueous discharge and from the intake into the reservoir via the reservoir pumps. Stored water flows back through the reservoir pumps to feed the circulators during low tides.

In all cases the velocity of approach to the intake structures is less than one foot per second, thus reducing the density of marine life approaching the revolving screens.

3. Closed Systems

Circulating cooling water within a closed system of waterways with nominal intake pipe as required for blow-down flushing and nominal intake pipe as required for makeup water was studied for three basic sysems which included spray module cooling canals, wet cooling towers and dry cooling towers. The wet cooling towers include mechanical draft and natural draft cooling systems. In regards to the wet cooling towers and the spray module canals a reasonable amount (60,000 GPM maximum) of makeup water is required and will be extracted from the Brown's River.

Requirements for system blow-down are discharged through subaqueous pipeline to the ocean. Blow-down is extracted from the discharge of the circulating water pumps. Drawing 2316-13-B4 shows this blow-down plan.

Foundations for the cooling towers are designed on the basis of spread footings or mats bearing on bedrock.

The water pumping structures are shown on Drawing 2316-13-BC1.

(a) Closed Circuit Canal – Spray Module Cooling

A canal with 8 ft. depth water is used to furnish water to 312 spray modules 8 abreast which cool the circulating water in the canals for subsequent recycling to the power plant condensers. Each spray module is made up of four (4) sprays which are interconnected and driven by separate pumps. The recommended spray module canal is as shown on Drawing 2316-13-B1 and B4. Two extensions were considered: one extending south for an additional 4500 ft. of effective length and one extending west of the Boston and Maine Railroad for an additional 6000 ft. of effective length. Both extensions were found to be uneconomical. The temperature rise through the condenser for the recommended canal is 25°F. The site earthwork is so designed as to provide balanced cut-fill. Seepage through the earth dikes is minimal with compensation for it together with evaporation and blow-down being by the makeup pumps.

(b) Wet Cooling Tower Systems

Natural and mechanical draft cooling towers on a closed system with makeup from Brown's River were investigated. The natural draft cooling tower plan consists of two-500 ft. diameter by 500 ft. high towers designed for a total duty of 1,280,000 GPM with a temperature rise through the condensers of 25°. The towers are designed for cooling the water to a 20 degree approach to a wet bulb temperature of 75°F. Four (4) pumps developing 18,200 BHP serve each unit and each unit is served independently by one cooling tower without interconnection. This plan is shown on Drawing 2316-13-C2.

The mechanical draft cooling towers consist of eight ten-cell sections with each ten-cell cooling tower having basin dimensions of 51 ft. by 361 ft. and overall dimensions of 69 ft. x 361 ft. with a height of 59 ft. 4 in. from the top of the basin wall to the top of the 18 ft. high fan cylinder. Ten 192 BHP fans serve each tower (one per cell section). The towers are designed for a total duty of 1,185,000 GPM having a temperature rise through the condensers of 27°F with an approach of 13° to a wet bulb temperature of 75°F. Three (3) pumps developing 13,600 BHP serve each generating unit and each unit is served by a bank of four-ten cell section cooling towers. Each four tower bank of cooling towers serving one generating unit is connected in parallel but each bank of towers is not interconnected: Drawing 2316-13-C1 shows the layout of the towers with connecting circulating water piping.

(c) Dry cooling Tower Systems

The dry cooling towers consist of two structures of 26 cells per structure with two 495 BHP fans provided per cell. Each structure occupies a 1352 ft. x 354 ft. area. The towers are designed for a total duty of 946,000 GPM with a temperature rise of 37°F through the condensers at a design dry bulb temperature of 90°F. Two (2) circulating water pumps developing 20,500 BHP serve each unit and each unit is served by one of the 26 cell cooling tower structures. The two cooling tower structures are not interconnected: one structure serves only one unit. Drawing 2316-13-C3 shows the layout of the towers with connecting circulating water piping.

B. ECONOMIC EVALUATIONS

The economic evaluation of each of the various plans consists of a summation of all comparable factors which effect the cost to own and operate the total plant. These factors are:

1. Fixed charges on investment which we have estimated at 15%, equalized, or levelized, over the life of the plant. These fixed charges comprise the following components:

   (a) Amortization of initial investment over the intended capital recovery period -- assumed at 30 years.

   (b) Return year by year on the unamortized position of the initial investment.

   (c) Income taxes payable in connection with this return on investment.

   (d) Other annual costs, the amount of which depends upon the investment – principally property taxes and property insurance.

2. Fuel cost differential resulting from turbine back pressure variations. This component of cost is based upon an estimated levelized fuel cost of $0.15 per MM Btu, an average load of 2150 MW (90% of full capacity) 7800 hours per year. This results in a capacity factor of approximately 80%. The average annual back pressure was calculated for each of the various open-cycle plans on the basis of an average ocean water temperature of 50°F. In the case of the closed-cycle evaporative cooling plans, the average condenser inlet temperatures were estimated for the optimum design to be:

   (a) 81°F for the natural draft wet cooling towers

   (b) 76°F for the mechanical draft wet cooling towers

   (c) 88°F for the power spray modules

The foregoing water temperatures were based upon the performance curves of the optimum cooling towers and spray modules, as shown in Exhibit XVIII. In the case of the dry cooling tower system, the average performance was based upon Exhibit XIX for an average ambient temperature of 55°F.

The differential heat rates resulting from the average back pressure of the various plans were based upon Exhibit XVII, which was developed from turbine manufacturer's data for an 1800 rpm, tandem-compound, six flow, 43/44 inch last stage blade turbine.

3. Condensing water pumping cost, spray pumping cost, and cooling tower fan cost. This component of cost has been based upon the calculated power requirement as shown on Exhibit III, for each of the various costs. Annual power cost has been calculated by the application of $0.15 per MM Btu fuel cost, 9800 Btu/kwh, and 8000 hours operation per year.

4. Other differential operating and maintenance cost. This is a relative cost item based upon the estimated additional cost of wet cooling towers and spray modules over the once-through systems. The estimate is based upon the assumption of a 10-year average life for the spray modules, mechanical draft towers and a portion (30%) of the natural draft towers.

5. Net generating capability penalty. This penalty covers the incremental cost of replacing the differential power lost through pump, fan and spray module power, plus differential capability loss through higher turbine back pressures. This Latter item has been calculated at the following ambient conditions:

   (a) 65°F maximum ocean water temperature for the once-through systems

   (b) 75°F wet bulb temperature for the closed cycle spray and wet cooling tower systems

   (c) 90°F dry bulb temperature for the dry cooling towers

   The incremental value of the capability penalty has been estimated at $120/kW at the 1972 price level and $160/kW escalated to 1980. The annual cost of the capability penalty is obtained by the application of the fixed charge rate of 15% to the foregoing $/kW evaluation.

The evaluated cost figures shown on Exhibit I and II have been capitalized, i.e., made equivalent to a lump sum capital cost, by dividing the annual cost by the fixed charge rate. In the case of Item I above, this "capitalized" value is identical with the estimated investment. In the case of Item 5 above, this value is identical to $120/kW or $160/kW, respectively.

C. OPTIMIZATIONS

In order to make an equitable comparison of the various basic systems, economic optimizations have been made of the various plans, using the economic evaluation procedures outlined in Section B above. The optimization studies are as follows:

1. Once-Through System Temperature Rise Optimization

   Exhibit XXI is a chart of total evaluated comparable cost vs. condenser temperature rise. The lowest, or optimum, cost is near the 40-45° temperature rise range.

2. Once-Through System Pipe Size Optimization

   Exhibit XXI is a chart of pipe diameter vs. evaluated comparable cost for a 15°F temperature rise system and a 45°F temperature rise system.

3. Wet Cooling Tower Optimization

   Exhibit XXII is a chart of cooling tower cooling range and approach to wet-bulb temperature vs. comparable evaluated cost for both the natural draft tower and the mechanical draft tower. The optimum natural draft cooling tower has a cooling range of 25°F and a cooled water approach to a 75°F wet-bulb temperature of 20°F.

   The optimum mechanical draft tower has a cooling range of 27°F and a cooled water approach to a 75°F wet-bulb temperature of 13°F.

   These optimum towers were used in the study for comparison with other plans.

4. Power Spray Module Optimization

Exhibit XXIII is a chart of comparable evaluated cost vs. turbine maximum back pressure. The use was made of turbine back pressure in the comparison because the turbine units presently manufactured in the U.S. are limited by their manufacturers to 5.0 in. Hg abs back pressure. The optimization chart (Exhibit XXIII) indicated that 5.0 in. Hg abs back pressure is approximately optimum. If the optimum back pressure had been higher than 5.0 in., the comparison with other plans would have utilized the number of power spray modules which would have limited the back pressure to 5.0 in. Hg abs.

The optimum number of power spray modules is 312.

5. Condenser Optimization

In all of the foregoing optimization studies the optimum sizing of the condenser was calculated for each "point" on the optimization chart (i.e., for each trial temperature rise, cooling tower approach, etc.).

In all cases, the condensers were selected to be installed with tubes perpendicular to the turbine axis. This limited the tube lengths to a range of 37 feet to 51 feet in order to conveniently fit the turbine foundation setting. This requirement in turn required a variation in tube diameter (assuming a fixed tube velocity).

In all cases, except the 15^{o} rise once-through system, the condenser optimization is limited by a minimum terminal temperature difference of 5^{o}F.

Optimum condenser data is tabulated on Exhibit III.

6. Dry Cooling Tower Optimization

The optimization of the dry cooling tower system was not included in this study. Instead, the size selection was in the optimum range of initial temperature difference recommended in a study prepared for the Environmental Production Agency, Water Quality Office, and entitled "Research on Dry-Type Cooling Towers for Thermal Electric Generation -- Part I".

D. INVESTMENT ESTIMATES

The base investment estimates were made at 1972 price levels for material and labor. Material prices on major material and equipment were obtained by vendor quotation. Check prices were obtained from two vendors for major material and equipment where feasible.

Material quotations were obtained as follows:

Concrete Pipe:	Price Brothers Company Interpace Corporation
Circulating Water Pumps & Motors:	Allis-Chalmers Corporation
Mechanical Draft Cooling Tower:	Marley Company Fluor Corporation
Natural Draft Cooling Towers:	Marley Company Fluor Corporation
Dry Cooling Towers:	Hudson Products Corp.
Condensers:	Ingersoll-Rand Co. Westinghouse Corp. (Price Book)
Electrical Equipment:	Allis-Chalmers Corp.
Power Spray Modules:	Ceramic Cooling Tower Co.

Labor Costs were estimated on the basis of experience with comparable construction.

Investment estimates include allowances for indirect construction costs, overhead and administration costs, and interest during construction.

Costs at 1972 level were escalated to the price level expected to be in effect for plant operating date of 1979 and 1980. Material prices were escalated at a rate of 4% per year (compounded). Labor costs were escalated at 5½% per year compounded.

Exhibits IV through XVI are tabulations of the estimates at the 1972 price level and as escalated for 1979-1980 operation.

SUMMARY OF EVALUATED COSTS
CONDENSING WATER STUDY
TWO - 1150 MW NUCLEAR UNITS
1972 PRICE LEVEL $1000

	ONCE - THROUGH - OPEN SYSTEMS										CLOSED SYSTEMS			
	INTAKE ON OCEAN SHORE				INLAND INTAKE NEAR PLANT						WET COOLING TOWERS		POWER SPRAY MODULES	DRY COOLING TOWERS
									STORAGE RESERVOIR FOR LOW-TIDE OPERATION		NATURAL DRAFT	MECH. DRAFT		
TEMPERATURE RISE °F (@ 2300 MW NET)	15		45		15		45		15	45	25	27	25	37
TYPE OF INLET TO INTAKE	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL
ESTIMATED COMPARABLE - INVESTMENT	102147	104848	57411	66501	120674	76959	65493	42161	87955	48549	55644	48618	35349	90398
CAPITALIZED DIFFERENTIAL ANNUAL FUEL COST RESULTING FROM BACK PRESSURE	*BASE*	*BASE*	570	570	*BASE*	*BASE*	570	570	*BASE*	570	3388	973	5534	5081
CAPITALIZED ANNUAL PUMPING, FAN AND SPRAY POWER COST	2215	2044	1715	1654	1825	1395	1349	1150	2255	1440	1339	2789	2228	5975
CAPITALIZED OTHER ANNUAL OPERATING & MAINTENANCE COST	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	200	200	2400	2750	1950	*BASE*
NET GENERATING CAPABILITY PENALTY @ $ 120/KW	1260	756	5902	5806	660	*BASE*	5338	5030	2640	5920	13476	11479	20535	44724
TOTAL COMPARABLE EVALUATED COST	105622	107648	65598	74531	123159	78354	72750	48911	93050	56679	76847	66609	65596	146178
DIFFERENTIAL EVALUATED COST	56711	58737	16687	25620	74248	29443	23839	*BASE*	44139	7768	27936	17698	16685	97267

EXHIBIT I

SUMMARY OF EVALUATED COSTS
CONDENSING WATER STUDY
TWO - 1150 MW NUCLEAR UNITS
COSTS ESCALATED FOR 1979 - 80 OPERATING DATES $1000

	ONCE - THROUGH - OPEN SYSTEMS										CLOSED SYSTEMS			
	INTAKE ON OCEAN SHORE				INLAND INTAKE NEAR PLANT						WET COOLING TOWERS		POWER SPRAY MODULES	DRY COOLING TOWERS
									STORAGE RESERVOIR FOR LOW - TIDE OPERATION		NATURAL DRAFT	MECH. DRAFT		
TEMPERATURE RISE °F (@ 2300 MW NET) TYPE OF INLET TO INTAKE	15		45		15		45		15	45	25	27	25	37
	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL
ESTIMATED COMPARABLE INVESTMENT	140165	144318	79154	92046	166169	106632	90345	58224	120700	66694	74623	65889	47650	122433
CAPITALIZED DIFFERENTIAL ANNUAL FUEL COST RESULTING FROM BACK PRESSURE	*BASE*	*BASE*	570	570	*BASE*	*BASE*	570	570	*BASE*	570	3388	973	5534	5081
CAPITALIZED ANNUAL PUMPING, FAN, AND SPRAY POWER COST	2215	2044	1715	1654	1825	1395	1349	1150	2255	1440	1939	2789	2228	5975
CAPITALIZED OTHER ANNUAL OPERATING & MAINTENANCE COST	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	*BASE*	260	260	3200	3600	2600	*BASE*
NET GENERATING CAPABILITY PENALTY @ $160 / KW	1680	1010	7900	7750	880	*BASE*	7100	6700	3520	7900	18250	15300	27300	59700
TOTAL COMPARABLE EVALUATED COST	144060	147372	89339	102020	168874	108027	99364	66644	126735	76864	101400	88551	85312	193189
DIFFERENTIAL EVALUATED COST	77416	80728	22695	35376	102230	41383	32720	*BASE*	60091	10220	34756	21907	18668	126545

EXHIBIT II

GENERAL DATA

	ONCE - THROUGH - OPEN SYSTEMS												CLOSED SYSTEMS			
	OCEAN INTAKE				INLAND INTAKE NEAR PLANT								WET COOLING TOWERS		POWER SPRAY MODULES	DRY COOLING TOWERS
									STORAGE RESERVOIR FOR LOW - TIDE OPERATION				NATURAL DRAFT	MECH. DRAFT		
	15		45		15		45		15		45		25	27	25	37
TEMPERATURE RISE °F	PIPE		CHANNEL		PIPE		CHANNEL		PIPE		CHANNEL		PIPE	CHANNEL	PIPE	CHANNEL
DESIGN WET BULB TEMP. & COLD WATER APPROACH F													75 - 20	75 - 13	75 - 28	
DESIGN DRY BULB TEMP. & COLD WATER APPROACH																90 - 67
TURBINE MAX. BACK PRESS AT DES. COLD WATER TEMP.	2.00		3.00		2.00		3.00		2.00		3.00		4.00	3.50	5.00	9.00
DIFF. MAX. GENERATING CAPABILITY - KW	BASE		-45080		BASE		-45080		BASE		-45080		-105340	-77800	-160464	-314000
TOTAL PUMP, FAN & SPRAY POWER - KW	28400(1)	26200(2)	22000(1)	21200(2)	23400(1)	17900(2)	17300(1)	14740(2)	39900		22180		24860	35760	28560	76600
NET DIFF. PLANT GENERATING CAPABILITY LOSS - KW	10500	6300	49180	48380	5500	BASE	44480	41920	22000		49360		112300	95660	171124	372700
CONDENSER																
90-10 Cu.Ni TUBES, #18 Bwg. 7.0 fps TUBE VEL.																
SURFACE - 59 FT. (each unit)	575,000		800,000		575,000		800,000		575,000		800,000		930,000	890,000	940,000	Spray Type
NUMBER OF PASSES	1		2		1		2		1		2		2	2	2	
TUBE DIA AND LENGTH	1-1/4" OD x 37'-0"		7/8" OD x 37'-0"		1-1/4" OD x 37'-0"		7/8" OD x 51'-0"		1¼" OD x 51'-0"		[illegible]" OD x 51'-0"		[illegible]" OD x 47'-0"	1" OD x 47'-0"	1[illegible]" OD x 45'-0"	
CIRCULATING WATER PUMPING																
PUMPING HEAD - FEET																
CONDENSER	8.1(1)	8.1(2)	29.5(1)	29.5(2)	8.1(1)	8.1(2)	29.5(1)	29.5(2)	8.1(3)	-(4)	29.5(3)	-(4)	21.0	22.3	20.1	66.5
INTAKE & CONDENSER FITTINGS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	-	5.0	-	5.0	5.0	5.0	
PIPE LINE	37.2	33.2	85.2	81.2	21.6 7.0	18.0 -	51.2 8.2	45.0 -	18.0 -	8.0 31.0	45.0 -	3.0 31.0	5.0	5.0	5.0	19.0
VELOCITY HEAD	2.2	2.2	2.4	2.4	2.0	2.0	2.4	2.4	2.0	2.0	2.4	2.4	2.0	2.0	2.0	
STATIC LIFT	-	-	-	-	-	-	-	-	-	-	-	-	62.0	41.0	-	60.5
TOTAL PUMPING HEAD	52.5	48.5	122.1	118.1	43.7	33.1	96.3	81.9	33.1	41.0	81.9	41.4	95.0	75.3	32.1	146.0
CIRCULATING WATER FLOW - EACH UNIT - GPM	1,067.000		355.000		1,067.000		355.000		1,067.000		355.000		640,000	592.500	535.000	473,000
PUMP POWER - EACH UNIT - Bhp & 85% PUMP efs	17100 -	15800	13300 -	12800	14100 -	11800	10400 -	8900	11800-13400		8900 - 4500		18200	13600	5250	20500
PUMP POWER - EACH UNIT - KW @ 90% ELEV. efs	14200 -	13100	11000 -	10600	11700 -	8950	8650 -	7370	8950-1100		7370 - 3720		12200	11300	4350	17000
NUMBER OF PUMPS - EACH UNIT	4		3		4		3		4	3	3	1	4	3	2	2
PUMP CAPACITY - EACH - GPM	267,000		120,000		267,000		120,000		267000-360000		120000-360000		160000	200000	267000	267500
MOTORS SIZE - Bhp	5000 -	4000	5000 -	50000	4000 -	3000	40000 -	30000	3000 - 5000		3000 - 5000		5000	5000	3000	11000
MOTORS SIZE - RPM	234		391		234		352		234 - 234		352 - 234		293	293	207	234
PUMP BELL DIA. X DISCHARGE NOZZLE - IN.	156 x 108		96 x 66		156 x 108		96 x 66		156x108-168x120		96x66 - 168x120		114 x 78	114 x 78	156 x 108	
COOLING TOWER FANS																
NUMBER OF FANS - EACH UNIT														40		52
FAN POWER - EACH FAN - Bhp														192		495
TOTAL Bhp - EACH UNIT														7680		25700
TOTAL FAN POWER-EACH UNIT-KW														6350		21300
MOTOR SIZE & SPEED														200 -		600 - 1800

(1) Pipe Suction to Intake (2) Channel to Intake (3) Circulating Water Pumps (4) Reservoir Make-up Pumps

SUMMARY OF EVALUATED COSTS
CONDENSING WATER STUDY
TWO - 1150 MW NUCLEAR UNITS
1972 PRICE LEVEL $1000

	ONCE - THROUGH - OPEN SYSTEMS										CLOSED SYSTEMS			
	INTAKE ON OCEAN SHORE				INLAND INTAKE NEAR PLANT						WET COOLING TOWERS		POWER SPRAY MODULES	DRY COOLING TOWERS
									STORAGE RESERVOIR FOR LOW - TIDE OPERATION		NATURAL DRAFT	MECH. DRAFT		
TEMPERATURE RISE °F	15		45		15		45		15	45	25	27	25	37
	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL	PIPE	CHANNEL
POWER SPRAY MODULES														
NUMBER OF SPRAY MODULES - TWO UNITS													312	
CANAL LENGTH - FEET													6240	
SPRAY PUMP POWER - EACH PSM - BHP													75	
SPRAY PUMP POWER - EACH UNIT - BHP													11700	
SPRAY PUMP POWER - EACH UNIT - KW													9700	
MAKE-UP PUMPING STATION														
NUMBER OF PUMPS, TWO UNITS											2	2	2	
PUMP CAPACITY, EACH PUMP, GPM-HEAD (feet)											25000-36	25000-36	25000-36	
MOTOR SIZE - BHP											300	300	300	
MOTOR SIZE - RPM											590	590	590	
MOTOR POWER REQUIRED-KW											230	230	230	
PUMP SUCTION PIPE SIZE - DIA (inches)											60	60	60	
BLOW-DOWN PIPE-LINE TO OCEAN														
PIPE - SIZE - INCHES											36	36	36	
MAXIMUM BLOW-DOWN - TWO UNITS - GPM											12000	12000	12000	
APPROXIMATE LENGTH OF PIPE - FEET											12000	12000	12000	
MAIN PIPE SIZE														
PUMP DISCHARGE PIPE - EACH UNIT	1 - 16'-0"		1 - 9'-0"		1 - 16'-0"		1 - 9'-0"		1-16'-0"	1-9'-0"	1-12'-0"	1-12'-0"	1-11'-0"	1-8'-6"
PUMP SUCTION PIPE - EACH UNIT	3 - 11'-0" (1)		1 - 11'-0" (1)		6 - 14'-0" (1)		2 - 14'-0" (1)		--	--	1-16'-0"	1-16'-0"	--	1-9'-6"
(1) For Pipe Suction-Alternate														
AVERAGE BACK PRESSURE & HEAT RATE														
AVERAGE ANNUAL BACK PRESSURE - In. Hg. Abs.	1.31		1.78		1.31		1.78		1.31	1.78	2.60	2.05	3.20	3.00
AVERAGE TURBINE NET HEAT RATE - Btu/Kwh	9547		9581		9547		9581		9547	9581	9749	9605	9871	9850
DIFFERENTIAL AVERAGE HEAT RATE - Btu/Kwh	Base		34		Base		34		Base	34	202	58	330	303

ESTIMATED INVESTMENT - INTAKE ON OCEAN SHORE

15° TEMP. RISE - BURIED PIPE INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1094	6064	7158			
CIRCULATING WATER PUMPS	120	3680	3800			
CIRCULATING WATER PUMP MOTORS	136	1380	1516			
TRAVELING WATER SCREENS	50	750	800			
HOT WATER RECIRC. PIPE		391	391			
SCREEN WASH FACILITIES	125	175	300			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND	420	180	600			
INTAKE & DISCHARGE STRUCTURES	3350	2428	5778			
INTAKE CHANNEL OR PIPE	4330	4330	8660			
CONCRETE PIPE - MATERIAL		25300	25300			
CONCRETE PIPE CONSTRUCTION	26449		26449			
ELECTRICAL WORK	217	649	865			
SUB-TOTAL	36301	45417	81718	52636	59496	112132
INDIRECT & OVERHEAD COSTS			20429			28033
TOTAL ESTIMATED COST			102147			140165

EXHIBIT IV

ESTIMATED INVESTMENT - INTAKE ON OCEAN SHORE
15° TEMP. RISE - OPEN CHANNEL INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1094	6064	7158			
CIRCULATING WATER PUMPS	100	3300	3400			
CIRCULATING WATER PUMP MOTORS	111	1105	1216			
TRAVELING WATER SCREENS	50	750	800			
HOT WATER RECIRC. PIPE		391	391			
SCREEN WASH FACILITIES	125	175	300			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND	420	180	600			
INTAKE & DISCHARGE STRUCTURES	2280	1663	3943			
INTAKE CHANNEL OR PIPE	8955	4400	13355			
CONCRETE PIPE - MATERIAL		25300	25300			
CONCRETE PIPE - CONSTRUCTION	26449		26449			
ELECTRICAL WORK (ex. pump motors)	217	649	866			
SUB-TOTAL	39811	44067	83878	57726	57728	115454
INDIRECT & OVERHEAD COSTS			20970			28864
TOTAL ESTIMATED COST			104848			144318

EXHIBIT V

ESTIMATED INVESTMENT - INTAKE ON OCEAN SHORE

45° TEMP. RISE - BURIED PIPE INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1282	7398	8680			
CIRCULATING WATER PUMPS	70	980	1050			
CIRCULATING WATER PUMP MOTORS	100	1040	1140			
TRAVELING WATER SCREENS	30	450	480			
HOT WATER RECIRC. PIPE		161	161			
SCREEN WASH FACILITIES	100	150	250			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND		*BASE*				
INTAKE & DISCHARGE STRUCTURES	1910	1385	3295			
INTAKE CHANNEL OR PIPE	1576	1576	3152			
CONCRETE PIPE - MATERIAL		9550	9550			
CONCRETE PIPE - CONSTRUCTION	17325		17325			
ELECTRICAL WORK	136	610	746			
SUB-TOTAL	22539	23390	45929	32682	30641	63323
INDIRECT & OVERHEAD COSTS			11482			15831
TOTAL ESTIMATED INVESTMENT			57411			79154

EXHIBIT VI

ESTIMATED INVESTMENT - INTAKE ON OCEAN SHORE

45° TEMP. RISE - OPEN CHANNEL INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1282	7398	8680			
CIRCULATING WATER PUMPS	70	980	1050			
CIRCULATING WATER PUMP MOTORS	86	864	950			
TRAVELING WATER SCREENS	30	450	480			
HOT WATER RECIRC. PIPE		161	161			
SCREEN WASH FACILITIES	100	150	250			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND		*BASE*				
INTAKE & DISCHARGE STRUCTURES	1230	892	2122			
INTAKE CHANNEL OR PIPE	7900	3877	11777			
CONCRETE PIPE - MATERIAL		9560	9560			
CONCRETE PIPE - CONSTRUCTION	17325		17325			
ELECTRICAL WORK (ex. pump motors)	136	610	746			
SUB-TOTAL	28169	25032	53201	40845	32792	73637
INDIRECT & OVERHEAD COSTS			13300			18409
TOTAL ESTIMATED COST			66501			92046

EXHIBIT VII

ESTIMATED INVESTMENT - INLAND INTAKE NEAR PLANT

15° TEMP. RISE - BURIED PIPE INTAKE FROM OCEAN

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1094	6064	7158			
CIRCULATING WATER PUMPS	100	3300	3400			
CIRCULATING WATER PUMP MOTORS	109	1107	1216			
TRAVELING WATER SCREENS	50	800	850			
HOT WATER RECIRC. PIPE		100	100			
SCREEN WASH FACILITIES	125	175	300			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND	420	180	600			
INTAKE & DISCHARGE STRUCTURES	5150	3721	8871			
INTAKE CHANNEL OR PIPE	-	-	-			
CONCRETE PIPE - MATERIAL		34300	34300			
CONCRETE PIPE - CONSTRUCTION	39100		39100			
ELECTRICAL WORK	109	435	544			
SUB-TOTAL	46267	50272	96539	67087	65856	132935
INDIRECT & OVERHEAD COSTS			24135			33234
TOTAL ESTIMATED INVESTMENT			120674			166169

EXHIBIT VIII

ESTIMATED INVESTMENT - INLAND INTAKE NEAR PLANT

15° TEMP. RISE - OPEN CHANNEL INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1094	6064	7158			
CIRCULATING WATER PUMPS	100	3300	3400			
CIRCULATING WATER PUMP MOTORS	83	827	910			
TRAVELING WATER SCREENS	50	800	850			
HOT WATER RECIRC. PIPE		100	100			
SCREEN WASH FACILITIES	125	175	300			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND	420	180	600			
INTAKE & DISCHARGE STRUCTURES	2280	1663	3943			
INTAKE CHANNEL OR PIPE	11075		11075			
CONCRETE PIPE - MATERIAL		14700	14700			
CONCRETE PIPE - CONSTRUCTION	17886		17887			
ELECTRICAL WORK (ex. pump motors)	109	435	544			
SUB-TOTAL	33233	28334	61567	48188	37118	85306
INDIRECT & OVERHEAD COSTS			15392			21326
TOTAL ESTIMATED COST			76959			106632

EXHIBIT IX

ESTIMATED INVESTMENT - INLAND INTAKE NEAR PLANT

45° TEMP. RISE - BURIED PIPE INTAKE FROM OCEAN

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1282	7398	8680			
CIRCULATING WATER PUMPS	70	980	1050			
CIRCULATING WATER PUMP MOTORS	72	690	762			
TRAVELING WATER SCREENS	30	500	530			
HOT WATER RECIRC. PIPE		80	80			
SCREEN WASH FACILITIES	100	150	250			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND		*BASE*				
INTAKE & DISCHARGE STRUCTURES	3320	2406	5726			
CONCRETE PIPE - MATERIAL		13770	13770			
CONCRETE PIPE - CONSTRUCTION	21030		21030			
ELECTRICAL WORK	82	334	416			
SUB-TOTAL	25996	26398	52394	37694	34581	72276
INDIRECT & OVERHEAD COSTS			13099			18069
TOTAL ESTIMATED INVESTMENT			65493			90345

EXHIBIT X

ESTIMATED INVESTMENT - INLAND INTAKE NEAR PLANT

45° TEMP. RISE - OPEN CHANNEL INTAKE

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1282	7398	8680			
CIRCULATING WATER PUMPS	70	980	1050			
CIRCULATING WATER PUMP MOTORS	70	650	720			
TRAVELING WATER SCREENS	30	500	530			
HOT WATER RECIRC. PIPE		80	80			
SCREEN WASH FACILITIES	100	150	250			
OTHER MECHANICAL INTAKE FACILITIES	10	90	100			
CIVIL WORK IN PLANT ISLAND		*BASE*				
INTAKE & DISCHARGE STRUCTURES	1230	402	2132			
INTAKE CHANNEL OR PIPE	4095		4095			
CONCRETE PIPE - MATERIAL		5550	5550			
CONCRETE PIPE - CONSTRUCTION	10126		10126			
ELECTRICAL WORK (ex pump motors)	82	334	416			
SUB-TOTAL	17095	16634	33729	24788	21791	46579
INDIRECT & OVERHEAD COSTS			8432			11645
TOTAL ESTIMATED COST			42161			58224

EXHIBIT XI

ESTIMATED INVESTMENT - INLAND INTAKE NEAR PLANT

45° TEMP. RISE - STORAGE RESERVOIR FOR LOW TIDE OPERATION

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1282	7398	8680			
CIRCULATING WATER PUMPS	70	980	1050			
PUMPED RESERVOIR MAKE-UP PUMPS	60	940	1000			
CIRCULATING WATER PUMP MOTORS	70	650	720			
RESERVOIR MAKE-UP PUMP MOTORS	30	330	360			
TRAVELING WATER SCREENS	60	1000	1060			
HOT WATER RECIRCULATION		80	80			
SCREEN WASH FACILITIES	200	300	500			
OTHER MECHANICAL INTAKE FACILITIES	15	135	150			
CIVIL WORK IN PLANT ISLAND		*BASE*				
INTAKE & DISCHARGE STRUCTURES	1230	892	2122			
RESERVOIR MAKE-UP PUMP STRUCTURES	730	520	1250			
PUMP STORAGE RESERVOIR	796	530	1321			
PUMP STORAGE PIPE LINES	2180	1190	3370			
INTAKE CHANNEL	663		663			
CONCRETE DISCHARGE PIPE - MATERIAL		5550	5550			
CONCRETE PIPE CONSTRUCTION	10126		10126			
ELECTRICAL WORK (ex. pump motors)	170	662	832			
SUB-TOTAL	17682	21157	38839	25639	27716	53355
INDIRECT & OVERHEAD COSTS			9710			13339
TOTAL ESTIMATED INVESTMENT			48549			66694

EXHIBIT XIII

ESTIMATED INVESTMENT - NATURAL DRAFT & MECHANICAL DRAFT
WET COOLING TOWERS

DESCRIPTION	NATURAL DRAFT TOWERS						MECHANICAL DRAFT TOWERS					
	1972 $1000			ESCALATED 1979-80 $1000			1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1348	9140	10488				1336	8490	9826			
CIRCULATING WATER PUMPS	80	2000	2080				80	2020	2100			
CIRCULATING WATER PUMPS MOTORS	126	1250	1376				90	940	1030			
ELECTRICAL FACILITIES	137	475	612				402	1644	2046			
MAKE-UP PUMPS & MOTORS	6	64	70				6	64	70			
MAKE-UP INTAKE & SUCTION PIPE	270	230	500				270	230	500			
BLOW-DOWN FACILITIES	557	450	1007				557	450	1007			
CIVIL WORK IN PLANT ISLAND	230	95	325				193	82	275			
PIPE LINES	1672	1600	3272				3380	3252	6632			
COOLING TOWERS, ERECTED		17250	17250					6820	6820			
COOLING TOWER BASINS	--	--	--				1050	450	1500			
COOLING TOWER FOUNDATIONS	4000	1035	5035				4050	1038	5088			
CIRCULATING WATER INTAKE STRUCTURE	1450	1050	2500				1160	840	2000			
SUB-TOTAL	9876	34539	44515	14320	45377	59698	12574	28320	38894	18232	34479	52711
INDIRECT & OVERHEAD COSTS			11129			14925			9724			13178
TOTAL ESTIMATED INVESTMENT			55644			74623			46818			65889

EXHIBIT XIV

ESTIMATED INVESTMENT - CLOSED CIRCUIT CANAL

SPRAY MODULE COOLING

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
CONDENSERS, INSTALLED	1334	8860	10194			
POWER SPRAY MODULES - MATERIAL		4866	4866			
POWER SPRAY MODULES - ERECTION & MOORING	300	400	700			
CIRCULATING WATER PUMPS	80	1620	1700			
CIRCULATING WATER PUMP MOTORS	48	472	520			
SPRAY WATER CANAL CONSTRUCTION	2870	--	2870			
ELECTRICAL FACILITIES	650	2456	3106			
MAKE-UP PUMPS & MOTORS	6	64	70			
MAKE-UP INTAKE & SUCTION PIPE	270	230	500			
BLOW-DOWN FACILITIES	557	450	1007			
CIVIL WORK IN PLANT ISLAND	210	90	300			
PIPE LINES	350	335	685			
CIRCULATING WATER INTAKE STRUCTURES	1000	761	1761			
SUB-TOTAL	7675	20604	28279	11129	26991	38120
INDIRECT OVERHEAD COSTS			7070			9530
TOTAL ESTIMATED INVESTMENT			35349			47650

EXHIBIT XV

ESTIMATED INVESTMENT - DRY COOLING TOWERS

DESCRIPTION	1972 $1000			ESCALATED 1979-80 $1000		
	LABOR	MATERIAL	TOTAL	LABOR	MATERIAL	TOTAL
DRY COOLING TOWERS - MATERIALS		29522	29522			
DRY COOLING TOWERS - FREIGHT & ERECTION	6099		6099			
DIRECT CONTACT CONDENSERS	453	3700	4153			
CIRCULATING WATER PUMPS & MOTORS	189	3717	3906			
CIRCULATING WATER PIPING & MISC.	6700	6487	13187			
CONDENSATE DUMP, VENT & REFILL SYSTEM	1856	1382	3238			
CIVIL WORK IN PLANT ISLAND	76	32	108			
ELECTRICAL & CONTROL	2255	2695	4950			
AUXILIARY COOLING WATER SYSTEM	200	600	800			
FOUNDATIONS & STRUCTURES	5100	1255	6355			
SUB-TOTAL	22928	49390	72318	33245	64701	97946
INDIRECT & OVERHEAD COSTS			18080			24487
TOTAL ESTIMATED INVESTMENT			90398			122433

EXHIBIT XVI

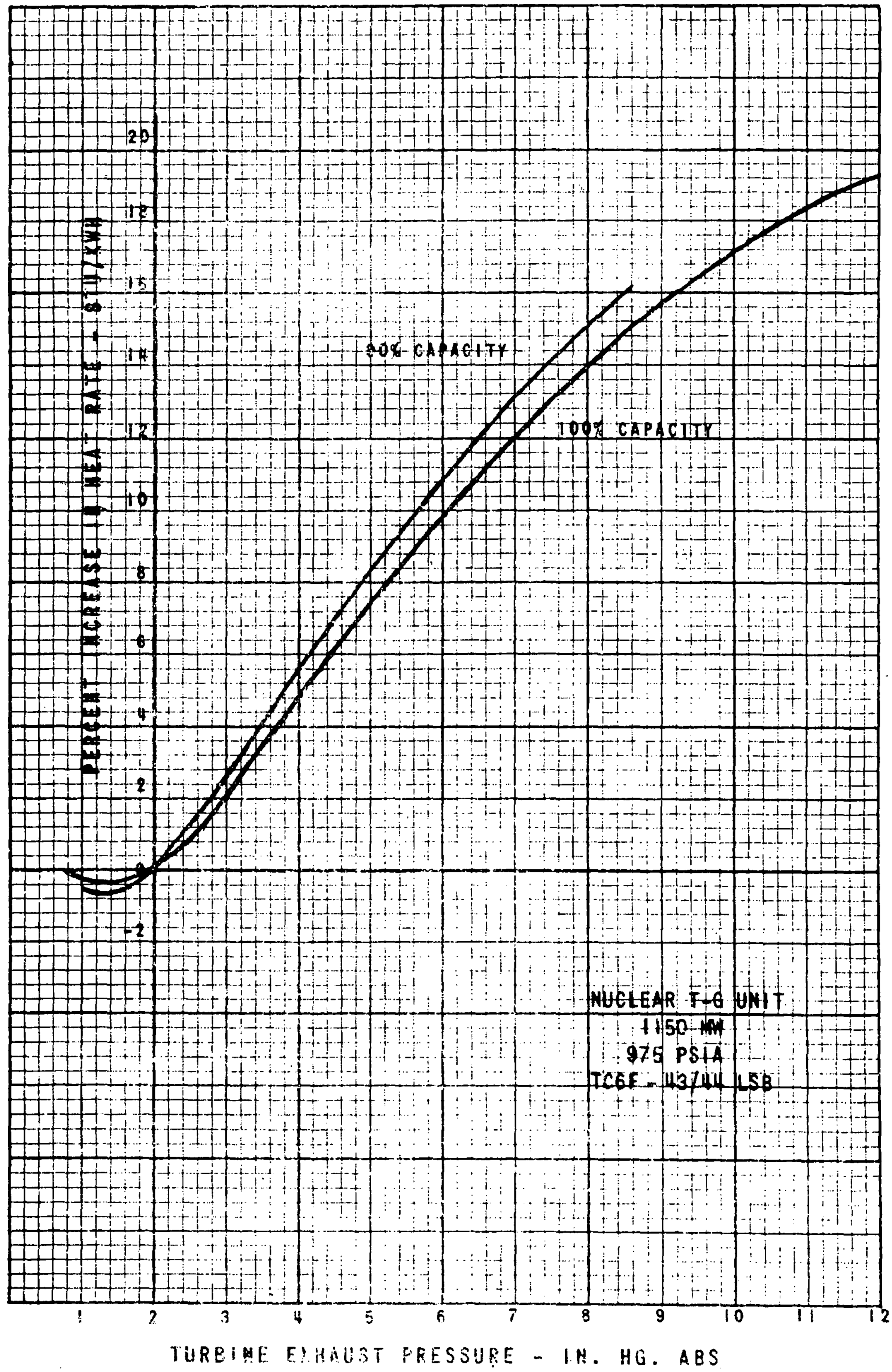


EXHIBIT XVII

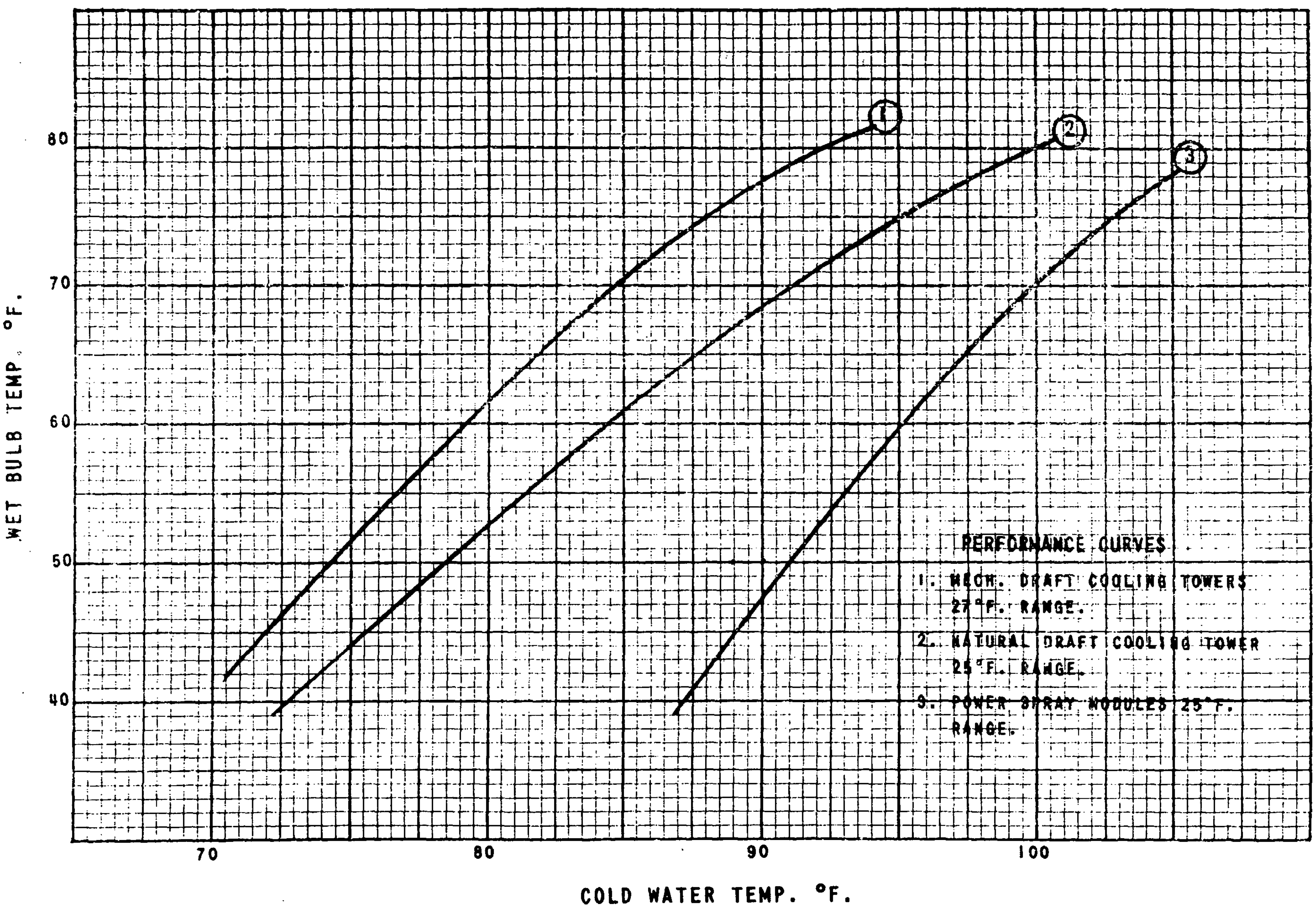
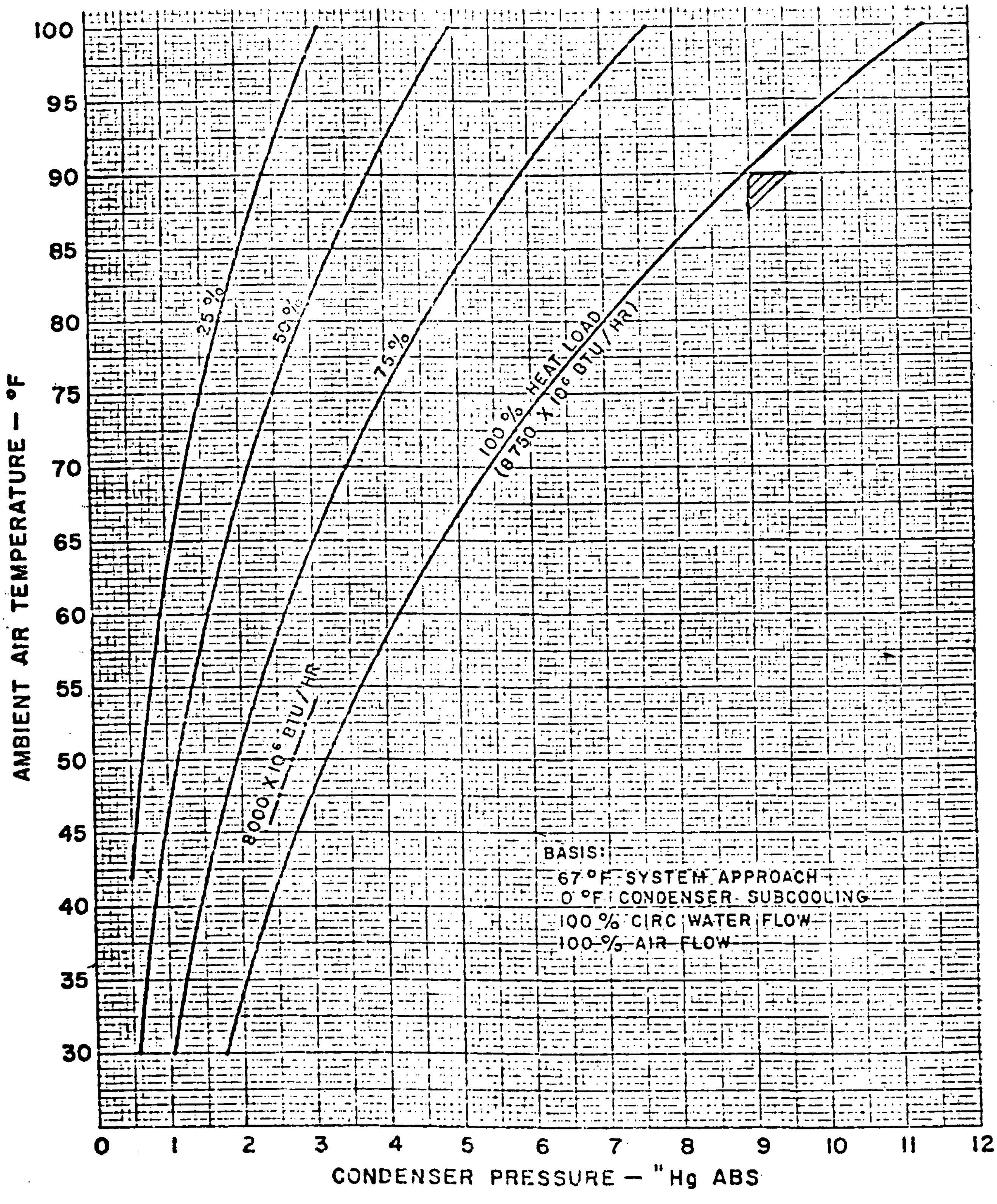


EXHIBIT XVIII



SCALE —	DATE
DRAWN RCH	1-5-7
APPROVED	
REVISED	

THIS PRINT IS THE PROPERTY OF HUDSON PRODUCTS CORPORATION AND SHALL BE RETURNED ON DEMAND. IT SHALL NOT BE TRACED OR REPRODUCED, OR USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTERESTS OF HUDSON PRODUCTS CORP.

FOR:

CHAS. T. MAIN, INC

DRAWING NO:

HUDSON PRODUCTS CORPORATION
HOUSTON, TEXAS

TITLE:

POWER PLANT
(INDIRECT SYSTEM)

CONDENSER PRESSURE VERSUS AMBIENT AIR TEMPERATURE WITH DRY COOLING SYSTEM

EXHIBIT XIX.

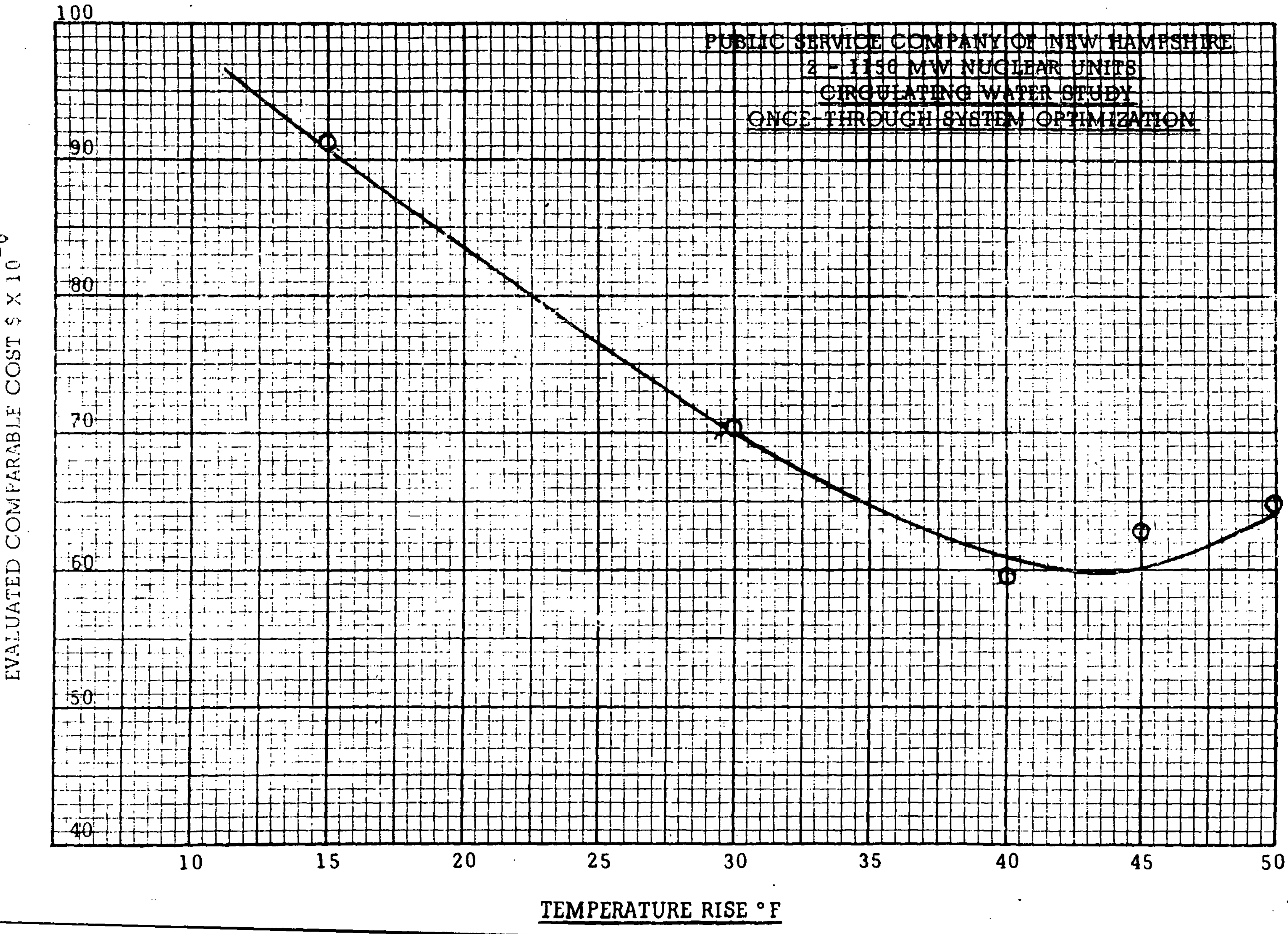

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
2 - 1150 MW NUCLEAR UNITS
CIRCULATING WATER STUDY
ONCE-THROUGH SYSTEM OPTIMIZATION
EVALUATED COMPARABLE COST $ X 10^-6
100
90
80
70
60
50
40
10
15
20
25
30
35
40
45
50
TEMPERATURE RISE °F

EXHIBIT XX

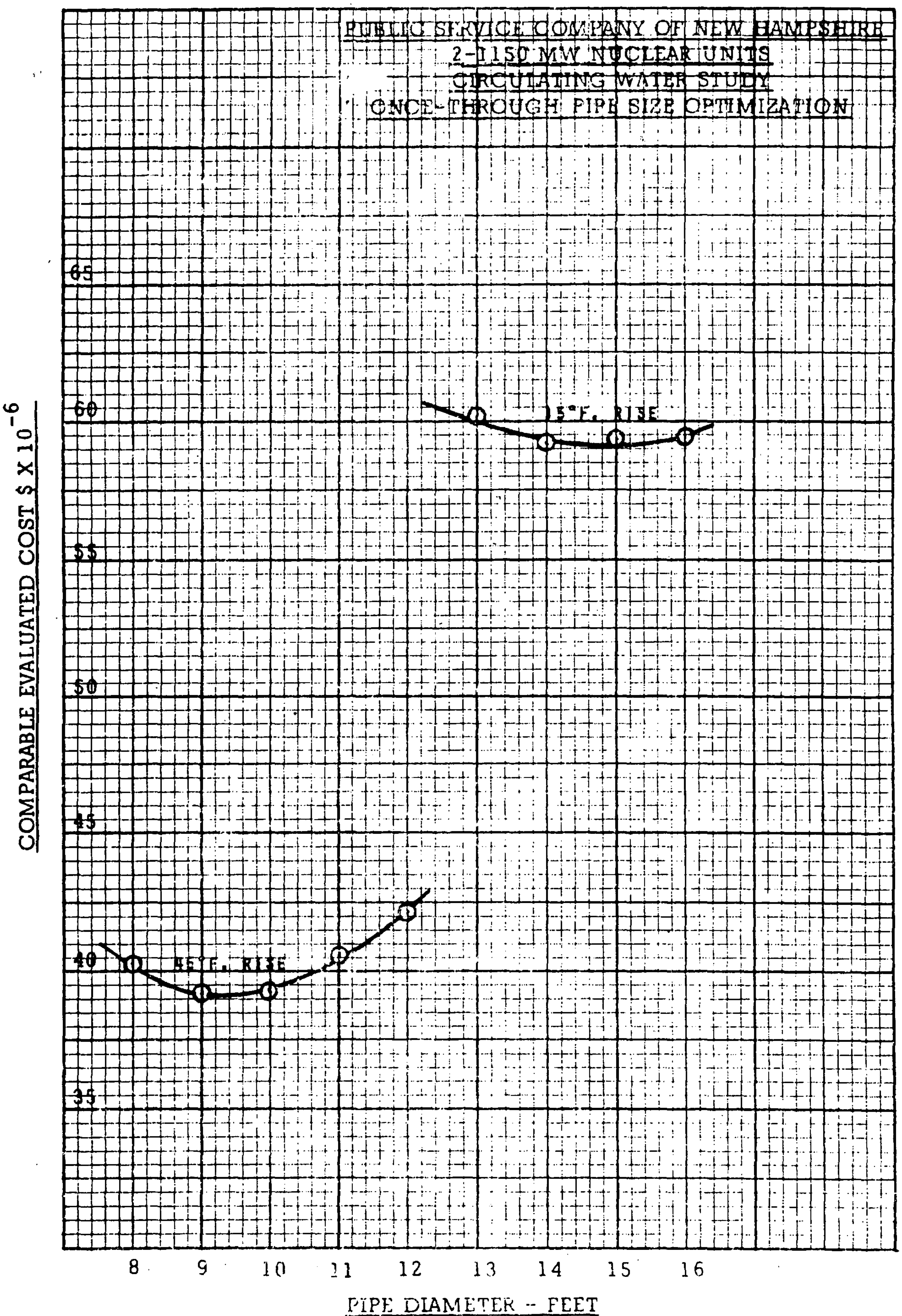

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
2-1150 MW NUCLEAR UNITS
CIRCULATING WATER STUDY
ONCE-THROUGH PIPE SIZE OPTIMIZATION
COMPARABLE EVALUATED COST $ X 10^-6
65
60
55
50
45
40
35
15°F. RISE
8
9
10
11
12
13
14
15
16
PIPE DIAMETER -- FEET

EXHIBIT XXI

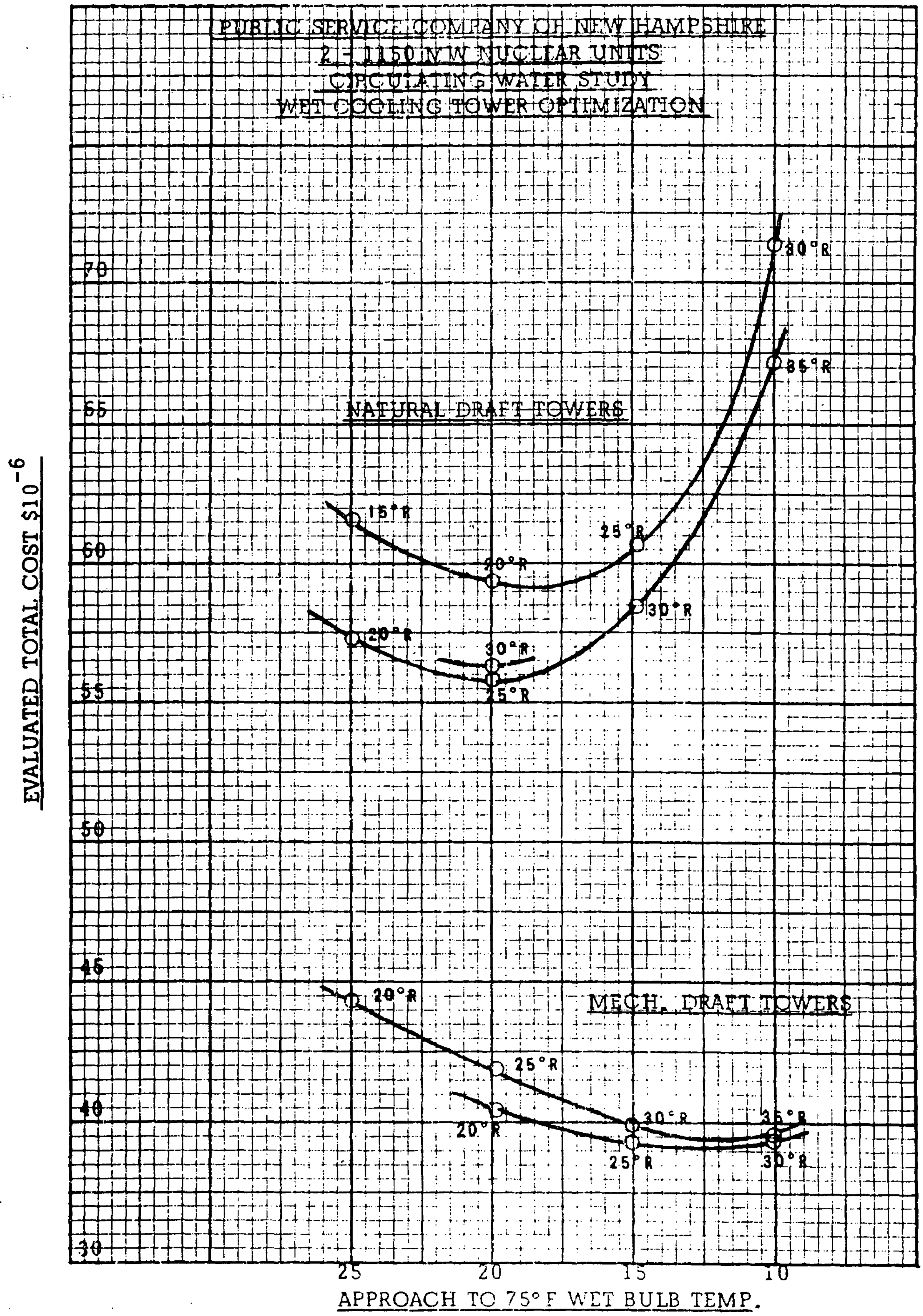


EXHIBIT XXII

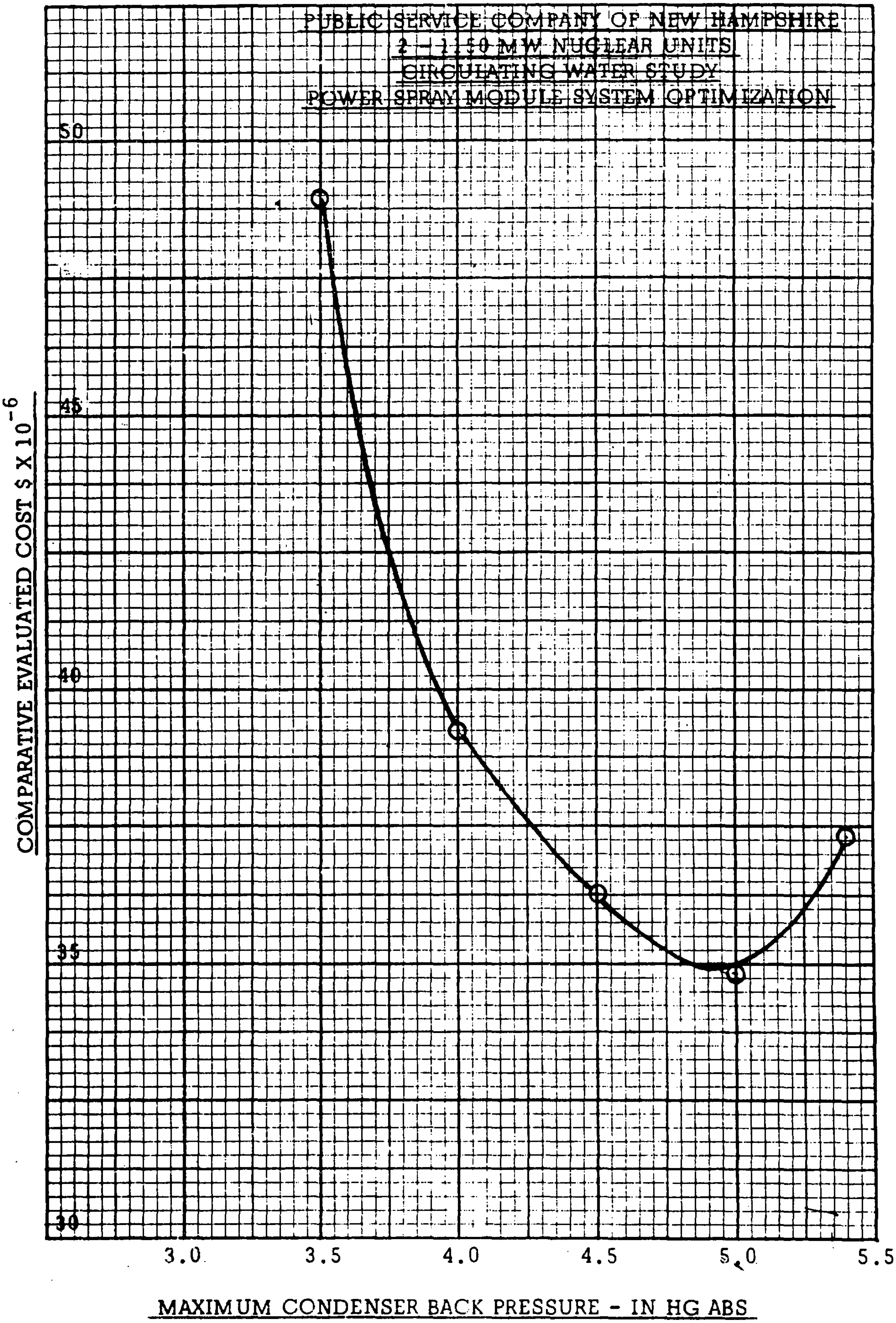
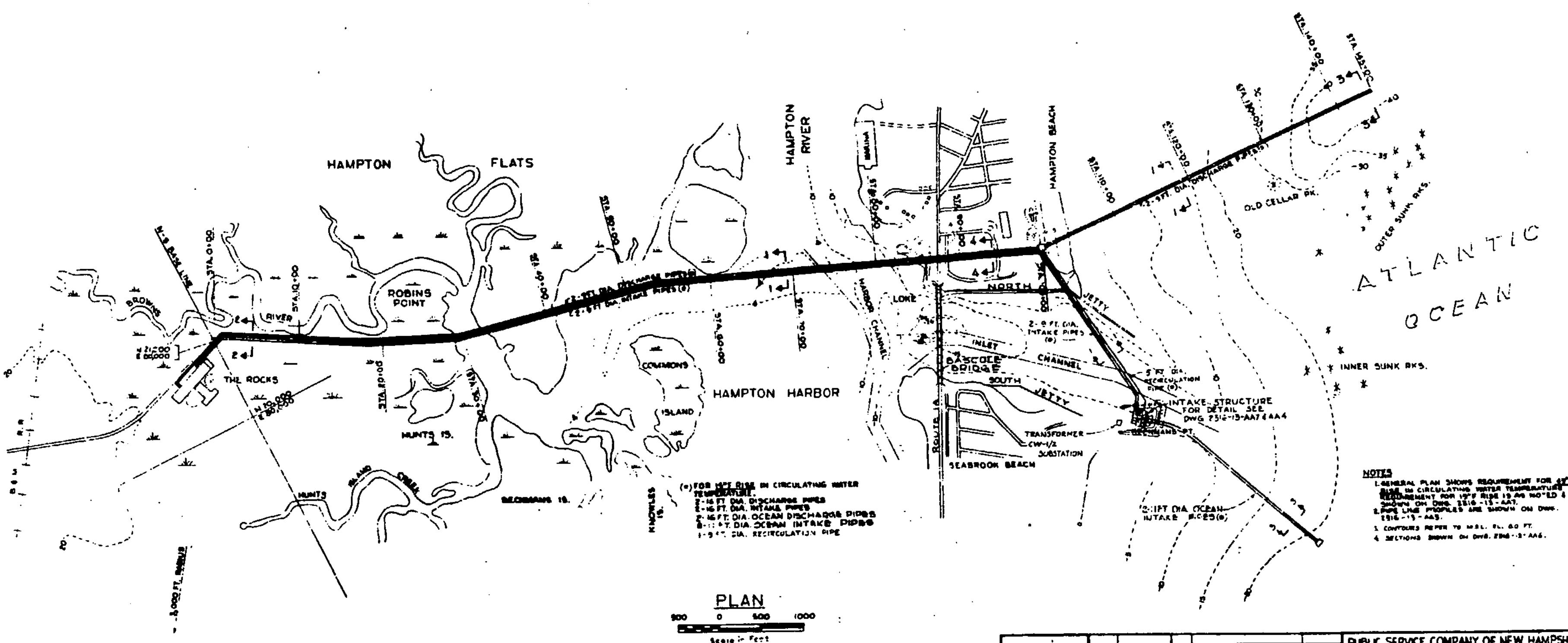


EXHIBIT XXIII



PLAN

900 0 500 1000
Scale in Feet

NOTES

1. GENERAL PLAN SHOWS REQUIREMENT FOR 39°F RISE IN CIRCULATING WATER TEMPERATURE. REQUIREMENT FOR 19°F RISE IS AS NOTED & SHOWN ON DWG. 2316-13-AA7.
2. PIPE LINE PROFILES ARE SHOWN ON DWG. 2316-13-AA5.
3. CONTOURS REFER TO M.S.L. EL. 0.0 FT.
4. SECTIONS SHOWN ON DWG. 2316-13-AA6.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

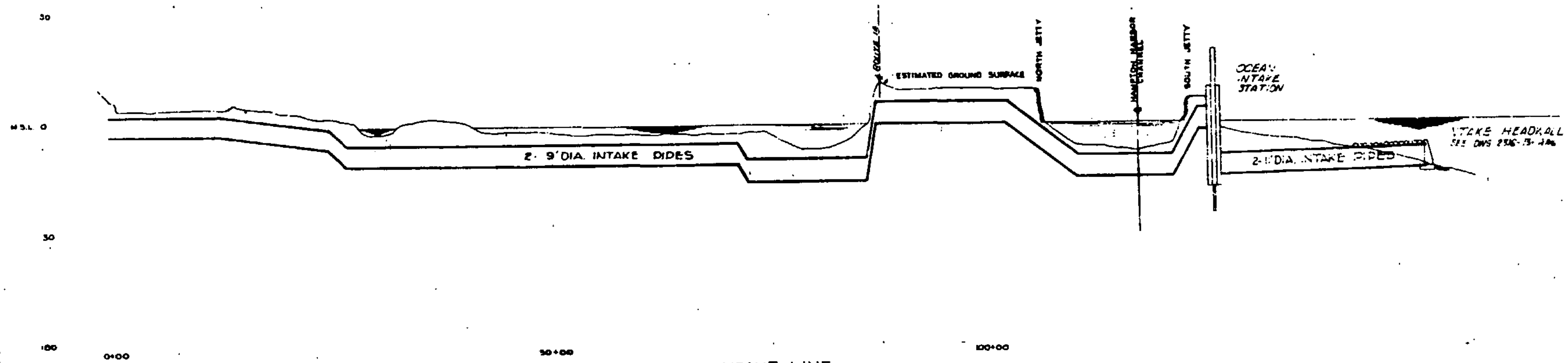
OCEAN INTAKE & DISCHARGE
OCEAN PUMP STATION
GENERAL PLAN

MAIN
CHAS. T. MAIN, INC.

SCALE AS SHOWN

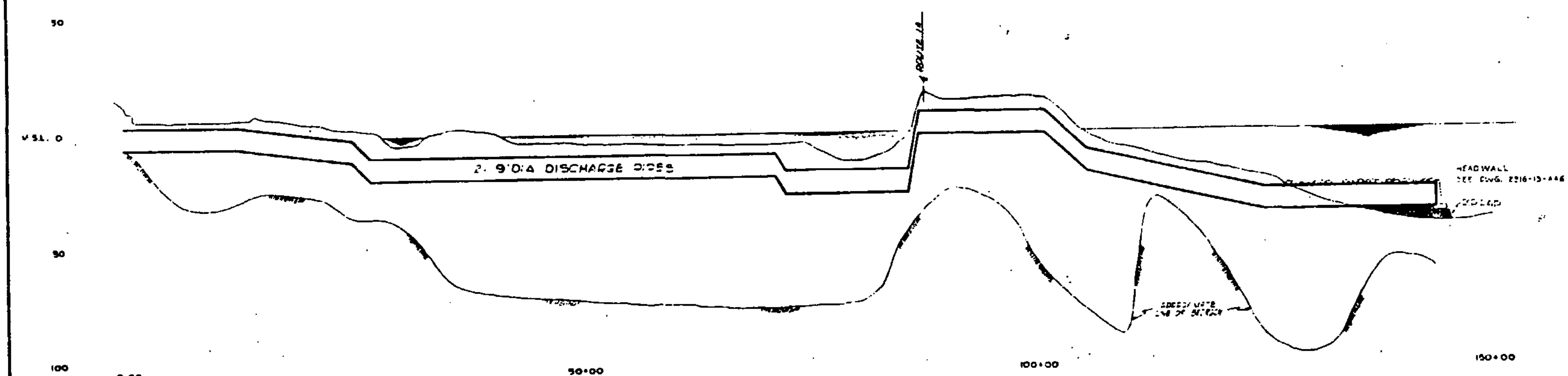
2316-13-AA1

1-9-72 REPORT



INTAKE LINE PROFILE

500 0 500 1000
Horiz. Scale in Feet
Vert. Scale (See Below)

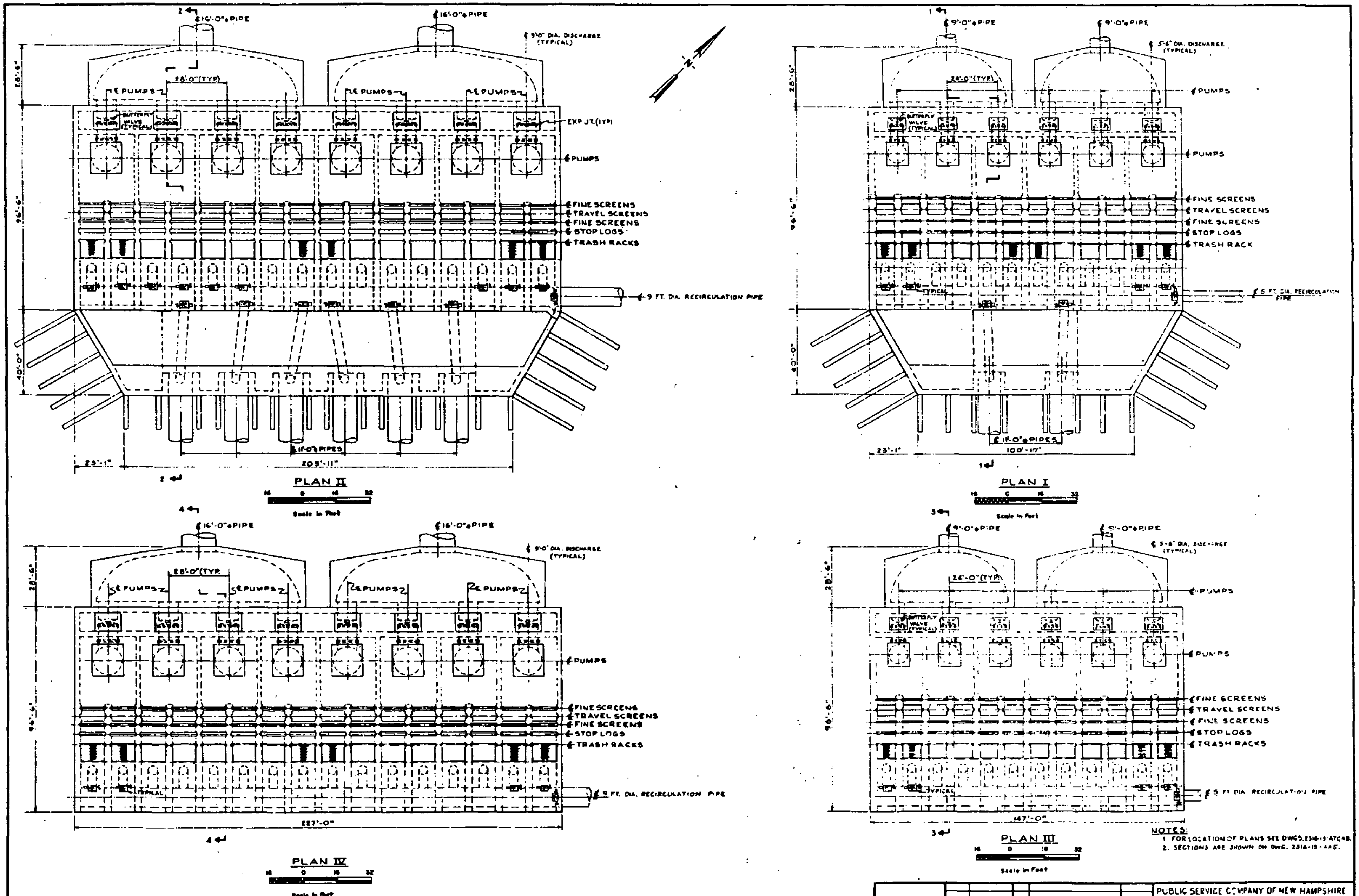


DISCHARGE LINE PROFILE

500 0 500 1000
Horiz. Scale in Feet
20 0 20 40
Vert. Scale in Feet

NOTES
1. GENERAL PLANS FOR THE DISCHARGE LINE ARE SHOWN ON DWG. 2316-13-AA1, AA2 & AB1
2. GENERAL PLAN FOR THE INTAKE LINE IS SHOWN ON DWG 2316-13-AA1

2-10-72 REPORT	PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK NUCLEAR STATION CIRCULATING WATER STUDY
Date Made 1-10-72	OCEAN INTAKE & DISCHARGE OCEAN PUMP STATION WATERWAY PROFILES
	MAIN CHAS. T. MAIN, INC.
	Scale AS NOTED 2316-13-AA3



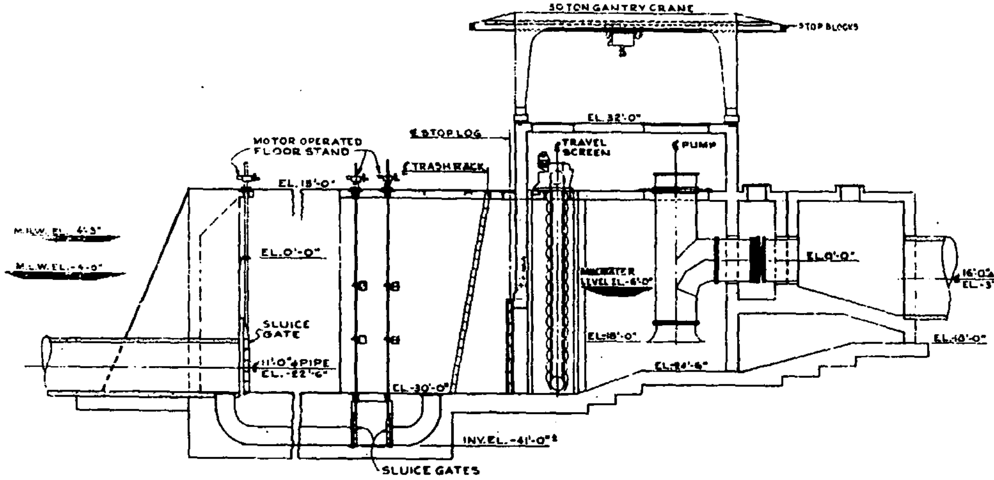
NOTES:
1. FOR LOCATION OF PLANS SEE DWGS. 2316-13-A7 & A8.
2. SECTIONS ARE SHOWN ON DWG. 2316-13-AA5.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

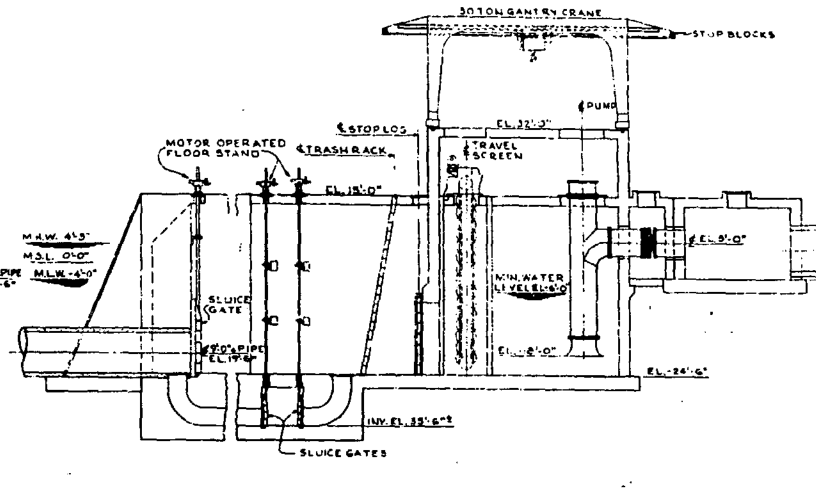
OCEAN INTAKE & DISCHARGE
OCEAN PUMP STATION
INTAKE STRUCTURE-PLANS

MAIN
CHAS. T. MAIN, INC.

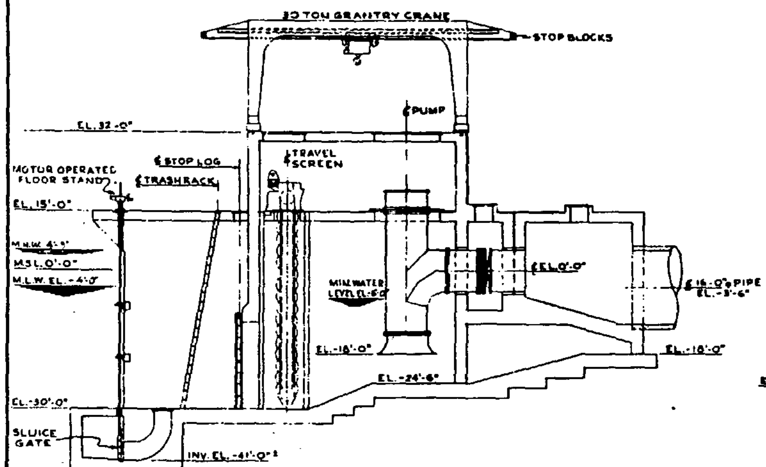
SCALE AS SHOWN
2316-13-AA4



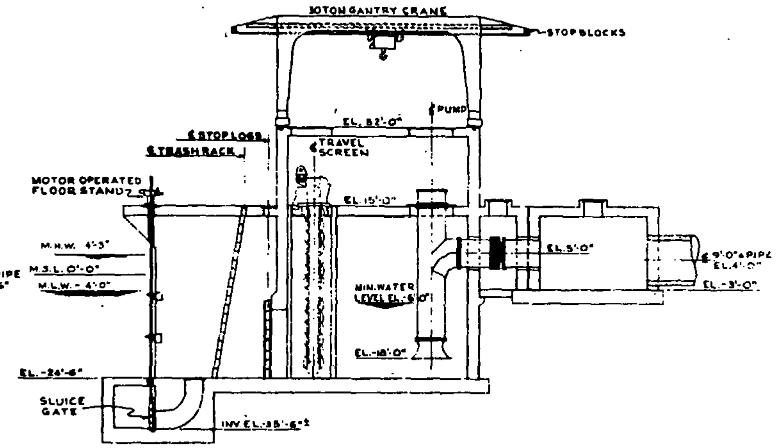
SECTION 2-2



SECTION 1-1



SECTION 4-4



SECTION 3-3

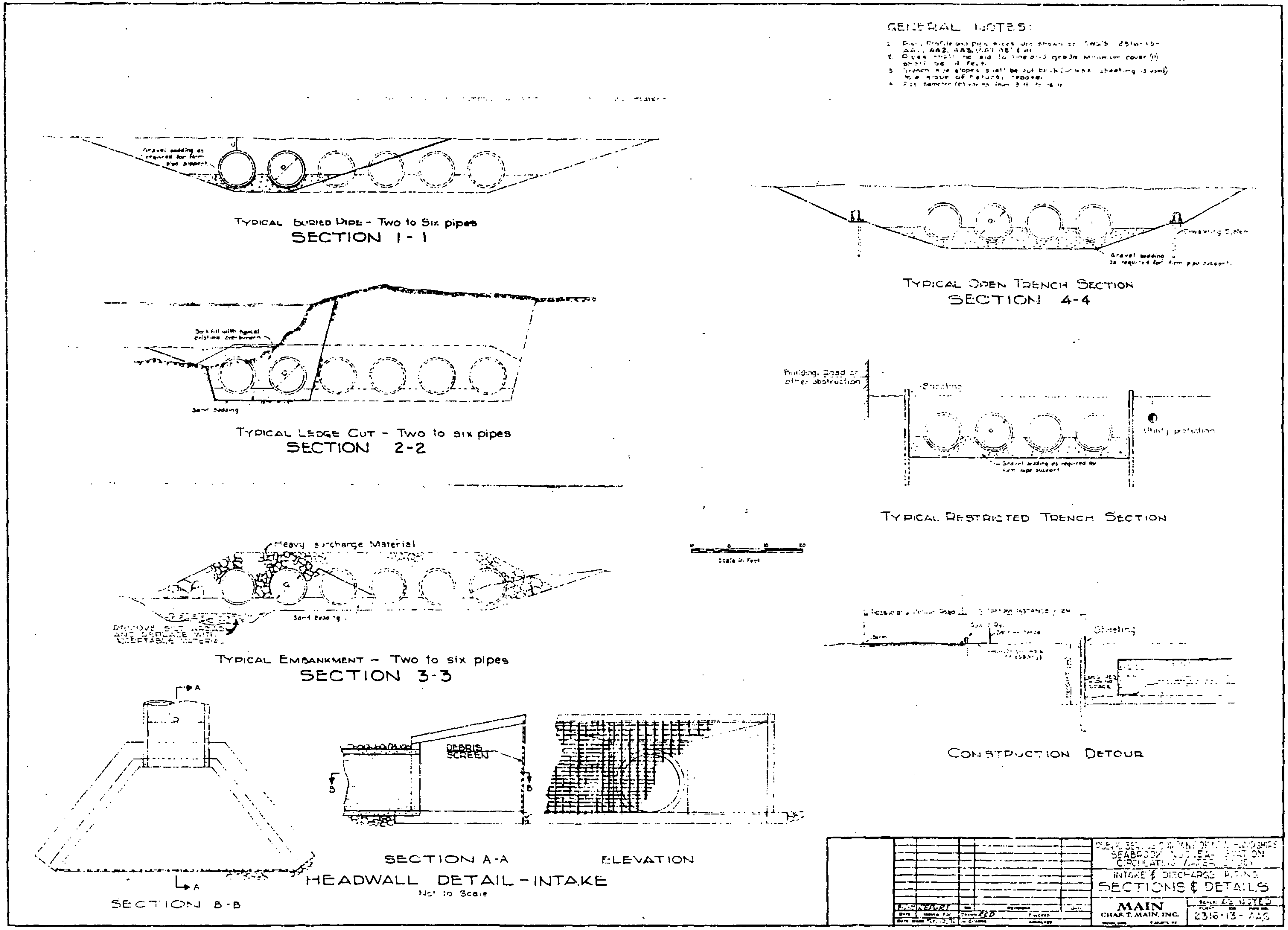
NOTES:
1. FOR LOCATIONS OF SECTIONS SEE DWG. 2316-3-AA4.

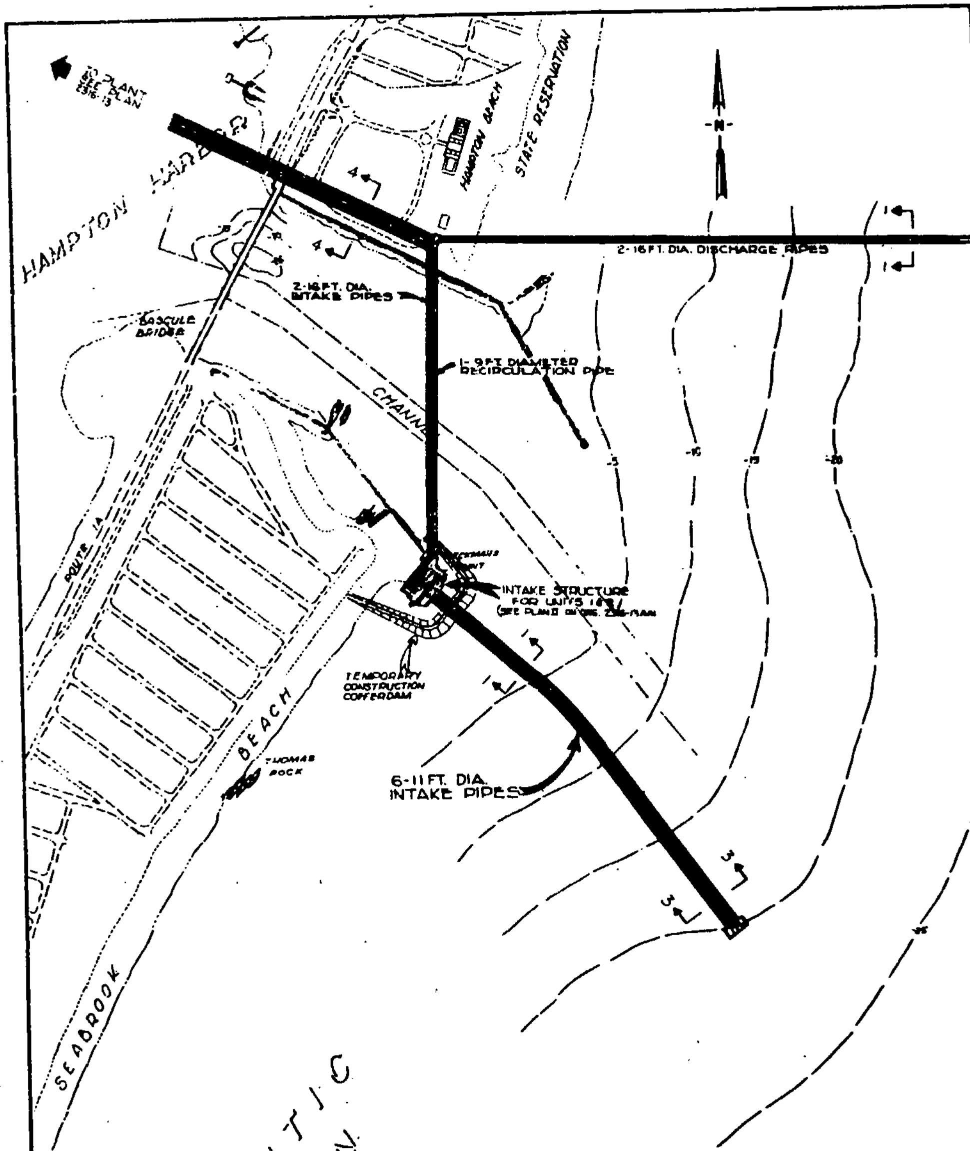
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

OCEAN-INTAKE & DISCHARGE
OCEAN PUMP STATION
INTAKE STRUCTURE - SECTIONS

MAIN
CHAS. T. MAIN, INC.

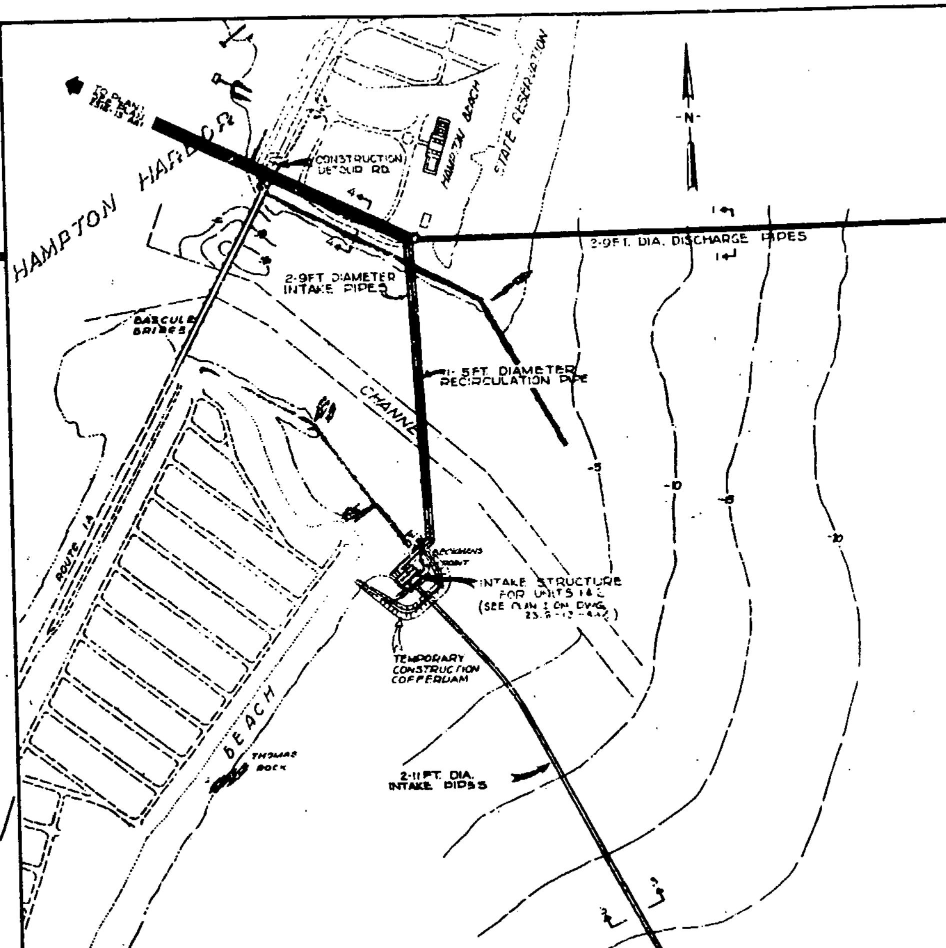
SCALE AS SHOWN
2316-13-AA5


GENERAL NOTES:
Typical Buried Pipe - Two to Six pipes
SECTION 1-1
Typical Ledge Cut - Two to six pipes
SECTION 2-2
Sand bedding
Heavy surcharge Material
Sand Bedding
Typical Embankment - Two to six pipes
SECTION 3-3
Typical Open Trench Section
SECTION 4-4
Dewatering System
Building, Road or other obstruction
Sheeting
Utility protection
Typical Restricted Trench Section
Scale in Feet
Sheeting
Construction Detour
DEBRIS SCREEN
SECTION A-A
ELEVATION
HEADWALL DETAIL - INTAKE
Not to Scale
SECTION B-B
INTAKE & DISCHARGE PIPING
SECTIONS & DETAILS
MAIN
CHAS. T. MAIN, INC.
Scale: AS NOTED
2316-13-AAG



PLAN - 15°F RISE IN CIRCULATING WATER TEMPERATURE

SCALE IN FEET



NOTES:

1. ALTERNATE ROUTING OF INTAKE PIPES IS SHOWN ON DWG. 2316-13-AA2.
2. SECTIONS ARE SHOWN ON DWG 2316-13-AA6
3. SECTIONS SHOW TYPICAL DESIGN FOR BOTH INTAKE AND DISCHARGE PIPES IN THE OCEAN. SECTIONS ARE TYPICAL FOR BOTH PLANS EXCEPT AS SHOWN.
4. EXTENSIVE ROCK EXCAVATION IS EXPECTED AT THE INTAKE STRUCTURE. SEE DWG. 2316-13-AA6 FOR A TYPICAL PIPE TRENCH ROCK EXCAVATION
5. ALTERNATE INTAKE STRUCTURE - OPEN CHANNEL IS SHOWN ON DWG. 2316-13-AB

PLAN - 45°F RISE IN CIRCULATING WATER TEMPERATURE

SCALE IN FEET

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

OCEAN INTAKE & DISCHARGE
OCEAN PUMP STATION
BURIED PIPELINE SUCTION TO INTAKES

MAIN
CHAS. T. MAIN, INC.

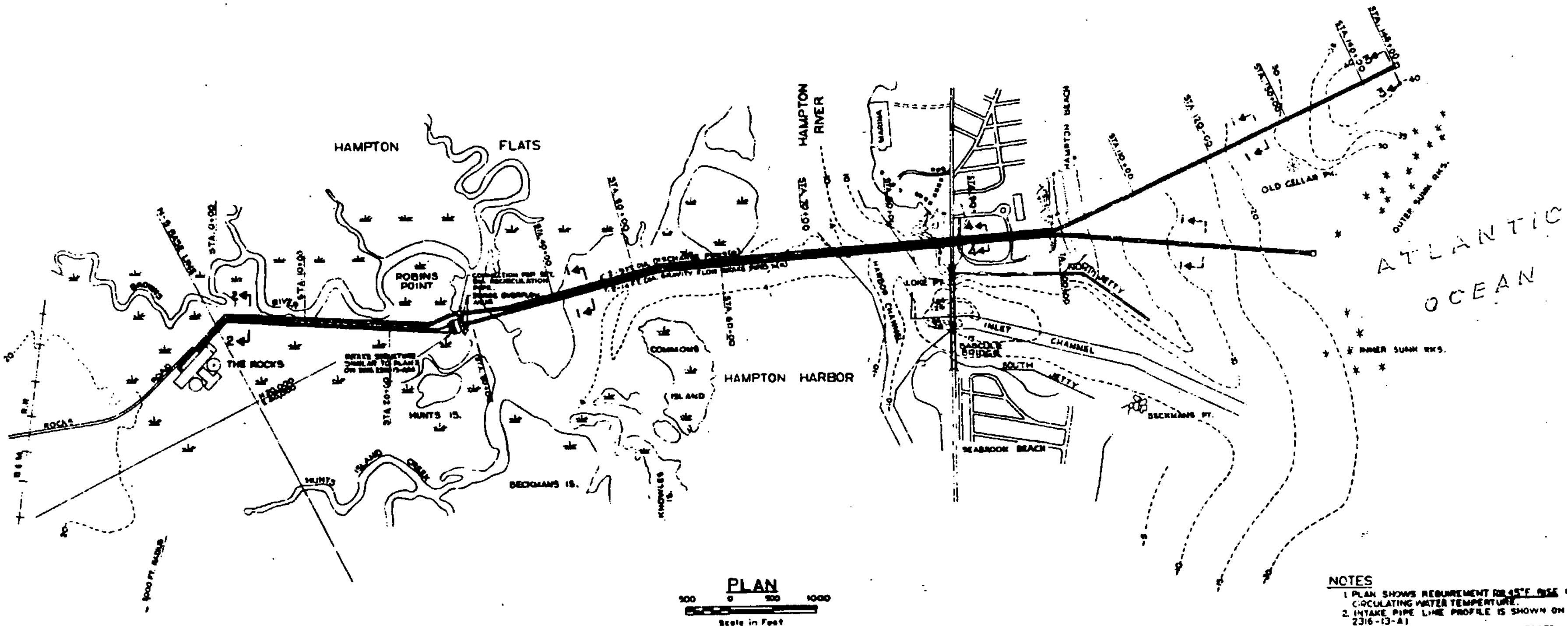
SCALE AS SHOWN

2316-13-AA7

REPORT

JAN. 1972

RCD



FOR 15°F RISE IN CIRCULATING WATER TEMPERATURE.
(●) 2-18 FT. DIA DISCHARGE PIPES
(●) 2-14 FT. DIA INTAKE PIPES

NOTES

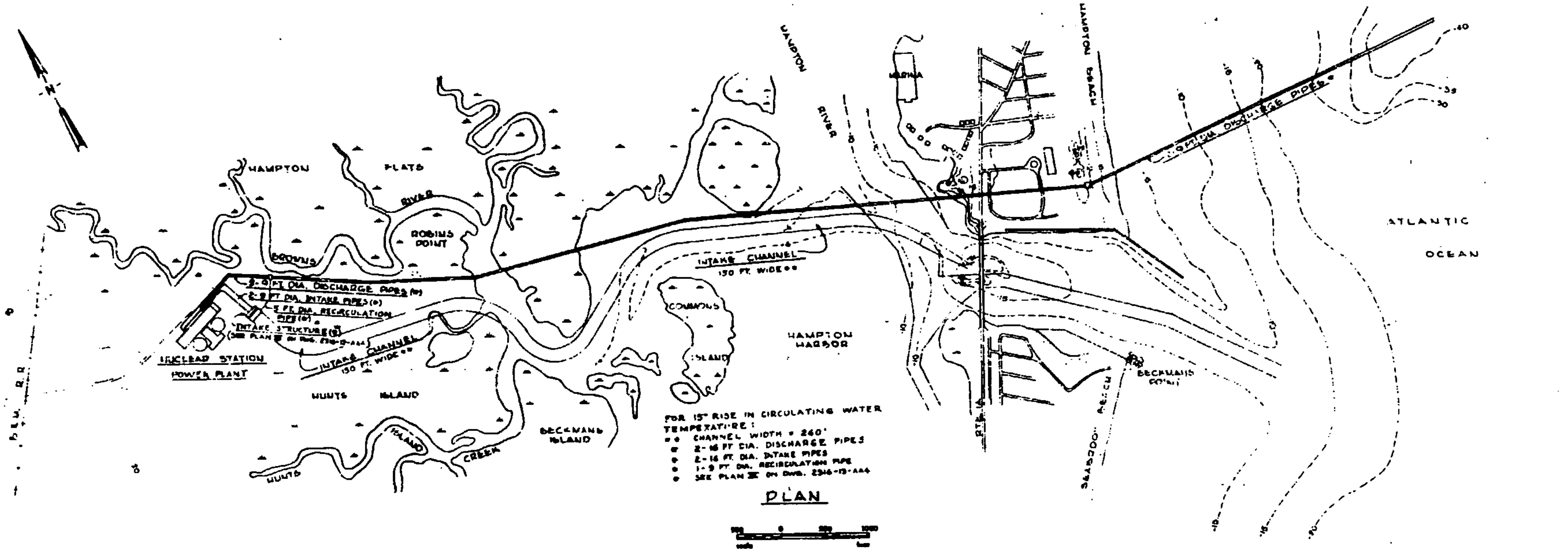
1. PLAN SHOWS REQUIREMENT FOR 45°F RISE IN CIRCULATING WATER TEMPERTURE.
2. INTAKE PIPE LINE PROFILE IS SHOWN ON DWG. 2316-13-A1
3. ALL PIPE TO BE BURIED OR SUBMERGED.
4. DISCHARGE PIPE LINE PROFILE IS SHOWN ON DWG. 2316-13-AA3.
5. CONTOURS REFER TO M.S.L. EL. 0.0 FT.
6. SECTIONS ARE SHOWN ON DWG. 2316-13-AA6.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

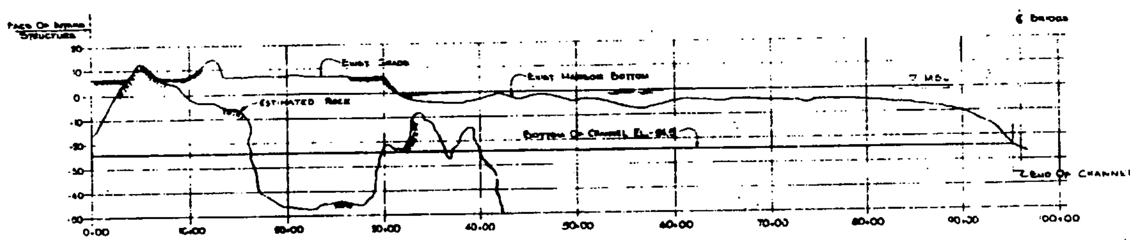
INLAND INTAKE NEAR PLANT
GENERAL PLAN- PIPE SUCTION FROM OCEAN

MAIN
CHAS. T. MAIN, INC.

2316-13-AB1



PLAN



PROFILE OF INTAKE CHANNEL

NOTES:
1. GENERAL PLAN SHOWS REQUIREMENT FOR 45° F. RISE IN CIRCULATING WATER TEMPERATURE REQUIREMENT FOR 15° F. RISE IS AS NOTED.
2. CONTOURS REFER TO M.S.L. EL. 0.0 FT.
3. FOR TYPICAL SECTION THRU 9 FT. DIA. PIPES SEE SEC 1-1 ON DWG. 2316-13-AA6.

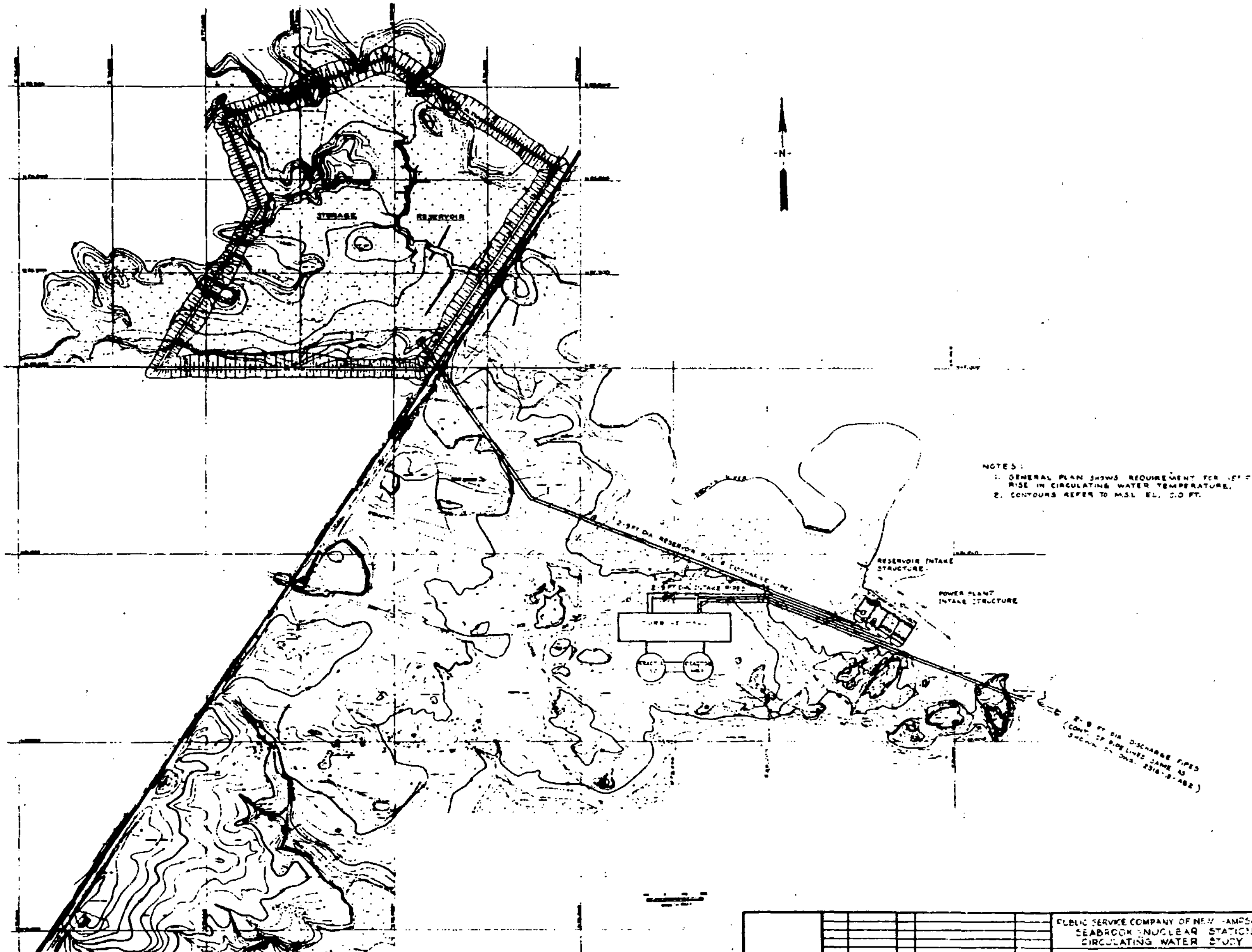
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

INLAND INTAKE NEAR PLANT
GENERAL PLAN-CHANNEL SUCTION

MAIN
CHAS. T. MAIN, INC.

SCALE AS SHOWN

2316-13-AB-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

INLAND INTAKE NEAR PLANT
GENERAL PLAN - PUMP STORAGE

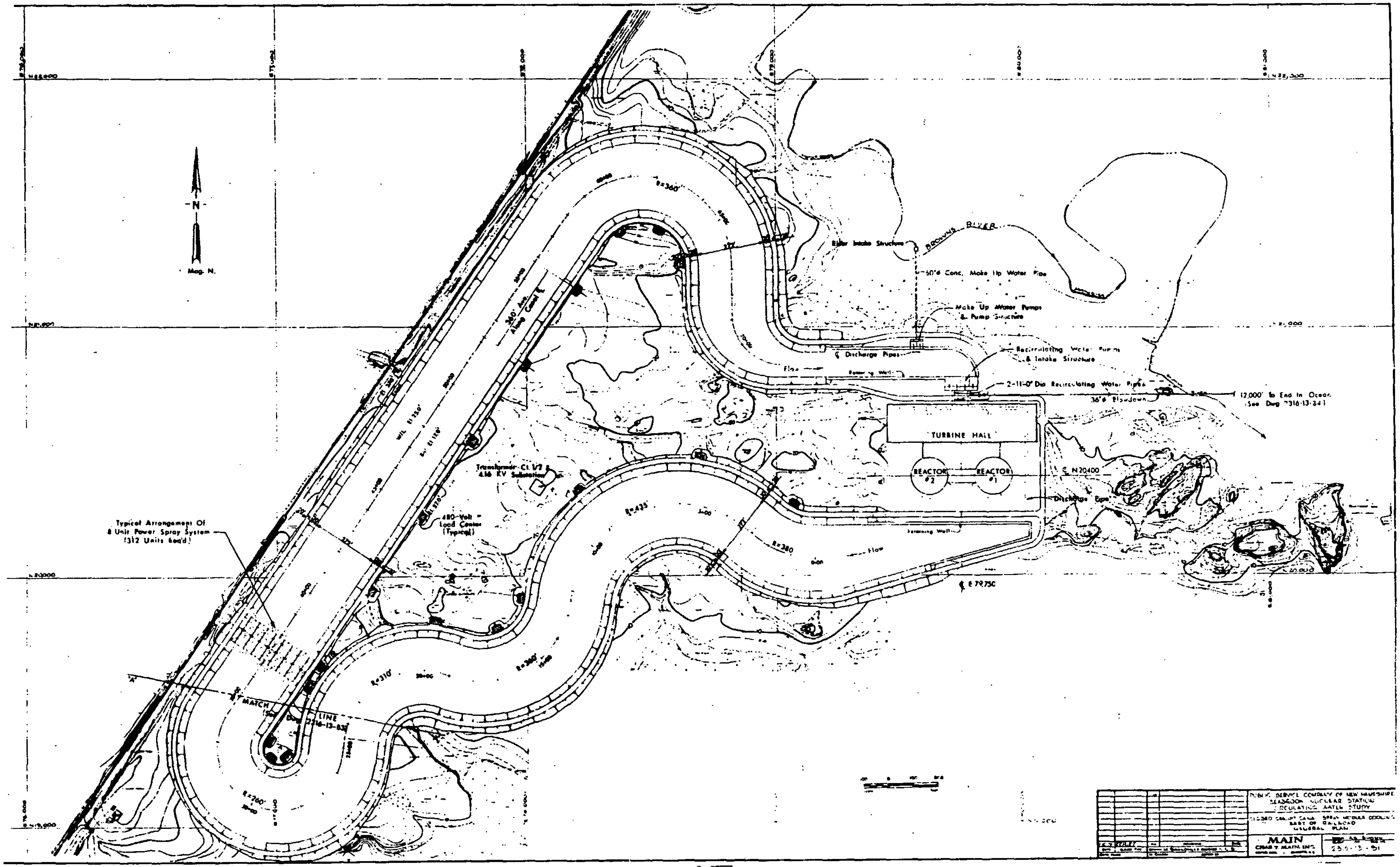
MAIN
CHAS. T. MAIN, INC.

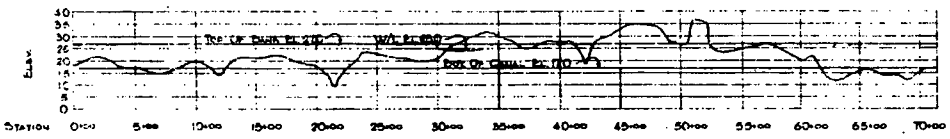
SCALE AS SHOWN

2316-13-AB3

REPORT

3-15-72

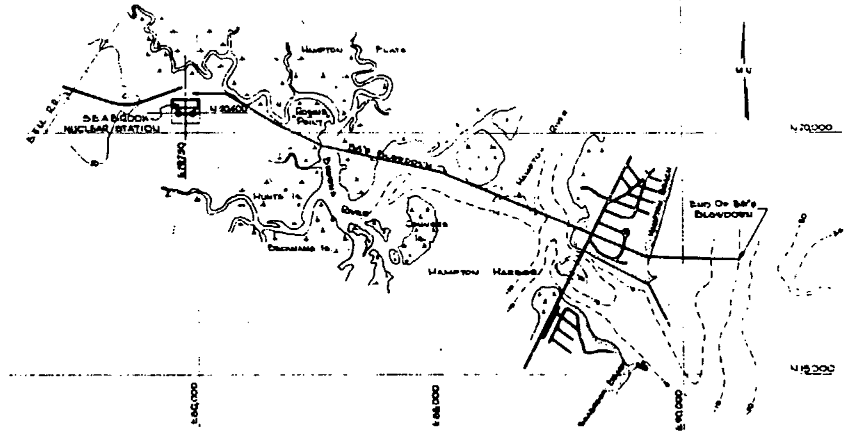

-N-
Mag. N.
Brown's River
River Intake Structure
50'ø Conc. Make Up Water Pipe
Make Up Water Pumps & Pump Structure
℄ Discharge Pipes
Recirculating Water Pumps & Intake Structure
2-11'-0" Dia Recirculating Water Pipes
36'ø Blowdown
12,000' To End In Ocean (See Dwg 2316-13-341)
TURBINE HALL
REACTOR #2
REACTOR #1
℄ N20400
Discharge Pipe
℄ E 79,750
Retaining Wall
Flow
R=360'
R=435'
R=380
R=310'
R=260'
360' Avg. Along Canal ℄
W/L El.120'
Transformer-Cl.1/2 & 4.16 KV Substation
480-Volt Load Center (Typical)
Typical Arrangement Of 8 Unit Power Spray System (312 Units Req'd)
MATCH LINE
Public Service Company of New Hampshire
Seabrook Nuclear Station
Circulating Water Study
Closed Circuit Canal Spray Module Cooling
East of Railroad
General Plan
MAIN
Chas. T. Main, Inc.



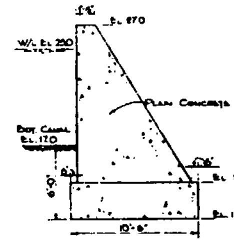
PROFILE - ℄ of CANAL - EAST of R.R.

PROFILE - ℄ of CANAL - S. EXTENSION (E. of R.R.)

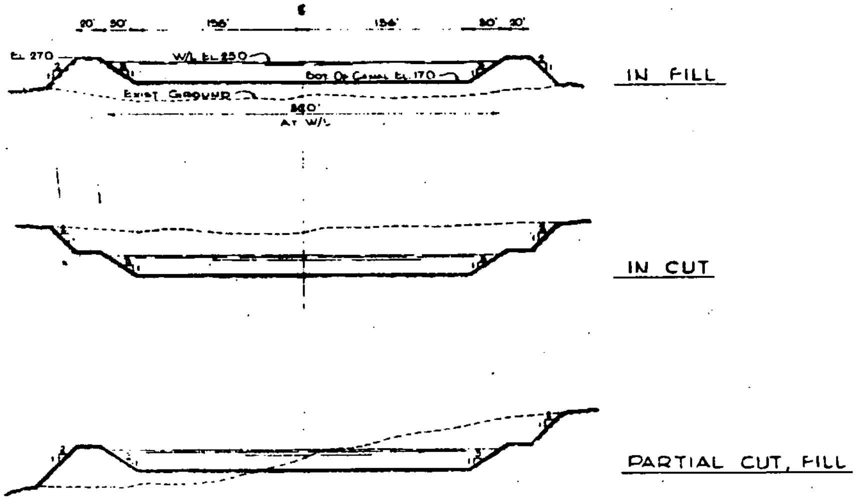
PROFILE - ℄ of CANAL - WEST of R.R.



KEY MAP



TYPICAL SECTION RETAINING WALL



TYPICAL SECTIONS

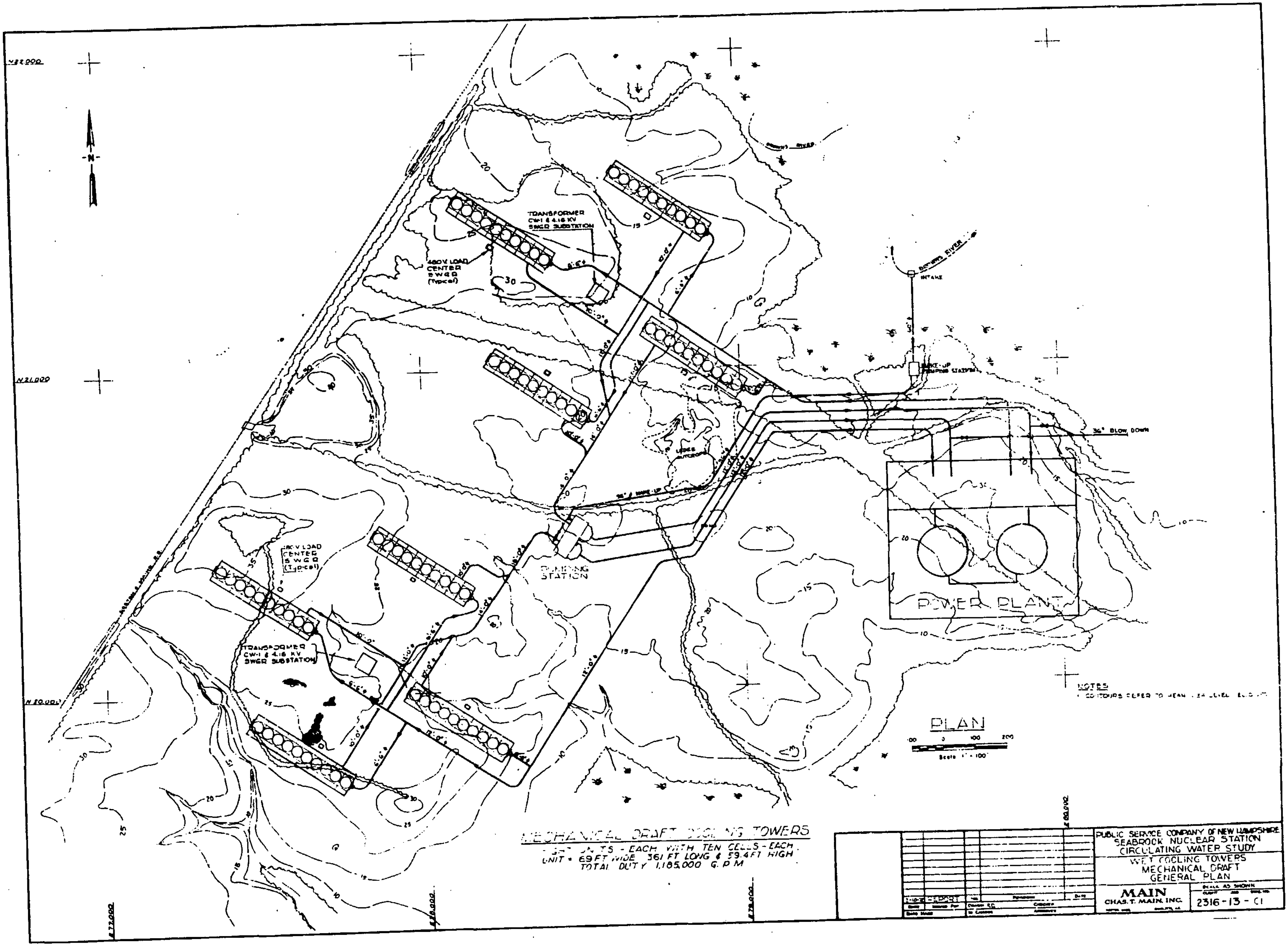
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY

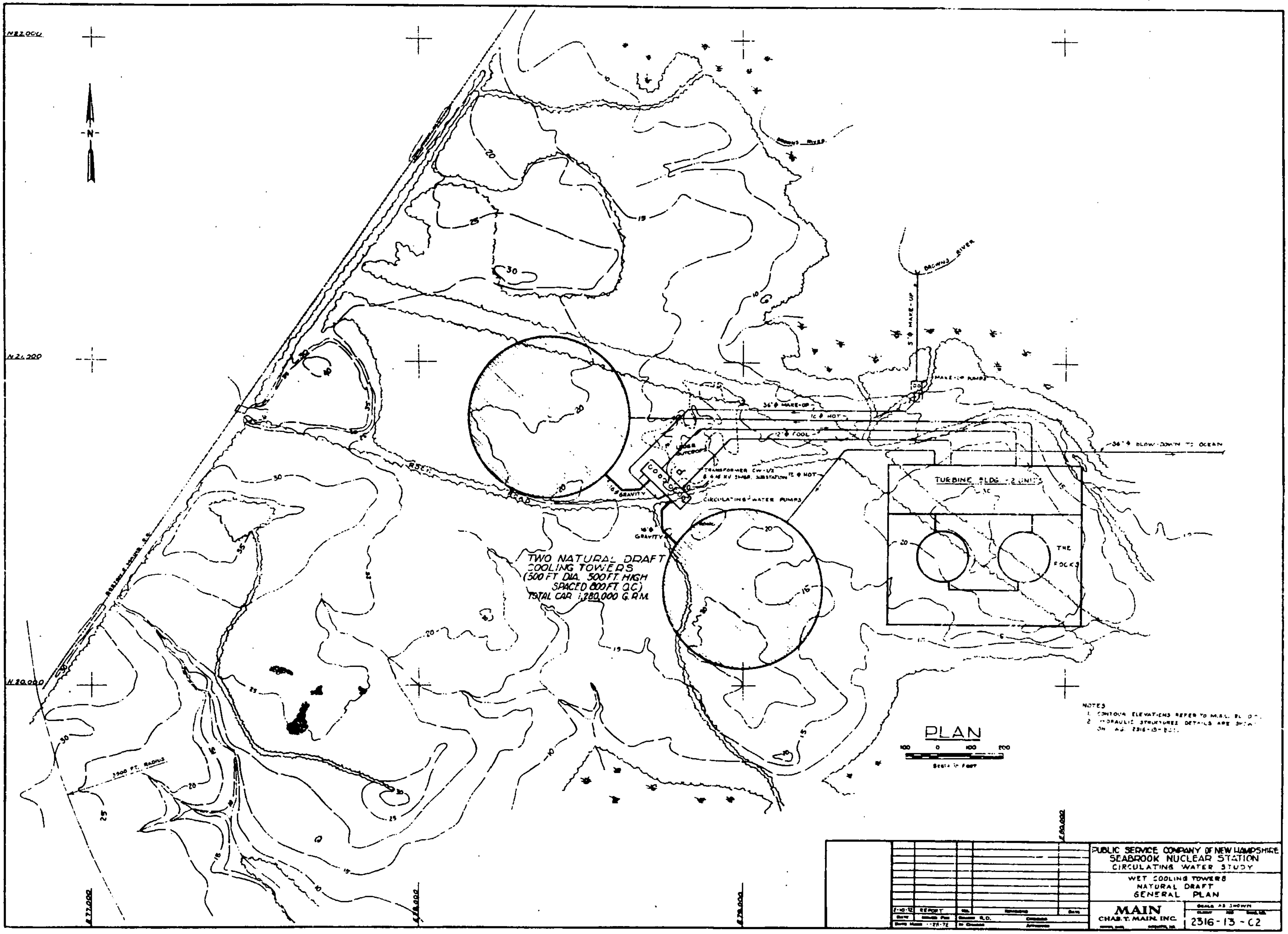
CLOSED CIRCUIT CANAL - SPRAY MO[illegible] [illegible]OLING
WATERWAY DETAIL

MAIN
CHAS. T. MAIN, INC.

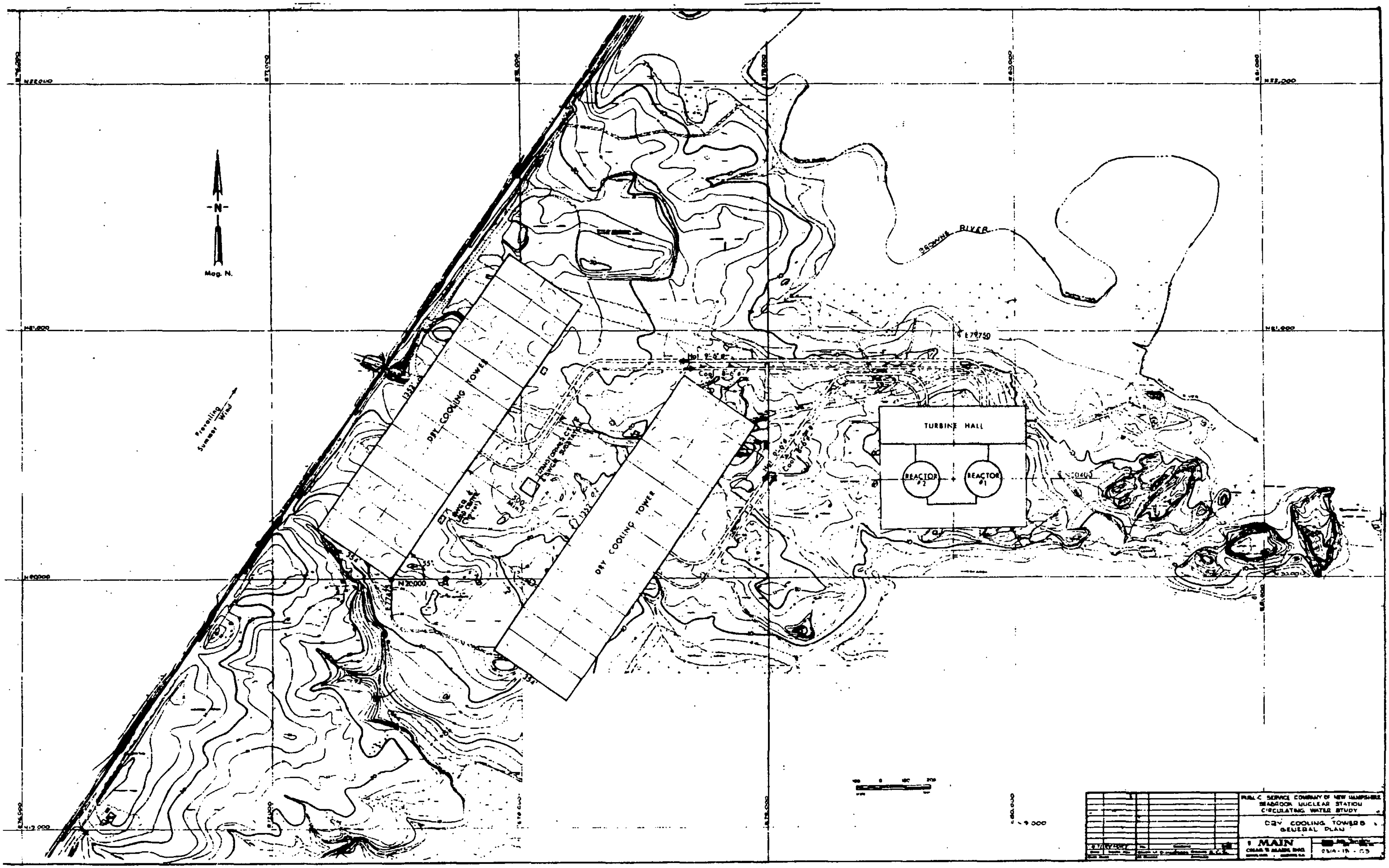
SCALE AS SHOWN

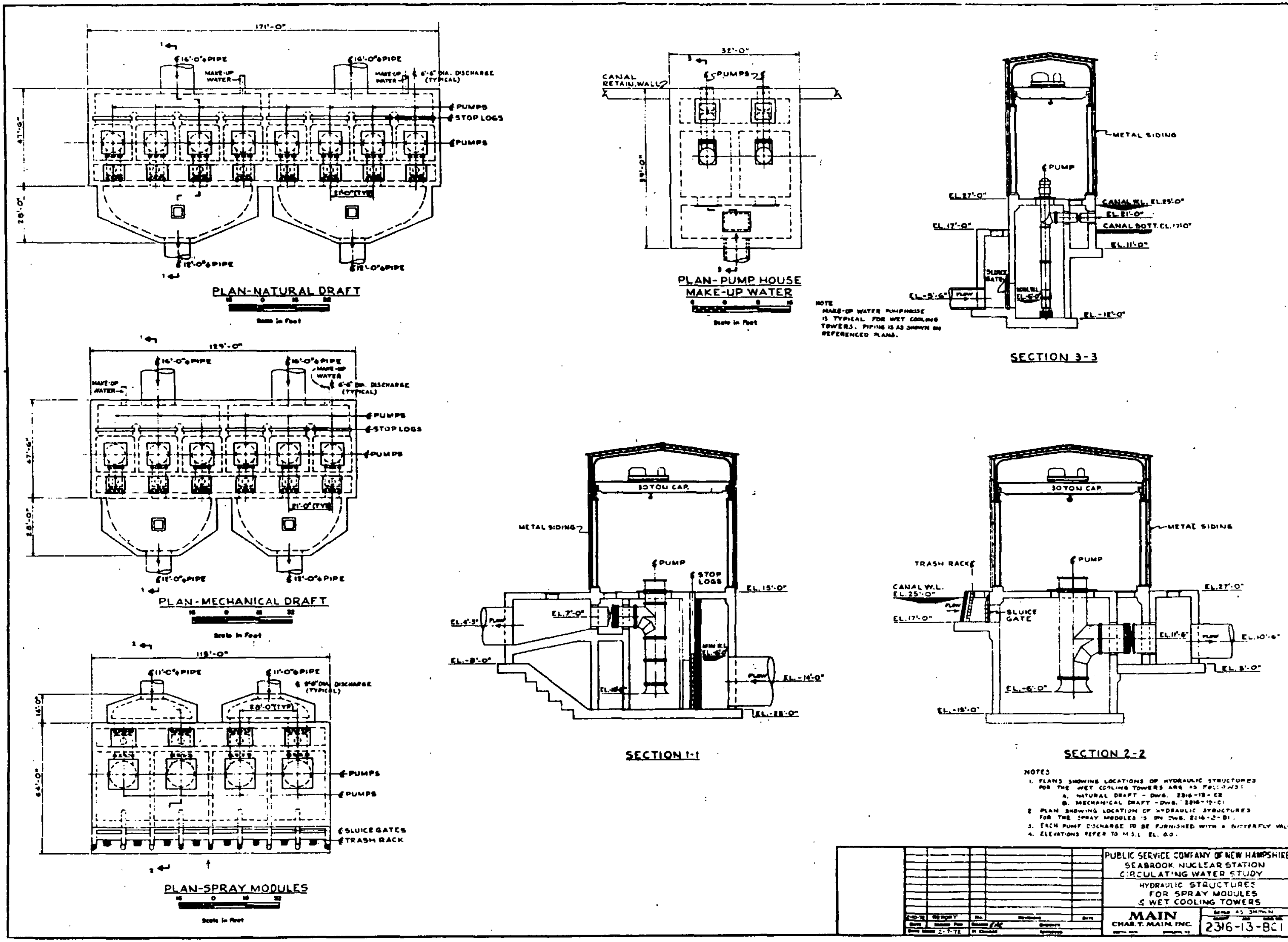
2516-18-B4

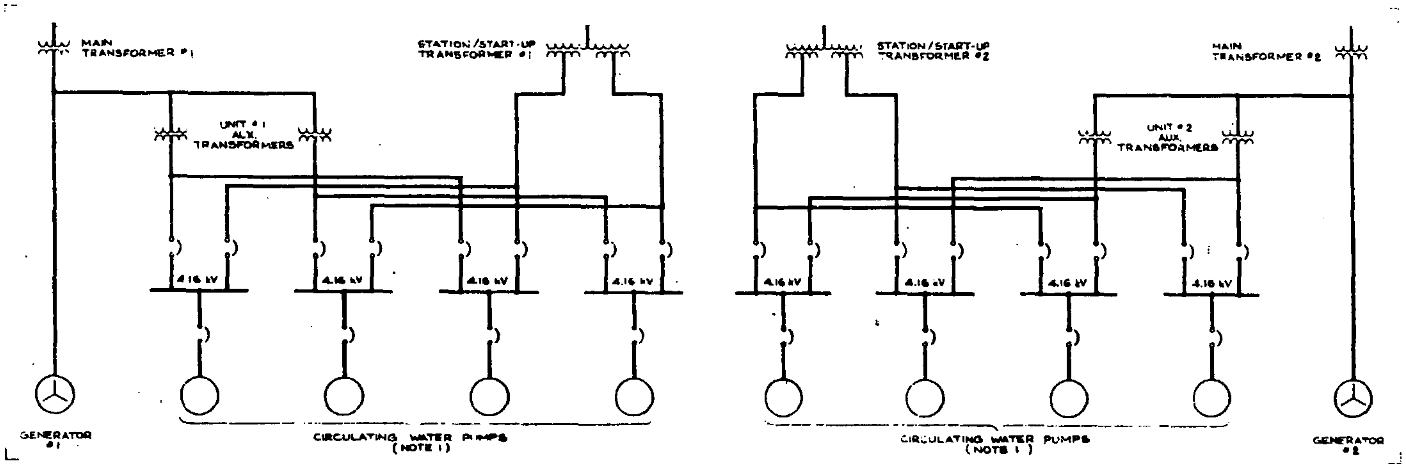

MECHANICAL DRAFT COOLING TOWERS
EIGHT UNITS - EACH WITH TEN CELLS - EACH
UNIT = 69 FT WIDE 361 FT LONG & 59.4 FT HIGH
TOTAL DUTY 1,185,000 G.P.M
PLAN
Scale 1" = 100'
NOTES
POWER PLANT
PUMPING STATION
TRANSFORMER
CW-1 & 4.16 KV
SWGR SUBSTATION
480V LOAD
CENTER
SWGR
(Typical)
INTAKE
36" BLOW DOWN
N 22,000
N 21,000
N 20,000
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY
WET COOLING TOWERS
MECHANICAL DRAFT
GENERAL PLAN
SCALE AS SHOWN
MAIN
CHAS. T. MAIN, INC.
2316-13-C1



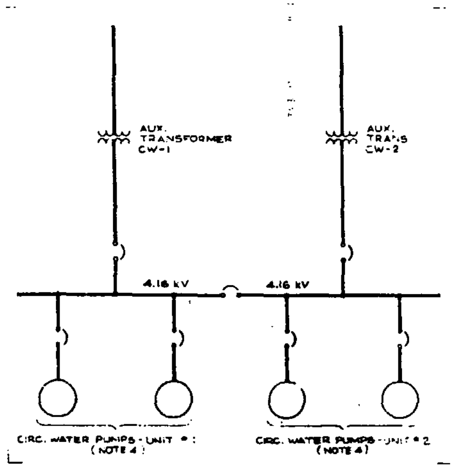
N 22,000
N 21,200
N 20,000
E 27,000
E 28,000
E 29,000
E 30,000
N
BROWNS RIVER
5'φ MAKE-UP
MAKE-UP PUMPS
36'φ MAKE-UP
16'φ HOT
12'φ COOL
36'φ BLOW-DOWN TO OCEAN
TRANSFORMER CW-1/2
12'φ HOT
CIRCULATING WATER PUMPS
16'φ GRAVITY
TURBINE BLDG - 2 UNITS
THE ROCKS
TWO NATURAL DRAFT
COOLING TOWERS
(500 FT. DIA. 500 FT. HIGH
SPACED 600 FT. O.C.)
TOTAL CAP. 1,280,000 G.P.M.
3500 FT. RADIUS
NOTES
PLAN
100 0 100 200
Scale in Feet
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY
WET COOLING TOWERS
NATURAL DRAFT
GENERAL PLAN
MAIN
CHAS. T. MAIN, INC.
2316-13-C2


N
Mag. N.
Prevailing Summer Wind
DRY COOLING TOWER
DRY COOLING TOWER
TURBINE HALL
REACTOR #2
REACTOR #1
BROWNS RIVER
N 82,000
N 81,000
N 80,000
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY
DRY COOLING TOWERS
GENERAL PLAN
MAIN
CHAS. T. MAIN, INC.
2514-15-C5

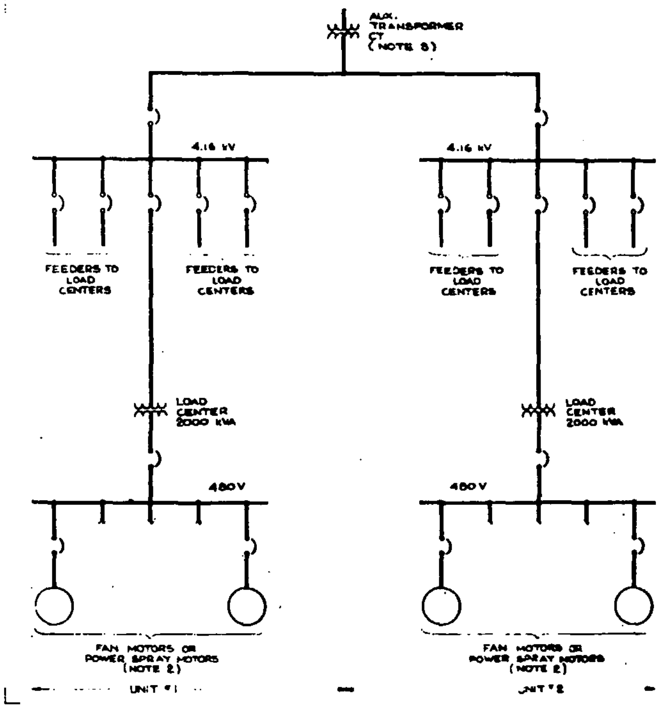

PLAN-NATURAL DRAFT
171'-0"
¢16'-0"ϕPIPE
MAKE-UP WATER
¢ 6'-6" DIA. DISCHARGE (TYPICAL)
¢PUMPS
¢STOP LOGS
¢PUMPS
47'-6"
28'-0"
21'-0"(TYP)
¢12'-0"ϕPIPE
Scale in Feet
PLAN-MECHANICAL DRAFT
129'-0"
¢16'-0"ϕPIPE
MAKE-UP WATER
¢ 6'-6" DIA. DISCHARGE (TYPICAL)
¢PUMPS
¢STOP LOGS
¢PUMPS
47'-6"
28'-0"
21'-0"(TYP)
¢12'-0"ϕPIPE
Scale in Feet
PLAN-SPRAY MODULES
115'-0"
¢11'-0"ϕPIPE
¢ 6'-6" DIA. DISCHARGE (TYPICAL)
28'-0"(TYP)
16'-0"
64'-0"
¢PUMPS
¢PUMPS
¢SLUICE GATES
¢TRASH RACK
Scale in Feet
PLAN-PUMP HOUSE MAKE-UP WATER
32'-0"
CANAL RETAIN.WALL
¢PUMPS
Scale in Feet
NOTE
MAKE-UP WATER PUMPHOUSE IS TYPICAL FOR WET COOLING TOWERS. PIPING IS AS SHOWN ON REFERENCED PLANS.
SECTION 3-3
METAL SIDING
¢PUMP
EL.27'-0"
CANAL W.L. EL.25'-0"
EL.21'-0"
CANAL BOTT. EL.17'-0"
EL.17'-0"
EL.11'-0"
SLUICE GATE
EL.-5'-6"
EL.-12'-0"
SECTION 1-1
30 TON CAP.
METAL SIDING
¢PUMP
¢STOP LOGS
EL.15'-0"
EL.4'-3"
EL.7'-0"
EL.-8'-0"
EL.-14'-0"
EL.-28'-0"
SECTION 2-2
30 TON CAP.
METAL SIDING
¢PUMP
TRASH RACK
CANAL W.L. EL.25'-0"
EL.17'-0"
SLUICE GATE
EL.27'-0"
EL.11'-6"
EL.10'-6"
EL.5'-0"
EL.-6'-0"
EL.-15'-0"
NOTES
1. PLANS SHOWING LOCATIONS OF HYDRAULIC STRUCTURES FOR THE WET COOLING TOWERS ARE AS FOLLOWS:
A. NATURAL DRAFT - DWG. 2316-13-C2
B. MECHANICAL DRAFT - DWG. 2316-13-C1
2. PLAN SHOWING LOCATION OF HYDRAULIC STRUCTURES FOR THE SPRAY MODULES IS ON DWG. 2316-3-B1.
3. EACH PUMP DISCHARGE TO BE FURNISHED WITH A BUTTERFLY VALVE.
4. ELEVATIONS REFER TO M.S.L. EL. 0.0.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION
CIRCULATING WATER STUDY
HYDRAULIC STRUCTURES FOR SPRAY MODULES & WET COOLING TOWERS
MAIN
CHAS. T. MAIN, INC.
SCALE AS SHOWN
2316-13-BC1



CIRCULATING WATER PUMPS - BASIC POWER SUPPLY SYSTEM



OCEAN PUMP STATION - CIRC. WATER PUMP POWER SUPPLY SYSTEM



COOLING TOWER & POWER SPRAY MODULE - POWER SUPPLY SYSTEM

NOTES:

1. NUMBER OF CIRCULATING WATER PUMPS DEPENDENT ON SYSTEM CHARACTERISTICS. SEE TABLE
2. NUMBER OF COOLING TOWER FANS OR POWER SPRAY PUMPS DEPENDENT ON SYSTEM CHARACTERISTICS. SEE TABLE
3. TRANSFORMER CAPACITY, PRIMARY VOLTAGE RATING, AND ARRANGEMENT OF WINDINGS DEPENDENT ON SYSTEM CHARACTERISTICS. TRANSFORMER LOCATED AT CENTER OF LOAD FOR ESTIMATING PURPOSES.
4. OCEAN PUMP STATION BASED ON TRANSFORMER(S) LOCATED AT PUMP STATION. TRANSFORMER CAPACITY, PRIMARY VOLTAGE RATING & NUMBER OF PUMPS DEPENDENT ON SYSTEM CHARACTERISTICS. SEE TABLE
5. DRY COOLING TOWER, CIRC. WATER PUMP MOTORS RATED FOR 13.2 KV.
6. REVERSING FACILITIES FOR COOLING TOWER FANS NOT SHOWN.
7. BALANCE OF PLANT AUXILIARY LOADS NOT SHOWN.

SYSTEM		OCEAN INTAKE STATION *		INLAND INTAKE STATION **		WET COOLING TOWERS		PSM PUMP STATION	DRY COOLING TOWER
						NATURAL DRAFT	MECHANICAL DRAFT		
CIRC. WATER PUMPS (EACH UNIT)	°F RNG	15	45	15	45	25	27	25	37
	GPM	[illegible]	[illegible]	[illegible]	[illegible]	640000	592500	558000	475000
	GPM/PUMP	[illegible]	[illegible]	[illegible]	[illegible]	160000	200000	267000	236500
	NO.	4	3	4	3	4	3	2	2
	HP	6000	5000	3000	3000	5000	5000	9000	11000
	RPM	334	391	334	352	295	295	207	334
	TOTAL BHP	19400	13300	[illegible]	8900	18200	19600	5250	20500
	TOTAL KW	[illegible]	14000	[illegible]	7373	12100	11300	4360	17000
COOLING TOWER FANS (EACH UNIT)	NO.						40		52
	HP						200		600
	RPM						1800		1800
	TOTAL BHP						7680		29700
	TOTAL KW						6550		21900
COOLING TOWER MAKE-UP PUMPS (EACH UNIT)	NO.					2	1	1	
	HP					300	300	300	
	RPM					590	590	590	
	TOTAL BHP					275	275	275	
	TOTAL KW					230	230	230	
POWER SPRAY PUMPS (ONE HALF TOTAL FOR TWO UNITS)	NO.							156	
	HP							75	
	RPM								
	TOTAL BHP							11700	
	TOTAL KW							9700	
TOTAL CIRC. WATER SYS. LOAD	KW	4880	11600	6880	7376	12430	17880	14260	38900

CIRC. WATER SYSTEM - UNIT ELECTRICAL DATA

* SEA SUCTION TO INTAKE
** CHANNEL SUCTION TO INTAKE

ELECTRICAL
ONE-LINE DIAGRAMS - CIRC. WATER STUDY BASIC SYSTEMS

MAIN
CHAS. T. MAIN, INC.

2916 | 15 | E1

APPENDIX G

Appendix G

Radioactivity Source Term Information

The following question and answer information is presented to comply with the request delineated in Appendix 2 of the Guide to the Preparation of Environmental Reports for Nuclear Power Plants. The answers are given for a single unit but they apply identically to each Seabrook unit. For information and reference the liquid and gaseous radioactivity effluent Technical Specifications are attached.

Basic Data for Seabrook Source Term Calculation:

Question 1. Reactor power (MWt) at which impact is to be analyzed.

Answer 1. The impact is analyzed at 3654 MWt, the core stretch power rating including +2% calorimetric uncertainty.

Question 2. Weight of U loaded (first loading and equilibrium cycle).

Answer 2. 99 metric tons (UO_2) first and subsequent loadings.

Question 3. Isotopic ratio in fresh fuel (first loading and equilibrium cycle).

Answer 3. The average enrichment of the initial and reload fuel is 2.80 weight percent of U-235.

Question 4. Expected percentage of leaking fuel.

Answer 4. The anticipated average level of fuel cladding defects is 0.2%.

Question 5. Escape rate coefficients used (or reference).

Answer 5.
a) Noble gases .... 6.5×10^{-8} sec^{-1}
b) Br, I, and Cs .... 1.3×10^{-8} sec^{-1}
c) Te .... 1.0×10^{-9} sec^{-1}
d) Mo .... 2.0×10^{-9} sec^{-1}
e) Sr and Ba .... 1.0×10^{-11} sec^{-1}
f) All others .... 1.6×10^{-12} sec^{-1}

Question 6. Plant capacity factor (%)

Answer 6. 90%

Question 7. Number of steam generators

Answer 7. Four

Question 8. Type of steam generators (recirculating, once through).

Answer 8. Vertical, recirculating, inverted "U" tube.

Question 9. Mass of primary coolant in system total (lb.) and mass of primary coolant in reactor (lb.).

Answer 9. Total mass of primary coolant = 5.5×10^5 lb.
Mass of coolant in reactor core = 3.1×10^4 lb.

Question 10. Primary coolant flow rate (lb/hr).

Answer 10. 1.52×10^8 lb/hr at rated conditions.

Question 11. Mass of steam and mass of liquid in each generator (lb.)

Answer 11. At rated full load conditions:
Mass of secondary liquid in each steam generator = 97,000 lbs.
Mass of steam in each steam generator = 5700 lbs.

Question 12. Total active mass of secondary coolant (lb.) (excluding condensate storage tanks).

Answer 12. The estimated total is 2.3×10^6 lbs., including steam generators and excluding condensate storage.

Question 13. Steam generator operating conditions (temperature, ^oF, pressure, psi, flow rate, lb/hr).

Answer 13. Normal operating pressure, full load = 1000 psia
Normal operating steam outlet temp. = 544.6^oF
Full load steam flow rate per steam generator = 4.04×10^6 lb/hr.

Question 14. The number, type and size of condensate demineralizer and total flow rate (lb/hr).

Answer 14. The total feedwater flow rate is 15.89×10^6 lb/hr. There is no condensate demineralization.

Question 15. What is the containment free volume (ft^3)?

Answer 15. The containment free volume is approximately 2.8×10^6 ft^3.

Question 16. What is the expected leak rate of primary coolant to the containment atmosphere (lb/hr)?

Answer 16. Expected leak rate is 14 lb/hr.

Question 17. Is there an internal air cleanup system for iodine in the containment? If so, what volume per unit time is circulated through it? What decontamination factor is expected? How long will the system be operated prior to purging?

Answer 17. A 4000 scfm charcoal filtration system is included for iodine cleanup within the containment. Two considerations dictate the utilization of this system-containment accessibility and the technical specification limit on iodine releases (Tech. Spec. 16.3.17, attached.) The system will be used as required for these considerations.

Question 18. How often is the containment purged? Is it filtered prior to release? Type of iodine cleanup system provided? What decontamination factor is expected?

Answer 18. Operational estimate for number of containment purges per year is four. This purge is filtered by HEPA and charcoal absorbers as required by Technical Specification 16.3.17 (attached). Expected DF's are > 100 for particulates and halogens.

Question 19. Give the total expected annual average letdown rate during power operation (lb/hr).

a) What fraction of the letdown is returned to the primary system? How is it treated? What are the expected decontamination factors for removal of principle isotopes?
b) How is Li and Cs normally controlled?
c) What fraction of this goes to boron control system? How is this treated, demineralization, evaporation, filtration?
d) Is plant designed for load follow or base load? What fraction of the letdown stream is diverted to the radwaste system for boron control? How is this treated (demineralization, evaporation, filtration, etc.) and what fraction will be discharged from the plant?

Answer 19. Letdown rate = 4.0×10^4 lb/hr.

a) Fraction returned to primary system is 100% during power operation with two exceptions. Periodically letdown is diverted from the chemical and volume control system to the boron recovery system for reactor coolant boron dilution in order to compensate for fuel burnup. The amount of reactor coolant diverted to boron recovery for this reason is estimated to be 1.0×10^6 lbs per year, or an annual average diversion rate of 116 lb/hr. This diverted letdown is processed by the boron recovery system and returned to the reactor makeup water storage tank for reuse within the reactor coolant system.

The second reason for letdown diversion is for tritium control (See section 3.5.1 of this report). This diversion is also to the boron recovery system and occurs once per core cycle. The amount of reactor coolant diverted to boron recovery for this purpose is estimated to be 1.67×10^6 lbs per year. This liquid is processed by the boron recovery system and discharged from the site instead of recycled. This treatment and discharge is analyzed in response to Question 31 of this questionnaire.

The reactor coolant letdown that is treated and returned directly to the reactor coolant system by the chemical and volume control system is subject to filtration, demineralization and degassification. The mixed-bed demineralizers consist of lithium-form cation and hydroxyl-form anion and are expected to exhibit the

the following decontamination factors;

All radionuclides except H, Cs, Y, Mo	10
H, Cs, Y, Mo	1

The degassifier stripping fraction for noble gases is discussed in question 20 of this questionnaire.

b) A cation demineralizer with hydrogen-form resin is included in the chemical and volume control system down-stream of the mixed-bed demineralizers. This is used for lithium control by passing the letdown stream through it intermittantly. The estimated use of this demineralizer is 10% of the time. This resin is expected to afford a DF of 10 for Cs, Y, and Mo isotopes.

c) Coolant sent to the boron recovery system is treated by filtration,evaporation, and demineralization. For more detail on this treatment, refer to the response to Question 31 of this questionnaire.

d) The Seabrook units are base loaded. However, capability for adjusting primary coolant boron concentration for load follow is included in the chemical and volume control system. This capability is afforded by the boron thermal regeneration system which takes letdown flow, adjusts boron upward or downward, and returns the flow to the letdown line. Thus, load follow is accomplished within the CVCS with no flow diversion to the boron recovery system or the liquid waste system.

<u>Question 20.</u> What fraction of the letdown stream is stripped of noble gases and iodines? How are these gases collected? What decay do they receive prior to release? Indicate stripping fraction?

<u>Answer 20.</u> The full letdown flow is capable of being diverted to a degassifier where the expected stripping fraction is close to 100% for all noble gases. No degassification of the halogens is expected within the degassifier.

The hydrogenated gas stream leaving the degassifier is processed by the waste gas processing system where the gas stream is dried and passed through carbon delay beds. Noble gases are absorbed on the charcoal and are delayed a minimum of 4 days for Kr isotopes and 60 days for Xe isotopes. This leaves Kr-85 as the only significant isotope remaining in the processed gas stream. This purified gas stream is generally recycled back to the primary system through the volume control tank or it may be released to the environment via the primary vent stack.

<u>Question 21.</u> How are the noble gases and iodines stripped from that portion of the letdown stream which is sent to the boron control system? How are these gases collected? What decay do they receive prior to release?

<u>Answer 21.</u> That portion of the reactor coolant letdown stream diverted to the boron recovery system is initially degased in the chemical and volume control system degassifier. Stripping fractions for noble gases within this degassifier are close to 100%. Further degassification of the coolant processed by the boron recovery system occurs in the boron recovery evaporator. The evaporator removes all remaining noble gases in the liquid and directs them to the gaseous waste processing system for holdup. The holdup time is sufficient to leave Kr-85 as the only significant isotope within a gas stream that may be released.

No halogen degassification is anticipated within the degassifier or the boron evaporator.

<u>Question 22.</u> Are the releases from the gaseous waste storage tanks passed through a charcoal absorber? What decontamination factor is expected?

<u>Answer 22.</u> The waste gas processing system utilizes carbon delay beds for the storage and subsequent decay of noble gases. As such, releases from the carbon beds require no additional charcoal filtration. The carbon bed discharge gas stream is HEPA filtered prior to release to the environment via the primary vent stack. Expected DF is > 100.

<u>Question 23.</u> How frequently is the system shutdown and degassed and by what method? How many volumes of the primary coolant system are degassed in this way each year? What fraction of the gases present are removed? What fraction of other principle nuclides are removed, and by what means? What decay time is provided?

<u>Answer 23.</u> Primary coolant degassification is capable of being performed continuously during power operation. The actual fraction of primary coolant diverted to the degassifier will be dependent on the concentration of dissolved fission product gases in the coolant. Expected stripping fractions in the degassifier are close to 100% for noble gases with no expected degassification of the halogens. The hydrogenated waste gas stream from the degassifier is passed through carbon delay beds which are capable of delaying xenon isotopes for a minimum of 60 days and krypton isotopes for a minimum of 4 days.

Startup of a unit following a hot or cold shutdown results in liquid flow to the boron recovery system. The boron recovery evaporator removes all the noble gases remaining in the liquid and directs them to the gaseous waste processing system. The estimated volume of primary coolant that is directed to the boron recovery system for one unit is 940,000 gal/year.

The removal of liquid phase radionuclides by evaporation and demineralization within the boron recovery system will be at a decontamination factor of at least 10^3. See the response to Question 31 of this questionnaire for elaboration.

Question 24. Are there other methods of degassing (i.e., through pressurizer, etc.)? If so describe. How is it treated?

Answer 24. No other degassification methods are planned.

Question 25. What is the expected leak rate of primary coolant to the secondary coolant (lb/hr)?

Answer 25. The anticipated annual average level of primary-to-secondary steam generator leakage is 7 lb/hr (20 gpd). This is a total for all 4 steam generators for each Seabrook unit.

Question 26. What is the expected rate of steam generator blowdown (lb/hr) during power operation with the expected leak rate noted in 25 above? Where are the gases from the blowdown vent discharged? Are there charcoal absorbers and/or condensers on the blowdown tank vent? If so, what decontamination factor is expected? How will the blowdown liquid be treated?

Answer 26. With 7 lb/hr primary-to-secondary steam generator leakage and a feedwater total solids content of 0.2 ppm, the blowdown rate required to maintain the steam generator secondary side chemistry within specifications (125 ppm total solids) is 25,100 lb/hr (50 gpm).

Blowdown is directed from the steam generators to the blowdown concentrators. Vapor and any gases evolved in the concentrators are directed to a feedwater heater where the vapor fraction is condensed. Non-condensable gases are directed from the feedwater heater to the condenser where they are removed by the air ejector and released from the site. The air ejector filter system will be utilized in accordance with Tech. Spec. 16.3.17 (attached).

Blowdown liquid is treated by the blowdown processing system. The design details of this system have not been specified at this time. Under evaluation for use in this system are evaporators, demineralizers, and similar processing equipment. The decontamination factor assumed for this system at this time is 100 for all radionuclides except tritium, for which DF = 1.

Question 27. What is the expected leak rate of steam to the turbine building (lb/hr)? What is the ventilation air flow through the turbine building (cfm)? Where is it discharged? Is the air filtered or treated before discharge? If so, provide expected performance.

Answer 27. A design basis estimate of turbine building leakage is 4 lb/day steam leakage and 250 lb/hr hot (380°F) condensate leakage. Turbine building air is discharged directly to the atmosphere unfiltered via roof ventilators at the rate of 900,000 scfm.

Question 28. What is the flow rate (cfm) of gaseous effluent from the main condenser ejector? What treatment is provided? Where is it released?

Answer 28. Air ejector effluent is discharged from site via the ventilation stack at a rate on the order of 10 sfm, depending upon condenser air-inleakage. This effluent is HEPA and charcoal filtered when the noble gas release rate reaches 0.1 µCi/second. (See Technical Specification 16.3.17, attached).

Question 29. What is the origin of the steam used in the gland seals (i.e., is it primary steam, condensate, or demineralized water from a separate source, etc.)? How is the effluent steam from the gland seals treated and disposed of?

Answer 29. The gland seals are operated with main steam. The gland seal effluent is condensed and any non-condensable gases are released unfiltered via the ventilation stack.

Question 30. What is the expected leak rate of primary coolant to the auxiliary building (lb/hr)? What is the ventilation air flow through the auxiliary building (cfm)? Where is it discharged? Is the air filtered or otherwise treated before discharged? If so, provide expected performance.

Answer 30. Expected primary coolant leak rate within the primary auxiliary building is 7 lb/hr of thermally cold liquid (below 212°F) and 0.35 lb/hr of thermally hot liquid (290°F). The ventilation flow rate from the PAB areas containing equipment subject to the above primary coolant leakage (the CVCS system) is ventilated at 7500 scfm. This ventilation air is HEPA and charcoal filtered before discharge via the ventilation stack.

Question 31. Provide average gallons/day and µCi/cc for following catagories of liquid effluents. Use currently observed data in the industry where different from the SAR or Environmental Report (indicate which is used).

a) High-level wastes (for example, primary coolant letdown, "clean" or low conductivity waste, equipment drains and deaerated wastes).
b) "Dirty" wastes (for example, floor drain wastes, high conductivity wastes, aerated wastes, and laboratory wastes).
c) Laundry, decontamination, and wash-down wastes.
d) Steam generator blowdown - give average flow rate and maximum short-term flows and their duration.
e) Drains from turbine building.
f) Frequency of regenerating condensate demineralizers and expected volume of regenerant solutions.

For these wastes (a - f) provide:
1. Number and capacity of collector tanks.
2. Fraction of water to be recycled and factors controlling decision.
3. Treatment steps - include number, capacity, and process decontamination factor for each principle nuclide for each step. If step is optional, state factors controlling decision.
4. Decay time from primary loop to discharge.

Answer 31. Sources

The sources of radioactive waste that are to be released from the Seabrook units are as follows:

(a) Reactor coolant letdown for tritium control
(b) Non-recycleable reactor coolant leakage
(c) Steam generator blowdown
(d) Secondary system condensate leakage
(e) Miscellaneous waste water such as laboratory drains, decontamination water, etc.

The list of potential sources of liquid to be discharged is reduced to the above because of the processing systems design principle at Seabrook to segregate, process, and recycle as much of the liquid extracted from the reactor coolant systems as possible. The systems provided to carry out this design principle are the boron recovery system and aerated waste recovery channel of the liquid waste processing system. These systems are described in Subsection 3.5.1 of this report. These descriptions illustrate the manner in which the collection and handling of the vast majority of liquid letdown and leakage from the reactor coolant systems are segregated from non-recycleable liquids and sent, after processing, to the reactor makeup water storage tanks for reuse within the reactor coolant systems.

Release Assumptions

The main assumptions and parameters used in estimating the magnitude of radioactive liquid discharges are as follows:

a) The radionuclides and their concentrations within the reactor coolant system are as listed in Table G-1 of this Appendix. These levels are based on the pertinent parameters given in response to previous questions of this questionnaire.
b) The radionuclides and their concentrations within the secondary side of the steam generators are as listed in Table G-2 of this Appendix. These levels are based on the pertinent parameters given in response to previous questions of this questionnaire.
c) The radionuclides and their concentrations within the secondary system condensate and feedwater are as listed in Table G-3 of this Appendix. These levels are based on the pertinent parameters given in response to previous questions in this questionnaire.

d) Liquids processed within either the boron recovery system or floor drain channel of the liquid waste system are decontaminated by the following factors:

All radionuclides except Iodine & Tritium.......	10^4
Iodine.....................................	10^3
Tritium....................................	1

e) No credit for radioactive decay of radionuclides between collection and release from the site.
f) Each unit operation is at 3654 Mwt at a 90% capacity factor.
g) Reactor coolant equilibrium tritium concentration is a maximum of 2.3 μCi/gm.

Releases

a) Tritium Control Reactor Coolant Letdown
As mentioned in subsection 3.5.1 of this report, tritium control considerations necessitate the anticipated need for discharging reactor coolant letdown after processing by the boron recovery system. The expected volume required for this measure is 200,000 gallons per refueling shutdown for each Seabrook unit. With the assumption of a refueling shutdown at each Seabrook unit each year, 400,000 gallons per year of this processed reactor coolant is released from the site. With the input liquid containing radionuclides at the Table G-1 values and with the processing DF's as stated above, the annual release from the Seabrook site (both units) from this source is as presented in Table 3.5-1 of this report.

b) Non-Recycleable Reactor Coolant Systems Leakage
The estimated average volumetric generation rates of non-recycleable primary system leakage are 40 gal/day inside the containment and 20 gal/day outside the containment. This liquid is collected in the 10,000 gallon floor drain tank, which is the head end of the floor drain channel of the liquid waste system. These generation rates are per unit and so the total input rate to the floor drain tank from both units is 120 gal/day. This liquid is assumed to contain radioactivity at reactor coolant concentrations, as listed in Table G-1. With the processing DF's as stated above, the annual release from the Seabrook site (both units) from this source is as presented in Table 3.5-2 of this report.

c) Steam Generator Blowdown
With reactor coolant radionuclide concentrations as listed in Table G-1 of this Appendix, the estimated average leakage of 20 gal/day of reactor coolant through the steam generator tubes results in equilibrium secondary side steam generator radionuclide concentrations as listed in Table G-2 of this Appendix. The steam generator secondary side blowdown rate associated with this leakage level is 50 gpm. The same leakage and blowdown rates are applied to both Seabrook units concurrently so that each steam generator blowdown concentrator is handling 50 gpm of blowdown liquid. The annual release from the Seabrook site (both units) from this source is as presented in Table 3.5-3 of this report.

d) Secondary System Condensate Leakage
Moisture carryover from and volatility within the steam generators result in the radionuclide concentrations within secondary system condensate water as listed in Table G-3 of this Appendix. The estimated average volumetric generation rate of this liquid is 10 gpm per unit. This liquid is discharged from the plant unprocessed which results in the annual release (both units) as presented in Table 3.5-4 of this report.

e) Miscellaneous Waste Liquids
The volume of laboratory sink drains, decontamination water, etc. that will be generated by the two Seabrook units total an estimated 100,000 gallons per year. (It should be noted that there will be no liquid waste generated from laundry operations at Seabrook since this effort will be contracted to an outside vendor.) The radioactivity content of this waste liquid is assumed to be 0.01% of the reactor coolant radionuclide levels given in Table G-1. The unprocessed discharge of this water from the Seabrook site amounts to the annual release presented in Table 3.5-5 of this report.

For the estimate of tritium releases from the above sources, refer to Subsection 3.5.1 of this report.

Question 32. Dilution flow rate for liquid effluents, minimum and normal gpm and total gallons per year.

Answer 32. Normal liquid effluent dilution flow rate is the flow due to the combined flows of the circulating and service water systems, 824,000 gpm. Minimum dilution flow is that due to one service water pump, 10,000 gpm.

Question 33. How is waste concentrate (filter cake, demineralizer resin, evaporator bottoms) handled? Give total volume, weight, and curies per day or year.

Answer 33. This information is given in Subsection 3.5.3 of this report.

Question 34. Include the expected annual volume of dry waste and curie content of each drum.

Answer 34. Refer to Subsection 3.5.3 of this report.

SEABROOK

ENVIRONMENTAL REPORT

TABLE G-1

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

RADIONUCLIDE	CONCENTRATION (μCi/gm)	RADIONUCLIDE	CONCENTRATION (μCi/gm)
I-131	5.0-1*	Cs-134	8.8-2
I-132	1.8-1	Cs-136	4.4-2
I-133	8.0-1	Cs-137	4.4-1
I-134	1.2-1	Te-132	5.2-2
I-135	4.4-1	Ba-140	9.0-4
		La-140	2.8-4
Sr-89	8.2-4	Ce-144	8.8-5
Sr-90	3.6-5		
Sr-91	6.2-3	Mn-54	7.9-4
Y-90	4.4-5	Mn-56	3.0-2
Y-91	1.2-3	Mn-58	2.6-2
Y-92	2.0-4	Co-60	7.7-4
Zr-95	1.3-4	Fe-59	1.1-3
Nb-95	1.4-4	Cr-51	9.5-4
Mo-99	6.6-1		

* 5.0-1 = 5.0×10^{-1}

SEABROOK

ENVIRONMENTAL REPORT

TABLE G-2

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS

RADIONUCLIDE	CONCENTRATION (μCi/gm)	RADIONUCLIDE	CONCENTRATION (μCi/gm)
I-131	1.3-4*	Cs-134	2.2-5
I-132	8.9-6	Cs-136	1.1-5
I-133	1.4-4	Cs-137	1.0-4
I-134	2.3-6	Te-132	1.3-5
I-135	4.6-5	Ba-140	2.4-7
		La-140	5.6-8
Sr-89	2.5-7	Ce-144	2.3-8
Sr-90	7.5-9		
Sr-91	8.2-7	Mn-54	2.2-7
Y-90	7.9-9	Mn-56	1.7-6
Y-91	3.3-7	Co-58	7.3-6
Y-92	1.3-8	Co-60	2.2-7
Zr-95	3.6-8	Fe-59	3.1-8
Nb-95	3.9-8	Cr-51	2.7-7
Mo-99	1.6-4		

* $1.3\text{-}4 = 1.3 \times 10^{-4}$

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ENVIRONMENTAL REPORT

TABLE G-3

SECONDARY SYSTEM CONDENSATE RADIONUCLIDE CONCENTRATIONS

RADIONUCLIDE	CONCENTRATION (μCi/gm)	RADIONUCLIDE	CONCENTRATION (μCi/gm)
I-131	1.3-6*	Cs-134	5.5-8
I-132	8.9-8	Cs-136	2.8-8
I-133	1.4-6	Cs-137	2.5-7
I-134	2.2-8	Te-132	3.3-8
I-135	4.6-7	Ba-140	6.0-10
		La-140	1.4-10
Sr-89	6.3-10	Ce-144	5.8-11
Sr-90	1.9-11		
Sr-91	2.1-9	Mn-54	5.4-10
Y-90	2.0-11	Mn-56	4.1-9
Y-91	8.3-10	Co-58	1.9-8
Y-92	3.3-11	Co-60	5.5-10
Zr-95	9.0-11	Fe-59	7.7-11
Nb-95	9.8-11	Cr-51	6.6-10
Mo-99	4.0-7		

* 1.3-6 = 1.3×10^{-6}

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ENVIRONMENTAL REPORT

TABLE G-4

NON-RECYCLEABLE REACTOR COOLANT LEAKAGE RELEASES
(total for both units)

RADIONUCLIDE	ANNUAL RELEASE (Curies/year)	RADIONUCLIDE	ANNUAL RELEASE (Curies/year)
I-131	7.8-3*	Cs-134	7.8-3
I-132	2.7-3	Cs-136	4.2-3
I-133	1.2-2	Cs-137	3.9-2
I-134	1.7-3	Te-132	8.1-4
I-135	6.6-3	Ba-140	1.3-5
		La-140	4.2-6
Sr-89	1.1-5	Ce-144	9.9-7
Sr-90	3.9-7		
Sr-91	5.7-6	Mn-54	1.2-5
Y-90	4.5-6	Mn-56	4.4-4
Y-91	1.8-4	Co-58	3.8-4
Y-92	2.1-5	Co-60	1.1-5
Zr-95	2.1-6	Fe-59	1.5-5
Nb-95	2.1-6	Cr-51	1.4-5
Mo-99	1.7-1		
		Total	0.25

*7.8-3 = 7.8×10^{-3}

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TABLE G-5

MISCELLANEOUS LIQUID RELEASES

RADIONUCLIDE	ANNUAL RELEASE (Curies/year)	RADIONUCLIDE	ANNUAL RELEASE (Curies/year)
I-131	2.0-2*	Cs-134	2.0-3
I-132	6.8-3	Cs-136	1.1-3
I-133	3.0-2	Cs-137	9.9-3
I-134	4.2-3	Te-132	2.0-3
I-135	1.7-2	Ba-140	3.2-5
		La-140	1.1-5
Sr-89	2.9-5	Ce-144	2.5-6
Sr-90	9.9-7		
Sr-91	1.4-5	Mn-54	2.9-5
Y-90	1.1-6	Mn-56	1.1-3
Y-91	4.5-5	Co-58	9.5-4
Y-92	5.3-6	Co-60	2.8-5
Zr-95	5.3-6	Fe-59	3.8-5
Nb-95	5.3-6	Cr-51	3.5-5
Mo-99	4.2-2		
		TOTAL	0.15

*2.02-2 = 2.0×10^{-2}

Technical Specification

16.3.16 Radioactive Liquid Release

Applicability: Applies to the controlled release of radioactive liquids from the site.

Objectives: To establish conditions for the release of radioactive liquids in order to assure that such releases are within the concentration limits expressed in 10 CFR Part 20 and in addition, to define objectives for radioactive liquid release in accordance with the proposed Appendix I to 10 CFR Part 50. The radioactive liquid release objectives so defined are as follows:

a) The annual total quantity of radioactivity in liquid releases from the site, excluding radioiodines, tritium, and dissolved noble gases, shall be less than 20 Curies;

b) The annual total quantity of radioiodines in liquid releases from the site shall be less than 28 Curies. The I-131 portion of this annual total quantity shall be less than 10 Curies;

c) The annual average concentration of radioactivity in liquid releases at the point of discharge to the Gulf of Maine, excluding tritium and dissolved noble gases, shall be less than 3.6×10^{-8} μCi/ml;

d) The annual average concentration of tritium in liquid releases at the point of discharge to the Gulf of Maine shall be less than 1×10^{-5} μCi/ml;

e) The annual average concentration of dissolved noble gases in liquid releases at the point of discharge to the Gulf of Maine shall be less than 2×10^{-6} μCi/ml.

Specifications: A. Release Quantities and Concentration of Discharged Radioactive Liquids

1. If the experienced release of radioactive liquids, when averaged over a calendar quarter, is such that these quantities if continued at the same release rate for a year would exceed twice the annual objectives the licensee will:

   a. make an investigation to identify the causes for such release rates;

   b. define and initiate a program of action to reduce such release rates to the objective levels, and;

   c. describe these actions in a report to the Commission within 30 days.

2. If the experienced release of radioactive liquids, when averaged over a calendar quarter, is such that these quantities if continued at the same release rate for a year would exceed eight times the annual objectives, the licensee shall define and initiate a program of action to assure that such release rates are reduced, and shall submit a report to the Commission within 7 days describing the causes for such release rates and the course of action taken to reduce them.

3. The rate of release of radioactive liquids from the site shall be controlled such that the instantaneous concentration of radioactivity in released liquids at the point of discharge to the Gulf of Maine does not exceed the values listed in 10 CFR Part 20, Appendix B, Table II, Column 2, with Notes 1 - 5 thereto.

B. Treatment and Monitoring

1. The radioactive liquid treatment and handling systems installed at Seabrook shall be maintained and operated with the intent of keeping radioactive liquid releases within the annual objectives of these Specifications.

2. Liquid released from the test tanks shall be continuously monitored by a process radiation monitor during release. The monitor shall be checked daily and calibrated at refueling intervals.

3. The liquid release monitor shall be set to alarm and automatically close the test tank discharge valve such that the 10 CFR Part 20 instantaneous release concentration limit is met.

4. Steam generator blowdown shall be continuously monitored, except that during periods when the monitor is not operating, daily grab samples shall be taken and analyzed for gross (β, γ) radioactivity content. The monitors shall be checked daily and calibrated at refueling intervals.

C. Sampling and Analysis

In addition to the above continuous monitoring requirements, radioactive liquid effluent sampling and analysis shall be performed in accordance with Table 16.3.16-1. Records shall be maintained and reports of the sampling and analysis results shall be submitted in accordance with Section 16.6.6 and 16.6.7 of these Specifications.

Basis: It is expected that the release of radioactive liquids from the Seabrook site will be kept within the expressed objective quantities and concentrations on the annual average and will not exceed instantaneously the applicable release concentration limits specified in 10 CFR 20.

The annual average release objectives provide reasonable assurance that the annual dose to the whole body or any single organ of an individual member of the general public will not exceed 5 millirems per year as a result of exposure to radionuclides released in liquid effluents from the Seabrook site. This assurance is derived from considerations of the behavior of released radionuclides within the critical marine exposure pathways for individuals in the Seabrook environment. This analysis shows that the consumption of shellfish caught in the Seabrook discharge area constitutes the maximum dose pathway. The evaluation of the doses to an individual from this pathway shows that at the objective release levels the maximum dose does not exceed 5 millirems. (Refer to PSAR Subsection 11.2.9 for this dose evaluation).

The basis for specifications A.1 and A.2 is to permit the licensee the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than the design objective levels but still within the concentration limits specified in 10 CFR Part 20. It is expected that using this operational flexibility under unusual operating conditions, the licensee shall exert every effort to keep levels of radioactivity in liquid releases within the design objective levels and that resulting annual releases will not exceed a small fraction of the annual average concentration limits specified in 10 CFR Part 20.

Radioactive liquid from the liquid waste processing system is collected and stored in tanks until a quantity sufficient for processing has accumulated. The processed liquid accumulates in the waste monitor tanks and is discharged after sampling and analysis through a recorder controller which provides a measure and control of volume of liquid released. The volume discharged, the analysis of the proportional composite sample, and knowledge of the available dilution flow provide the basis for reporting the quantity and concentration of radioactivity released.

The operating manual will identify all equipment installed in radioactive liquid treatment and handling systems and will specify detailed procedures for operating and maintaining this equipment.

The radioactive liquid release objectives expressed in this Specification are based upon the guidelines contained in the proposed Appendix I to 10 CFR Part 50. Since these guidelines have not been adopted as yet, the release objectives of this Specification will be reviewed at the time Appendix I becomes a regulation to assure that this Specification is based upon the guidelines contained therein.

References:

PSAR, Section 11.1, Source Terms
PSAR, Section 11.2, Liquid Waste Systems
PSAR, Section 11.4, Process and Effluent Radiological Monitoring Systems
Tech. Spec. Sections 16.6.6 and 16.6.7, Records and Reporting of Radioactive Releases to the Environment

Table 16.3.16-1

RADIOACTIVE LIQUID RELEASE SAMPLING AND ANALYSIS

A. Test Tank Releases

Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Each Batch	Gross β, γ	10^{-7} μCi/ml
One Batch/Month	Dissolved Noble Gases	10^{-4} μCi/ml
Weekly Proportional Composite (1)	Ba-140, La-140, I-131	10^{-6} μCi/ml
Monthly Proportional Composite (1)	Gamma Emitters	10^{-6} μCi/ml (2)
	H-3	10^{-5} μCi/ml
	Gross α	10^{-7} μCi/ml
Quarterly Proportional Composite (1)	Sr-89, Sr-90	10^{-8} μCi/ml (5)

B. Secondary System Blowdown and Leakage Releases (3)

Sampling Frequency	Type of Activity Analysis	Sensitivity Analysis
Weekly	Gross β, γ	10^{-7} μCi/ml
	Ba-140, La-140, I-131	10^{-6} μCi/ml
One Sample/Month	Dissolved Noble Gases	10^{-4} μCi/ml
Monthly Proportional Composite (4)	Gamma Emitters	10^{-6} μCi/ml (2)
	H-3	10^{-5} μCi/ml
	Gross α	10^{-7} μCi/ml
Quarterly Proportional Composite (4)	Sr-89, Sr-90	10^{-8} μCi/ml (5)

NOTES:

(1) A proportional sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid discharged from the site.

(2) For certain mixtures of gamma emitters, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measureable.

(3) Secondary system blowdown and secondary system leakage are each subject to the sampling and analysis requirements contained in Part B.

(4) Since these potential sources of radioactive liquid are discharged on a continuous rather than batch basis, the volume of liquid to be used as a basis for obtaining proportional samples from secondary blowdown and leakage is that amount discharged over the period of one week.

(5) One quarterly proportional composite sample will be collected and analyzed for Sr-89 and Sr-90. The proportional inputs to this sample will be from the monitor tank, secondary blowdown, and secondary leakage releases.

Technical Specification

16.3.17 Radioactive Gaseous Release

Applicability: Applies to the controlled release of all gaseous radioactive waste discharged from the site.

Objective: To establish conditions for the release of gaseous radioactive wastes that assure that all such releases are within the guidelines of 10 CFR Part 20 and, in addition, to define objectives for limiting these releases in accordance with the proposed Appendix I to 10 CFR Part 50. The gaseous release objectives so defined are as follows:

a. Averaged over a yearly interval. the total release rate of radioactive isotopes from both units, except (1) iodine and (2) particulate isotopes with half lives greater than 8 days, shall be limited as follows:

$$Q \lesssim \frac{8.6 \times 10^{-5}}{\bar{E}_\gamma} \quad \text{Ci/sec}$$

where Q is the total release rate in Ci/sec and $\bar{E}_\gamma$ is the average gamma decay energy of the mixture in Mev/disintegration.

b. Averaged over a yearly interval the release rate of (1) iodines and (2) particulate isotopes with half lives greater than 8 days, from both units shall be limited as follows:

$$\Sigma \frac{Qi}{(MPC)_i} \leq 30 \ m^3/\text{sec}$$

where Qi is the release rate of isotope i in Ci/sec and $(MPC)_i$ is defined for isotope i in column 1, Table II, Appendix B to 10 CFR Part 20 in μCi/cc (Ci/m^3).

Specifications: A. <u>Release Quantities of Radioactive Materials in Gaseous Waste</u>

1. If the experienced rate of release of radioactive materials in gaseous wastes, when averaged over a calendar quarter is such that these quantities if continued at the same release rate for a year would exceed twice the annual objectives, the licensee will:

   a. make an investigation to identify the causes for such release rates;

   b. define and initiate a program of action to reduce such release rates to the design levels;

   c. describe these actions in a report to the Commission within 30 days.

2. If the experienced rate of release of radioactive material in gaseous wastes, when averaged over a calendar quarter, is such that these quantities if continued at the same release rate for a year would exceed eight times the annual objectives, the licensee shall define and initiate a program of action to assure that such release rates are reduced, and shall submit a report to the Commission within 7 days describing the causes for such release rates and the course of action taken to reduce them.

B. <u>Treatment and Monitoring</u>

1. The radioactive gaseous waste equipment installed at Seabrook shall be maintained and operated with the intent of keeping releases within the annual objectives of this specification.

2. Radioactive gases discharged through the stack shall be continuously monitored for gross noble gas, particulate

and iodine activity. Whenever these monitors are inoperable an appropriate grab sample shall be taken and analyzed daily. The gross radiogas monitor shall be tested daily and calibrated at refueling intervals.

3. During power operation, the condenser air ejector discharge shall be continuously monitored for gross radiogas activity. Whenever this monitor is inoperable, grab samples shall be taken and analyzed for gross activity daily. The air ejector monitor shall be tested daily and calibrated at refueling intervals.

4. Release of gaseous waste from the carbon delay beds shall be continuously monitored for gross radioactivity. The effluent monitor shall be tested prior to any release from this system and shall be calibrated at refueling intervals.

5. Gaseous waste from the carbon delay beds shall be filtered through high efficiency particulate filters.

6. Gases waste from the condenser air ejector shall be filtered by high efficiency particulate and charcoal filters whenever the gross release rate from this system exceeds 10^{-7} Ci/sec.

7. Primary containment building purge shall be filtered by high efficiency particulate and charcoal filters whenever the concentration of I-131 inside the building exceeds 10^{-9} μCi/cc.

8. The maximum activity to be contained in the carbon delay beds shall not exceed 1.28×10^{5} Ci of Xe-133 equivalent.

C. <u>Sampling and Analysis</u>

In addition to the above continuous sampling and monitoring requirements, gaseous radioactive waste sampling and activity analysis shall be performed in accordance with Table 16.3.17-1. Records shall be maintained and reports of the sampling and analysis results shall be submitted in accordance with Sections 16.6.6 and 16.6.7 of these Specifications.

Basis: It is expected that the releases of radioactive materials in gaseous waste will be kept within the objective levels and will not exceed on an instantaneous basis the concentration limits specified in 10 CFR 20. The release levels specified provide reasonable assurance that the maximum dose to the whole body or any organ of an individual in the population will not exceed 5 mrem per year.

The objective release rate for noble gases and short lived particulates is based on a maximum whole body (γ) dose rate at the restricted area boundary of 5 mrem/year. This objective also provides reasonable assurance that the maximum skin dose to any individual in the population will not exceed 5 mrem/year. The bases for these dose calculations are discussed in subsection 11.3.9 of the PSAR.

The objective release rate for iodine and particulates is based on a 5 mrem/year thyroid dose to the critical individual in the population. The bases for this dose calculation are discussed in subsection 11.3.9 of the PSAR.

The specification for the air ejector and containment purge filter systems assures that releases from these systems will be kept within the objectives of proposed Appendix I and that unfiltered releases will never exceed the estimates given in section 11.3 of the PSAR.

The maximum activity specified for the carbon delay beds limits the offsite exposure dose to 5 rem from an accident involving the release of the contents of these beds. This dose is well below the limit of 10 CFR Part 100.

The radioactive gaseous release objectives expressed in this specification are based upon the guideline contained in the proposed Appendix I to 10 CFR Part 50. Since these guidelines have not yet been adopted, the objectives of this specification will be reviewed at the time Appendix I becomes a regulation to assure that this specification is based upon the guidelines contained therein.

TABLE 16.3.17-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

Carbon Delay Bed

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Weekly	Gross Gamma	10^{-5} µCi/cc
		Individual Gamma Emitters	10^{-4} µCi/cc(1)

Containment Venting Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Each Vent	Gross Gamma	10^{-5} µCi/cc
		Individual Gamma Emitters	10^{-4} µCi/cc(1)
Dehumidified Sample	Each Vent	H-3	10^{-6} µCi/cc
Charcoal	Each Vent	I-131	10^{-10} µCi/cc

Condenser Air Ejector Releases

Sample Type	Sample Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Monthly	Gross Gamma	10^{-4} µCi/cc
		Individual Gamma Emitters	10^{-3} µCi/cc(1)

TABLE 16.3.17-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

Gas Decay Tank Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Each Drum Release	Gross Gamma	10^{-5} μCi/cc
		Individual Gamma Emitters	10^{-4} μCi/cc(1)

Containment Venting Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Each Vent	Gross Gamma	10^{-5} μCi/cc
		Individual Gamma Emitters	10^{-4} μCi/cc(1)
Dehumidified Sample	Each Vent	H-3	10^{-6} μCi/cc
Charcoal	Each Vent	I-131	10^{-10} μCi/cc

Condenser Air Ejector Releases

Sample Type	Sample Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Monthly	Gross Gamma	10^{-4} μCi/cc
		Individual Gamma Emitters	10^{-3} μCi/cc(1)

Stack Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis
Gas	Quarterly	Gross Gamma	10^{-6} μCi/cc
		Individual Gamma Emitters	10^{-5} μCi/cc (1)
Dehumidified Sample	Each Decay Drum Release	H-3	10^{-6} μCi/cc
Charcoal	Weekly	I-131, I-133, I-135	3×10^{-12} μCi/cc
Particulates	Weekly	Gross β, γ	3×10^{-12} μCi/cc
	Weekly	Ba-140, La-140, I-131	3×10^{-11} μCi/cc
	Monthly Composite of Weekly Samples	Gross β, γ	3×10^{-12} μCi/cc
		Individual Gamma Emitters	3×10^{-11} μCi/cc
	Quarterly Composite of Weekly Samples	Sr-89, Sr-90	1×10^{-11} μCi/cc
	One Weekly Sample/Quarter	Gross α	3×10^{-12} μCi/cc

(1) For certain mixtures of gamma emitters, it may not be possible to measure radionuclides at levels near their sensitivity limits when other nuclides are present in the sample at much higher levels. Under these circumstances, it will be more appropriate to calculate the levels of such radionuclides using observed ratios with those radionuclides which are measurable.

MASSACHUSETTS ELECTRIC COMPANY

CHARITABLE CONTRIBUTIONS AND DONATIONS - 10 YEAR 1972

Miscellaneous Donations and Contributions (Charged to Accounts Other than 426.01 or 926.13

NONE

APPENDIX H

SEABROOK

Environmental Report

APPENDIX H

METEOROLOGICAL DATA SUMMARIES

The meteorological data collected at the Seabrook site were used to prepare seasonal and annual joint frequency distributions of wind speed and wind direction by atmospheric stability class. Atmospheric stability determination was based on the vertical temperature gradient and the Pasquill categories A through G defined in Regulatory Guide 1.23. The joint frequency distributions are presented in the tables that follow.

Table H-1

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	0	1	0	3	0	11	1	0	0	1	2	1	1	2	0	1	24
(1)	0.0	1.1	0.0	3.3	0.0	12.1	1.1	0.0	0.0	1.1	2.2	1.1	1.1	2.2	0.0	1.1	26.4
(2)	0.0	0.0	0.0	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	1.1
4.1- 6.0	0	2	0	2	4	13	3	0	0	2	4	2	8	4	1	0	45
(1)	0.0	2.2	0.0	2.2	4.4	14.3	3.3	0.0	0.0	2.2	4.4	2.2	8.8	4.4	1.1	0.0	49.5
(2)	0.0	0.1	0.0	0.1	0.2	0.6	0.1	0.0	0.0	0.1	0.2	0.1	0.4	0.2	0.0	0.0	2.0
6.1- 8.0	0	0	4	1	0	0	0	0	0	1	0	0	7	1	1	0	15
(1)	0.0	0.0	4.4	1.1	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	7.7	1.1	1.1	0.0	16.5
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.7
OVER 8.0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	6
(1)	0.0	2.2	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	6.6
(2)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS	0	5	7	6	4	24	4	0	0	4	6	3	16	7	4	1	91
(1)	0.0	5.5	7.7	6.6	4.4	26.4	4.4	0.0	0.0	4.4	6.6	3.3	17.6	7.7	4.4	1.1	100.0
(2)	0.0	0.2	0.3	0.3	0.2	1.1	0.2	0.0	0.0	0.2	0.3	0.1	0.7	0.3	0.2	0.0	4.1

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 91

Table H-2
SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	1	0	1	1	4	4	5	0	0	1	5	2	3	6	1	1	35
(1)	1.3	0.0	1.3	1.3	5.3	5.3	6.6	0.0	0.0	1.3	6.6	2.6	3.9	7.9	1.3	1.3	46.1
(2)	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.2	0.1	0.1	0.3	0.0	0.0	1.6
4.1- 6.0	1	0	2	1	1	3	2	0	1	1	3	3	7	4	1	0	30
(1)	1.3	0.0	2.6	1.3	1.3	3.9	2.6	0.0	1.3	1.3	3.9	3.9	9.2	5.3	1.3	0.0	39.5
(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.0	0.0	1.4
6.1- 8.0	0	2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	6
(1)	0.0	2.6	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.0	0.0	7.9
(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
OVER 8.0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	4
(1)	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.3	1.3	0.0	5.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS	2	3	4	3	5	7	7	0	1	3	8	5	11	12	4	1	76
(1)	2.6	3.9	5.3	3.9	6.6	9.2	9.2	0.0	1.3	3.9	10.5	6.6	14.5	15.8	5.3	1.3	100.0
(2)	0.1	0.1	0.2	0.1	0.2	0.3	0.3	0.0	0.0	0.1	0.4	0.2	0.5	0.5	0.2	0.0	3.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 76

Table H-3

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0		1	0	1	2	3	10	5	1	0	2	4	4	5	3	2	0	43
	(1)	0.9	0.0	0.9	1.9	2.8	9.4	4.7	0.9	0.0	1.9	3.8	3.8	4.7	2.8	1.9	0.0	40.6
	(2)	0.0	0.0	0.0	0.1	0.1	0.5	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0	2.0
4.1- 6.0		2	2	1	2	5	2	5	1	2	3	0	3	9	8	1	0	46
	(1)	1.9	1.9	0.9	1.9	4.7	1.9	4.7	0.9	1.9	2.8	0.0	2.8	8.5	7.5	0.9	0.0	43.4
	(2)	0.1	0.1	0.0	0.1	0.2	0.1	0.2	0.0	0.1	0.1	0.0	0.1	0.4	0.4	0.0	0.0	2.1
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	1	4	6	2	0	13
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.8	5.7	1.9	0.0	12.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.6
OVER 8.0		0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	4
	(1)	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	3.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
ALL SPEEDS		3	3	2	4	8	12	10	2	2	5	4	8	18	20	5	0	106
	(1)	2.8	2.8	1.9	3.8	7.5	11.3	9.4	1.9	1.9	4.7	3.8	7.5	17.0	18.9	4.7	0.0	100.0
	(2)	0.1	0.1	0.1	0.2	0.4	0.5	0.5	0.1	0.1	0.2	0.2	0.4	0.8	0.9	0.2	0.0	4.8

(Direction columns NNE through N are grouped under the heading DIRECTION.)

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 106

Table H-4

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)	DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	11	8	1	6	12	8	15	15	4	4	10	15	17	8	18	14	166
(1)	1.0	0.7	0.1	0.5	1.1	0.7	1.4	1.4	0.4	0.4	0.9	1.4	1.6	0.7	1.6	1.3	15.2
(2)	0.5	0.4	0.0	0.3	0.5	0.4	0.7	0.7	0.2	0.2	0.5	0.7	0.8	0.4	0.8	0.6	7.5
1.6- 4.0	15	74	44	29	34	42	48	35	26	23	22	34	46	60	37	36	605
(1)	1.4	6.8	4.0	2.7	3.1	3.8	4.4	3.2	2.4	2.1	2.0	3.1	4.2	5.5	3.4	3.3	55.4
(2)	0.7	3.4	2.0	1.3	1.5	1.9	2.2	1.6	1.2	1.0	1.0	1.5	2.1	2.7	1.7	1.6	27.5
4.1- 6.0	5	23	45	22	10	4	0	3	5	13	6	17	27	40	13	1	234
(1)	0.5	2.1	4.1	2.0	0.9	0.4	0.0	0.3	0.5	1.2	0.5	1.6	2.5	3.7	1.2	0.1	21.4
(2)	0.2	1.0	2.0	1.0	0.5	0.2	0.0	0.1	0.2	0.6	0.3	0.8	1.2	1.8	0.6	0.0	10.6
6.1- 8.0	0	5	20	4	2	1	0	0	0	2	1	0	5	24	5	1	70
(1)	0.0	0.5	1.8	0.4	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.5	2.2	0.5	0.1	6.4
(2)	0.0	0.2	0.9	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	1.1	0.2	0.0	3.2
OVER 8.0	0	5	7	2	0	0	0	0	0	0	0	0	0	3	0	0	17
(1)	0.0	0.5	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.6
(2)	0.0	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8
ALL SPEEDS	31	115	117	63	58	55	63	53	35	42	39	66	95	135	73	52	1092
(1)	2.8	10.5	10.7	5.8	5.3	5.0	5.8	4.9	3.2	3.8	3.6	6.0	8.7	12.4	6.7	4.8	100.0
(2)	1.4	5.2	5.3	2.9	2.6	2.5	2.9	2.4	1.6	1.9	1.8	3.0	4.3	6.1	3.3	2.4	49.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 1092

Table H-5

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
								DIRECTION									
0.0- 1.5	10	7	2	3	3	9	9	11	8	10	16	21	27	12	10	10	168
(1)	1.6	1.2	0.3	0.5	0.5	1.5	1.5	1.8	1.3	1.6	2.6	3.5	4.4	2.0	1.6	1.6	27.6
(2)	0.5	0.3	0.1	0.1	0.1	0.4	0.4	0.5	0.4	0.5	0.7	1.0	1.2	0.5	0.5	0.5	7.6
1.6- 4.0	15	6	10	13	15	17	11	10	20	28	24	61	50	67	18	13	378
(1)	2.5	1.0	1.6	2.1	2.5	2.8	1.8	1.6	3.3	4.6	3.9	10.0	8.2	11.0	3.0	2.1	62.2
(2)	0.7	0.3	0.5	0.6	0.7	0.8	0.5	0.5	0.9	1.3	1.1	2.8	2.3	3.0	0.8	0.6	17.2
4.1- 6.0	0	1	1	0	0	1	1	0	7	5	6	4	9	12	1	1	49
(1)	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.0	1.2	0.8	1.0	0.7	1.5	2.0	0.2	0.2	8.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.2	0.4	0.5	0.0	0.0	2.2
6.1- 8.0	0	0	2	0	1	0	0	0	1	1	0	0	1	2	0	0	8
(1)	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.3	0.0	0.0	1.3
(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
OVER 8.0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5
(1)	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
(2)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS	25	16	18	16	19	27	21	21	36	44	46	86	87	93	29	24	608
(1)	4.1	2.6	3.0	2.6	3.1	4.4	3.5	3.5	5.9	7.2	7.6	14.1	14.3	15.3	4.8	3.9	100.0
(2)	1.1	0.7	0.8	0.7	0.9	1.2	1.0	1.0	1.6	2.0	2.1	3.9	4.0	4.2	1.3	1.1	27.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 608

Table H-6

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION																
		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		3	0	2	2	4	5	4	0	2	6	8	10	12	8	7	1	74
	(1)	2.8	0.0	1.9	1.9	3.7	4.6	3.7	0.0	1.9	5.6	7.4	9.3	11.1	7.4	6.5	0.9	68.5
	(2)	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.0	0.1	0.3	0.4	0.5	0.5	0.4	0.3	0.0	3.4
1.6- 4.0		0	0	0	1	0	2	1	0	2	4	5	6	4	5	2	1	33
	(1)	0.0	0.0	0.0	0.9	0.0	1.9	0.9	0.0	1.9	3.7	4.6	5.6	3.7	4.6	1.9	0.9	30.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.2	0.1	0.0	1.5
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		3	1	2	3	4	7	5	0	4	10	13	16	16	13	9	2	108
	(1)	2.8	0.9	1.9	2.8	3.7	6.5	4.6	0.0	3.7	9.3	12.0	14.8	14.8	12.0	8.3	1.9	100.0
	(2)	0.1	0.0	0.1	0.1	0.2	0.3	0.2	0.0	0.2	0.5	0.6	0.7	0.7	0.6	0.4	0.1	4.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 108

Table H-7

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	2	1	0	2	6	2	5	4	5	9	12	42	16	6	3	116
	(1)	0.8	1.7	0.8	0.0	1.7	5.1	1.7	4.2	3.4	4.2	7.6	10.2	35.6	13.6	5.1	2.5	98.3
	(2)	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.5	1.9	0.7	0.3	0.1	5.3
1.6- 4.0		0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	1.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	2	1	0	2	6	2	5	4	5	9	12	42	18	6	3	118
	(1)	0.8	1.7	0.8	0.0	1.7	5.1	1.7	4.2	3.4	4.2	7.6	10.2	35.6	15.3	5.1	2.5	100.0
	(2)	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.5	1.9	0.8	0.3	0.1	5.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 118

Table H-8

SEABROOK

30 FT WIND DATA DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS SPRING (MAR 72 - MAY 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	25	17	6	11	21	28	30	31	18	25	43	58	98	44	43	28	526
(1)	1.1	0.8	0.3	0.5	1.0	1.3	1.4	1.4	0.8	1.1	2.0	2.6	4.5	2.0	2.0	1.3	23.9
(2)	1.1	0.8	0.3	0.5	1.0	1.3	1.4	1.4	0.8	1.1	2.0	2.6	4.5	2.0	2.0	1.3	23.9
1.6- 4.0	32	81	56	49	56	86	71	46	48	59	62	108	109	145	60	52	1120
(1)	1.5	3.7	2.5	2.2	2.5	3.9	3.2	2.1	2.2	2.7	2.8	4.9	5.0	6.6	2.7	2.4	50.9
(2)	1.5	3.7	2.5	2.2	2.5	3.9	3.2	2.1	2.2	2.7	2.8	4.9	5.0	6.6	2.7	2.4	50.9
4.1- 6.0	8	28	49	27	20	23	11	4	15	24	19	29	60	68	17	2	404
(1)	0.4	1.3	2.2	1.2	0.9	1.0	0.5	0.2	0.7	1.1	0.9	1.3	2.7	3.1	0.8	0.1	18.4
(2)	0.4	1.3	2.2	1.2	0.9	1.0	0.5	0.2	0.7	1.1	0.9	1.3	2.7	3.1	0.8	0.1	18.4
6.1- 8.0	0	7	27	6	3	1	0	0	1	4	1	1	18	34	8	1	112
(1)	0.0	0.3	1.2	0.3	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	1.5	0.4	0.0	5.1
(2)	0.0	0.3	1.2	0.3	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	1.5	0.4	0.0	5.1
OVER 8.0	0	12	13	2	0	0	0	0	0	1	0	0	0	7	2	0	37
(1)	0.0	0.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	1.7
(2)	0.0	0.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	1.7
ALL SPEEDS	65	145	151	95	100	138	112	81	82	113	125	196	285	298	130	83	2199
(1)	3.0	6.6	6.9	4.3	4.5	6.3	5.1	3.7	3.7	5.1	5.7	8.9	13.0	13.6	5.9	3.8	100.0
(2)	3.0	6.6	6.9	4.3	4.5	6.3	5.1	3.7	3.7	5.1	5.7	8.9	13.0	13.6	5.9	3.8	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2199

DATA RECOVERY = 99.6 PERCENT

Table H-9

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	3
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	1.1	0.0	3.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		0	0	2	4	6	7	5	0	1	1	6	5	8	5	2	0	52
	(1)	0.0	0.0	2.1	4.3	6.4	7.4	5.3	0.0	1.1	1.1	6.4	5.3	8.5	5.3	2.1	0.0	55.3
	(2)	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.0	0.0	0.0	0.3	0.2	0.4	0.2	0.1	0.0	2.4
4.1- 6.0		0	0	1	3	1	0	0	0	0	1	1	5	3	9	1	0	25
	(1)	0.0	0.0	1.1	3.2	1.1	0.0	0.0	0.0	0.0	1.1	1.1	5.3	3.2	9.6	1.1	0.0	26.6
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.4	0.0	0.0	1.2
6.1- 8.0		0	0	6	2	0	0	0	0	0	0	0	0	3	3	0	0	14
	(1)	0.0	0.0	6.4	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.2	0.0	0.0	14.9
	(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.6
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		0	0	9	9	7	7	5	0	1	3	7	10	15	17	4	0	94
	(1)	0.0	0.0	9.6	9.6	7.4	7.4	5.3	0.0	1.1	3.2	7.4	10.6	16.0	18.1	4.3	0.0	100.0
	(2)	0.0	0.0	0.4	0.4	0.3	0.3	0.2	0.0	0.0	0.1	0.3	0.5	0.7	0.8	0.2	0.0	4.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 94

Table H-10

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	4
	(1)	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	0.0	0.0	5.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1.6- 4.0		0	2	3	3	7	7	3	0	0	2	2	5	7	4	2	2	49
	(1)	0.0	2.8	4.2	4.2	9.9	9.9	4.2	0.0	0.0	2.8	2.8	7.0	9.9	5.6	2.8	2.8	69.0
	(2)	0.0	0.1	0.1	0.1	0.3	0.3	0.1	0.0	0.0	0.1	0.1	0.2	0.3	0.2	0.1	0.1	2.3
4.1- 6.0		0	1	0	0	1	1	1	0	0	1	2	0	3	4	1	0	15
	(1)	0.0	1.4	0.0	0.0	1.4	1.4	1.4	0.0	0.0	1.4	2.8	0.0	4.2	5.6	1.4	0.0	21.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.7
6.1- 8.0		0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
	(1)	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	2.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	3	3	4	8	8	4	0	0	3	4	6	11	11	3	2	71
	(1)	1.4	4.2	4.2	5.6	11.3	11.3	5.6	0.0	0.0	4.2	5.6	8.5	15.5	15.5	4.2	2.8	100.0
	(2)	0.0	0.1	0.1	0.2	0.4	0.4	0.2	0.0	0.0	0.1	0.2	0.3	0.5	0.5	0.1	0.1	3.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 71

Table H-11

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	5
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	1.6	4.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
1.6- 4.0		2	1	0	4	15	11	5	0	0	4	13	7	7	5	4	1	79
	(1)	1.6	0.8	0.0	3.2	12.0	8.8	4.0	0.0	0.0	3.2	10.4	5.6	5.6	4.0	3.2	0.8	63.2
	(2)	0.1	0.0	0.0	0.2	0.7	0.5	0.2	0.0	0.0	0.2	0.6	0.3	0.3	0.2	0.2	0.0	3.7
4.1- 6.0		0	1	2	4	5	1	1	0	0	1	3	6	5	10	2	0	41
	(1)	0.0	0.8	1.6	3.2	4.0	0.8	0.8	0.0	0.0	0.8	2.4	4.8	4.0	8.0	1.6	0.0	32.8
	(2)	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.5	0.1	0.0	1.9
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		2	2	2	8	20	12	6	0	0	5	16	13	13	16	7	3	125
	(1)	1.6	1.6	1.6	6.4	16.0	9.6	4.8	0.0	0.0	4.0	12.8	10.4	10.4	12.8	5.6	2.4	100.0
	(2)	0.1	0.1	0.1	0.4	0.9	0.6	0.3	0.0	0.0	0.2	0.7	0.6	0.6	0.7	0.3	0.1	5.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 125

Table H-12

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
		DIRECTION																
0.0- 1.5		8	8	6	11	12	18	19	19	16	6	21	21	15	18	11	9	218
	(1)	1.0	1.0	0.7	1.3	1.4	2.1	2.3	2.3	1.9	0.7	2.5	2.5	1.8	2.1	1.3	1.1	26.0
	(2)	0.4	0.4	0.3	0.5	0.6	0.8	0.9	0.9	0.7	0.3	1.0	1.0	0.7	0.8	0.5	0.4	10.1
1.6- 4.0		5	9	26	29	81	73	38	9	25	60	68	27	26	25	10	9	520
	(1)	0.6	1.1	3.1	3.5	9.6	8.7	4.5	1.1	3.0	7.1	8.1	3.2	3.1	3.0	1.2	1.1	61.9
	(2)	0.2	0.4	1.2	1.3	3.7	3.4	1.8	0.4	1.2	2.8	3.1	1.2	1.2	1.2	0.5	0.4	24.0
4.1- 6.0		0	1	10	0	2	1	1	1	5	25	6	6	6	11	1	0	76
	(1)	0.0	0.1	1.2	0.0	0.2	0.1	0.1	0.1	0.6	3.0	0.7	0.7	0.7	1.3	0.1	0.0	9.0
	(2)	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.0	0.2	1.2	0.3	0.3	0.3	0.5	0.0	0.0	3.5
6.1- 8.0		0	0	11	1	0	1	0	0	0	1	2	0	0	3	0	0	19
	(1)	0.0	0.0	1.3	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.4	0.0	0.0	2.3
	(2)	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.9
OVER 8.0		0	0	5	0	1	0	0	0	0	0	0	0	0	1	0	0	7
	(1)	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS		13	18	58	41	96	93	58	29	46	92	97	54	47	58	22	18	840
	(1)	1.5	2.1	6.9	4.9	11.4	11.1	6.9	3.5	5.5	11.0	11.5	6.4	5.6	6.9	2.6	2.1	100.0
	(2)	0.6	0.8	2.7	1.9	4.4	4.3	2.7	1.3	2.1	4.3	4.5	2.5	2.2	2.7	1.0	0.8	38.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 840

Table H-13
SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	5	14	8	12	9	21	28	29	25	30	41	35	23	9	3	6	298
(1)	0.8	2.3	1.3	2.0	1.5	3.5	4.7	4.8	4.2	5.0	6.8	5.8	3.8	1.5	0.5	1.0	49.7
(2)	0.2	0.6	0.4	0.6	0.4	1.0	1.3	1.3	1.2	1.4	1.9	1.6	1.1	0.4	0.1	0.3	13.8
1.6- 4.0	1	3	10	7	12	13	18	6	21	49	54	44	27	12	6	1	284
(1)	0.2	0.5	1.7	1.2	2.0	2.2	3.0	1.0	3.5	8.2	9.0	7.3	4.5	2.0	1.0	0.2	47.4
(2)	0.0	0.1	0.5	0.3	0.6	0.6	0.8	0.3	1.0	2.3	2.5	2.0	1.2	0.6	0.3	0.0	13.1
4.1- 6.0	0	0	4	0	0	0	0	0	0	5	0	0	3	2	0	0	14
(1)	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.5	0.3	0.0	0.0	2.3
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.6
6.1- 8.0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
(1)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OVER 8.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	6	17	23	20	21	34	46	35	46	64	96	79	53	23	9	7	599
(1)	1.0	2.8	3.8	3.3	3.5	5.7	7.7	5.8	7.7	14.0	16.0	13.2	8.8	3.8	1.5	1.2	100.0
(2)	0.3	0.8	1.1	0.9	1.0	1.6	2.1	1.6	2.1	3.9	4.4	3.7	2.4	1.1	0.4	0.3	27.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 599

Table H-14

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	2	5	4	7	10	9	13	21	29	21	31	12	2	1	168
	(1)	0.4	0.0	0.9	2.2	1.7	3.1	4.4	3.9	5.7	9.2	12.7	9.2	13.5	5.2	0.9	0.4	73.4
	(2)	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.4	0.6	1.0	1.3	1.0	1.4	0.6	0.1	0.0	7.8
1.6- 4.0		0	0	1	3	0	3	0	1	0	5	10	12	14	11	0	0	60
	(1)	0.0	0.0	0.4	1.3	0.0	1.3	0.0	0.4	0.0	2.2	4.4	5.2	6.1	4.8	0.0	0.0	26.2
	(2)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.5	0.6	0.6	0.5	0.0	0.0	2.8
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	0	3	8	4	10	10	10	13	26	39	34	45	23	2	1	229
	(1)	0.4	0.0	1.3	3.5	1.7	4.4	4.4	4.4	5.7	11.4	17.0	14.8	19.7	10.0	0.9	0.4	100.0
	(2)	0.0	0.0	0.1	0.4	0.2	0.5	0.5	0.5	0.6	1.2	1.8	1.6	2.1	1.1	0.1	0.0	10.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 229

Table H-15

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	2	2	3	7	4	4	6	6	4	9	22	37	75	16	2	3	202
(1)	1.0	1.0	1.5	3.4	1.9	1.9	2.9	2.9	1.9	4.4	10.7	18.0	36.4	7.8	1.0	1.5	98.1
(2)	0.1	0.1	0.1	0.3	0.2	0.2	0.3	0.3	0.2	0.4	1.0	1.7	3.5	0.7	0.1	0.1	9.3
1.6- 4.0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	4
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	1.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	2	2	3	7	4	4	7	6	4	10	22	37	76	17	2	3	206
(1)	1.0	1.0	1.5	3.4	1.9	1.9	3.4	2.9	1.9	4.9	10.7	18.0	36.9	8.3	1.0	1.5	100.0
(2)	0.1	0.1	0.1	0.3	0.2	0.2	0.3	0.3	0.2	0.5	1.0	1.7	3.5	0.8	0.1	0.1	9.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 206

Table H-16

SEABROOK

30 FT WIND DATA   DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS   SUMMER (JUN 72 - AUG 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	17	24	19	35	29	50	63	63	58	67	113	115	147	57	20	21	898
(1)	0.8	1.1	0.9	1.6	1.3	2.3	2.9	2.9	2.7	3.1	5.2	5.3	6.8	2.6	0.9	1.0	41.5
(2)	0.8	1.1	0.9	1.6	1.3	2.3	2.9	2.9	2.7	3.1	5.2	5.3	6.8	2.6	0.9	1.0	41.5
1.6- 4.0	8	15	42	50	121	114	70	16	47	122	153	100	90	63	24	13	1048
(1)	0.4	0.7	1.9	2.3	5.6	5.3	3.2	0.7	2.2	5.6	7.1	4.6	4.2	2.9	1.1	0.6	48.4
(2)	0.4	0.7	1.9	2.3	5.6	5.3	3.2	0.7	2.2	5.6	7.1	4.6	4.2	2.9	1.1	0.6	48.4
4.1- 6.0	0	3	17	7	9	3	3	1	5	33	12	18	20	36	5	0	172
(1)	0.0	0.1	0.8	0.3	0.4	0.1	0.1	0.0	0.2	1.5	0.6	0.8	0.9	1.7	0.2	0.0	7.9
(2)	0.0	0.1	0.8	0.3	0.4	0.1	0.1	0.0	0.2	1.5	0.6	0.8	0.9	1.7	0.2	0.0	7.9
6.1- 8.0	0	0	18	4	0	1	0	0	0	1	3	0	3	7	0	0	37
(1)	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	1.7
(2)	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	1.7
OVER 8.0	0	0	5	1	1	0	0	0	0	0	0	0	0	2	0	0	9
(1)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
ALL SPEEDS	25	42	101	97	160	168	136	80	110	223	281	233	260	165	49	34	2164
(1)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0
(2)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2164   DATA RECOVERY = 98.0 PERCENT

Table H-17

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	1.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0		1	1	0	1	3	1	0	0	0	1	2	3	5	3	0	1	22
	(1)	1.8	1.8	0.0	1.8	5.3	1.8	0.0	0.0	0.0	1.8	3.5	5.3	8.8	5.3	0.0	1.8	38.6
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	1.1
4.1- 6.0		1	1	7	3	0	0	0	0	0	0	0	0	2	4	0	1	19
	(1)	1.8	1.8	12.3	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	0.0	1.8	33.3
	(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.9
6.1- 8.0		0	0	5	0	0	0	0	0	0	0	0	0	2	4	2	0	13
	(1)	0.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	3.5	0.0	22.8
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.6
OVER 8.0		0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
	(1)	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	3.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS		2	2	12	5	3	1	0	0	0	1	2	3	9	12	3	2	57
	(1)	3.5	3.5	21.1	8.8	5.3	1.8	0.0	0.0	0.0	1.8	3.5	5.3	15.8	21.1	5.3	3.5	100.0
	(2)	0.1	0.1	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.6	0.1	0.1	2.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 57

Table H-18

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
	(1)	1.6	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		0	0	1	2	2	1	1	0	0	4	2	2	11	7	3	3	39
	(1)	0.0	0.0	1.6	3.1	3.1	1.6	1.6	0.0	0.0	6.3	3.1	3.1	17.2	10.9	4.7	4.7	60.9
	(2)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.5	0.3	0.1	0.1	1.9
4.1- 6.0		0	1	6	0	0	1	0	0	0	0	0	2	3	1	2	1	17
	(1)	0.0	1.6	9.4	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	3.1	4.7	1.6	3.1	1.6	26.6
	(2)	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.8
6.1- 8.0		0	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	6
	(1)	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	1.6	0.0	9.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	1	8	2	2	2	2	0	0	4	2	4	14	12	6	4	64
	(1)	1.6	1.6	12.5	3.1	3.1	3.1	3.1	0.0	0.0	6.3	3.1	6.3	21.9	18.8	9.4	6.3	100.0
	(2)	0.0	0.0	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.2	0.7	0.6	0.3	0.2	3.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 64

Table H-19

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

								DIRECTION									
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	4
(1)	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	1.3	0.0	5.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2
1.6- 4.0	1	2	0	1	3	3	1	0	2	3	2	8	15	5	2	0	48
(1)	1.3	2.5	0.0	1.3	3.8	3.8	1.3	0.0	2.5	3.8	2.5	10.1	19.0	6.3	2.5	0.0	60.8
(2)	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.4	0.7	0.2	0.1	0.0	2.4
4.1- 6.0	0	0	4	1	0	0	0	0	0	1	0	1	3	5	3	1	19
(1)	0.0	0.0	5.1	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3	3.8	6.3	3.8	1.3	24.1
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.9
6.1- 8.0	0	0	0	2	0	0	0	0	0	0	0	0	1	3	0	0	6
(1)	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.8	0.0	0.0	7.6
(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3
OVER 8.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2
(1)	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	2.5
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS	1	2	4	5	3	4	1	0	2	4	2	11	19	13	7	1	79
(1)	1.3	2.5	5.1	6.3	3.8	5.1	1.3	0.0	2.5	5.1	2.5	13.9	24.1	16.5	8.9	1.3	100.0
(2)	0.0	0.1	0.2	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.1	0.5	0.7	0.6	0.3	0.0	3.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 79

Table H-20

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DIRECTION

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	11	12	7	7	3	8	8	3	5	6	6	8	7	12	13	14	130
(1)	1.6	1.7	1.0	1.0	0.4	1.2	1.2	0.4	0.7	0.9	0.9	1.2	1.0	1.7	1.9	2.0	18.8
(2)	0.5	0.6	0.3	0.3	0.1	0.4	0.4	0.1	0.2	0.3	0.3	0.4	0.3	0.6	0.6	0.7	6.4
1.6- 4.0	19	20	35	16	37	16	12	11	9	26	21	29	46	41	36	29	403
(1)	2.7	2.9	5.1	2.3	5.3	2.3	1.7	1.6	1.3	3.8	3.0	4.2	6.6	5.9	5.2	4.2	58.2
(2)	0.9	1.0	1.7	0.8	1.8	0.8	0.6	0.5	0.4	1.3	1.0	1.4	2.3	2.0	1.8	1.4	20.0
4.1- 6.0	4	11	11	1	0	0	0	0	3	10	6	6	18	30	5	5	110
(1)	0.6	1.6	1.6	0.1	0.0	0.0	0.0	0.0	0.4	1.4	0.9	0.9	2.6	4.3	0.7	0.7	15.9
(2)	0.2	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.3	0.3	0.9	1.5	0.2	0.2	5.4
6.1- 8.0	4	3	2	0	0	0	0	0	0	0	0	0	6	10	2	3	30
(1)	0.6	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.4	0.3	0.4	4.3
(2)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.1	0.1	1.5
OVER 8.0	0	0	6	3	0	0	0	0	0	0	0	0	2	7	1	0	19
(1)	0.0	0.0	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.1	0.0	2.7
(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.9
ALL SPEEDS	38	46	61	27	40	24	20	14	17	42	33	43	79	100	57	51	692
(1)	5.5	6.6	8.8	3.9	5.8	3.5	2.9	2.0	2.5	6.1	4.8	6.2	11.4	14.5	8.2	7.4	100.0
(2)	1.9	2.3	3.0	1.3	2.0	1.2	1.0	0.7	0.8	2.1	1.6	2.1	3.9	5.0	2.8	2.5	34.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 692

Table H-21

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	8	4	2	7	7	5	9	19	22	16	25	24	33	30	15	11	237
(1)	1.2	0.6	0.3	1.0	1.0	0.7	1.3	2.8	3.3	2.4	3.7	3.6	4.9	4.5	2.2	1.6	35.2
(2)	0.4	0.2	0.1	0.3	0.3	0.2	0.4	0.9	1.1	0.8	1.2	1.2	1.6	1.5	0.7	0.5	11.7
1.6- 4.0	3	0	7	3	4	6	0	5	12	41	37	48	93	72	18	10	359
(1)	0.4	0.0	1.0	0.4	0.6	0.9	0.0	0.7	1.8	6.1	5.5	7.1	13.8	10.7	2.7	1.5	53.3
(2)	0.1	0.0	0.3	0.1	0.2	0.3	0.0	0.2	0.6	2.0	1.8	2.4	4.6	3.6	0.9	0.5	17.8
4.1- 6.0	1	1	2	11	3	1	0	0	1	0	0	1	5	21	0	2	49
(1)	0.1	0.1	0.3	1.6	0.4	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.7	3.1	0.0	0.3	7.3
(2)	0.0	0.0	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.0	0.1	2.4
6.1- 8.0	0	0	3	5	0	0	0	0	0	0	0	0	2	9	3	1	23
(1)	0.0	0.0	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.4	0.1	3.4
(2)	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.1
OVER 8.0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5
(1)	0.0	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
(2)	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS	12	7	14	29	14	12	9	24	35	57	62	73	133	132	36	24	673
(1)	1.8	1.0	2.1	4.3	2.1	1.8	1.3	3.6	5.2	8.5	9.2	10.8	19.8	19.6	5.3	3.6	100.0
(2)	0.6	0.3	0.7	1.4	0.7	0.6	0.4	1.2	1.7	2.8	3.1	3.6	6.6	6.5	1.8	1.2	33.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 673

Table H-22

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		3	1	2	1	2	0	4	3	10	11	25	10	39	24	4	2	141
	(1)	1.5	0.5	1.0	0.5	1.0	0.0	2.1	1.5	5.2	5.7	12.9	5.2	20.1	12.4	2.1	1.0	72.7
	(2)	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.1	0.5	0.5	1.2	0.5	1.9	1.2	0.2	0.1	7.0
1.6- 4.0		0	1	0	2	3	0	0	1	0	3	5	3	13	21	1	0	53
	(1)	0.0	0.5	0.0	1.0	1.5	0.0	0.0	0.5	0.0	1.5	2.6	1.5	6.7	10.8	0.5	0.0	27.3
	(2)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.6	1.0	0.0	0.0	2.6
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		3	2	2	3	5	0	4	4	10	14	30	13	52	45	5	2	194
	(1)	1.5	1.0	1.0	1.5	2.6	0.0	2.1	2.1	5.2	7.2	15.5	6.7	26.8	23.2	2.6	1.0	100.0
	(2)	0.1	0.1	0.1	0.1	0.2	0.0	0.2	0.2	0.5	0.7	1.5	0.6	2.6	2.2	0.2	0.1	9.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 194

Table H-23

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		2	2	0	2	0	1	2	2	6	17	18	37	112	35	8	4	248
	(1)	0.8	0.8	0.0	0.8	0.0	0.4	0.8	0.8	2.3	6.5	6.9	14.2	43.1	13.5	3.1	1.5	95.4
	(2)	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.8	0.9	1.8	5.5	1.7	0.4	0.2	12.3
1.6- 4.0		0	0	0	0	0	0	0	0	0	1	0	2	4	5	0	0	12
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.8	1.5	1.9	0.0	0.0	4.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.6
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		2	2	0	2	0	1	2	2	6	18	18	39	116	40	8	4	260
	(1)	0.8	0.8	0.0	0.8	0.0	0.4	0.8	0.8	2.3	6.9	6.9	15.0	44.6	15.4	3.1	1.5	100.0
	(2)	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.9	0.9	1.9	5.7	2.0	0.4	0.2	12.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 260

Table H-24

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	25	19	11	17	12	15	24	27	43	50	74	81	191	101	42	31	763
(1)	1.2	0.9	0.5	0.8	0.6	0.7	1.2	1.3	2.1	2.5	3.7	4.0	9.5	5.0	2.1	1.5	37.8
(2)	1.2	0.9	0.5	0.8	0.6	0.7	1.2	1.3	2.1	2.5	3.7	4.0	9.5	5.0	2.1	1.5	37.8
1.6- 4.0	24	24	43	25	52	27	14	17	23	79	69	95	187	154	60	43	936
(1)	1.2	1.2	2.1	1.2	2.6	1.3	0.7	0.8	1.1	3.9	3.4	4.7	9.3	7.6	3.0	2.1	46.4
(2)	1.2	1.2	2.1	1.2	2.6	1.3	0.7	0.8	1.1	3.9	3.4	4.7	9.3	7.6	3.0	2.1	46.4
4.1- 6.0	6	14	30	16	3	2	0	0	4	11	6	10	31	61	10	10	214
(1)	0.3	0.7	1.5	0.8	0.1	0.1	0.0	0.0	0.2	0.5	0.3	0.5	1.5	3.0	0.5	0.5	10.6
(2)	0.3	0.7	1.5	0.8	0.1	0.1	0.0	0.0	0.2	0.5	0.3	0.5	1.5	3.0	0.5	0.5	10.6
6.1- 8.0	4	3	11	7	0	0	0	0	0	0	0	0	11	30	8	4	78
(1)	0.2	0.1	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.4	0.2	3.9
(2)	0.2	0.1	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.4	0.2	3.9
OVER 8.0	0	2	6	8	0	0	0	0	0	0	0	0	2	8	2	0	28
(1)	0.0	0.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.4
(2)	0.0	0.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.4
ALL SPEEDS	59	62	101	73	67	44	38	44	70	140	149	186	422	354	122	88	2019
(1)	2.9	3.1	5.0	3.6	3.3	2.2	1.9	2.2	3.5	6.9	7.4	9.2	20.9	17.5	6.0	4.4	100.0
(2)	2.9	3.1	5.0	3.6	3.3	2.2	1.9	2.2	3.5	6.9	7.4	9.2	20.9	17.5	6.0	4.4	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2019

DATA RECOVERY = 92.4 PERCENT

Table H-25

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0		0	0	0	0	0	0	0	0	0	0	1	3	1	1	0	0	6
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	21.4	7.1	7.1	0.0	0.0	42.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
4.1- 6.0		0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3
	(1)	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.1	0.0	0.0	21.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
6.1- 8.0		0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3
	(1)	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	21.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	14.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
ALL SPEEDS		0	1	1	0	0	0	0	0	0	0	1	3	4	4	0	0	14
	(1)	0.0	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	21.4	28.6	28.6	0.0	0.0	100.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 14

Table H-26

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	0	0	0	0	0	0	0	0	0	1	3	4	0	2	0	0	10
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.1	12.1	0.0	6.1	0.0	0.0	30.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.5
4.1- 6.0	0	1	0	0	0	0	0	0	0	0	0	1	8	4	1	0	15
(1)	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	24.2	12.1	3.0	0.0	45.5
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.7
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	5
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	6.1	0.0	0.0	15.2
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.1	0.0	0.0	9.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS	0	1	0	0	0	0	0	0	0	1	3	5	12	10	1	0	33
(1)	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.1	15.2	36.4	30.3	3.0	0.0	100.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.5	0.0	0.0	1.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 33

Table H-27

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
									DIRECTION									
0.0- 1.5		0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
	(1)	0.0	1.6	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		0	0	0	0	0	0	0	0	0	1	10	6	2	5	0	1	25
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	15.6	9.4	3.1	7.8	0.0	1.6	39.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.1	0.2	0.0	0.0	1.2
4.1- 6.0		1	0	0	0	0	0	0	0	0	0	3	1	9	8	1	0	23
	(1)	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	1.6	14.1	12.5	1.6	0.0	35.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.4	0.0	0.0	1.1
6.1- 8.0		0	0	2	0	0	0	0	0	0	0	0	2	3	4	0	0	11
	(1)	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	4.7	6.3	0.0	0.0	17.2
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.5
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	4.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS		1	1	2	0	0	1	0	0	0	1	13	9	14	20	1	1	64
	(1)	1.6	1.6	3.1	0.0	0.0	1.6	0.0	0.0	0.0	1.6	20.3	14.1	21.9	31.3	1.6	1.6	100.0
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.6	0.9	0.0	0.0	3.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 64

Table H-28

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DIRECTION

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		6	3	1	2	1	1	4	3	7	6	8	15	13	14	12	10	106
	(1)	0.6	0.3	0.1	0.2	0.1	0.1	0.4	0.3	0.7	0.6	0.9	1.6	1.4	1.5	1.3	1.1	11.3
	(2)	0.3	0.1	0.0	0.1	0.0	0.0	0.2	0.1	0.3	0.3	0.4	0.7	0.6	0.6	0.6	0.5	4.9
1.6- 4.0		28	8	2	2	3	5	8	7	13	16	28	34	65	75	54	83	431
	(1)	3.0	0.9	0.2	0.2	0.3	0.5	0.9	0.7	1.4	1.7	3.0	3.6	6.9	8.0	5.8	8.9	46.0
	(2)	1.3	0.4	0.1	0.1	0.1	0.2	0.4	0.3	0.6	0.7	1.3	1.6	3.0	3.5	2.5	3.8	19.9
4.1- 6.0		6	8	10	7	1	0	0	2	1	4	9	15	48	58	13	18	200
	(1)	0.6	0.9	1.1	0.7	0.1	0.0	0.0	0.2	0.1	0.4	1.0	1.6	5.1	6.2	1.4	1.9	21.3
	(2)	0.3	0.4	0.5	0.3	0.0	0.0	0.0	0.1	0.0	0.2	0.4	0.7	2.2	2.7	0.6	0.8	9.2
6.1- 8.0		2	0	3	4	0	0	0	0	0	0	1	15	40	52	3	1	121
	(1)	0.2	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	4.3	5.5	0.3	0.1	12.9
	(2)	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.8	2.4	0.1	0.0	5.6
OVER 8.0		0	2	9	12	0	0	0	0	0	0	1	5	12	38	0	0	79
	(1)	0.0	0.2	1.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.3	4.1	0.0	0.0	8.4
	(2)	0.0	0.1	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	1.8	0.0	0.0	3.6
ALL SPEEDS		42	21	25	27	5	6	12	12	21	26	47	84	178	237	82	112	937
	(1)	4.5	2.2	2.7	2.9	0.5	0.6	1.3	1.3	2.2	2.8	5.0	9.0	19.0	25.3	8.8	12.0	100.0
	(2)	1.9	1.0	1.2	1.2	0.2	0.3	0.6	0.6	1.0	1.2	2.2	3.9	8.2	10.9	3.8	5.2	43.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 937

Table H-29

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	5	3	0	3	2	7	8	18	24	12	22	34	37	23	9	4	211
(1)	0.6	0.3	0.0	0.3	0.2	0.8	0.9	2.1	2.7	1.4	2.5	3.9	4.2	2.6	1.0	0.5	24.2
(2)	0.2	0.1	0.0	0.1	0.1	0.3	0.4	0.8	1.1	0.6	1.0	1.6	1.7	1.1	0.4	0.2	9.7
1.6- 4.0	6	4	4	3	2	4	6	8	21	32	75	130	111	76	15	8	505
(1)	0.7	0.5	0.5	0.3	0.2	0.5	0.7	0.9	2.4	3.7	8.6	14.9	12.7	8.7	1.7	0.9	57.8
(2)	0.3	0.2	0.2	0.1	0.1	0.2	0.3	0.4	1.0	1.5	3.5	6.0	5.1	3.5	0.7	0.4	23.3
4.1- 6.0	0	0	3	7	5	0	0	2	5	26	6	19	26	11	1	1	112
(1)	0.0	0.0	0.3	0.8	0.6	0.0	0.0	0.2	0.6	3.0	0.7	2.2	3.0	1.3	0.1	0.1	12.8
(2)	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.1	0.2	1.2	0.3	0.9	1.2	0.5	0.0	0.0	5.2
6.1- 8.0	0	0	0	7	2	0	1	1	1	0	2	4	8	2	0	0	28
(1)	0.0	0.0	0.0	0.8	0.2	0.0	0.1	0.1	0.1	0.0	0.2	0.5	0.9	0.2	0.0	0.0	3.2
(2)	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.1	0.0	0.0	1.3
OVER 8.0	0	0	3	8	5	0	0	0	0	0	0	0	1	0	0	0	17
(1)	0.0	0.0	0.3	0.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.9
(2)	0.0	0.0	0.1	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
ALL SPEEDS	11	7	10	28	16	11	15	29	51	70	105	187	183	112	25	13	873
(1)	1.3	0.8	1.1	3.2	1.8	1.3	1.7	3.3	5.8	8.0	12.0	21.4	21.0	12.8	2.9	1.5	100.0
(2)	0.5	0.3	0.5	1.3	0.7	0.5	0.7	1.3	2.4	3.2	4.8	8.6	8.4	5.2	1.2	0.6	40.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 873

Table H-30

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		4	2	1	2	3	0	1	6	7	3	14	14	16	17	4	4	98
	(1)	2.9	1.4	0.7	1.4	2.2	0.0	0.7	4.3	5.1	2.2	10.1	10.1	11.6	12.3	2.9	2.9	71.0
	(2)	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.3	0.3	0.1	0.6	0.6	0.7	0.8	0.2	0.2	4.5
1.6- 4.0		0	0	0	1	0	0	1	0	0	3	9	5	11	8	1	0	39
	(1)	0.0	0.0	0.0	0.7	0.0	0.0	0.7	0.0	0.0	2.2	6.5	3.6	8.0	5.8	0.7	0.0	28.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.2	0.5	0.4	0.0	0.0	1.8
4.1- 6.0		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		4	2	2	3	3	0	2	6	7	6	23	19	27	25	5	4	138
	(1)	2.9	1.4	1.4	2.2	2.2	0.0	1.4	4.3	5.1	4.3	16.7	13.8	19.6	18.1	3.6	2.9	100.0
	(2)	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.3	0.3	0.3	1.1	0.9	1.2	1.2	0.2	0.2	6.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 138

Table H-31
SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	2	0	1	0	3	3	7	15	17	38	12	1	1	101
	(1)	0.9	0.0	0.0	1.9	0.0	0.9	0.0	2.8	2.8	6.5	13.9	15.7	35.2	11.1	0.9	0.9	93.5
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.7	0.8	1.8	0.6	0.0	0.0	4.7
1.6- 4.0		0	0	0	0	0	0	0	1	0	0	0	1	4	1	0	0	7
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.9	3.7	0.9	0.0	0.0	6.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	0	0	2	0	1	0	4	3	7	15	18	42	13	1	1	108
	(1)	0.9	0.0	0.0	1.9	0.0	0.9	0.0	3.7	2.8	6.5	13.9	16.7	38.9	12.0	0.9	0.9	100.0
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.3	0.7	0.8	1.9	0.6	0.0	0.0	5.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 108

Table H-32

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	16	9	2	9	6	10	13	30	41	28	59	80	104	66	26	19	518
(1)	0.7	0.4	0.1	0.4	0.3	0.5	0.6	1.4	1.9	1.3	2.7	3.7	4.8	3.0	1.2	0.9	23.9
(2)	0.7	0.4	0.1	0.4	0.3	0.5	0.6	1.4	1.9	1.3	2.7	3.7	4.8	3.0	1.2	0.9	23.9
1.6- 4.0	34	12	6	6	5	9	15	16	34	53	126	183	194	168	70	92	1023
(1)	1.6	0.6	0.3	0.3	0.2	0.4	0.7	0.7	1.6	2.4	5.8	8.4	9.0	7.8	3.2	4.2	47.2
(2)	1.6	0.6	0.3	0.3	0.2	0.4	0.7	0.7	1.6	2.4	5.8	8.4	9.0	7.8	3.2	4.2	47.2
4.1- 6.0	7	10	14	14	6	0	0	4	6	30	18	36	92	82	16	19	354
(1)	0.3	0.5	0.6	0.6	0.3	0.0	0.0	0.2	0.3	1.4	0.8	1.7	4.2	3.8	0.7	0.9	16.3
(2)	0.3	0.5	0.6	0.6	0.3	0.0	0.0	0.2	0.3	1.4	0.8	1.7	4.2	3.8	0.7	0.9	16.3
6.1- 8.0	2	0	6	11	2	0	1	1	1	0	3	21	54	62	3	1	168
(1)	0.1	0.0	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.5	2.9	0.1	0.0	7.8
(2)	0.1	0.0	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.5	2.9	0.1	0.0	7.8
OVER 8.0	0	2	12	20	5	0	0	0	0	0	1	5	16	43	0	0	104
(1)	0.0	0.1	0.6	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.0	0.0	0.0	4.8
(2)	0.0	0.1	0.6	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.0	0.0	0.0	4.8
ALL SPEEDS	59	33	40	60	24	19	29	51	82	111	207	325	460	421	115	131	2167
(1)	2.7	1.5	1.8	2.8	1.1	0.9	1.3	2.4	3.8	5.1	9.6	15.0	21.2	19.4	5.3	6.0	100.0
(2)	2.7	1.5	1.8	2.8	1.1	0.9	1.3	2.4	3.8	5.1	9.6	15.0	21.2	19.4	5.3	6.0	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2167

DATA RECOVERY = 99.2 PERCENT

Table H-33

SEABROOK

30 FT WIND DATA

DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS

ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	1	0	0	1	0	3	0	5
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	1.2	0.0	2.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0	1	2	2	8	9	19	6	0	1	3	11	12	15	11	2	2	104
(1)	0.4	0.8	0.8	3.1	3.5	7.4	2.3	0.0	0.4	1.2	4.3	4.7	5.9	4.3	0.8	0.8	40.6
(2)	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	1.2
4.1- 6.0	1	4	8	8	5	13	3	0	0	3	5	7	14	18	2	1	92
(1)	0.4	1.6	3.1	3.1	2.0	5.1	1.2	0.0	0.0	1.2	2.0	2.7	5.5	7.0	0.8	0.4	35.9
(2)	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.0	1.1
6.1- 8.0	0	0	16	3	0	0	0	0	0	1	0	0	12	10	3	0	45
(1)	0.0	0.0	6.3	1.2	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	4.7	3.9	1.2	0.0	17.6
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.5
OVER 8.0	0	2	3	1	0	0	0	0	0	0	0	0	2	1	1	0	10
(1)	0.0	0.8	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.4	0.0	3.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS	2	8	29	20	14	32	9	0	1	8	16	19	44	40	11	3	256
(1)	0.8	3.1	11.3	7.8	5.5	12.5	3.5	0.0	0.4	3.1	6.3	7.4	17.2	15.6	4.3	1.2	100.0
(2)	0.0	0.1	0.3	0.2	0.2	0.4	0.1	0.0	0.0	0.1	0.2	0.2	0.5	0.5	0.1	0.0	3.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 256

Table H-34

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		2	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	7
	(1)	0.8	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	2.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		1	2	5	6	13	12	9	0	0	8	12	13	21	19	6	6	133
	(1)	0.4	0.8	2.0	2.5	5.3	4.9	3.7	0.0	0.0	3.3	4.9	5.3	8.6	7.8	2.5	2.5	54.5
	(2)	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	1.6
4.1- 6.0		1	3	8	1	2	5	3	0	1	2	5	6	21	13	5	1	77
	(1)	0.4	1.2	3.3	0.4	0.8	2.0	1.2	0.0	0.4	0.8	2.0	2.5	8.6	5.3	2.0	0.4	31.6
	(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.0	0.9
6.1- 8.0		0	2	2	2	0	0	0	0	0	0	0	0	4	8	1	0	19
	(1)	0.0	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	3.3	0.4	0.0	7.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
OVER 8.0		0	1	0	0	0	0	0	0	0	1	0	0	1	4	1	0	8
	(1)	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	1.6	0.4	0.0	3.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS		4	8	15	9	15	17	13	0	1	11	17	20	48	45	14	7	244
	(1)	1.6	3.3	6.1	3.7	6.1	7.0	5.3	0.0	0.4	4.5	7.0	8.2	19.7	18.4	5.7	2.9	100.0
	(2)	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.2	0.2	0.6	0.5	0.2	0.1	2.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 244

Table H-35

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

		DIRECTION																
SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	1	0	0	0	2	0	0	0	0	0	2	1	1	2	2	11
	(1)	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.3	0.5	0.5	2.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		4	3	1	7	21	24	11	1	2	10	29	25	29	18	8	2	195
	(1)	1.1	0.8	0.3	1.9	5.6	6.4	2.9	0.3	0.5	2.7	7.8	6.7	7.8	4.6	2.1	0.5	52.1
	(2)	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.2	0.1	0.0	2.3
4.1- 6.0		3	3	7	7	10	3	6	1	2	5	6	11	26	31	7	1	129
	(1)	0.8	0.8	1.9	1.9	2.7	0.8	1.6	0.3	0.5	1.3	1.6	2.9	7.0	8.3	1.9	0.3	34.5
	(2)	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.1	0.0	1.5
6.1- 8.0		0	0	2	2	0	0	0	0	0	0	0	3	8	13	2	0	30
	(1)	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.1	3.5	0.5	0.0	8.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.4
OVER 8.0		0	1	0	1	0	0	0	0	0	0	0	0	0	6	1	0	9
	(1)	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.3	0.0	2.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS		7	8	10	17	31	29	17	2	4	15	35	41	64	69	20	5	374
	(1)	1.9	2.1	2.7	4.5	8.3	7.8	4.5	0.5	1.1	4.0	9.4	11.0	17.1	18.4	5.3	1.3	100.0
	(2)	0.1	0.1	0.1	0.2	0.4	0.3	0.2	0.0	0.0	0.2	0.4	0.5	0.7	0.8	0.2	0.1	4.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 374

Table H-36

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		36	31	15	26	28	35	46	40	32	22	45	59	52	52	54	47	620
	(1)	1.0	0.9	0.4	0.7	0.8	1.0	1.3	1.1	0.9	0.6	1.3	1.7	1.5	1.5	1.5	1.3	17.4
	(2)	0.4	0.4	0.2	0.3	0.3	0.4	0.5	0.5	0.4	0.3	0.5	0.7	0.6	0.6	0.6	0.5	7.3
1.6- 4.0		67	111	107	76	155	136	106	62	73	125	139	124	183	201	137	157	1959
	(1)	1.9	3.1	3.0	2.1	4.4	3.8	3.0	1.7	2.0	3.5	3.9	3.5	5.1	5.6	3.8	4.4	55.0
	(2)	0.8	1.3	1.3	0.9	1.8	1.6	1.2	0.7	0.9	1.5	1.6	1.5	2.1	2.4	1.6	1.8	22.9
4.1- 6.0		15	43	76	30	13	5	1	6	14	52	27	44	99	139	32	24	620
	(1)	0.4	1.2	2.1	0.8	0.4	0.1	0.0	0.2	0.4	1.5	0.8	1.2	2.8	3.9	0.9	0.7	17.4
	(2)	0.2	0.5	0.9	0.4	0.2	0.1	0.0	0.1	0.2	0.6	0.3	0.5	1.2	1.6	0.4	0.3	7.3
6.1- 8.0		6	8	36	9	2	2	0	0	0	3	4	15	51	89	10	5	240
	(1)	0.2	0.2	1.0	0.3	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.4	1.4	2.5	0.3	0.1	6.7
	(2)	0.1	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	1.0	0.1	0.1	2.8
OVER 8.0		0	7	27	17	1	0	0	0	0	0	1	5	14	49	1	0	122
	(1)	0.0	0.2	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.4	0.0	0.0	3.4
	(2)	0.0	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.0	0.0	1.4
ALL SPEEDS		124	200	261	158	199	178	153	108	119	202	216	247	399	530	234	233	3561
	(1)	3.5	5.6	7.3	4.4	5.6	5.0	4.3	3.0	3.3	5.7	6.1	6.9	11.2	14.9	6.6	6.5	100.0
	(2)	1.5	2.3	3.1	1.8	2.3	2.1	1.8	1.3	1.4	2.4	2.5	2.9	4.7	6.2	2.7	2.7	41.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 3561

Table H-37

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	28	28	12	25	21	42	54	77	79	68	104	114	120	74	37	31	914
(1)	1.0	1.0	0.4	0.9	0.8	1.5	2.0	2.8	2.9	2.5	3.8	4.1	4.4	2.7	1.3	1.1	33.2
(2)	0.3	0.3	0.1	0.3	0.2	0.5	0.6	0.9	0.9	0.8	1.2	1.3	1.4	0.9	0.4	0.4	10.7
1.6- 4.0	25	13	31	26	33	40	35	29	74	150	190	283	281	227	57	32	1526
(1)	0.9	0.5	1.1	0.9	1.2	1.5	1.3	1.1	2.7	5.4	6.9	10.3	10.2	8.2	2.1	1.2	55.4
(2)	0.3	0.2	0.4	0.3	0.4	0.5	0.4	0.3	0.9	1.8	2.2	3.3	3.3	2.7	0.7	0.4	17.9
4.1- 6.0	1	2	10	18	8	2	1	2	13	36	12	24	43	46	2	4	224
(1)	0.0	0.1	0.4	0.7	0.3	0.1	0.0	0.1	0.5	1.3	0.4	0.9	1.6	1.7	0.1	0.1	8.1
(2)	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.2	0.4	0.1	0.3	0.5	0.5	0.0	0.0	2.6
6.1- 8.0	0	0	6	12	3	0	1	1	2	1	3	4	11	13	3	1	61
(1)	0.0	0.0	0.2	0.4	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.4	0.5	0.1	0.0	2.2
(2)	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.7
OVER 8.0	0	4	6	12	5	0	0	0	0	0	0	0	1	0	0	0	28
(1)	0.0	0.1	0.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
(2)	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS	54	47	65	93	70	84	91	109	168	255	309	425	456	360	99	68	2753
(1)	2.0	1.7	2.4	3.4	2.5	3.1	3.3	4.0	6.1	9.3	11.2	15.4	16.6	13.1	3.6	2.5	100.0
(2)	0.6	0.5	0.8	1.1	0.8	1.0	1.1	1.3	2.0	3.0	3.6	5.0	5.3	4.2	1.2	0.8	32.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 2753

Table H-38

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	11	3	7	10	13	12	19	18	32	41	76	55	98	61	17	8	481
(1)	1.6	0.4	1.0	1.5	1.9	1.8	2.8	2.7	4.8	6.1	11.4	8.2	14.6	9.1	2.5	1.2	71.9
(2)	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.4	0.5	0.9	0.6	1.1	0.7	0.2	0.1	5.6
1.6- 4.0	0	1	1	7	3	5	2	2	2	15	29	26	42	45	4	1	185
(1)	0.0	0.1	0.1	1.0	0.4	0.7	0.3	0.3	0.3	2.2	4.3	3.9	6.3	6.7	0.6	0.1	27.7
(2)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.3	0.3	0.5	0.5	0.0	0.0	2.2
4.1- 6.0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2
(1)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	11	5	9	17	16	17	21	20	34	56	105	82	140	106	21	9	669
(1)	1.6	0.7	1.3	2.5	2.4	2.5	3.1	3.0	5.1	8.4	15.7	12.3	20.9	15.8	3.1	1.3	100.0
(2)	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.4	0.7	1.2	1.0	1.[illegible]	1.2	0.2	0.1	7.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 669

Table H-39

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DIRECTION

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		6	6	4	11	6	12	10	16	17	38	64	103	267	79	17	11	667
	(1)	0.9	0.9	0.6	1.6	0.9	1.7	1.4	2.3	2.5	5.5	9.2	14.9	38.6	11.4	2.5	1.6	96.4
	(2)	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.7	1.2	3.1	0.9	0.2	0.1	7.8
1.6- 4.0		0	0	0	0	0	0	1	1	0	2	0	3	9	9	0	0	25
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.3	0.0	0.4	1.3	1.3	0.0	0.0	3.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.3
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		6	6	4	11	6	12	11	17	17	40	64	106	276	88	17	11	692
	(1)	0.9	0.9	0.6	1.6	0.9	1.7	1.6	2.5	2.5	5.8	9.2	15.3	39.9	12.7	2.5	1.6	100.0
	(2)	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.5	0.7	1.2	3.2	1.0	0.2	0.1	8.1

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 692

Table H-40

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		83	69	38	72	68	103	130	151	160	170	289	334	540	268	131	99	2705
	(1)	1.0	0.8	0.4	0.8	0.8	1.2	1.5	1.8	1.9	2.0	3.4	3.9	6.3	3.1	1.5	1.2	31.6
	(2)	1.0	0.8	0.4	0.8	0.8	1.2	1.5	1.8	1.9	2.0	3.4	3.9	6.3	3.1	1.5	1.2	31.6
1.6- 4.0		98	132	147	130	234	236	170	95	152	313	410	486	580	530	214	200	4127
	(1)	1.1	1.5	1.7	1.5	2.7	2.8	2.0	1.1	1.8	3.7	4.8	5.7	6.8	6.2	2.5	2.3	48.3
	(2)	1.1	1.5	1.7	1.5	2.7	2.8	2.0	1.1	1.8	3.7	4.8	5.7	6.8	6.2	2.5	2.3	48.3
4.1- 6.0		21	55	110	64	38	28	14	9	30	98	55	93	203	247	48	31	1144
	(1)	0.2	0.6	1.3	0.7	0.4	0.3	0.2	0.1	0.4	1.1	0.6	1.1	2.4	2.9	0.6	0.4	13.4
	(2)	0.2	0.6	1.3	0.7	0.4	0.3	0.2	0.1	0.4	1.1	0.6	1.1	2.4	2.9	0.6	0.4	13.4
6.1- 8.0		6	10	62	28	5	2	1	1	2	5	7	22	86	133	19	6	395
	(1)	0.1	0.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	1.6	0.2	0.1	4.6
	(2)	0.1	0.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	1.6	0.2	0.1	4.6
OVER 8.0		0	16	36	31	6	0	0	0	0	1	1	5	18	60	4	0	178
	(1)	0.0	0.2	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.0	0.0	2.1
	(2)	0.0	0.2	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.0	0.0	2.1
ALL SPEEDS		208	282	393	325	351	369	315	256	344	587	762	940	1427	1238	416	336	8549
	(1)	2.4	3.3	4.6	3.8	4.1	4.3	3.7	3.0	4.0	6.9	8.9	11.0	16.7	14.5	4.9	3.9	100.0
	(2)	2.4	3.3	4.6	3.8	4.1	4.3	3.7	3.0	4.0	6.9	8.9	11.0	16.7	14.5	4.9	3.9	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 8549

DATA RECOVERY = 97.3 PERCENT

APPENDIX I

APPENDIX I

LAND PLANNING & SITE DESIGN STUDY
SEABROOK STATION
SEABROOK, NEW HAMPSHIRE

Prepared for
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, NEW HAMPSHIRE

By KLING/PLANNING
A Division of The Kling Partnership
Philadelphia, Pennsylvania

November 1972

Norman Day, AIP
Director, Kling/Planning

Kimti L. Sharma, Assoc. AIP
Project Coordinator

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PREFACE & INTRODUCTION

In August 1972, Kling/Planning was asked by Public Service Company of New Hampshire (PSNH) to undertake a land planning and site design study for a proposed major generating station at Seabrook, New Hampshire.

The site previously selected by PSNH for this two unit, 2280 Megawatt generating plant contained approximately 650 acres. It is located directly west of Hampton Harbor, in the Town of Seabrook.

In order to carry out this study and to make appropriate design recommendations it was necessary for Kling/Planning staff to analyze the physical, environmental, and community character of the site and its surrounding area in relation to the construction and operation of the proposed generating station.

Specific engineering/operational, environmental, and community objectives for the study were derived from meetings and discussions with the staff of PSNH, with its prime engineering consultant, United Engineers & Constructors (UE&C), with other project consultants including Nuclear Services Division of Yankee Atomic Electric Company, and with various local and regional planning agencies.

The site design and related recommendations set forth in this report ultimately emerged through a process of balancing environmental, engineering and community objectives and criteria.

Architectural studies dealt only with overall physical plant location and visual relationships as seen from the surrounding areas without attempting to analyze in any major way the basic plan layout engineered, to date, by PSNH and UE&C. Potential concepts for a possible educational center were discussed, but not dealt with in the recommendations, beyond the question of general location and access.

The general location of the generating station's main structures and the basic pattern of access roads and rail lines have been reasonably determined; however, adjustments in the orientation or exact location of individual components and service roads may be necessary as more detailed engineering and architectural design work continues.

Final plans, in terms of detailed site planning and landscape design as well as architectural treatment of the building masses and their interiors, remain to be developed. The basic land use plan for protection, conservation, and active educational and recreational use of the site will also require more detailed articulation along with the elaboration of techniques for protection of the environmentally important features of the site and restoration of those portions of the site expected to be disturbed during the construction process.

SITE AERIAL VIEW—EXISTING

PLATE 1

I. SCOPE & FUNCTION OF KLING/PLANNING ACTIVITIES

A. Project Scope & Description

1. Scope

The scope of Kling/Planning study was to provide PSNH with:

a. A comprehensive analysis of the environmental characteristics and development constraints of the proposed site for the Seabrook Generating Station.

b. A preliminary plan for the location of the main building complex and a generalized land use plan for the balance of the land.

Simply stated, the charge was to assist PSNH in determining how a large generating station could be built and operated in this location in such a way as to minimize negative environmental and community impact and provide positive recreational and educational benefits to the immediate and larger communities.

2. Scope Limits

The proposed site, the focus of this study had been selected by PSNH prior to the initiation of this study; similarly, a number of other decisions had been already made. The size and general configuration of the proposed generating station along with the proposed method of cooling and a number of other design construction and operational requirements had been determined, and Kling/Planning was directed to accept these established inputs.

This study was further limited to include only the land above the extreme spring high tide (elev. 7.5') from the promontory of the site west to the Boston & Maine Railroad with the exception of the area west of the tracks required for construction of the generating station.

This study, specifically, was not to include any analysis of the salt marsh, the Brown's River area, Hampton Harbor, the barrier beach or State Park, the ocean, or the proposed intake and discharge piping system.

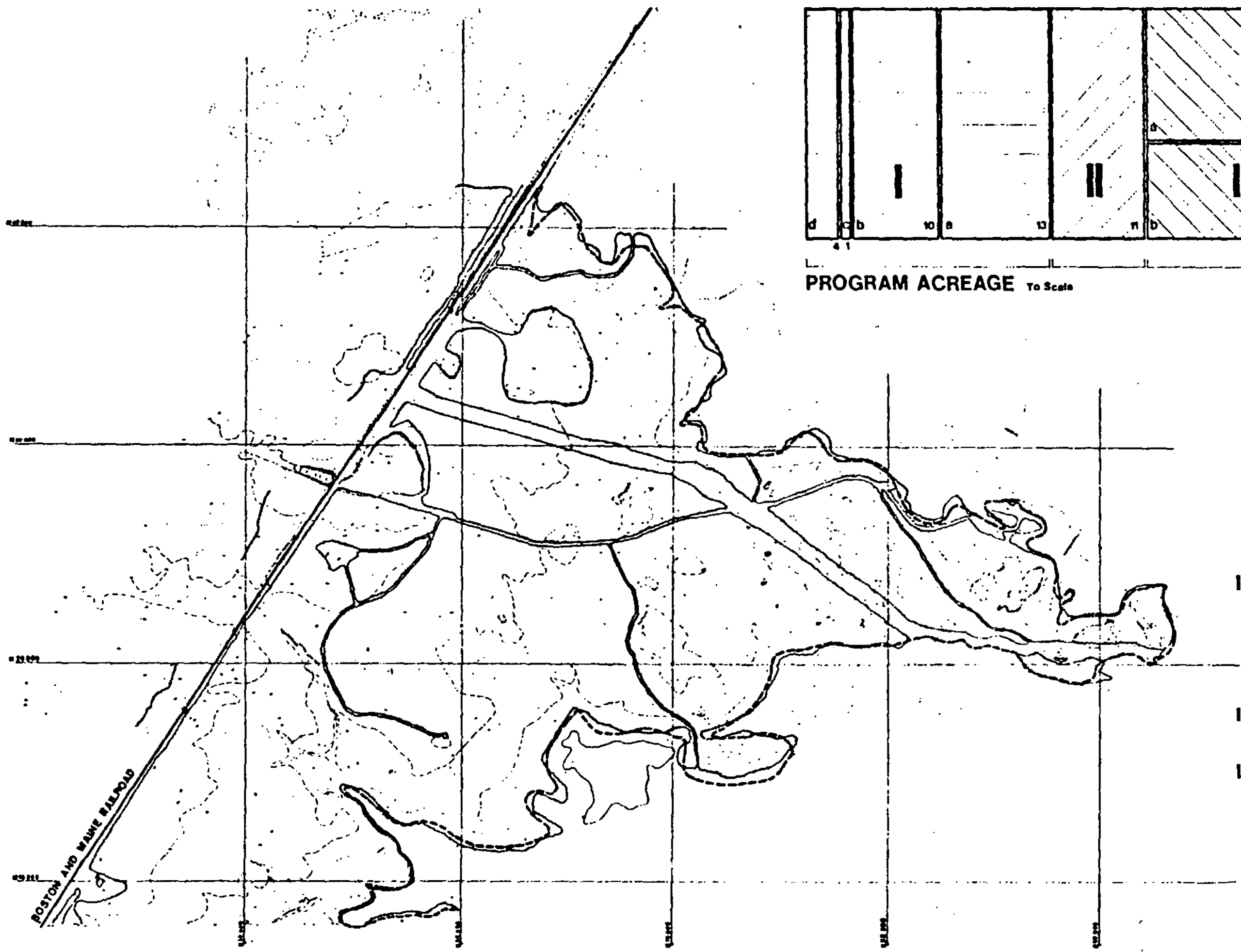
3. The Plant Site

The site for the Seabrook Station is located in the northern part of the Town of Seabrook, Rockingham County, New Hampshire. It is approximately 8 miles southeast of the County seat of Exeter and 5 miles northeast of Amesbury, Massachusetts. The center of the Boston Metropolitan Area is approximately 40 miles south of the site. The nearest large population center, inclusive of the small surrounding towns, is Portsmouth, New Hampshire, which is approximately 11 miles north of the site.

The site contained within a 3000' radius from the center of the generating station complex consists of approximately 650 acres of land on the western shore of Hampton Harbor. Of the total 650 acres, 430 acres are salt marsh, 220 acres are high ground of which 163 acres lie east of the B&M Railroad tracks. The area adjacent to the site is generally undeveloped and sparsely populated.

4. Physical Function Area Requirements

The following table lists the component parts of the generating station by function and indicates the approximate land area required for each (Figure 1):



I	PLANT FACILITIES:	ACRES
a	GENERATING PLANT 1	13
b	GENERATING PLANT 2	10
c	SWITCHYARD	1
d	WAREHOUSE, GATEHOUSE, EMPLOYEE AND VISITOR PARKING	4
		28
II	ENVIRONMETAL AND NUCLEAR ENERGY EDUCATION CENTER	11
III	CONSTRUCTION PROCESS AREAS:	
a	CONSTRUCTION PARKING - 1500 CARS	15
b	CONSTRUCTION OPERATIONS	11.5
c	LAYDOWN AREA	10
d	CONCRETE BATCH PLANT	7
e	HEAVY EQUIP. MAINT. AREA	3
		46.5

TOTAL ACRES 85.5

DEVELOPMENT PROGRAM Fig. 1

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

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Function

a. Plant facilities

	Area in Acres	
Plant - Unit No. 1	13	
Plant - Unit No. 2	10	
Switchyard (345 KV)	1	
Warehouse, gate house, employees & visitors parking	4	
Sub total		28

b. Construction process areas

Construction parking area	15	
Construction operations Area	11.5	
Laydown area	10	
Concrete batch plant	7	
Heavy equipment maintenance area	3	
Sub total		46.5

C. Environmental & Nuclear Centers & allocated exterior areas	11
Approximate Total Area	85.5 Ac.

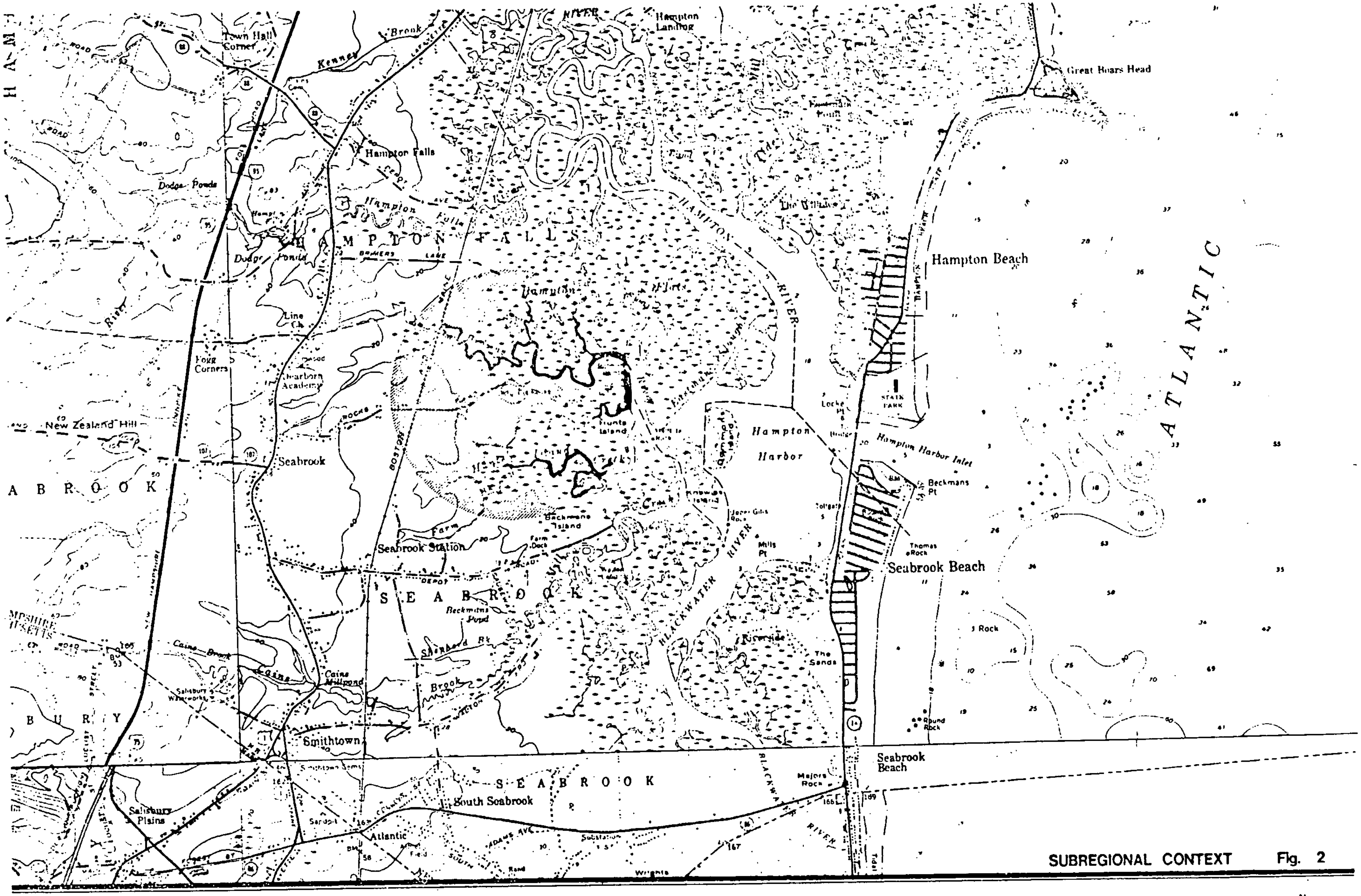
B. Record of Procedure & Analysis

1. Kling/Planning Study Objectives

The objectives of the Kling/Planning study were as follows:

a. Survey and analyze the physical, environmental, and community character of the Seabrook site in its site context.

b. Survey and analyze the immediate site as to determine the best location and orientation for the plant in consideration of all relevant engineering, operational, construction, environmental and community impact objectives and criteria derived from this study.



SUBREGIONAL CONTEXT Fig. 2

SEABROOK STATION

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c. Consider the aesthetic aspects of the main generating station structures as to site location on the site and their visual impact on the surrounding area.

d. Develop design concepts for plant location and for the best long term use of all other land within the site to be controlled by the PSNH.

e. Assist PSNH in preparation for their presentations and hearings with the Bulk Power Supply Site Evaluation Committee, the Public Utilities Commission of New Hampshire, the public, and others through the development of pertinent models, written, and graphic materials.

2. Reconnaissance and Survey

a. Meetings with the staff of PSNH and its engineering staff to determine their objectives and criteria for the study and for the generating station development.

b. Visits to the site and the surrounding area to visually survey and document the site and surrounding area photographically, from the air and from the ground.

c. Meetings with PSNH and UE&C, together and separately to define design constraints, to discuss the location of the plant, and to outline spatial requirements of the plant's component parts.

d. Discussions with PSNH and Nuclear Services Division of Yankee Atomic Electric Company (Yankee) in reference to determination of spatial requirements during the construction process both in time and in area.

e. Interface with the following public agencies to determine regulatory controls, goals, objectives, attitudes, and key issues:

- State of New Hampshire, Office of State Planning
- Southeastern New Hampshire Regional Planning Commission
- Town of Seabrook Planning Board
- Town of Hampton Falls Planning Board
- Town of Hampton

II. PRINCIPAL CRITERIA AND OBJECTIVES

A. Engineering and Operational Objectives

The principal engineering objectives and criteria were reviewed through a series of group working sessions that included members of the PSNH staff responsible for the project, PSNH's consulting engineer, UE&C, and Kling/Planning. These objectives are outlined below:

1. Engineering/Operational Objectives

   a. Meet the engineering, safety, and site operational requirements of the project as derived and discussed within the scope of the Kling/Planning Study. These requirements or criteria deal with the plant units, their relationship to each other, and their position and orientation on the site.

   b. Accommodate an efficient construction process and layout through the analysis of the area functions, their relationship to one another, and the work flow of labor and materials as per Kling/Planning discussions with PSNH, UE&C, and Yankee.

   c. Minimize construction costs of the project in the aggregate by consideration of comparisons in the plant's site location and orientation, the plant's process and layout, and the road, rail, piping, and transmission line rights of way -- all in reference to the site's physical characteristics.

   d. Reserve space for future expansion. Although future expansion is not presently being considered by PSNH for this site, briefly review areas on-site adjacent to the plant in its alternative site positions for any expansion with its effect upon the site's natural environmental and other physical characteristics.

e. Reserve space for evaporative cooling equipment in the event once-through open system of intake and discharge of ocean water offshore, is not approved.

B. Environmental Objectives

The principal criteria and objectives that guided the development of the site plan may be stated as follows:

1. Protect the natural processes to the greatest degree possible over the entire site. Specifically this would include avoidance of encroachment into the salt marsh by the construction activities or elements of the power station complex, and maintenance of natural drainage patterns wherever possible.

2. Preserve and maintain areas ecologically significant to the site, the Town of Seabrook and the New Hampshire seacoast region.

3. Preserve and maintain areas of recreational and visual significance.

4. Minimize disturbance of the site during construction and in plant operation.

5. Enhance the area as a whole.

C. Community Impact Objectives

The evolutions of the site design also responds to the following objectives.

1. Maintain continuous public assess to

   a. clam flats
   b. salt marsh
   c. Brown's River
   d. The Rocks

2. Minimize cost and complexity of land acquisition and relocation problems within the exclusion zone.

3. Consider provision of recreational facilities for residents of the Town of Seabrook and others.

4. Provide for possible public use of those portions of site not needed for plant operation.

5. Develop the possibility of an Education Center for power and environment related subjects.

6. Minimize the disruption of traffic on U. S. Route 1 during the construction of the plant.

III. CHARACTERIZATION OF THE SITE AND IMMEDIATE ENVIRONS

A. Seabrook Community Context

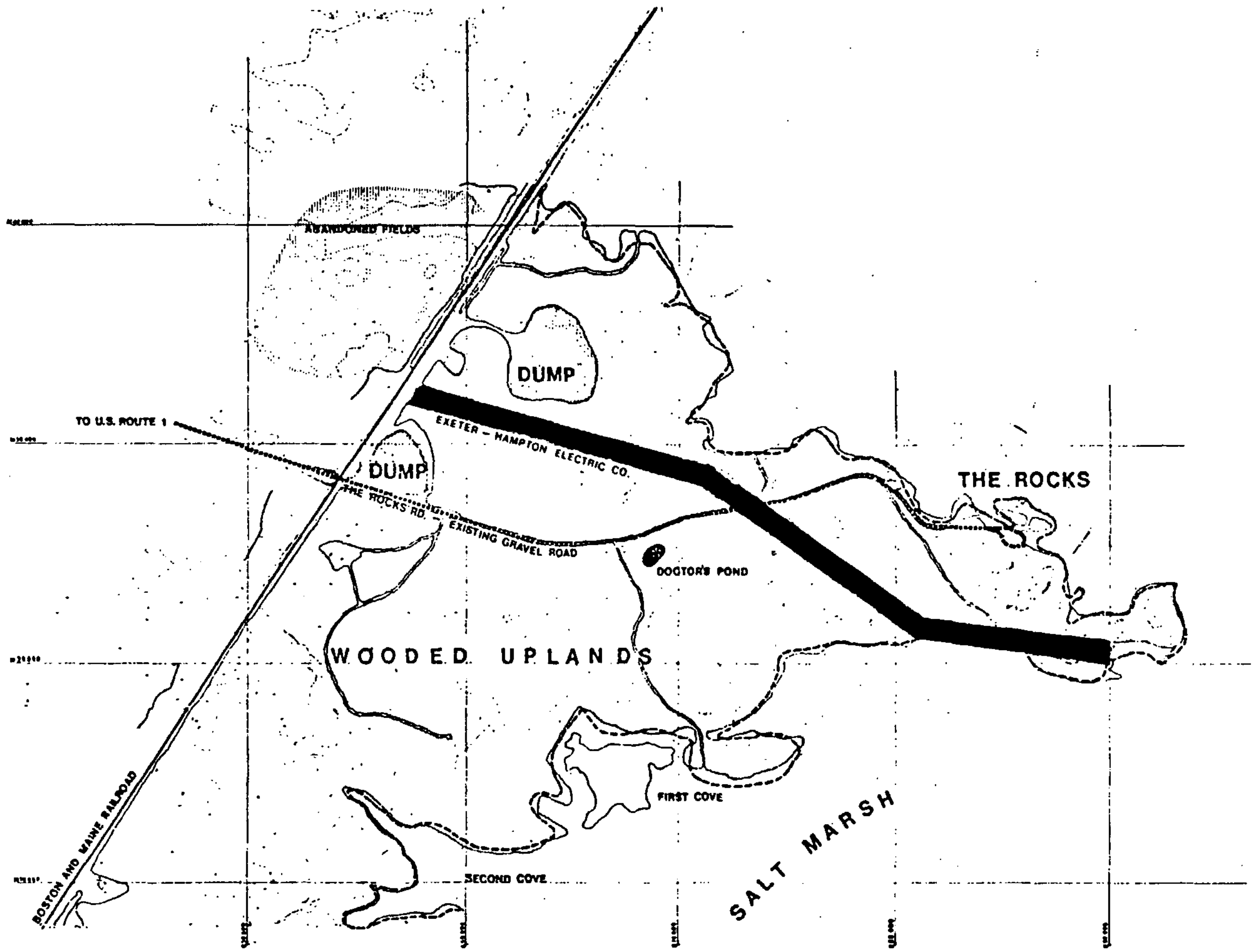
The site is located in the Town of Seabrook, Rockingham County, New Hampshire. Boston is about 40 miles to the south and Portsmouth, New Hampshire is about 12 miles north of the site (Figure 2). The environs of the site are generally rural, however the new growth in the township is clearly suburban. The growth in Seabrook has been predominantly garden apartments and mobile homes. Many of the people occupying the garden apartments are employed in Massachusetts. Another factor contributing to this growth in population is the conversion of seasonal homes to year round occupancies. Seabrook does not have a public sanitary utility system, therefore all development relies upon ground disposal sanitary systems.

According to the U. S. Census of Population (1970), resident population of Seabrook was 3,053 persons. During the summer season, the population is estimated to be in excess of 5,000 persons. The permanent residents are concentrated in the south central section of the town near Collins Street and South Main Street. The Route I corridor is another population center. Both of these areas are well out of the range of the exclusion zone.

The Interstate Route I-95 and U. S. I (Lafayette Road) are the principal roads serving the New Hampshire coast and Seabrook. Lafayette Road has been developing as a traditional commercial strip. These highways provide access to the power station site.

B. Characterization of the Site's Existing Environment

The land form of the generator construction site is a triangular promontory surrounded by a tidal salt marsh. The site is underlain with a hard igneous rock, and it is punctuated by a high point at the most easterly edge known as "The Rocks". A saddle dominates the central portion of the site. When measured from the rail line the site is approximately 3700' long and about 1500' wide at its midpoint. The rail line divides the site into two



EXISTING SITE CONDITIONS Fig. 3

SEABROOK STATION

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parcels totalling about 220 acres, 57 of which lie to the west of the right of way. The total land area east of the rail line and above extreme high tide (elevation 7.5) is about 163 acres.

1. Historical Land Use

Seabrook marsh, which surrounds the power station complex site has a long history of agricultural uses that began in the early 18th century and continued until the late 19th century. The salt marsh was a basic and reliable natural source of hay for the local farmers' cattle. Concurrently, the upland areas of the site were logged for the larger white pines and oaks. As evidenced by the remnant rock walls, some of the original forested areas were cleared for farmland.

2. Existing Conditions and Activities

Agricultural uses of the site and salt marsh concluded at the beginning of the 20th century. Today, the northwest part of the site is occupied by an open burning dump which is operated by the Town of Seabrook for its residents on land owned by Public Service Company. The Exeter-Hampton Electric Company maintains a transmission line with a right of way across the site of about 100'. An area locally known as The Rocks is located on the eastern section of the site. This area is used as a favorite access point to the clam flats lying to the east (Figure 3).

3. Bed Rock Geology and Depth to Bed Rock

The Seabrook Station site is underlain by a hard igneous rock known as Newberryport Quartz Diorite. It is very competent and the boring logs show retrievals to have averaged between 90% and 100%. In many areas rock outcrops are apparent and in some instances are above elevation +15 feet. The depth to bed rock drops considerably to elevation -40 feet in the northwest area of the site. Figure 4 describes the depth to bed rock conditions.

4. <u>Vegetation</u>

The Seabrook Nuclear Generating Station Site for the most purposes can be described as being entirely wooded, except for about 5 acres of land currently being used as the dump, a gravel road known as the Rocks Road, and a highly disturbed area in the northwest section of the site. The disturbed areas are old abandoned fields now occupied by thin stands of white pine. The agricultural and lumbering activities of the 18th and 19th centuries have greatly affected the original nature of the site's woodlands. Consequently, one cannot think of them as being primeval or virgin stands. Hodgson's report recognized the following forest communities.

a. Hardwood - Red Cedar Edge; edge of marsh.

b. Upland Oak - Hickory; rocky ledges often adjacent to marsh.

c. Swamp Hardwoods; upland areas with poorly drained soils.

d. Upland hardwood - Evergreen; older interior forest areas.

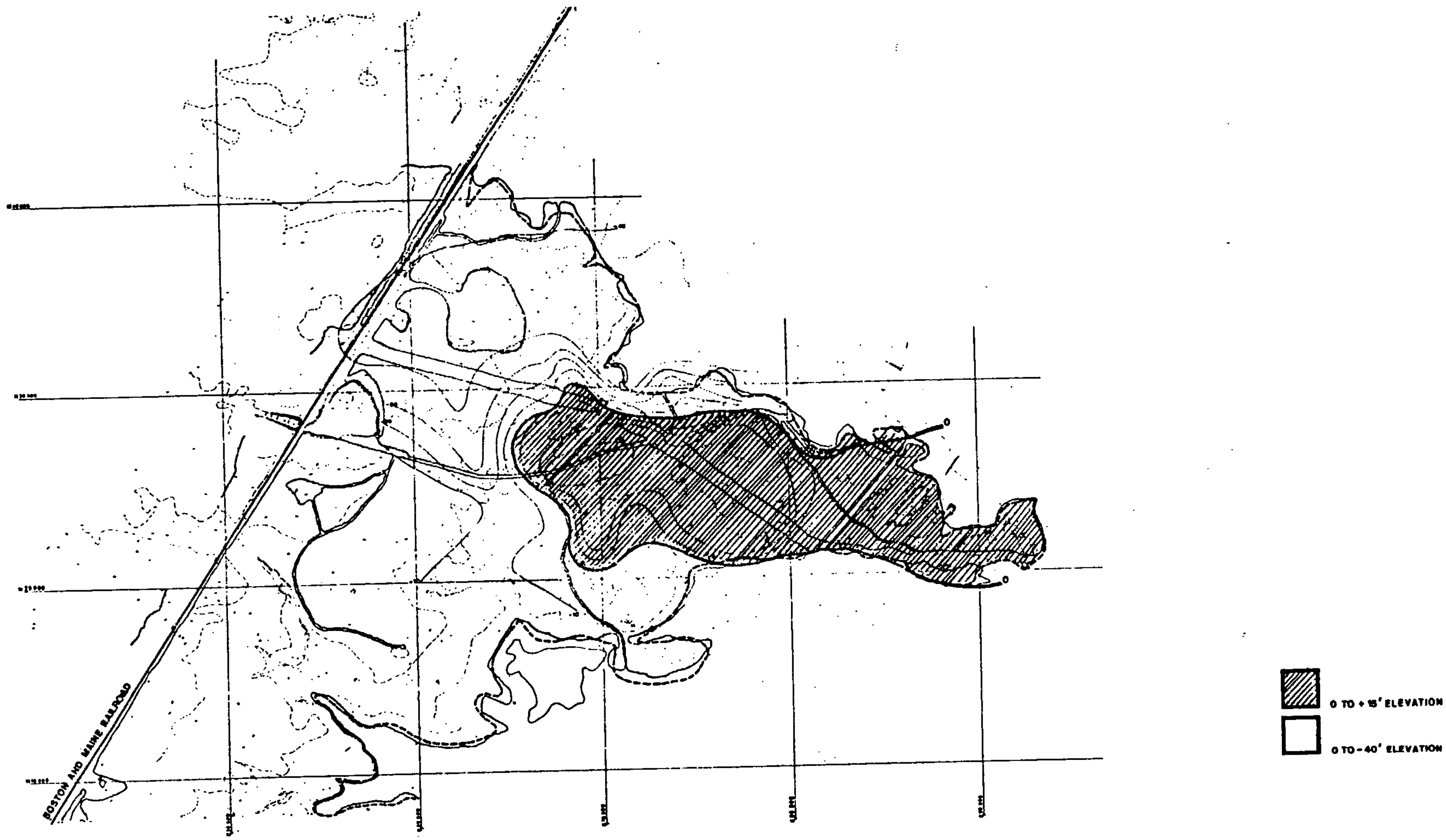
e. Hemlock Ravine; along an intermittent well shaded stream.

f. Old Field Pine; disturbed areas formerly in cultivation.

These forest associations are shown in Figure 5, and are briefly described below. Plant Communities and their zonations are illustrated in Figure 6.

a. <u>Hardwood - Red Cedar Edge</u>

Virtually the entire perimeter of the site along the salt marsh is lined with a narrow band of hardwood tree



DEPTH TO BEDROCK Fig. 4

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cover composed of red cedar, red and white oaks, shagbark and pignut hickories. In moister edge conditions red maple, black gum, and swamp white oaks dominate the upper canopy.

The understory is made up of bayberry, shadbush, sumac, catbrier and poison ivy. In addition the edge is occupied by thickets of high bush blueberry, wildrose, catbrier and sassafras.

Development Implications

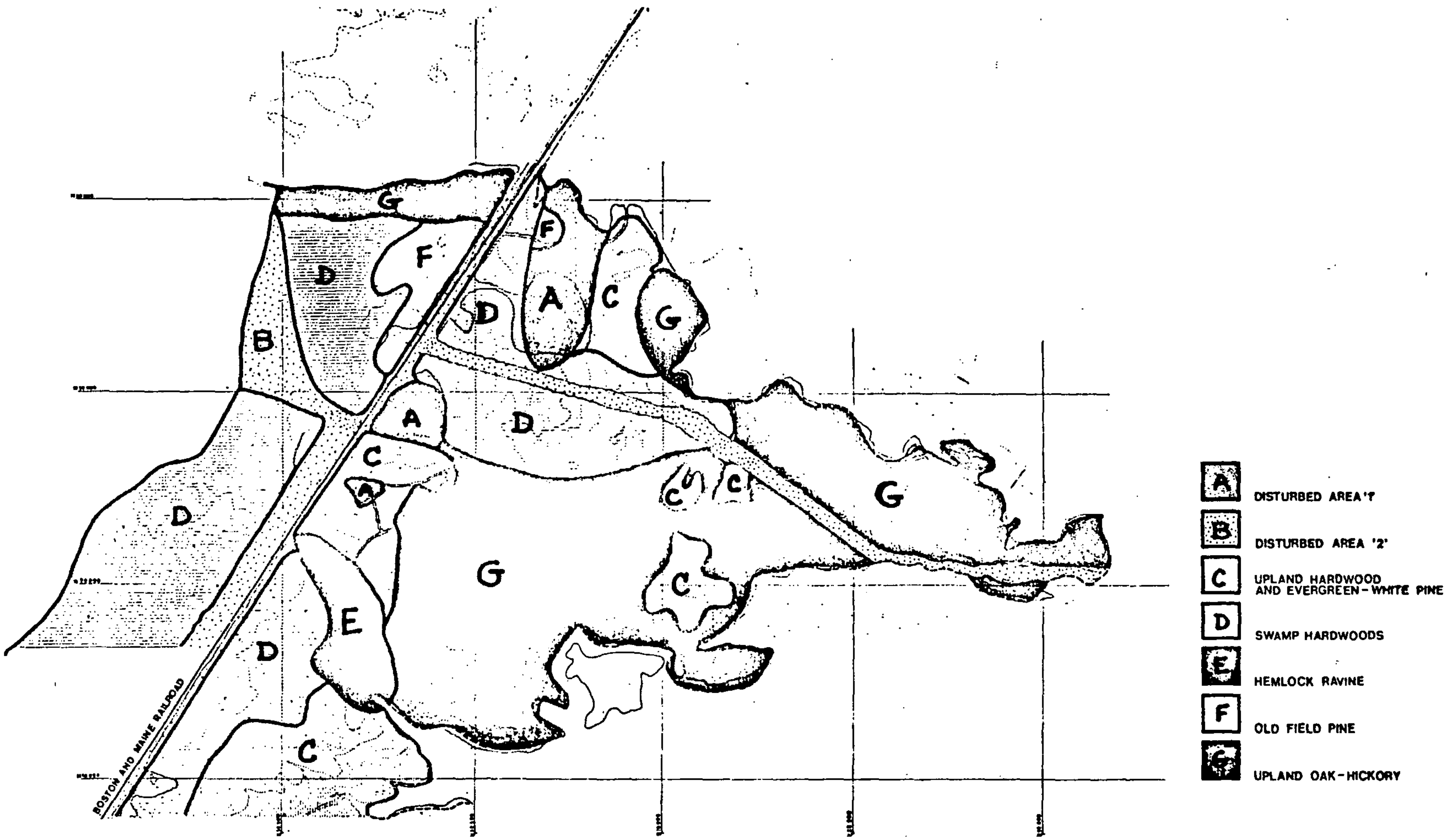
This narrow (200' max.) storm swept band of trees and shrubs bears the brunt of the prevailing winds and high salinity rates resulting from unusual high tides. This is a specialized plant community that has successfully adapted to a harsh and demanding enviroment. It's key function is to offer protection to the upland forest, therefore if it is greatly disturbed one can expect the upland forest edge to become subject to windthrow.

The edge, including Red Cedars, also provides an important visual screen that will function to reduce the visual impact of the plant both on the site and from adjacent areas.

Development of the site, wherever possible, should be limited to a distance of 200' from the protecting edge in order to assure a reduced impact on the forest communities and the visual effects of the completed project.

b. Upland Oak-Hickory

The upper canopy of this forest type is dominated by Red, White and Black Oak that occupy the areas of the site where bedrock is near or at the surface. In some areas along the Rocks Road it



FOREST TYPES Fig. 5

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is apparent that this growth has in-filled former pasture lands. The canopy is not dense, the trees are widely spaced, and the stems are not over 24 inches diameter at breast height.

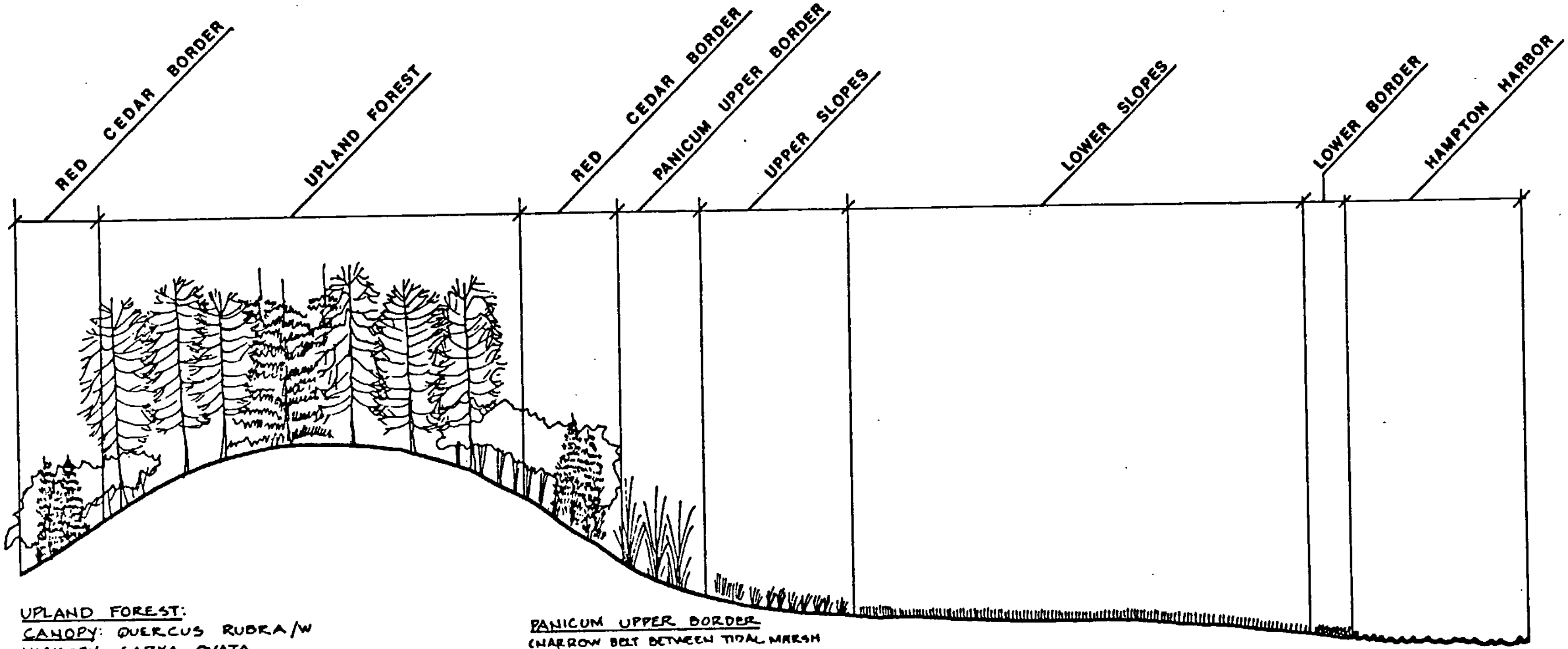
The understory is made up of catbrier, Lowbush blueberry, Grey dogwood, poison ivy, Bayberry and Shadbush.

Implications for Development

The Upland Oak-Hickory forests on the site are well drained. Their key function with regard to the project is their ability to reduce the visual impact of the power station. This is especially true of the forest that occupies the area known as "The Rocks". In addition to its visual qualities the Upland oak-hickory offers an important educational resource, especially in the transition zone between the Upland Hardwoods located in the southwestern area of the site adjacent to the Hemlock ravine. The project and its construction process should, therefore, be discouraged from expanding unnecessarily into this zone.

c. Swamp Hardwoods

The upper canopy is dominated by Red maple, Red and White oak and occasional Tupelo. This forest type is associated with soils which are poorly drained and have surface water during the winter, late fall and early spring. These soils occur to the north of Rocks Road and generally along both sides of the Boston and Maine Railroad, that portion of the site most disturbed by man's past activities, i.e. the dump and old abandoned fields.



UPLAND FOREST:
CANOPY: QUERCUS RUBRA/W
HICKORY - CARYA OVATA
BLACK GUM - NYSSA SYLVATICA
WHITE PINE - PINUS STROBUS

UNDER STORY - THICKETS
HIGH BUSH BLUEBERRY - VACCINIUM CORYMBOSUM
WILD ROSE - ROSA RUGOSA
CATBRIER - SMILAX ROTUNDIFOLIA

UPLAND SHRUB BORDER
(BETWEEN THE TIDAL MARSH AND THE UPLAND FOREST)
SUMAC - RHUS COPALLINA
ROSE - ROSA RUGOSA
SASSAFRAS - SASSAFRAS ALBIDUM
HIGH BUSH BLUEBERRY - VACCINIUM CORYMBOSUM

PANICUM UPPER BORDER
(NARROW BELT BETWEEN TIDAL MARSH AND THE UPLANDS)
PANICUM GRASS - PANICUM VIRGATUM
GROWS IN TUSSOCKS

UPPER SLOPES
(HIGHER ELEVATIONS OF THE MARSH
JUNCUS GERARDI DOMINENT GRASS/W
CORD GRASS SPARTINA PATENS
GOLDEN ROD - SOLIDAGO SEMPERVIRENS

LOWER SLOPES
CORDGRASS - SPARTINA PATENS DOMINENT
ASSOCIATED WITH MEAN HIGHTIDE LEVELS
MOST EXTENSIVE ZONE IN THE MARSH

LOWER BORDER
SPARTINA ALTERNIFLORA
OCCURS AS A THIN LINE ALONG BLUFF LIKE BAY FRONTS BETWEEN THE MARSH AND OPEN WATER

PLANT COMMUNITIES AND ZONATIONS
Fig. 6

Implications for Development

This forest community has a versatile ability to adapt to changing water regimes. Their prime function during and after development should be to provide areas for the filtration and disposal of storm surface water and silt and sediment abatement areas. The swamp hardwoods areas are suitable locations for parking lots, warehouses and the switchyard components of the project.

d. Upland Hardwood-Evergreen

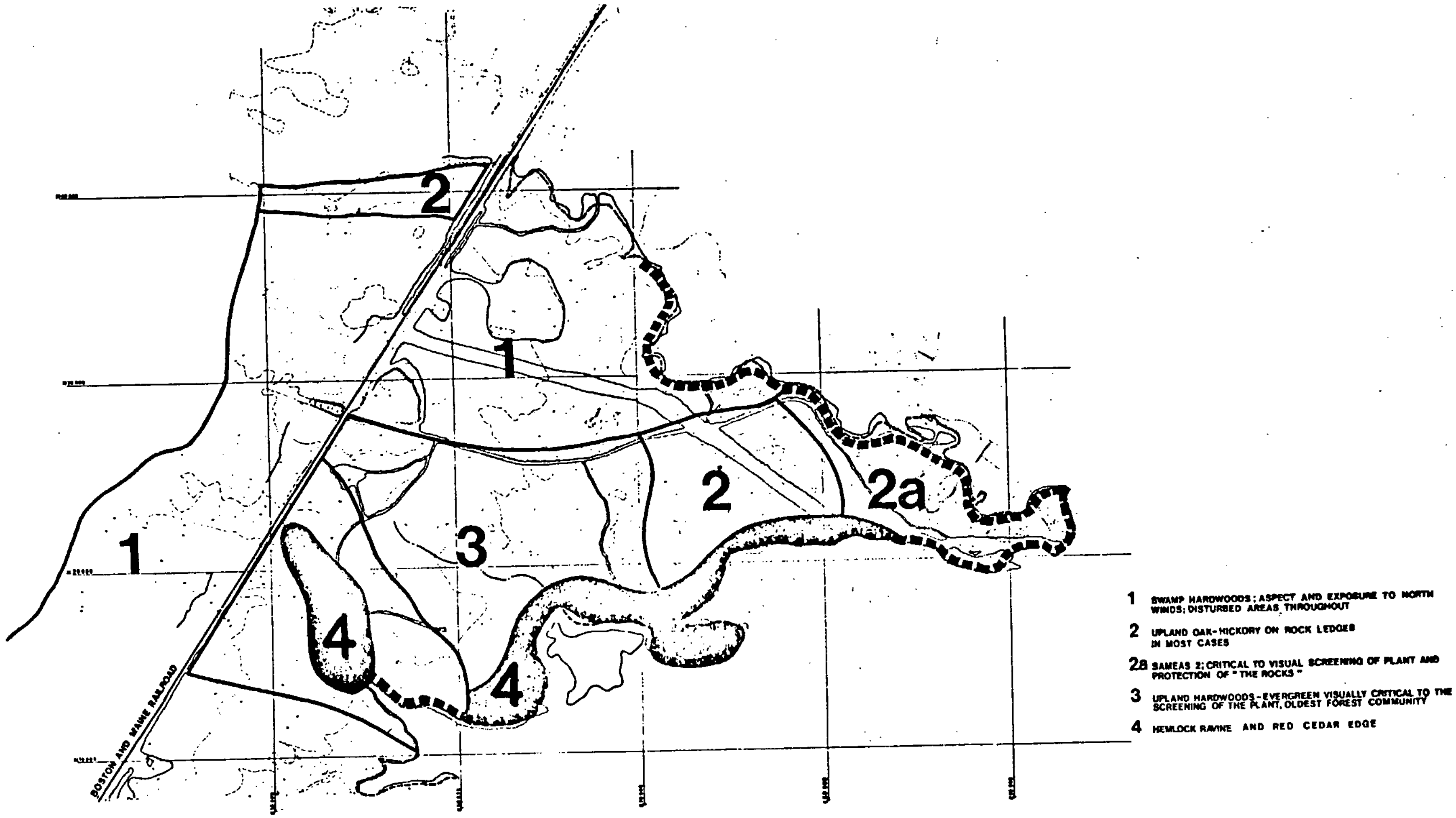
This forest type is the oldest plant community found in the study area and is located south of Rocks Road and west of the existing transmission line. The upper canopy is composed of Red and Black Oaks. Beech and Hemlock are found in abundance. It is, aesthetically and ecologically, a valuable forest type found on the site.

Implications for Development

Every attempt should be made to minimize the impact of the project development on this forest community because of its inability to adjust to radical changes in water regime and exposure. In the southwestern sector of the site it enjoys a protected habitat and is associated with the Hemlock ravine's drainage area. These forest types combine to form a unique and significant study area not found elsewhere on the site and should be retained.

e. Hemlock Ravine

The Hemlock ravine occupies about 8 acres and is located in the extreme southwestern area of the site on the steep slopes of an intermittent stream.



COMPARATIVE VALUES OF THE FOREST TYPES Fig. 7

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Implications for Development

The Hemlock ravine and its drainage area should be excluded from all intensive development. The preservation of the adjacent drainage area is also necessary to assure the continued survival of the stand. Its specialization contributes to its vulnerability to radical change or overuse. The ravine and its supporting drainage area, occupied by the upland hardwood forest, form a unique site resource that could become one of the focii of the generating station's educational center.

f. Old Field Pine

White pine dominates this forest type which recently invaded fields that were formerly used for agricultural uses. The stands are dense and generally homogenous. For the most part the Old Fields are located west of the Boston & Maine rights of way, north of Rocks Road.

Implications for Development

Because of their location on the site and their pioneer character the Old Field Pine stands offer no constraints to development. Their value, however, rests in their ability to visually screen certain aspects of the generating station complex.

5. Comparative Values of the Forest Types

a. Figure 7 graphically displays the relative values of the forest types found on the site with regard to the generating station development. The forest areas are ranked in order of ascending importance.

The selected criteria for establishing the comparative values are listed below.

(1) Uniqueness to the site and the Seabrook sub-region.

(2) Sensitivity to major changes in the forest habitat.

(3) Abundance on the site.

(4) Visual amenity.

(5) Educational potential.

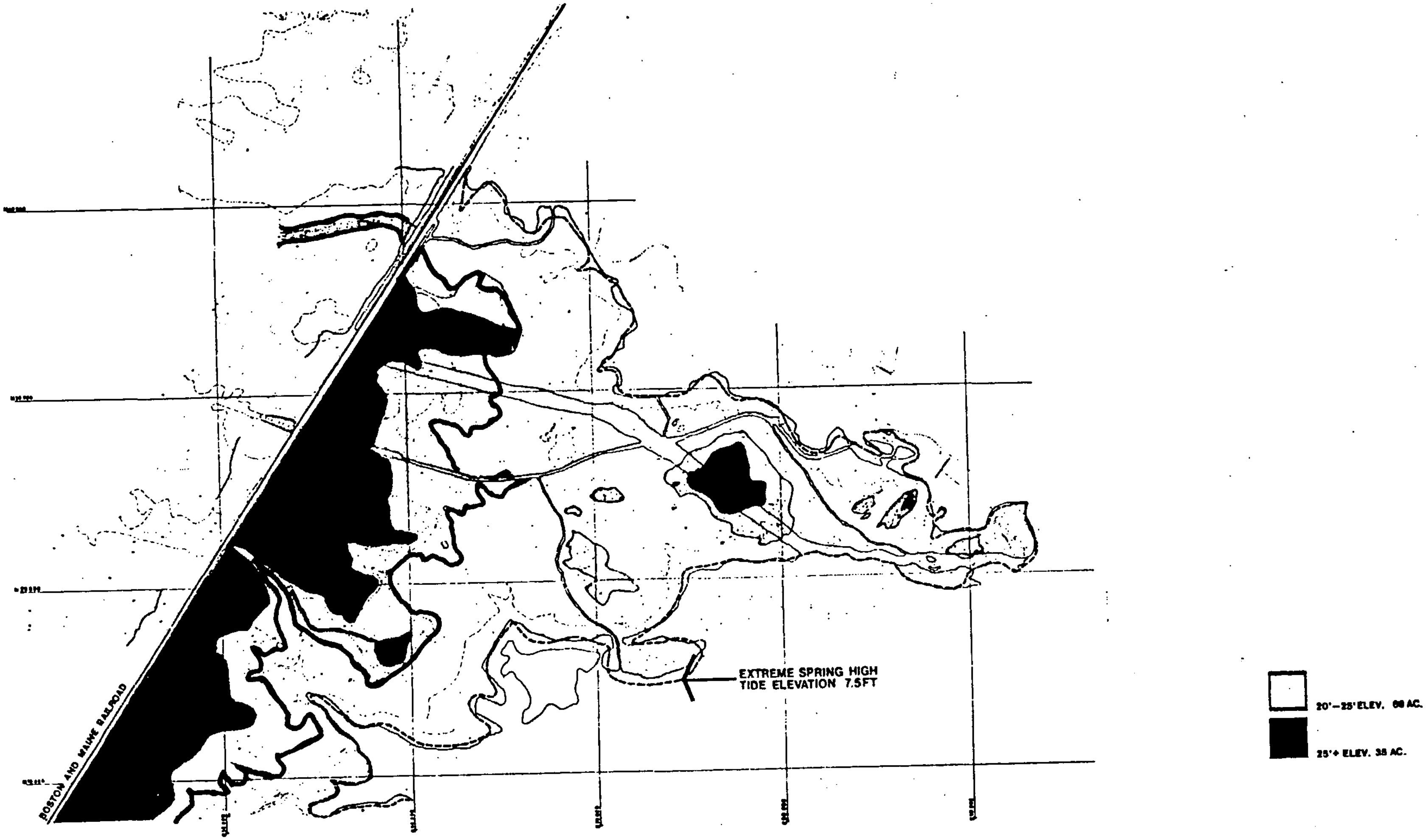
b. Description of the Forest Areas.

Area 1. Swamp Hardwoods and Old Field Pine; approximately 123 acres. The canopy is dominated by Red maple which has an aspect and exposure to the north winter winds. Both the Swamp Hardwood and Old Field communities are associated with previous disruptions resulting from agriculture practices.

Area 2. Upland Oak Hickory; approximately 21 acres. This forest type is associated with well drained soil and very frequently are sited on rocky ledges. The trees are thinly spaced, somewhat stunted and have a light canopy overhead.

Area 2a. Upland Oak-Hickory; approximately 14 acres. Essentially the same conditions prevail in this area, however its geographical location is critical with regard to the provision of a visual screen of the project as it would be seen from north, east and south.

Area 3. Upland Hardwoods - Evergreen; approximately 24 acres. This canopy is well developed with the dominance of Red and Black oaks. Beech and



AREAS ABOVE ELEVATION 20' Fig. 8

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Hemlock make up another important sector of this forest type. These areas are ecologically and aesthetically important to the site.

Area 4. Hemlock Ravine; The Red Cedar Edge and the Habitat of the Wild Coffee Flower; approximately 39 acres. These vegetation zones are difficult to replace and play an important role in maintaining the natural systems of the site.

6. Areas Above Elevation 20' and 25'

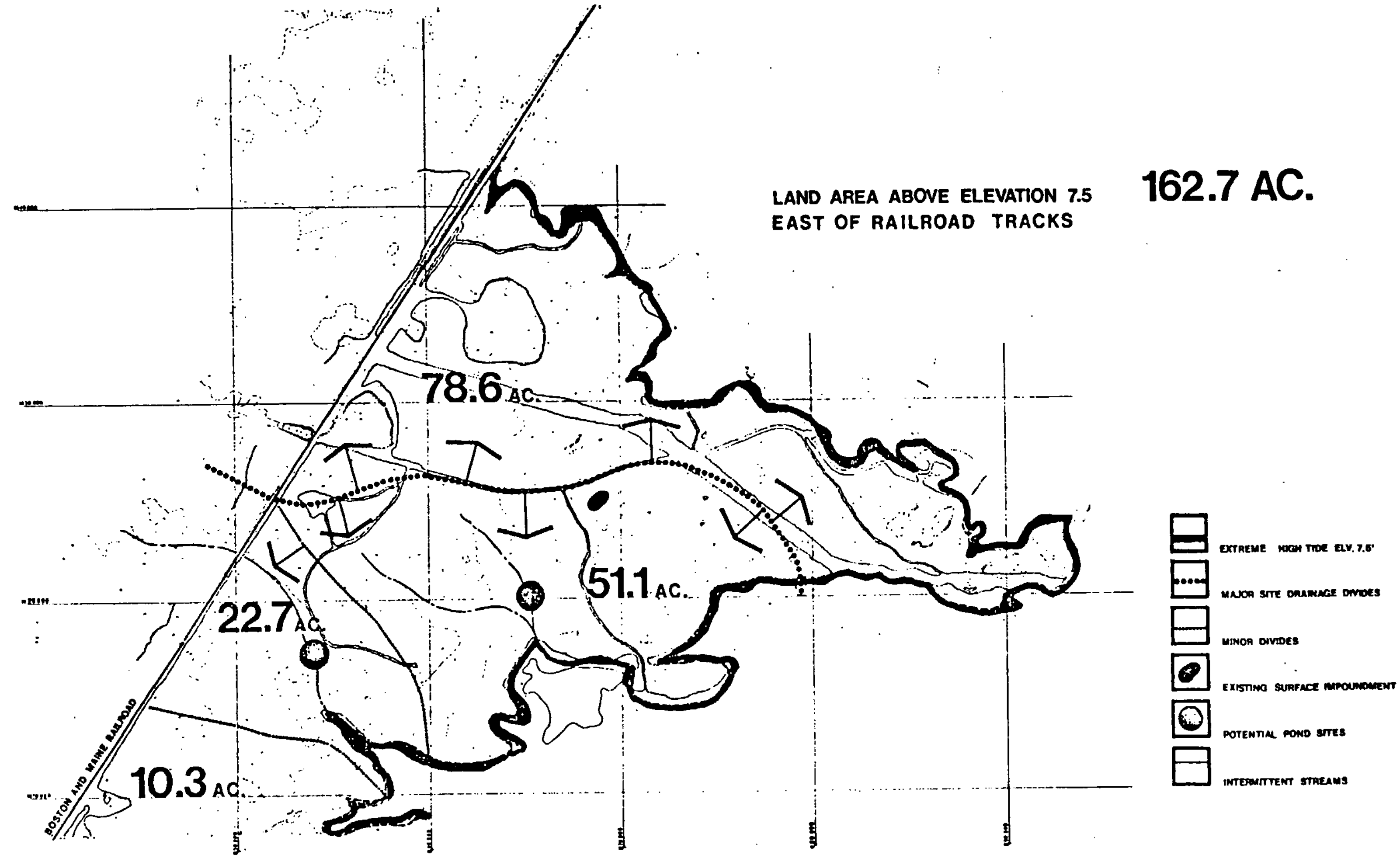
Figure 8 delineates those areas of the site that are 20' to 25' above mean/sea level. As a safety precaution, the power station complex has been set at an approximate elevation of 20'. Those areas above elevation 20' occupy approximately 103 acres of the site, east of the Boston and Maine Railroad. Areas with elevations 25' and above occupy approximately 35 acres.

7. Surface Drainage

The Rocks Road generally defines the major site drainage divide, with the surface water draining in a north-south pattern. As shown on Figure 9, minor divides surround the Hemlock ravine area and comprise about 13 acres. Except for a 0.5 acre pond, known as Doctor's Pond, which is fed by surface drainage, no permanent surface waters are found on the site. The surface soils are heavier and less permeable on the south side of the major drainage divide, consequently two intermittent streams are found here. The potential for surface impoundments exists at the base of these streams.

Implications for Development

In order to minimize the concentration of storm water runoff, the siting of the generating station should take advantage of the existing



SURFACE DRAINAGE Fig. 9

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natural drainage patterns by distributing the runoff to the north side of the major drainage divide which runs along ridge line coincident with Rock Road. Excluding the construction lay down space from the drainage areas that support the Hemlock ravine would result in the continual survival of this unique site feature.

8. Natural Systems and Areas of Unique Ecological Significance

Figure 10 identifies those natural features of the site that are unique and ecologically significant. This is the wild coffee (Triosteum aurantiacum) habitat areas located along the southern perimeter of the site east to the existing transmission line right of way, the Hemlock ravine, and the hardwood edge.

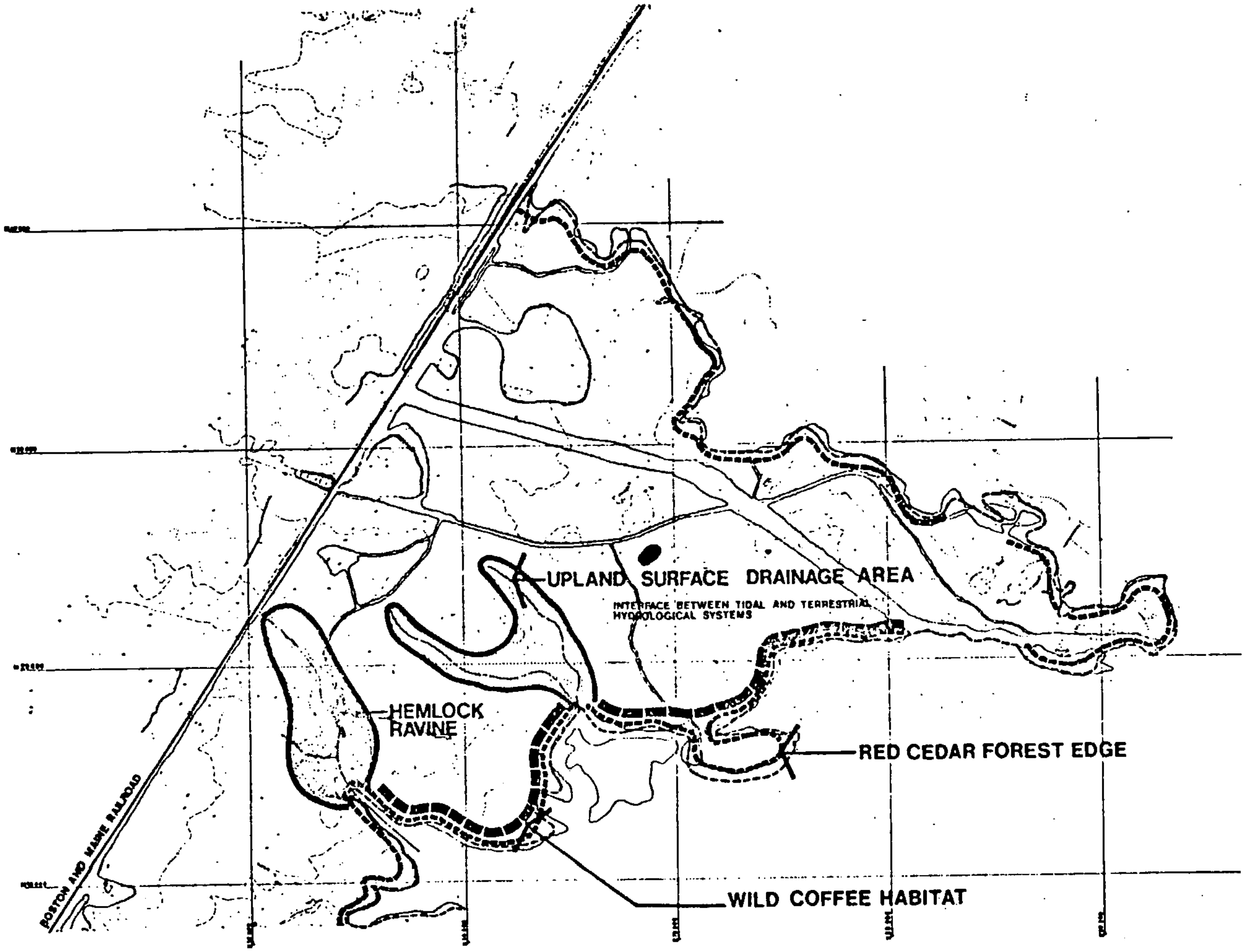
Implications for Development

a. Wild coffee habitat area

Hodgson's study of the indigenous plant life reported the first record in New Hampshire of the herbaceous wild flower known as wild coffee. With regard to its occurrence throughout the rest of northern New England, it is only found in Maine on three or four widely separated locations. The site development of the generator station should be directed away from this area.

b. Hemlock Ravine

The ravine and its adjacent drainage areas should be recognized for its uniqueness to the site, and for this reason, it has been recommended for exclusion from both the project and construction layout development areas.



NATURAL SYSTEMS AND AREAS OF ECOLOGICAL SIGNIFICANCE Fig. 10

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c. Red Cedar Hardwood Edge

The entire perimeter of the site is bounded by a Red Cedar hardwood edge that protects the interior woodlands from the winds, salt spray and seasonal high tides. The site design of the generator station complex should preserve this edge wherever possible.

9. Recreational and Visual Significance

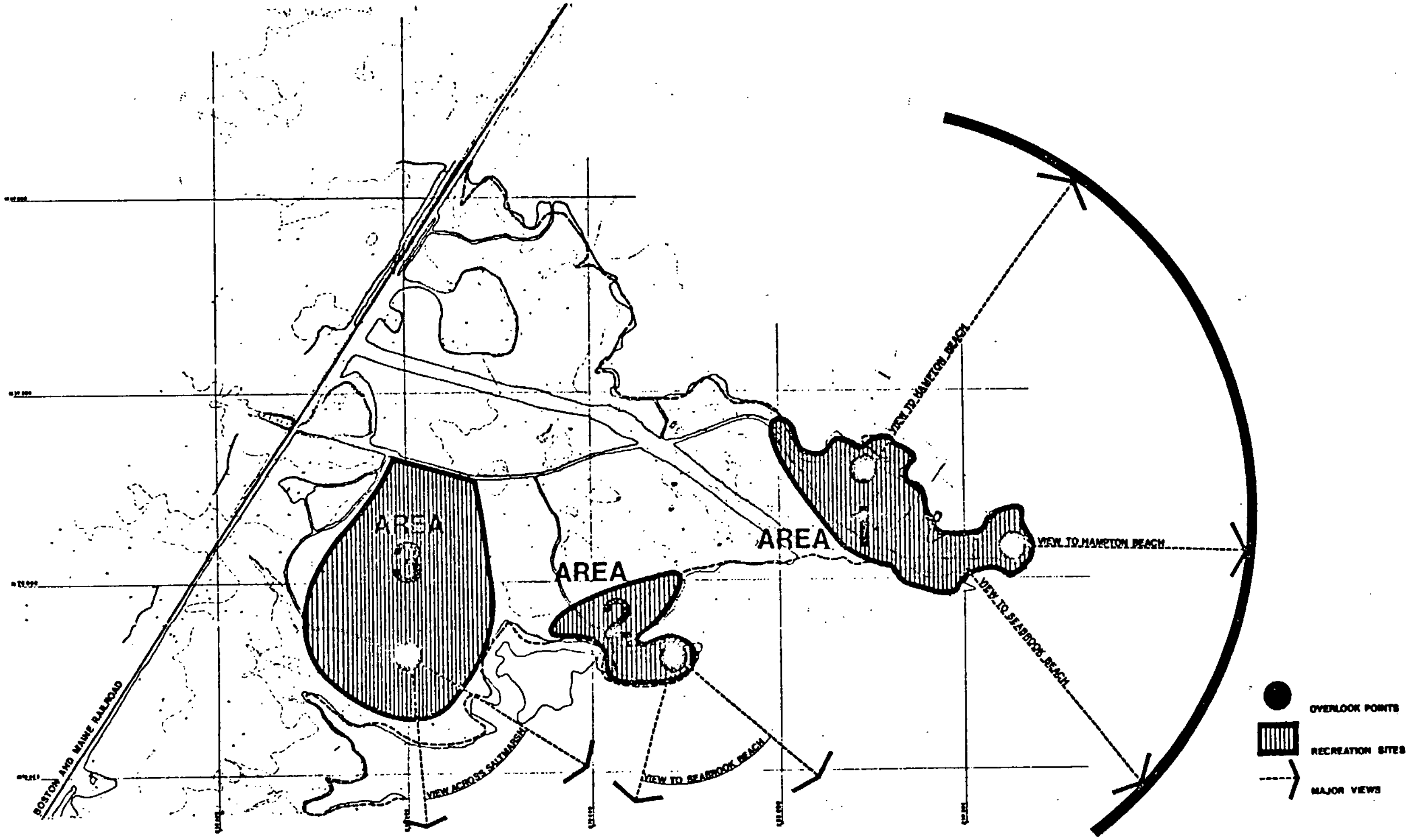
Figure 11 identifies those areas on the site that hold recreational and visual significance. The Rocks, Area 1, currently serves as an access point for local clammers, and commands wide views across the salt marsh toward Hampton Harbor and Beach. Area 2 includes a landscape feature locally known as the third cove and a former rock island. The third cove has important views across the salt marsh toward Seabrook Beach. Area 3, known as the second cove, includes the base of the Hemlock Ravine and overlooks a salt water pond that serves as a waterfowl feeding area.

Implications for Development

The landscape features described above should be considered as important elements that hold a high potential for either educational or recreational activities. The areas known as the Rocks should continue to provide access to local clammers. Area 2, or the third cove, can function in association with the second cove as an education and environmental study center.

10. Synthesis and Summary of Natural Factors and Development Constraints

In order to ascertain the relative value and importance of the natural systems of the site as with respect to the development program, a synthesis map was developed (Figure 12). The elements of the natural systems were ranked in ascending importance (1-4), according to their sensitivity to drastic change, degree of man's prior disturbance of the site's natural systems, construction



RECREATIONAL AND VISUALLY SIGNIFICANT AREAS Fig. 11

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limitations such as shallow depth to bed rock, natural surface drainage patterns and uniqueness to the site and Seabrook sub-region.

Development Implications

Priority Area No. 1. It consists of disturbed areas such as the town dump, existing transmission lines and abandoned old fields. The swamp hardwood forest community is the dominant forest type associated with these zones.

Natural Functions

Most of this area has been radically altered in recent times, therefore the natural function can be described as recovery in nature.

Recommendations

This area can absorb the fullest impact of the development program. The generating station, construction spaces, and access roads should, wherever possible, be located in this area.

Priority Area (West) No. 2. It is composed of Upland Oak-Hickory forest type. Shallow depth to bed rock can be expected in the northernmost sections of this area. The individual trees are well developed.

Natural Functions

This area is representative of the undisturbed forest type that occupied the site prior to man's disturbance. It is stable and can withstand some environmental change.

Recommendations

This area can effectively provide a screen that will act to reduce the visual impact of the generating complex. Construction will by necessity have to encroach into this area. Nevertheless, this encroachment should be limited to construction laydown spaces. After construction, a landscape restoration program could improve this area.

Priority Area (East) No. 2 - The Rocks. The forest type in this area is essentially the same as Area No. 3. However, its geographical location and landform are significant with regard to the major views afforded and the access to the clam flats.

Recommendations

This area is recommended for exclusion from all development because it offers an important opportunity to screen the generating complex from Hampton Beach and will retain the historical access point to the clam flats. A limited parking area should be provided in conjunction with a boat ramp able to accommodate small craft of about 16 feet in length.

Priority Area No. 3. It consists of the surface drainage areas that sustain the Hemlock ravine, and the wetlands on the site that support the oldest sections of the Upland Hardwood Forest - Hemlock Beech.

Natural Functions

1. Upland surface drainage areas that provide the interface between tidal and terrestrial hydrological systems.

2. Supporting drainage areas for the Hemlock ravine and the oldest forest type which is the Upland Hardwood - Hemlock Beech.

Recommendations

These areas should be utilized for limited educational and recreational activities. The site plan should designate this area for use as the educational center site.

Priority Area No. 4. It is composed of the Hemlock ravine, the perimeter buffer edge including Red Cedar Hardwoods, and the habitat for the wild coffee flower.

Natural Functions

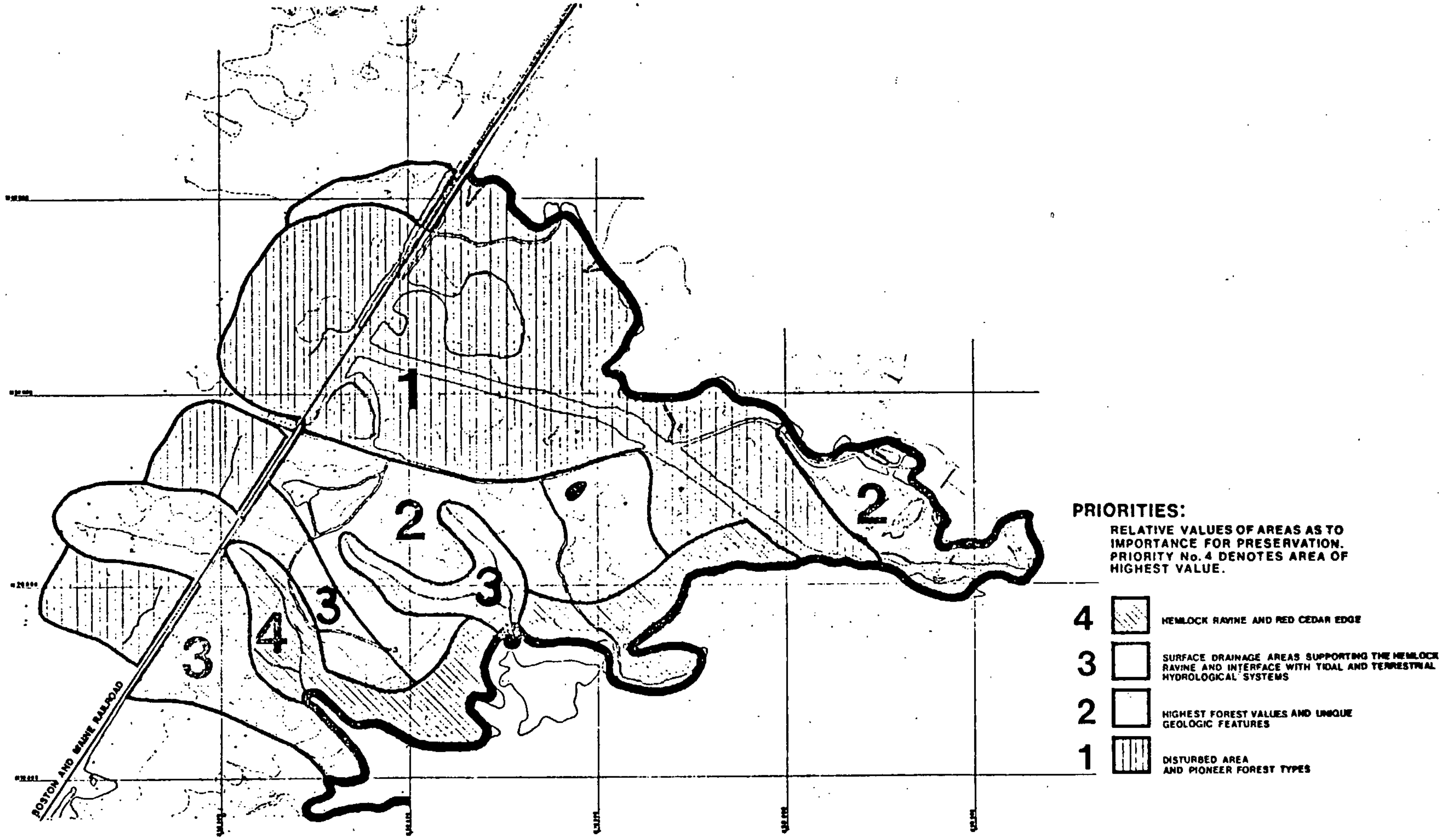
1. Unique to the site and northern New England.

2. Protection of interior woodlands from winds, salt spray and extreme spring high tides.

3. Interface with tidal and terrestrial hydrological and ecological systems.

Recommendations

This area is recommended for conservation. Construction activity, if any, should be limited and controlled carefully.



SYNTHESIS OF NATURAL FACTORS Fig. 12

IV. PHYSICAL STRUCTURES -- DESIGN, CONSTRUCTION & OPERATIONS

A. The Generating Plant

1. General Description, Operations & Servicing

The nuclear generating station at Seabrook, as conceived by PSNH with UE&C, is comprised of two nuclear generating units with a combined net electrical output of 2280 Megawatts, or 1140 Megawatts each unit. The two-unit plant requires a plant area of approximately 23 acres with the two units sited adjacent to each other for maximum service, operations, and security efficiency. Thirteen acres of land are allocated to the functions of unit no. 1, 10 acres for unit no. 2.

The plant is to be served by both rail and road in the form of a spur line into both units from the Boston & Maine railroad line bordering the site on the west, and an access and service road from the major north-south arterial, U. S. Route 1, further to the west.

Rail rights of way are required into the turbine halls and into the fuel storage ends of each unit. The access and service road enters the plant complex to link up with a service road surrounding the plant and surrounding each unit. At the entrance to the plant, a gate house will provide a positive security checkpoint for employees, service personnel, and the public, if and when permitted. This checkpoint will be the only legitimate means of entry and exit from the immediate plant area within a security fence which is to surround the plant, exclusive of gates at the rail spur rights of way for occasional use to permit servicing the plant.

As part of the total generating station complex, but outside of the plant area, 40,000 sq. ft. of warehousing space, the gate house for positive access control, and a parking area for plant employees and visitors (100 cars) will be required for a total estimated land area of about 4 acres.

Summary of Plant Facilities Area

Function	* Area (acres)
Generating Unit #1 plant	13
Generating Unit #2 plant	10
Switchyard (345 KV)	1
Warehouse, gate house, employees & visitors parking	4
Total	* 28 Acres (approx.)

* Exclusive of rights of way and land areas beyond immediate limits of function named.

2. Plant Components

Each plant unit is made up of a series of component structures which house the equipment and processes for storage and treatment of the fuel, generation of steam, and creation of the electricity required. Along with these structures are those which house the support and monitoring functions of the plant. Those structures which have the greatest visual impact, aside from the massing of the entire unit, are as follows: **

- The nuclear reactor containment building, a domed cylindrical structure with a diameter of 150' and a height to the top of dome of 190'.

- The turbine hall housing the turbine units necessary to generate electricity. It is 325' long x 135' wide and 140' high. Attached to the turbine hall is a heater bay space measuring 325' long x 65' wide and 65' high.

** Due to the preliminary state of the design, all dimensions are approximate.

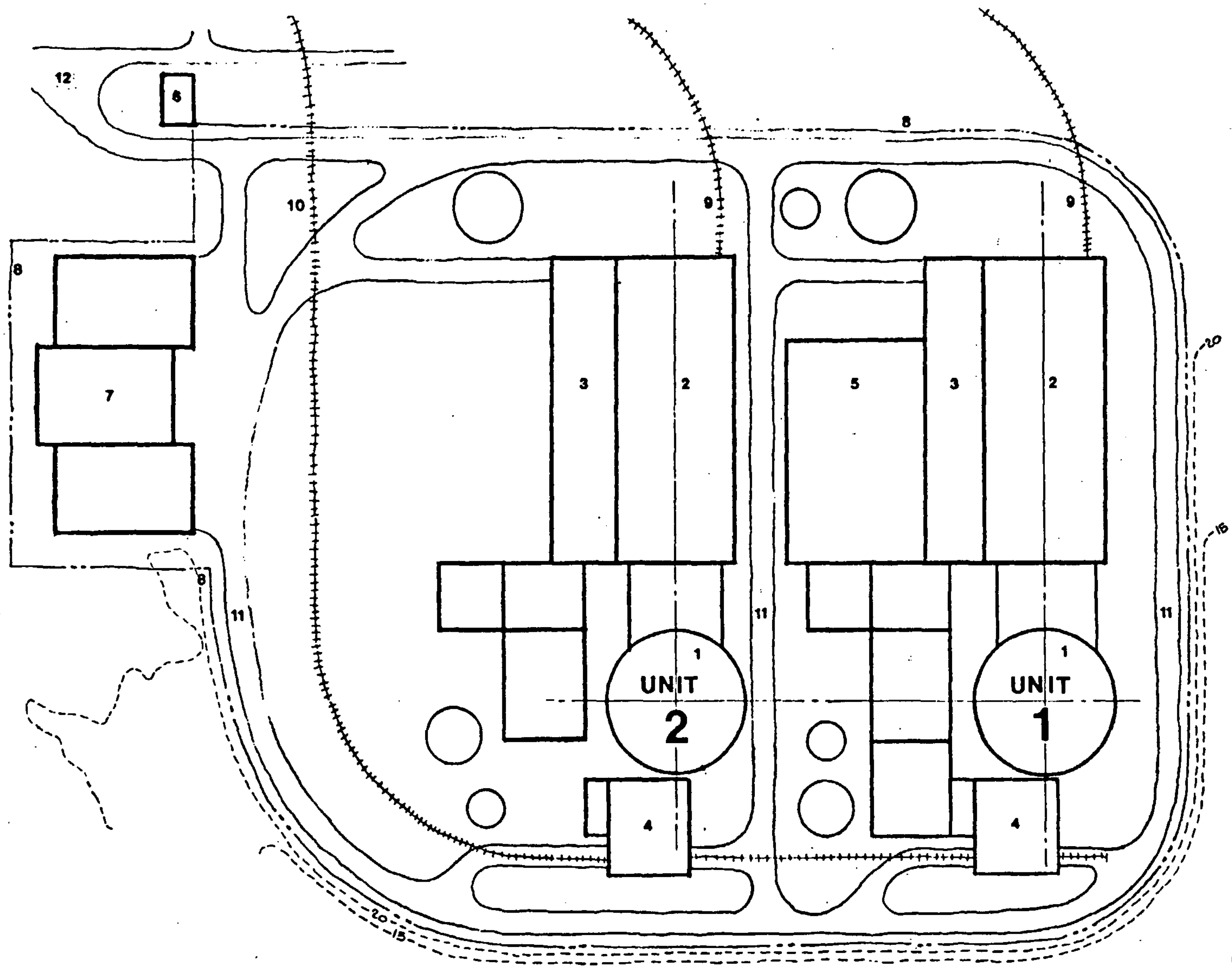
- A fuel storage building of 107' long x 92' wide and 80' high for storage, shipping, and receiving of new and spent fuel.

The plant will contain, at a minimum, structures and areas for the following functions, also shown in figure 13.

Function and/or Structure	Unit 1	Unit 2
Nuclear Reactor Containment	*	*
Turbine Hall	*	*
Heater Bay	*	*
Fuel Storage Building	*	*
Primary Auxiliary Building	*	*
Control Room	*	*
Diesel Generator Building	*	*
Waste Treatment	*	
Pump Room	*	*
Personnel decontamination area (change, lockers, and shower areas)		
Administration & Service Building	*	
Office Building		*
Tanks:		
Refueling Water	*	*
Primary Water	*	*
Demineralized Water & Condensate Storage	*	*
Fire Protection	*	
Spent fuel pool; cooling and cleanup	*	*
Condensate tube withdrawal area	*	*
Total Plant Area (acres)	13	10

23 Acres Total - Units 1 and 2

NOTE: Function and/or structure noted by asterisk under Unit 1 or Unit 2 indicates the physical location of its structure only with service to either or both units.



LEGEND

1 CONTAINMENT STRUCTURE
2 TURBINE HALL
3 HEATER BAY
4 FUEL STORAGE
5 ADMINISTRATION & SERVICE
6 GATEHOUSE
7 WAREHOUSE
8 SECURITY FENCE
9 RAIL SPUR TO TURBINE HALL
10 RAIL SPUR TO FUEL STORAGE
11 PLANT SERVICE ROAD
12 PLANT ACCESS

PLANT LAYOUT & COMPONENTS · Fig. 13

0 25 50 100 200 300

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B. Plant Component Relationships as Affecting Siting

The physical relationships between nuclear generating units no. 1 and no. 2, and that of the individual structures and other components within each unit have been, for the purposes of this study, set by engineering, safety, and operational requirements. It was found, during the process of this study, that two basic modifications in these relationships could be considered to satisfy several specific criteria in the development of Kling/Planning recommendations.

1. Flipping of the original UE&C component layout of both unit 1 and unit 2 around the major turbine hall/containment structure axis so as to effect shorter cooling water intake and discharge piping. For any one site location, comparing the above layout for layout, with piping rights of way from the north and east, this modification could save approximately 160 linear feet of piping to unit 1 and approximately 270 linear feet of piping to unit 2. An additional 50 linear feet of piping is also saved, theoretically, by the dimension reduction discussed below.

2. Reduction of the distance between the administration and service building of unit 1 and the turbine hall of unit 2 from 100' to 50' decreases the overall limit of structure dimension for both units by 50' in one direction. This would help to preserve, to a greater degree, the environmentally important edges of the site at the salt marsh and reduce the total area required in the site interior.

C. Specific Engineering/Operations Criteria

1. Plant elevation

Grade elevation of the generating plant, including units 1 and 2, shall be at 20' to 25' above sea level.

2. Access

a. Rail and road access is to be provided to both the turbine hall and the fuel storage ends of both units 1 and 2 ("cold" and "hot" sides of the generating plants respectively). Rail rights of way must be provided for construction and on-site equipment assembly purposes and continued for plant servicing requirements after completion of construction. Radii of rail curves into the units are to be not less than 250'.

b. Provision is to be made for accommodation of special rail vehicles such as "schnaubel cars" for the transport to the site of oversized, overweight plant components during construction and plant operation. To avoid rail spurs with a minimum of 1400' turning radii into the plant units required for these special rail cars, a 350' (minimum) long unloading point on the plant rail spur is required as close to the main line as possible, and before the beginning of the normal rail turns into the plant itself. These plant components will be transferred to truck at this unloading point.

c. New fuel is to be delivered to the plant by truck. Depending upon the economics and regulations in effect at the time of fuel shipments, spent fuel is to be removed from the site by rail or truck.

3. The generating plant should be situated to minimize rock excavation. Location of the generating plant should reflect consideration of fill necessary to reach the required plant elevation.

4. Areas which deal with radioactive materials and their handling, and the processes in which they are involved, are to be segregated from those functions where these materials and processes are not involved. Through a series of enclosed walkways and tunnels, personnel involved with radioactive processes, as designated, will pass through a decontamination unit, having change, locker, and shower facilities. This unit is to serve both of the generating units and should, therefore, be located between them.

5. Consideration should be given to the orientation of containment structures for it will have impact upon land acquisition. In addition, location of containment units in any area will restrict activity in the adjacent areas.

6. At this point in the design of the generating plant, two 9' diameter discharge and two 9' diameter intake pipes will be required to handle its cooling water requirement. The routing for this piping will, in general, be eastward through the salt marsh, under Hampton Beach and out into the ocean. The high cost of running this piping indicates the need to minimize piping length wherever possible.

7. Rail spur and access road rights of way to the plant should be minimized in terms of length and width to preserve as much of the site as possible. Economics of engineering, operations, and servicing of the plant also dictate this requirement.

   Access to the plant by road will be from a main road running west to Route I. This road will tie into the service road ringing the plant, once inside the security area. Both of these road systems should be in place at the commencement of construction to be used during the construction process, and subsequently for plant operations.

The existing public road to the south of the main access road is to have its eastern terminus just west of the B&M railroad to reinforce the single-entrance concept of the plant and to preserve the low traffic character of this existing road in keeping with community desires.

8. Basic security control for the plant is to be provided by fence around the plant's perimeter just outside the service road that rings it. A single security checkpoint will be provided with a gate house, at the main access road to the plant where it meets the fence. Secondary gates will be located at points of penetration by the service rail spurs for occasional use only.

   The road to the education center, under consideration, will turn off south from the main access road just before the gate house. Access to the public areas east of the plant out on the promontory will be by road starting at the security fence. Both public roads discussed above should have their entrances visually controlled from the gate house.

9. Future expansion of the generating plant is at this point in time not being considered, nor are any plans being made by PSNH for such expansion.

10. <u>Surface Cooling Contingency</u>. As set down in the Charles T. Main, Inc., Engineers, report dated April 1972 entitled "Seabrook Nuclear Plant Condensing Water Study" (relative to comparative methods of condensing turbine exhaust steam in the generating plant and alternative to the once-through open system of intake and discharge of ocean water offshore), the concept of closed circuit canals with a spray module cooling system with site coverage exceeding roughly 2.6 million square feet was reviewed.

Within the scope of this Kling/Planning study, the spray module cooling alternative, using extensively the east side of the B&M railroad tracks, is not compatible with this study's objectives.

D. The Construction Process

This section sets forth the basic requirements of the construction process for Seabrook Station. Interrelationships of these requirements are shown, however the emphasis is on the relationship of these requirements to the Site.

1. Objectives

The objectives in development of a construction process layout for the plant are:

a. Develop a layout of areas which is efficient for the construction work flow process, minimizing the time and distance required to move labor and materials in support of the goal of execution of the work at the least cost in the shortest possible time.

b. Minimize land acquisition by keeping all facets of the construction process within the 3000' exclusion zone.

c. Protect the site from the destruction of its natural environment and its existing ecosystems to the greatest degree possible.

d. Assist in keeping the construction of a facility of such great scope from having a community impact any greater than absolutely necessary.

2. Construction Process Areas

Close to 47 acres of site area using both sides of the existing B&M railroad tracks, as necessary, will be required for the construction process of the plant exclusive of the immediate plant construction site itself. Major components of the total area requirements are briefly described below:

a. Construction parking - 1500 cars: 15 acres. This area must be adjacent to the construction operations area which will be immediately adjacent to the construction site. This parking space may be made up of several areas rather than just one; however, the small size of the site and this space's essential proximity to the main service and entrance road almost dictates a single location. This relationship to the construction operations area will be essential to the efficiency and economics of the labor flow to and from the construction site.

b. Construction operations area: 11.5 acres. This area will contain the following functions:

   Change and wash houses; toilet facilities.

   Offices and shacks for supervisory personnel.

   Supervisory personnel parking.

   Equipment parking.

   Time office.

   Equipment maintenance and storage areas.

   Welding shops, etc.

   Warehouse - to be permanent for future plant use.

c. Construction laydown area: 10 acres. This area will be used for the receiving, storage and finishing of such materials as piping and structural steel. Although this area may be located off-site, its proximity to the construction site is essential. Size of loads being hauled by truck, rail, or both should place this area along and adjacent to both mode rights of way.

Construction laydown space can also be provided within the immediate construction site, depending upon the construction sequencing for the two units.

d. Concrete batch plant: 7 acres. The batch plant may be located off-site but must be located so as to allow free movement of trucks on a very strict time schedule to and from the construction site. Storage of aggregates and cements and operation of filling the trucks do not make for compatibility with other construction processes, and therefore may require a more remote location.

e. Heavy equipment maintenance yard: 3 acres. This area may also be located off-site, and is for the servicing and maintenance of large pieces of construction equipment such as cranes, grading equipment, etc. Its location should not be below transmission lines.

It is important that those areas which can be placed off-site, be located on the west side of the existing B&M tracks and adjacent to the main access road to the plant to permit as much land as possible on the east side to be left undisturbed - i.e., the Hemlock ravine and the site's peripheral areas.

f. Summary - Construction Process Areas

- Construction parking-1500 cars	15	ac.
- Construction operations area	11.5	ac.
- Laydown area - piping and structural steel (may be off-site)	10	ac.
- Concrete batch plant (may be off-site)	7	ac.
- Heavy equipment maintenance yard (may be off-site)	3	ac.
Total construction process areas	46.5	ac.

3. Construction Roads

The main service and access road to the plant will serve as the main construction road and must be constructed for heavy duty use. The same requirement will apply to the in-plant ring service roads.

Construction roads should follow transmission line rights of way, existing scars, and disturbed land areas wherever possible.

4. Construction Work Force & Site Accessibility

The main access road to the plant is the only road presently contemplated for construction use providing positive plant security (exclusive of any spur road required for construction of the education center).

5. Rail/Road Crossings

Due to the existing and expected infrequent service on the B&M railroad tracks, crossing of the tracks by the construction (main access) road will be at grade.

6. Cooling Water Intake/Discharge Pipelines

Placement of this piping through the salt marsh, the river and harbor areas, etc. will probably require a six-month construction period in any one area due to the digging process, placement of the pipe, and restoration of the overburden.

Construction schedule will be set to avoid periods of severe weather. Work will begin in March and continue through November.

Impact of the construction will be minimized during the summer vacation periods.

Construction of the pipeline across Hampton Harbor will hopefully be held to one season.

7. Cooling Water Intake Structure

Location of this structure is proposed for a point immediately north of the Hampton Harbor inlet. Design and construction of this building or structure must take into account its location within the state park and be physically compatible with the community in which it sits. Recreational facilities and areas, where disturbed or eliminated, should be replaced here or elsewhere.

8. Construction Debris

Removal from the site may be by truck, rail, or both.

9. Approximate Construction Schedule -- Commencement of Work as Conceived by PSNH & Yankee.

Anticipated time for construction startup is January 1975, at which time parking areas, job mobilization, excavation, rough grading, will begin.

Summary: Plant construction time (anticipated)

Commence:	1975
Complete:	1981
Duration:	± 72 months
	50-54 months of heavy construction

E. The Education Center

Kling/Planning was asked to consider the client's desire to provide educational facilities for the public, in the fields of nuclear energy and environmental science, as part of their plan for a generating station at Seabrook. These educational facilities are proposed to be another point of interest on the site of Seabrook Station. However, it must be emphasized that the concept for the Education Center is in its very preliminary stages of development.

1. Objectives

As primary to Kling/Planning's consideration of these proposed education facilities, the following objectives are set forth:

a. Select a suitable general location, on the site, for the proposed Education Center.

b. Provide a conducive environment for the proposed educational functions.

c. Develop an educational facility to explain the need for environmental protection in an age of increasing population, commercial growth, and industrial expansion.

d. Develop an educational facility to explain the principles of nuclear power, its use as an energy source for generating power, the advantages of its use as an energy source, its implications to the consumer of electric power, its impact upon the power industry in the future, and the role that PSNH plays as part of the industry.

2. Concept as to Function

The Kling/Planning team saw the opportunity for PSNH to develop in both a physical and functional sense a symbol of the increasingly strong relationship and cooperative spirit necessary between the power industry in search of new sites for its generating plants and those forces, on a local, regional and national level, concerned with the environmental ramifications of constructing and operating such facilities. Kling/Planning saw PSNH's concept of nuclear and environmental education facilities at Seabrook Station as an opportunity to create such a timely, functional symbol.

Combining of the energy and environmental education centers in one building could reinforce this concept of cooperation in a physical sense and would permit the interaction of people interested in one subject with those interested in the other.

V. PROPOSED SITE PLAN AND LAND ALLOCATION

A. Response to Criteria

Kling/Planning considered, developed, reviewed, and carefully evaluated a number of alternative schemes for the location of the generating plant and its concomitant requirements. The proposed scheme (Figure 14) is recommended because it strikes the best balance in meeting the greatest number of engineering/operational, environmental, and community impact criteria derived during the process of Kling/Planning study as discussed in earlier parts of this report. It offers the greatest opportunity to preserve the site's natural environment, and to provide public access to the site for recreational and educational purposes without conflicting with the construction and daily operational requirements of proposed Seabrook Station. Response of the proposed scheme to the Engineering, Environmental and Community Impact is outlined below:

1. Response to the Engineering Criteria

   a. Meets the engineering/operational requirements of the project including the locational and orientation needs of the two generating units, and segregation of their hot and cold sides.

   b. Accommodates an efficient construction process by providing ample and contiguous space for various functional areas, and the flow of labor and materials.

   c. Provides good accessibility by rail and road.

   d. Offers direct security control of the public activity areas on the site.

   e. Provides acceptable lengths and routes for intake and discharge pipes, and transmission lines.

f. Minimizes rock excavation, and the volumes of fill required to obtain a +20' elevation for the plant complex.

g. Reserves space for a surface evaporative cooling system in the event proposed once-through open system of intake and discharge of ocean water offshore is not approved.

2. Response to the Environmental Criteria

a. Protects important natural processes over the entire site through the presentation of a buffer zone around the perimeter of the site, and maintains important natural drainage patterns.

b. Preserves and maintains areas ecologically significant to the site including Hemlock Ravine and its supporting surface drainage areas.

c. Preserves and maintains areas of recreational and visual significance such as the Rocks, the first cove, and the second cove.

d. Minimizes impact of the construction process through intensive use of disturbed areas, such as the dump, and right of way of existing transmission lines, for construction activities.

e. Avoids any filling of the salt marsh.

f. Enhances the Site as a whole through recommendations that include the restoration of existing dumps and replantations of right of way of existing transmission lines that will no longer be utilized.

3. Response to the Community Impact Criteria

a. Maintains continuous public access to the clam flats, the salt marsh, the Brown's River, and the Rocks.

b. Provides recreation facilities for the Town of Seabrook, through recommendations that include ball fields, and a boat ramp.

c. Makes provisions for the Education Center with potential for educational opportunities.

B. Proposed Site Plan

The Proposed Site Plan (Figure 14) shows the physical relationships between the major components of the plant, other functional areas, and the Education Center. It shows the site location of important physical functions incorporated into the proposed Seabrook Station. These are briefly described below:

1. Access

a. Proposed Seabrook Station will be served by both rail and road.

b. The only access to the site by road is from the west through the proposed access and service road which takes off from the major north-south arterial serving the area, U. S. Route 1.

c. Rail service to the plant is from the Boston & Maine railroad line running through the site on the west.

2. Parking

a. The main parking area for employees, and visitors to the plant is immediately to the north of the main access and service road at the gate house just outside the security fence.

b. Additional parking areas are provided for visitors to the Education Center, and the Rocks.

3. <u>The Plant</u>

a. The plant, including the two generating units, has been sited so as to cause minimal degree of disturbance to the environmentally important areas of the site.

b. The location of the plant as shown in the Site Plan (Figure 14) has been set to respond to the engineering/operational, and community impact criteria.

c. There is a buffer edge of 200 feet (approximately) protecting the generator complex all around. This buffer edge is carefully preserved in the northeast and southeast corners of the complex; it helps to provide a visual screen to the project as seen from the north, south and east; and it preserves important natural processes.

d. At the entrance to the generator complex, a gate house provides a security checkpoint for employees, service personnel and the public, if an when permitted.

4. <u>The Warehouse</u>

a. The warehouse is located within the security fence to the west of the generating unit no. 2, immediately off the plant service road.

b. It will be built and completed at the beginning of the plant construction as one of the components in the construction operations area, and retained for later use.

5. Active Recreation

   a. Area west of the B&M Railroad is recommended for active recreation facilities such as ball fields and tennis courts.

   b. The main road into the Site will also provide access to these active recreation areas.

6. The Rocks

   a. Continued public access to the Rocks, and the clam flats lying to the east, is maintained; however, the use of the western part of the road is discontinued. As shown in Figure 14, retained part of the Rocks Road meets the proposed access road near the security checkpoint located to the west of the plant.

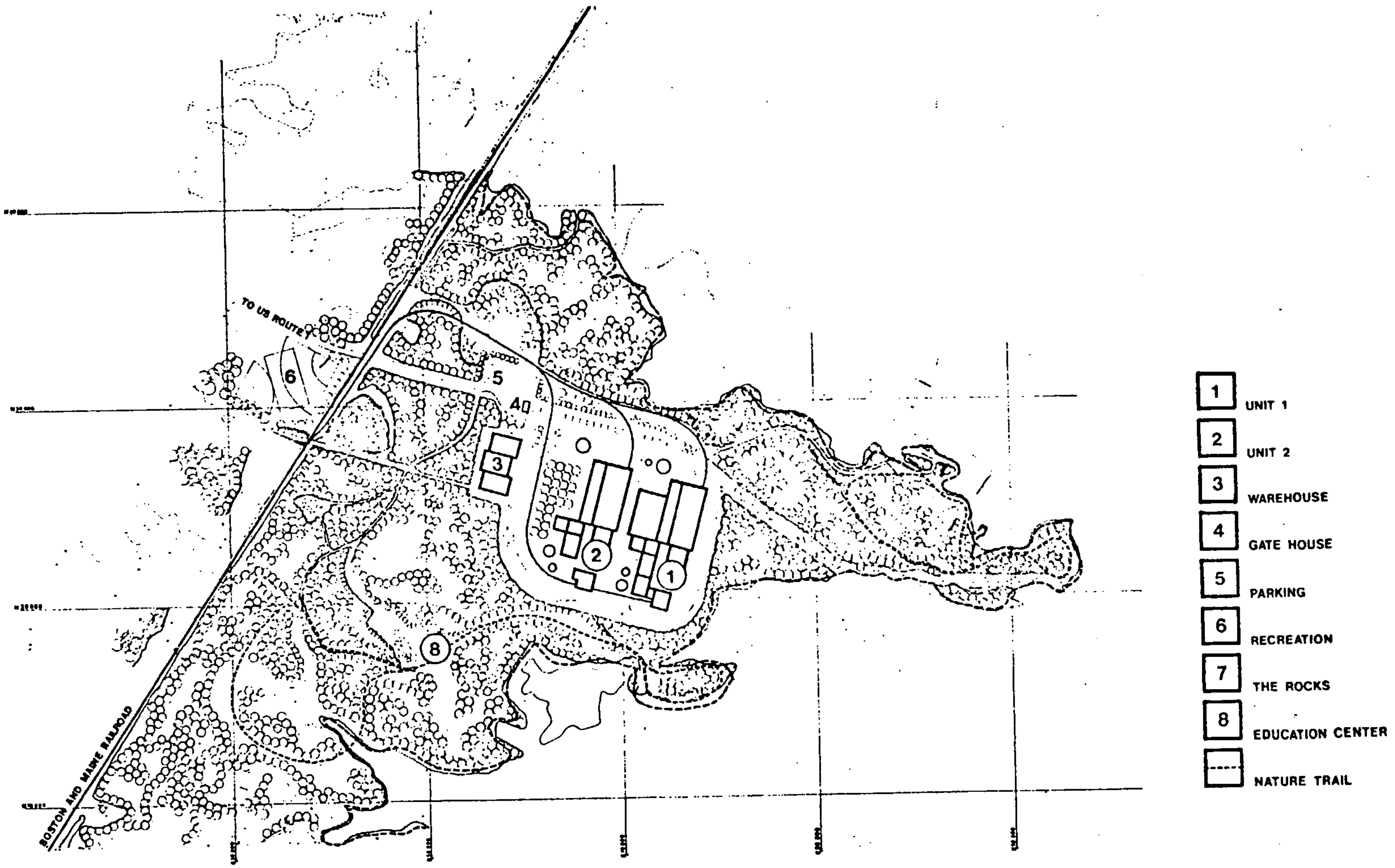
   b. Limited parking facilities are proposed at the terminal end of the Rocks Road, as intensive public use of the area is not recommended.

   c. A boat ramp is proposed to facilitate the launching of small boats, traditionally used by the residents of the surrounding area.

7. The Education Center

   a. As shown in the Proposed Site Plan (Figure 14), the approach road to the Education Center will branch off from the main access road just before the gate house.

   b. Parking area for the visitors to the Education Center is located immediately adjacent to the Center. It is not yet possible to estimate the parking requirements.



PROPOSED SITE PLAN Fig. 14

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

KLING/PLANNING

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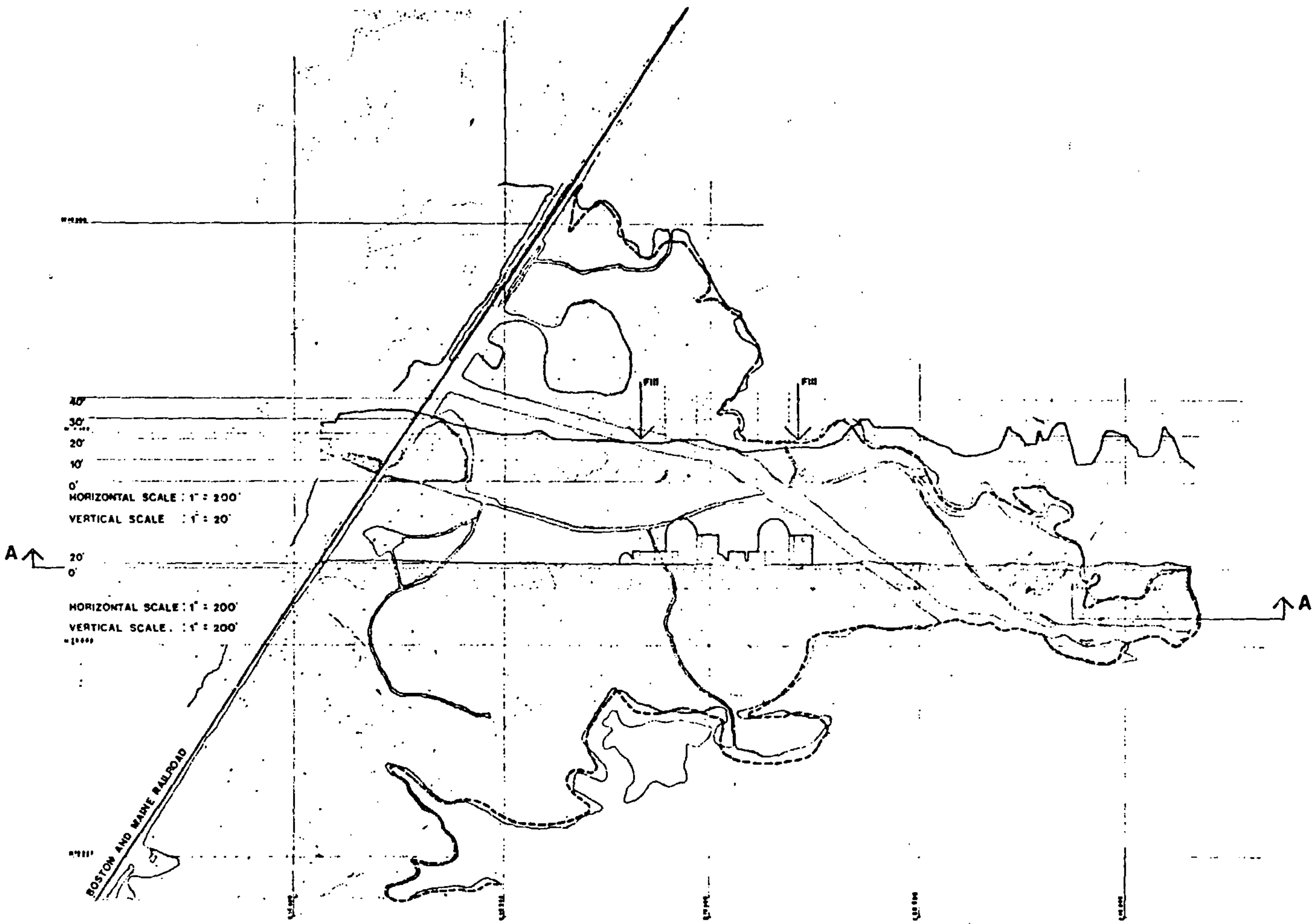


SITE SECTION Fig. 15

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

KLING/PLANNING

N

c. The Education Center is located in the heart of the most preserved area of the Seabrook Site. Easy accessibility from its location to the Hemlock ravine, the salt marsh and its border areas, and the oak-hickory forest could make the Center an eminently suitable place for nature study and passive recreation.

d. In considering the Education Center, it has been recognized that the development of a detailed design program is beyond the scope of this study. The Education Center as shown in the accompanying Site Plan is, therefore, meant to show only the general location of the proposed facility.

C. Proposed Land Allocation

Figure 16 shows the proposed allocation of land for 248.5 acres of the Seabrook Station Site, the subject of Kling/Planning study. Recommended land use categories, and their function, are outlined below.

1. Generating Station

The plant complex occupies a land area of 28 acres. Most of this area will be secured with a perimeter fence, and entry into it will be controlled through a gate house. It will not generally be accessible to the public.

2. Landscape Restoration

Land allocated for landscape restoration includes most of the area utilized during the construction process. After construction, a restoration program is recommended for this area. The program should involve grade restoration and reforestation. It also has potential for creating recreation facilities. Total land area allocation for this use is 30.5 acres.

3. Environmental Conservation

Land recommended for environmental conservation occupies an area of 65.2 acres. The principal function of this area is to protect the natural systems inherent to the site. It is important to minimize the impact of the construction process on the area. Activities should be limited to nature study areas, hiking trails, and environmental conservation study projects.

4. Recreation

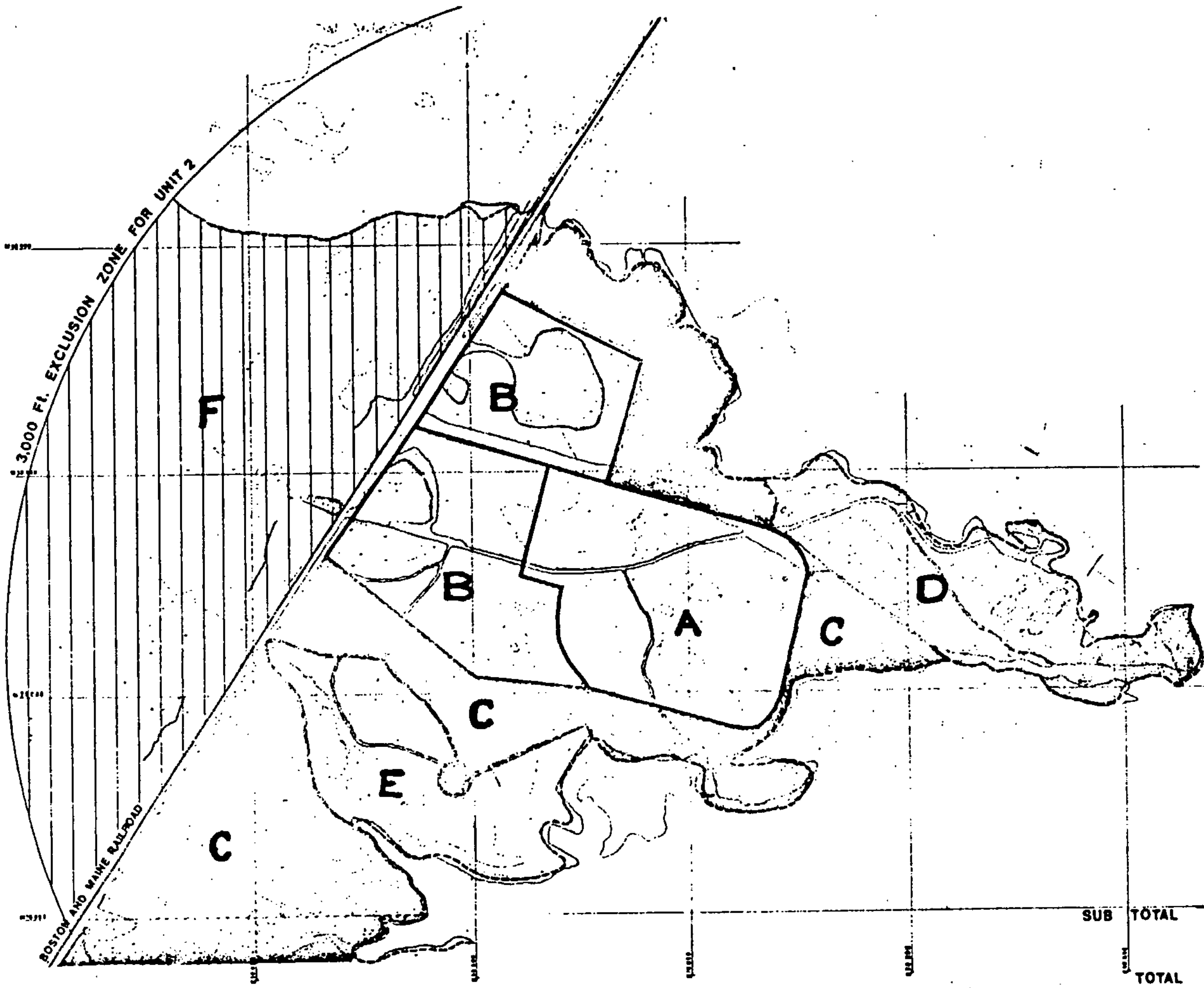
This area includes the promontory known as "The Rocks". Its main function is to provide traditionally used public access to the clam flats. It occupies 21.3 acres of land.

5. Environmental Education

Land allocated for educational activities has an area of 17.7 acres. This area includes the Hemlock ravine and the tidal pond. The proposed Education Center is located in this area. The area is subject to deterioration through overuse, and it is, therefore, important to control the level of activity in this area.

6. Recreational and Conservation

Occupying an area of 85.8 acres, land allocated for recreation and conservation is located on the west side of the B&M Railroad. Part of this area is recommended for active public recreation.



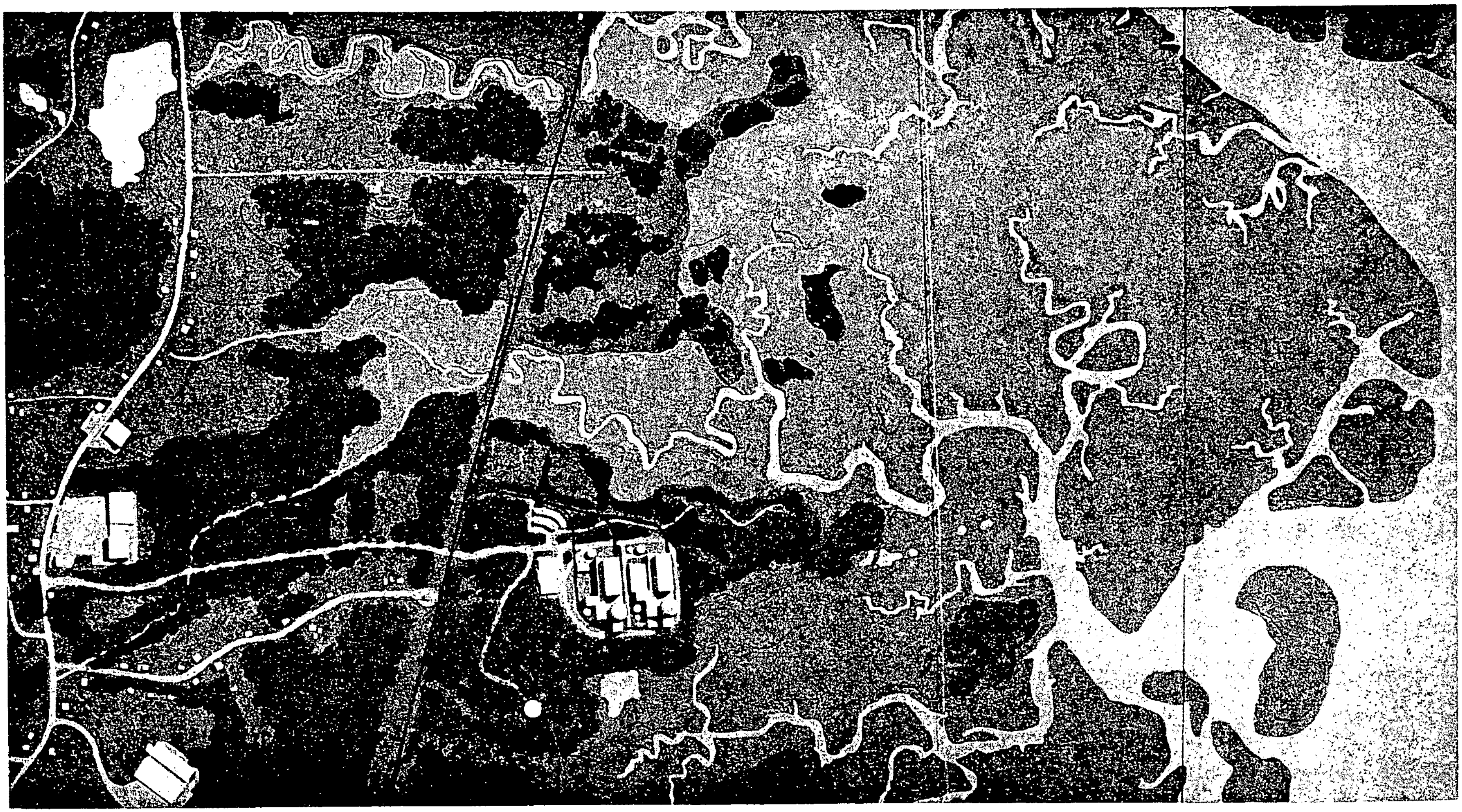
28.00 AC.	A	GENERATING STATION
30.50	B	LANDSCAPE RESTORATION
65.20	C	ENVIRONMENTAL CONSERVATION
21.30	D	RECREATION
17.70	E	ENVIRONMENTAL EDUCATION
SUB TOTAL 162.70		
85.80	F	RECREATION AND CONSERVATION
TOTAL 248.50 ACRES		

LAND USE PLAN Fig. 16

SEABROOK STATION

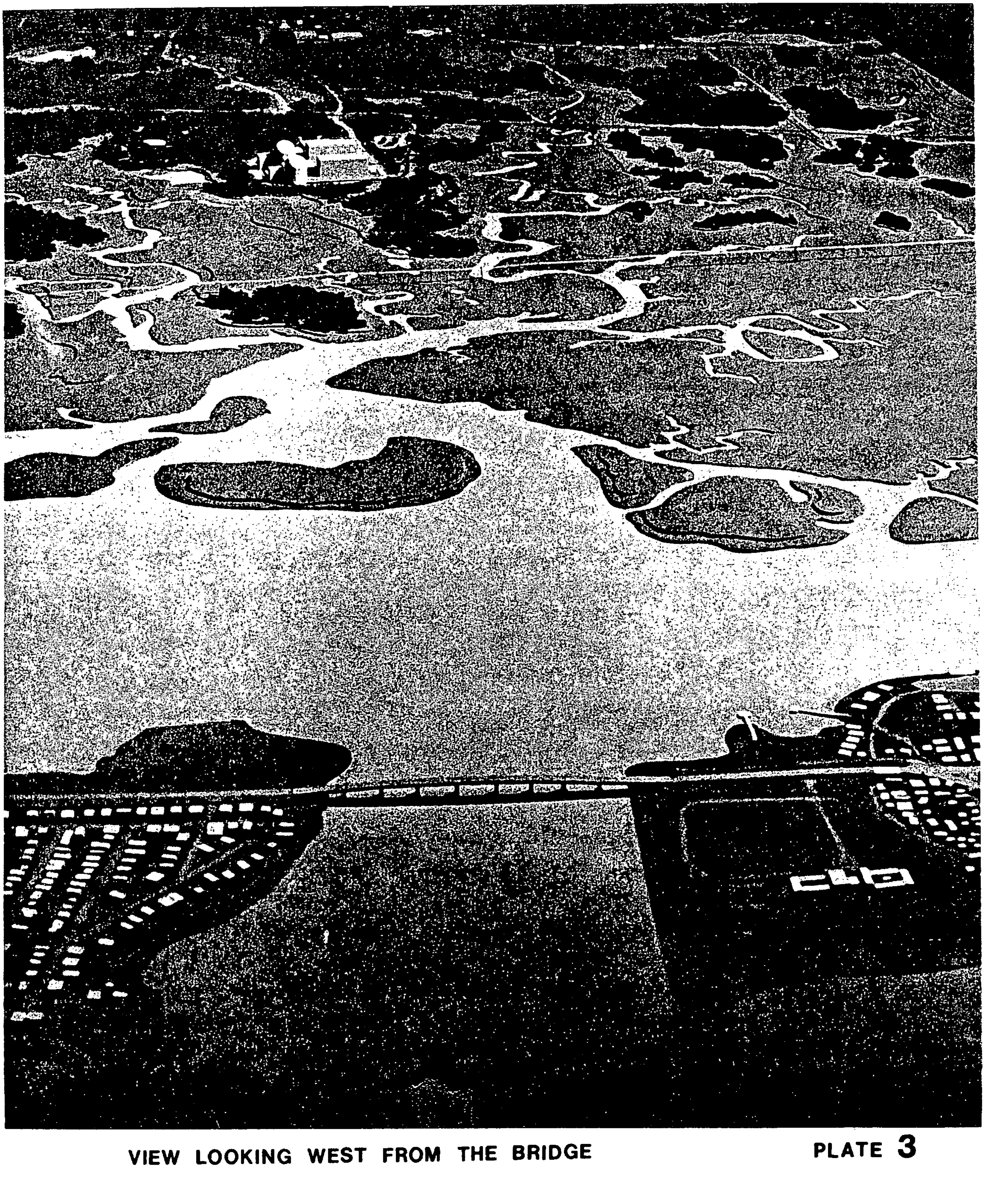
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

KLING/PLANNING

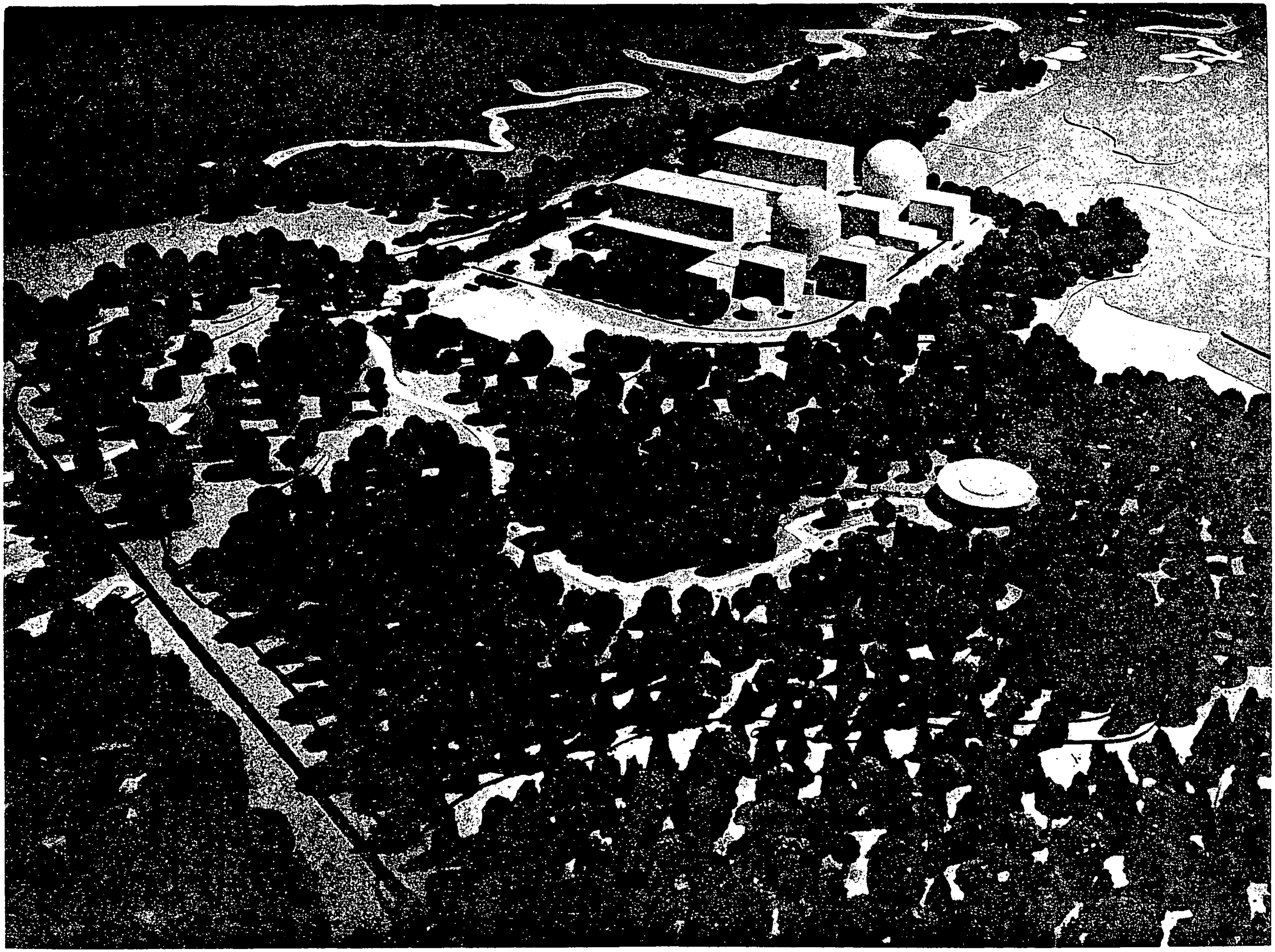


SITE : AERIAL VIEW — PROPOSED

PLATE 2

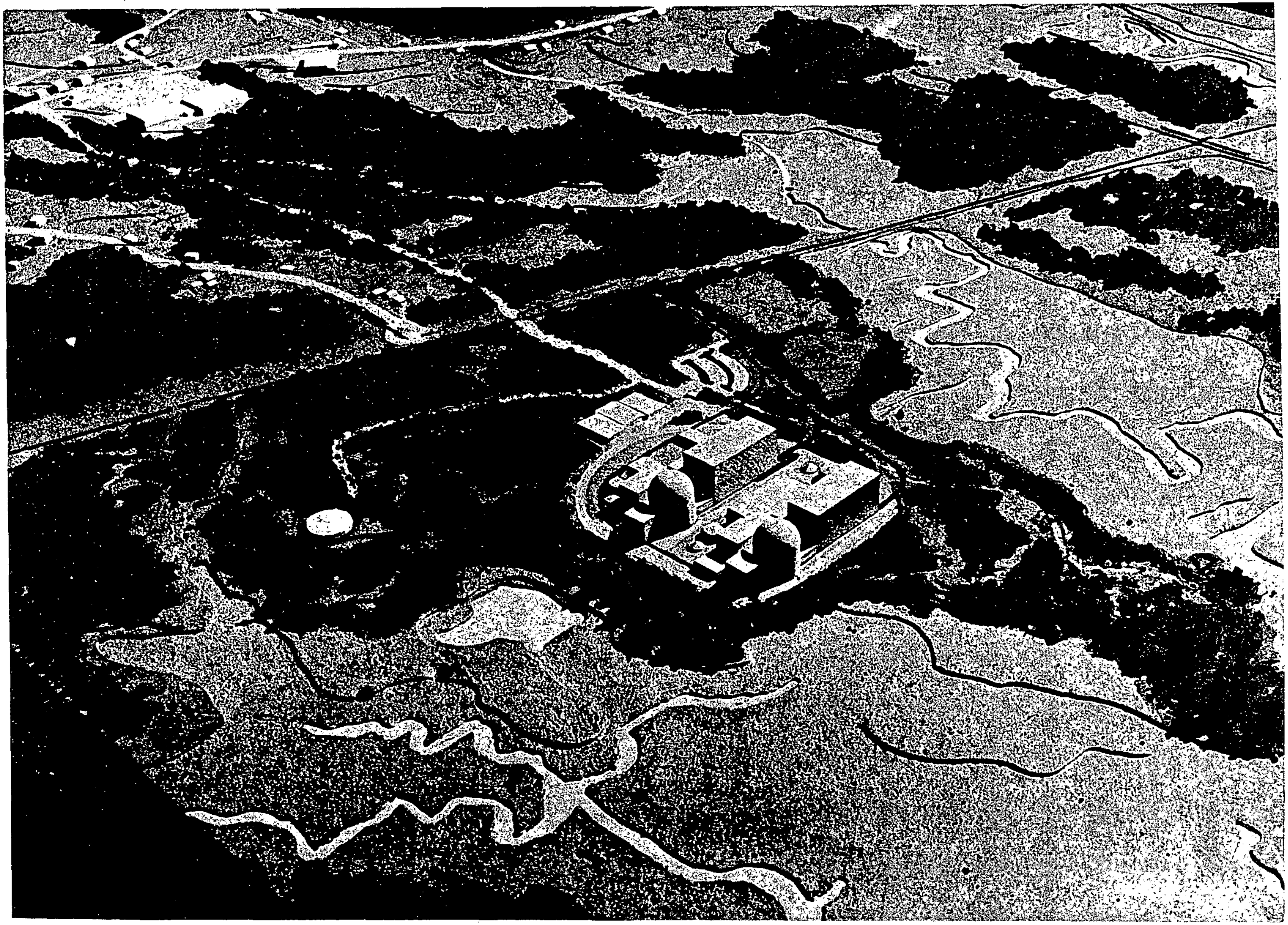


VIEW LOOKING WEST FROM THE BRIDGE PLATE 3



VIEW OF PLANT & EDUCATION CENTER LOOKING NORTHEAST

PLATE 4



VIEW OF SITE LOOKING NORTHWEST

PLATE 5

APPENDIX J

APPENDIX J

BUOYANT JET DISCHARGE MODEL

SEABROOK NUCLEAR STATION - UNIT # 1
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

REPORT

for

EBASCO SERVICES INCORPORATED

by

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August, 1969

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ABSTRACT

Hydraulic model studies of the buoyant jet discharge from the proposed Seabrook Nuclear Station, Unit #1, of the Public Service Company of New Hampshire are currently underway at the Alden Research Laboratories, Worcester Polytechnic Institute, Holden, Massachusetts. A model suitable for studying the buoyant jet discharge has been constructed and equipped with the necessary flow measuring equipment, a supply of heated water, and temperature sensing and recording instruments.

The model has been adjusted to accurately reproduce prototype operation and field conditions. This report presents the results of the model data collected for a horizontal discharge from a 9.5 foot pipe with 30 feet of submergence at normal flow rates of 600 and 980 cubic feet per second and a temperature rise of 47 F and 30 F respectively.

Data from the two reported tests were collected and analyzed to determine the dilution of the discharge jet with the ocean water considering both velocities and temperature rises, disturbances at the point of jet flow intersection with the water surface, "flow away" velocities and temperatures, and bottom scour along the centerline of the discharge jet.

Generally, less dilution of the jet resulted at the lower flow rate and velocity. However, the lower flow rate produced a smaller surface disturbance, the resulting "flow away" conditions affected a smaller area, and possible bottom scour effects were less.

INTRODUCTION

A model to study the buoyant jet discharge from the proposed Seabrook Nuclear Station, Unit #1, of the Public Service Company of New Hampshire has been constructed in an open air model basin at the Alden Research Laboratories.

The model studies were undertaken to determine the dilution pattern and effects of the circulating water discharge in the ocean. The studies were conducted for normal plant operating conditions.

A plan view drawing of the model showing layout, appurtenances and dimensions is included as Figure 1.

Design

To study a particular hydraulic condition with a physical model requires that the model conform to the laws of hydraulic similitude. If turbulent flow will exist under prototype conditions, turbulent flow must also exist in the model. In addition, it is generally true that gravity and inertia forces predominate and govern the characteristics of open channel flow.

To meet the first condition of hydraulic similitude the value of Reynold's Number (a measure of the amount of turbulence) must at least exceed 500. Reynold's Number, N_R, is expressed as:

$$N_R = \frac{V R}{\nu}$$

where: V = velocity in feet per second

R = hydraulic radius in feet

ν = kinematic viscosity in square feet per second

The second condition of hydraulic similitude requires that the ratio of inertia forces to gravity forces be the same for model and prototype.

The Froude Number as generally applied to "free surface" modeling is the square root of this ratio. The Froude Number, N_F, is expressed as:

$$N_F = \frac{V}{\sqrt{g\,D}}$$

where:

V = velocity in feet per second

g = gravitational acceleration in feet per second^2

D = depth of water in feet or head = H

For sufficiently high Reynold's Number model similitude for free surface flow requires that Froude numbers of model and prototype be equal. This requirement in combination with the chosen length ratio, L_R, determines the various parameter ratios. The length ratio is a prototype length, L_P, divided by the corresponding model length, L_M. The various relationships then become:

Physical Relationship	Ratio
Horizontal Distance	$L_P/L_M = L_R$
Vertical Distance	$H_P/H_M = H_R$
Area	$L_R\,H_R = A_R$
Velocity	$\sqrt{H_R} = V_R$
Discharge	$A_R\,V_R = Q_R$
Density	$\rho_R = 1$
Temperature	$T_R = 1$

Note:

Subscripts:

P denotes prototype
M denotes model
R denotes ratio

It should be noted that the modeling of density or specific weight in accordance with Froude Number equality requires that the ratio between model specific weight and prototype specific weight be unity. When specific weight differences are caused by temperature differences, this requirement will be fulfilled by modeling temperature on a one-to-one basis as well.

For the tests reported herein a 4 inch diameter pipe was used in the model to produce a buoyant jet as would be produced by a 9.5 foot diameter pipe in the prototype. Also, in order to study the velocity distribution ("flow away" velocities) in the area beyond the point of jet surfacing, a 2 inch discharge pipe was used in order to model a greater area within the existing model boundaries. Therefore, the following scale ratios were obtained:

Parameter	Scale Ratios	
	With 4 inch pipe	With 2 inch pipe
Length, L_R	1:28.3	1:55.2
Head (Depth), H_R	1:28.3	1:55.2
Area, A_R	1:802	1:3042
Velocity, V_R	1:5.32	1:7.43
Discharge, Q_R	1:4267	1:22590
Density, ρ_R	1:1	1:1
Temperature, F	1:1	1:1

Construction

The model, as shown in Figure 1, is constructed on a five inch reinforced concrete slab poured on grade. The model boundaries are four inch reinforced concrete walls two feet high which form a watertight concrete basin for the model. This basin is rectangular in cross section except for a built-up concrete mound at the jet discharge to simulate prototype conditions. See Photos 1 through 3.

Water is supplied to one side of the model from the laboratory water supply by a vertical propeller pump through a 12 inch pipeline. This flow is measured using an air-water differential manometer connected across a calibrated 12 inch by 8 inch venturi meter installed in the pipeline. Upon entering the model basin this flow is distributed by a baffle wall to provide a uniform flow across the model width. The flow is discharged from the basin through rectangular gates at the opposite side of the model into a channel leading back to the supply pump or to waste. In this manner, water may be recirculated through the model or discharged to waste as desired. See Photos 4 through 6.

Heated water for the jet discharge flow is provided by a remote LP gas-fired boiler and pumped to the model site through a 4" pipeline. The desired temperatures are attained by tempering the heated water flow with cooler water from the laboratory supply. The mixed flow is then measured using a second air-water differential manometer connected across a calibrated orifice plate. See Photo 6.

All pipelines have appropriate valves for controlling flow rates.

Background

The mechanics of a submerged jet has been the subject of rather extensive theoretical as well as experimental study throughout the last two decades. In this country experimental studies were carried out as early as 1929 (1)* while the first significant

* Numbers in parentheses refer to the bibliography on Page 9.

theoretical study, supported by experiments, dates back approximately 20 years [2]. Since then significant work has been done at California Institute of Technology, Iowa State University and other laboratories. Among significant contributions from abroad should be mentioned extensive theoretical and experimental studies at the laboratory in Delft, Holland [3] and at Chalmers University, Sweden [4].

While extensive studies of the jet mechanics have been carried out relatively little has been devoted to the surface spread ("flow away" velocities) of the water after the vertical momentum of the jet is lost. So called two-layer flow has been studied but generally with purposes other than the one of main interest in this connection, namely, the further dilution of the water when it reaches the water surface.

Sub-surface jets are generally divided into three groups: Non-buoyant jets, buoyant jets and intermediate jets although the borderlines between the three types are not well defined. The horizontally issuing, non-buoyant jet will remain horizontal and the entrainment is dependent exclusively on the initial momentum and the cross sectional shape at the point of discharge. The buoyant jet has little initial momentum and will rise to the surface due to buoyant force. The entrainment is dependent on the submergence, i.e. the vertical height from the point of issue to the water surface, and the density difference between the jet water and the ambient water. The mixing mechanics of such a flow is less efficient than that of a momentum jet. The characteristics of the jet studied here places it in the group of intermediate jets. Both momentum and buoyancy are important factors in determining the entrainment and the jet trajectory.

The parameters used to describe the jet behaviour are the dimensionless densimetric Froude number and the depth of submergence. The densimetric Froude number (a variation of the Froude number cited previously) is for a round jet defined as:

$$F_D = \frac{V_o}{\sqrt{g' D_o}}$$

V_o = velocity at the point of discharge

g' = apparent acceleration of gravity

D_o = diameter of the jet at the point of discharge

The apparent acceleration of gravity is dependent on the density difference between the ambient water density and the density of the jet water:

$$g' = \frac{\rho_i - \rho_A}{\rho_i} (g) = \frac{\gamma_i - \gamma_A}{\gamma_i} (g)$$

ρ_A and γ_A are density and specific weight respectively of ambient water.

ρ_i and γ_i are density and specific weight respectively of jet water.

g is acceleration due to gravity.

It is seen that for ambient water and jet water of the same density $g' = 0$, the horizontal jet remains horizontal and for $\rho_A = 0$, thus $g' = g$ which essentially is a water jet issuing into air.

The relative submergence is expressed in a dimensionless form as y / D_o where y is the depth from the water surface to the centerline of the jet at the point of discharge. Similarly a dimensionless distance along the initial direction of the jet is expressed as X / D_o.

Figure 2, based on a theoretical solution given in (4), shows the jet center line dilutions S_m as functions of the above described parameters F_D and y / D_o. Subscript m stands for minimum since the dilution along the jet center line is less than anywhere else in a plane perpendicular to the center line.

$$S_m = \frac{C_o}{C} = \text{dilution along jet centerline}$$

where: C_o = concentration of a tracer in the issuing jet

C = concentration at the sampling point

It should also be noted that the letter "S" is used in this report to indicate dilution at any point in the model. The expression for "S" is similar to the expression above

$$S = \frac{C_o}{C}$$

BIBLIOGRAPHY

(1) A. M. Rawn and H. K. Palmer:

Pre-Determining the Extent of a Sewage Field in Sea Water.
ASCE TRANSACTIONS - Paper No. 1750 (1930)

(2) M. L. Albertson et al.

Diffusion of Submerged jets
ASCE TRANSACTIONS 115 (1950)

(3) G. Abraham:

Jet Diffusion in Stagnant Ambient Fluid
Delft Hydraulics Laboratory
Publication No. 29 (1963)

(4) K. Cederwall:

Hydraulics of Marine Waste Water Disposal
Chalmers Institute of Technology, Sweden
Report No. 42 (1968)

TEST PROGRAM

Instrumentation

In addition to calibrated Venturi meters and orifice plates to measure flow in closed conduits the model study necessitated measurement of temperatures and open channel velocities of the water. Temperatures were recorded using thermocouples of premium grade polyvinyl chloride insulated wire connected to two multi-point 24 channel potentiometric recorders. Thermocouple probes were attached to moveable traverse rods as shown on Photo 8. Each probe could be adjusted vertically to record temperatures at various depths. The moveable traverse rods allowed temperatures to be recorded at various positions in the model on a predetermined grid. Two thermocouple recorders were available with twenty four thermocouples connected to each allowing forty-eight temperatures to be recorded in thirty-six seconds. See Photo 7. In addition, 23 thermistor probes connected to a thermistor-thermometer was available for additional measurements as needed. Standard laboratory glass mercury thermometers were also used for checking absolute temperatures and measuring ambient air conditions.

Velocity measurements in the model were made in a variety of ways. Velocities in the jet stream were measured using miniature calibrated current meters. Cross flow velocities were measured using model drogue-floats and a stop-clock timer. "Flow away" velocities were measured by inserting dye into the surface layer and timing its rate of movement.

Procedures

Each test commenced by filling the model to the desired depth as determined by the test conditions and establishing the proper cross flow to simulate ocean currents and maintain an equilibrium temperature condition in the model.

After allowing sufficient time for steady state conditions to develop the jet flow was introduced using heated water pumped from the remotely located boiler. The desired flow rate in the jet was set by a control valve and measured using an air-water differential manometer connected across a calibrated orifice plate. The desired temperature was established by mixing cold water from the laboratory supply with the heated water from the boiler. Both glass mercury thermometers and the recorders were used to check ambient and jet temperatures.

A three-dimensional grid system was established to locate the points where measurements were to be taken in both vertical and horizontal directions. To properly measure and define the issuing jet a close spacing of the measuring points were necessary. As the distance from the jet increased and, consequently, temperature and velocity gradients flattened, measuring points could be more widely spaced. Therefore, with an established three-dimensional grid, measurements were taken at every grid line intersection in the area close to the jet flow and at every other, every third, or every fourth intersection as the distance from the jet increased. The optimum grid dimensions and location of measuring points on the grid was determined during the preliminary model tests. See Figure 1.

Preliminary model tests were necessary to check the operation of the model and to insure the model flows and water levels could be properly controlled and measured. In addition, several tests were conducted with various configurations to check instrumentation and to establish measurement and recording procedures. The data obtained during these tests was processed to determine the adequacy of procedures, and these procedures were modified as necessary until satisfactory results were obtained. The model was then ready for use with a given set of test conditions.

Ambient temperatures for each test were measured during start-up and monitored during the test period using thermocouple probes located at the cross-flow distributor and at the jet pipe just behind the point of discharge.

After a suitable interval, to allow equilibrium conditions to develop between the jet discharge and the receiving body of water, temperature and velocity measurements were made. Velocities were measured and recorded at transverse and longitudinal points of the predetermined grid at various water depths. Sufficient points were recorded to define the jet size and shape.

Temperature measurements were made in a similar fashion to velocity measurements using the measuring grid system except that forty-eight points were recorded at one time. The temperature probes were set at the desired elevation and the traverse rods at the corresponding location. The recorders were turned on and allowed to record for several cycles to assure repeatability of measurements. The probes and rods were then moved to the next location and the process repeated.

To study "flow away" velocities the model was modified by replacing the 4 inch jet discharge pipe with a 2 inch pipe. The model scale ratio then became 1:55.2. The gates for maintaining the proper water level were adjusted accordingly.

As indicated above results from model calibration tests, in part determine conditions and some procedures for further testing. As the test program continues the testing procedures become more rigid but to a degree reflected the background information and experience previously obtained and evaluated. Essentially, the early tests of a given test program provide a foundation on which to build and a direction for later tests. The ultimate goal is, of course, to obtain the optimum solution to the problem under study without unnecessary testing.

The tests reported herein represent results after a good foundation of information and experience on the particular problem under study had been established.

Test Conditions

The following table gives the conditions for tests reported herein. The notations are as follows: Jet discharge rate Q, differential of jet above ambient water temperature ΔT_o, diameter D_o, initial jet velocity V_o, depth to centerline of pipe Y_o, model linear scale ratio L_R.

Unless otherwise indicated, all data and results are in terms of prototype dimensions.

Test No.	L_R	D_o, ft.	Y_o, ft.	Q, cfs	ΔT_o, F.	V_o, fps
006	28.3	9.5	34.8	980	30	14.0
007	28.3	9.5	34.8	600	47	8.5
008	55.2	9.5	34.8	980	30	14.0
009	55.2	9.5	34.8	600	47	8.5

In order to obtain velocity information farther from the point of discharge than is possible in Tests #006 and #007, Tests #008 and #009 were conducted with the model adjusted from a scale ratio of 1:28.3 to a scale ratio of 1:55.2.

TEST RESULTS

Summary Table of Results

Test No.	006	007	008	009
Pipe Diameter, ft.	9.5	9.5	9.5	9.5
Discharge, cfs	980	600	980	600
Velocity, ft/sec	14	8.5	14	8.5
ΔT - Point of Discharge	30F	47F	30F	47F
Max. ΔT - Point of Surfacing	6F	13F	-	-
Location of Point of Surfacing, ft.	200	125	-	-
Horizontal Distance Traveled Along Bottom, ft.	150	75	-	-
Distance (ft) from Point of Discharge to Flow Away Velocity = 1 ft/sec	-	-	1000+	400+

Test #006 (1:28.3 Scale Ratio)

Results of Test #006 are presented in Figures 3 through 8. This test was conducted with a temperature rise (ΔT) of 30 F. With a pipe diameter of 9.5 feet and a flow rate of 980 cfs the densimetric Froude number was 11.0. The depth of water was 34.7 feet measured from the pipe center line which yields a relative submergence of 3.7. The exit velocity was 14 fps.

Figure 3 shows the measured surface isotherms, in terms of temperature differentials, based on ambient water temperature. The figure indicates that the location where the jet trajectory intersects the water surface occurred approximately 200 feet from the point of discharge. Under these conditions the temperatures in this area are the maximum surface temperatures and produced a temperature rise of 6 F. The dilution based on these results is $S_m = 5.0$ which is in reasonable agreement with $S_m = 4.0$ as obtained from Figure 2, using the above values of densimetric Froude number and relative submergence.

Figure 3 shows that the area of elevated surface temperature stretched down stream in the jet direction and that little heating of the surface takes place in the upstream direction. This indicates that the velocity distribution was governed mainly by the momentum of the jet. This is borne out by Figure 7 which does not show the measured surface velocities traveling upstream. Thus all the heated surface water is flowing away from the point of discharge in the direction of the pipe centerline and the tendency to form a surface counterflow is reduced by the effect of the initial momentum and by the entrainment flow.

Both Figures 3 and 7 show a lateral displacement of the jet. This was caused by the lateral flow introduced as an entrainment flow to simulate ocean drift and to maintain a temperature equilibrium in the model. The effect on the jet trajectory of this low velocity flow indicates that the resulting direction of the "flow away" water is sensitive to wind and along shore currents in the surrounding ocean. At some distance from the point of discharge the ocean currents would dominate, namely at the distance where the initial momentum is essentially lost.

Figure 4 shows the measured temperature distribution in a horizontal plane 17 feet below the water surface. The lateral dimensions of the jet at this elevation were small compared with the dimensions of the probe spacing. This was most likely the reason why the maximum temperature was the same as at the surface. A somewhat higher temperature at the center of the jet might have been expected.

Figure 5 shows the temperature distribution in a horizontal plane at the pipe center line. It is seen that the maximum temperature was reduced by 50% from 30 F to 15 F at approximately 100 feet from the point of discharge.

Figure 6 shows the temperature distribution in a vertical plane along the jet trajectory. The plot gives an idea of the vertical position of jet center line. For about 3/4 of the distance to the point where the jet intersects the surface the momentum is predominant and the jet remains close to the bottom. The buoyancy forces the jet water towards the surface over the remaining distance to the point of surfacing. During the passage through the essentially horizontal position of the trajectory the temperature decreases from ΔT_o = 30 F to about ΔT = 9 F while only 3 F is lost during the remaining travel to the surface. This indicates that the mixing and dilution associated with the momentum is more efficient than that due to the buoyancy.

Figure 8 shows the measured velocities in a vertical plane along the jet trajectory.

The velocity distribution is in good agreement with the temperature distribution shown in Figure 6. Velocities of about 10 fps persist to a distance of about 100 feet from the point of discharge.

Test #007 (1:28.3 Scale Ratio)

Figures 9 through 14 show the results of Test #007. The test was conducted with a temperature rise of 47 F. The pipe diameter was maintained at 9.5 feet but the discharge flow rate was reduced to 600 cfs. With these dimensions the densimetric Froude number and relative submergence values are 4.9 and 3.7 respectively.

Figure 9 shows the measured surface isotherms. It is noted that the location where the jet trajectory intersects the water surface was much closer to the point of discharge than with the previously reported test. There were two factors contributing to this, namely, lower exit velocity and, therefore, reduced initial momentum, and increased buoyancy due to the higher temperature differential. The lower jet energy and subsequent lower rate of entrainment resulted in reduced dilution. The minimum surface dilution based on the measured maximum temperature rise of 13 F was $S_m = 3.6$ as compared to $S_m = 5.0$ for Test #006.

As with Test #006 the discharge was essentially in the jet downstream direction with little tendency to form a surface counter flow which is substantiated in the measured velocity distribution shown in Figures 13 and 14. In comparison with Test #006, Figure 7, the reduction of velocities with distance from the point of discharge was considerably stronger in the test with less momentum. Thus at a distance of 400 feet from the point of discharge the "flow away" velocities were only 0.5 fps while 1.0 fps was measured at the same distance in Test #006.

Figure 10 shows the temperature distribution at a depth corresponding to 17 feet and Figure 11 shows the temperature distribution at the elevation of the pipe center line.

Figure 12 shows the temperature distribution in a vertical plane along the jet trajectory. The relatively rapid rise of the jet center line from the bottom is apparent. In comparison with Figure 6 of Test #006 it is noted that the temperature effect along the bottom is less dominant with the slower, more buoyant jet. At a distance of 100 feet from the point of discharge the bottom temperature rise was only 5 F with the 47 F release while the 30 F release produced a bottom temperature rise of approximately 10 F at the same distance. The tendency of the warmer release to rise towards the surface is apparent from Figure 12. The thickness of the temperature affected layer was approximately 20 feet at 200 feet from the point of discharge in Test #007. At the same distance in Test #006 the entire depth was affected. The model studies show that as the distance from the point at which the jet surfaces increases the thickness of the affected surface layer decreases.

Figure 14 gives the measured velocity distribution in a vertical plane along the jet trajectory and indicates the effect of the relatively high buoyancy. In Test #007 the tendency of the jet to travel along the bottom was less than in Test #006 as indicated by a comparison of Figures 8 and 14.

Test #008 (1:55.2 Scale Ratio)

The test conditions of Test #006 and Test #007 were repeated at a model scale of 1:55.2 as Test #008 and Test #009 respectively.

Figure 15 gives the measured velocity distribution in terms of isobars of velocity and arrows indicating the approximate directions for the surface layer. The effect of the initial jet momentum is apparent at a distance of more than 1000 feet. In addition the density spread yielding velocities in the transverse direction may also be seen. Obviously the velocity distribution was sensitive to lateral currents in the ambient water.

Test #009 (1:55.2 Scale Ratio)

Figure 16 gives the surface velocity field. In comparison with Figure 15 it is noted that the momentum effect is considerably less and velocities are, in general, lower. For the conditions of Test #009 an ocean current would have more effect than for Test #008.

Surface Action in the Area of Jet Surfacing

The buoyancy acting on the plume forces it to the surface at a distance which is dependent on the initial momentum and the density difference between the jet water and the receiving water. Therefore, the exact location of the point of jet surfacing will vary depending on the design temperature rise the discharge velocities and the temperature of the inlet and receiving waters.

The flow conditions within the area of the surface action are dependent both on initial momentum and the buoyancy. The jet exhibits a random behavior shedding large volumes of water which appear bounded and rise to the surface where the water spreads laterally. This phenomenon appears within the general area of the surface action, shifting from one point to another causing instantaneous changes in water level.

Three different approaches were used to get a picture of the activity in the area. A miniature current meter was used to measure velocity variations in different areas. A water level transducer was used with a chart recorder to obtain water level fluctuations and two simple wooden scale models of 12 foot row boats were observed in the area of surface action.

980 cfs jet flow, ΔT_o = 30 F, V_o = 14 fps.

The area of the surface action was approximately 50 - 80 feet wide by 140 - 160 feet long. Within most of this area horizontal velocities fluctuated rapidly between 0 and as high as 6.5 fps.

Water level fluctuations were recorded with amplitudes of approximately 0.75' while differences between high and low water levels, not immediately succeeding each other were in the order of one foot. Figure 17 gives examples of recorder output. Records taken with no jet flow indicated fluctuations of the order of 0.25 feet.

The observation of boat models indicated that a small boat could be subjected to definite lateral movements when in the area of surface action caused by the jet. It was observed that the boats were not overturned.

600 cfs jet flow, ΔT_o = 47 F, V_o = 8.5 fps.

The area of surface action was considerably smaller than with the 980 cfs flow having a width of approximately 50 feet and a length of 60 - 70 feet. The general activity of the flow within this area was not much different from that observed with the 980 cfs. The velocities fluctuated between zero and 5.5 fps.

The measured water level fluctuations were approximately the same as for the 980 cfs flow. Figure 18 gives an example of records taken with the 600 cfs flow.

Observation of model boats indicated that in terms of the intensity of the surface action the two test results are quite similar, the main difference being the size of the active area.

For both tests it should be noted that the location of the area of surface action will change with varying density difference between cooling water discharge and ambient water.

Velocities along the Bottom

The velocity distribution along the ocean bottom is dependent on the initial velocity from the discharge conduit, the buoyancy of the discharge water and ocean currents. The higher the buoyancy the sooner will the jet center line rise from the bottom with reduced bottom velocities as a consequence. Therefore, the condition with no heating of the cooling water will produce more severe problems from the point of view of scour.

In order to evaluate the tendency of scour, velocity measurements were carried out at 5 stations along the center line of the jet. Measurements were performed with both the 980 cfs flow yielding an initial velocity of 14 fps and the 600 cfs flow with an initial velocity of 8.5 fps. In both cases a non-heated jet flow was used in order to obtain bottom velocities on the conservative side (i.e. high side). No cross flow was applied in order to ensure that the jet would proceed along the center line of the pipe.

Figure 19 shows the measured bottom velocities with the 980 cfs jet flow. At 85 feet from the conduit exit the velocity was still 10 fps. but reduced to 6 fps at 140 feet. At 200 feet the center line velocity was 4 fps and at 260 feet less than 2 fps.

Figure 20 shows the velocities with a 600 cfs jet flow. The maximum velocity was 6 fps at 85 feet from the point of discharge with a reduction to about 3.5 fps at 140 feet. At 200 feet was found 2.5 fps and at 260 feet less than 2 fps.

CONCLUSIONS

The two sets of test conditions for the tests reported constituted extremes in terms of buoyancy effects due to the rather high ambient temperatures of the receiving water. Lower ambient temperatures, which would be more characteristic of the prototype, result in less density difference between discharge water and receiving water, decreasing the density difference results in increasing the densimetric Froude number. From Figure 2 it is apparent that as the densimetric Froude number increases with a constant Y/D in the range of values typical of the prototype, the rate of dilution will also increase. Therefore it should be concluded that the dilution rates obtained in the model are on the conservative side and that even higher dilutions could be expected in the prototype.

The two tests exhibited somewhat different results in terms of the cooling water behavior.

Tests #006 and #008 representing the proposed operation conditions of the power plant with 980 cfs flow yielded a dilution of $S_m = 5.0$ at the center line of the jet, approximately 200 feet from the point of discharge where it reached the surface. As the cooling water continued to mix with the surface water the dilution increased; at a distance of 550 feet from the discharge point the dilution had increased to $S = 10.0$.

The temperature pattern within the jet trajectory indicated that the jet stayed close to the ocean bottom for approximately 150 feet. At the point of surfacing the jet exhibited a uniform temperature from the surface to near the ocean bottom. The effect changed substantially 40 feet from the point of surfacing where the jet affects only about the top 15 feet of water.

The velocity measurements along the ocean bottom indicated substantial velocities (4 fps or greater) to approximately 190 feet from the discharge point or where the jet began to surface rapidly. From the surface velocity measurements, velocities of 1 fps were recorded at 1000 feet from the discharge point. This would indicate that the momentum of the jet will carry it at least 1000 feet before the ambient currents of the ocean will dominate the jet flow.

Tests #007 and #009 simulating the proposed operation of the power plant with 600 cfs flow yielded dilutions of Sm = 3.6 at the point of surfacing, 125 feet from the point of discharge, and S = 11.8 at 400 feet from the point of discharge.

The temperature pattern within the jet showed that unlike Test #006 the jet turned towards the surface much closer to the point of discharge. At 75 feet from the discharge point the trajectory of the jet was upwards rather than along the bottom. At its surfacing location the jet exhibited a stratified temperature distribution from the surface to near the ocean bottom. At 250 feet from the point of discharge the jet affected less than the top 10 feet of water.

The velocity pattern of the jet indicated that at 100 feet from the point of discharge the bottom velocity was less than 1 fps. The surface velocities indicated that at 750 feet the velocity on the surface had decreased to 0.5 fps.

Based on the results of tests #006, #007, #008 and #009 it can be concluded that in either normal operating condition, the temperature rise over the ambient temperature of the ocean will be 3 F or less. 550 feet from the point of discharge. This temperature differential will only be in the top 15 feet and will decrease as the distance from the point of discharge increases. The momentum inherent in the jet will carry at least 1000 feet for the 980 cfs flow, and between 800 and 1000 feet for the 600 cfs flow before the ocean current will dominate.

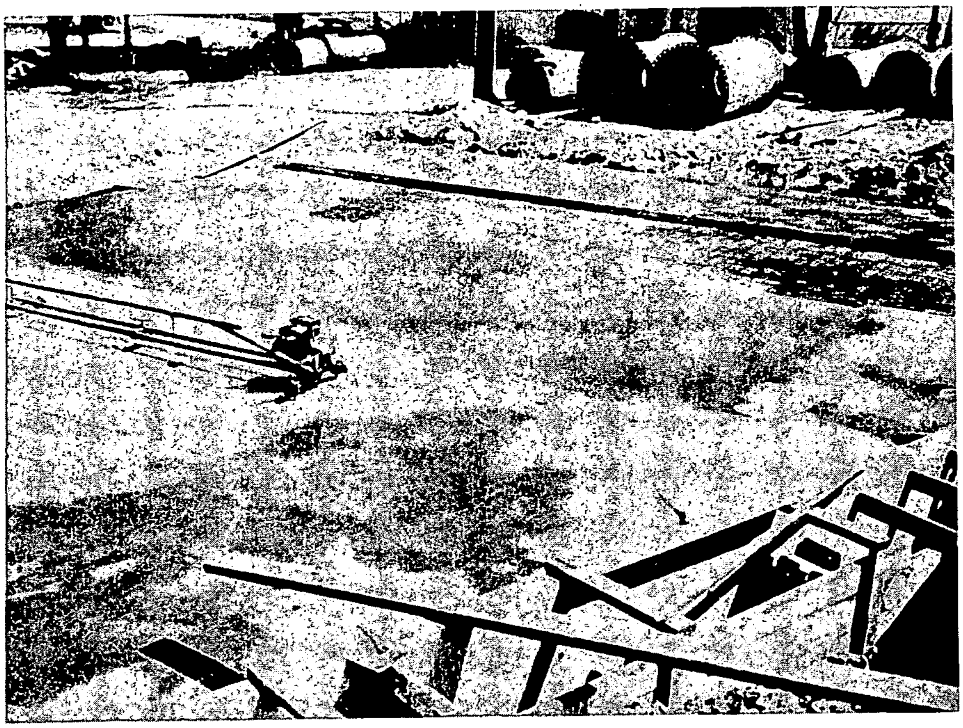


PHOTO 1 MODEL REINFORCED CONCRETE SLAB ON GRADE

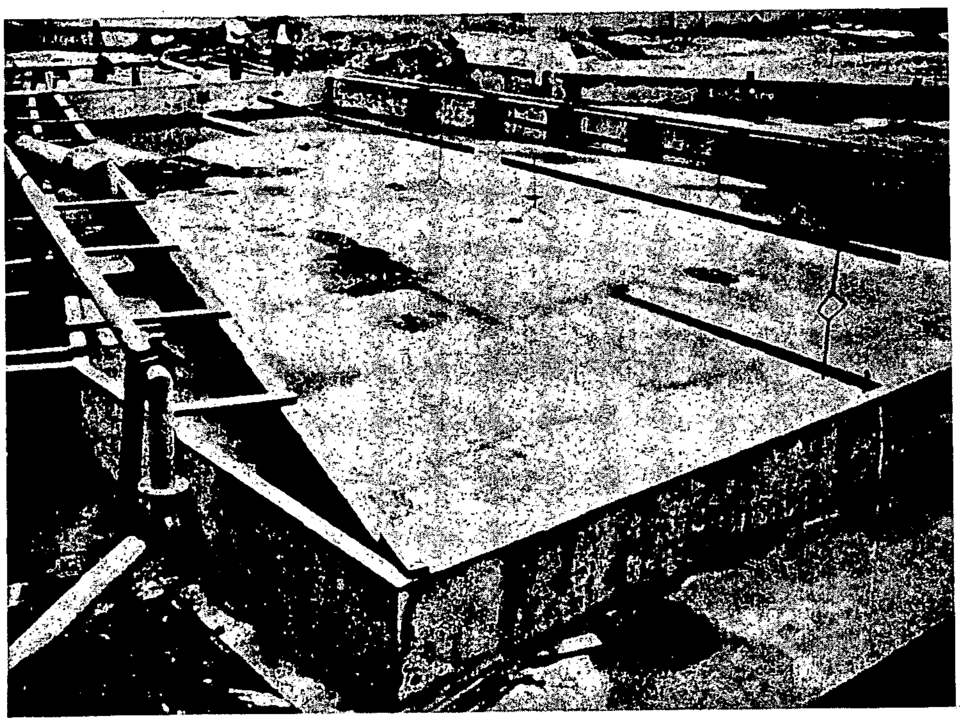


PHOTO 2 COMPLETED MODEL

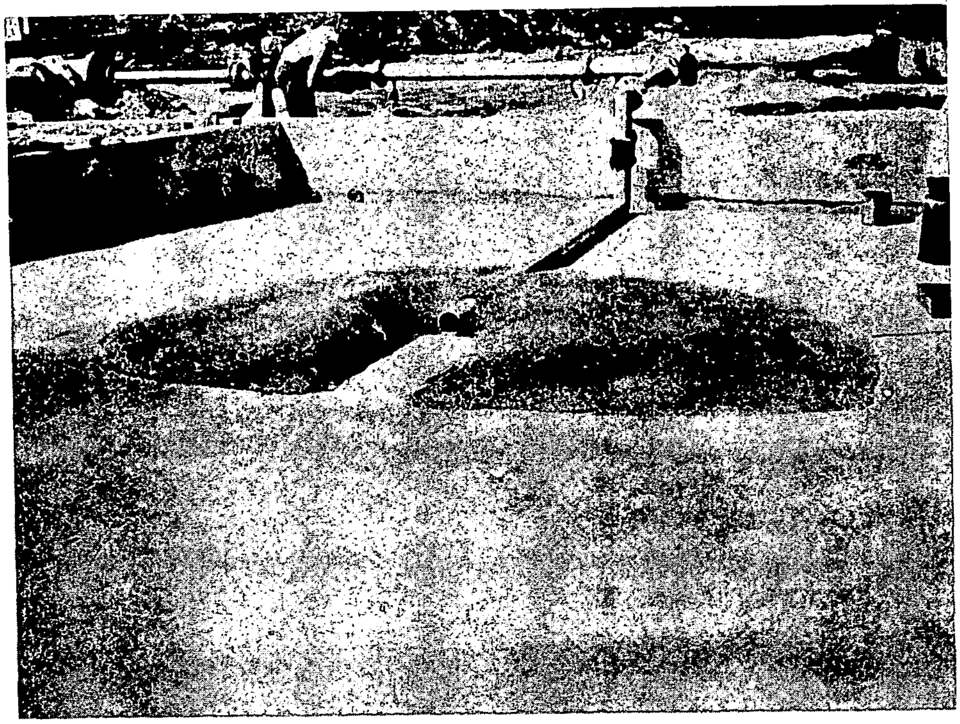


PHOTO 3 JET PIPE DISCHARGE CONSTRUCTION

PHOTO 4 MODEL WATER SUPPLY DISTRIBUTOR

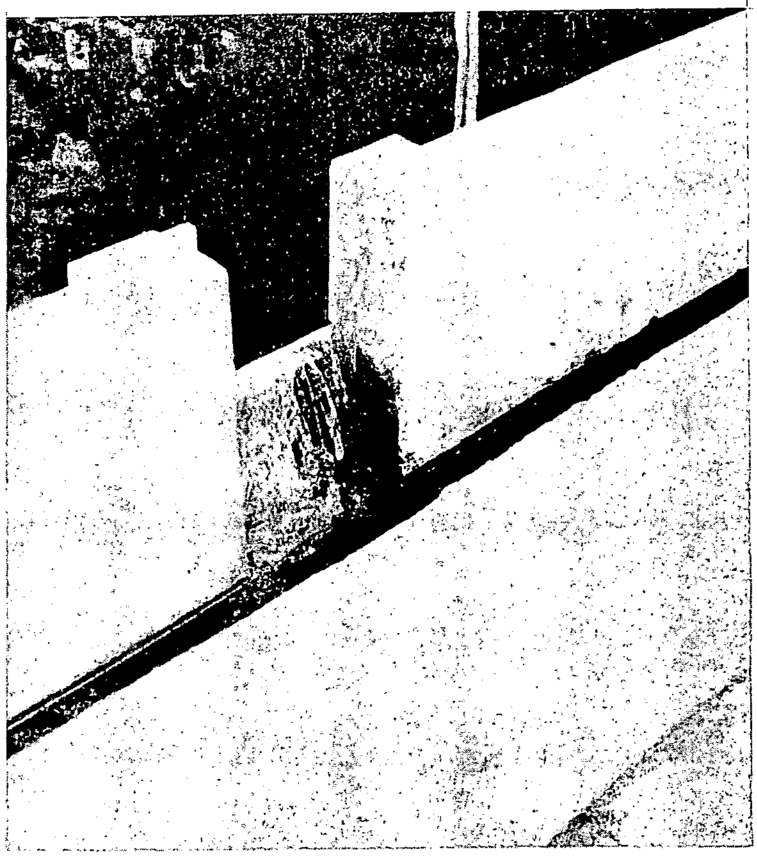


PHOTO 5 MODEL DISCHARGE GATE

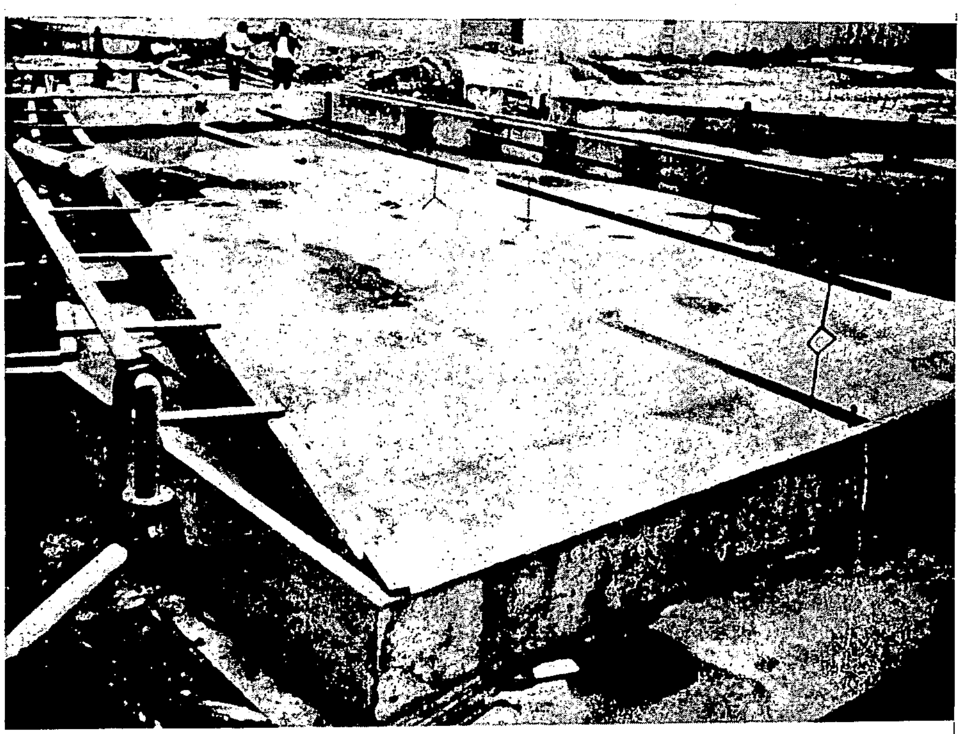


PHOTO 6 MODEL DISCHARGE GATES (ON RIGHT)
HEATED WATER LINE FROM BOILER
TO JET DISCHARGE (ON LEFT)

PHOTO 7 MULTIPOINT 24 CHANNEL POTENTIONMETRIC THERMOCOUPLE RECORDERS

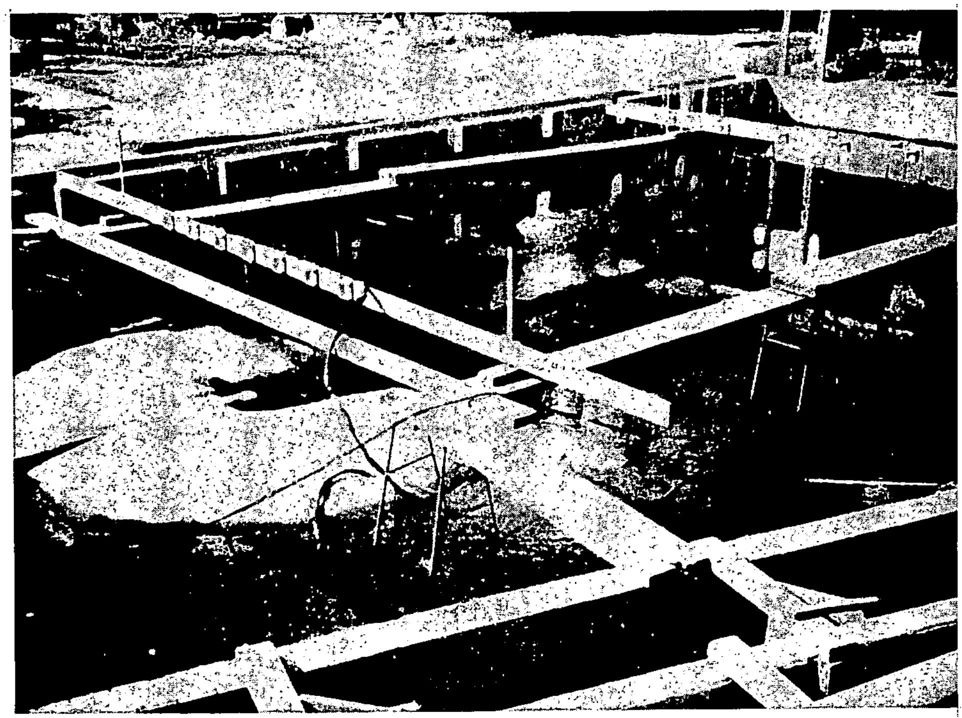


PHOTO 8 TEMPERATURE PROBES ON MOVEABLE TRAVERSE RODS

SEABROOK MODEL STUDY

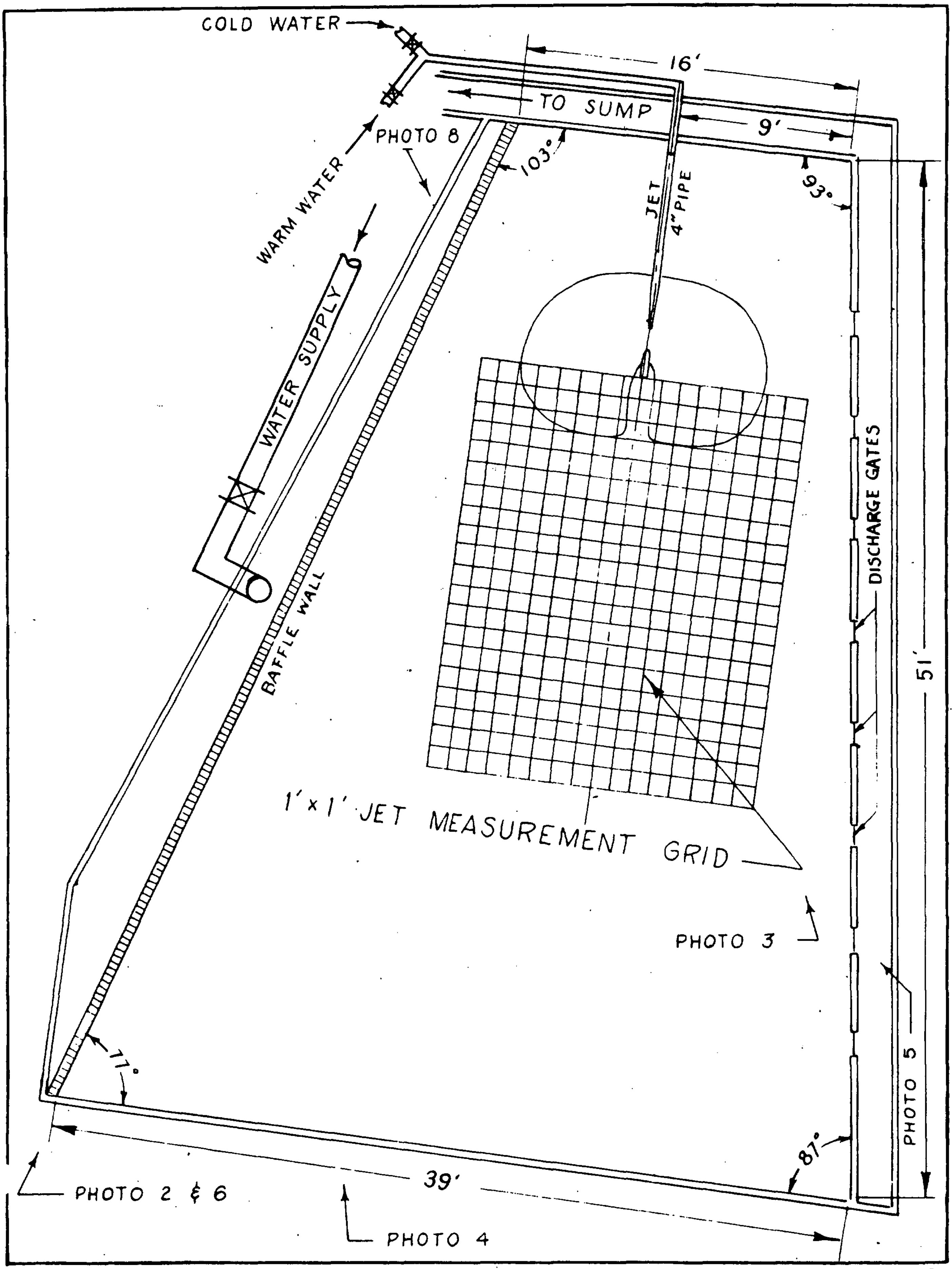


FIGURE 1

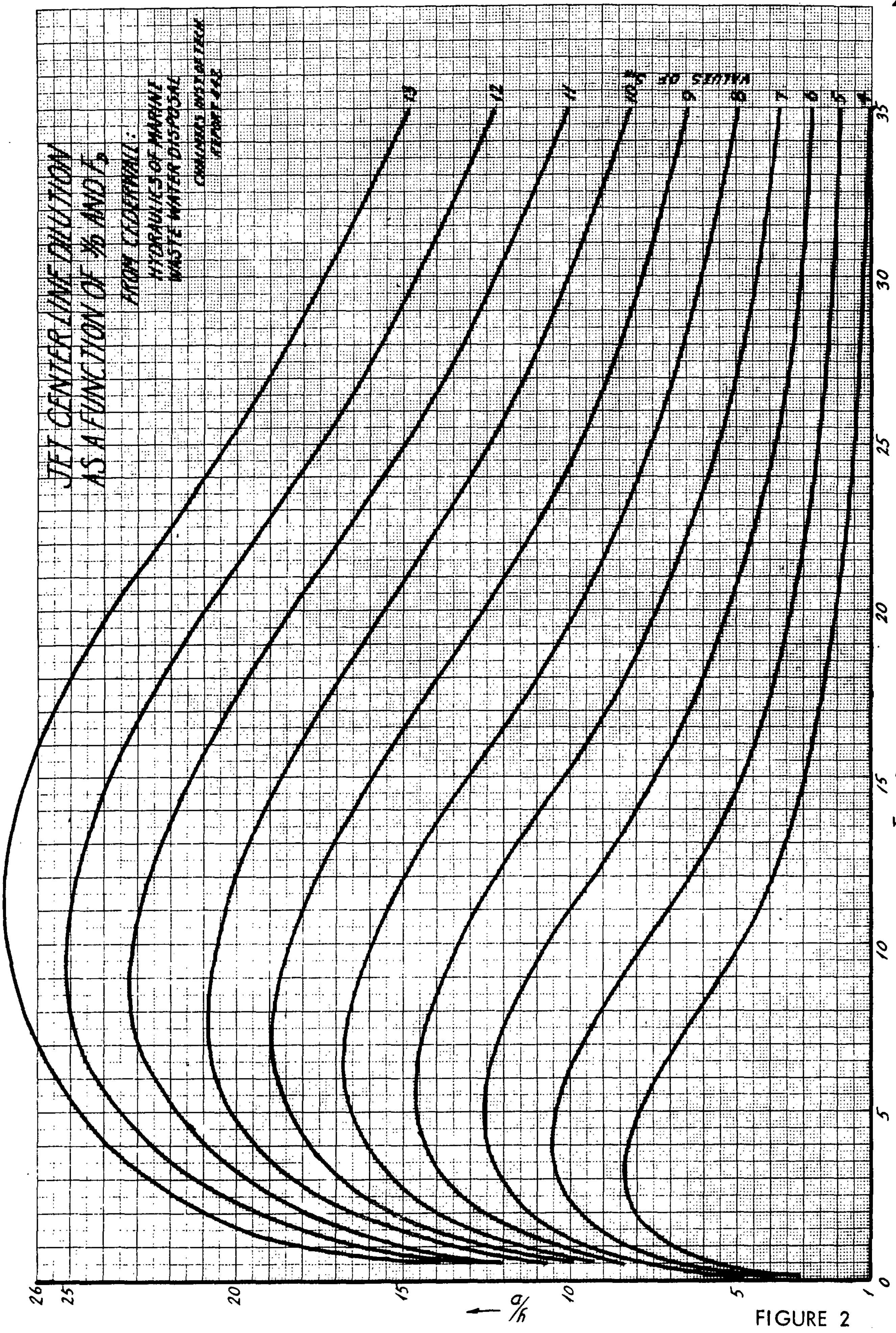
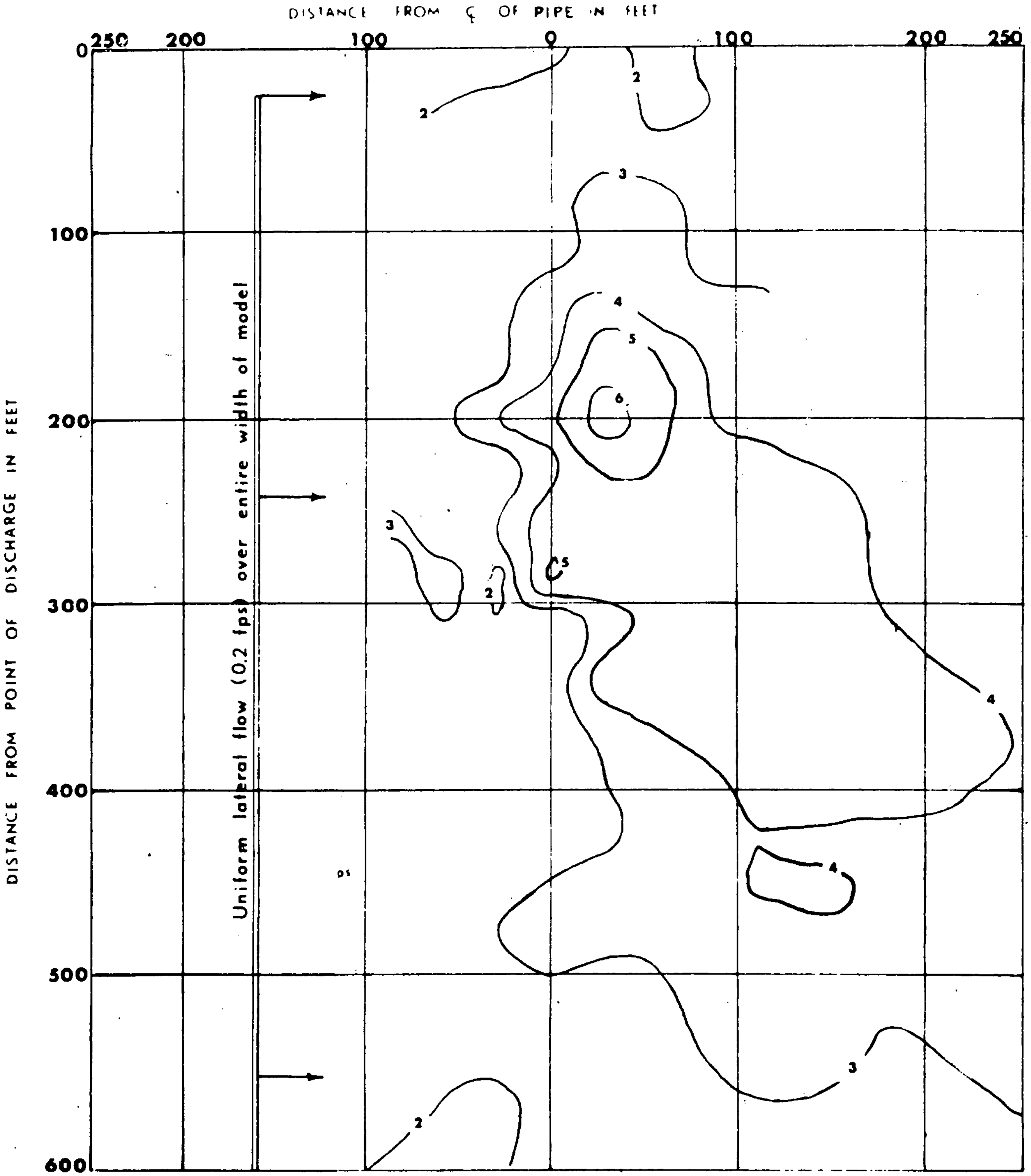

JET CENTER LINE DILUTION
AS A FUNCTION OF y/D AND F_D
FROM CEDERWALL:
HYDRAULICS OF MARINE
WASTE WATER DISPOSAL
CHALMERS INST OF TECH
VALUES OF y/D
15
12
11
10
9
8
7
6
5
4
F_D
0
5
10
15
20
25
30
35
S/h
1
5
10
15
20
25
26

FIGURE 2

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT SURFACE

(ΔT's in Degrees F)



TEST 006

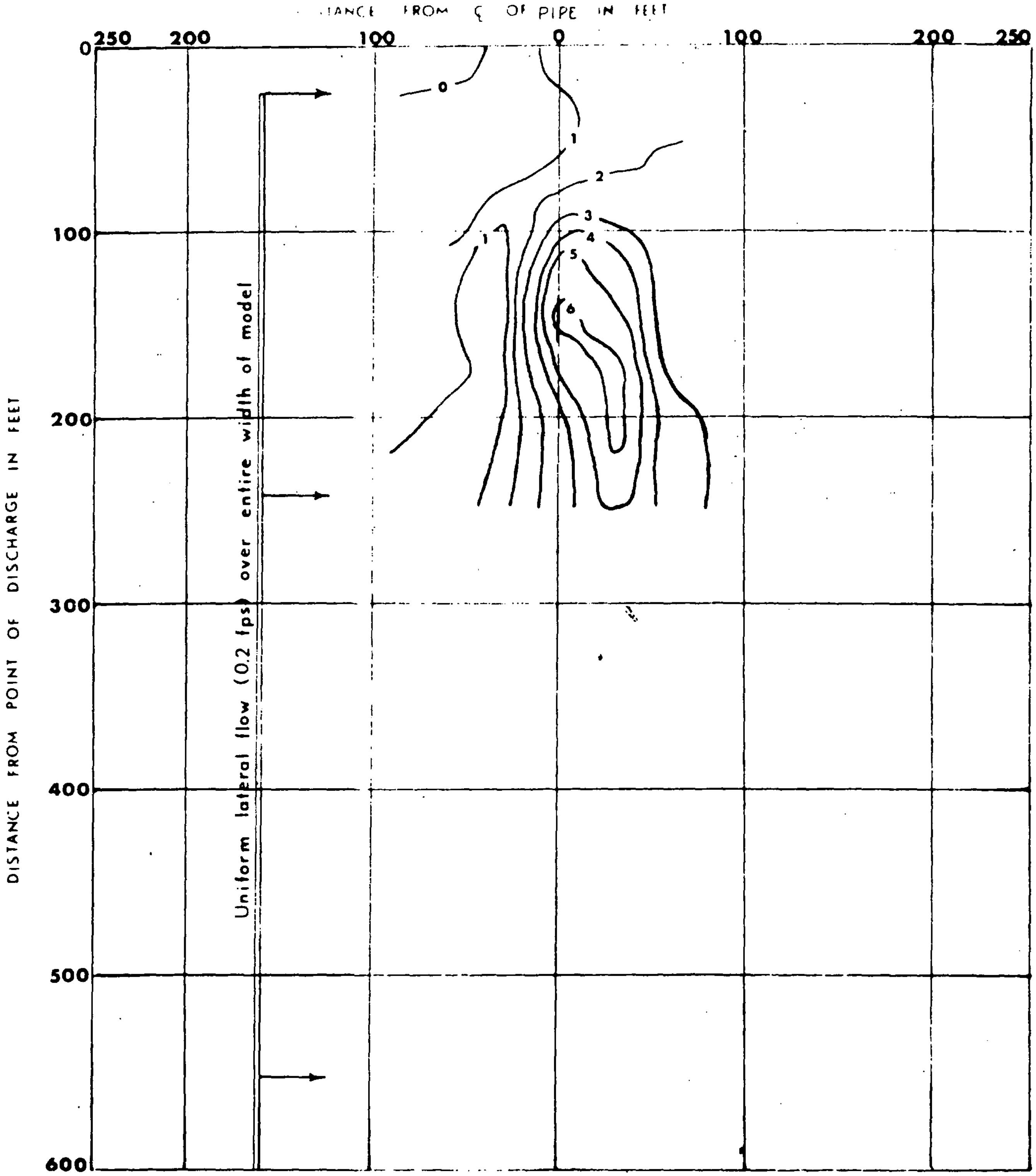
TEMP DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75 %	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

FIGURE 3

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT 17' DEPTH

(ΔT's in Degrees F)



TEST 006

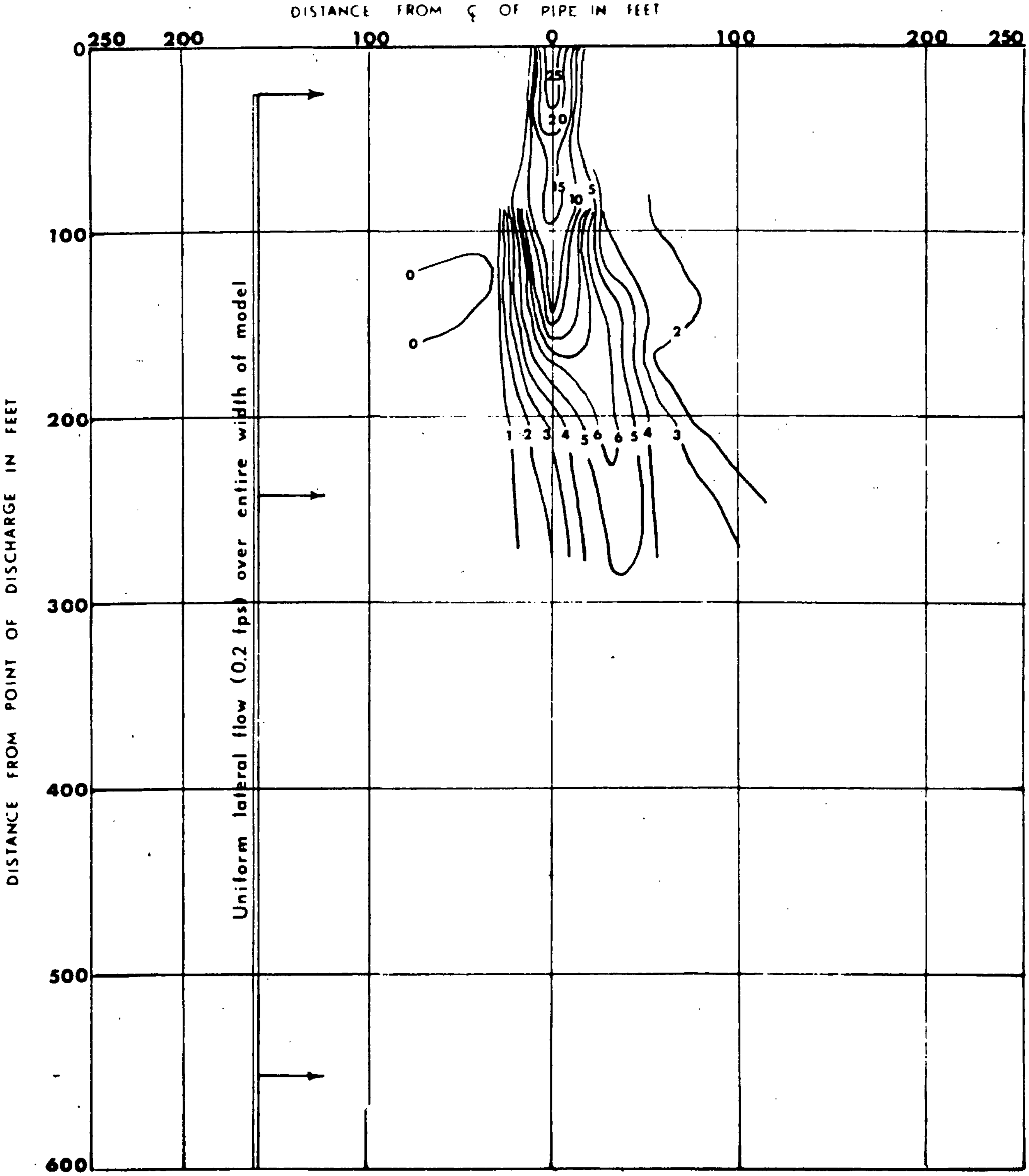
TEMP DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75%	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

FIGURE 4

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT 35' DEPTH

(ΔT's in Degrees F)



TEST 006

TEMP DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75%	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

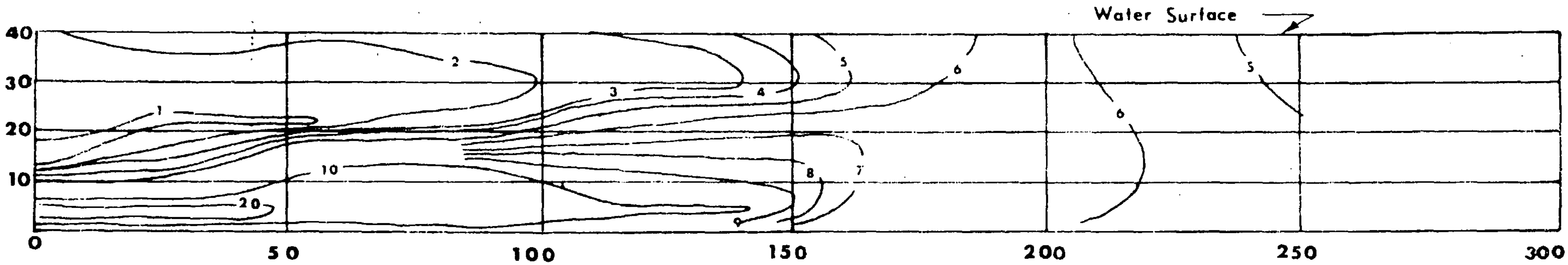
FIGURE 5

SEABROOK MODEL STUDY

VERTICAL PROFILE ISOTHERMS ALONG JET CENTERLINE

(ΔT's in Degrees F)

HEIGHT ABOVE BOTTOM IN FEET



DISTANCE FROM POINT OF DISCHARGE IN FEET

TEST 006

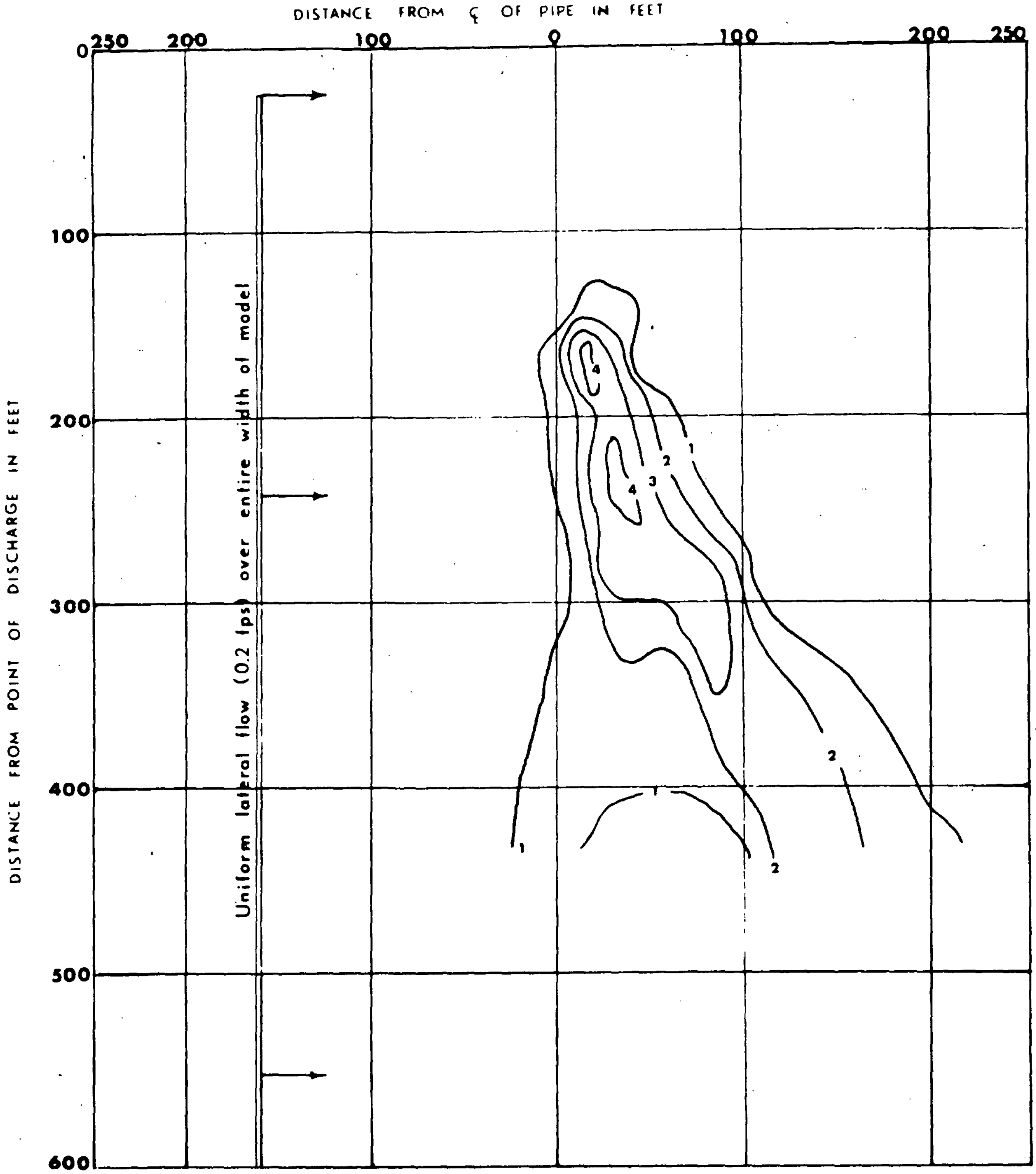
TEMP. DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75 %	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

FIGURE 6

SEABROOK MODEL STUDY

PLAN VELOCITY DISTRIBUTION AT SURFACE

(V's in fps)



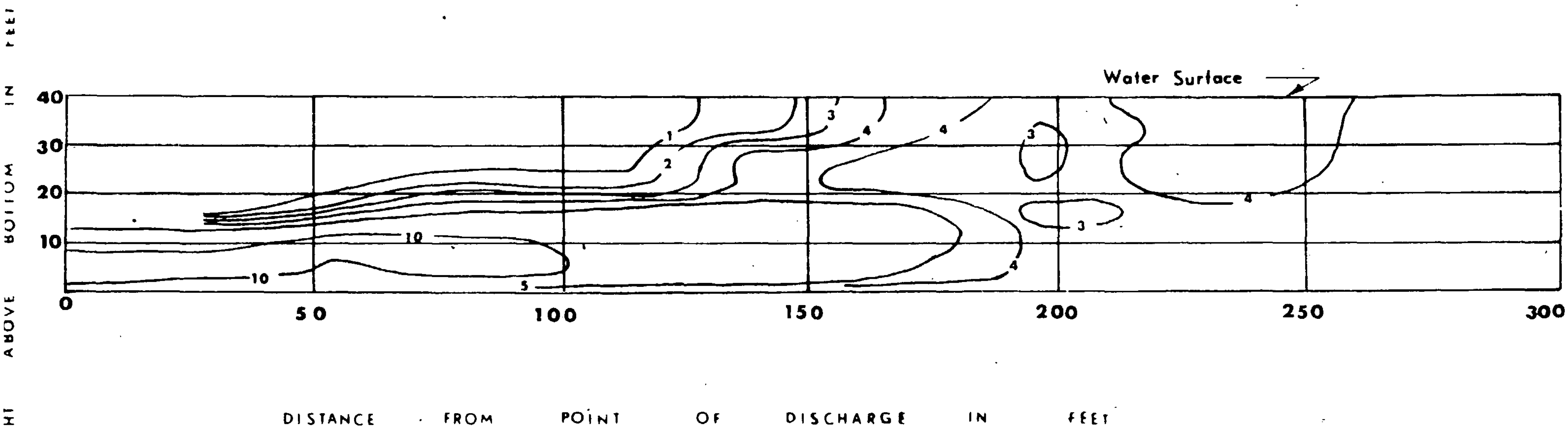
TEST 006

TEMP DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75%	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

FIGURE 7

SEABROOK MODEL STUDY

VERTICAL PROFILE VELOCITY DISTRIBUTION ALONG JET CENTERLINE
(V's in fps)



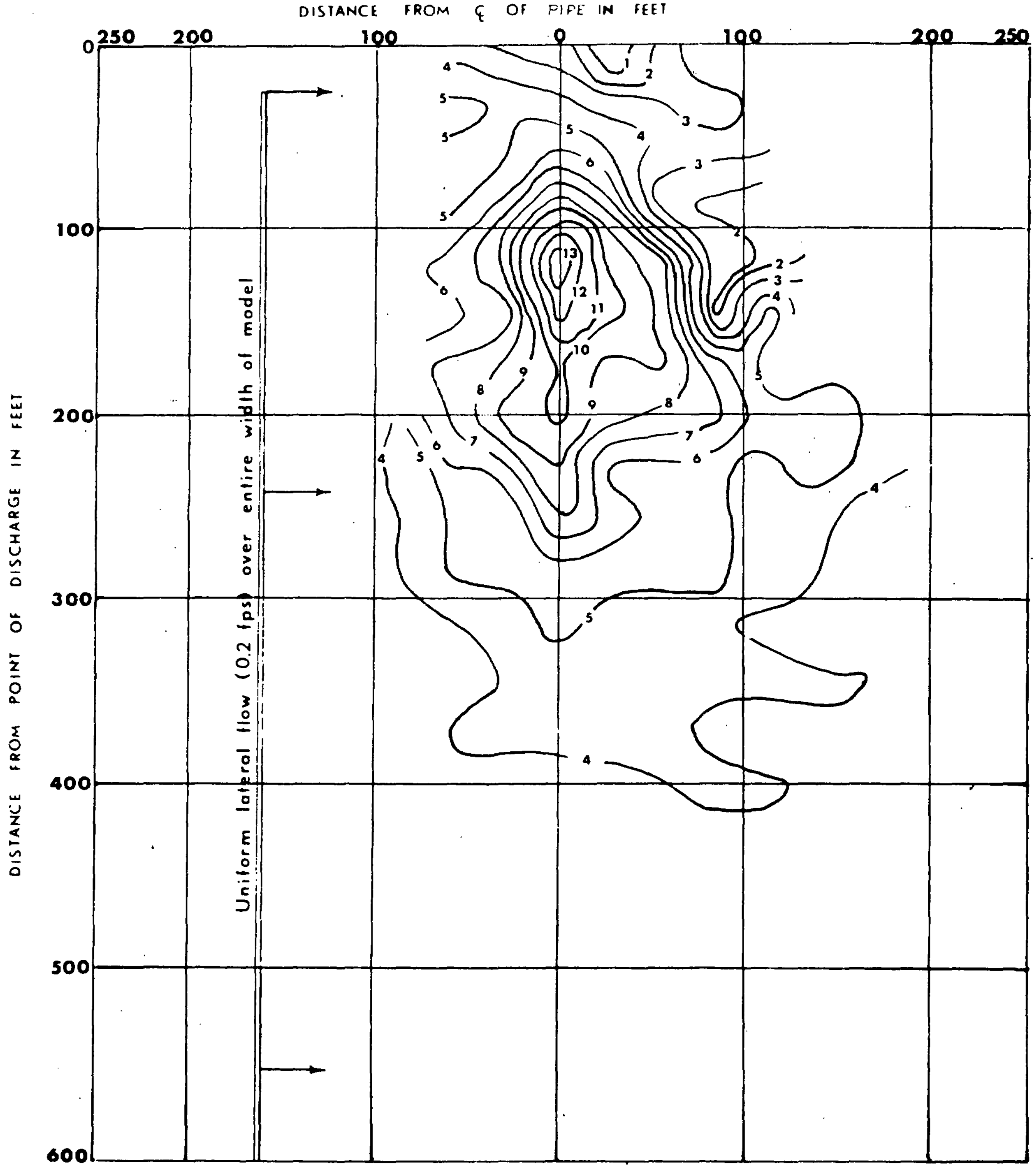
TEST 006

TEMP DIFFERENCE	30 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	75 %	JET DISCHARGE	980 cfs
AMB AIR TEMP	79 F	JET VELOCITY	14 fps
AMB WATER TEMP	75.1 F	PIPE DIAMETER	9.5 ft

FIGURE 8

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT SURFACE
(ΔT's in Degrees F)



TEST 007

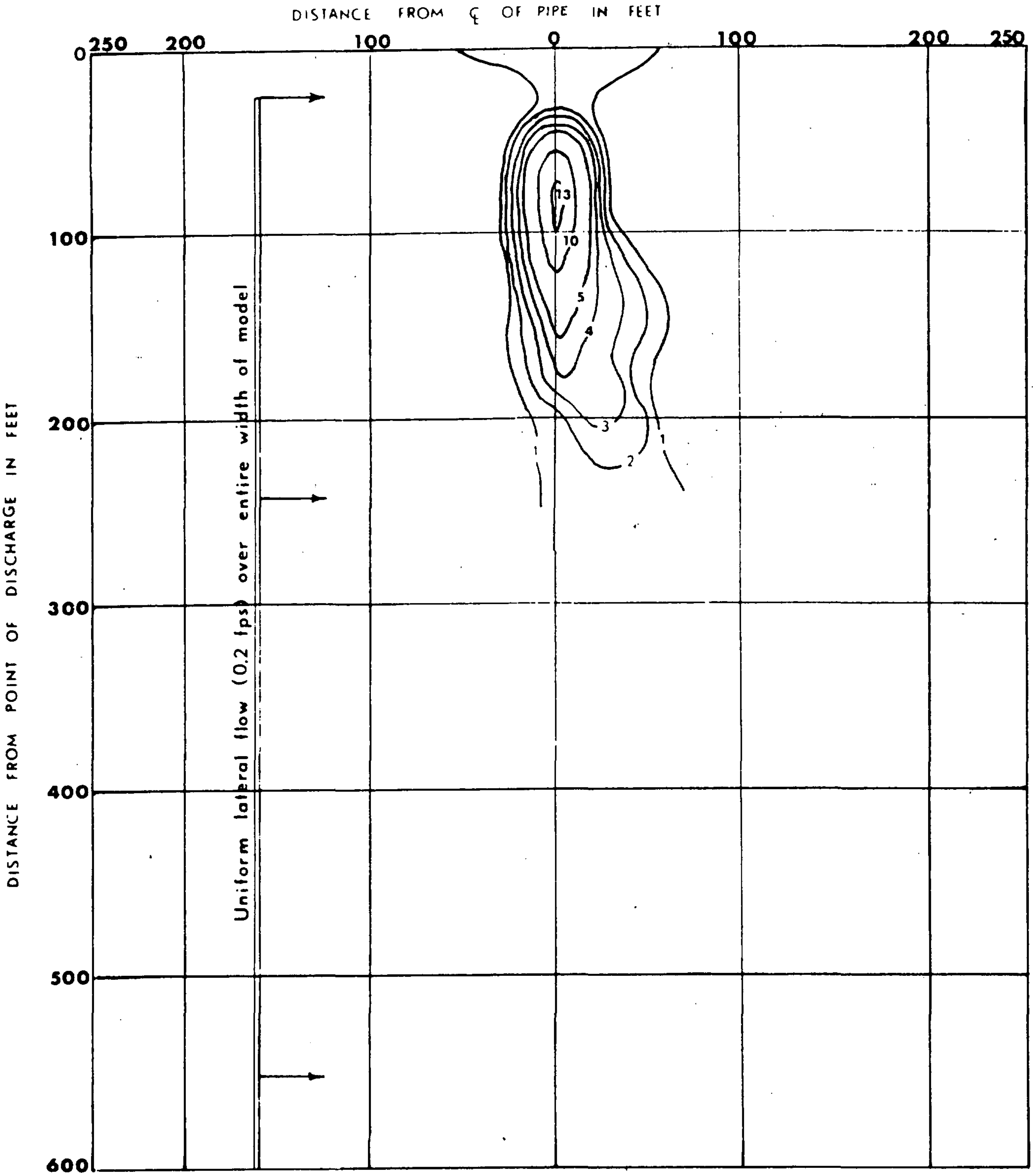
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57%	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 9

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT 17' DEPTH

(ΔT's in Degrees F)



TEST 007

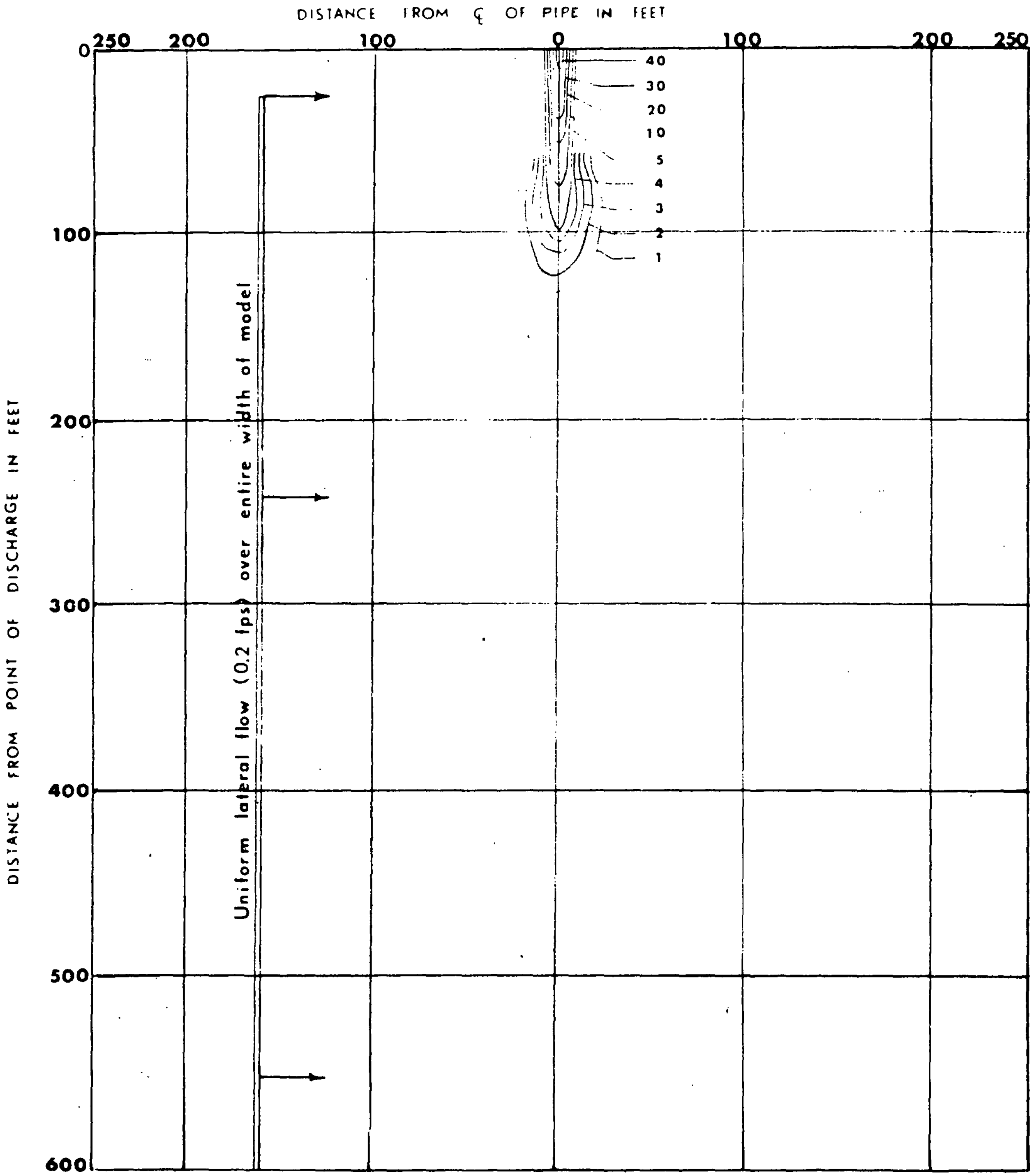
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57%	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 10

SEABROOK MODEL STUDY

PLAN ISOTHERMS AT 35' DEPTH

(ΔT's in Degrees F)



TEST 007

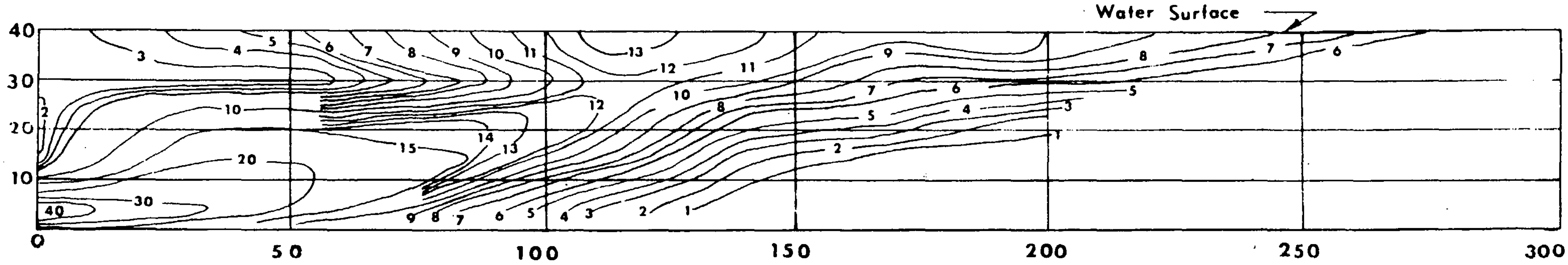
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57%	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 11

SEABROOK MODEL STUDY

VERTICAL PROFILE ISOTHERMS ALONG JET CENTERLINE

(ΔT's in Degrees F)



DISTANCE FROM POINT OF DISCHARGE IN FEET

TEST 007

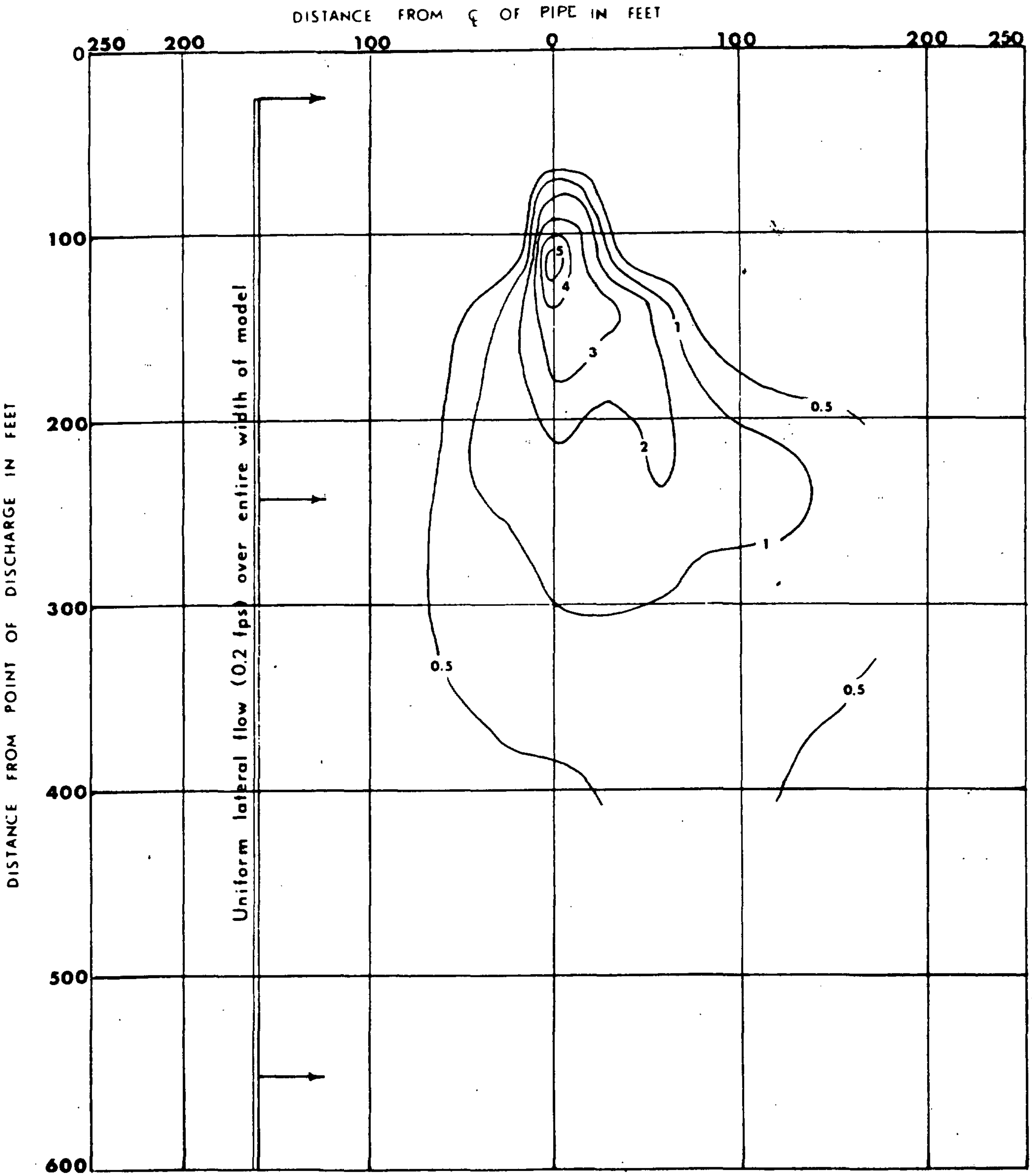
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57%	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 12

SEABROOK MODEL STUDY

PLAN VELOCITY DISTRIBUTION AT SURFACE

(V's in fps)



TEST 007

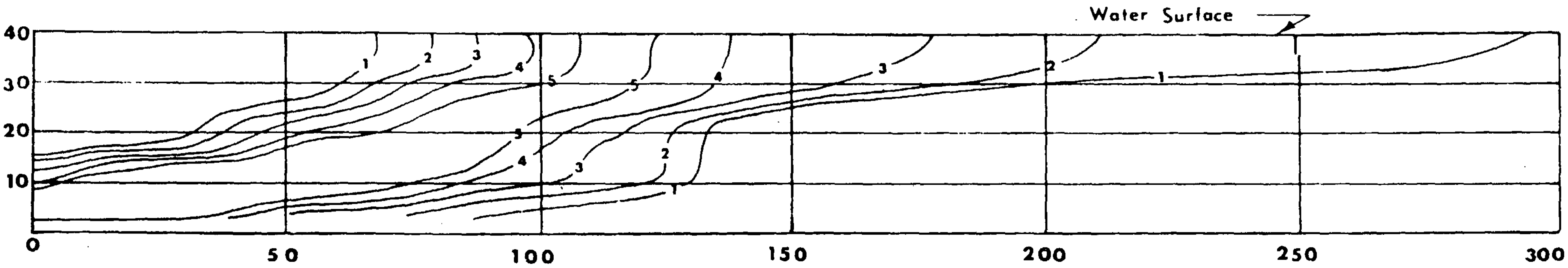
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57 %	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 13

SEABROOK MODEL STUDY

VERTICAL PROFILE VELOCITY DISTRIBUTION ALONG JET CENTERLINE

(V's in fps)



TEST 007

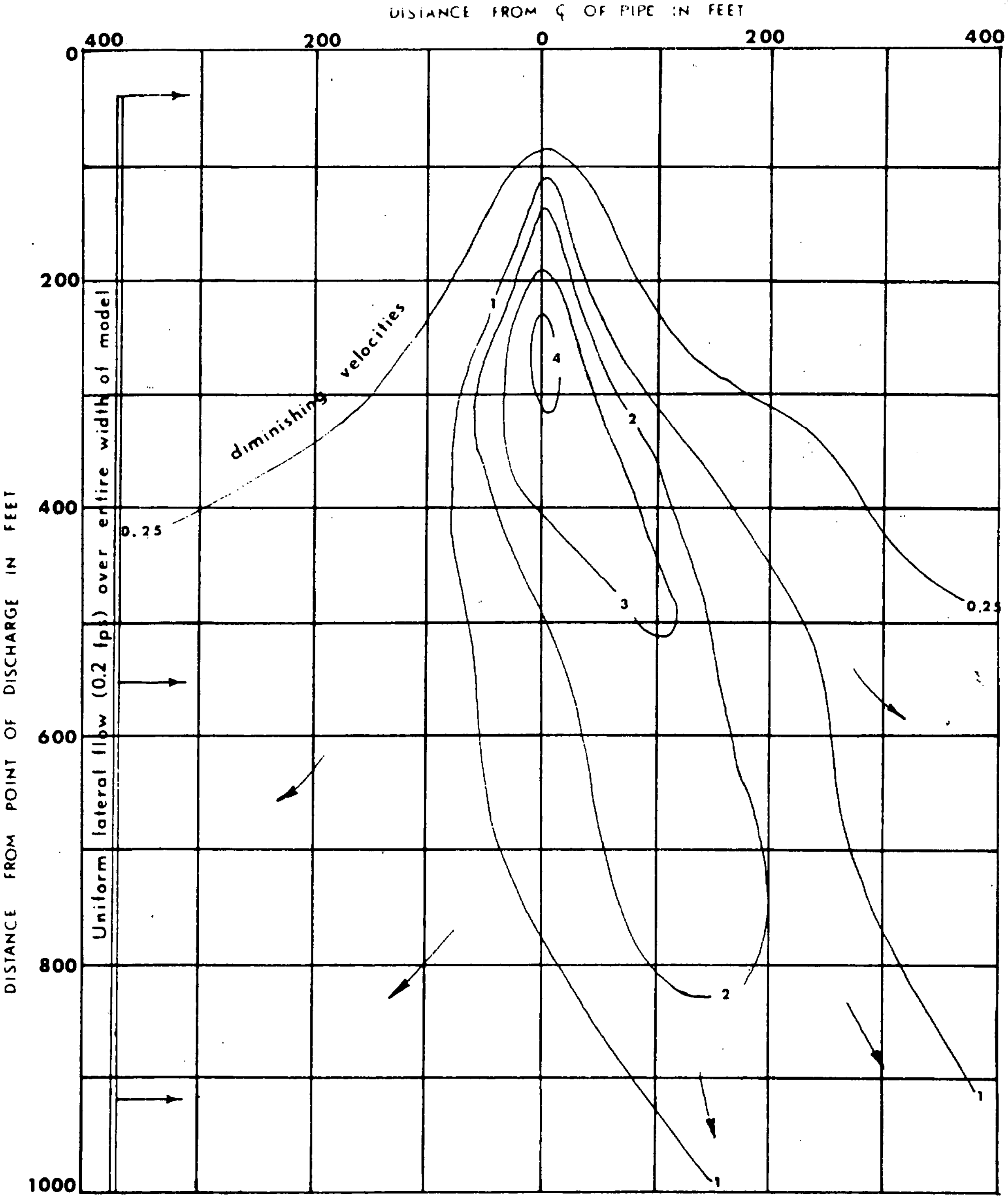
TEMP DIFFERENCE	47 F	SCALE RATIO	28.3
RELATIVE HUMIDITY	57%	JET DISCHARGE	600 cfs
AMB AIR TEMP	85 F	JET VELOCITY	8.5 fps
AMB WATER TEMP	79.6 F	PIPE DIAMETER	9.5 ft

FIGURE 14

SEABROOK MODEL STUDY

PLAN VELOCITY DISTRIBUTION AT SURFACE

(V's in fps)



TEST 008

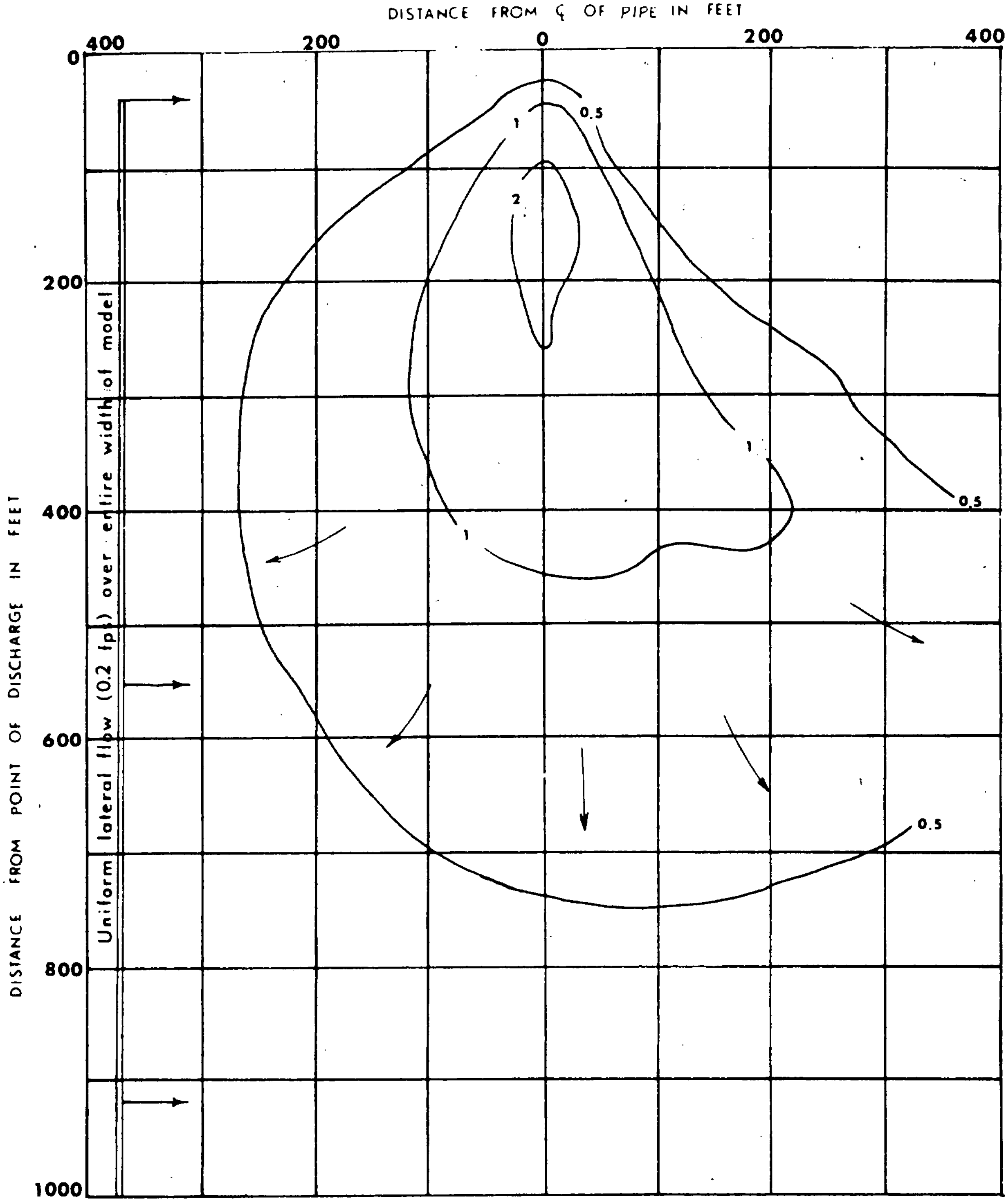
TEMP DIFFERENCE	30 F	SCALE RATIO	55.2
RELATIVE HUMIDITY	54%	JET VELOCITY	14 fps
AMB AIR TEMP	88.0 F	JET DISCHARGE	980 cfs
AMB WATER TEMP	80.7 F	PIPE DIAMETER	9.5 ft

FIGURE 15

SEABROOK MODEL STUDY

PLAN VELOCITY DISTRIBUTION AT SURFACE

(V's in fps)



TEST 009

TEMP DIFFERENCE	47 F	SCALE RATIO	55.2
RELATIVE HUMIDITY	42 %	JET VELOCITY	8.5 fps
AMB AIR TEMP	73.5 F	JET DISCHARGE	600 cfs
AMB WATER TEMP	66 F	PIPE DIAMETER	9.5 ft

FIGURE 16

SEABROOK MODEL STUDY

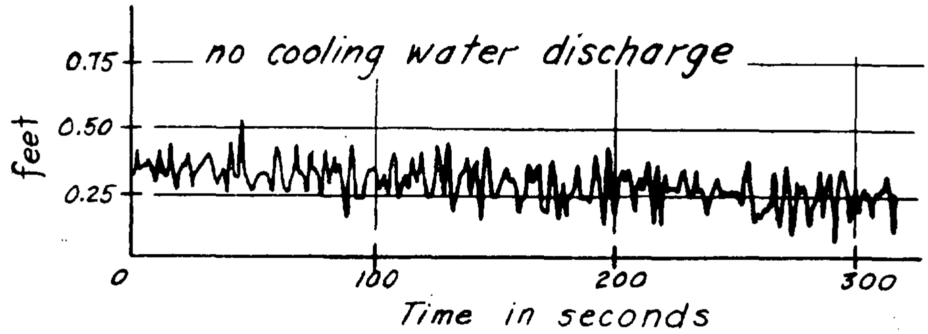
RECORDING

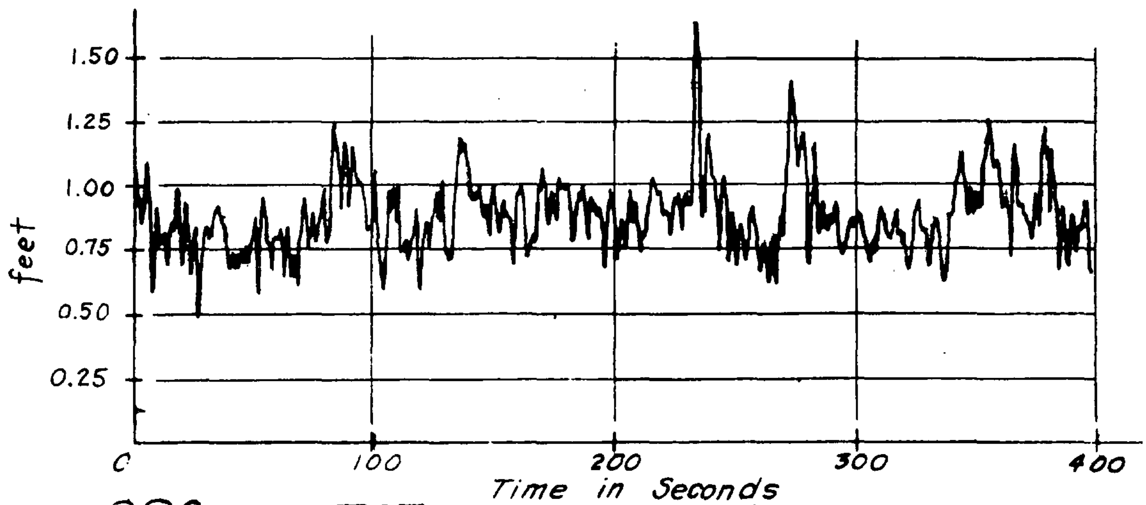
of

WATER SURFACE ACTION

at

POINT OF SURFACING





980 CFS JET FLOW, $V_o = 14$ FPS, $\Delta T_o = 30$ F

FIGURE 17

SEABROOK MODEL STUDY

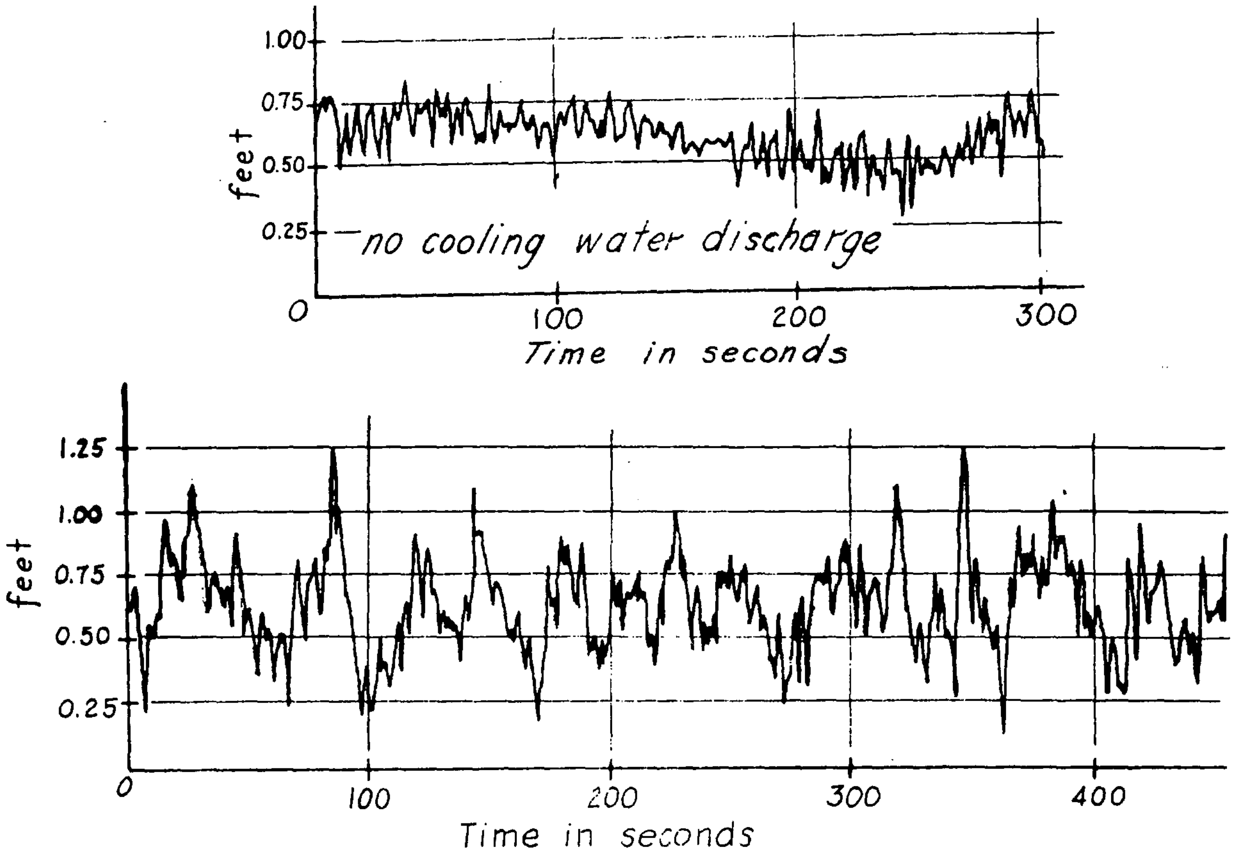
RECORDING

of

WATER SURFACE ACTION

at

POINT OF SURFACING



600 CFS JET FLOW, $V_o = 8.5 FPS$, $\Delta T_o = 47 F$

FIGURE 18

SEABROOK MODEL STUDY

VELOCITY DISTRIBUTIONS ALONG CENTERLINE OF NONBUOYANT JET

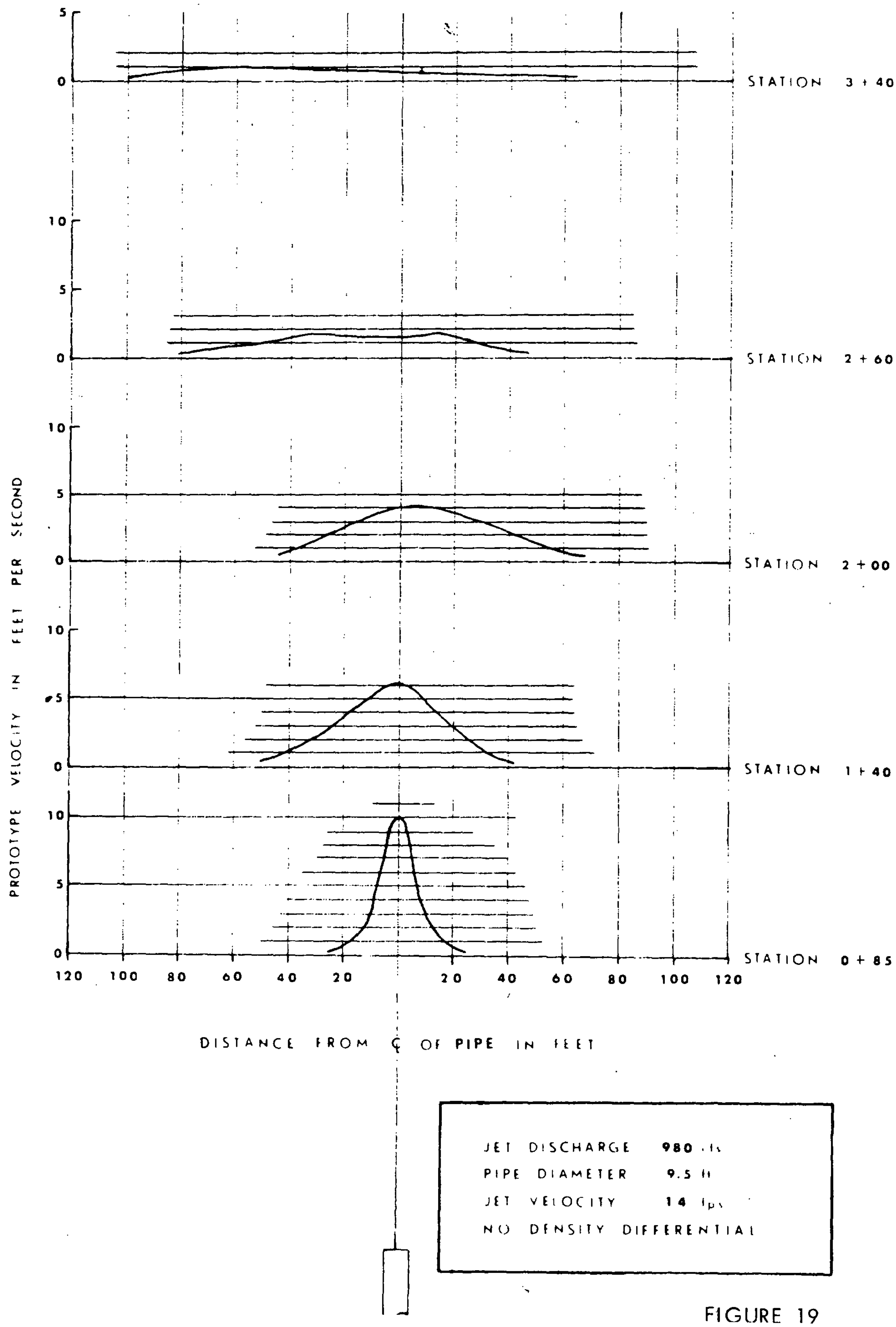
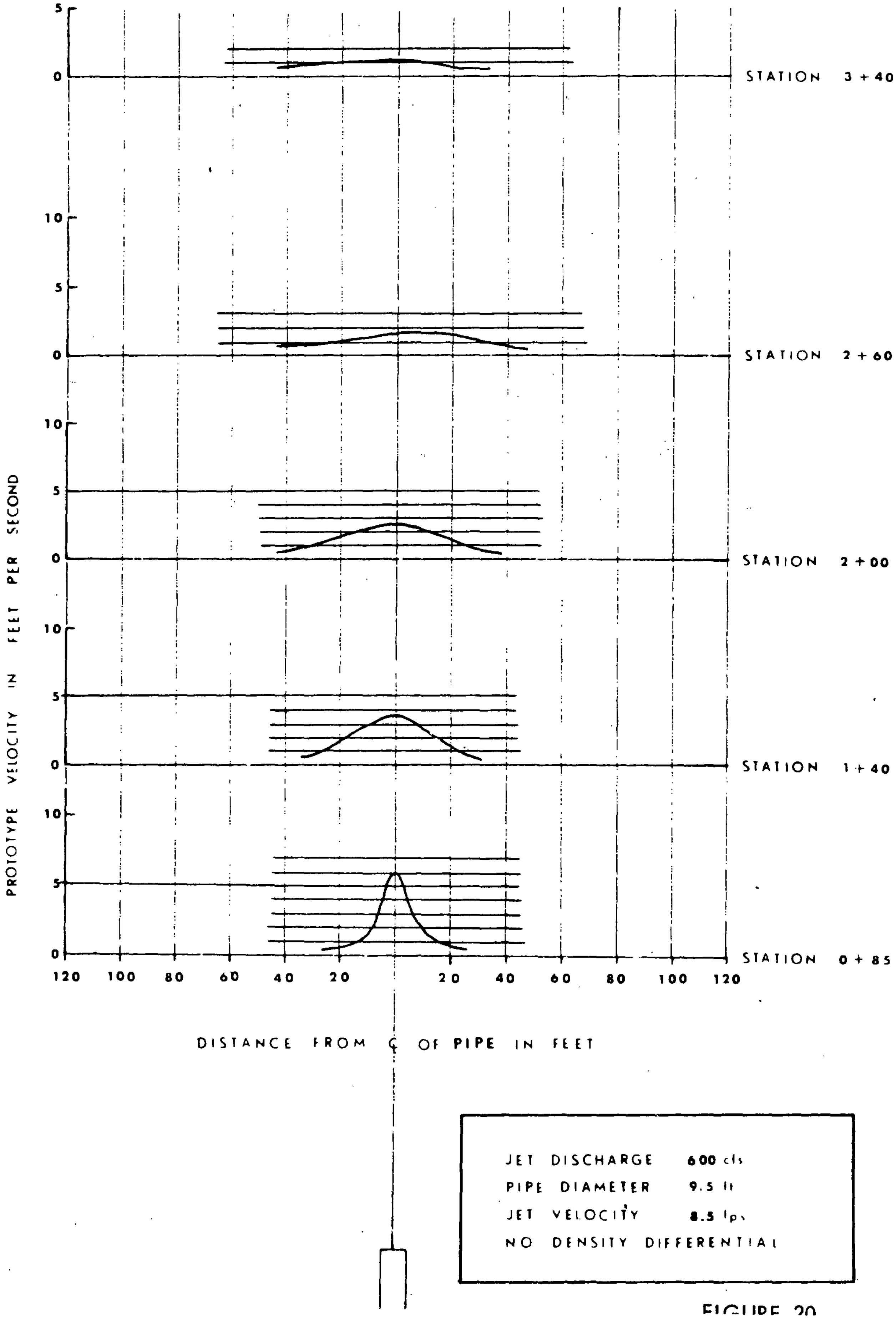


FIGURE 19

SEABROOK MODEL STUDY

VELOCITY DISTRIBUTIONS ALONG CENTERLINE
OF NONBUOYANT JET



JET DISCHARGE 600 cfs
PIPE DIAMETER 9.5 ft
JET VELOCITY 8.5 fps
NO DENSITY DIFFERENTIAL

FIGURE 20

APPENDIX K

APPENDIX K

THERMAL DISCHARGE APPLICATION REPORT

CIRCULATING WATER SYSTEM

SEABROOK NUCLEAR STATION UNIT NO. 1

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for

Public Service Company of New Hampshire

CONTENTS

Page

I - SUMMARY

II - DISCUSSION

CONTENTS

I - SUMMARY

A - PURPOSE

This report describes the procedures followed and the results obtained from a series of studies and tests designed to determine the optimum location for the discharge of heated condenser cooling water from the proposed Seabrook Nuclear Station, Unit No. 1 and to predict effects of this discharge on the temperature of the receiving water.

B - SCOPE

The studies included a hydrographic test program conducted by Webster Martin Company of Burlington, Vermont in the Atlantic Ocean offshore of the Hampton Beach State Park. In addition a Hydraulic Model Test was conducted at Alden Research Laboratories in Worcester, Massachusetts.

The hydrographic studies included; continuous releases of Rhodamine B dye at various locations in the ocean, a dye concentration monitoring program in the ocean extending up and down the coast from the release points, measurement of ocean current directions and velocities at each of the dye release points, measurement of wind speed and direction during the duration of the dye releases and the recording of temperatures and salinities for each release point.

The hydraulic model study included tests of heated subaqueous jet discharges having varying velocities and varying temperature differences between the jet and the receiving water.

C - RESULTS

1) The buoyant jet model studies indicated that with normal summer operation (440 000 gallons per minute circulating water flow and 30 F condenser rise) the minimum dilution of the discharge jet between its point of discharge and the point at which it reaches the surface will be 5 to 1, resulting in a localized surface area 6 F warmer than ambient ocean temperatures. The jet will surface approximately 200 feet beyond the point of discharge. Approximately 350 feet from the point the jet surfaces the dilution will be about 10 to 1, resulting in surface temperatures

only about 3 F above that of the surrounding water with only the top 10 feet of the water column being affected. Velocity measurements indicated that the momentum of the discharge plume would result in horizontal velocities of one foot per second at 1000 feet or more from the discharge point.

2) Power station operation differs from summer to winter in that less circulating water is required as the intake water temperature decreases. In a winter operating mode two or three pumps may be used instead of four pumps. To investigate the extreme conditions, model studies were conducted with a two pump flow of 269 000 gallons per minute and a temperature rise of 47 F.

   The model study indicated that with this winter operation, the minimum dilution of the jet between its point of discharge and the point at which it reaches the surface will be 3.6 to 1 resulting in a localized maximum temperature rise 13 F above ambient ocean temperatures. The jet will surface approximately 125 feet beyond the point of discharge. Approximately 275 feet from the point the jet surfaces the dilution will be about 11.8 to 1, resulting in surface temperatures only about 4 F above that of the surrounding water, affecting only the top 10 feet of the water column. Velocity measurements indicated that the momentum of the discharge plume would result in horizontal velocities of 0.5 foot per second at about 700 feet from the discharge point.

3) The current direction and velocity measurement at the offshore discharge point indicate that the net drift for the top 10 feet of the water column, determined over a 12-day period has a velocity of about 0.185 foot per second and travels in a due north direction.

4) Analysis of the dye plumes resulting from a continuous dye release, located approximately 4900 feet offshore from Hampton Beach State Park yields the following. The area in which the dye concentration equals or exceeds 0.5 part per billion (equivalent to a temperature increase of about 1.3 F for the design heat rejection rate) averages approximately 300 acres. The location and configuration of this 300 acre area is wind and tide dependent and shifts continuously.

5) Recirculation of dye to Hampton Harbor from the dye release point located 4900 feet offshore of Hampton Beach State Park occurred on 3 of 15 flood tides monitored. The maximum concentrations recorded in the harbor varied from 0.1 to 0.5 part per billion at flood slack which could be considered equivalent to approximately 0.25 F to 1.3 F, neglecting any heat loss to the atmosphere. No residual concentration of dye was found in the harbor on any ebb slack period, indicating that any diluted discharge water entering the harbor on a flood tide would be flushed from the harbor on the following ebb tide.

6) During the months of August and September 1969 the difference between the maximum and the minimum daily water temperatures measured at Hampton Bridge averaged 10.6 F and on one occasion was as high as 16 F.

D - CONCLUSIONS

Based on the results of the hydrographic study program and the hydraulic model studies the following conclusions have been reached.

1) A high velocity submerged jet from an open end pipe is an effective method of forcing rapid mixing and dilution of the heated effluent with the receiving ocean water, thereby minimizing any thermal effects on the surrounding area.

2) The natural drift of the receiving water and the inherent momentum of the diluted effluent plume at the surface will tend to carry the plume away from the discharge point and prevent any tendency for local temperature buildup in the ocean, along the coast or in Hampton Harbor.

3) The discharge pipe should be terminated 3900 feet from the low waterline at Hampton Beach State Park since the momentum of the discharge jet dominates the ambient ocean currents for 1000 feet or more beyond the end of the pipe.

II - DISCUSSION

A - GENERAL

The procedure used in setting up and interpreting the hydrographic study program was established by Ebasco Services engineers, for Public Service Company of New Hampshire, with the consultation and assistance of Dr J H Carpenter, Research Scientist from the Johns Hopkins University. Actual field work was done by Webster-Martin Inc of Burlington, Vermont. The model study was conducted by Alden Research Laboratories under the supervision of Ebasco with consultation from Dr Carpenter. Also Mr Richard O Eaton PE of Rockville, Maryland has been retained as a consultant on coastal engineering problems, his expertise has been utilized in the area of discharge pipe stability and installation, as well as system operations.

B - DESCRIPTION OF SYSTEM

The discharge system will consist of a 9-1/2 foot inside diameter reinforced concrete pressure pipe. The pipe will extend from the turbine building eastward under the marsh, the harbor and Hampton Beach State Park to a discharge point offshore in the Atlantic Ocean. It will convey heated condenser cooling water and service water to the offshore discharge point. This heated effluent will be discharged to the ocean at a rate of about 440 000 gallons per minute and will have a normal maximum temperature of approximately 95 F.

The layout of the pipe route and cross sections showing the proposed trench dimensions are shown on Figure 1. Where the pipe crosses navigable waterways, the pipe will be placed at a depth below mean low water as designated by the Corps of Engineers. At the discharge point in the ocean the crown of the pipe will be covered by a minimum of 35 feet of water at mean low water. The termination point for the discharge pipe is about 3900 feet from the low waterline at Hampton Beach (see Figure 1).

C - DYE RELEASE

Two separate dye studies were conducted offshore from Hampton Beach in the vicinity of the proposed condensing water discharge point. The first dye release took place in December 1968 for a period of 5 days, while the second was conducted in April and May of 1969 for a period of 45 days.

The December release was made primarily to determine the gross pattern of the dye plume and to develop a test technique for the long-term April-May release.

The same procedure was used for both studies. A 40 percent solution of Rhodamine B dye was pumped from the shore through a 3/8 inch diameter hose to an offshore discharge point. The dye solution was pumped at a constant rate by a chemical proportioning pump housed in a shed located near the Hampton Beach State Park bathhouse. The hose was buried across the beach weighted and laid on the ocean bottom outward to the release point. A mooring was set at the release point and the hose was brought to the surface and fastened to a buoy so that the dye was released just below the water surface. Dye was released continuously and at a constant rate throughout both test periods. The release rate during the December study was 4.1 pounds of dye solution per hour, while during the April-May study the release rate was 2.4 pounds of dye solution per hour.

During the December study the dye release point was about 3900 feet offshore, just north of Outer Sunk Rocks. For the April-May study five different release points were tested, three north of the rocks and two south of the Hampton Harbor Inlet. Locations of the release points are shown on Figure 2.

Dye tracking stations were established for each study. During the December release tracking stations were fixed on navigation buoys and shore reference points as shown on Figure 3. For the April-May release a total of 25 reference buoys were moored in a grid pattern extending about 6 miles along the coast - northward as far as North Beach and southward to Salisbury Beach. See Figure 4.

Dye concentrations were measured with a boat-mounted Turner Model 111 Fluorometer and recorded with a Rustrak Recorder on a strip chart on which time of sampling, tracking course and fluorometer setting were noted. Water to be sampled was pumped through the fluorometer from an inlet located on the bottom of the boat, about 2-1/2 feet below the water surface. All sampling was done while under way, except for vertical sample runs which were made periodically to determine the variation of dye concentration with depth. Sampling procedure was to measure the dye concentration from the release point outward to the limit of detectable dye concentrations.

Sample runs were made on each daylight slack tide, whenever weather permitted. During the December release period 10 sampling runs were made and the dye concentration pattern for each run was plotted. During the April-May study 73 sampling runs were made and the dye concentration patterns plotted.

In both of the dye release studies the shape and direction of the dye plume were found to be wind and tide dependent. There was no persistence of any one plume direction. Likewise there was no buildup of dye in any area around the dye release point, despite the fact that dye was pumped continuously for 45 days in the April-May test and a total of 2600 pounds of dye solution released. Even with the wind persisting in one direction the plume position was shifted by the action of tidal currents and no one pattern held for more than a few hours.

Although some dye entered the harbor on at least one flood tide from each of the release points, it was flushed out with the ebbing tide and there was little or no residual dye in the harbor at the end of any ebb tide period.

During the December release, which was made on the north side of the harbor entrance, dye entered the harbor on 1 out of a total of 3 flood tide cycles monitored. With the April-May release three different release points north of the harbor were tested. The initial release point was located about 3100 feet offshore from the low water line on the beach opposite the inshore end of Outer Sunk Rocks. Dye was released for a total of 11 days, but due to an intense storm only nine flood tides were monitored. Dye entered the harbor during eight of these flood tides and maximum dye concentration in the harbor varied from 0.1 to 1.0 parts per billion (equivalent to 0.25 F to 2.6 F with no heat loss to the atmosphere considered) at flood slack. Maximum concentrations occurred with northeasterly and easterly winds and these winds predominated during the test period. The second release point was located about 3900 feet offshore from the beach opposite the midpoint of the rocks. Dye was released from this point for 8 days. On 8 of the 11 flood tides monitored, dye concentrations were measured in the harbor. Maximum concentrations recorded varied from 0.6 to 1.6 parts per billion (equivalent to 1.5 F to 4 F, with no heat loss to the atmosphere considered) at flood slack. Maximum concentrations occurred with northeasterly and easterly winds which persisted throughout the test period. The third release point was located about 4900 feet offshore just beyond the offshore end of Outer Sunk Rocks. During the 12 days that dye was released from this point, 15 flood tides were monitored and dye entered the harbor on only three of these tides. Maximum concentrations recorded in the harbor varied from 0.1 to 0.5 part per billion (equivalent to 0.25 F to 1.3 F, with no heat loss to the atmosphere considered) at flood slack. The maximum concentrations occurred with northeasterly and easterly winds which predominated at the start of the period. Southwest winds dominated the last portion of the test period.

Although the results obtained at the northern release points were entirely satisfactory, releases were also made at two locations south of the inlet. Releases were made for 3 days from each location and eight flood tides were monitored. On three of these periods dye concentrations ranging from 0.2 to 0.5 part per billion (equivalent to 0.5 F to 1.3 F, with no heat loss to the atmosphere considered) were recorded in the harbor area. The dye entered the harbor on a flood tide with southerly and southeasterly winds. Northerly and westerly winds prevailed during the test period.

Based on the results of the dye release studies, it is planned to make the circulating water discharge north of the harbor inlet and to terminate the discharge pipe about 3900 feet from the low water line at Hampton Beach. The northern discharge point was chosen for two reasons: first deep water can be reached more readily on the north side than on the south, and second the southeast winds which caused the dye to enter the harbor from the southerly discharge point are more prevalent in the summer than the northeast winds which might carry dye into the harbor from the northern release points. The offshore termination of the discharge pipe was chosen to minimize the chances of warm water excursion into the estuary. Although dye releases from the two inshore release points did not result in significant dye concentrations in the harbor, the incidence of any discernible dye in the harbor was reduced considerably with the offshore location. Since the circulating water will be released along the bottom at a high velocity, it will not be necessary to extend the pipe the entire distance to the offshore release point to obtain the benefits of this surface location. Based on model test data, the momentum of the discharge jet will dominate the ambient currents for at least 1000 feet. Therefore, the discharge pipe terminal point has been chosen approximately 1000 feet inshore from the farthest offshore release point to obtain the same results.

The intense narrow plume of high dye concentration in the vicinity of the release point is not characteristic of water temperature patterns and cannot be so translated. Mixing will not be dependent on the natural diffusive characteristics of the receiving waters as in the case of the low velocity surface dye release. The high velocity subaqueous discharge will result in rapid dilution of the heated water by momentum mixing. Although the higher dye concentrations cannot be related to temperature, concentrations of about 1 ppb can be related approximately to temperature, this relationship can be used to give an indication of the size of the area within a given isotherm. This is done by determining the weight of water diluting the dye and relating this to the warm water discharge. The relationship is developed as follows:

Assume that at any isotherm of temperature increase the system is in equilibrium, in other words as much dye is being lost from the system as is being added. Thus for any dye concentration the mass of the diluting water in pounds per hour can be calculated as follows:

$$W = \frac{R}{C}$$

where W = Mass of diluting water in pounds per hour
R = Rate of dye release in pounds per hour
C = Concentration in pounds of dye/pounds of water

For a concentration of 1 ppb and a release rate of 2.4 pounds per hour, the weight of the diluting water will be 2.4 billion pounds per hour. If the discharge had been heated water rather than dye, the equation becomes

$$W = \frac{Q}{c_p \ T}$$

where T = Temperature increase above ambient, F
Q = Heat rejection rate in Btu per hour
c_p = Btu per pound per F

Therefore the approximate relationship between dye concentration and temperature differential for the proposed Seabrook Nuclear Station Unit No. 1 can be calculated as follows:

1) Discharge rate of dye solution, 2.4 pounds per hour
2) Diluting water required for reading of 1 ppb = 2.4 billion pounds per hour

3) Plant heat rejection rate, 6300 million Btu per hour

4) Equivalent temperature increase in 2.4 billion pounds of water, 2.6 F

5) Thus for the design plant heat rejection rate a dye concentration of 1 ppb is equivalent to a temperature increase of about 2.6 F

Figures 5 through 30 give plots in which dye concentrations have been converted to expected temperature differentials. These isotherms are conservative (high) since no loss of heat to the atmosphere has been considered.

Using this relationship, the size of the warm water patches which would lie within the isotherm denoting a 1.3 F increase in surface temperature has been planimetered from the dye plot sheets for the farthest offshore release point. From the data gathered for this release point there were 11 well-defined dye patches. The largest area within the 1.3 F isotherm of temperature increase was 460 acres and the smallest was 23 acres. The average size was 280 acres. If the single 23 acre patch were eliminated from the group, the average size would be about 305 acres. This would not represent an isothermal condition from top to bottom in the water column but would be indicative of the temperature increase in the upper 10 feet or less. This would also indicate that, under coincident adverse easterly wind and flooding tide conditions, water 1 to 1.5 F warmer than the ambient ocean temperature could enter the harbor. As indicated by the dye release, however, there would be no buildup in the estuary nor would there be any residual heat in the harbor after ebb tide. Moreover, natural water temperature fluctuations within the estuary are far greater than the 1 to 1.5 F which might result from a short term excursion of diluted warm water effluent into the estuary.

In the above temperature estimates no account has been made of thermal decay due to heat loss to the atmosphere across the air-water interface since this decay would be at a relatively slow rate because of the very small increase in water temperature above normal. If thermal decay were considered it would always result in decreasing the size of the area within any given isotherm.

In order to assist in the interpretation of the dye studies, wind velocities were measured with a recording anemometer mounted on the roof of the Hampton State Park Beach House. In addition water temperature and salinity measurements were made daily at the dye release point.

Results of the anemometer data collected during the offshore dye release is shown in the form of wind roses for the three dye release points on the north side of the harbor, see Figures 31, 32 and 33. From these exhibits it can be shown that generally the greater frequency of wind came from the northwest to southwest, but the stronger winds during the test period came from the southeast to northeast.

With the winds coming from the southwest, the possibility of any recirculation of diluted effluent water to the harbor is highly improbable as evidenced by the results of the data obtained from dye release Point 3 and observation of the wind rose for this point given in Figure 33.

Plots showing the temperature profile with depth at the beginning and end of the release period for each dye release point are given on Figures 34, 35 and 36. Plots showing salinity profiles with depth for the same locations and times as above are given on Figures 37, 38 and 39.

When the density is calculated considering both the salinity and temperature of the water, a density difference of .003 gr/cc or less is found at each of the dye release locations indicating essentially no vertical density stratification in the water column. Figures 40, 41 and 42 give plots of density vs depth for each release point.

Figure 44 tabulates daily maximum and minimum surface and bottom water temperatures recorded at the Hampton Harbor Bridge during the period August 15, 1969 to September 11, 1969. This data is the initial output of a continuing water temperature monitoring program which is a part of the ecological studies being conducted in Hampton Harbor.

D - <u>CURRENT METERS</u>

Throughout the April-May release period, tidal current direction and velocity were measured and recorded at the dye release points with two Geodyne Model 102-1 current meters. Meters were installed one above the other with the lower meter 8 feet above the bottom and the upper meter 8 feet below the water surface at mean low water. See Figure 43. Each time the dye release point was moved the meters were also moved.

During the severe storm of April 23-25 the current meters dragged their moorings. This resulted in temporary malfunction of the meters voiding a small portion of the data. The major portion of the record, however, is intact.

Current meter data was recorded on film which was processed using Geodyne's computer programs. Output obtained includes a computer print-out of the current direction and velocity time averaged for 5 minute intervals, a histogram and scatter plot of current velocity with a vector trace of current direction and velocity.

Results obtained from the current meter study at the third dye release point, conducted over a period of 12 days are summarized below.

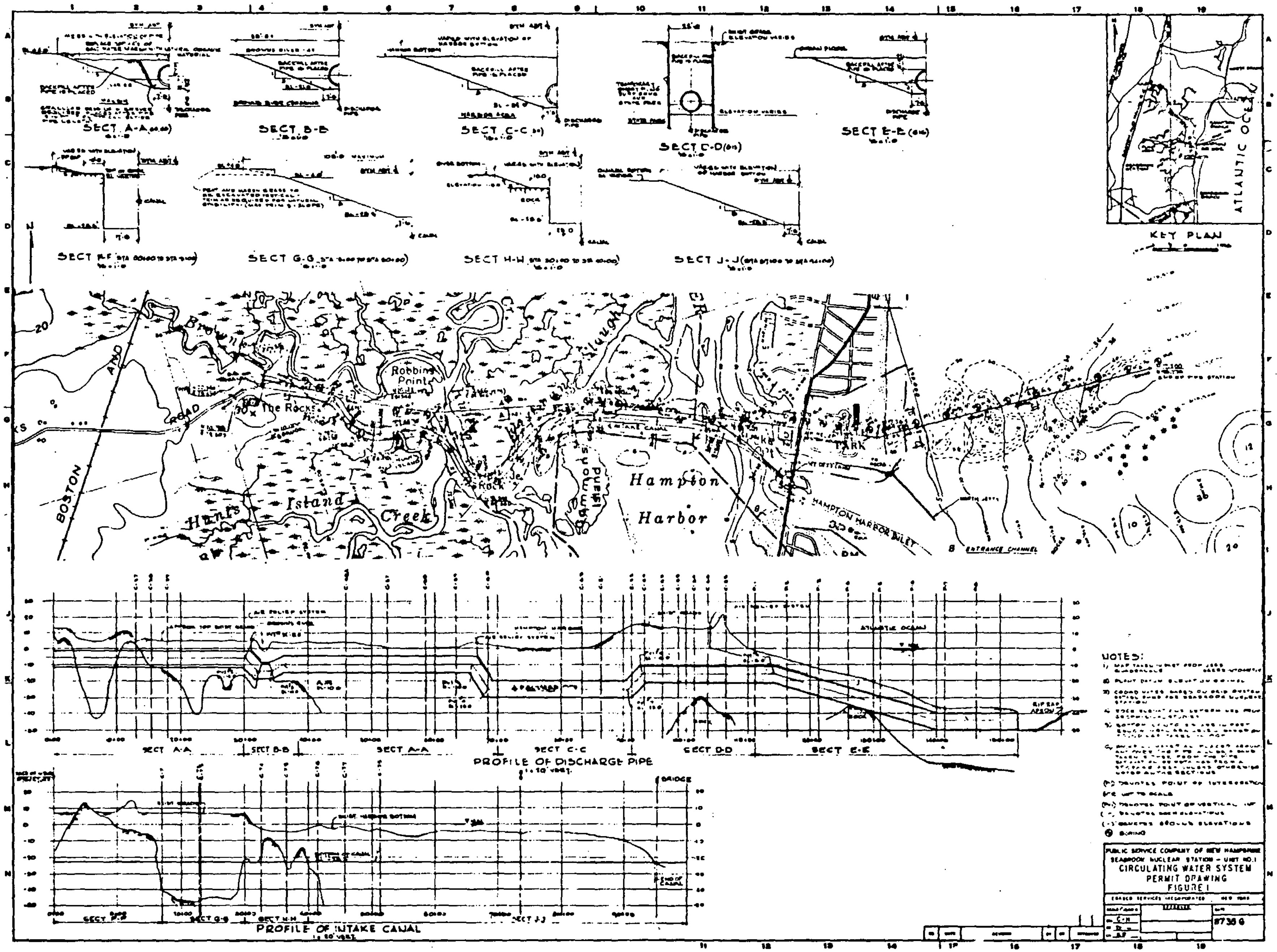
Meter Depth	Net Drift	Net Direction (Magnetic)
0.2 depth	0.185 fps	15°
0.8 depth	0.076 fps	303°

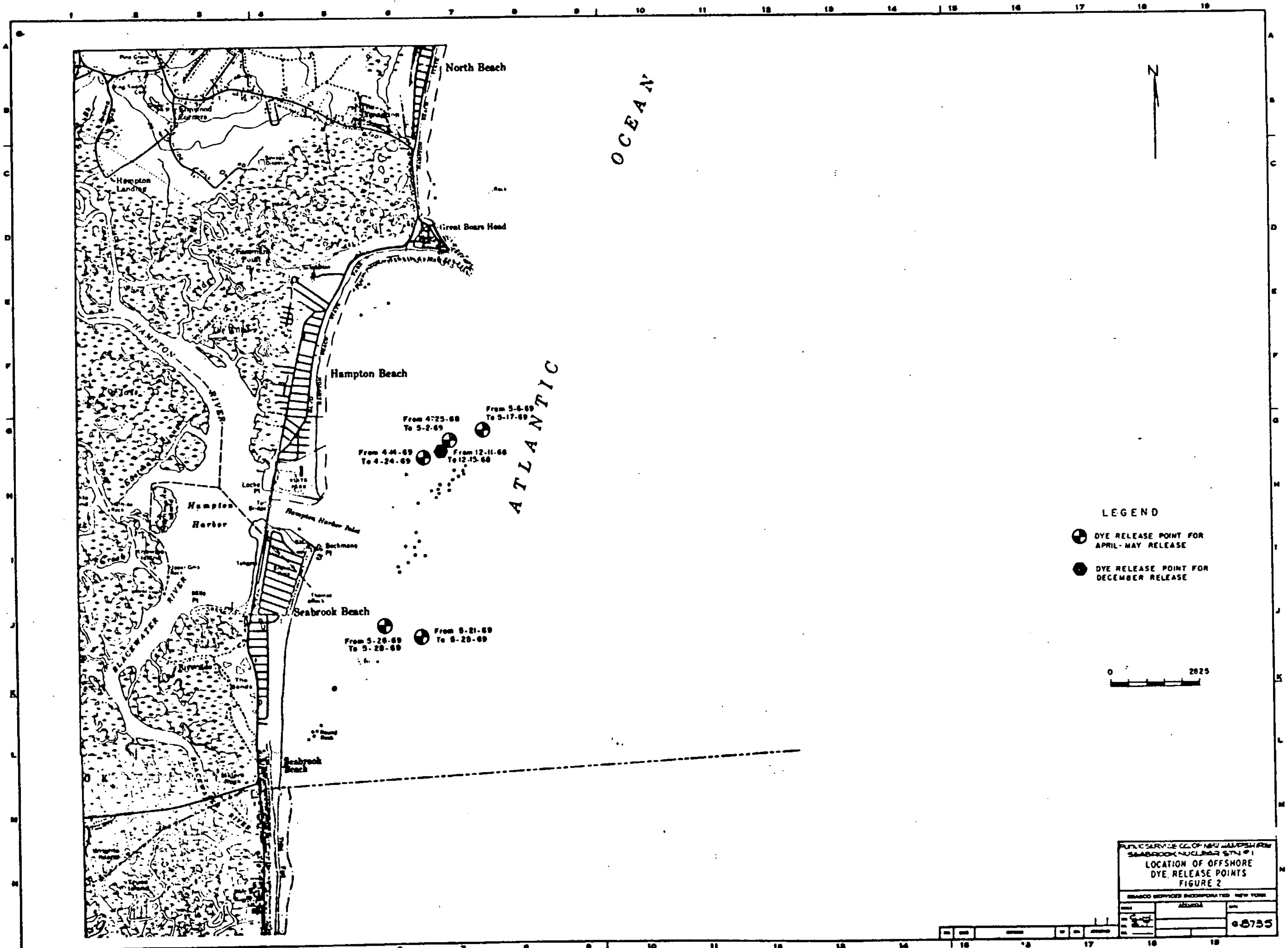
Since the diluted effluent water will be limited to the upper 10 feet or less only the upper meter will be considered. Using the upper meter only there is a net drift of 0.185 foot per second traveling in a direction bearing north 15° east measured clockwise from magnetic north, correcting this angle to a true north bearing the azimuth is 359°, indicating that the ocean drift in the area of discharge will be in a due north direction. This shows that in the area where the momentum of the plume is overcome by the ocean currents, the net drift will be in a northerly direction.

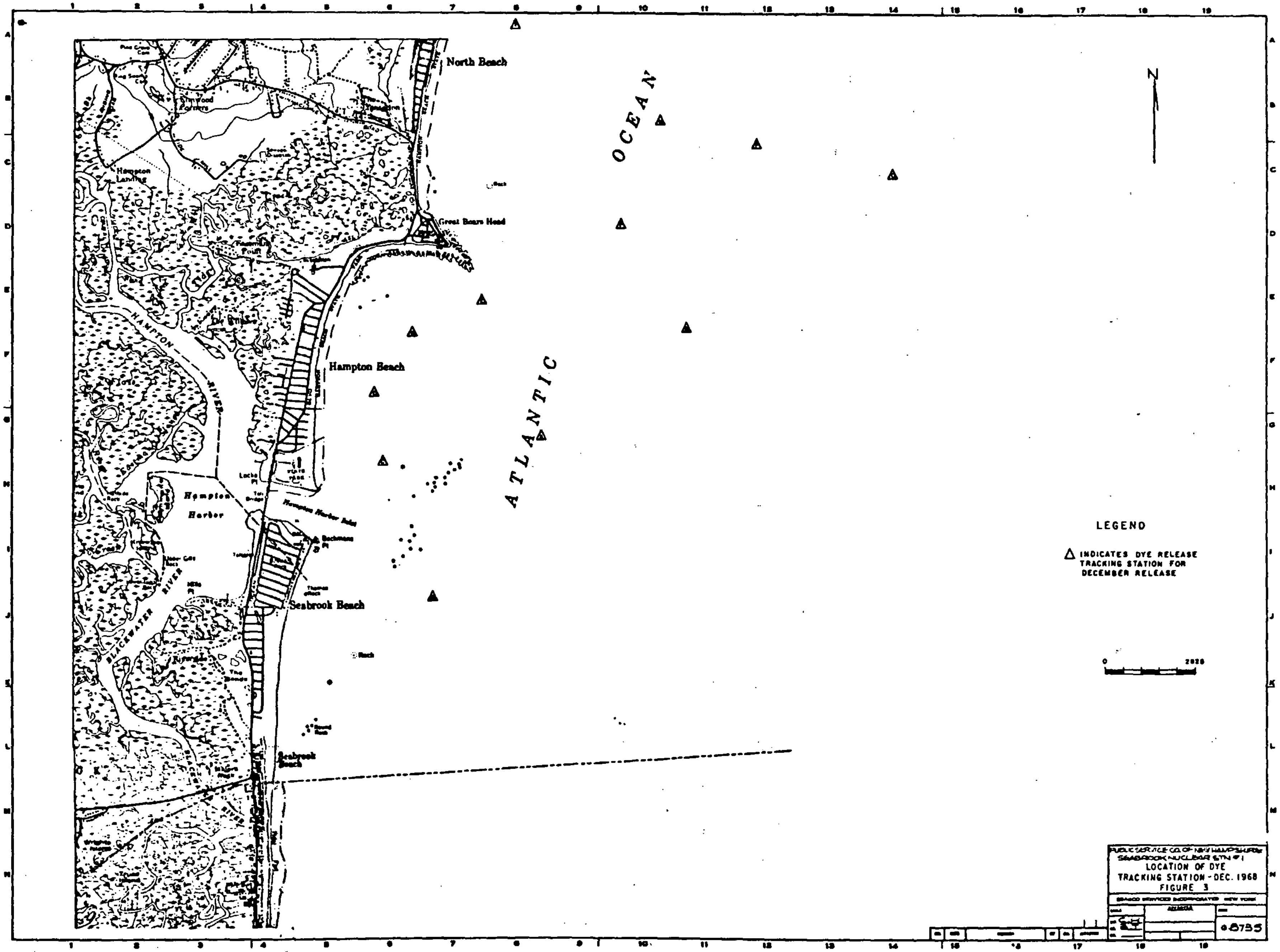
E - HYDRAULIC MODEL STUDY

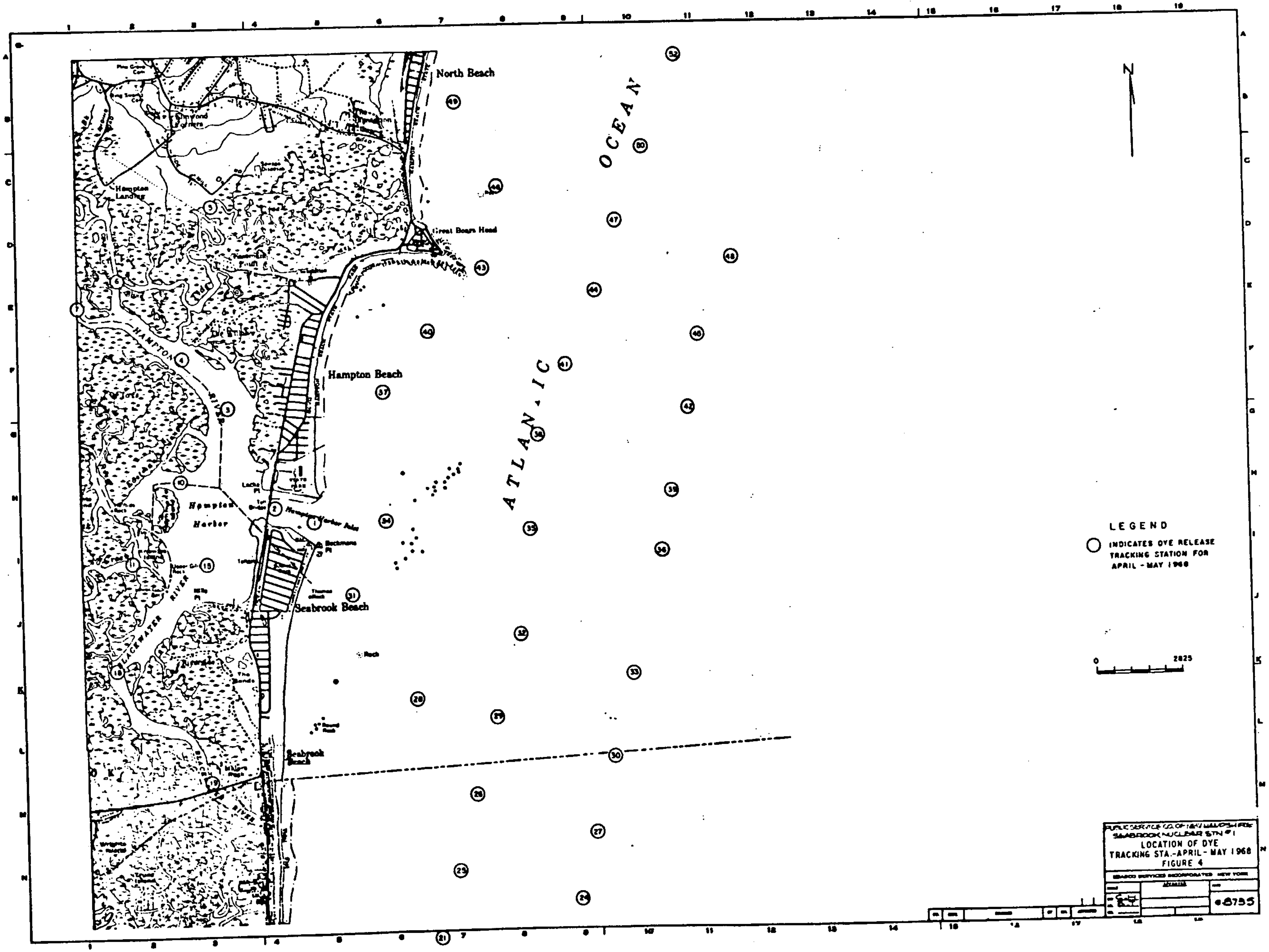
The report from Alden Research Laboratories on the buoyant jet discharge model tests is given as Appendix A of this report.

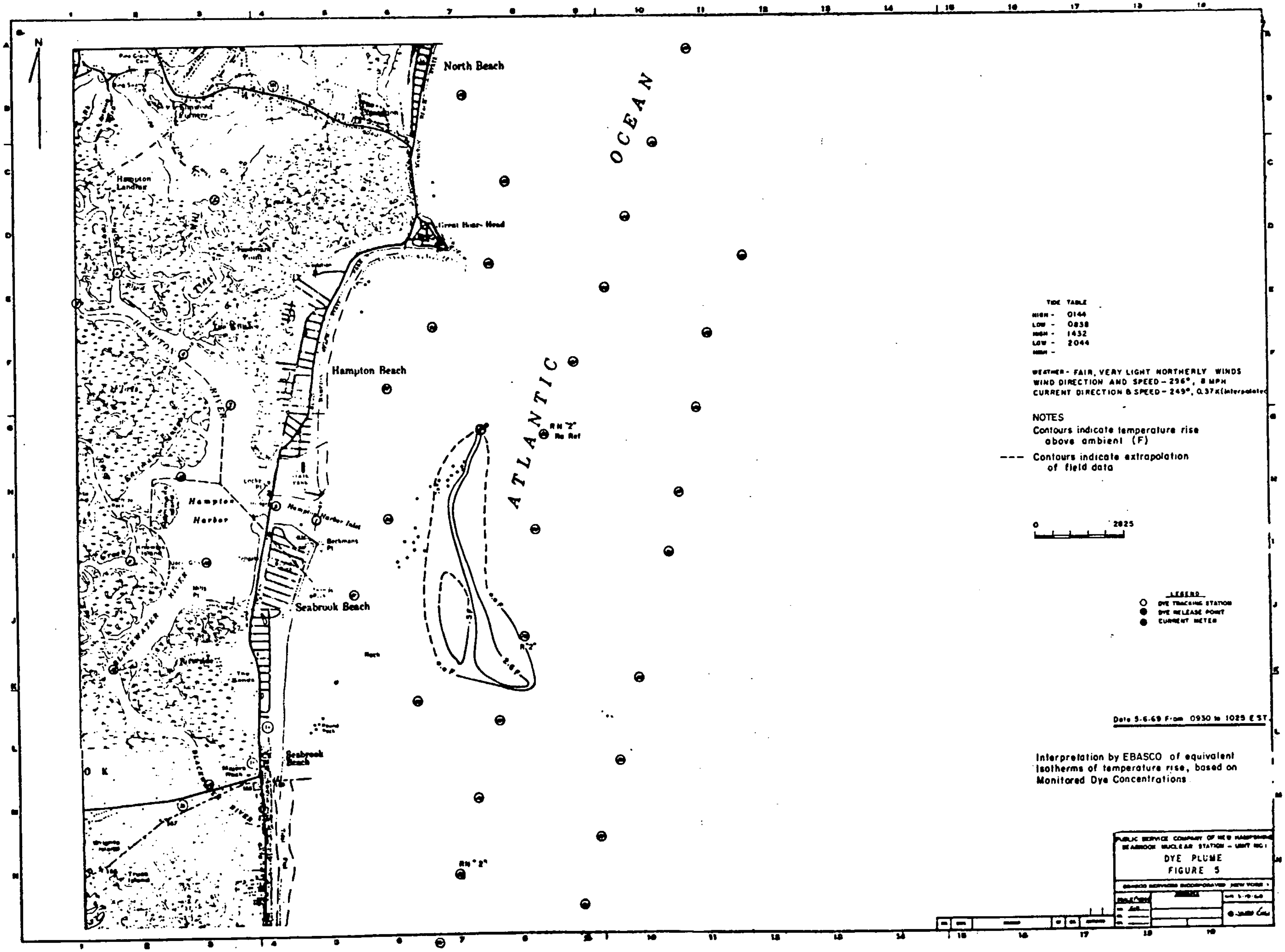
F - LIST OF FIGURES


SECT A-A
SECT B-B
SECT C-C
SECT D-D
SECT E-E
SECT F-F
SECT G-G
SECT H-H
SECT J-J
KEY PLAN
ATLANTIC OCEAN
Robbins Point
The Rocks
Hunts Island Creek
Hampton Harbor
HAMPTON HARBOR INLET
ENTRANCE CHANNEL
BOSTON AND
ROAD
PROFILE OF DISCHARGE PIPE
PROFILE OF INTAKE CANAL
BRIDGE
NOTES:
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
CIRCULATING WATER SYSTEM
PERMIT DRAWING
FIGURE I

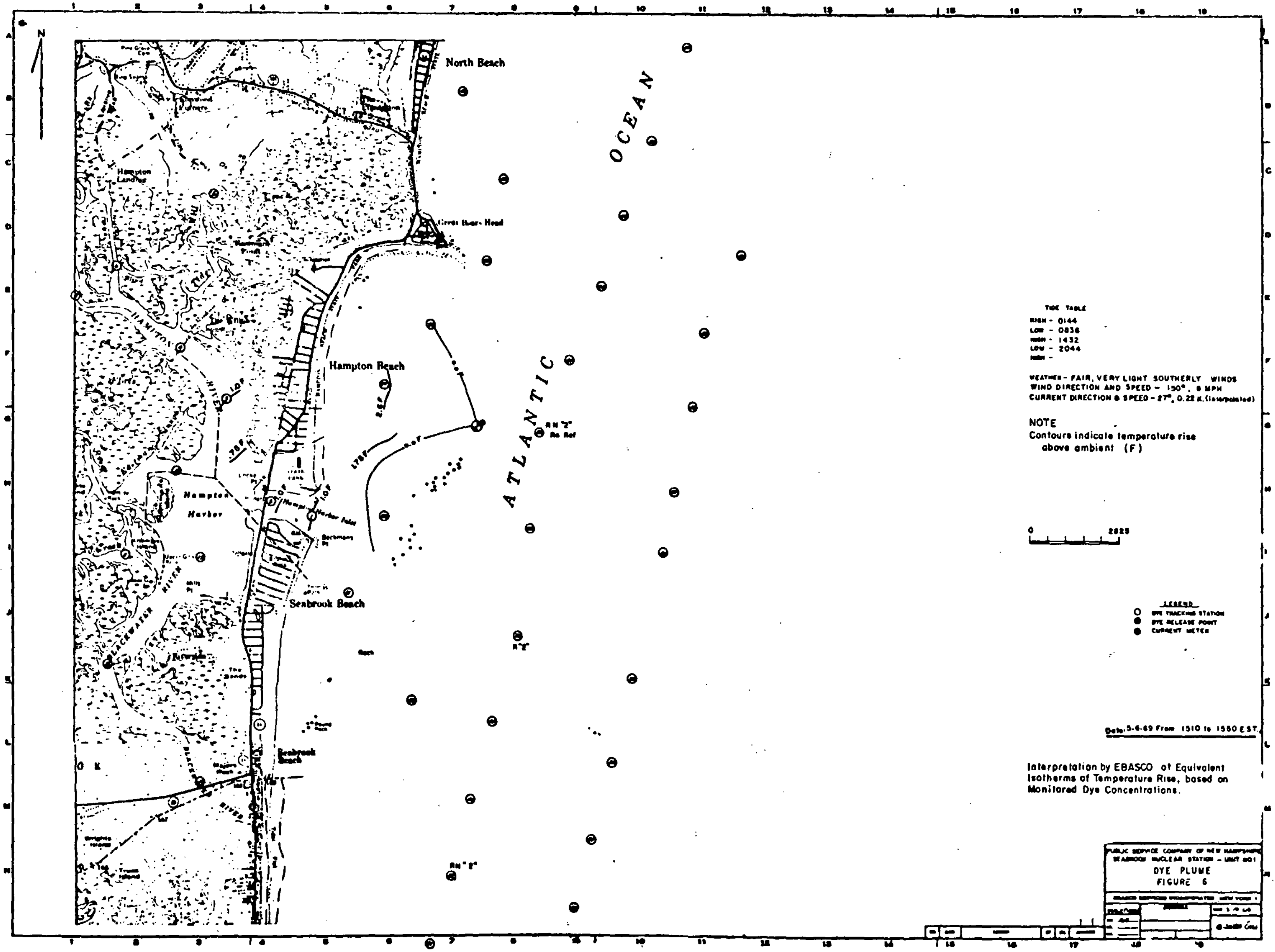

North Beach
OCEAN
Hampton Landing
Great Boars Head
Hampton Beach
ATLANTIC
From 4-25-69
To 5-2-69
From 5-6-69
To 5-17-69
From 4-14-69
To 4-24-69
From 12-11-68
To 12-13-68
Hampton Harbor
Hampton Harbor Inlet
HAMPTON RIVER
BLACKWATER RIVER
Seabrook Beach
From 5-26-69
To 5-28-69
From 5-21-69
To 5-28-69
N
LEGEND
DYE RELEASE POINT FOR APRIL-MAY RELEASE
DYE RELEASE POINT FOR DECEMBER RELEASE
0
2625
PUBLIC SERVICE CO. OF NEW HAMPSHIRE
SEABROOK NUCLEAR STN #1
LOCATION OF OFFSHORE
DYE. RELEASE POINTS
FIGURE 2
9-8735

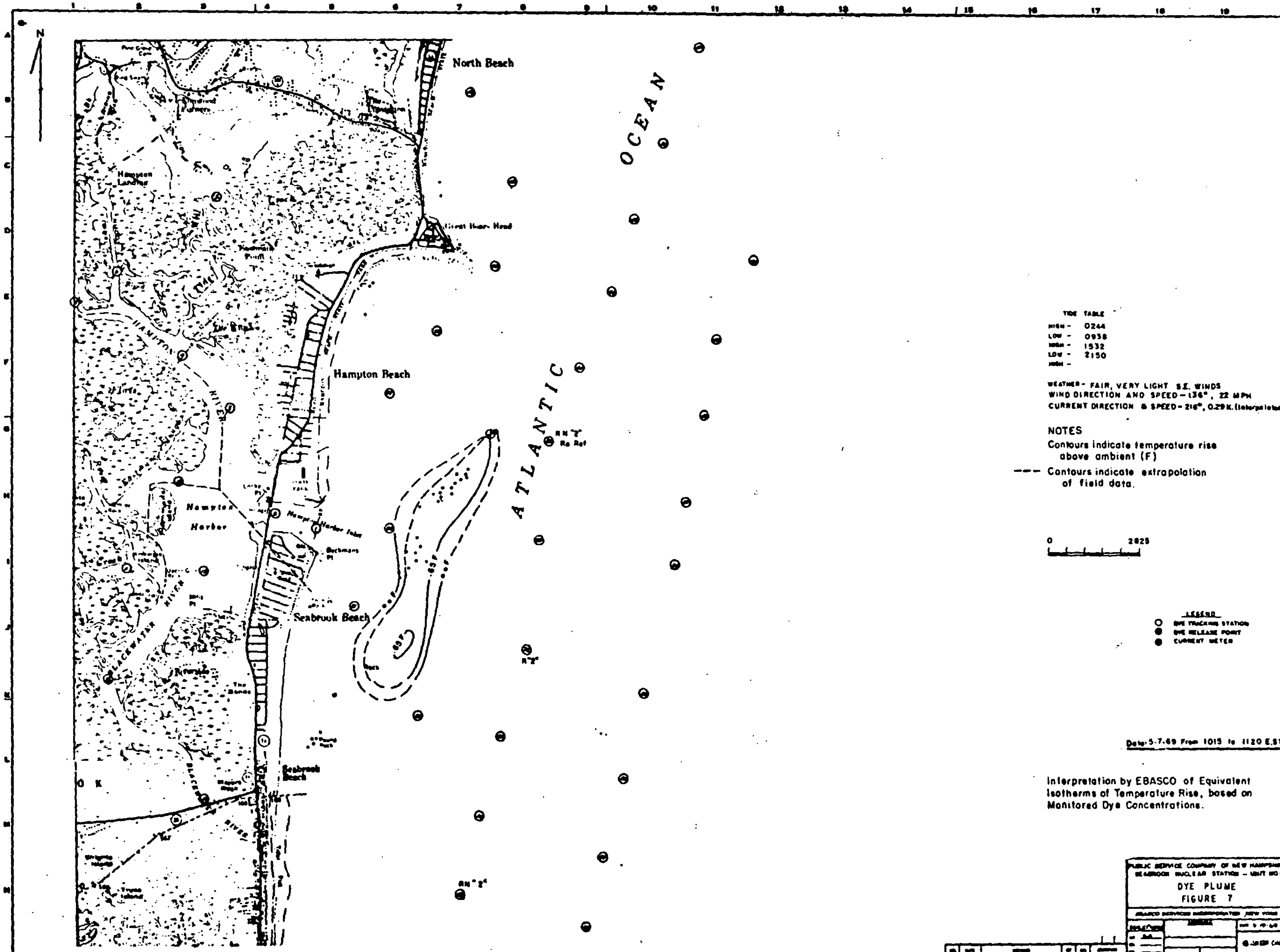

North Beach
OCEAN
Great Boars Head
Hampton Beach
ATLANTIC
Hampton Harbor
Seabrook Beach
HAMPTON RIVER
BLACKWATER RIVER
N
LEGEND
INDICATES DYE RELEASE TRACKING STATION FOR DECEMBER RELEASE
0
PUBLIC SERVICE CO. OF NEW HAMPSHIRE
SEABROOK NUCLEAR STN #1
LOCATION OF DYE
TRACKING STATION - DEC. 1968
FIGURE 3
8795

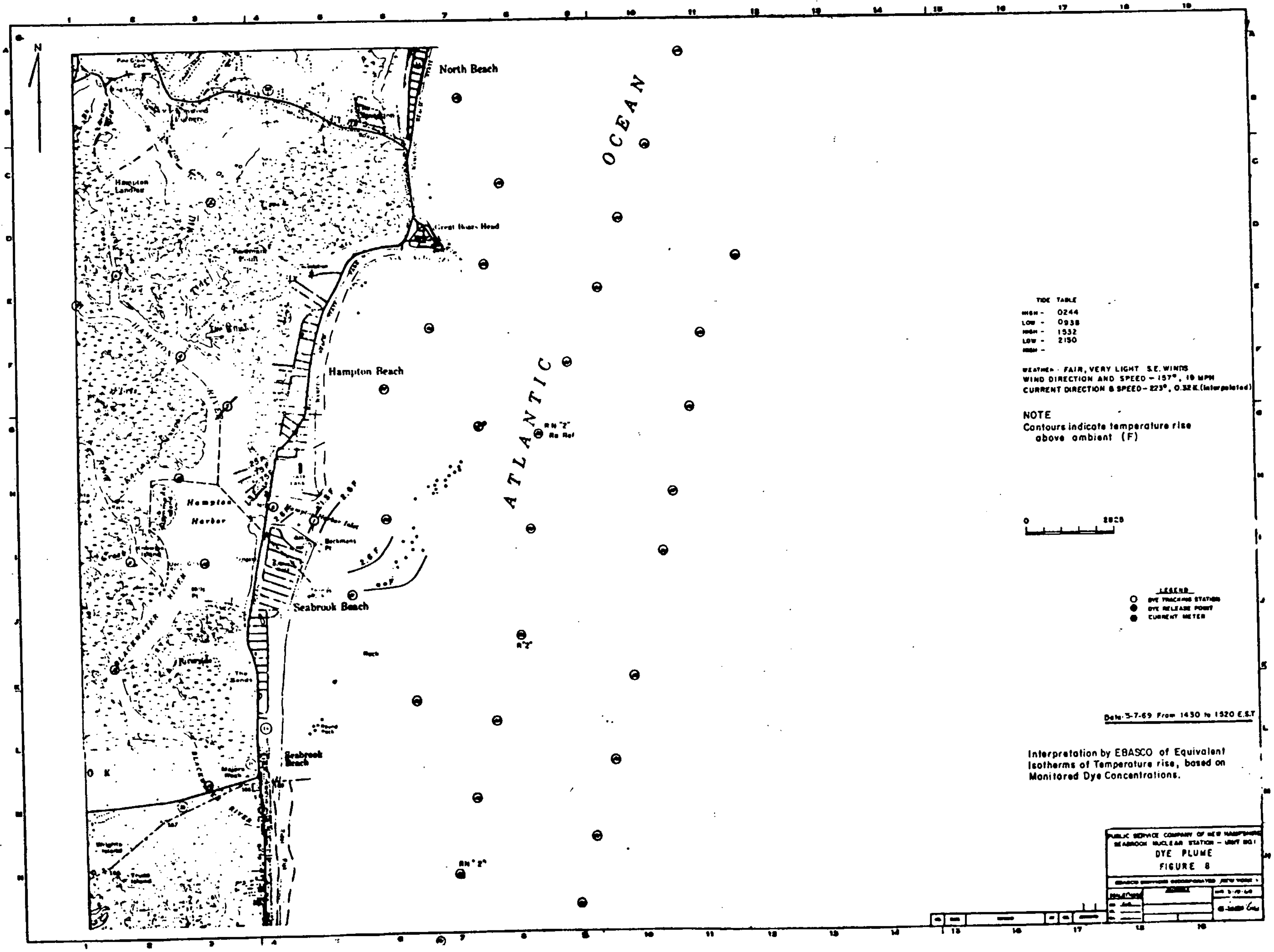

North Beach
Great Boars Head
Hampton Beach
Seabrook Beach
Seabrook Beach
Hampton Harbor
HAMPTON RIVER
ATLANTIC OCEAN
LEGEND
INDICATES DYE RELEASE TRACKING STATION FOR APRIL - MAY 1968
0
2825
PUBLIC SERVICE CO. OF NEW HAMPSHIRE
SEABROOK NUCLEAR STN #1
LOCATION OF DYE
TRACKING STA.-APRIL- MAY 1968
FIGURE 4
#8735



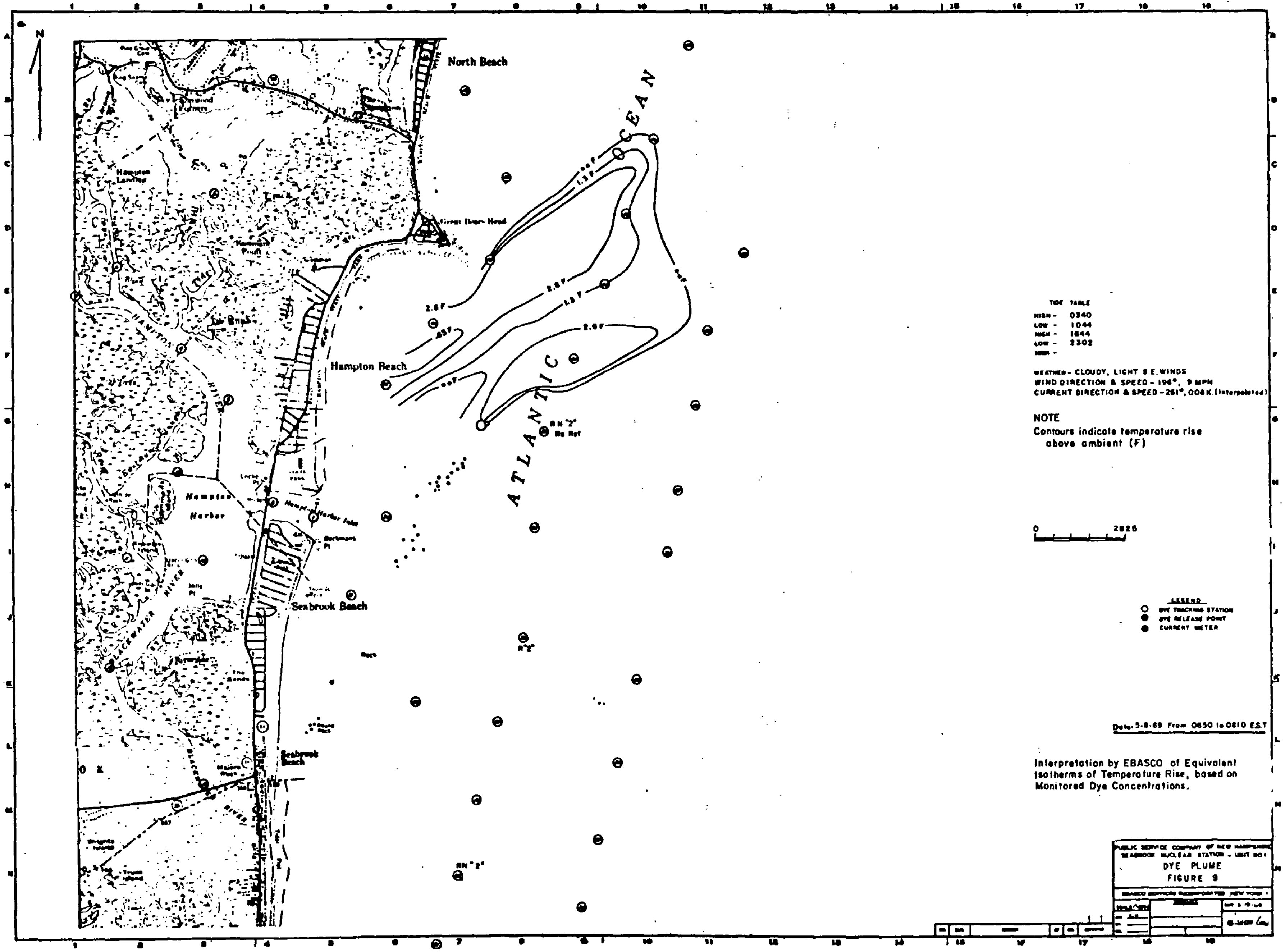
North Beach
Great Boars Head
Hampton Beach
Hampton Harbor
Seabrook Beach
ATLANTIC OCEAN
RN "2"
TIDE TABLE
HIGH - 0144
LOW - 0838
HIGH - 1432
LOW - 2044
WEATHER - FAIR, VERY LIGHT NORTHERLY WINDS
WIND DIRECTION AND SPEED - 296°, 8 MPH
CURRENT DIRECTION & SPEED - 249°, 0.37K (interpolated)
NOTES
Contours indicate temperature rise above ambient (F)
--- Contours indicate extrapolation of field data
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-6-69 From 0930 to 1025 EST
Interpretation by EBASCO of equivalent isotherms of temperature rise, based on Monitored Dye Concentrations
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 5

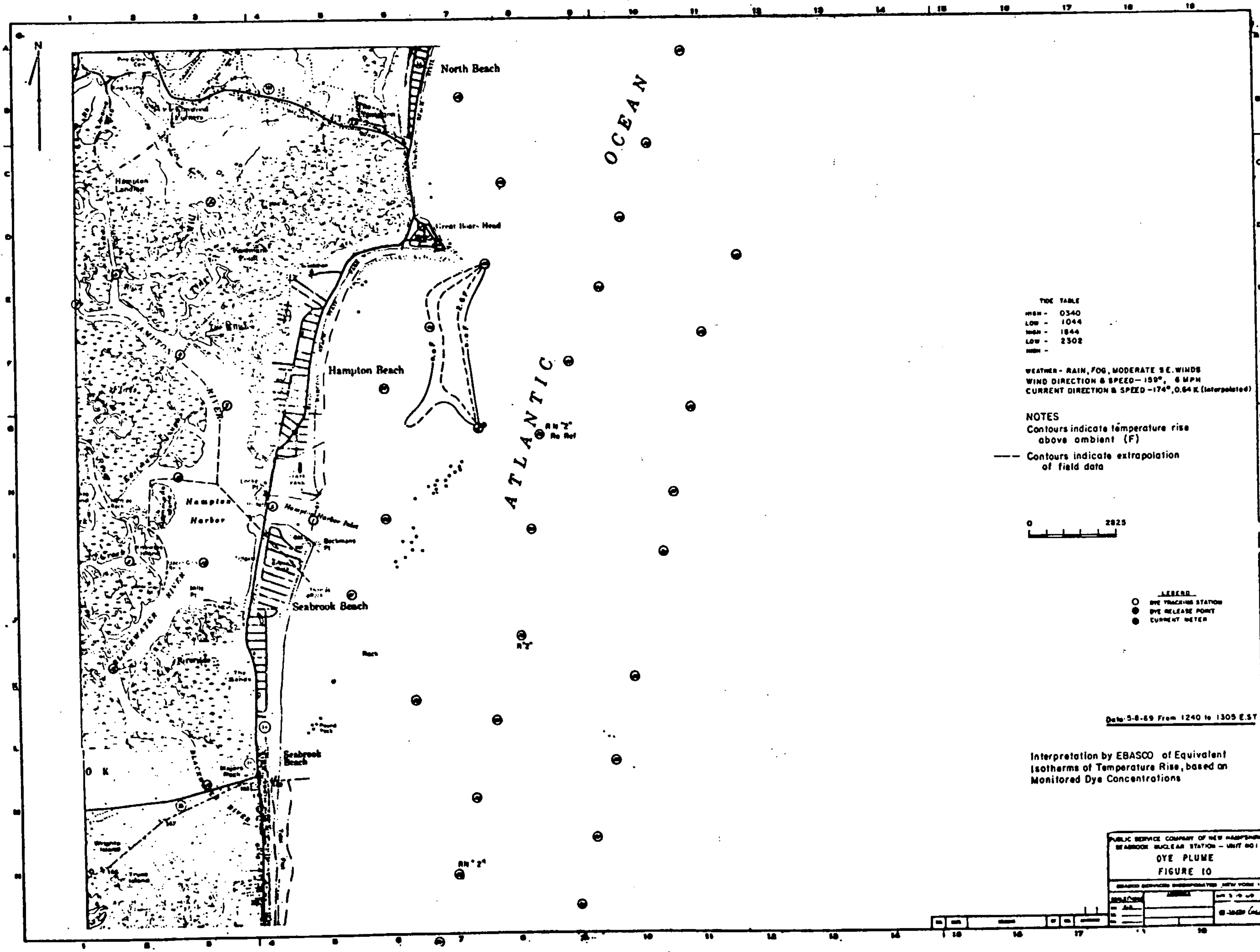

North Beach
OCEAN
ATLANTIC
Hampton Beach
Hampton Harbor
Seabrook Beach
Hampton Landing
TIDE TABLE
HIGH - 0144
LOW - 0836
HIGH - 1432
LOW - 2044
HIGH -
WEATHER - FAIR, VERY LIGHT SOUTHERLY WINDS
WIND DIRECTION AND SPEED - 150°, 8 MPH
CURRENT DIRECTION & SPEED - 27°, 0.22 K. (Interpolated)
NOTE
Contours indicate temperature rise above ambient (F)
0
2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-6-69 From 1510 to 1580 E.S.T.
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 6


North Beach
Great Boar's Head
Hampton Beach
Hampton Harbor
Seabrook Beach
ATLANTIC
OCEAN
N
TIDE TABLE
HIGH - 0244
LOW - 0938
HIGH - 1532
LOW - 2150
HIGH -
WEATHER - FAIR, VERY LIGHT S.E. WINDS
WIND DIRECTION AND SPEED - 136°, 22 MPH
CURRENT DIRECTION & SPEED - 216°, 0.29 K. (Interpolated)
NOTES
Contours indicate temperature rise above ambient (F)
--- Contours indicate extrapolation of field data.
0
2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-7-69 From 1015 to 1120 E.S.T.
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 7

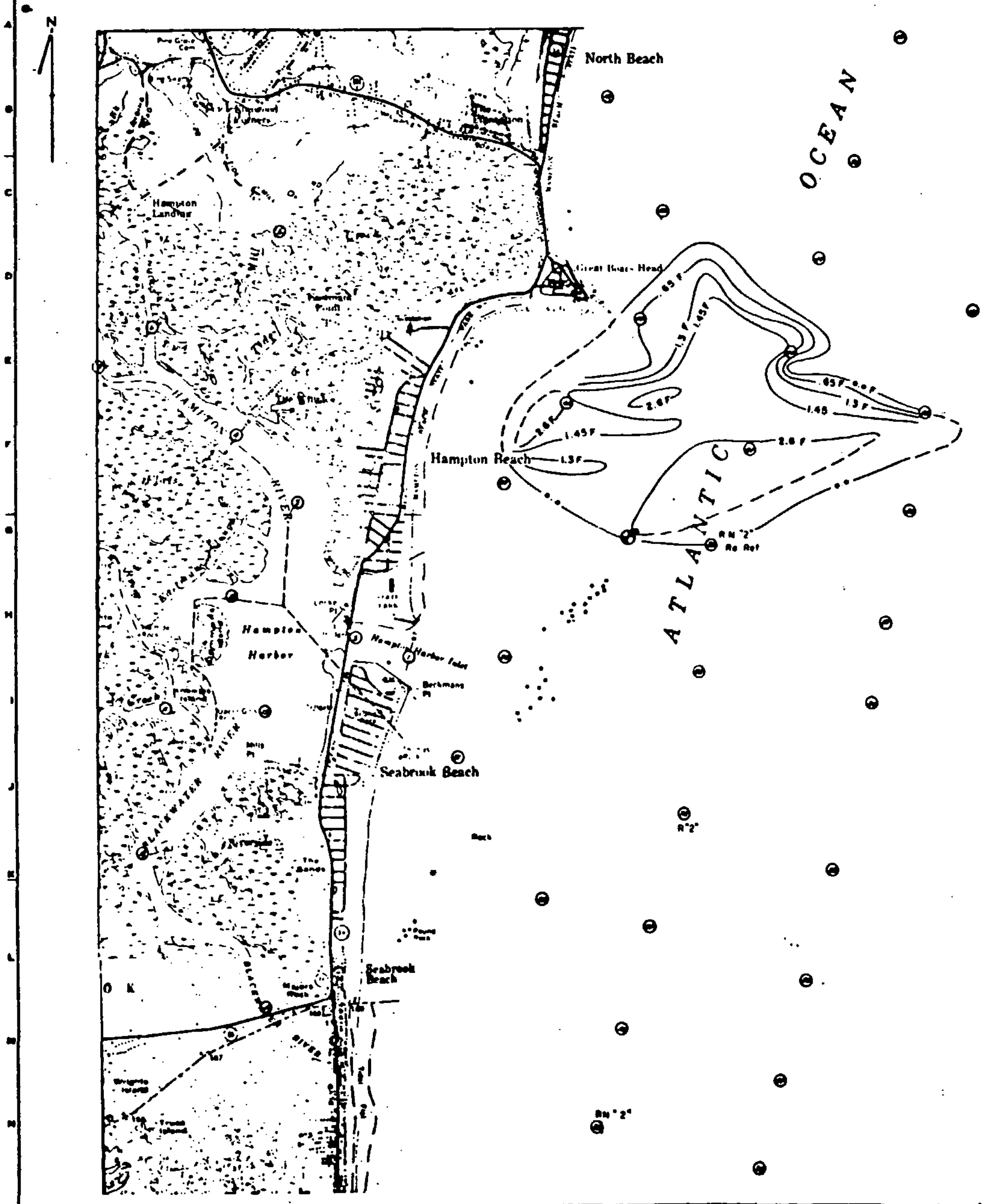


North Beach
OCEAN
ATLANTIC
Great Boars Head
Hampton Beach
Hampton Harbor
Seabrook Beach
Hampton Landing
Bachmans Pt
TIDE TABLE
HIGH - 0244
LOW - 0938
HIGH - 1532
LOW - 2150
HIGH -
WEATHER - FAIR, VERY LIGHT S.E. WINDS
WIND DIRECTION AND SPEED - 157°, 10 MPH
CURRENT DIRECTION & SPEED - 223°, 0.32 K (Interpolated)
NOTE
Contours indicate temperature rise above ambient (F)
0
2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-7-69 From 1430 to 1520 E.S.T
Interpretation by EBASCO of Equivalent Isotherms of Temperature rise, based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 8


North Beach
Hampton Beach
Seabrook Beach
Hampton Harbor
ATLANTIC OCEAN
2.6 F
1.3 F
0.6 F
RN "2"
TIDE TABLE
HIGH - 0340
LOW - 1044
HIGH - 1644
LOW - 2302
WEATHER - CLOUDY, LIGHT S.E. WINDS
WIND DIRECTION & SPEED - 196°, 9 MPH
CURRENT DIRECTION & SPEED - 261°, 008 K. (Interpolated)
NOTE
Contours indicate temperature rise above ambient (F)
0 2826
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-8-69 From 0650 to 0810 E.S.T.
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 9



North Beach
Great Boar's Head
Hampton Beach
Hampton Harbor
Seabrook Beach
Seabrook Beach
Hampton Landing
ATLANTIC
OCEAN
TIDE TABLE
HIGH - 0340
LOW - 1044
HIGH - 1644
LOW - 2302
HIGH -
WEATHER - RAIN, FOG, MODERATE S.E. WINDS
WIND DIRECTION & SPEED - 159°, 6 MPH
CURRENT DIRECTION & SPEED - 174°, 0.64 K (interpolated)
NOTES
Contours indicate temperature rise above ambient (F)
--- Contours indicate extrapolation of field data
0
2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-8-69 From 1240 to 1305 E.S.T
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 10



TIDE TABLE	
HIGH -	0502
LOW -	1150
HIGH -	1750
LOW -	
HIGH -	

WEATHER -
WIND DIRECTION & SPEED — 212°, 15 MPH
CURRENT DIRECTION & SPEED - 57°, 0.77 (Interpolated)

NOTES
Contours indicate temperature rise above ambient (F)
---- Contours indicate extrapolation of field data

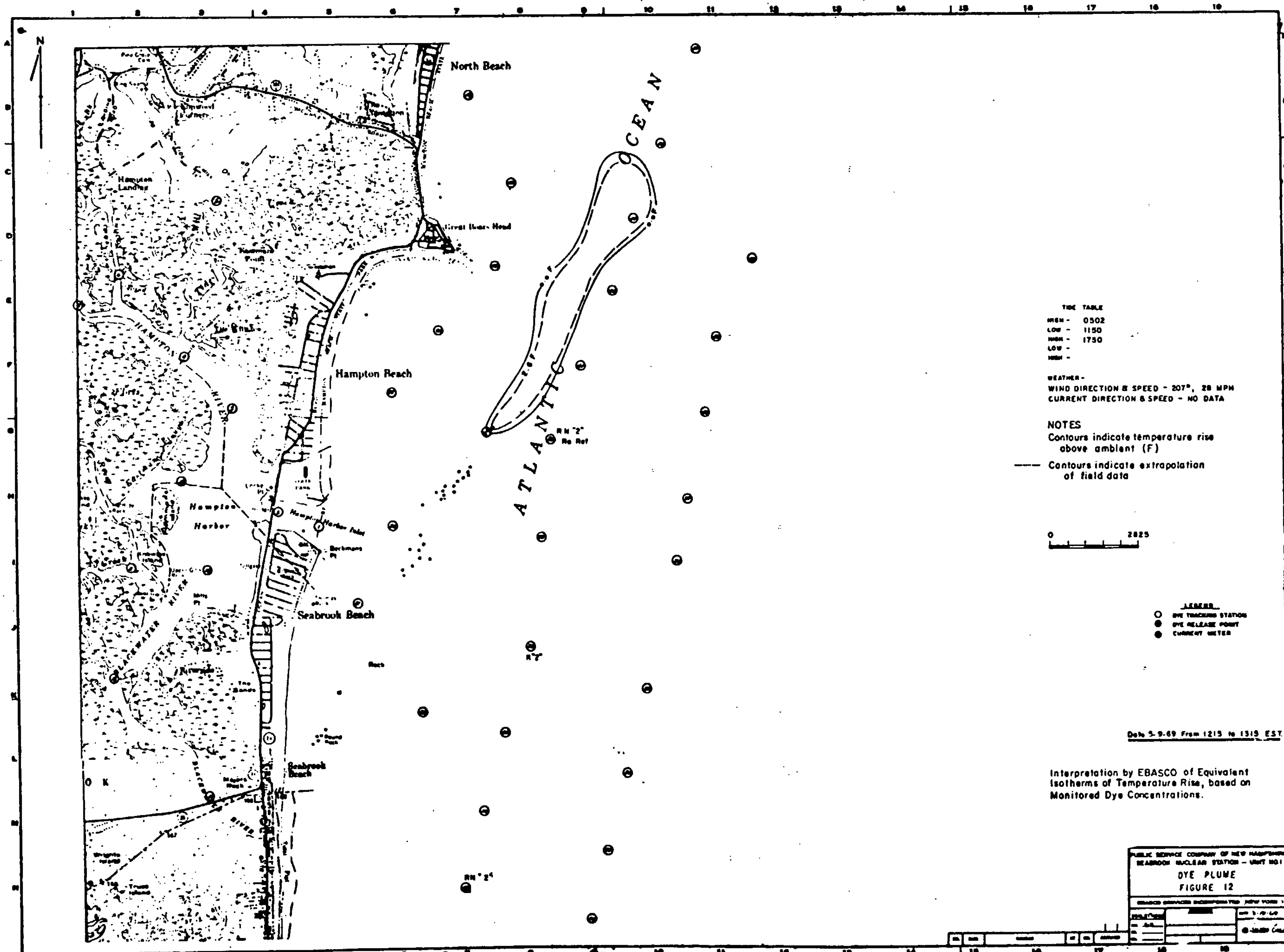
0 2025

LEGEND
○ DYE TRACKING STATION
● DYE RELEASE POINT
● CURRENT METER

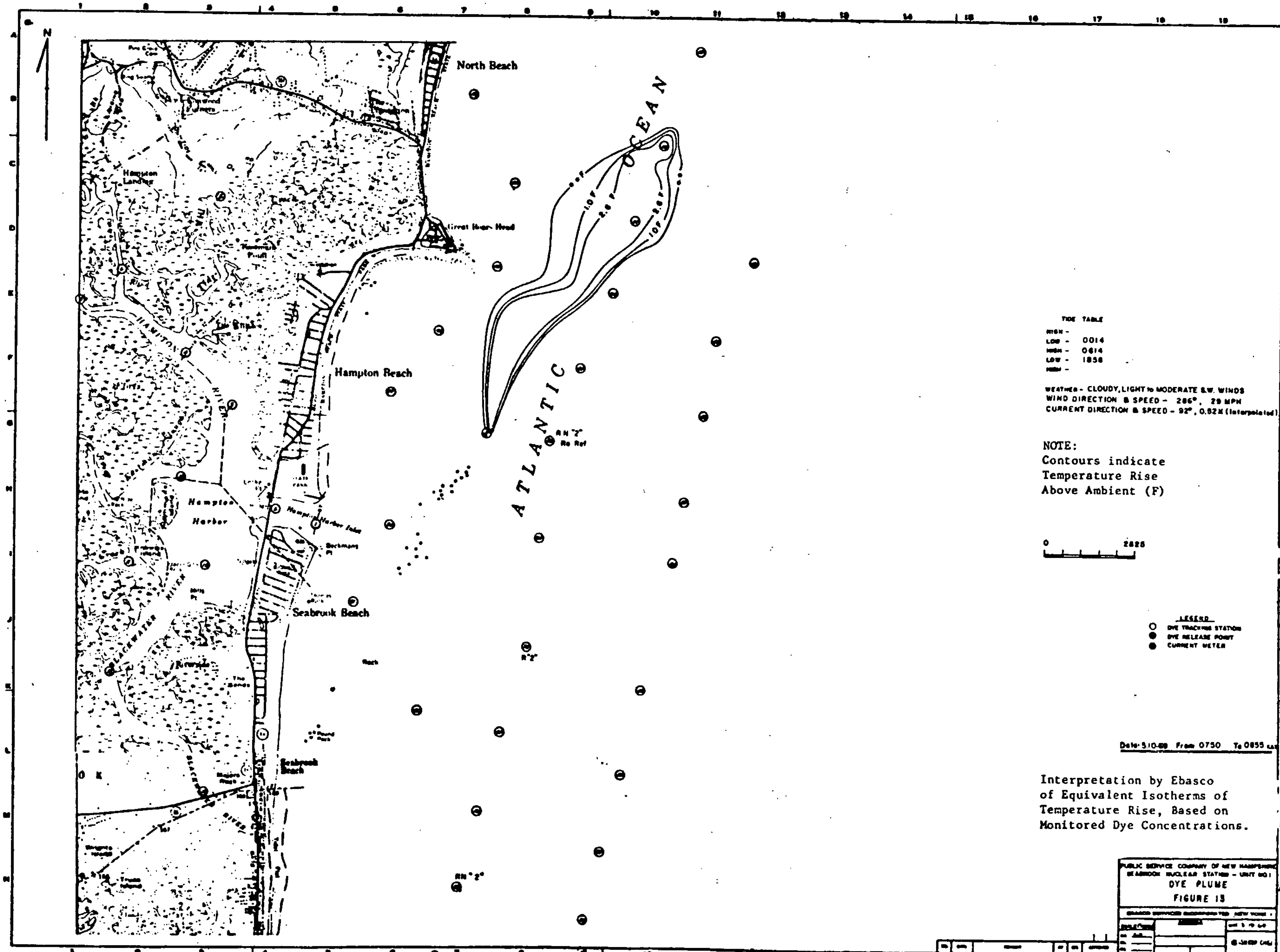
Date: 5-9-69 From 0650 to 0810 E.S.T.

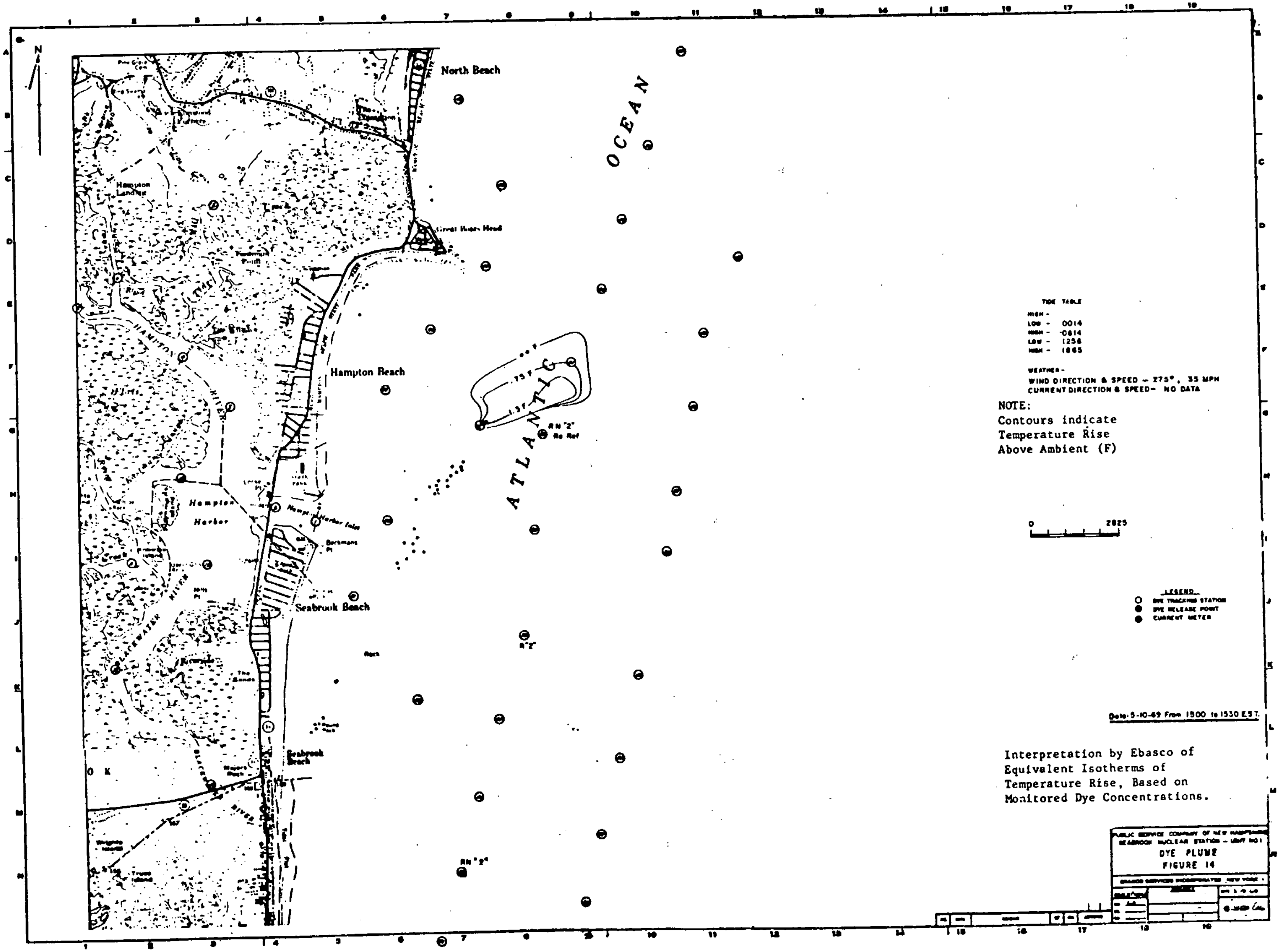
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations.

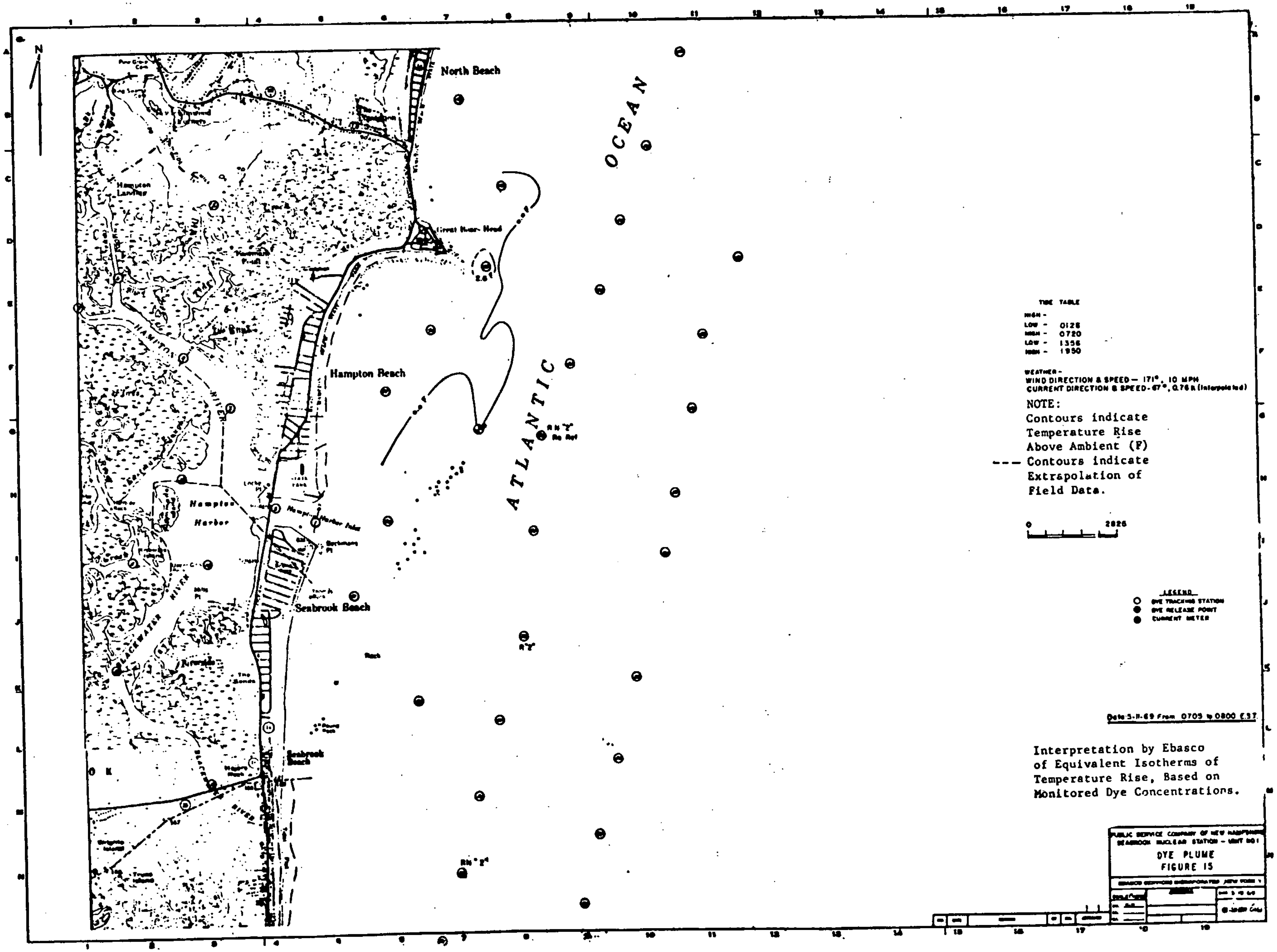
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 11
EBASCO SERVICES INCORPORATED NEW YORK

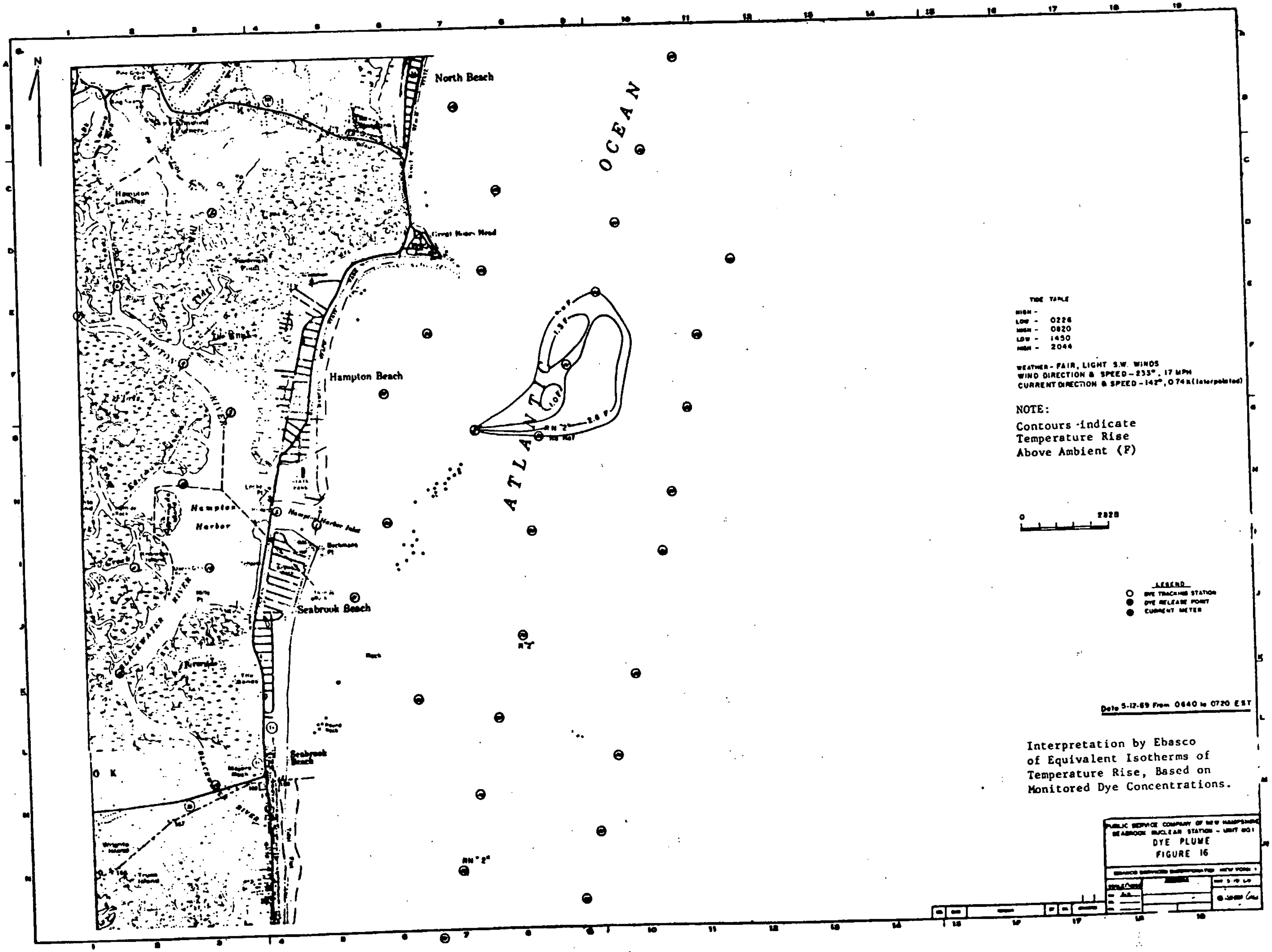


North Beach
Great Boars Head
Hampton Beach
Hampton Harbor
Hampton Harbor Inlet
Seabrook Beach
Hampton Landing
ATLANTIC OCEAN
RN "2" Ra Ref
TIDE TABLE
HIGH - 0502
LOW - 1150
HIGH - 1750
LOW -
HIGH -
WEATHER -
WIND DIRECTION & SPEED - 207°, 28 MPH
CURRENT DIRECTION & SPEED - NO DATA
NOTES
Contours indicate temperature rise above ambient (F)
Contours indicate extrapolation of field data
0 2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-9-69 From 1215 to 1315 EST
Interpretation by EBASCO of Equivalent Isotherms of Temperature Rise, based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 12

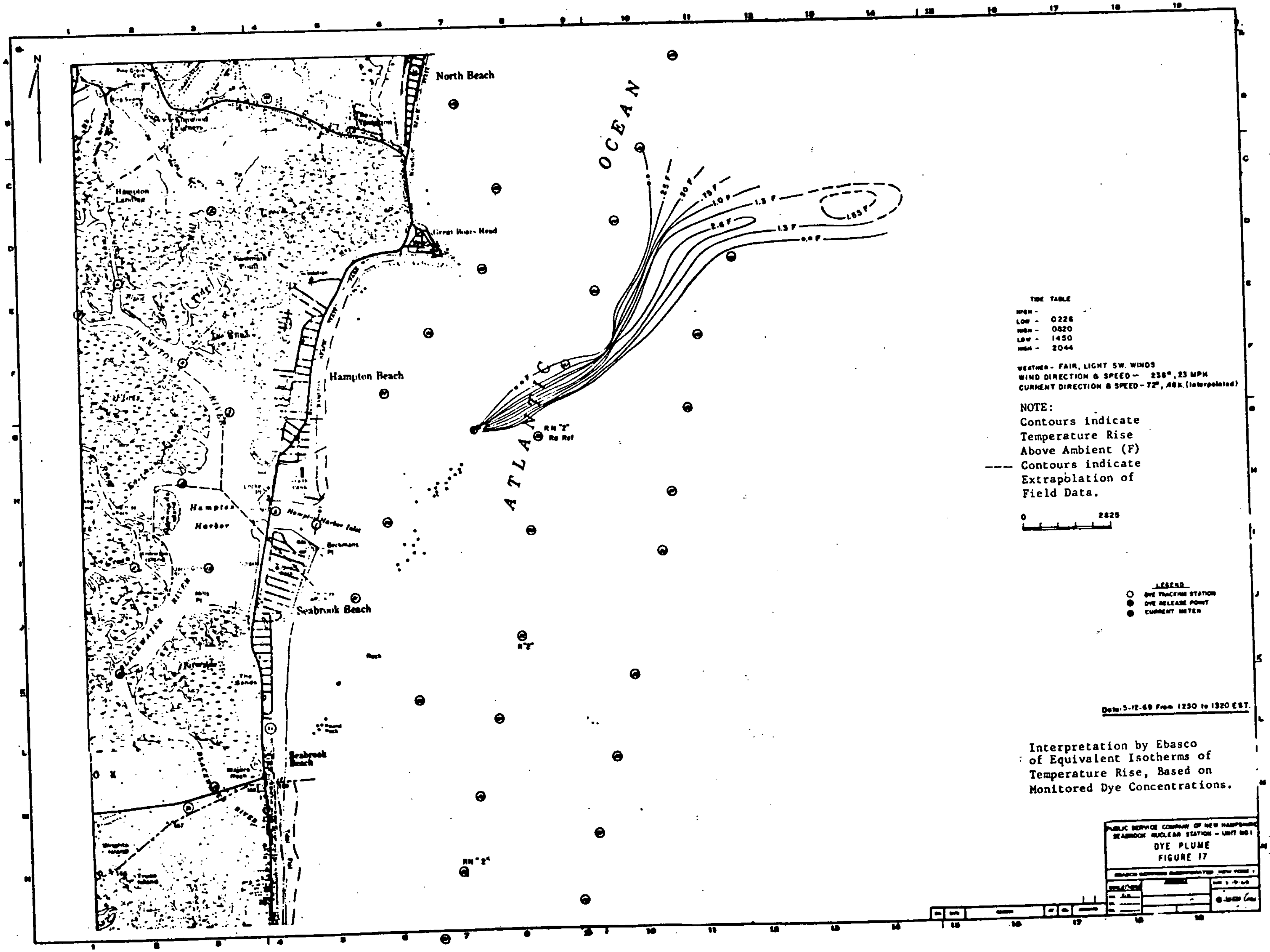

North Beach
Hampton Beach
Seabrook Beach
Hampton Harbor
ATLANTIC OCEAN
RN "2"
TIDE TABLE
HIGH -
LOW - 0014
HIGH - 0614
LOW - 1856
HIGH -
WEATHER - CLOUDY, LIGHT to MODERATE S.W. WINDS
WIND DIRECTION & SPEED - 286°, 29 MPH
CURRENT DIRECTION & SPEED - 92°, 0.82 K (Interpolated)
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
0 2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-10-69 From 0750 To 0855
Interpretation by Ebasco
of Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 13


North Beach
ATLANTIC
OCEAN
Hampton Beach
Hampton Harbor
Seabrook Beach
Seabrook Beach
TIDE TABLE
HIGH -
LOW - 0014
HIGH - 0614
LOW - 1256
HIGH - 1865
WEATHER -
WIND DIRECTION & SPEED - 275°, 35 MPH
CURRENT DIRECTION & SPEED - NO DATA
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
0
2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-10-69 From 1500 to 1530 E.S.T.
Interpretation by Ebasco of
Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
DYE PLUME
FIGURE 14

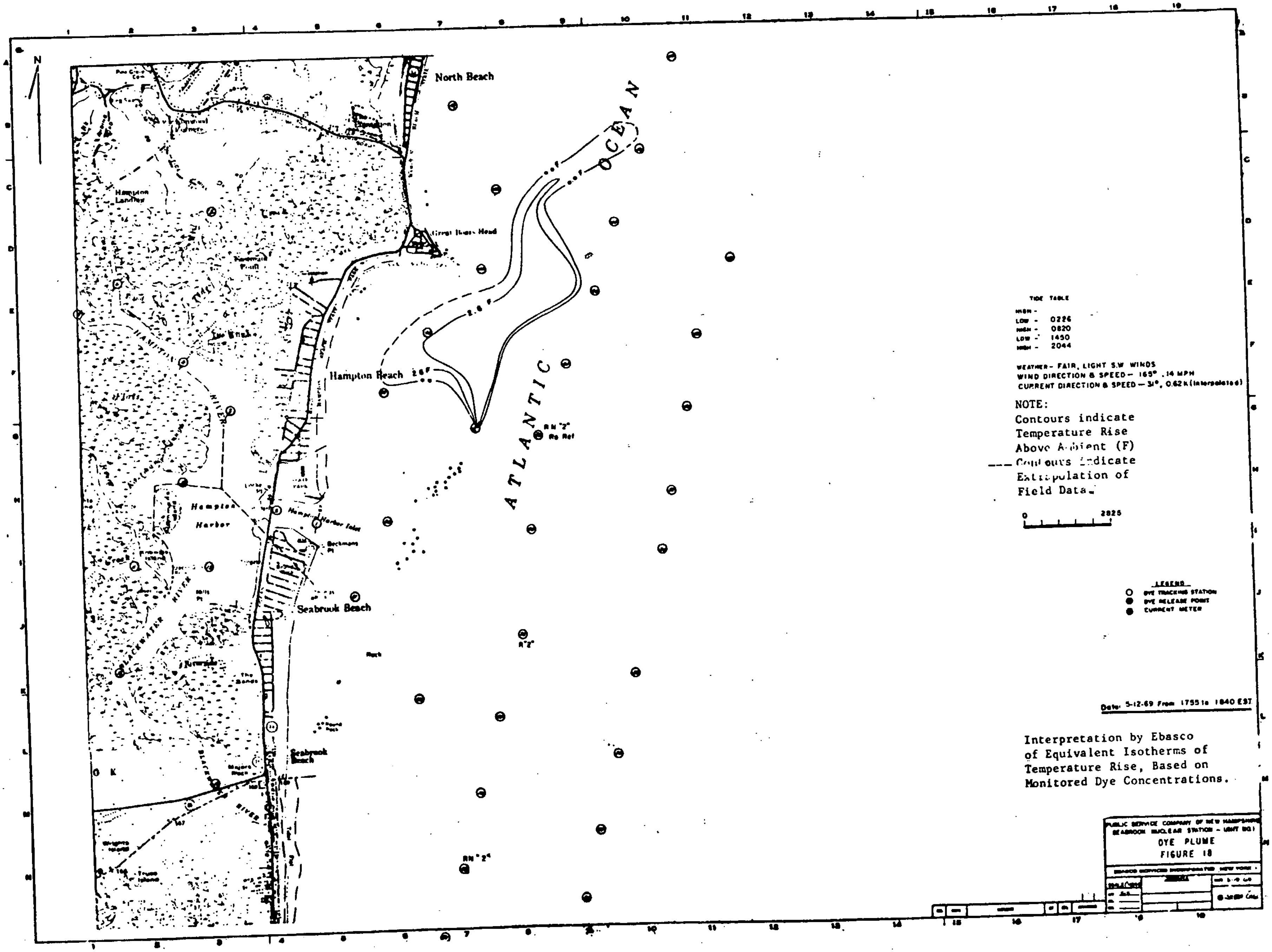

N
North Beach
Hampton Landing
Hampton Beach
Hampton Harbor
Seabrook Beach
ATLANTIC OCEAN
TIDE TABLE
HIGH -
LOW - 0125
HIGH - 0720
LOW - 1356
HIGH - 1950
WEATHER -
WIND DIRECTION & SPEED — 171°, 10 MPH
CURRENT DIRECTION & SPEED - 67°, 0.76 k (Interpolated)
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
--- Contours indicate
Extrapolation of
Field Data.
0
2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-11-69 From 0705 to 0800 E.S.T.
Interpretation by Ebasco
of Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 15

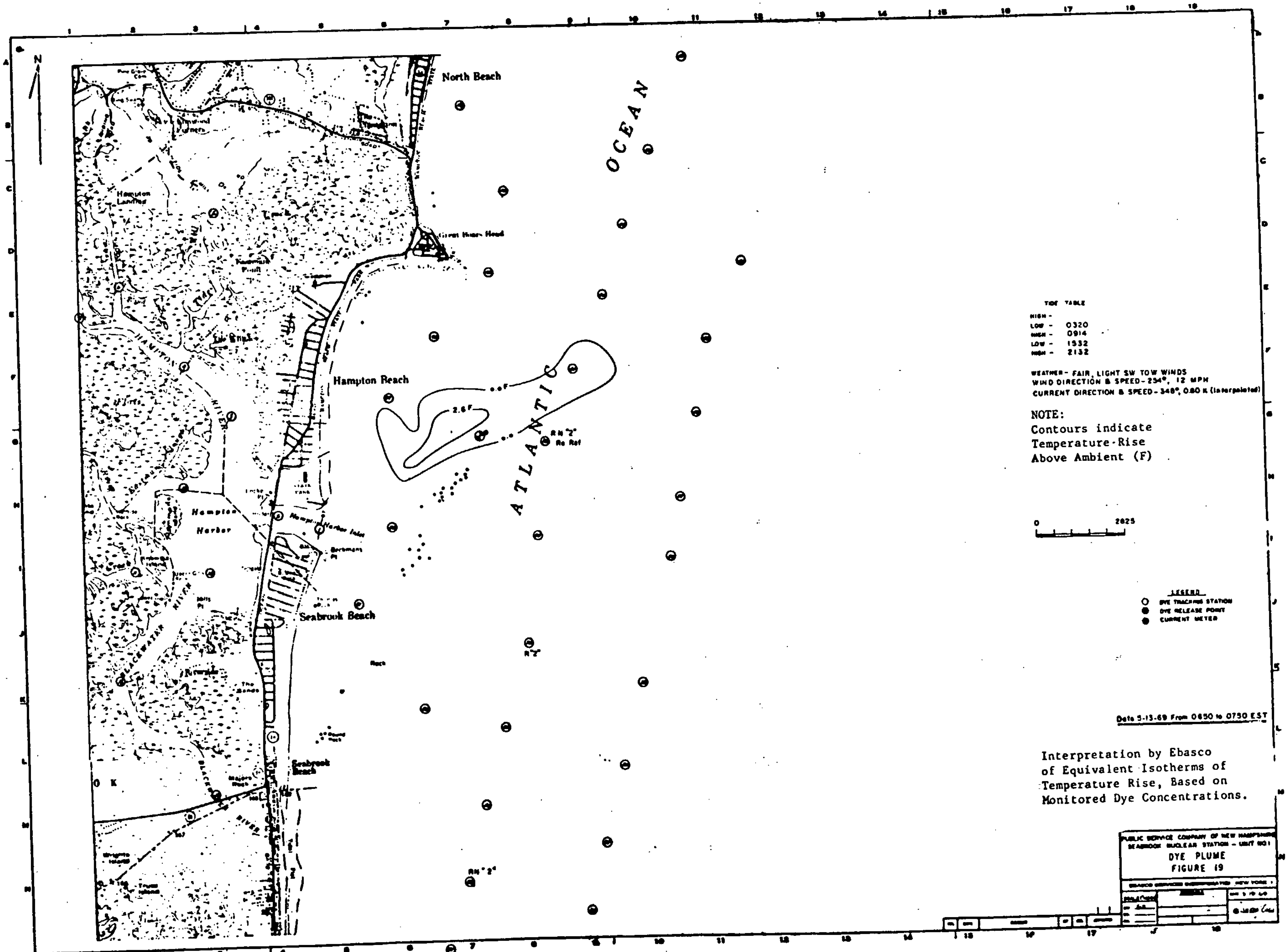


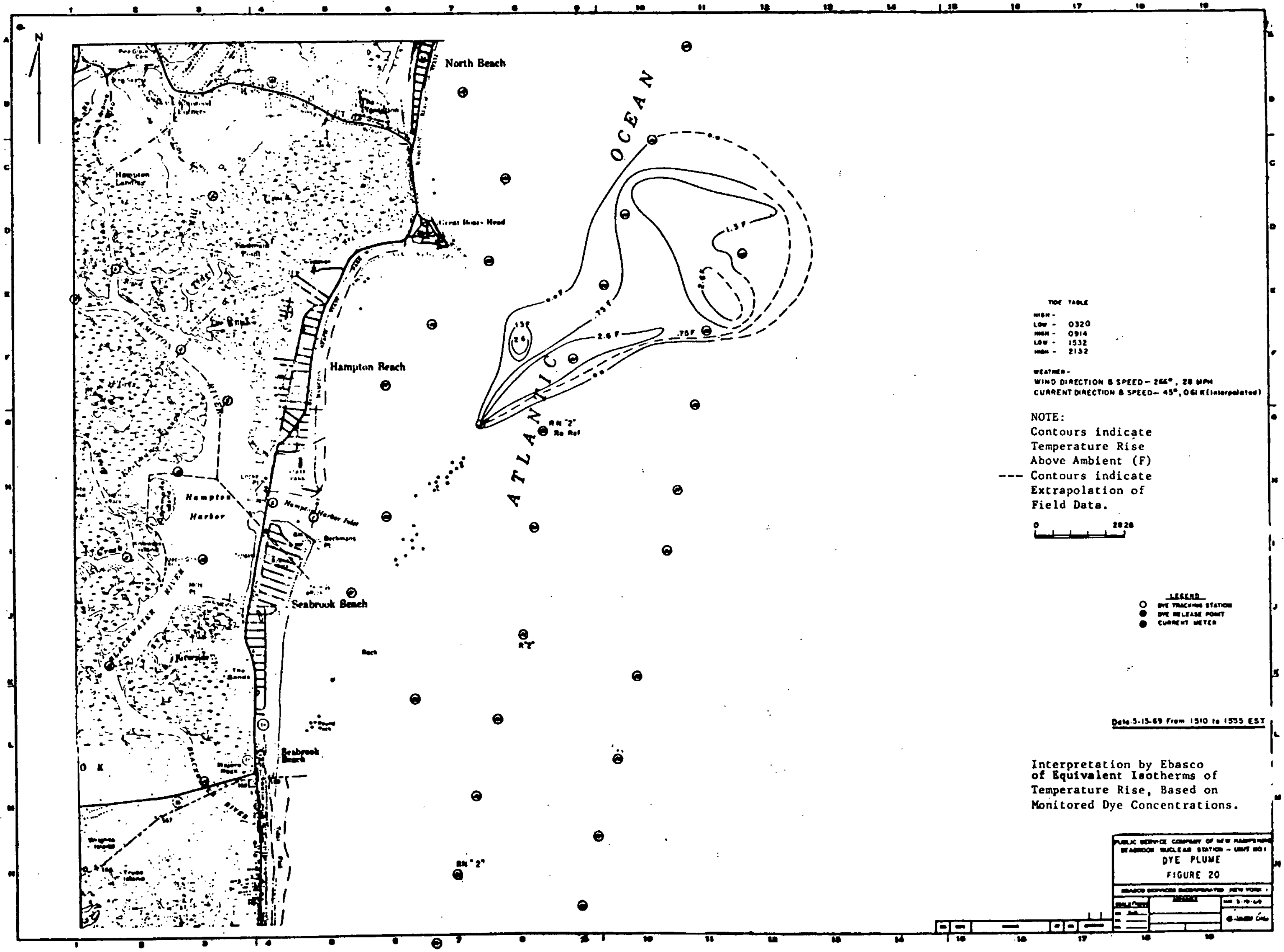
North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
Hampton River
Blackwater River
TIDE TABLE
HIGH -
LOW - 0226
HIGH - 0820
LOW - 1450
HIGH - 2044
WEATHER - FAIR, LIGHT S.W. WINDS
WIND DIRECTION & SPEED - 233°, 17 MPH
CURRENT DIRECTION & SPEED - 142°, 0.74 K (interpolated)
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
0
2828
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-12-69 From 0640 to 0720 EST
Interpretation by Ebasco
of Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 16



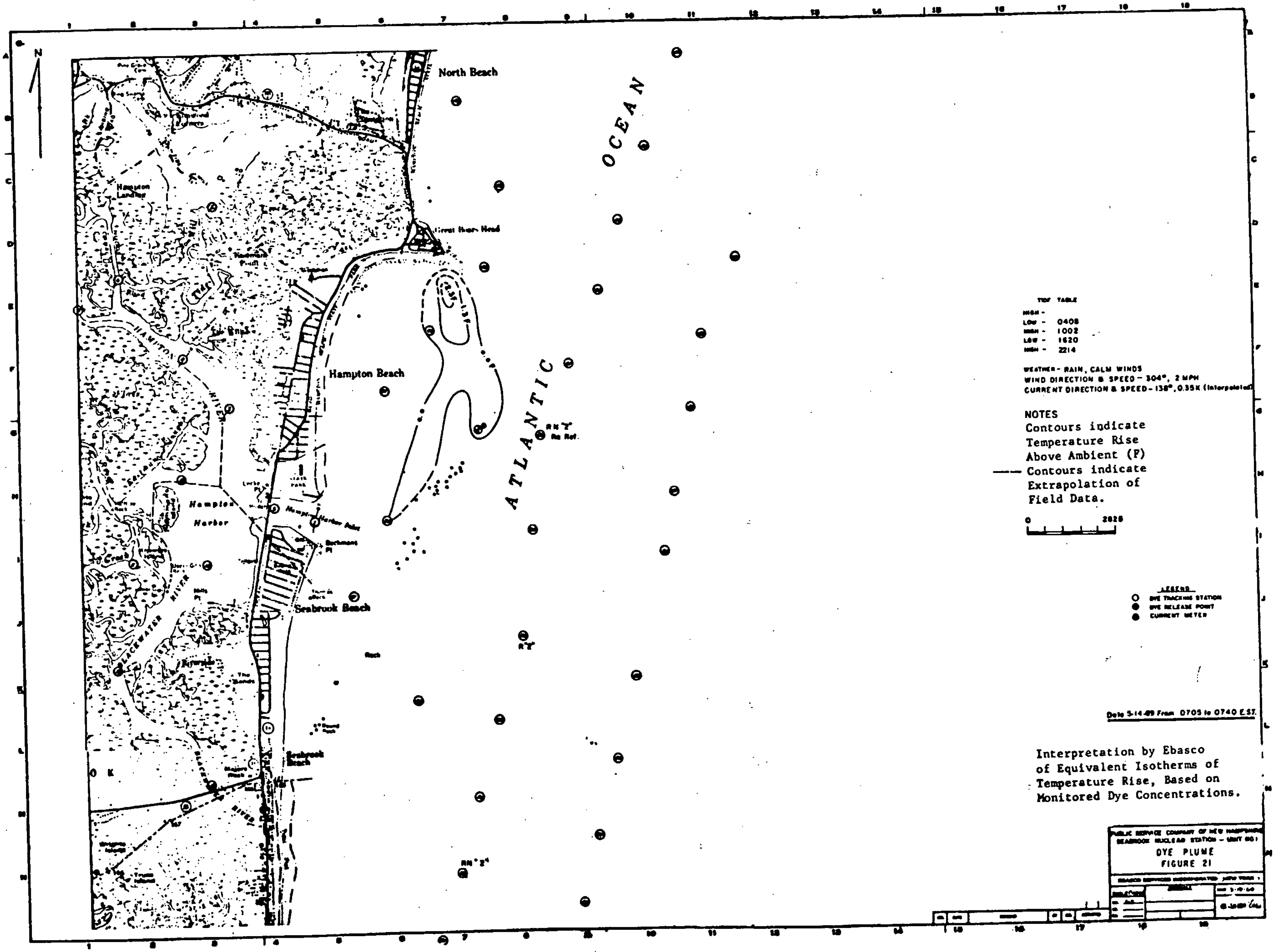
North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
Hampton River
Blackwater River
2.5 F
2.0 F
1.5 F
1.0 F
1.3 F
2.6 F
0.9 F
0.65 F
RN "2" Rg Ref
TIDE TABLE
HIGH -
LOW - 0226
HIGH - 0820
LOW - 1450
HIGH - 2044
WEATHER - FAIR, LIGHT SW. WINDS
WIND DIRECTION & SPEED - 238°, 23 MPH
CURRENT DIRECTION & SPEED - 72°, .48K (Interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0 2825
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-12-69 From 1230 to 1320 EST.
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 17

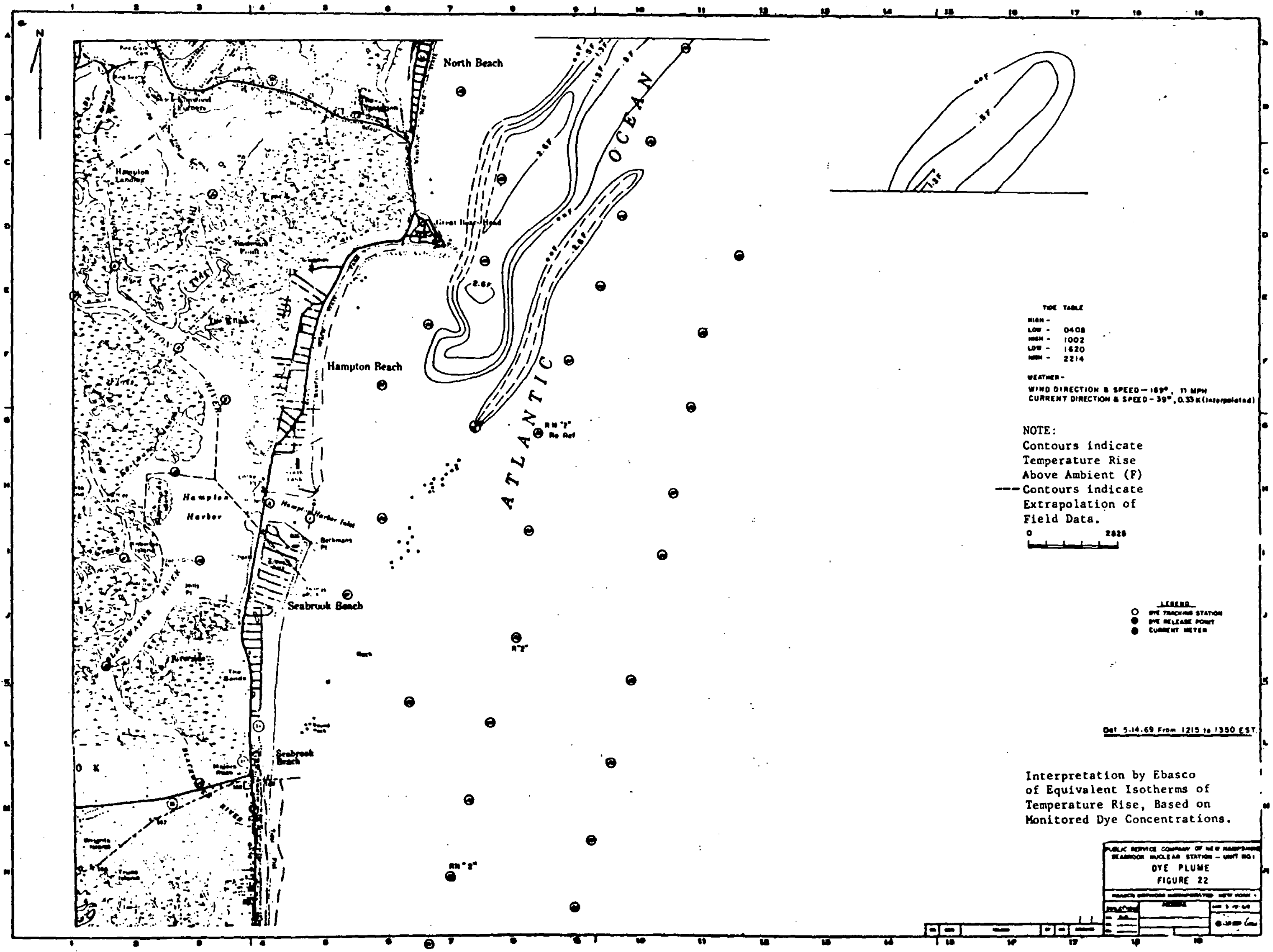

North Beach
Hampton Landing
Great Boars Head
Hampton Beach
ATLANTIC OCEAN
Hampton Harbor
Hampton River
Hampton Harbor Inlet
Seabrook Beach
Blackwater River
R N "2"
N
TIDE TABLE
HIGH -
LOW - 0226
HIGH - 0820
LOW - 1450
HIGH - 2044
WEATHER - FAIR, LIGHT S.W. WINDS
WIND DIRECTION & SPEED - 165°, 14 MPH
CURRENT DIRECTION & SPEED - 31°, 0.62 K (Interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date: 5-12-69 From 1755 to 1840 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 18

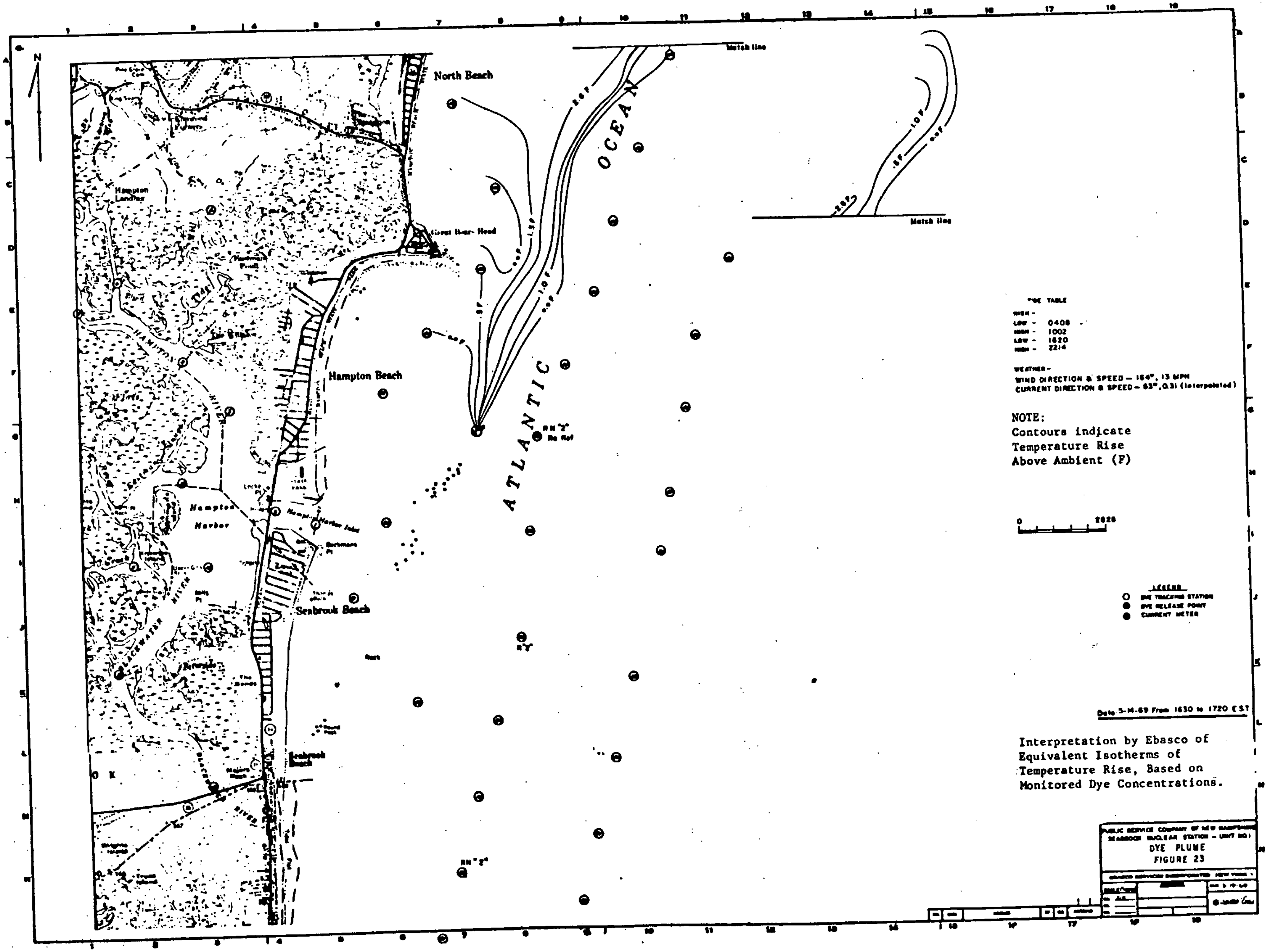

North Beach
OCEAN
ATLANTIC
Hampton Beach
Hampton Harbor
Seabrook Beach
2.6°F
TIDE TABLE
HIGH -
LOW - 0320
HIGH - 0914
LOW - 1532
HIGH - 2132
WEATHER - FAIR, LIGHT SW TO W WINDS
WIND DIRECTION & SPEED - 234°, 12 MPH
CURRENT DIRECTION & SPEED - 348°, 0.80 K (interpolated)
NOTE:
Contours indicate
Temperature-Rise
Above Ambient (F)
0
2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-13-69 From 0650 to 0750 EST
Interpretation by Ebasco
of Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 19

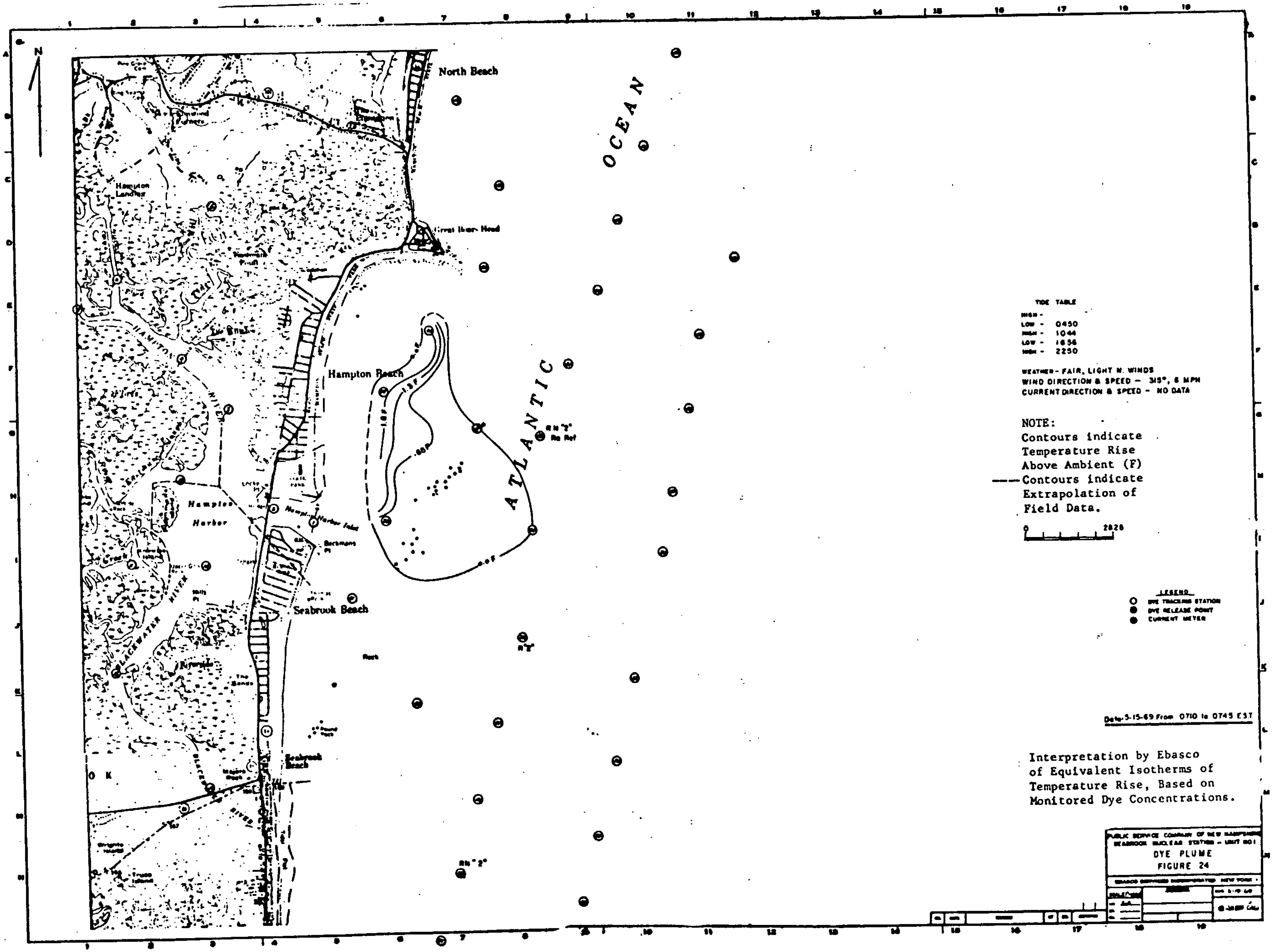


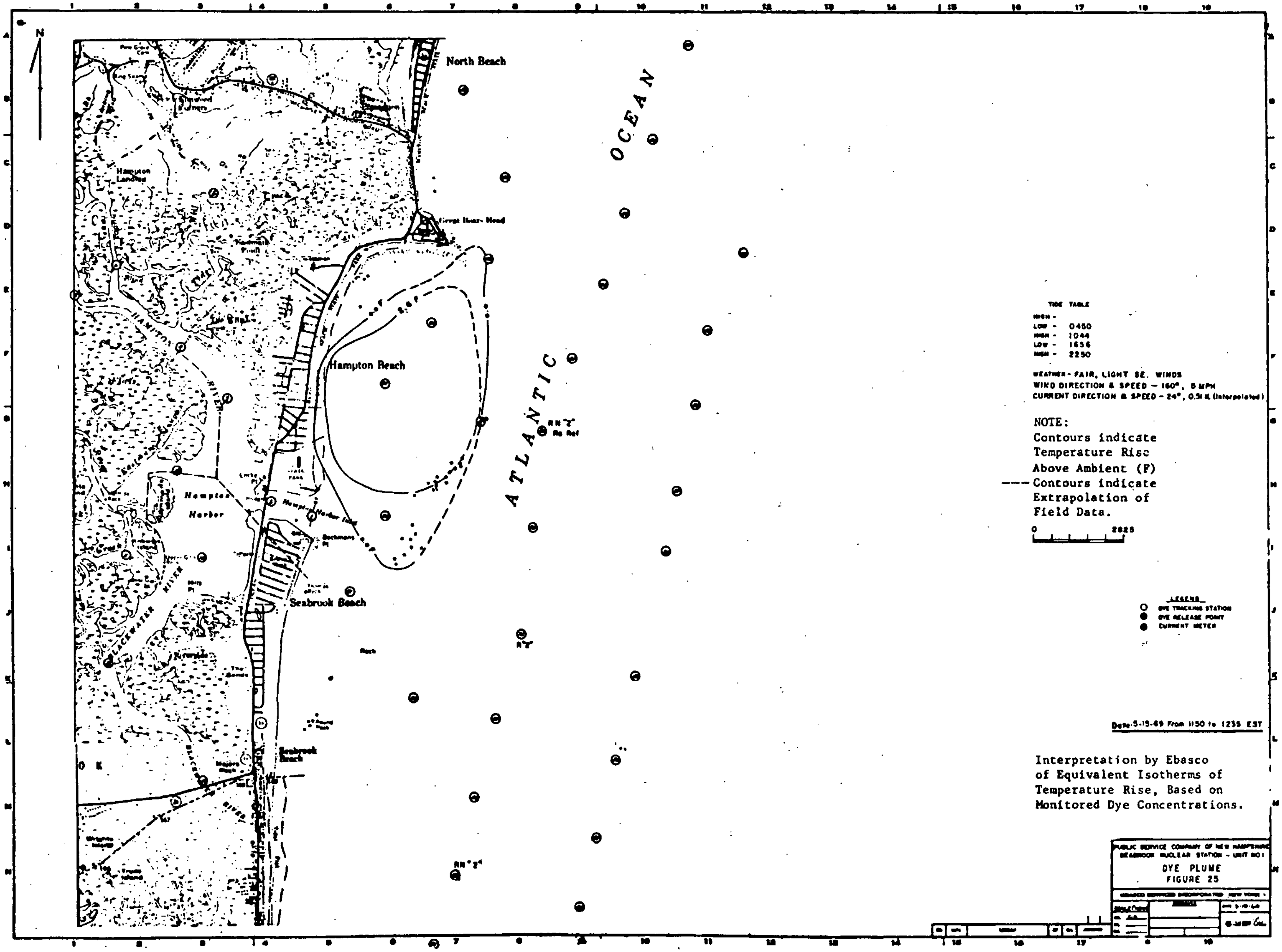
N
North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
1.3 F
2.6 F
.75 F
RN "2"
TIDE TABLE
HIGH -
LOW - 0320
HIGH - 0914
LOW - 1532
HIGH - 2132
WEATHER -
WIND DIRECTION & SPEED – 266°, 28 MPH
CURRENT DIRECTION & SPEED – 45°, 0.61 K (interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0
2828
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-15-69 From 1510 to 1555 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION – UNIT NO 1
DYE PLUME
FIGURE 20
EBASCO SERVICES INCORPORATED NEW YORK


North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
TIDE TABLE
LOW - 0408
HIGH - 1002
LOW - 1620
HIGH - 2214
WEATHER - RAIN, CALM WINDS
WIND DIRECTION & SPEED - 304°, 2 MPH
NOTES
Contours indicate Temperature Rise Above Ambient (F)
Contours indicate Extrapolation of Field Data.
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
DYE PLUME
FIGURE 21

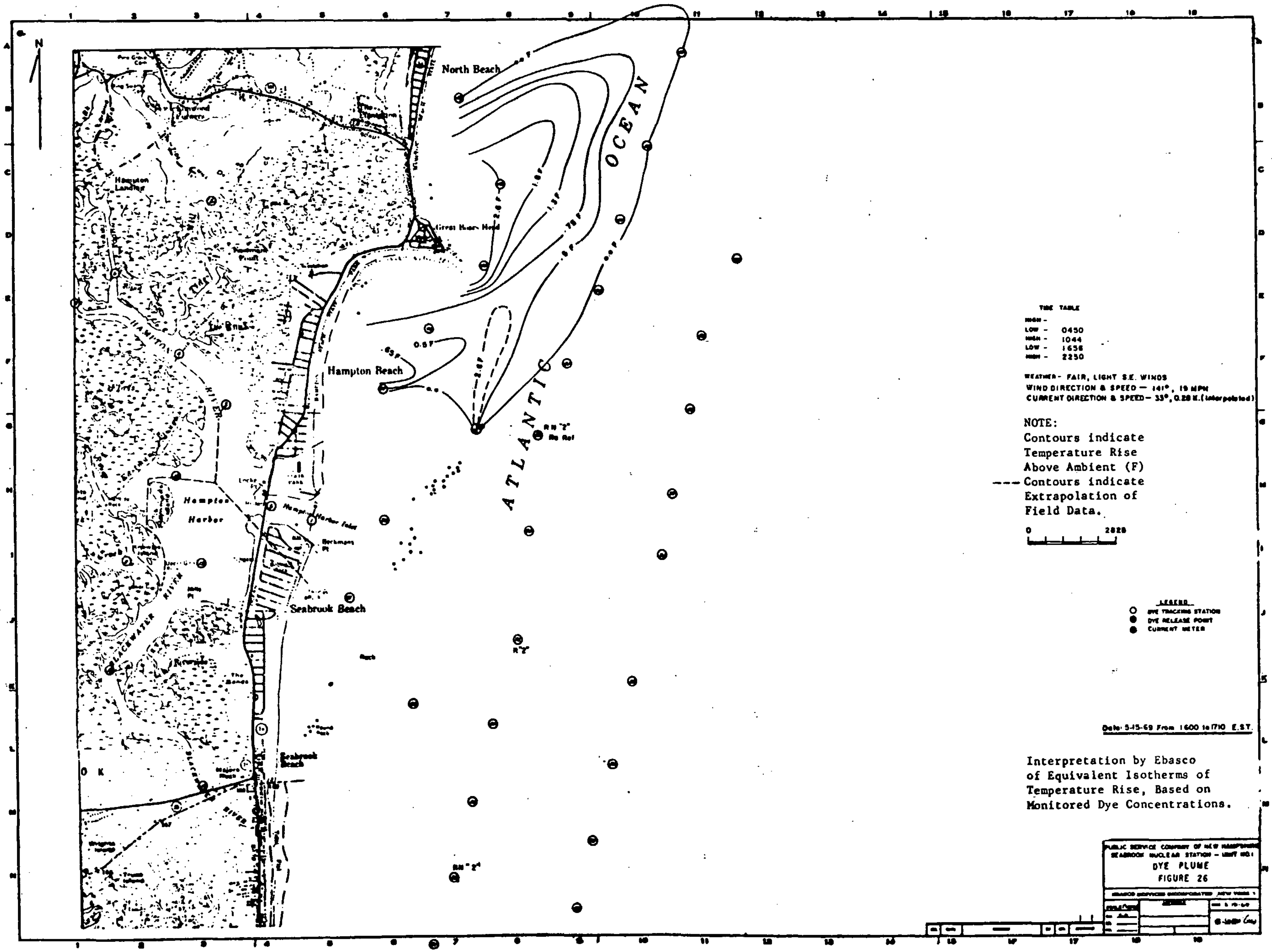

North Beach
Hampton Beach
Seabrook Beach
ATLANTIC OCEAN
Hampton Harbor
TIDE TABLE
HIGH -
LOW - 0408
HIGH - 1002
LOW - 1620
HIGH - 2214
WEATHER -
WIND DIRECTION & SPEED - 169°, 11 MPH
CURRENT DIRECTION & SPEED - 39°, 0.33 K (Interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0 2826
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Dat 5-14-69 From 1215 to 1350 EST.
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 22

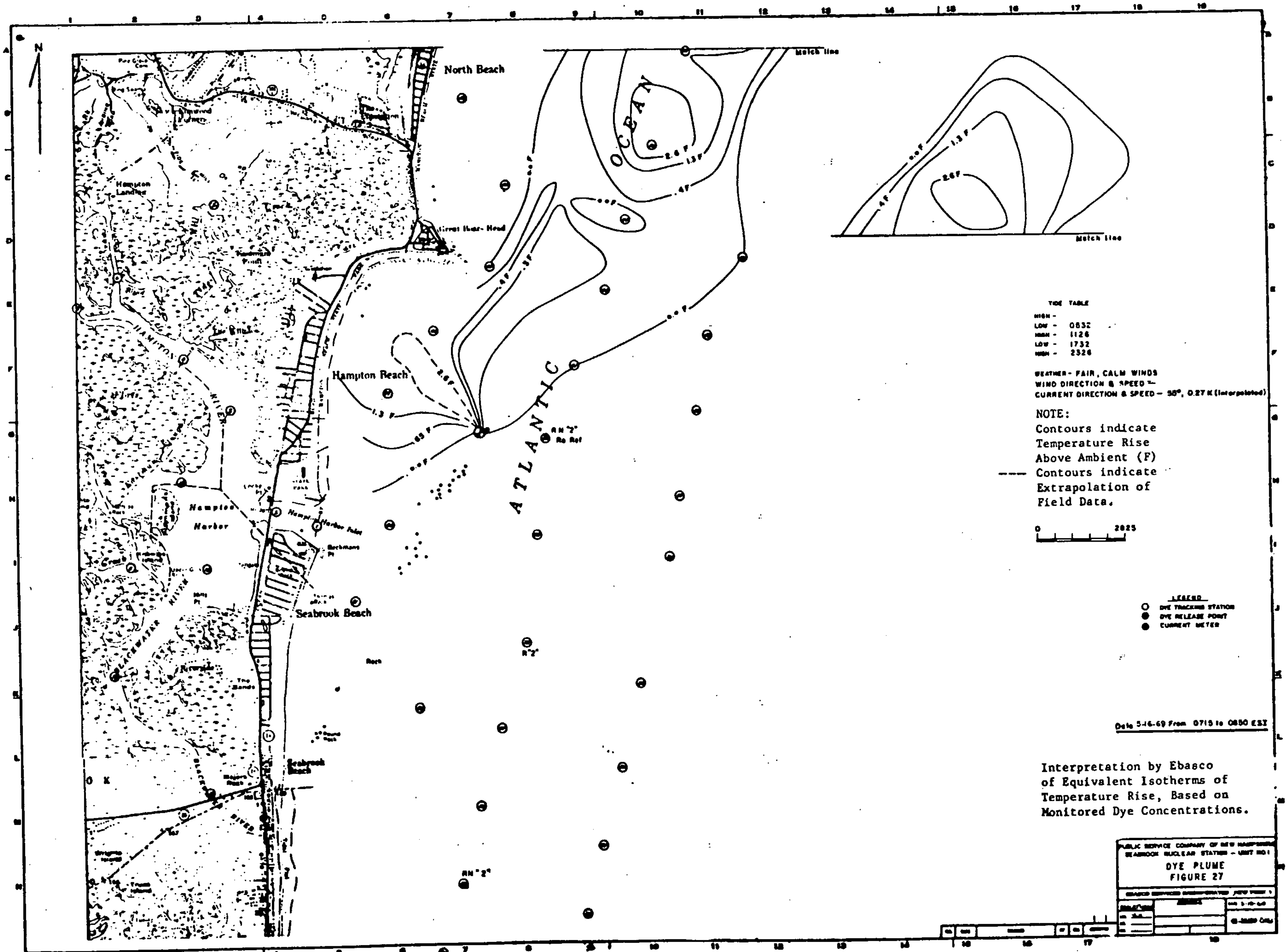

North Beach
Hampton Beach
Seabrook Beach
Hampton Harbor
ATLANTIC
OCEAN
Match line
TIDE TABLE
HIGH -
LOW - 0408
HIGH - 1002
LOW - 1620
HIGH - 2214
WEATHER -
WIND DIRECTION & SPEED — 164°, 13 MPH
CURRENT DIRECTION & SPEED — 63°, 0.31 (Interpolated)
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Interpretation by Ebasco of
Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
DYE PLUME
FIGURE 23

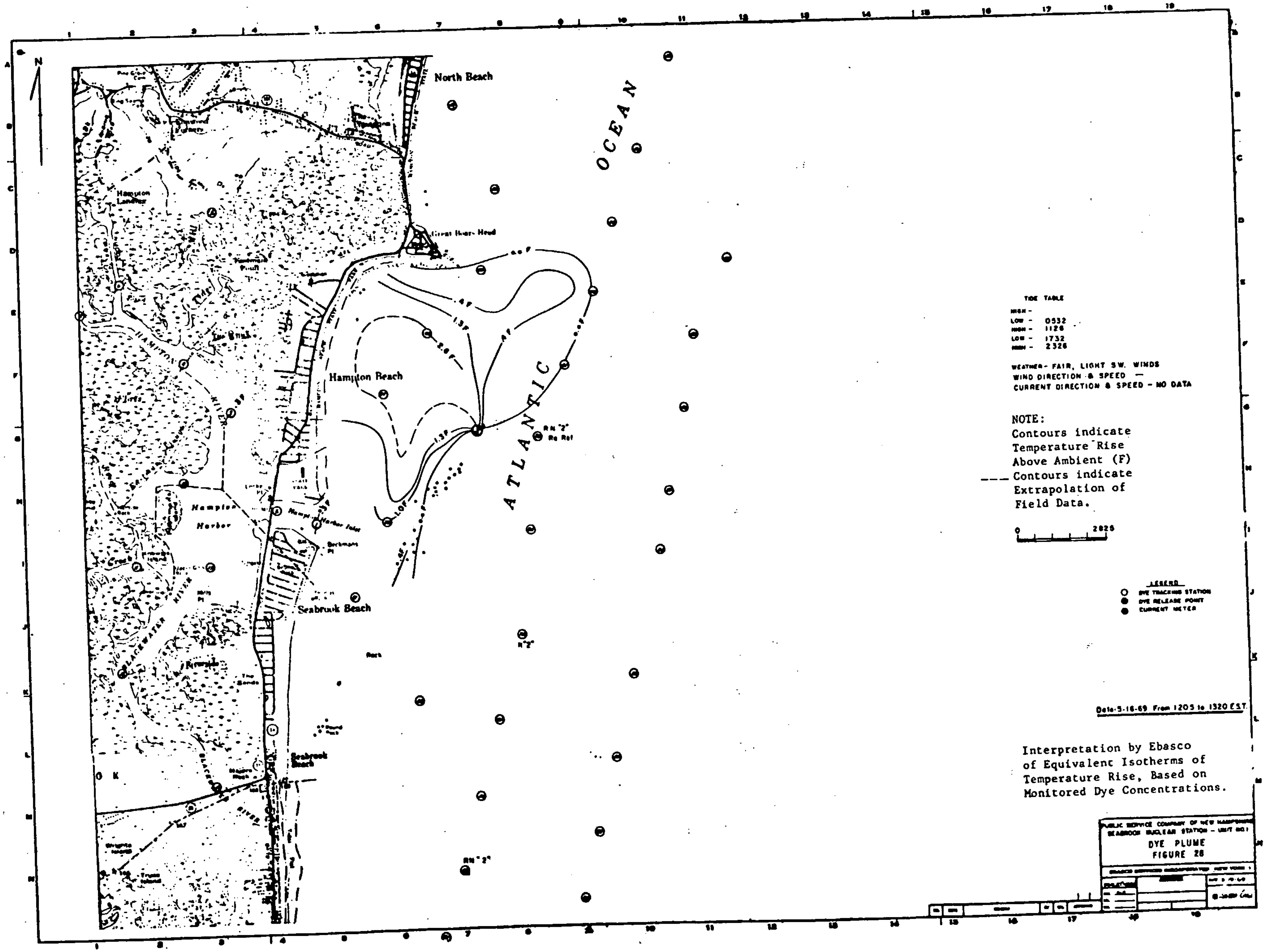

North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
TIDE TABLE
HIGH -
LOW - 0450
HIGH - 1044
LOW - 1656
HIGH - 2250
WEATHER - FAIR, LIGHT N. WINDS
WIND DIRECTION & SPEED - 315°, 6 MPH
CURRENT DIRECTION & SPEED - NO DATA
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0
2828
LEGEND
DYE TRACING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-15-69 From 0710 to 0745 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 24

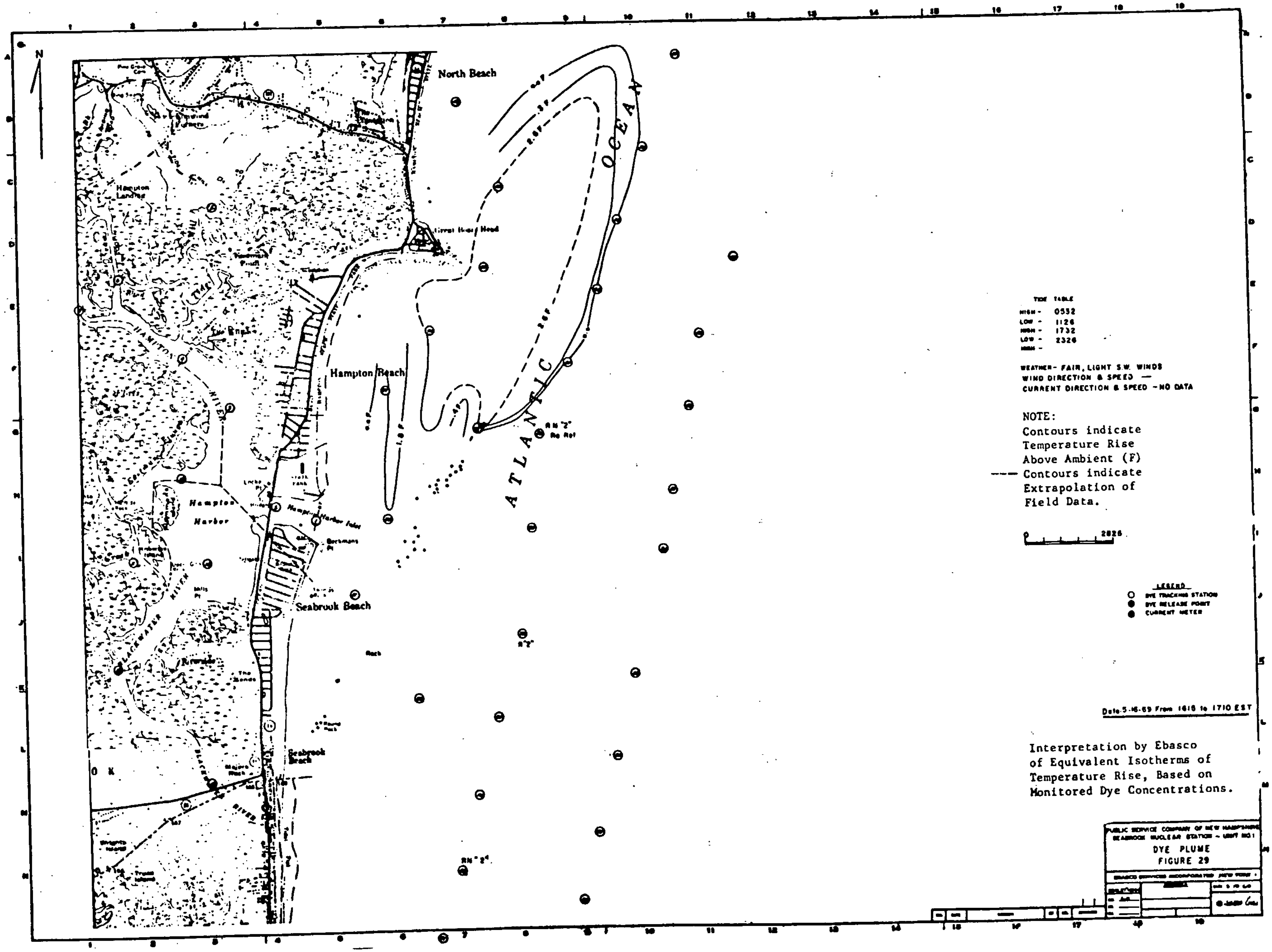


N
North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
TIDE TABLE
HIGH -
LOW - 0450
HIGH - 1044
LOW - 1656
HIGH - 2250
WEATHER - FAIR, LIGHT SE. WINDS
WIND DIRECTION & SPEED — 160°, 5 MPH
CURRENT DIRECTION & SPEED - 24°, 0.5 K (Interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
---- Contours indicate Extrapolation of Field Data.
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-15-69 From 1150 to 1235 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 25

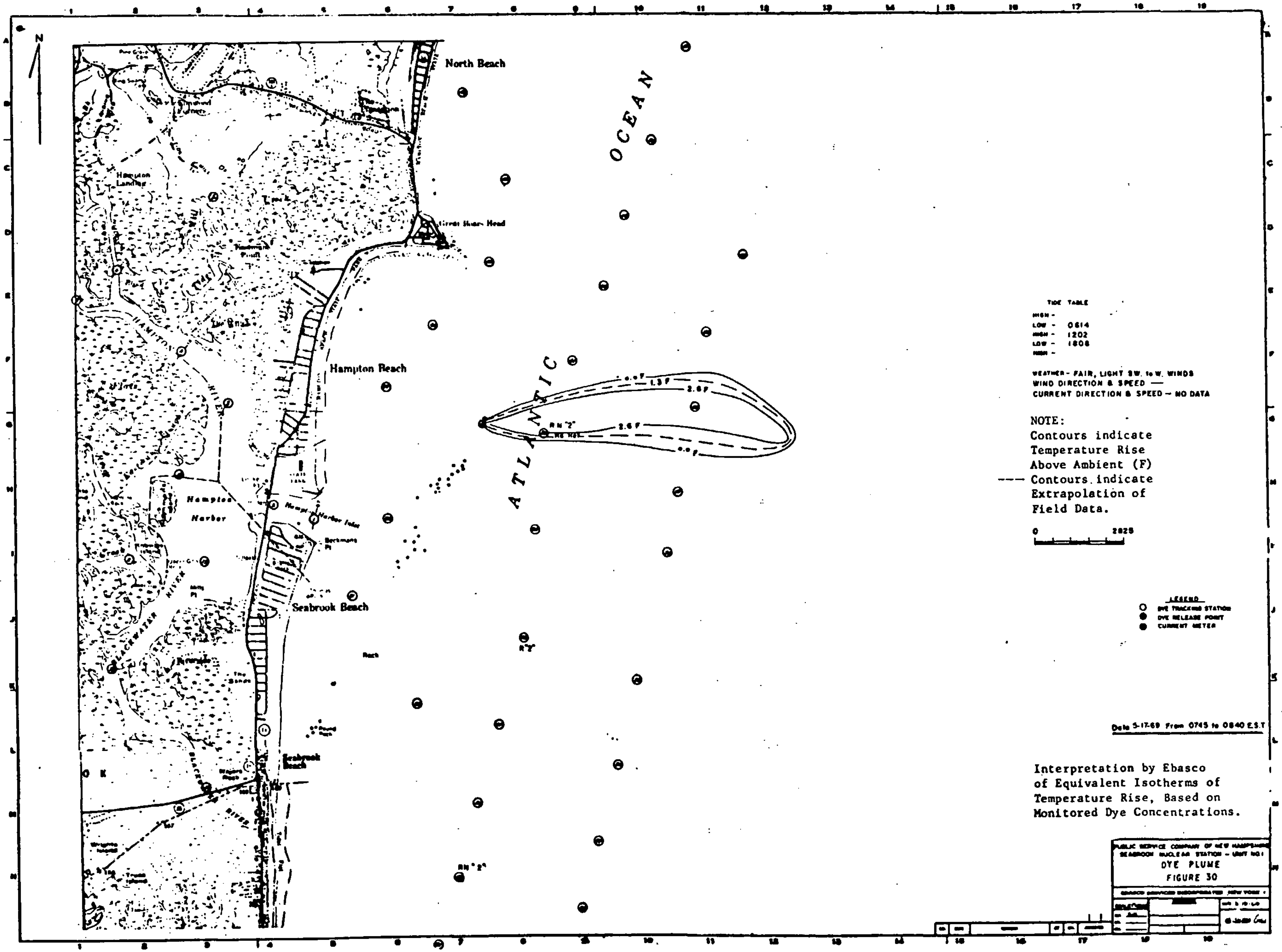

N
North Beach
Hampton Beach
Seabrook Beach
Hampton Harbor
ATLANTIC
OCEAN
TIDE TABLE
LOW - 0450
HIGH - 1044
LOW - 1656
HIGH - 2250
WEATHER - FAIR, LIGHT S.E. WINDS
WIND DIRECTION & SPEED — 141°, 19 MPH
NOTE:
Contours indicate
Temperature Rise
Above Ambient (F)
Contours indicate
Extrapolation of
Field Data.
0
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-15-69 From 1600 to 1710 E.S.T.
Interpretation by Ebasco
of Equivalent Isotherms of
Temperature Rise, Based on
Monitored Dye Concentrations.
SEABROOK NUCLEAR STATION – UNIT NO. 1
DYE PLUME
FIGURE 26

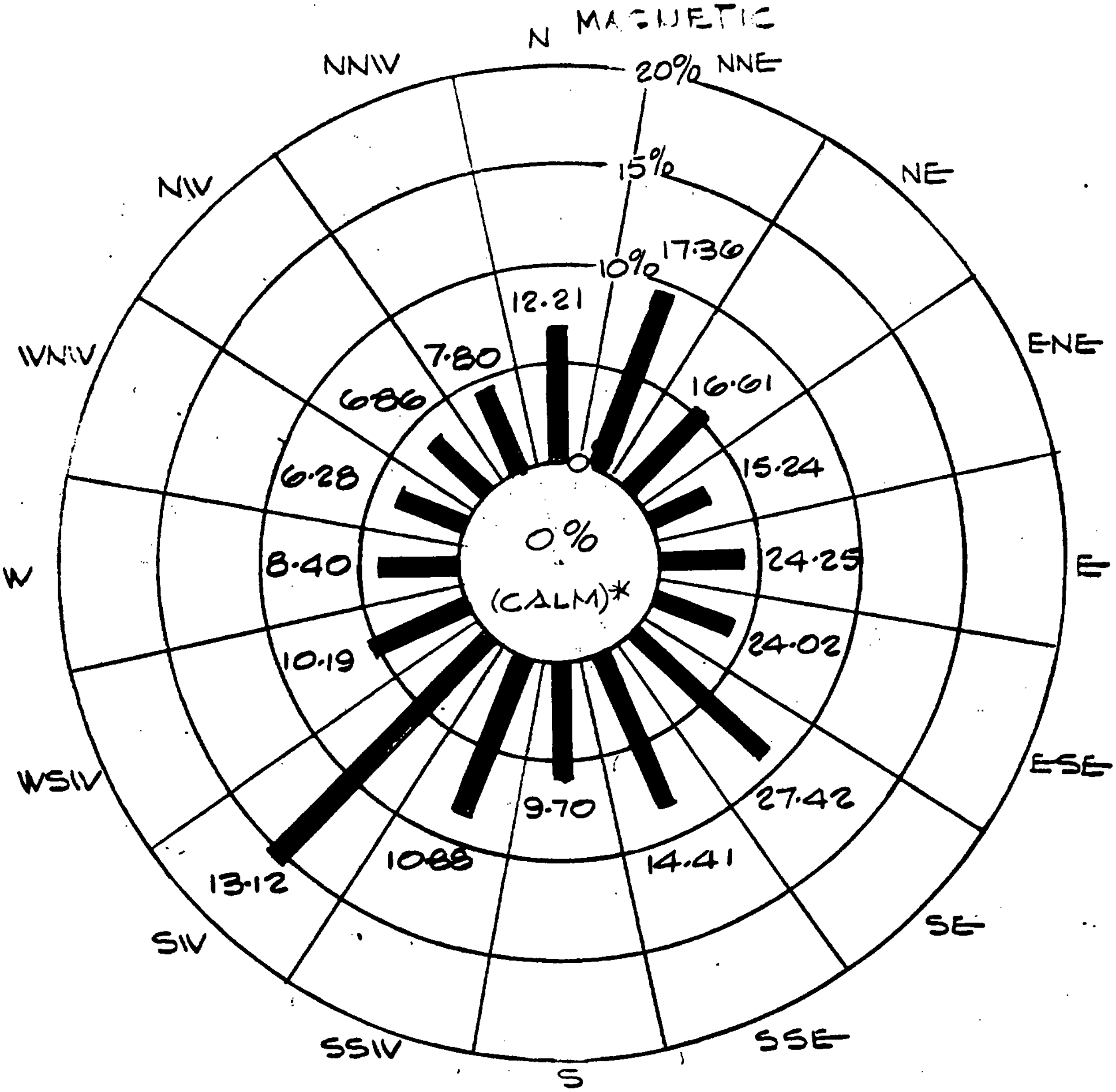

N
North Beach
Hampton Landing
Hampton Beach
Hampton Harbor
Seabrook Beach
OCEAN
ATLANTIC
Match line
TIDE TABLE
HIGH -
LOW - 0832
HIGH - 1126
LOW - 1732
HIGH - 2326
WEATHER - FAIR, CALM WINDS
WIND DIRECTION & SPEED -
CURRENT DIRECTION & SPEED - 0.27 K (Interpolated)
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
---- Contours indicate Extrapolation of Field Data.
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-16-69 From 0715 to 0850 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
SEABROOK NUCLEAR STATION - UNIT NO 1
DYE PLUME
FIGURE 27


North Beach
OCEAN
ATLANTIC
Hampton Beach
Seabrook Beach
Hampton Harbor
RN "2"
TIDE TABLE
HIGH -
LOW - 0532
HIGH - 1126
LOW - 1732
HIGH - 2326
WEATHER - FAIR, LIGHT S.W. WINDS
WIND DIRECTION & SPEED —
CURRENT DIRECTION & SPEED - NO DATA
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
--- Contours indicate Extrapolation of Field Data.
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-16-69 From 1205 to 1320 E.S.T.
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
SEABROOK NUCLEAR STATION - UNIT NO. 1
DYE PLUME
FIGURE 28



North Beach
Hampton Landing
Hampton Beach
Hampton Harbor
Seabrook Beach
ATLANTIC
OCEAN
TIDE TABLE
HIGH - 0552
LOW - 1126
HIGH - 1732
LOW - 2326
HIGH -
WEATHER- FAIR, LIGHT S.W. WINDS
WIND DIRECTION & SPEED —
CURRENT DIRECTION & SPEED - NO DATA
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
---- Contours indicate Extrapolation of Field Data.
0
2026
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-16-69 From 1616 to 1710 EST
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK NUCLEAR STATION - UNIT NO.1
DYE PLUME
FIGURE 29


N
North Beach
Hampton Beach
Seabrook Beach
Hampton Harbor
Hampton Landing
ATLANTIC OCEAN
1.3 F
2.6 F
TIDE TABLE
HIGH -
LOW - 0614
HIGH - 1202
LOW - 1808
HIGH -
WEATHER - FAIR, LIGHT S.W. to W. WINDS
WIND DIRECTION & SPEED —
CURRENT DIRECTION & SPEED — NO DATA
NOTE:
Contours indicate Temperature Rise Above Ambient (F)
---- Contours indicate Extrapolation of Field Data.
0 2025
LEGEND
DYE TRACKING STATION
DYE RELEASE POINT
CURRENT METER
Date 5-17-69 From 0745 to 0840 E.S.T
Interpretation by Ebasco of Equivalent Isotherms of Temperature Rise, Based on Monitored Dye Concentrations.
DYE PLUME
FIGURE 30



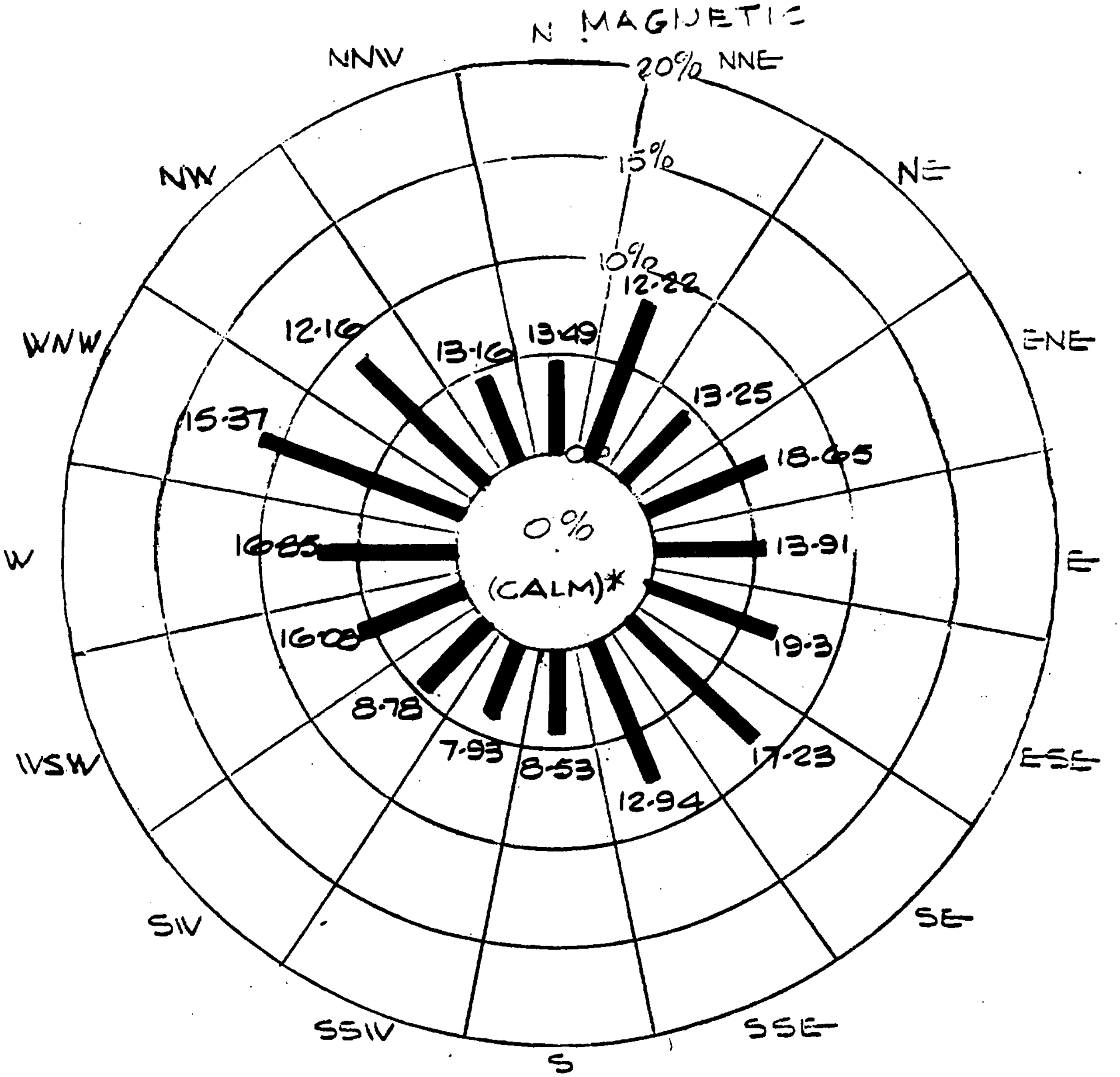
AVERAGE WIND SPEED: 14.05 M.P.H.

* DEFINED AS WIND SPEED < 3 M.P.H.

RADIALS INDICATE SECTOR WIND FREQUENCY (PERCENT)

NUMBERS INDICATE AVERAGE WIND SPEED PER SECTOR (M.P.H.)

PUBLIC SERVICE CO. NEW HAMPSHIRE SEABROOK NUCLEAR STN. Nº 1
WIND ROSE FOR DYE RELEASE POINT Nº 1 APRIL 14 TO APRIL 24 FIGURE 31



AVERAGE WIND SPEED: 16.17 M.P.H.

*DEFINED AS WIND SPEED < 3 M.P.H.

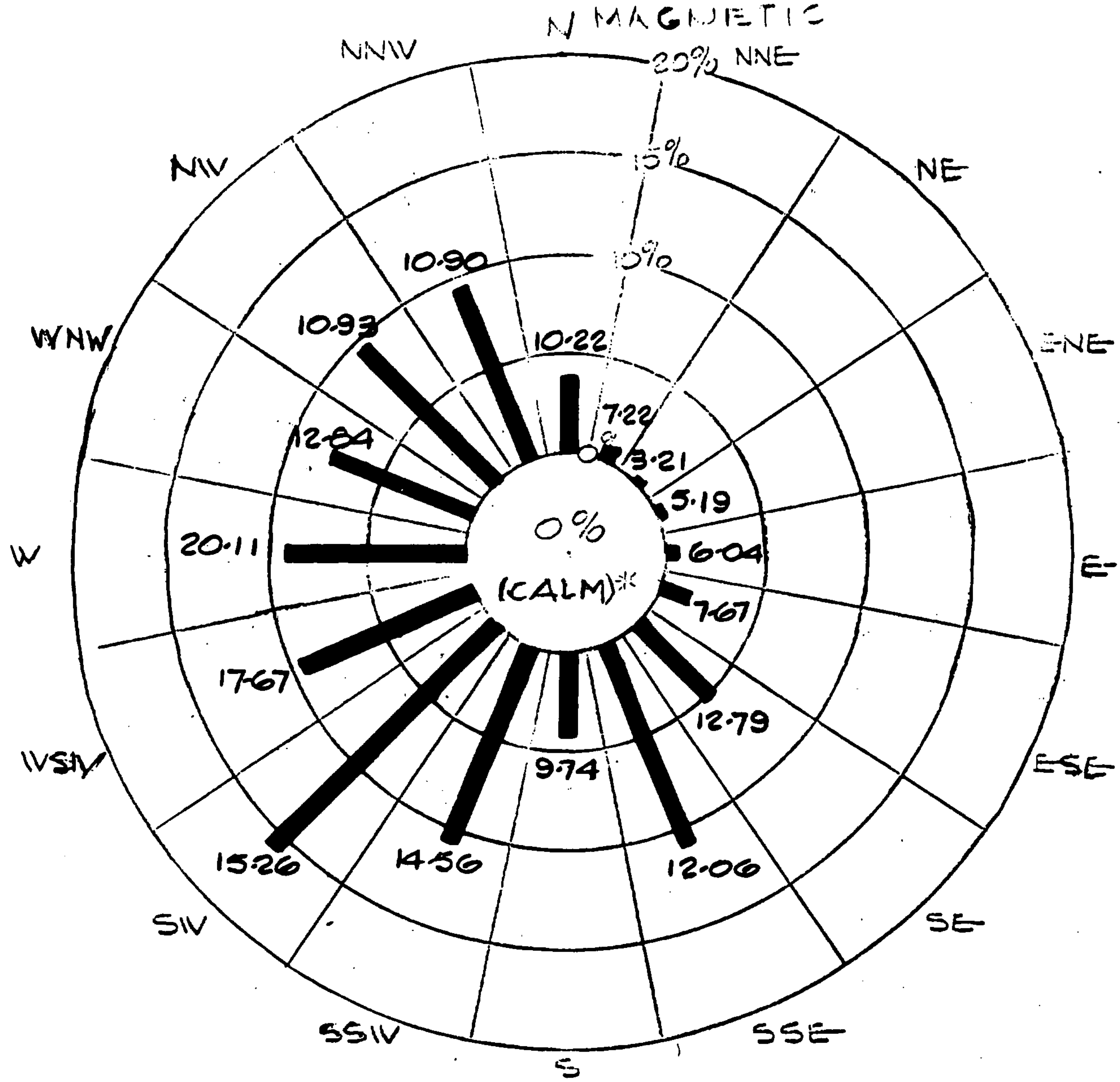
RADIALS INDICATE SECTOR WIND FREQUENCY (PERCENT)

NUMBERS INDICATE AVERAGE WIND SPEED PER SECTOR (M.P.H.)

PUBLIC SERVICE CO. NEW HAMPSHIRE
SEABROOK NUCLEAR STN. Nº 1

WIND ROSE FOR DYE RELEASE POINT Nº 2 APRIL 25 TO MAY 2

FIGURE 32



AVERAGE WIND SPEED: 11.03 M.P.H.

* DEFINED AS WIND SPEED < 3 M.P.H.

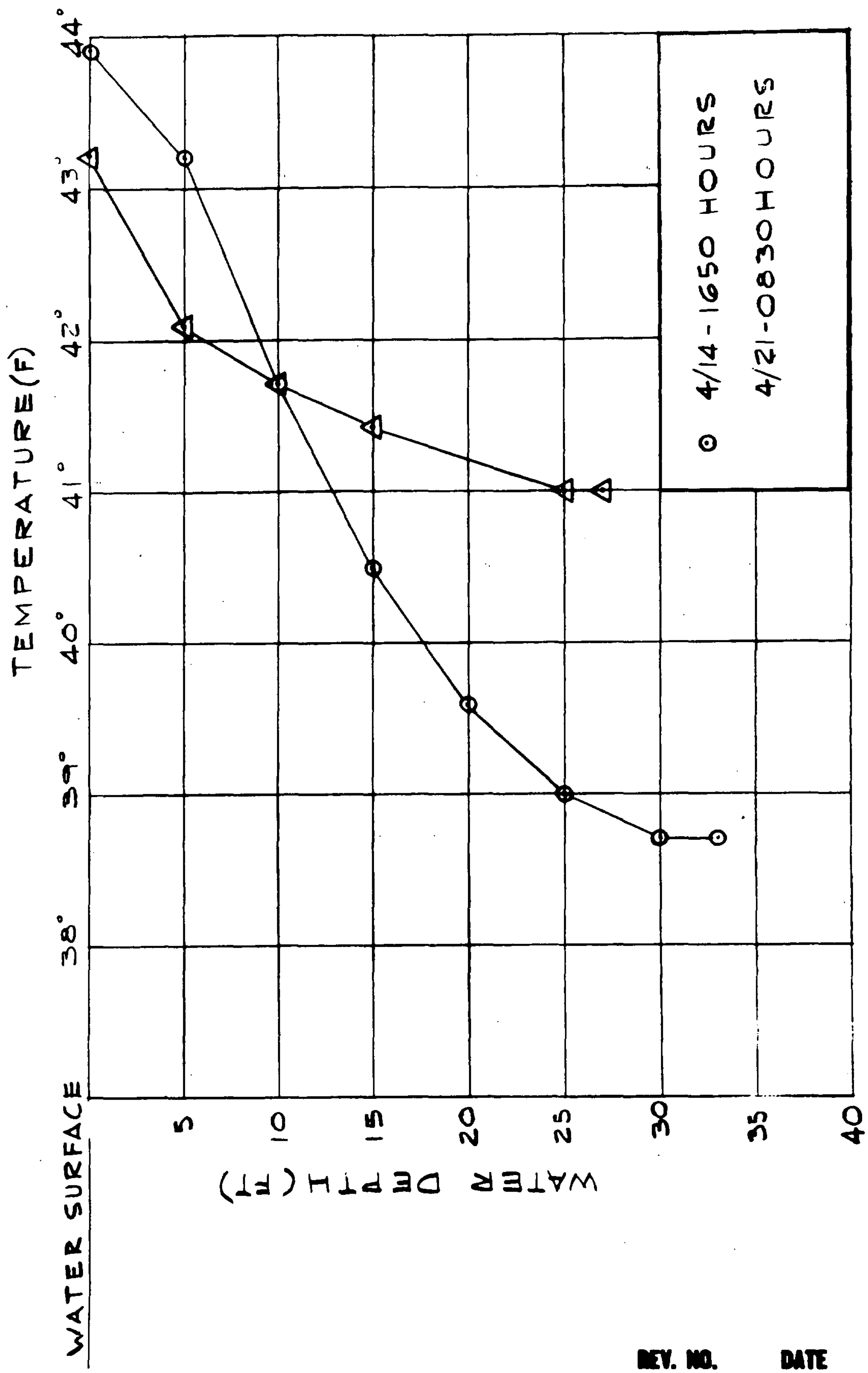
RADIALS INDICATE SECTOR WIND FREQUENCY (PER CENT)

NUMBERS INDICATE AVERAGE WIND SPEED PER SECTOR (M.P.H.)

PUBLIC SERVICE CO. NEW HAMPSHIRE
SEABROOK NUCLEAR STN. Nº 1

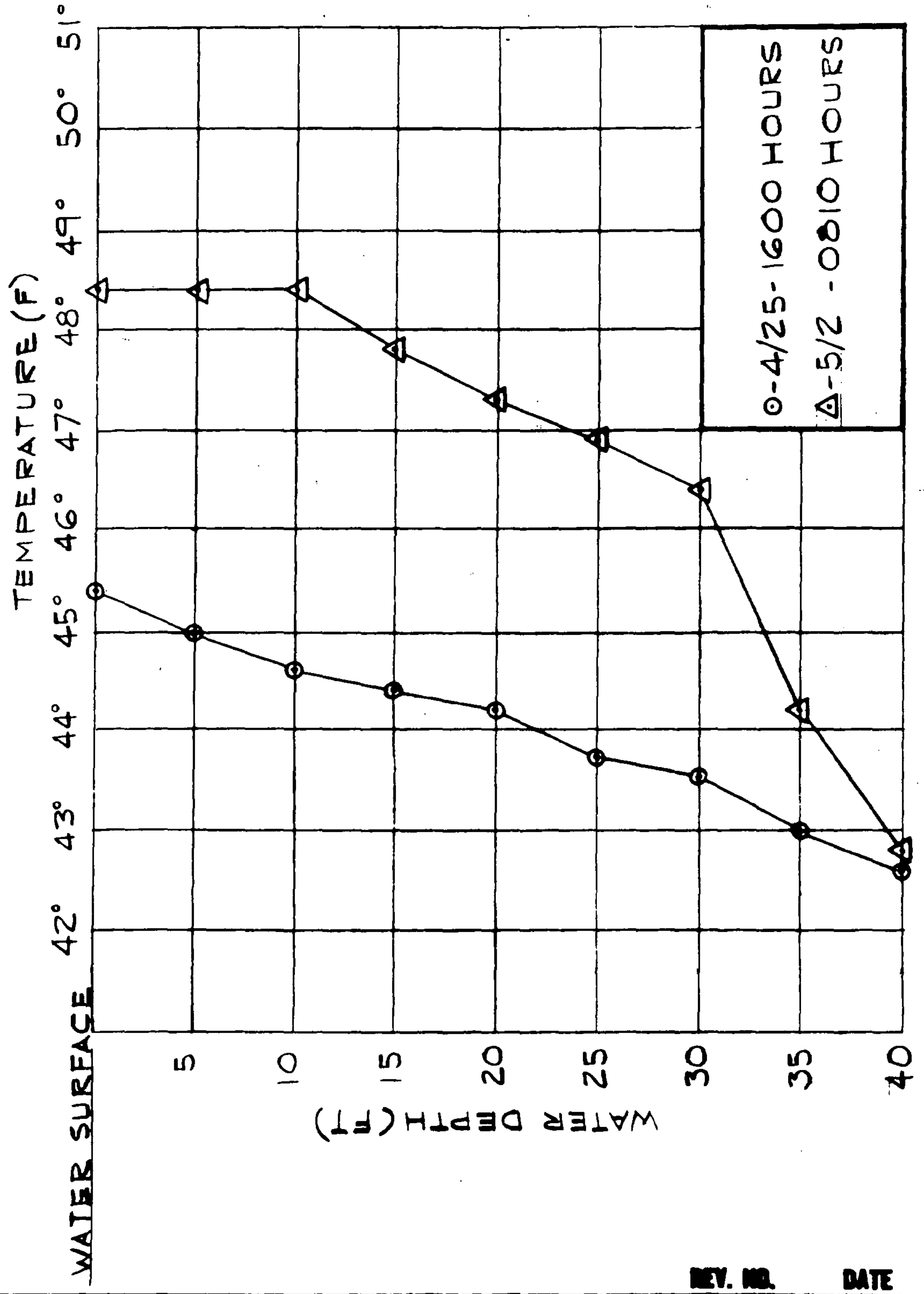
WIND ROSE FOR DYE RELEASE POINT Nº 3 MAY 3 TO MAY 17

FIGURE 33



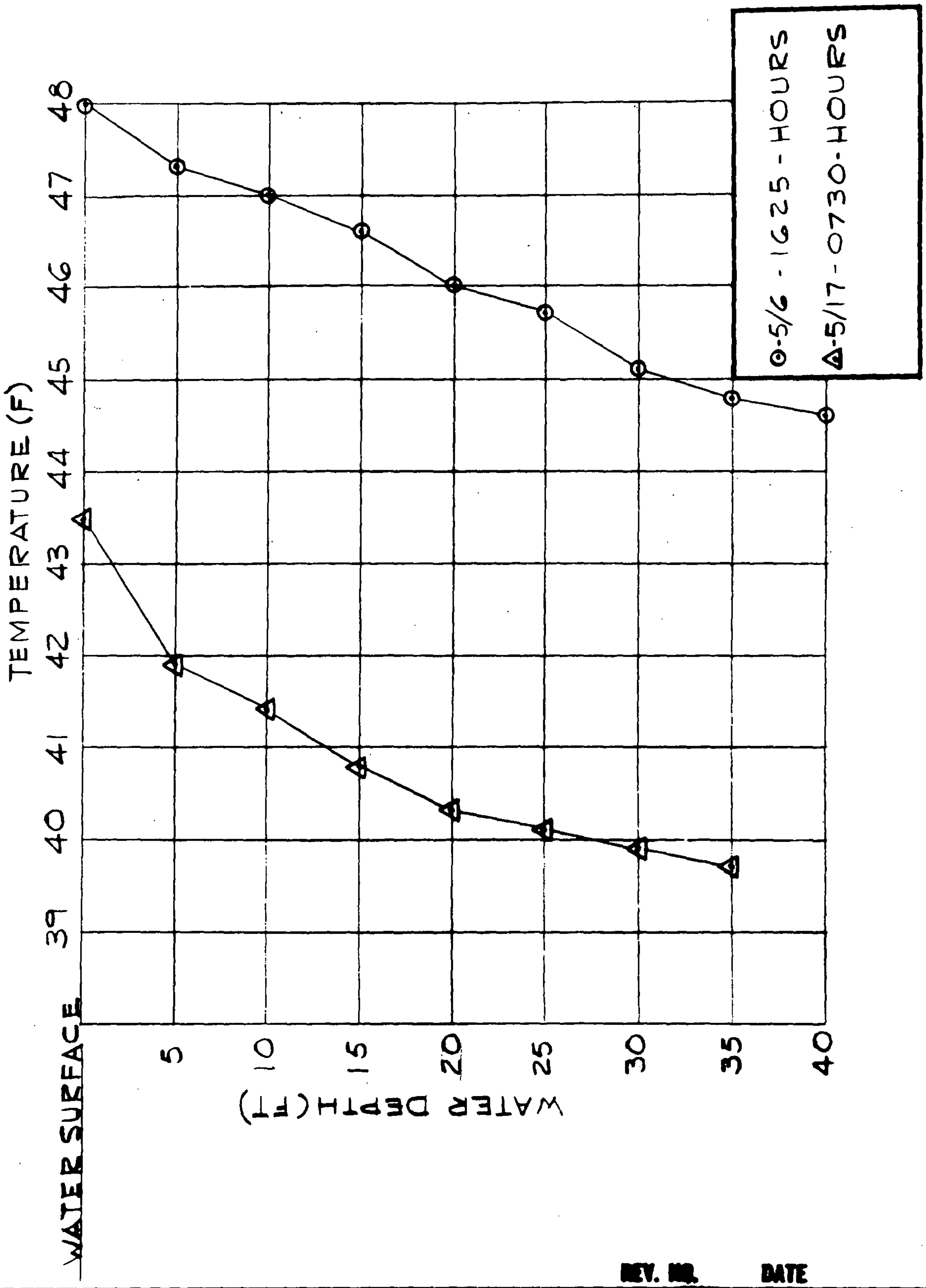
REV. NO. DATE

EBASCO SERVICES INCORPORATED NEW YORK	TEMP. VS. DEPTH DYE RELEASE PT. #1 FIGURE 34	A-8735
DIV. C-H DR. RD SCALE ____ CH. ____ DATE ____ — APPROVED		



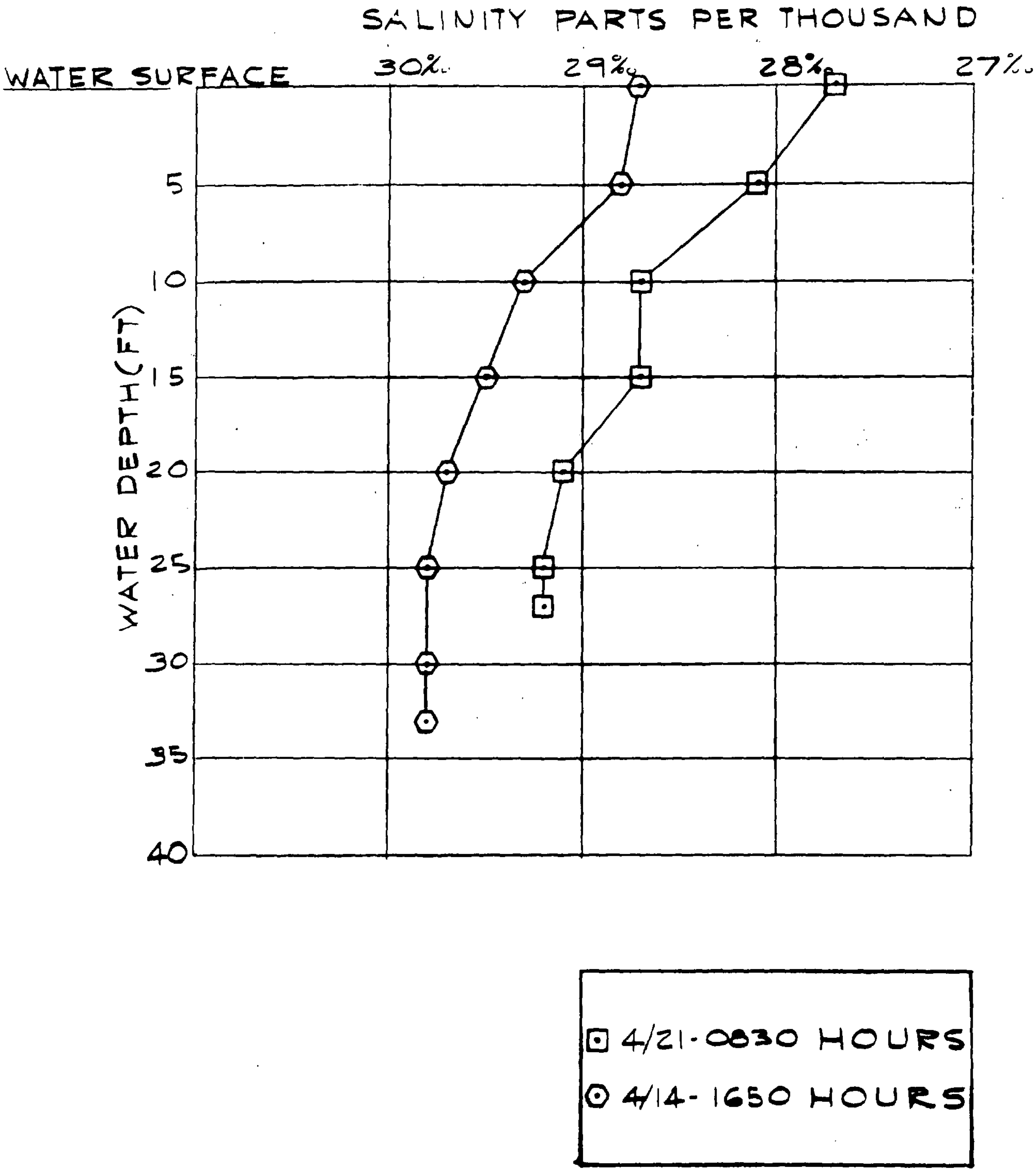
REV. NO. DATE

EBASCO SERVICES INCORPORATED NEW YORK	TEMP VS DEPTH DYE RELEASE PT# 2 FIGURE 35	A-8735
DIV. C-H DR. RB APPROVED SCALE CH. DATE		



REV. NO.	DATE

EBASCO SERVICES INCORPORATED NEW YORK DIV. C-H DR. BB SCALE ___ CH. ___ DATE ___ APPROVED	TEMP VS DEPTH DYE RELEASE PT # 3 FIGURE 36	A-8735



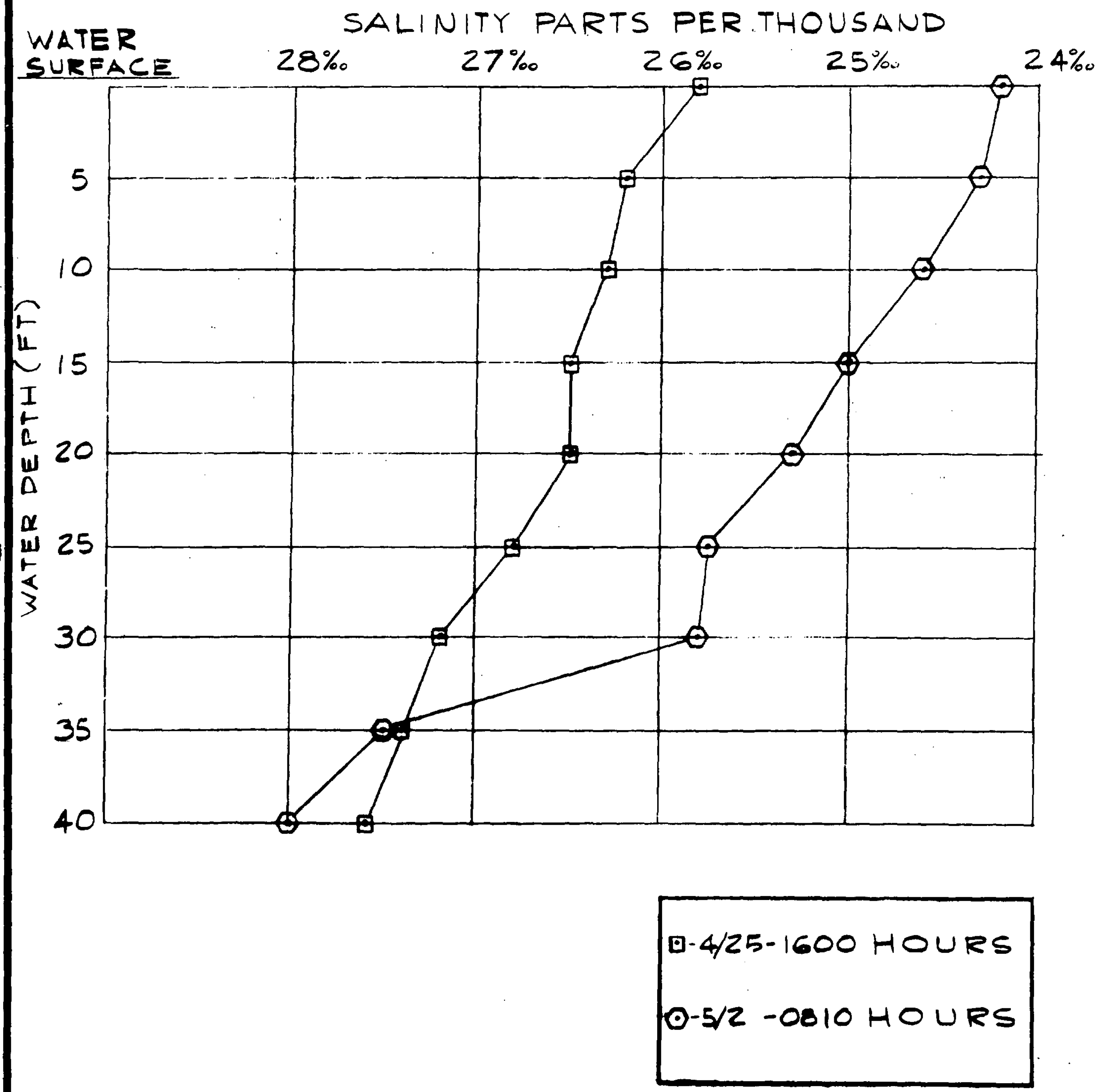
REV. NO. DATE

EBASCO SERVICES INCORPORATED
NEW YORK

DIV. C-H DR. RB
SCALE ____ CH. ____
DATE ____
APPROVED

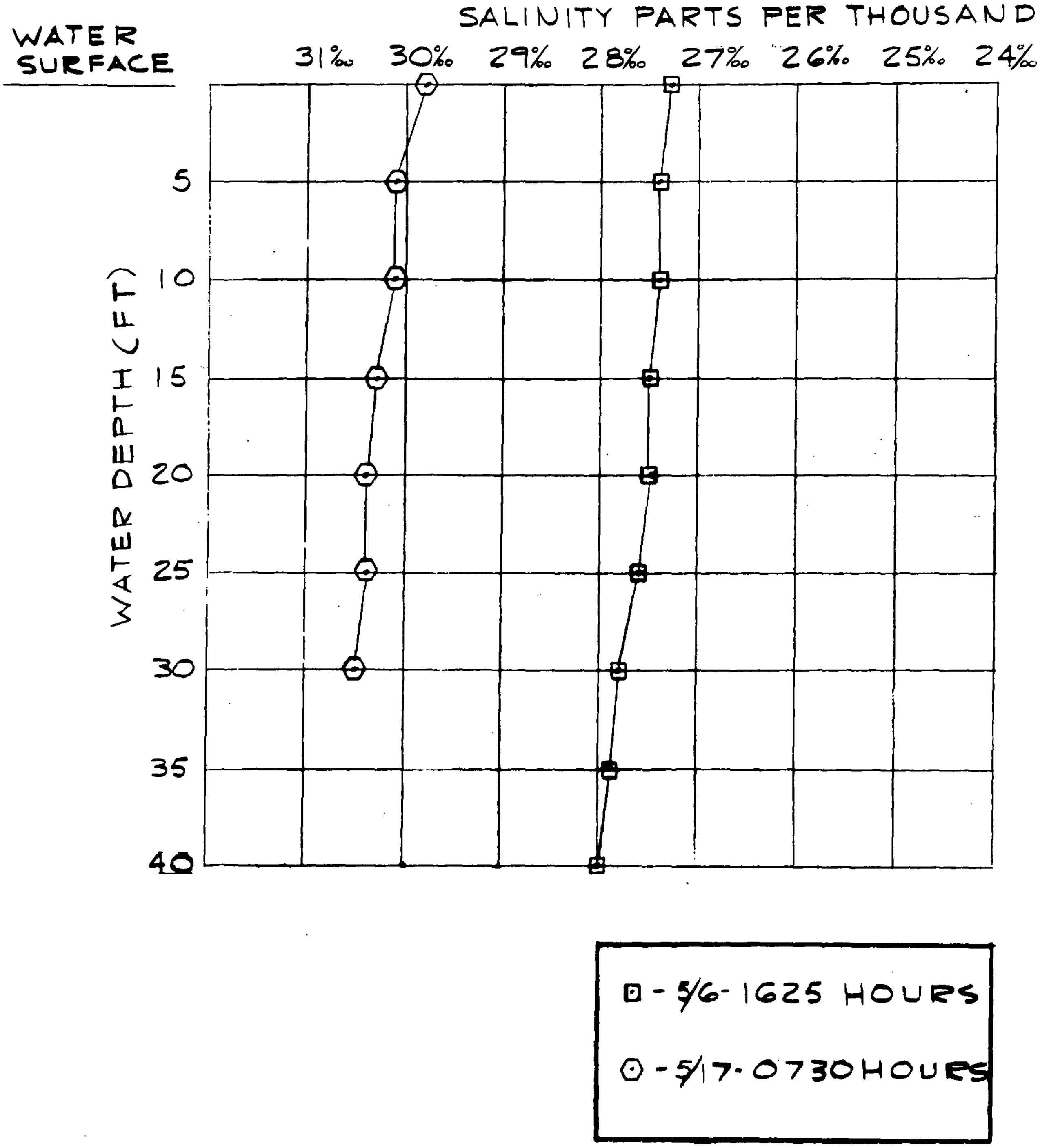
SALINITY VS. DEPTH
DYE RELEASE PT #1
FIGURE 37

A-8735



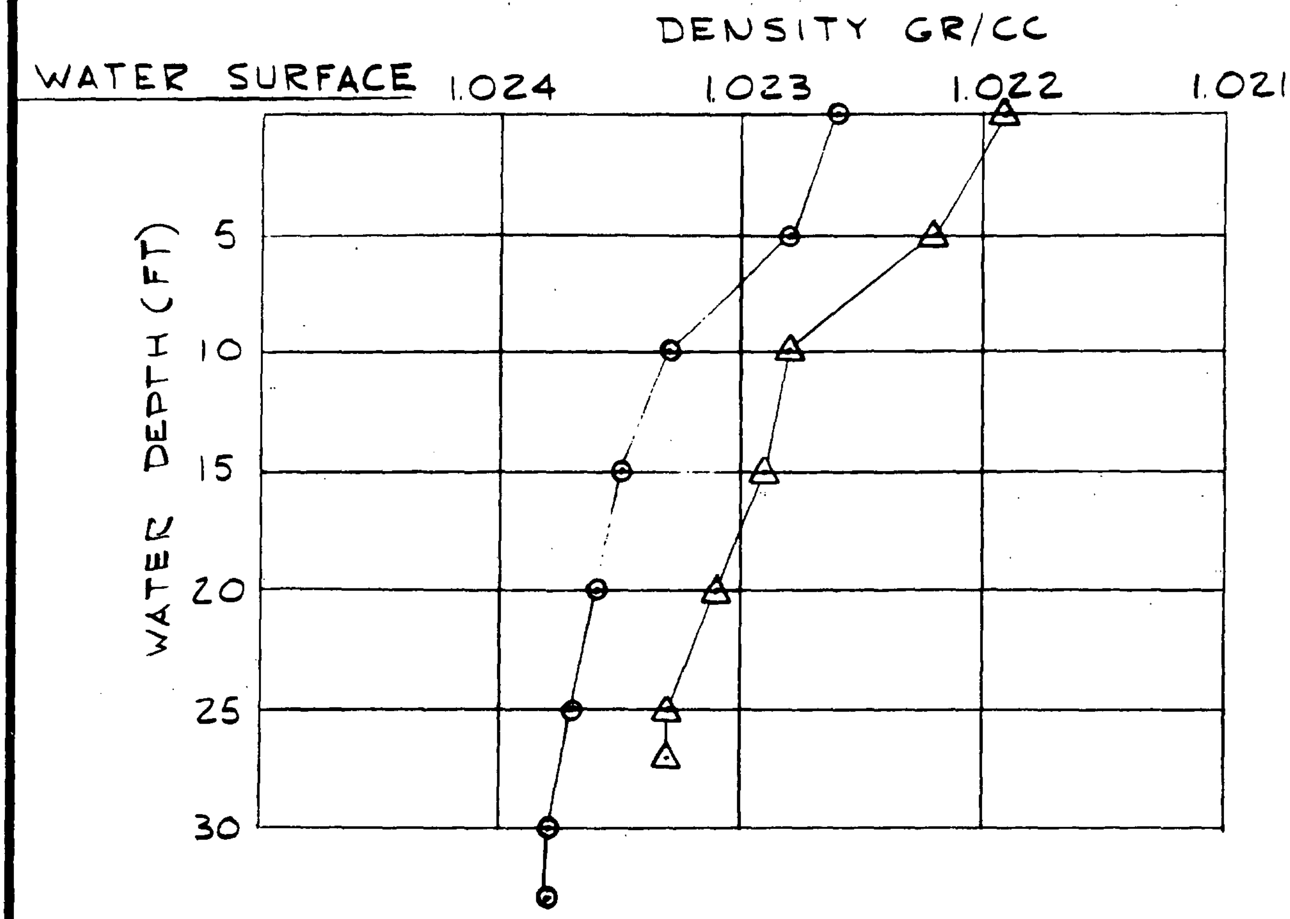
REV. NO. DATE

EBASCO SERVICES INCORPORATED NEW YORK	SALINITY VS DEPTH DYE RELEASE PT #2 FIGURE 38	A-8735
DIV. C-H DR. RB SCALE CH. DATE — APPROVED		



REV. NO. DATE

EBASCO SERVICES INCORPORATED NEW YORK DIV. C-H DR. RB SCALE ____ CH. ____ DATE ____ APPROVED	SALINITY VS DEPTH DYE RELEASE PT # 3 FIGURE 39	A-8735



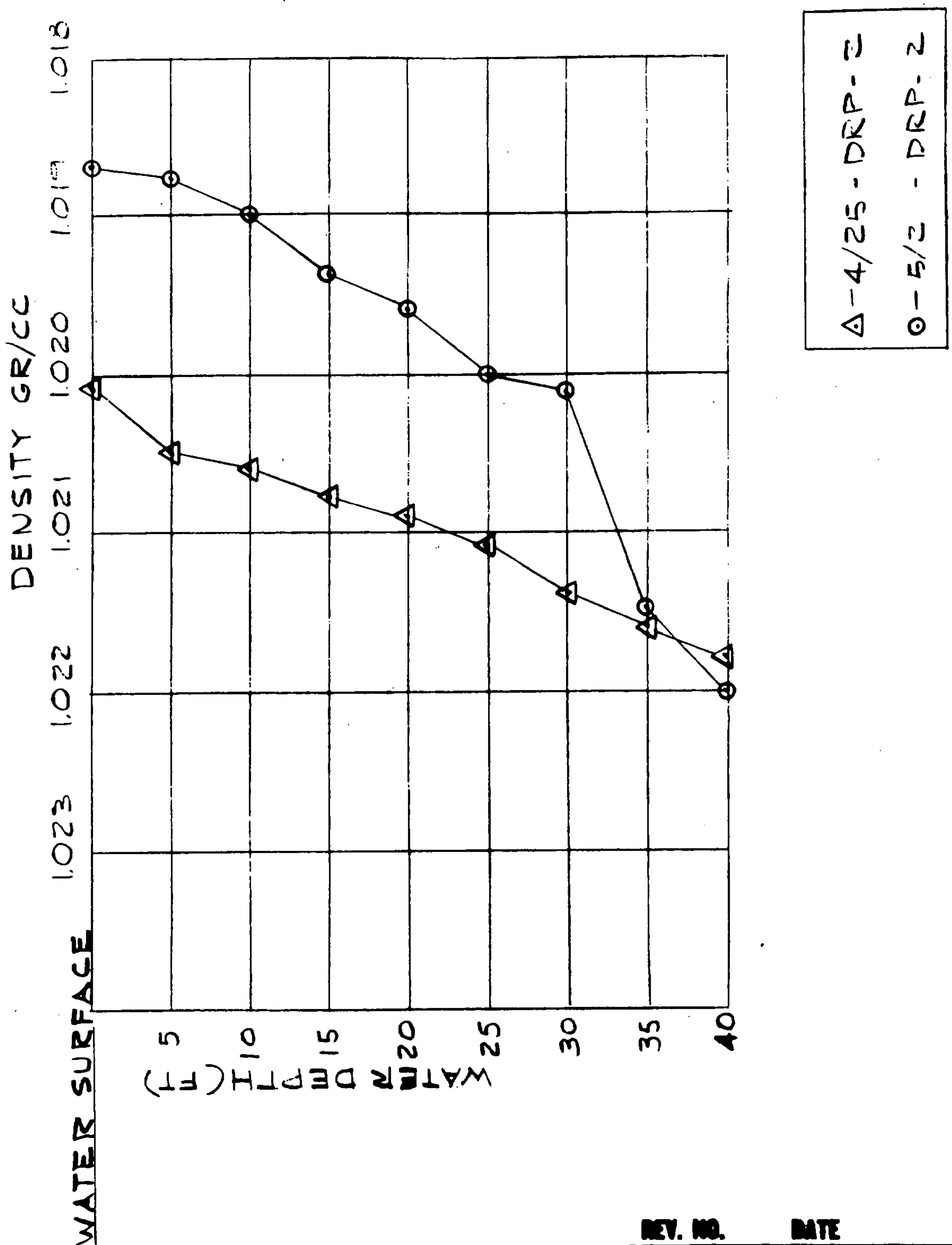
REV. NO. DATE

EBASCO SERVICES INCORPORATED
NEW YORK

DIV. DR.
SCALE CH.
DATE
APPROVED

DENSITY VS. DEPTH
DYE RELEASE PT. 1
FIGURE 40

A-



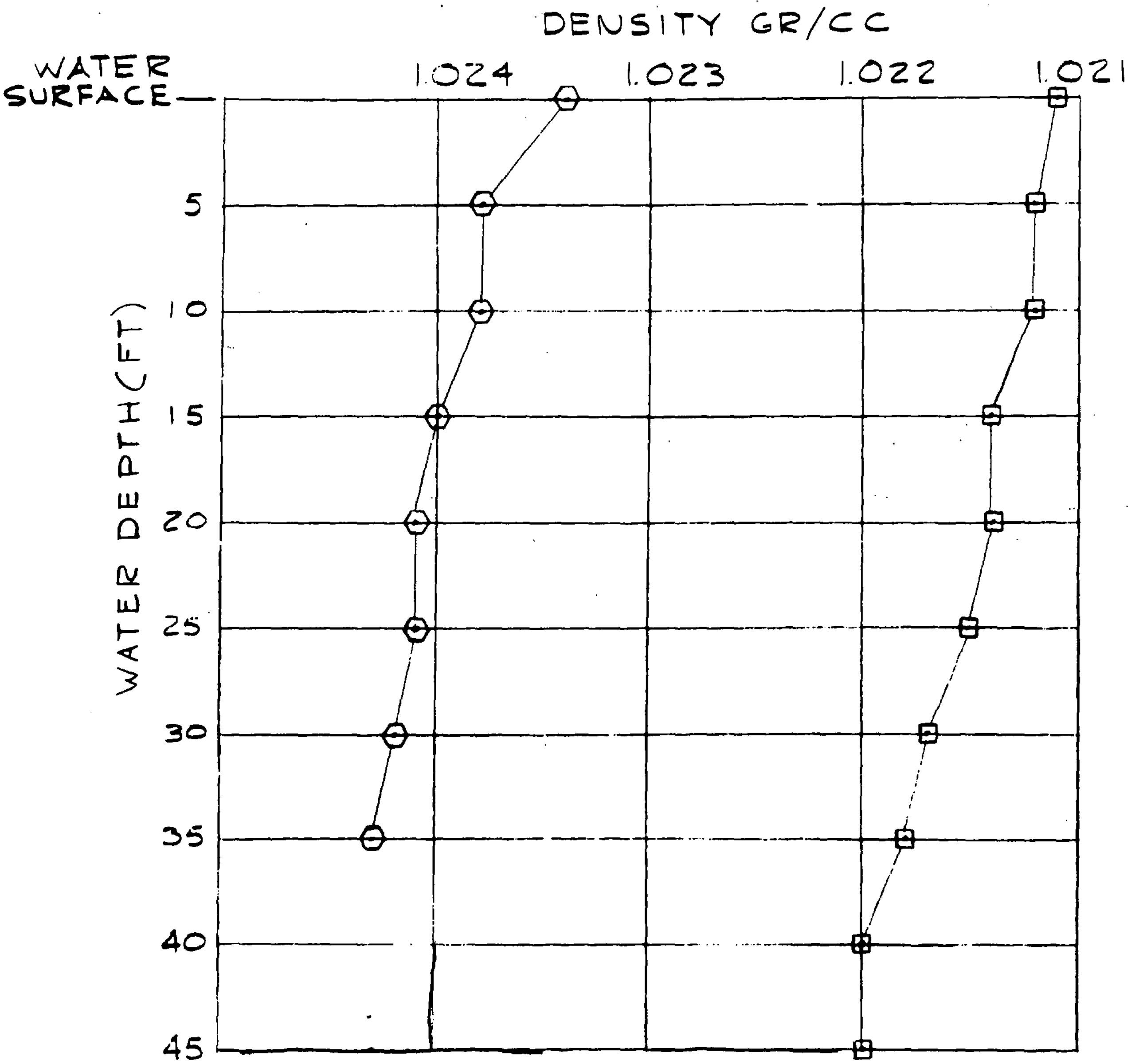
REV. NO. DATE

EBASCO SERVICES INCORPORATED
NEW YORK

DIV. C-H DR. RB
SCALE ____ CH. ____
DATE ____
APPROVED

DENSITY VS DEPTH
DYE RELEASE PT 2
FIGURE 41

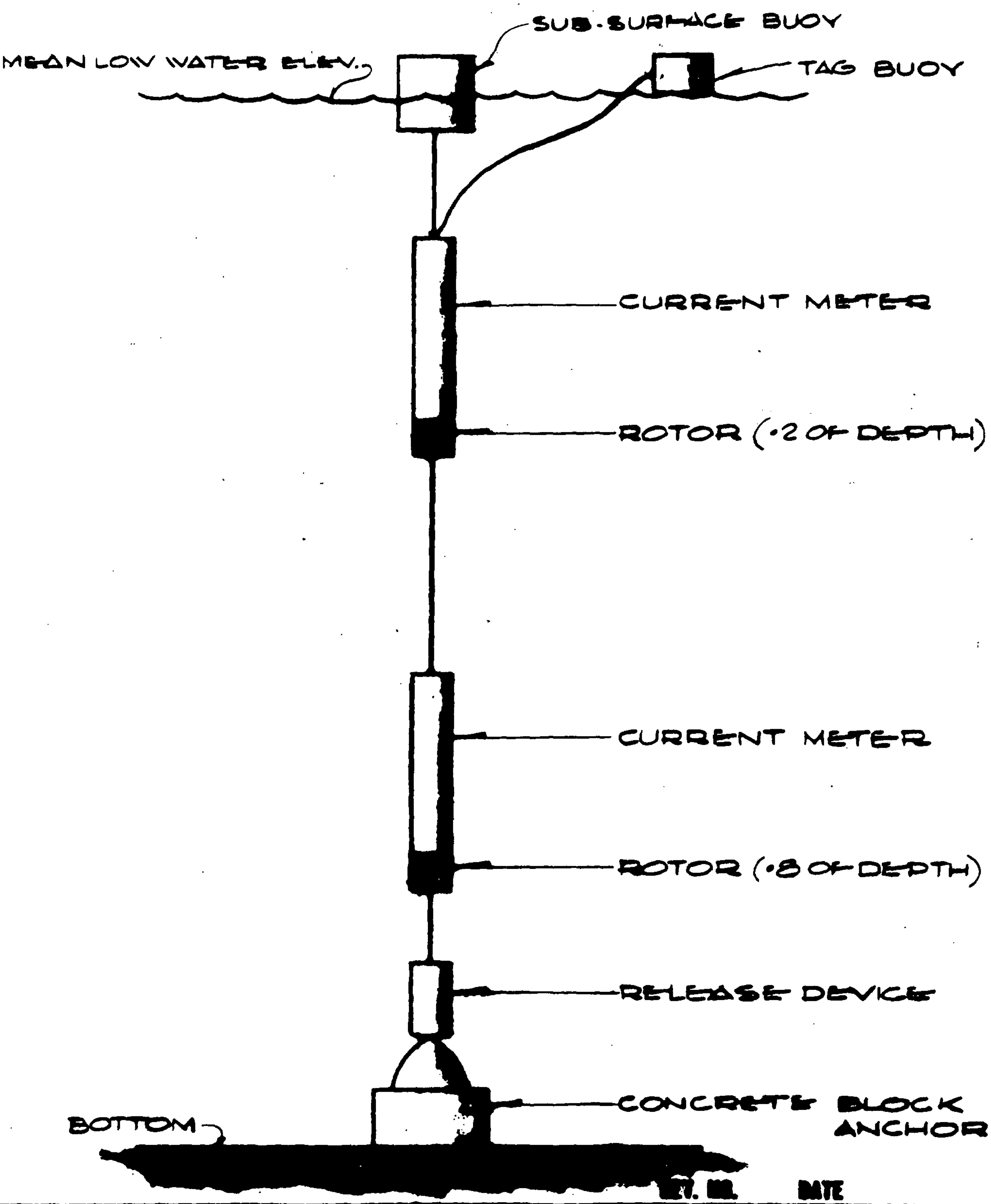
A-8735



REV. NO. DATE

EBASCO SERVICES INCORPORATED NEW YORK	DENSITY VS DEPTH DYE RELEASE PT 3 FIGURE 42	A-
DIV.____ DR.____ SCALE____ CH.____ DATE____ APPROVED		

TYPICAL TWO CURRENT METER INSTALLATION



REV. NO. DATE

EBASCO SERVICES INCORPORATED
NEW YORK

DIV. DR.
SCALE CH.
DATE

APPROVED

CURRENT METER INSTALLATION
FIGURE 43

A-8735

Maximum - Minimum Temperatures
Hampton Harbor Bridge
August 15 - September 11, 1969

Date	Surface Temperatures (C) Maximum	Surface Temperatures (C) Minimum	Bottom Temperatures (C) Maximum	Bottom Temperatures (C) Minimum
August 15, 1969	19.0	14.0	19.0	14.0
August 16, 1969	18.9	14.5	19.5	14.0
August 17, 1969	19.5	11.5	19.5	11.5
August 18, 1969	19.0	10.9	18.0	10.5
August 19, 1969	18.0	10.0	17.5	10.0
August 20, 1969	17.0	10.5	17.0	10.5
August 21, 1969	15.5	11.5	15.5	11.5
August 22, 1969	15.0	11.0	15.0	11.5
August 23, 1969	18.9	10.0	16.0	12.0
August 24, 1969	19.0	13.0	18.5	13.0
August 25, 1969	21.5	14.0	19.0	12.0
August 26, 1969	23.9	15.5	18.0	12.0
August 27, 1969	-	-	17.5	13.5
August 28, 1969	-	-	17.5	14.0
August 29, 1969	-	-	18.0	14.0
August 30, 1969	-	-	18.5	14.0
August 31, 1969	-	-	18.5	14.0
September 1, 1969	-	-	19.0	13.0
September 2, 1969	-	-	17.5	13.5
September 3, 1969	-	-	18.0	16.0
September 4, 1969	-	-	18.5	16.5
September 5, 1969	-	-	18.5	15.5
September 6, 1969	-	-	18.0	11.5
September 7, 1969	-	-	18.0	15.8
September 8, 1969	-	-	15.0	14.0
September 9, 1969	-	-	14.5	14.0
September 10, 1969	-	-	16.0	14.0
September 11, 1969	-	-	14.5	14.0

APPENDIX L

APPENDIX L

NEPLAN

New England Power Planning

174 BRUSH HILL AVENUE

WEST SPRINGFIELD, MASSACHUSETTS 01089

TELEPHONE (413) 785-5871

October 2, 1972

To: Members of the NEPOOL
Planning Committee

Gentlemen:

This copy of the "New England Load and Capacity Report" summarizes estimates of monthly peak loads for October, 1972 through December, 1973, and the August and December peak loads for an additional nine year period through 1982. The peak loads used in this report are compiled as a summation of individual company peak loads. The generation capability changes included in this report are summarized in Appendix "B" and "C". Appendix "B" indicates the present generation schedule and Appendix "C" represents a possible plan for future uncommitted generation.

Appendix "C" in the report represents current judgment as to the types of capacity and sizes of units which are appropriate to provide the additional required capacity for the years 1979 through 1982 that is not specified under additions in Appendix "B". Further studies are underway which may change the types and sizes of units. The net capability in this appendix has been incorporated in the report as "Uncommitted Capability" for these years.

The New England generation outage rates are currently under study due to recent experience. Consequently, the objective reserves and excess or deficient MW values needed to meet the reliability criteria, which normally appear in the December summary (page 1) have been omitted from this report.

Sincerely,

J. R. Smith
Director

NEW ENGLAND

LOAD AND CAPACITY REPORT

1971-1982

Prepared from Estimates Collected
By the NEPOOL Planning Committee in
September, 1972

INDEX

October 1, 1972

S U M M A R Y

SYSTEM CAPABILITIES AND ESTIMATED PEAK LOAD - DEC. ONLY - 1972 - 1982

	Dec. 1972	Dec. 1973	Dec. 1974	Dec. 1975	Dec. 1976	Dec. 1977	Dec. 1978	Dec. 1979	Dec. 1980	Dec. 1981	Dec. 1982
Total Capability - MW Item #25	16891	18013	20514	21937	22368	24137	25321	28481	30730	33280	34800
Total Peak Load - MW Item #26	13423	14502	15643	16853	18169	19564	21073	22698	24459	26345	28378
Reserve Before Maintenance - MW Item #27	3468	3511	4871	5084	4199	4573	4248	5783	6271	6935	6422
% Reserve Before Maintenance Item #28	25.8	24.2	31.1	30.2	23.1	23.4	20.2	25.5	25.6	26.3	22.6
Scheduled Maintenance - MW Item #29	81	0	0	0	0	0	0	0	0	0	0
Reserve After Maintenance - MW Item #30	3387	3511	4871	5084	4199	4573	4248	5783	6271	6935	6422
% Reserve After Maintenance Item #31	25.2	24.2	31.1	30.2	23.1	23.4	20.2	25.5	25.6	26.3	22.6

S U M M A R Y

GENERATION ADDITIONS, RERATING AND RETIREMENTS

	Dec. 1972	Dec. 1973	Dec. 1974	Dec. 1975	Dec. 1976	Dec. 1977	Dec. 1978	Dec. 1979	Dec. 1980	Dec. 1981	Dec. 1982
Existing Capability	14527	14282	14141	14086	13834	13832	13830	13831	13831	13830	13830
Retirements	-192	-126	-1	-60	-	-4	-	-	-	-	-
Reratings	+2	-	-	+1	-	+1	-	-	-	-	-
Adj. for Purchases and Sales	- 55	-15	-54	-193	-2	+1	+1	-	-1	-	-
Net Capability	14282	14141	14086	13834	13832	13830	13831	13831	13830	13830	13830
Peak Load	13423	14502	15643	16853	18169	19564	21073	22698	24459	26345	28378
Misc. Small Additions	141	144	169	219	222	266	269	269	269	269	269
Salem Harbor	465	465	465	465	465	465	465	465	465	465	465
Pilgrim #1, #2, and #3	657	657	657	657	657	657	1837	1837	2987	2987	2987
Vermont Yankee	513	513	540	540	540	540	540	540	540	540	540
Maine Yankee	583	583	792	825	855	855	855	855	855	855	855
Northfield #1, #2, #3, and #4	250	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Middletown #4	-	400	400	400	400	400	400	400	400	400	400
B. F. Cleary	-	110	110	110	110	110	110	110	110	110	110
Millstone #2	-	-	830	830	830	830	830	830	830	830	830
Bear Swamp #1 and #2	-	-	600	600	600	600	600	600	600	600	600
Newington	-	-	400	400	400	400	400	400	400	400	400
Brayton Point #4	-	-	465	465	465	465	465	465	465	465	465
Mystic #7	-	-	-	587	587	587	587	587	587	587	587
Coke Works	-	-	-	445	445	445	445	445	445	445	445
Canal #2	-	-	-	560	560	560	560	560	560	560	560
MEPCO/NB Purchase #2	-	-	-	-	400	400	400	400	400	400	400

S U M M A R Y
(Cont'd)
GENERATION ADDITIONS, RERATING AND RETIREMENTS

	Dec. 1972	Dec. 1973	Dec. 1974	Dec. 1975	Dec. 1976	Dec. 1977	Dec. 1978	Dec. 1979	Dec. 1980	Dec. 1981	Dec. 1982
Vermont Unloc. Comb. Cycle	-	-	-	-	-	277	277	277	277	277	277
W. F. Wyman #4	-	-	-	-	-	600	600	600	600	600	600
NEES-North Shore	-	-	-	-	-	850	850	850	850	850	850
N.U. Nuclear	-	-	-	-	-	-	-	1150	1150	2300	2300
Seabrook #1 and #2	-	-	-	-	-	-	-	1150	1150	2300	2300
Unloc. Comb. Cycle	-	-	-	-	-	-	-	310	310	310	930
Undetermined Purchase	-	-	-	-	-	-	-	400	400	400	400
Unloc. Gas Turbines	-	-	-	-	-	-	-	150	350	600	600
Rome Point #1 and #2	-	-	-	-	-	-	-	-	900	900	1800
Total Capability	16891	18013	20514	21937	22368	24137	25321	28481	30730	33280	34800

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL

	Dec. 1971	Summer 1972	
1. Nominal Conventional Thermal Capability (MW)	9749	*10124	
2. Conventional Thermal Capability Reduction (MW)	1	155	
3. Conventional Thermal Capability (1 minus 2) (MW)			
Boston Edison	1749	1737	*Includes Salem Harbor #4 Coincident Generation of 450 MW.
Fitchburg	61	61	
Maine: Bangor	57	56	
CMP Co.	399	396	
MPS Co.	23	23	
Montaup	404	400	
Municipals-Braintree	38	36	
-Holyoke	31	31	
-Taunton	73	63	
-Wallingford	28	23	
NEES	1833	*2241	
NEGEA	774	734	
Newport	14	14	
Northeast Utilities	2524	2417	
PSNH	696	692	
UI	1011	1011	
Vermont Group	33	34	
Total Conventional Thermal Capability (MW)	9748	9969	
4. Nominal Nuclear Capability (MW)	1410	1410	
5. Nuclear Capability Reduction (MW)	0	60	

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL (Cont'd)

	Dec. 1971	Summer 1972
6. Nuclear Capability (4 minus 5) (MW)		
Conn. Yankee	575	550
Northeast Utilities	660	655
Mass. Yankee	175	145
Total Nuclear Capability (MW)	1410	1350
7. Nominal Gas Turbine Capability (MW)	1361	1463
8. Gas Turbine Capability Reduction (MW)	0	283
9. Gas Turbine Capability (7 minus 8) (MW)		
Boston Edison	291	246
Fitchburg	-	24
Maine: Bangor	10	5
CMP Co.	46	39
Montaup	48	39
Municipals-Holyoke	10	9
-Peabody	20	17
NEES	45	40
NEGEA	24	38
Northeast Utilities	645	500
PSNH	111	90
UI	21	17
Vermont Group	90	116
Total Gas Turbine Capability (MW)	1361	1180

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL
(Cont'd)

	Dec. 1971	Summer 1972
10. Nominal Combined Cycle Capability (MW)	-	-
11. Combined Cycle Capability Reduction (MW)	-	-
12. Combined Cycle Capability (10 minus 11) (MW)	-	-
13. Nominal Diesel Capability (MW)	227	233
14. Diesel Capability Reduction (MW)	0	0
15. Diesel Capability (13 minus 14) (MW)		
Maine: Bangor	24	24
CMP Co.	4	4
MPS Co.	13	13
Municipals-Braintree	5	5
-Hudson	15	20
-Peabody	11	11
-Shrewsbury	5	5
-Wolfeboro	3	3
NEES	82	83
NEGEA	11	11
Newport	14	14
Northeast Utilities	15	15
PSNH	3	3
Vermont Group	22	22
Total Diesel Capability (MW)	227	233

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL
(Cont'd)

	Dec. 1971	Summer 1972
16. Nominal Hydro Capability (MW)	1247	1247
17. Hydro Capability Reduction (MW)	8	91
18. Dependable Hydro Capability (16 minus 17) (MW)		
Maine: Bangor	27	25
CMP Co.	294	294
MPS Co.	2	2
Municipal-Holyoke	2	1
NEES	546	546
Northeast Utilities	246	175
PSNH	48	48
Vermont Group	74	65
Total Dependable Hydro Capability (MW)	1239	1156
19. Nominal Pumped Storage Capability (MW)	32	32
20. Pumped Storage Capability Reduction (MW)	0	0
21. Dependable Pumped Storage Capability (19 minus 20) (MW)		
Northeast Utilities	32	32
Total Dependable Pumped Storage Capability (MW)	32	32

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL (Cont'd)

	Dec. 1971	Summer 1972
22. Firm Purchases Within the New England Area (MW)		
Boston Edison	1	1
CMP Co.	10	10
Northeast Utilities	20	20
Total Firm Purchases Within the New England Area (MW)	31	31
23. Firm Purchases Outside New England Area (MW)		
MPS Co.	49	49
MEPCO./NB Purchase #1	280	260
Vermont Group	150	150
NB/Emergency Outside Purchase	-	120
Total Firm Purchases Outside New England Area (MW)	479	579
24. Firm Obligations Outside New England Area (MW)	-	-
25. Total Capability (MW) (3 plus 6, plus 9, plus 15, plus 18, plus 21, plus 22, plus 23)	14527	*14530

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL
(Cont'd)

		Dec. 1971		Summer 1972	
26.	Internal Peak Loads (MW)				
	Boston Edison	1791		1995	
	Fitchburg	60		58	
	Maine: Bangor	148		128	
	CMP Co.	790		703	
	MPS Co.	80		60	
	Montaup	528		469	
	Municipals-Braintree	44		46	
	-Holyoke	35		34	
	-Hudson	17		15	
	-Peabody	45		48	
	-Taunton	63		60	
	-Shrewsbury	24		17	
	-Wallingford	51		54	
	-Wolfeboro	5		4	
	NEES	2536		2298	
	NEGEA	451		475	
	Newport	70		59	
	Northeast Utilities	3195		3137	
	PSNH	806		690	
	UI	754		836	
	Vermont Group	652		475	
	Total Loads (Non-Coincident - MW)	12145		11661	
	(Coincident - MW)	12135	@ 5-6 P.M. on 12/22/71	11464	@ 11-12 N on 8/25/72
27.	Reserve Margin Before Unavailable Capacity (MW) (25 minus 26 Coincident)	2392		3066	
28.	Percent Reserve Before Unavailable Capacity (27 divided by 26)	19.7		26.7	

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS - ACTUAL (Cont'd)

	Dec. 1971	Summer 1972
29. Unavailable Capacity (MW)**	905	2731
30. Reserve Margin After Unavailable Capacity (MW) (27 minus 29)	1487	335
31. Percent Reserve After Unavailable Capacity (30 divided by 26 Coincident)	12.3	2.9
32. Capability Increase With Median Hydro (MW)	16	61
33. Median Hydro Capability (MW)	1255	1217
34. Total Capability With Median Hydro (MW) (25 plus 32)	14543	14591
35. Reserve Margin With Median Hydro Before Unavailable Capacity (MW) (34 minus 26)	2408	3127
36. Percent Reserve With Median Hydro Before Unavailable Capacity (35 divided by 26 Coincident)	19.8	27.3

**Unavailable Capacity (MW)

	Dec. 1971		Summer 1972
Scheduled	155		581
Forced Outage	227	Unsched. Outages	2150
Unavailable For Other Reasons	523		
Total Unavailable Capacity (MW)	905		2731

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
1. Nominal Conventional Thermal Capability (MW)										10139	10114	10029
2. Conventional Thermal Capability Reduction (MW)										57	-1	-1
3. Conventional Thermal Capability (1 minus 2) (MW)												
Boston Edison										1757	1732	1732
Fitchburg										61	61	61
Maine: Bangor										57	57	57
CMP Co.										396	398	398
MPS Co.										23	23	23
Montaup										400	404	404
Municipals-Braintree										38	38	38
-Holyoke										31	31	31
-Taunton										73	73	73
-Wallingford										23	23	23
NEES										2291	2291	2206
NEGEA										761	761	761
Newport										14	14	14
Northeast Utilities										2417	2467	2467
PSNH										694	696	696
UI										1011	1011	1011
Vermont Group										35	35	35
Total Conventional Thermal Capability (MW)										10082	10115	10030
4. Nominal Nuclear Capability (MW)										1410	2324	3163

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
5. Nuclear Capability Reduction (MW)										0	0	0
6. Nuclear Capability (4 minus 5) (MW)												
Boston Edison										-	657	657
Conn. Yankee										575	575	575
Maine-Yankee										-	-	583
Northeast Utilities										660	660	660
Mass. Yankee										175	175	175
Vermont Yankee										-	257	513
Total Nuclear Capability (MW)										1410	2324	3163
7. Nominal Gas Turbine Capability (MW)										1475	1475	1475
8. Gas Turbine Capability Reduction (MW)										0	0	0
9. Gas Turbine Capability (7 minus 8) (MW)												
Boston Edison										291	291	291
Fitchburg										30	30	30
Maine: Bangor										5	5	5
CMP Co.										46	46	46
Montaup										48	48	48
Municipals-Holyoke										10	10	10
-Peabody										20	20	20
NEES										45	45	45
NEGEA										48	48	48

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
9. Gas Turbine Capability (7 minus 8) (MW) (Cont'd)												
Northeast Utilities										656	656	656
PSNH										111	111	111
UI										21	21	21
Vermont Group										144	144	144
Total Gas Turbine Capability (MW)										1475	1475	1475
10. Nominal Combined Cycle Capability (MW)										-	-	-
11. Combined Cycle Capability Reduction (MW)										-	-	-
12. Combined Cycle Capability (10 minus 11) (MW)										-	-	-
13. Nominal Diesel Capability (MW)										236	241	241
14. Diesel Capability Reduction (MW)										0	0	0
15. Diesel Capability (13 minus 14) (MW)												
Maine: Bangor										24	24	24
CMP Co.										4	4	4
MPS Co.										13	13	13

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
15. Diesel Capability (13 minus 14) (MW) (Cont'd)												
Municipals-Braintree										5	5	5
-Hudson										20	20	20
-Peabody										11	11	11
-Shrewsbury										5	5	5
-Wolfeboro										3	3	3
NEES										83	83	83
NEGEA										14	14	14
Newport										14	14	14
Northeast Utilities										15	20	20
PSNH										3	3	3
Vermont Group										22	22	22
Total Diesel Capability (MW)										236	241	241
16. Nominal Hydro Capability (MW)										1246	1246	1246
17. Hydro Capability Reduction (MW)										47	16	3
18. Dependable Hydro Capability (16 minus 17) (MW)												
Maine: Bangor										22	26	27
CMP Co.										294	294	294
MPS Co.										2	2	2
Municipal-Holyoke										2	2	2

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
18. Dependable Hydro Capability (16 minus 17) (MW) (Cont'd)												
NEES										546	546	546
Northeast Utilities										212	236	246
PSNH										48	48	48
Vermont Group										73	76	78
Total Dependable Hydro Capability (MW)										1199	1230	1243
19. Nominal Pumped Storage Capability (MW)										32	32	282
20. Pumped Storage Capability Reduction (MW)										0	0	0
21. Dependable Pumped Storage Capability (19 minus 20) (MW)												
Northeast Utilities										32	32	282
Total Dependable Pumped Storage Capability (MW)										32	32	282
22. Firm Purchases Within the New England Area (MW)												
Boston Edison										1	1	1
CMP Co.										10	10	10
Northeast Utilities										20	20	20

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
22. Firm Purchases Within the New England Area (MW) (Cont'd)												
Total Firm Purchases Within the New England Area (MW)										31	31	31
23. Firm Purchases Outside New England Area (MW)												
MPS Co.										49	56	56
MEPCO/NB Purchase #1										260	260	260
Vermont Group										150	150	150
Total Firm Purchases Outside New England Area (MW)										459	466	466
24. Firm Obligations Outside New England Area (MW)												
MPS Co.										-	-	40
Total Firm Obligations Outside New England Area (MW)										-	-	40
25. Total Capability (MW) (3 plus 6, plus 9, plus 15, plus 18, plus 21, plus 22, plus 23 and minus 24)										14924	15914	16891

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
26. Estimated Internal Peak Loads (MW)												
Boston Edison										1780	1775	1850
Fitchburg										58	61	62
Maine: Bangor										132	148	161
CMP Co.										749	795	849
MPS Co.										69	78	82
Montaup										486	524	566
Municipals-Braintree										45	45	46
-Holyoke										30	34	39
-Hudson										15	16	18
-Peabody										42	45	49
-Taunton										54	63	67
-Shrewsbury										22	24	26
-Wallingford										44	52	53
-Wolfeboro										4	4	5
NEES										2316	2638	2834
NEGEA										422	447	477
Newport										66	71	78
Northeast Utilities										2946	3315	3644
PSNH										743	796	885
UI										732	787	855
Vermont Group										575	657	777
Total Loads (MW)										11330	12375	13423
27. Reserve Margin Before Maintenance (MW) (25 minus 26)										3594	3539	3468
28. Percent Reserve Before Maintenance (27 divided by 26)										31.7	28.6	25.8

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct. 1972	Nov. 1972	Dec. 1972
29. Scheduled Maintenance (MW)										2387	420	81
30. Reserve Margin After Maintenance (MW) (27 minus 29)										1207	3119	3387
31. Percent Reserve After Maintenance (30 divided by 26)										10.7	25.2	25.2
32. Capability Increase With Median Hydro (MW)										28	26	16
33. Median Hydro Capability (MW)										1227	1256	1259
34. Total Capability With Median Hydro (MW) (25 plus 32)										14952	15940	16907
35. Reserve Margin With Median Hydro Before Maintenance (MW) (34 minus 26)										3622	3565	3484
36. Percent Reserve With Median Hydro Before Maintenance (35 divided by 26)										32.0	28.8	26.0

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
1. Nominal Conventional Thermal Capability (MW)	10001	10001	9983	9923	9923	10323	10323	10323	10323	10323	10323	10323
2. Conventional Thermal Capability Reduction (MW)	-1	-1	-1	-1	1	37	166	166	154	1	-1	-1
3. Conventional Thermal Capability (1 minus 2) (MW)												
Boston Edison	1732	1732	1732	1732	1732	1732	1712	1712	1712	1732	1732	1732
Fitchburg	33	33	33	33	33	33	33	33	33	33	33	33
Maine: Bangor	57	57	57	57	57	56	56	56	56	57	57	57
CMP Co.	398	398	398	398	398	395	395	395	395	398	398	398
MPS Co.	23	23	23	23	23	23	23	23	23	23	23	23
Montaup	404	404	404	344	344	340	340	340	340	344	344	344
Municipals-Braintree	38	38	38	38	38	38	36	36	38	38	38	38
-Holyoke	31	31	31	31	31	31	31	31	31	31	31	31
-Taunton	73	73	73	73	73	73	63	63	73	73	73	73
-Wallingford	23	23	23	23	23	23	23	23	23	23	23	23
NEES	2206	2206	2206	2206	2206	2206	2157	2157	2157	2206	2206	2206
NEGEA	761	761	761	761	761	734	734	734	734	761	761	761
Newport	14	14	14	14	14	14	14	14	14	14	14	14
Northeast Utilities	2467	2467	2467	2467	2467	2867	2819	2819	2819	2867	2867	2867
PSNH	696	696	678	678	676	676	676	676	676	676	678	678
UI	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011
Vermont Group	35	35	35	35	35	34	34	34	34	35	35	35
Total Conventional Thermal Capability (MW)	10002	10002	9984	9924	9922	10286	10157	10157	10169	10322	10324	10324

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
4. Nominal Nuclear Capability (MW)	3163	3163	3163	3163	3163	3163	3163	3163	3163	3163	3163	3163
5. Nuclear Capability Reduction (MW)	0	0	0	0	0	11	51	51	41	11	0	0
6. Nuclear Capability (4 minus 5) (MW)												
Boston Edison	657	657	657	657	657	657	657	657	657	657	657	657
Conn-Yankee	575	575	575	575	575	575	550	550	550	575	575	575
Maine-Yankee	583	583	583	583	583	583	583	583	583	583	583	583
Northeast Utilities	660	660	660	660	660	660	655	655	655	660	660	660
Mass-Yankee	175	175	175	175	175	175	165	165	175	175	175	175
Vermont-Yankee	513	513	513	513	513	502	502	502	502	502	513	513
Total Nuclear Capability (MW)	3163	3163	3163	3163	3163	3152	3112	3112	3122	3152	3163	3163
7. Nominal Gas Turbine Capability (MW)	1475	1475	1475	1475	1475	1475	1475	1475	1475	1475	1475	1475
8. Gas Turbine Capability Reduction (MW)	0	0	0	0	0	230	278	278	275	0	0	0
9. Gas Turbine Capability (7 minus 8) (MW)												
Boston Edison	291	291	291	291	291	291	246	246	246	291	291	291
Fitchburg	30	30	30	30	30	24	24	24	24	30	30	30
Maine: Bangor	5	5	5	5	5	5	5	5	5	5	5	5
CMP Co.	46	46	46	46	46	39	39	39	39	46	46	46
Montaup	48	48	48	48	48	39	39	39	39	48	48	48
Municipals-Holyoke	10	10	10	10	10	9	9	9	9	10	10	10
Peabody	20	20	20	20	20	20	17	17	20	20	20	20

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
9. Gas Turbine Capability (7 minus 8) (MW) (Cont'd)												
NEES	45	45	45	45	45	40	40	40	40	45	45	45
NEGEA	48	48	48	48	48	38	38	38	38	48	48	48
Northeast Utilities	656	656	656	656	656	517	517	517	517	656	656	656
PSNH	111	111	111	111	111	90	90	90	90	111	111	111
UI	21	21	21	21	21	17	17	17	17	21	21	21
Vermont Group	144	144	144	144	144	116	116	116	116	144	144	144
Total Gas Turbine Capability (MW)	1475	1475	1475	1475	1475	1245	1197	1197	1200	1475	1475	1475
10. Nominal Combined Cycle Capability (MW)	-	-	-	-	-	-	110	110	110	110	110	110
11. Combined Cycle Capability Reduction (MW)	-	-	-	-	-	-	3	3	0	0	0	0
12. Combined Cycle Capability (10 minus 11) (MW)												
Taunton	-	-	-	-	-	-	107	107	110	110	110	110
Total Combined Cycle Capability (MW)	-	-	-	-	-	-	107	107	110	110	110	110
13. Nominal Diesel Capability (MW)	241	241	241	241	241	241	241	241	244	244	244	244
14. Diesel Capability Reduction (MW)	0	0	0	0	0	0	0	0	0	0	0	0

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
5. Diesel Capability (13 minus 14) (MW)												
Maine: Bangor	24	24	24	24	24	24	24	24	24	24	24	24
CMP Co.	4	4	4	4	4	4	4	4	4	4	4	4
MPS Co.	13	13	13	13	13	13	13	13	13	13	13	13
Municipals-Braintree	5	5	5	5	5	5	5	5	5	5	5	5
-Hudson	20	20	20	20	20	20	20	20	20	20	20	20
-Peabody	11	11	11	11	11	11	11	11	11	11	11	11
-Shrewsbury	5	5	5	5	5	5	5	5	8	8	8	8
-Wolfeboro	3	3	3	3	3	3	3	3	3	3	3	3
NEES	83	83	83	83	83	83	83	83	83	83	83	83
NEGEA	14	14	14	14	14	14	14	14	14	14	14	14
Newport	14	14	14	14	14	14	14	14	14	14	14	14
Northeast Utilities	20	20	20	20	20	20	20	20	20	20	20	20
PSNH	3	3	3	3	3	3	3	3	3	3	3	3
Vermont Group	22	22	22	22	22	22	22	22	22	22	22	22
Total Diesel Capability (MW)	241	241	241	241	241	241	241	241	244	244	244	244
16. Nominal Hydro Capability (MW)	1245	1245	1242	1242	1227	1226	1226	1226	1226	1226	1226	1226
17. Hydro Capability Reduction (MW)	10	30	79	59	26	19	41	91	89	47	16	3
18. Dependable Hydro Capability (16 minus 17) (MW)												
Maine: Bangor	28	27	27	23	24	27	25	25	24	22	26	27
CMP Co.	294	294	294	294	294	294	294	294	294	294	294	294
MPS Co.	2	2	2	2	2	2	2	2	2	2	2	2

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
18. Dependable Hydro Capability (16 minus 17) (MW) (Cont'd)												
Municipals-Holyoke	2	2	2	2	2	1	1	1	1	2	2	2
NEES	546	527	488	498	510	531	531	531	531	531	531	531
Northeast Utilities	245	245	234	233	238	235	224	174	177	211	235	245
PSNH	48	48	45	45	45	44	44	44	44	44	44	44
Vermont Group	70	70	71	86	86	73	64	64	64	73	76	78
Total Dependable Hydro Capability (MW)	1235	1215	1163	1183	1201	1207	1185	1135	1137	1179	1210	1223
19. Nominal Pumped Storage Capability (MW)	282	282	532	532	782	782	1032	1032	1032	1032	1032	1032
20. Pumped Storage Capability Reduction (MW)	0	0	0	0	0	0	0	0	0	0	0	0
21. Dependable Pumped Storage Capability (19 minus 20) (MW)												
Northeast Utilities	282	282	532	532	782	782	1032	1032	1032	1032	1032	1032
Total Dependable Pumped Storage Capability (MW)	282	282	532	532	782	782	1032	1032	1032	1032	1032	1032

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
22. Firm Purchases Within the New England Area (MW)												
Boston Edison	1	1	1	1	1	1	1	1	1	1	1	1
CMP Co.	10	10	10	10	10	10	10	10	10	10	10	10
Northeast Utilities	20	20	20	20	20	20	20	20	20	20	20	20
Total Firm Purchases Within the New England Area (MW)	31	31	31	31	31	31	31	31	31	31	31	31
23. Firm Purchases Outside New England Area (MW)												
MPS Co.	57	57	57	63	63	64	57	57	57	57	61	61
MEPCO/NB Purchase #1	260	260	260	260	260	260	240	240	240	240	240	240
Vermont Group	150	150	150	150	150	150	150	150	150	150	150	150
Total Firm Purchases Outside New England Area (MW)	467	467	467	473	473	474	447	447	447	447	451	451
24. Firm Obligations Outside New England Area (MW)												
MPS Co.	40	40	40	40	40	40	40	40	40	40	40	40
Total Firm Obligations Outside New England Area (MW)	40	40	40	40	40	40	40	40	40	40	40	40
25. Total Capability (MW) (3 plus 6, plus 9, plus 12, plus 15, plus 18, plus 21, plus 22, plus 23 and minus 24)	16856	16836	17016	16982	17248	17378	17469	17419	17452	17952	18000	18013

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
26. Estimated Internal Peak Loads (MW)												
Boston Edison	1820	1805	1721	1650	1680	1975	2025	2025	1985	1840	1900	1940
Fitchburg	60	58	57	57	57	57	59	62	59	60	63	64
Maine: Bangor	162	152	145	131	132	132	137	141	151	142	162	174
CMP Co.	841	813	763	747	746	755	787	800	779	804	853	911
MPS Co.	78	77	75	73	72	67	60	63	66	73	81	85
Montaup	556	533	494	494	487	502	518	523	518	521	561	606
Municipals-Braintree	46	46	44	44	43	43	46	49	46	45	47	49
-Holyoke	36	35	32	30	28	35	37	36	35	32	35	40
-Hudson	17	16	16	15	14	16	16	16	15	16	18	20
-Peabody	52	47	44	46	44	52	58	56	47	37	43	48
-Taunton	67	64	60	58	58	60	62	65	62	57	67	71
-Shrewsbury	25	24	23	20	20	20	20	20	21	22	23	27
-Wallingford	52	53	49	45	47	55	55	56	53	46	54	55
-Wolfeboro	5	6	5	4	4	4	4	5	4	4	5	5
NEES	2761	2662	2500	2432	2362	2554	2633	2642	2659	2560	2849	3069
NEGEA	460	444	420	412	420	455	490	506	473	456	483	514
Newport	75	74	71	67	64	65	67	65	69	70	76	83
Northeast Utilities	3645	3464	3252	3115	3064	3246	3506	3504	3508	3205	3593	3982
PSNH	885	848	809	760	750	750	799	799	760	819	877	975
UI	836	804	774	751	732	894	924	944	932	778	830	920
Vermont Group	777	743	675	600	543	505	505	520	550	630	730	864
Total Loads (MW)	13256	12768	12029	11551	11367	12242	12808	12897	12792	12217	13350	14502
27. Reserve Margin Before Maintenance (MW) (25 minus 26)	3600	4068	4987	5431	5881	5136	4661	4522	4660	5735	4650	3511
28. Percent Reserve Before Maintenance (27 divided by 26)	27.2	31.9	41.5	47.0	51.7	42.0	36.4	35.1	36.4	46.9	34.8	24.2

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Jan. 1973	Feb. 1973	March 1973	April 1973	May 1973	June 1973	July 1973	Aug. 1973	Sept. 1973	Oct. 1973	Nov. 1973	Dec. 1973
29. Scheduled Maintenance (MW)	0	233	966	1709	1992	969	910	985	1010	1991	815	0
30. Reserve Margin After Maintenance (MW) (27 minus 29)	3600	3835	4021	3722	3889	4167	3751	3537	3650	3744	3835	3511
31. Percent Reserve After Maintenance (30 divided by 26)	27.2	30.0	33.4	32.2	34.2	34.0	29.3	27.4	28.5	30.6	28.7	24.2
32. Capability Increase With Median Hydro (MW)	13	13	22	15	16	26	35	61	57	28	26	16
33. Median Hydro Capability (MW)	1248	1228	1185	1198	1217	1233	1220	1196	1194	1207	1236	1239
34. Total Capability With Median Hydro (MW) (25 plus 32)	16869	16849	17038	16997	17264	17404	17504	17480	17509	17980	18026	18029
35. Reserve Margin With Median Hydro Before Maintenance (MW) (34 minus 26)	3613	4081	5009	5446	5897	5162	4696	4583	4717	5763	4676	3527
36. Percent Reserve With Median Hydro Before Maintenance (35 divided by 26)	27.3	32.0	41.6	47.1	51.9	42.2	36.7	35.5	36.9	47.2	35.0	24.3

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
1. Nominal Conventional Thermal Capability (MW)	10723	11188	12720	12720	12720	12720	12716	14166	14166	14166	14166	14166
2. Conventional Thermal Capability Reduction (MW)	168	-1	175	-1	175	-1	174	-2	189	-2	189	-2
3. Conventional Thermal Capability (1 minus 2) (MW)												
Boston Edison	1712	1732	2299	2319	2299	2319	2299	2319	2299	2319	2299	2319
Fitchburg	33	33	33	33	33	33	33	33	33	33	33	33
Maine: Bangor	56	57	56	57	56	57	56	57	56	57	56	57
CMP Co.	395	398	395	398	395	398	395	998	995	998	995	998
MPS Co.	23	23	23	23	23	23	23	23	23	23	23	23
Montaup	340	344	620	624	620	624	620	624	620	624	620	624
Municipals-Braintree	36	38	36	38	36	38	36	38	36	38	36	38
-Holyoke	31	31	31	31	31	31	31	31	31	31	31	31
-Taunton	63	73	63	73	63	73	63	73	63	73	63	73
-Wallingford	23	23	23	23	23	23	23	23	23	23	23	23
NEES	2157	2671	2574	2634	2574	2634	2574	3484	3409	3484	3409	3484
NEGEA	734	761	993	1018	993	1018	993	1018	993	1018	993	1018
Newport	14	14	14	14	14	14	14	14	14	14	14	14
Northeast Utilities	2819	2867	2819	2867	2819	2867	2819	2867	2819	2867	2819	2867
PSNH	1074	1078	1076	1078	1076	1078	1076	1078	1076	1078	1076	1078
UI	1011	1011	1456	1456	1456	1456	1456	1456	1456	1456	1456	1456
Vermont Group	34	35	34	35	34	35	31	32	31	32	31	32
Total Conventional Thermal Capability (MW)	10555	11189	12545	12721	12545	12721	12542	14168	13977	14168	13977	14168

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
4. Nominal Nuclear Capability (MW)	4229	4229	4262	4262	4292	4292	4292	4292	4292	5472	6622	7772
5. Nuclear Capability Reduction (MW)	51	0	51	0	51	0	51	0	51	0	51	0
6. Nuclear Capability (4 minus 5) (MW)												
Boston Edison	657	657	657	657	657	657	657	657	657	1837	1837	1837
Conn-Yankee	550	575	550	575	550	575	550	575	550	575	550	575
Maine-Yankee	792	792	825	825	855	855	855	855	855	855	855	855
Northeast Utilities	1485	1490	1485	1490	1485	1490	1485	1490	1485	1490	2635	2640
Mass-Yankee	165	175	165	175	165	175	165	175	165	175	165	175
PSNH	–	–	–	–	–	–	–	–	–	–	–	1150
Vermont-Yankee	529	540	529	540	529	540	529	540	529	540	529	540
Total Nuclear Capability (MW)	4178	4229	4211	4262	4241	4292	4241	4292	4241	5472	6571	7772
7. Nominal Gas Turbine Capability (MW)	1475	1475	1475	1475	1475	1475	1519	1519	1519	1519	1519	1519
8. Gas Turbine Capability Reduction (MW)	278	0	278	0	278	0	286	0	286	0	286	0
9. Gas Turbine Capability (7 minus 8) (MW)												
Boston Edison	246	291	246	291	246	291	246	291	246	291	246	291
Fitchburg	24	30	24	30	24	30	24	30	24	30	24	30
Maine: Bangor	5	5	5	5	5	5	5	5	5	5	5	5
CMP Co.	39	46	39	46	39	46	39	46	39	46	39	46

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
9. Gas Turbine Capability (7 minus 8) (MW) (Cont'd)												
Montaup	39	48	39	48	39	48	39	48	39	48	39	48
Municipals-Holyoke	9	10	9	10	9	10	9	10	9	10	9	10
-Peabody	17	20	17	20	17	20	34	40	34	40	34	40
NEES	40	45	40	45	40	45	40	45	40	45	40	45
NEGEA	38	48	38	48	38	48	57	72	57	72	57	72
Northeast Utilities	517	656	517	656	517	656	517	656	517	656	517	656
PSNH	90	111	90	111	90	111	90	111	90	111	90	111
UI	17	21	17	21	17	21	17	21	17	21	17	21
Vermont Group	116	144	116	144	116	144	116	144	116	144	116	144
Total Gas Turbine Capability (MW)	1197	1475	1197	1475	1197	1475	1233	1519	1233	1519	1233	1519
9A. Uncommitted Gas Turbine Capability (MW)	-	-	-	-	-	-	-	-	-	-	-	150
10. Nominal Combined Cycle Capability (MW)	110	110	160	160	160	160	437	437	437	437	437	437
11. Combined Cycle Capability Reduction (MW)	3	0	3	0	3	0	33	0	33	0	33	0
12. Combined Cycle Capability (10 minus 11) (MW)												
Braintree	-	-	50	50	50	50	50	50	50	50	50	50
Taunton	107	110	107	110	107	110	107	110	107	110	107	110
Vermont Group	-	-	-	-	-	-	247	277	247	277	247	277
Total Combined Cycle Capability (MW)	107	110	157	160	157	160	404	437	404	437	404	437

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
12A. Uncommitted Combined Cycle Capability (MW)	-	-	-	-	-	-	-	-	-	-	240	310
13. Nominal Diesel Capability (MW)	243	243	243	243	243	246	246	246	246	249	249	249
14. Diesel Capability Reduction (MW)	0	0	0	0	0	0	0	0	0	0	0	0
15. Diesel Capability (13 minus 14) (MW)												
Maine: Bangor	24	24	24	24	24	24	24	24	24	24	24	24
CMP Co.	4	4	4	4	4	4	4	4	4	4	4	4
MPS Co.	13	13	13	13	13	13	13	13	13	13	13	13
Municipals-Braintree	5	5	5	5	5	5	5	5	5	5	5	5
-Hudson	20	20	20	20	20	20	20	20	20	20	20	20
-Peabody	11	11	11	11	11	11	11	11	11	11	11	11
-Shrewsbury	8	8	8	8	8	11	11	11	11	14	14	14
-Wolfeboro	2	2	2	2	2	2	2	2	2	2	2	2
NEES	83	83	83	83	83	83	83	83	83	83	83	83
NEGEA	14	14	14	14	14	14	14	14	14	14	14	14
Newport	14	14	14	14	14	14	14	14	14	14	14	14
Northeast Utilities	20	20	20	20	20	20	20	20	20	20	20	20
PSNH	3	3	3	3	3	3	3	3	3	3	3	3
Vermont Group	22	22	22	22	22	22	22	22	22	22	22	22
Total Diesel Capability (MW)	243	243	243	243	243	246	246	246	246	249	249	249
16. Nominal Hydro Capability (MW)	1251	1251	1251	1251	1251	1251	1251	1251	1251	1251	1251	1251

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
7. Hydro Capability Reduction (MW)	91	3	91	2	91	2	91	2	91	2	91	2
8. Dependable Hydro Capability (16 minus 17) (MW)												
Maine: Bangor	25	27	25	28	25	28	25	28	25	28	25	28
CMP Co.	294	294	294	294	294	294	294	294	294	294	294	294
MPS Co.	2	2	2	2	2	2	2	2	2	2	2	2
Municipal-Holyoke	1	2	1	2	1	2	1	2	1	2	1	2
NEES	556	556	556	556	556	556	556	556	556	556	556	556
Northeast Utilities	174	245	174	245	174	245	174	245	174	245	174	245
PSNH	44	44	44	44	44	44	44	44	44	44	44	44
Vermont Group	64	78	64	78	64	78	64	78	64	78	64	78
Total Dependable Hydro Capability (MW)	1160	1248	1160	1249	1160	1249	1160	1249	1160	1249	1160	1249
9. Nominal Pumped Storage Capability (MW)	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
0. Pumped Storage Capability Reduction (MW)	0	0	0	0	0	0	0	0	0	0	0	0
1. Dependable Pumped Storage Capability (19 minus 20) (MW)												
NEES	600	600	600	600	600	600	600	600	600	600	600	600
Northeast Utilities	1032	1032	1032	1032	1032	1032	1032	1032	1032	1032	1032	1032
Total Dependable Pumped Storage Capability (MW)	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632	1632

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
2. Firm Purchases Within the New England Area (MW)												
Boston Edison	1	1	1	1	1	1	1	1	1	1	1	1
CMP Co.	10	10	10	10	10	10	10	10	10	10	10	10
Total Firm Purchases Within the New England Area (MW)	11	11	11	11	11	11	11	11	11	11	11	11
3. Firm Purchases Outside New England Area (MW)												
MPS Co.	61	68	68	77	77	32	32	33	33	34	34	34
MEPCO/NB Purchase #1	200	200	-	-	-	-	-	-	-	-	-	-
MEPCO/NB Purchase #2	-	-	-	-	400	400	400	400	400	400	400	400
Vermont Group	150	150	150	150	150	150	150	150	150	150	150	150
Total Firm Purchases Outside New England Area (MW)	411	418	218	227	627	582	582	583	583	584	584	584
3A. Uncommitted Purchases (MW)	-	-	-	-	-	-	-	-	-	-	400	400
4. Firm Obligations Outside New England Area (MW)												
MPS Co.	41	41	43	43	43	-	-	-	-	-	-	-
Total Firm Obligations Outside New England Area (MW)	41	41	43	43	43	-	-	-	-	-	-	-
25. Total Capability (MW) (3 plus 6, plus 9, plus 9A, plus 12, plus 12A, plus 15, plus 18, plus 21, plus 22, plus 23, plus 23A and minus 24)	19453	20514	21331	21937	21770	22368	22051	24137	23487	25321	26461	28481

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
5. Estimated Internal Peak Loads (MW)												
Boston Edison	2180	1975	2250	2100	2420	2235	2595	2380	2780	2535	2980	2695
Fitchburg	65	68	69	72	73	77	78	82	83	87	88	92
Maine: Bangor	152	192	163	210	177	230	192	252	209	275	227	301
CMP Co.	858	977	920	1048	987	1124	1058	1205	1135	1293	1217	1386
MPS Co.	67	91	71	97	76	103	81	110	86	117	92	125
Montaup	560	649	600	695	643	745	688	797	737	854	790	915
Municipals-Braintree	51	52	55	55	57	57	60	60	63	63	67	67
-Holyoke	38	42	41	44	43	47	45	49	47	51	50	54
-Hudson	17	21	19	23	21	25	23	27	25	29	27	31
-Peabody	63	50	74	62	83	67	94	73	105	79	118	85
-Taunton	70	75	73	80	77	84	82	89	86	94	91	100
-Shrewsbury	21	29	22	30	23	32	24	34	25	37	26	40
-Wallingford	58	57	61	60	64	63	67	66	70	70	74	73
-Wolfeboro	5	6	5	6	5	7	5	7	6	8	6	8
NEES	2859	3412	3187	3647	3433	3920	3715	4203	4002	4509	4314	4834
NEGEA	536	545	568	578	602	613	640	650	678	689	720	731
Newport	69	88	72	93	78	99	83	105	89	111	95	117
Northeast Utilities	3792	4290	4099	4637	4426	5014	4793	5411	5180	5837	5596	6304
PSNH	879	1073	969	1182	1067	1302	1176	1434	1295	1580	1426	1740
UI	1027	992	1116	1070	1205	1149	1300	1231	1402	1320	1516	1414
Vermont Group	563	959	625	1064	691	1176	764	1299	844	1435	933	1586
Total Loads (MW)	13930	15643	15059	16853	16251	18169	17563	19564	18947	21073	20453	22698
7. Reserve Margin Before Maintenance (MW) (25 minus 26)	5523	4871	6272	5084	5519	4199	4488	4573	4540	4248	6008	5783
8. Percent Reserve Before Maintenance (27 divided by 26)	39.6	31.1	41.6	30.2	34.0	23.1	25.6	23.4	24.0	20.2	29.4	25.5

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1974	Dec. 1974	Aug. 1975	Dec. 1975	Aug. 1976	Dec. 1976	Aug. 1977	Dec. 1977	Aug. 1978	Dec. 1978	Aug. 1979	Dec. 1979
29. Scheduled Maintenance (MW)	500	0	500	0	700	0	700	0	700	0	700	0
30. Reserve Margin After Maintenance (MW) (27 minus 29)	5023	4871	5772	5084	4819	4199	3788	4573	3840	4248	5308	5783
31. Percent Reserve After Maintenance (30 divided by 26)	36.1	31.1	38.3	30.2	29.7	23.1	21.6	23.4	20.2	20.2	26.0	25.5
32. Capability Increase With Median Hydro (MW)	61	16	61	15	61	15	61	15	61	15	61	15
33. Median Hydro Capability (MW)	1221	1264	1221	1264	1221	1264	1221	1264	1221	1264	1221	1264
34. Total Capability With Median Hydro (MW) (25 plus 32)	19514	20530	21392	21952	21831	22383	22112	24152	23548	25336	26522	28496
35. Reserve Margin With Median Hydro Before Maintenance (MW) (34 minus 26)	5584	4887	6333	5099	5580	4214	4549	4588	4601	4263	6069	5798
36. Percent Reserve With Median Hydro Before Maintenance (35 divided by 26)	40.1	31.2	42.1	30.3	34.3	23.2	25.9	23.5	24.3	20.2	29.7	25.5

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
1. Nominal Conventional Thermal Capability (MW)	14166	14166	14166	14166	14166	14166
2. Conventional Thermal Capability Reduction (MW)	189	-2	189	-2	189	-2
3. Conventional Thermal Capability (1 minus 2) (MW)						
Boston Edison	2299	2319	2299	2319	2299	2319
Fitchburg	33	33	33	33	33	33
Maine: Bangor	56	57	56	57	56	57
CMP Co.	995	998	995	998	995	998
MPS Co.	23	23	23	23	23	23
Montaup	620	624	620	624	620	624
Municipals-Braintree	36	38	36	38	36	38
-Holyoke	31	31	31	31	31	31
-Taunton	63	73	63	73	63	73
-Wallingford	23	23	23	23	23	23
NEES	3409	3484	3409	3484	3409	3484
NEGEA	993	1018	993	1018	993	1018
Newport	14	14	14	14	14	14
Northeast Utilities	2819	2867	2819	2867	2819	2867
PSNH	1076	1078	1076	1078	1076	1078
UI	1456	1456	1456	1456	1456	1456
Vermont Group	31	32	31	32	31	32
Total Conventional Thermal Capability (MW)	13977	14168	13977	14168	13977	14168
4. Nominal Nuclear Capability (MW)	9822	9822	10972	12122	13022	13022
5. Nuclear Capability Reduction (MW)	51	0	51	0	51	0

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
6. Nuclear Capability (4 minus 5) (MW)						
Boston Edison	2987	2987	2987	2987	2987	2987
Conn-Yankee	550	575	550	575	550	575
Maine-Yankee	855	855	855	855	855	855
NEES	900	900	900	900	1800	1800
Northeast Utilities	2635	2640	3785	3790	3785	3790
Mass-Yankee	165	175	165	175	165	175
PSNH	1150	1150	1150	2300	2300	2300
Vermont-Yankee	529	540	529	540	529	540
Total Nuclear Capability (MW)	9771	9822	10921	12122	12971	13022
7. Nominal Gas Turbine Capability (MW)	1519	1519	1519	1519	1519	1519
8. Gas Turbine Capability Reduction (MW)	286	0	286	0	286	0
9. Gas Turbine Capability (7 minus 8) (MW)						
Boston Edison	246	291	246	291	246	291
Fitchburg	24	30	24	30	24	30
Maine: Bangor	5	5	5	5	5	5
CMP Co.	39	46	39	46	39	46
Montaup	39	48	39	48	39	48
Municipals-Holyoke	9	10	9	10	9	10
-Peabody	34	40	34	40	34	40
NEES	40	45	40	45	40	45
NEGEA	57	72	57	72	57	72
Northeast Utilities	517	656	517	656	517	656

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
). Gas Turbine Capability (7 minus 8) (MW) (Cont'd)						
PSNH	90	111	90	111	90	111
UI	17	21	17	21	17	21
Vermont Group	116	144	116	144	116	144
Total Gas Turbine Capability (MW)	1233	1519	1233	1519	1233	1519
)A. Uncommitted Gas Turbine Capability (MW)	130	350	305	600	525	600
). Nominal Combined Cycle Capability (MW)	437	437	437	437	437	437
l. Combined Cycle Capability Reduction (MW)	33	0	33	0	33	0
2. Combined Cycle Capability (MW) (10 minus 11)						
Braintree	50	50	50	50	50	50
Taunton	107	110	107	110	107	110
Vermont Group	247	277	247	277	247	277
Total Combined Cycle Capability (MW)	404	437	404	437	404	437
2A. Uncommitted Combined Cycle Capability (MW)	240	310	240	310	720	930
3. Nominal Diesel Capability (MW)	249	249	249	249	249	249
4. Diesel Capability Reduction (MW)	0	0	0	0	0	0

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
15. Diesel Capability (13 minus 14) (MW)						
Maine: Bangor	24	24	24	24	24	24
CMP Co.	4	4	4	4	4	4
MPS Co.	13	13	13	13	13	13
Municipals-Braintree	5	5	5	5	5	5
-Hudson	20	20	20	20	20	20
-Peabody	11	11	11	11	11	11
-Shrewsbury	14	14	14	14	14	14
-Wolfeboro	2	2	2	2	2	2
NEES	83	83	83	83	83	83
NEGEA	14	14	14	14	14	14
Newport	14	14	14	14	14	14
Northeast Utilities	20	20	20	20	20	20
PSNH	3	3	3	3	3	3
Vermont Group	22	22	22	22	22	22
Total Diesel Capability (MW)	249	249	249	249	249	249
16. Nominal Hydro Capability (MW)	1251	1251	1251	1251	1251	1251
17. Hydro Capability Reduction (MW)	91	2	91	2	91	2
18. Dependable Hydro Capability (16 minus 17) (MW)						
Maine: Bangor	25	28	25	28	25	28
CMP Co.	294	294	294	294	294	294
MPS Co.	2	2	2	2	2	2

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
8. Dependable Hydro Capability (16 minus 17) (MW) (Cont'd)						
Municipal-Holyoke	1	2	1	2	1	2
NEES	556	556	556	556	556	556
Northeast Utilities	174	245	174	245	174	245
PSNH	44	44	44	44	44	44
Vermont Group	64	78	64	78	64	78
Total Dependable Hydro Capability (MW)	1160	1249	1160	1249	1160	1249
9. Nominal Pumped Storage Capability (MW)	1632	1632	1632	1632	1632	1632
0. Pumped Storage Capability Reduction (MW)	0	0	0	0	0	0
1. Dependable Pumped Storage Capability (19 minus 20) (MW)						
NEES	600	600	600	600	600	600
Northeast Utilities	1032	1032	1032	1032	1032	1032
Total Dependable Pumped Storage Capability (MW)	1632	1632	1632	1632	1632	1632
2. Firm Purchases Within the New England Area (MW)						
Boston Edison	1	1	1	1	1	1
CMP Co.	10	10	10	10	10	10
Total Firm Purchases Within the New England Area (MW)	11	11	11	11	11	11

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
23. Firm Purchases Outside New England Area (MW)						
MPS Co.	34	33	33	33	33	33
MEPCO/NB Purchase #2	400	400	400	400	400	400
Vermont Group	150	150	150	150	150	150
Total Firm Purchases Outside New England Area (MW)	584	583	583	583	583	583
23A. Uncommitted Purchases (MW)	400	400	400	400	400	400
24. Firm Obligations Outside New England Area (MW)	-	-	-	-	-	-
25. Total Capability (MW) (3 plus 6, plus 9, plus 9A, plus 12, plus 12A, plus 15, plus 18, plus 21, plus 22, plus 23, and plus 23A)	29791	30730	31115	33280	33865	34800

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
26. Estimated Internal Peak Loads (MW)						
Boston Edison	3200	2870	3430	3050	3680	3240
Fitchburg	93	98	99	103	104	110
Maine: Bangor	247	329	269	360	292	396
CMP Co.	1306	1487	1400	1595	1501	1710
MPS Co.	98	133	105	142	112	152
Montaup	846	980	905	1049	969	1123
Municipals-Braintree	70	70	74	74	77	77
-Holyoke	52	56	55	59	57	62
-Hudson	30	34	32	36	35	39
-Peabody	133	92	150	99	169	107
-Taunton	97	106	103	112	109	118
-Shrewsbury	27	45	28	47	29	49
-Wallingford	78	77	82	81	86	85
-Wolfeboro	6	8	7	9	8	10
NEES	4649	5179	5008	5555	5391	5945
NEGEA	761	775	809	822	860	873
Newport	100	125	107	133	113	141
Northeast Utilities	6052	6810	6549	7346	7085	7932
PSNH	1571	1916	1730	2110	1905	2324
UI	1640	1517	1775	1627	1917	1746
Vermont Group	1031	1752	1139	1936	1258	2139
Total Loads (MW)	22087	24459	23856	26345	25757	28378
27. Reserve Margin Before Maintenance (MW) (25 minus 26)	7704	6271	7259	6935	8108	6422

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS (Cont'd)

	Aug. 1980	Dec. 1980	Aug. 1981	Dec. 1981	Aug. 1982	Dec. 1982
28. Percent Reserve Before Maintenance (27 divided by 26)	34.9	25.6	30.4	26.3	31.5	22.6
29. Scheduled Maintenance (MW)	700	0	700	0	700	0
30. Reserve Margin After Maintenance (MW) (27 minus 29)	7004	6271	6559	6935	7408	6422
31. Percent Reserve After Maintenance (30 divided by 26)	31.7	25.6	27.5	26.3	28.8	22.6
32. Capability Increase With Median Hydro (MW)	61	15	61	15	61	15
33. Median Hydro Capability (MW)	1221	1264	1221	1264	1221	1264
34. Total Capability With Median Hydro (25 plus 32)	29852	30745	31176	33295	33926	34815
35. Reserve Margin With Median Hydro Before Maintenance (MW) (34 minus 26)	7765	6286	7320	6950	8169	6437
36. Percent Reserve With Median Hydro Before Maintenance (35 divided by 26)	35.2	25.7	30.7	26.4	31.7	22.7

APPENDIX A

GENERAL NOTES

A. The Northeast Group and Vermont Group are reported in total only and include the following systems:

Northeast Utilities Group

City of Norwalk Second Taxing District
City of Norwich Department of Public Utilities
The Connecticut Light & Power Company
Farmington River Power Company
The Hartford Electric Light Company
Holyoke Water Power Company
Western Massachusetts Electric Company

Vermont Group

Burlington Electric Light Department
Central Vermont Public Service Corporation
Citizens Utilities
Green Mountain Power Corporation

(Also included are 21 municipals, cooperatives and small utilities served through the above systems.)

B. Municipals listed are:

Braintree Electric Light Department
Holyoke Gas and Electric Department
Hudson Light & Power Company
Peabody Municipal Light Department
Shrewsbury Electric Light Department
Taunton Municipal Lighting Plant
Borough Electric Works of Wallingford
Municipal Electric Department of Wolfeboro

C. It should be borne in mind that the peak data collected was for specified hours. Some companies are planning on day peaks rather than evening peaks; and, times of occurrence of evening peaks also differ so that the data shown does not necessarily indicate the most critical periods for certain sections of the system.

EXPLANATION OF ITEMS BY NUMBER

1. Nominal Conventional Thermal Capability (MW)

   is the maximum claimed full load net winter rating capability at which the owner will operate the unit for the duration of the peak load which is assumed to be 8 hours for June thru September 15 and 2 hours the rest of the year. This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

2. Conventional Thermal Capability Reduction (MW)

   is the difference between the maximum claimed full load net winter ratings and the established full load net seasonal rating capabilities and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

   These reductions are due to circulating water temperature, ambient temperature, kVA limits of generators, steam heating loads and other reductions necessary during certain periods of the year.

3. Conventional Thermal Capability (MW) - Item #1 minus Item #2

4. Nominal Nuclear Capability (MW)

   is the maximum claimed full load net winter rating capability at which the owner will operate the unit for the duration of the peak load which is assumed to be 8 hours for June thru September 15 and 2 hours the rest of the year. This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

5. Nuclear Capability Reduction (MW)

   is the difference between the maximum claimed full load net winter ratings and the established full load net seasonal rating capabilities and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

   These reductions are due to circulating water temperature, ambient temperature, kVA limits of generators, steam heating loads and deratings prior to refueling of the reactor.

6. Nuclear Capability (MW) - Item #4 minus Item #5

7. Nominal Gas Turbine Capability (MW)

is the maximum claimed full load net winter rating capability at 20°F which the owner will operate the unit for the duration of the peak (assumed to be 2 hours) and reflects values approved by the NEPOOL Operating Committee, where it has jurisdiction.

8. Gas Turbine Capability Reduction (MW)

is the difference between the maximum claimed full load net winter ratings and similar full load net seasonal rating capabilities based on 90°F and peak load duration of 8 hours for June thru September.

These reductions are due to ambient temperature, kVA limits of generators, and other reductions necessary during certain periods of the year.

9. Gas Turbine Capability - (MW) - Item #7 minus Item #8

9A. Uncommitted Gas Turbine Capability (MW)

represents the gas turbine units recommended for installation by the NEPOOL Planning Committee whose location and ownership has not yet been determined. Further details in Appendix C.

10. Nominal Combined Cycle Capability (MW)

is the maximum claimed full load net winter capability at which the owner will operate the unit for the duration of the peak load which is assumed to be 8 hours for June thru September 15 and 2 hours the rest of the year. The gas turbine portion of the plant being rated on a 20°F ambient in the winter. This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

11. Combined Cycle Capability Reduction (MW)

is the difference between the maximum claimed full load net winter ratings and the established full load net seasonal rating capabilities. The gas turbine portion of the plant being rated on a 90°F ambient in the summer months of June thru September. The values reflect those approved by the NEPOOL Operating Committee where it has jurisdiction.

These reductions are due to circulating water temperature, ambient temperature, kVA limits of generators, steam heating loads and other reductions necessary during certain periods of the year.

12. Combined Cycle Capability (MW) - Item #10 minus Item #11

12A. Uncommitted Combined Cycle Capability (MW)

represents the amount of combined cycle capacity recommended for installation by the NEPOOL Planning Committee whose location and ownership has not yet been determined. Further details are available in Appendix C.

13. Nominal Diesel Capability (MW)

is the maximum claimed full load net winter rating capability at which the owner will operate the unit for the duration of the peak load which is assumed to be 8 hours for June thru September 15 and 2 hours the rest of the year. This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

14. Diesel Capability Reduction (MW)

is the difference between the maximum claimed full load net winter ratings and the established full load net seasonal rating capabilities and reflects the values approved by the NEPOOL Operating Committee where it has jurisdiction.

These reductions are due to ambient temperature, kVA limits of generators, and other reductions necessary during certain periods of the year.

15. Diesel Capability (MW) - Item #13 minus Item #14

16. Nominal Hydro Capability (MW)

gives the total installed potential capability of the company's hydroelectric plants under the specific flow conditions of the nameplate rating without respect to the energy available or the characteristics of the load.

17. Hydro Capability Reduction (MW)

reflects the difference between the nameplate hydro capability and the dependable hydro capacity.

18. Dependable Hydro Capacity (MW) - Item #16 minus Item #17

gives the hydro capacity under adverse flow conditions based on stream flows equivalent to the year giving the most adverse flow conditions on record during the critical period of system operation. Capacity in any month is that capacity that can be relied upon for serving system load and firm power commitments on the basis of the energy available in that month and its use as limited by the characteristics of the load to be served.

19. Nominal Pumped Storage Capability (MW)

gives the total installed potential capability of the company's pump storage hydro plants under the specified flow conditions.

20. Pumped Storage Capability Reduction (MW)

reflects the difference between the nameplate pumped storage capability and the dependable pumped storage capacity.

21. Dependable Pumped Storage Capacity (MW) - Item #19 minus Item #20

gives the pumped storage capacity which can be relied upon to carry system load or provide dependable reserve capacity at the usual time of annual system peak, taking into account such factors as limitations in plant capability due to reservoir drawdown, the energy equivalent of storage in the upper reservoir, and the available pumping energy on a daily or weekly pumping cycle.

22. Firm Purchases Within the New England Area (MW)

shows the amount stated in the contract of firm power which is intended to be available at the usual time of the annual and monthly company peaks from municipals, industries, etc. within the companies that are not otherwise included in the report.

23. Firm Purchases Outside the New England Area (MW)

shows the amount stated in the contract of firm power which is intended to be available at the time of the annual system peak, from utilities outside the New England area.

23A. Uncommitted Purchase (MW)

represents a tentative purchase from the New Brunswick Electric Power Commission which is presently under study and negotiation. Details are in Appendix C.

24. Firm Obligations Outside the New England Area (MW)

shows the amount as stated in the contract of firm power committed or obligated which is intended to be available at the usual time of the respondents system peak.

25. Total Capability (MW)

sum of Items #3, #6, #9, #9A, #12, #12A, #15, #18, #21, #22, #23, #23A, minus #24.

26. Estimated Internal Peak Loads (MW)

each system has reported peak load data on the basis of integrated demands for 60 minute clock-hour intervals and should coincide as to the hour of occurrence as follows:

March - September, Inclusive	11-12N
January, February, October, November, December	5-6PM

27. Reserve Margin Before Maintenance (MW)

Item #25 minus Item #26.

28. Percent Reserve Before Maintenance (%)

Item #27 divided by Item #26 x 100.

29. Scheduled Maintenance (MW)

shows the maintenance affecting capability at the time of peak loads.

30. Reserve Margin After Maintenance (MW)

Item #27 minus Item #29.

31. Percent Reserve After Maintenance (%)

Item #30 divided by Item #26 x 100.

32. Capability Increase With Median Hydro (MW)

will reflect the difference between the "Dependable Hydro Capacity" (Item #18) and the "Median Hydro Capacity".

33. Median Hydro Capability (MW)

information reported under average or median flow conditions has been made on the assumption of the recurrence of flows equivalent to a year which would give the average annual potential output or has been based on median flow or output for each month whichever is believed will present the most realistic condition for the system.

34. Total Capability With Median Hydro (MW)

Item #25 plus Item #32.

35. Reserve Margin With Median Hydro Before Maintenance (MW)

Item #34 minus Item #26.

36. Percent Reserve With Median Hydro Before Maintenance (%)

Item #35 divided by Item #26 x 100.

APPENDIX B

ACTUAL CHANGES IN GENERATING CAPACITY SINCE LAST REPORT

ACTUAL RETIREMENTS

COMPANY	STATION	EQUIPMENT	CHANGE IN NOMINAL MW	DATE MONTH YEAR
Vermont Group	Rutland Gas Turbine #3	Gas Turbine	- 5.0	March 15, 1972
New England Gas. & Elec. Assoc.	Cannon Street #9	Conv. Thermal	- 8.0	June 1, 1972
Northeast Utilities	Stamford	Interm. Fossil	-57.0	June 20, 1972
MEPCO/N.B. Purchase #1	--	Interm. Fossil	-20.0	July 1, 1972
Northeast Utilities	Danielson #1	Gas Turbine	- 6.0	July 1, 1972
Central Maine Power Co.	Kezar Falls	Hydro	- .3	July 1, 1972

APPENDIX B

ACTUAL CHANGES IN GENERATING CAPACITY SINCE LAST REPORT

ACTUAL RERATINGS

COMPANY	STATION	EQUIPMENT	CHANGE IN NOMINAL MW	DATE MONTH	YEAR
Central Maine Power Co.	Mason #4	Conv. Thermal	- .6	May	1, 1972
New England Gas & Elec. Assoc.	Kendall	Conv. Thermal	-2.0	May	1, 1972
New England Gas & Elec. Assoc.	Blackstone	Conv. Thermal	-2.0	May	1, 1972
New England Gas & Elec. Assoc.	Cannon Street	Conv. Thermal	-1.0	May	1, 1972
Boston Edison	Edgar	Conv. Thermal	+8.0	June	1, 1972
New England Electric System	-	Diesels	+1.0	June	1, 1972
Vermont Group	Miscellaneous	Gas Turbine	+2.5	June	22, 1972
*Municipal Electric Division	Wallingford, Conn.	Conv. Thermal	*-5.0	Aug.	1, 1972
New England Electric System	Lynnway	Conv. Thermal	-7.0	Aug.	1, 1972

*Capability of station reduced to 23 MW to live up to the State of Connecticut Air Control Code.

APPENDIX B

ACTUAL CHANGES IN GENERATING CAPACITY SINCE LAST REPORT

ACTUAL ADDITIONS

COMPANY	STATION	EQUIPMENT	CHANGE IN NOMINAL MW	DATE MONTH YEAR
New England Gas & Elec. Assoc.	Kendall G.T. #2	Jet Gas Turbine	24.0	March 31, 1972
Vermont Group	Berlin	Gas Turbine	56.5	June 1, 1972
Fitchburg Gas & Elec. Light Co.	Fitchburg #7	Gas Turbine	30.0	Aug. 1, 1972
Hudson Light and Power Dept.	Cherry Street	Diesel	5.6	Aug. 1, 1972
New England Electric System	Salem Harbor #4	Int./Peak Fossil	465.0	Aug. 24, 1972

APPENDIX B

COMMITTED AND PLANNED CHANGES IN GENERATING EQUIPMENT

RETIREMENTS

COMPANY	STATION	EQUIPMENT	CHANGE IN NOMINAL MW	DATE MONTH	DATE YEAR
Vermont Group	Various	Hydro	- 1.0	Oct.	1972
Bangor Hydro-Electric Co.	Graham #2	Gas Turbine	- 5.0	Oct.	1972
Boston Edison Co.	"L" Street #9	Conv. Thermal	-25.0	Nov.	1972
New England Electric System	Webster St. #8	Conv. Thermal	-35.0	Dec.	1972
New England Electric System	Lynnway #1, 2, 3, & 6	Conv. Thermal	-50.0	Dec.	1972
Fitchburg Gas & Elec. Light Co.	Fitchburg #1, 2, 3, & 5	Conv. Thermal	-28.0	Jan.	1973
Northeast Utilities	Dwight #2, 3, & 4	Hydro	- 1.2	Jan.	1973
Public Ser. Co. of N.H.	Kelleys	Hydro	-	March	1973
Public Ser. Co. of N.H.	Kelleys #1 & 2	Conv. Thermal	-18.0	March	1973
Public Ser. Co. of N.H.	Jackman Sta.	Hydro	- 3.0	March	1973
Montaup	Fall River	Conv. Thermal	-14.0	April	1973
Montaup	Pawtucket #3, 4, & 5	Conv. Thermal	-26.0	April	1973
Montaup	E. Bridgewater #2, 3, & 4	Conv. Thermal	-20.0	April	1973
New England Electric System	Deerfield #5	Hydro	-15.0	May	1973
Public Ser. Co. of N.H.	Canaan Station	Hydro	- 1.0	June	1973
MEPCO/N.B. Purchase #1	-	Interm. Fossil	-20.0	July	1973
Municipal Electric Dept.	Wolfeboro, N.H.	Diesels	- 0.3	Jan.	1974
MEPCO/N.B. Purchase #1	-	Interm. Fossil	-40.0	July	1974
Municipal Electric Dept.	Wolfeboro, N.H.	Diesels	- 0.3	Jan.	1975
New England Electric System	South St. #8	Conv. Thermal	-37.0	Jan.	1975
MEPCO/N.B. Purchase #1	(end of Purchase)	Interm. Fossil	-200.0	July	1975
New England Gas & Elec. Assoc.	Blackstone #2 & 4	Conv. Thermal	- 8.0	July	1975
New England Gas & Elec. Assoc.	Cannon St. #4 & L. P. Boilers	Conv. Thermal	-15.0	July	1975
Municipal Electric Dept.	Wolfeboro, N.H.	Diesels	- 0.5	Jan.	1976
Vermont Group	Milton	Conv. Thermal	- 4.0	Aug.	1977

APPENDIX B

COMMITTED AND PLANNED CHANGES IN GENERATING EQUIPMENT

RERATINGS

COMPANY	STATION	EQUIPMENT	CHANGE IN NOMINAL MW	DATE	
				MONTH	YEAR
Vermont Yankee	Vernon	Base Load Nuclear	+256.0	Dec.	1972
Maine Yankee	Wiscasset	Base Load Nuclear	+209.0	Mar.	1974
Vermont Yankee	Vernon	Base Load Nuclear	+ 27.0	Apr.	1974
Maine Yankee	Wiscasset	Base Load Nuclear	+ 33.0	Apr.	1975
Maine Yankee	Wiscasset	Base Load Nuclear	+ 30.0	May	1976

APPENDIX B

COMMITTED AND PLANNED CHANGES IN GENERATING EQUIPMENT

ADDITIONS

COMPANY	LOCATION	MW CAPABILITY NAME-PLATE	MW CAPABILITY NOM. CAP.	**TYPE	NAME OF MANUFACTURER TURBINE	NAME OF MANUFACTURER BOILER	EXPECTED DATE OF OPERATION MONTH	EXPECTED DATE OF OPERATION YEAR
Norwich, City of (N.U. Group)	Norwich	16.75	16.75	Gas Turbine	-	-	Sept.	1972
New Eng. Gas & Elec. Assoc.	Martha's Vineyard	3.0	3.0	Diesel	G.M.	-	Oct.	1972
Boston Edison Co.	Pilgrim #1	657.0	657.0	Nuc.-Base Load	G.E.	G.E.	Nov.	1972
Vermont Yankee	Vernon	537.3	257.0	Nuc.-Base Load	G.E.	-	Nov.	1972
Norwalk Sec. Tax. Dist. (N.U.G.)	Norwalk	5.0	5.0	Diesel	-	-	Nov.	1972
Maine Yankee	Wiscasset	-	583.0	Base Load Nuclear	West.	C.E.	Dec.	1972
Northeast Utilities	Northfield #4	211.5	250.0	Pump. Stor. Hydro	G.E.	-	Dec.	1972
Northeast Utilities	Northfield #1	211.5	250.0	Pump. Stor. Hydro	G.E.	-	March	1973
Northeast Utilities	Northfield #2	211.5	250.0	Pump. Stor. Hydro	G.E.	-	May	1973
Northeast Utilities	Middletown #4	375.4	400.0	Int./Peak Fossil	G.E.	-	June	1973
Northeast Utilities	Northfield #3	211.5	250.0	Pump. Stor. Hydro	G.E.	-	July	1973
Taunton Mun. Light Plant	B.F. Cleary Sta. #9	110.0	110.0	Combined Cycle (90 MW Thermal) (20 MW Gas Turbine)	G.E.	Riley	July	1973
*Shrewsbury Elec. Light	Peaking Plant	-	2.75	Diesel	-	-	Sept.	1973
New England Elec. Sys.	New Deerfield #5	15.0	15.0	Conv. Hydro	West.	-	March	1974
New England Elec. Sys.	Fife Brook	11.0	10.0	Conv. Hydro	West.	-	April	1974
Northeast Utilities	Millstone #2	860.7	830.0	Nuc.-Base Load	G.E.	-	April	1974
New England Elec. Sys.	Bear Swamp #2	300.0	300.0	Pump. Stor. Hydro	Toshiba	-	May	1974
Public Ser. Co. of N.H.	Newington, N.H.	424.0	400.0	Int./Peak Fossil	West.	C.E.	June	1974
New England Elec. Sys.	Bear Swamp #1	300.0	300.0	Pump. Stor. Hydro	Toshiba	-	July	1974
New England Elec. Sys.	Brayton Point #4	437.0	465.0	Int./Peak Fossil	G.E.	Riley	Dec.	1974
Boston Edison Co.	Mystic #7	587.0	587.0	Base/Int. Fossil	G.E.	C.E.	May	1975
United Illuminating	Coke Works	-	445.0	Base/Int. Fossil	G.E.	C.E.	June	1975
Braintree Elec. Light Dept.	Potter Station	-	50.0	Combined Cycle	-	-	July	1975
NEGEA & EUA	Canal #2	-	560.0	Base/Int. Fossil	West.	B&W	July	1975

APPENDIX B

COMMITTED AND PLANNED CHANGES IN GENERATING EQUIPMENT

ADDITIONS

COMPANY	LOCATION	MW CAPABILITY NAME-PLATE	MW CAPABILITY NOM. CAP.	**TYPE	NAME OF MANUFACTURER TURBINE	NAME OF MANUFACTURER BOILER	DATE OPERATION MONTH	DATE OPERATION YEAR
MEPCO/N.B. Purchase #2 (Start)	-	-	200.0	Interm. Fossil	-	-	Jan.	1976
MEPCO/N.B. Purchase #2 (Increase)	-	-	200.0	Interm. Fossil	-	-	July	1976
*Shrewsbury Elec. Light.	Peaking Plant	-	2.75	Diesel	-	-	Fall	1976
Peabody Mun. Light Plant	Peabody	17.3	20.0	Gas Turbine	Turbo Power	-	-	1977
New England Gas & Elec. Assoc.	Unknown	-	24.0	Jet Gas Turbine	-	-	July	1977
Vermont Group	Undecided	277.0	277.0	Combined Cycle	West.	-	Aug.	1977
Central Maine Power Co.	W. F. Wyman #4	-	600.0	Base/Int. Fossil	-	-	Nov.	1977
New Eng. Elec. Sys.	North Shore	850.0	850.0	Base/Int. Fossil	G.E.	-	Nov.	1977
*Shrewsbury Elec. Light.	Peaking Plant	-	2.75	Diesel	-	-	Fall	1978
Boston Edison Co.	Pilgrim #2	1180.0	1180.0	Nuc.-Base Load	G.E.	C.E.	Nov.	1978
Northeast Utilities	To Be Determined	-	1150.0	Nuc.-Base Load	G.E.	West.	May	1979
P.S.N.H. & U.I.	Seabrook #1	1150.0	1150.0	Nuc.-Base Load	-	West.	Nov.	1979
Boston Edison	Pilgrim #3	1180.0	1150.0	Nuc.-Base Load	G.E.	C.E.	June	1980
New Eng. Elec. Sys.	***Rome Point #1	900.0	900.0	Nuc.-Base Load	-	-	June	1980
Northeast Utilities	To Be Determined	1150.0	1150.0	Nuc.-Base Load	-	-	May	1981
P.S.N.H. & U.I.	Seabrook #2	1150.0	1150.0	Nuc.-Base Load	-	-	Nov.	1981
New Eng. Elec. Sys.	***Rome Point #2	900.0	900.0	Nuc.-Base Load	-	-	June	1982

*Figures used taken from L & C Report dated 3/1/72.
**See note on page 56.
***Tentative location.

APPENDIX B

COMMITTED AND PLANNED CHANGES IN GENERATING EQUIPMENT

ADDITIONS

**The following notations under type of generation indicate:

a) Int./Peak. Fossil = Intermediate/Peaking Fossil capacity having daily, on line-off line cycling capability with a heat rate greater than 10,000 (approximately 10,300-10,600) Btu/kWh with 1,800 psi throttle pressure. These units are expected to start daily cycling (on line-off line) soon after initial commercial operation.

b) Base/Int. Fossil = Base Load/Intermediate Fossil capacity having daily, on line-off line, cycling capability with a heat rate less than 10,000 (approximately 9,400-9,700) Btu/kWh and in general have a 2,400 psi throttle pressure. These units are expected to operate base loaded during weekdays, shutting down on weekends only, for several years after initial commercial operation.

APPENDIX C

A POSSIBLE PLAN FOR PROVIDING FUTURE UNCOMMITTED GENERATION

LOCATION	TYPE OF EQUIPMENT	NET CAPABILITY (MW)	DATE OF SERVICE
Unlocated	Combined Cycle	S-240/W-310	May 1979
Uncommitted Purch.	Intermediate Fossil	400	July 1979
Unlocated	Gas Turbines	S-130/W-150	Oct. 1979
Unlocated	Gas Turbines	S-175/W-200	Oct. 1980
Unlocated	Gas Turbines	S-220/W-250	Oct. 1981
Unlocated	Combined Cycle	S-480/W-620	May 1982

Note: The schedule above represents a current judgment as to the types of capacity and size of units which are appropriate to provide the required capacity for the years in question. However, further studies are underway which may change the types and sizes of units as pool plans are firmed up. The net capability shown above has been incorporated in this report as uncommitted capability for the years 1979 through 1982.

APPENDIX M

APPENDIX M

NUCLEAR PLANT SITE STUDY

FOR

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

APRIL 14, 1967

JACKSON & MORELAND DIVISION
UNITED ENGINEERS & CONSTRUCTORS INC.
600 PARK SQUARE BUILDING
BOSTON, MASSACHUSETTS 02116

JACKSON & MORELAND
DIVISION OF UNITED ENGINEERS & CONSTRUCTORS INC.
600 Park Square Building, Boston, Mass. 02116 • Telephone 617-482-8100

April 14, 1967

Mr. Eliot Priest, Vice President
Public Service Company of New Hampshire
1087 Elm Street
Manchester, New Hampshire 03105

Subject: Nuclear Plant - Site Study

Dear Mr. Priest:

Herewith is our final report covering studies to locate and evaluate sites for a multiple unit nuclear power plant of 1600 MWe capacity on the Public Service Company of New Hampshire system. We recommend the Rollins Farm area on the Piscataqua River in Newington as the most economical site for such a plant.

Consideration of waste heat disposal requirements and proposed water use regulations determined that no inland fresh water sites are suitable for a large Power Plant using a conventional once-through condenser cooling water system and that avoidance of a $4 to $8 per KWe additional cost for cooling towers requires an oceanside or tidal salt water site. Comparative estimates of the site variable costs of four salt water sites evaluated show a large advantage in favor of the Rollins Farm area. For site development alone the capital savings at Rollins for construction of two 800 MWe units is at least 1.3 million dollars. With land, transmission and tax factors added, the capital advantage of Rollins is about 10 million dollars.

Consideration of nuclear plant siting factors indicates that the Rollins Farm area compares favorably with presently licensed sites. However, discussion with the regulatory agencies regarding three factors is recommended to afford maximum assurance that the Rollins Farm site may be considered suitable for the proposed use. These factors are: (1) use of the Piscataqua River for waste heat disposal; (2) proximity to Pease Air Base and to Portsmouth; (3) the limited exclusion zone. We would be pleased to participate in such discussions.

The final report summarizes the many alternatives and factors considered in this site selection together with the studies and evaluations which provide the basis for these conclusions and recommendations

Very truly yours,

JACKSON & MORELAND DIVISION

P. F. Gorman

P. F. Gorman, Manager
Power Department

PFG:VMW:jac
R.N. 9197

cc: Mr. E. Priest (20)

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I. INTRODUCTION

Objectives

This study has the following objectives:

(1) To determine areas which may be considered potential sites for a large nuclear power plant on the Public Service Company of New Hampshire system.

(2) To select the most desirable site based upon economic comparison combined with judgement and experience evaluations of the non-reducible factors.

Ground Rules

The ground rules established for this study are:

(1) The type of nuclear steam supply system has not been determined but site evaluations shall be based upon use of commercial boiling water or pressurized water reactors.

(2) The maximum unit size to be considered is 800 MWe and the site shall be suitable for an installed capacity of at least 1600 MWe.

(3) The site shall preferably be in New Hampshire due to public relations and tax considerations. However, sites in neighboring states are to be considered and evaluated.

(4) Final transmission, land and tax evaluations will be made by Public Service Company of New Hampshire.

(5) Evaluation of sites on the Merrimack River or in other inland locations must consider the cost of cooling towers or other facilities to control the water temperature.

II. SUMMARY

Comparisons of the population distributions around most of the potential power plant sites in New Hampshire with those around several licensed nuclear plant sites show that the New Hampshire locations compare favorably in this respect. The Newington and Rye sites are located in the more densely populated and developed coastal region of New Hampshire and near the city of Portsmouth (25,000 population), but even these sites compare favorably and should experience little difficulty with licensing from the standpoint of population distribution.

Waste heat disposal requirements, however, are becoming increasingly more restrictive on power plant siting. Recently enacted or proposed legislation and regulations are placing stringent controls on the use of public waters, especially fresh water streams and lakes, for heat sinks. Investigation of New Hampshire's largest streams, i.e., the Connecticut, the Merrimack, and the Androscogin, show that none have sufficient flow on a year around basis to handle the waste heat disposal from a 1600 MWe plant. Studies of methods of augmenting cooling capacities by stream flow regulation or through evaporative cooling schemes using the large man made lakes at Moore Dam or the proposed Gilead and Pontook developments indicated that these solutions were not practical. It was therefore concluded that for a plant of this size, inland sites with natural cooling capacity adequate to comply with the new water use regulations are not available and adequate heat sinks cannot economically be provided through civil constructions. The economic penalty associated with a nuclear power plant employing cooling towers over a plant using a once-through cooling

water system is in the order of $4 to $8 per kilowatt, the exact value being dependent upon site associated considerations. The capital cost differential for a 1600 MWe plant was assumed to be 10 million dollars for this study.

Concentrated effort was focused on locating sites having access to the ocean or to tidal water to satisfy waste heat disposal requirements at minimum cost. Careful surveys of the short New Hampshire coastal region, and bordering areas in Maine and Massachusetts, uncovered four sites having potential for siting of a large nuclear power station. The estimated differential site development costs for two 800 MWe units on these sites, exclusive of land, transmission and tax factors, are:

Site	Differential Cost Above Base - $10^6$$
Rollins Farm, Newington	Base
Gerrish Island, Maine	+ 1.3
Odiornes Point, Rye	+ 2.6
Hampton Flats, Hampton	+ 6.0

In Public Service Company of New Hampshire's judgement, large tax savings in Newington will more than offset some added transmission costs at the Rollins Farm site and increase the net advantage of this site to approximately 10 million dollars. Further detailed comparisons with inland sites are not warranted since no unusual or excessive acquisition, development, transmission, construction or other site related costs that would offset the cooling water cost advantage are associated with the Rollins Farm site. The Rollins Farm area is therefore evaluated to be the most economic site for a nuclear power plant.

The Rollins Farm site has an ample supply of condenser cooling water. About 15 times the condenser through-put flows up and down the Piscataqua past this location on each tidal cycle. The theorectical temperature rise in the river is only about 1.3F.

The population surrounding the Rollins Farm site, for all distances up to 25 miles, is less than at the Millstone, Oyster Creek and Indian Point sites licensed by the AEC. By comparison this indicates a favorable site from the population standpoint. Exhibits 1 and 2 in this report provide a graphical comparison of population distributions and their effects on calculated integrated doses for the Rollins Farm and several licensed sites.

The distance from a reactor on the Rollins Farm site to the border of the densely populated section of Portsmouth is on the order of 2½ miles. This is small by 10CFR-100 guidelines but is not considered unreasonable. The Portsmouth population is just over the 25,000 criteria mark; it was 18,830 in 1950, and 25,833 in 1960.

An exclusion radius of 0.4 miles seems reasonably attainable at Rollins Farm. The 10CFR-100 guidelines which indicate an exclusion requirement of 1.2 miles for a 2500 MWt (about 800 MWe) reactor are not directly applicable since distance can be traded for containment and safeguards systems. For example, Indian Point 2 for a 2758/3218 MWt reactor has an actual exclusion of 0.3 miles; Oyster Creek for 1600/2000 MWt has 0.25 miles; Malibu for 1473/1000 MWt has 0.16 miles; Connecticut Yankee for 1473/1825 MWt has 0.32 miles and Millstone Point for 1727/2030 MWt has 0.50 miles.

The area immediately surrounding the exclusion zone at Rollins Farm is not heavily populated. It contains mostly well scattered industrial and commercial establishments. A major highway is at the boundary line; a railroad line runs through the property; transmission facilities are in the area; and the reactor area is accessible to deep water shipping. Foundation conditions, geology, meteorology and seismicity, while not investigated in detail are not expected to present any unusual problems.

Two aspects of the Rollins Farm area not completely determinate from our studies are:

1. Possible restrictions on the use of the Piscataqua tidal waters for heat disposal.

2. Possible licensing restrictions due to the nearness to Pease Air Base and the city of Portsmouth or the limited exclusion radius available.

Definite measures aimed at eliminating all uncertainties and gaining full assurance on the use of this site are in order before ancillary commitments or plans are consumated. In this regard we suggest:

1. Hold formal discussion of record with the pertinent state or local regulatory or licensing agencies regarding a plant having the total 1600 MWe site capacity to determine that restrictions on water use or other local problems will not affect the present or future units at the site.

2. Hold informal discussions with the AEC Division of Licensing and Regulation to advise them of your intentions and scheduling, acquaint them with the site and environs and to gain any possible guidance in licensing of this site.

Brief letters of opinion on the suitableness of the seismological, geological and meteorological conditions at the site and a few soil borings to define the general nature of the foundation conditions are advisable. These should be based upon the minimum practical effort with the realization that formal and detailed evaluations of all the "siting-ologies" will be required for the Construction Permit Application to the AEC.

III. TECHNICAL DISCUSSION OF SITE SELECTION FACTORS

A. AEC Licensing Requirements

The published official criteria covering the effects of population on nuclear reactor siting are included in Title 10, Code of Federal Regulations, Part 100, Reactor Site Criteria and USAEC Report TID-14844, both published in early 1962. It is generally accepted, however, and readily ascertained from examination of recent applications and licensing, that these published "guideline" criteria are more conservative than those used in present practice. Therefore, the recommended criterion today for evaluating the merits of a site in regard to its population is comparison with licensed sites. Jackson & Moreland is engaged in a detailed study project on this subject for the AEC. From that study the cumulative population curve and the indexing ratio curve have evolved as very useful tools for comparing sites. Exhibit 1 (Sheet 1 and 2) shows the cumulative population curves of the four final sites compared to other sites. Exhibit 2 shows the Newington and Littleton sites on "index ratio" plots, which indicate that the population distribution at these sites compare very favorably with the licensed sites of Millstone, Oyster Creek and Indian Point. More recent work on the referenced study project has suggested the classifying of sites by their indexing ratios. Sites with ratios less than 0.2 are classed "rural", ratios of 0.2 to 2.0 are classed sub-urban, etc. Newington, with an indexing range of 0.2 to 0.5, is very nearly in the rural classification. Indian Point, Oyster Creek, Millstone and Connecticut Yankee are in the sub-urban classification while Dresden is classed as rural. These classifications have no official significance, as yet, but they are submitted as very useful and forceful tools for comparing the relative effects of population distributions at different sites. Also perceptible in recent plant designs are trends toward a single highest standard of safety and standardized designs rather than custom tailored plants, making it even more difficult to relate plant cost factors to population.

The probable exclusion zone radii at Rollins Farm and Odiornes Point will be in the 2000 to 2500 foot range and at Hampton and Gerrish 3000 feet or more are possible. Exclusion zones of a half mile are now regarded as conservative for licensing. At least one large plant in the process of licensing has an exclusion radius of approximately 1600 feet.

A reactor on the Rollins Farm site will be about 6000 feet from the Portsmouth city line and about $2\frac{1}{2}$ miles from the densely populated city area. These values are less than might be hoped for but the cumulative population plots shown in Exhibit 1 indicate no significant differences between the four coastal sites evaluated and compare favorably with many previously licensed sites.

B. Availability of Condenser Cooling Water

A 1600 MWe light water nuclear power plant will require about 2400 cfs of condenser cooling water (10.6×10^9 Btu/hr heat rejection with 20F rise through the condenser). No stream in or near New Hampshire can provide this amount of water continuously. New regulations aimed at preserving the natural character of streams and lakes and at protecting the fishlife are seeking maximum water temperature of 63F.
The natural temperature of most lakes and streams approach or exceed this value during the summer season. Therefore, any site at an inland location will require augmented cooling facilites such as cooling towers or cooling

ponds. The cost of providing such additional cooling capacity will greatly exceed the advantage of lower land costs at inland sites.

Four sites were evaluated that could use the ocean for a heat sink. These were Gerrish Island in Maine and Odiornes Point in Rye, directly on the ocean, Hampton Flats using Hampton Harbor waters, and Rollins Farm in Newington using the large tidal flows of the Piscataqua River. The Gerrish and Odirones sites being directly on the open ocean have ample supplies of cooling water. At Hampton Flats, the volume of water in the harbor at low tide is very small compared to the condenser flow being roughly equivalent to about 6 hours of flow. The amount of water entering and leaving the harbor on a tidal cycle is only about 1.3 times the condenser flow. Even with considerable construction in the harbor to direct flows, the estimated time for recirculation through the condensers is about four hours. Since evaporative cooling capacity of the harbor is small, it is not practical to both draw and return water to the harbor. Therefore, the only way this site can be utilized is to gain another access to the ocean and either draw from or discharge to the ocean directly. This is the scheme developed in the comparative cost estimate.

The Rollins Farm site is just downstream on the Piscataqua from the inlet to the Great and Little Bays. These large bodies of water, about 5000 acres of surface, have seven foot tides. A calculated minimum of 156×10^7 cubic feet of water flow up the Piscataqua past Rollins Farm on each flood tide and down again on the ebb tide. This is approximately 15 times the condenser through-put in a twelve hour cycle. Thus, the theoretical temperature rise of the water is only 1.3F. Of course, there will be channels of hotter water but the stream is very wide and the currents are swift and diverse, even at slack time, and it is quite inconceivable the heat disposal would be a serious problem here.

C. Economics - Site Development

As discussed in the previous sections, it was determined that all inland sites will require some type of forced cooling facilities to augment or supplement the water supplies available for waste heat disposal. The exact differential cost of cooling towers for a large power plant is dependent on site related conditions but is in the range of $4 to $8 per kilowatt, including equipment and operation and maintenance charges. For this study, the differential cost for cooling towers was assumed to be 10 million dollars for a plant of 1600 MWe total capacity. Therefore, all inland sites, when compared with coastal sites having sufficient natural cooling capacity, have an evaluated differential cost penalty of 10 million dollars. Investigation into the use of man made lakes to augment stream cooling capacity uncovered no practical and economic means of meeting the new stringent water temperature regulations by this approach.

Four possible sites that could use the ocean as a heat sink were found from map and field surveys. These were the Rollins Farm at Newington on the tidal range of the Piscataqua, the Hampton Flats - Hampton Harbor area with a direct access to the ocean and Gerrish Island in Maine and Odiornes Point (Fort Dearborn area) in Rye, both of the latter having direct ocean frontage. All of these four coastal sites have individual differences requiring evaluation for purposes of comparison. Gerrish Island has good exclusion zone potential and land is probably easiest to obtain, however, it has poor road access, no railroad, and a long transmission access. Odiornes Point has good road access and fair water, railroad, and transmission access. It is in a high rent residential district and has questions regarding public reaction and the use of public park lands (Fort Dearborn) for an exclusion zone. Hampton Harbor has a good exclusion zone available, good railroad access and fair road access, however, it will require large and costly civil works to make adequate cooling capacity available and there is question regarding public reaction due to the large beach and summer resort population in the area. Questions relating to Rollins Farm in Newington have been previously discussed and include the exclusion radius, proximity to Portsmouth and Pease Air Base, and use of the tidal flow of the Piscataqua River for waste heat disposal.

To evaluate and compare these four sites, approximate differential estimates of the major site varying plant costs were prepared. The plant layouts and summary sheets of these estimates are attached as Exhibits 3 through 7. For each site the plant location shown considered arrangement of the circulating water system, exclusion zone requirements, grades, storm protection, road and railroad access, shipping requirements and similar items. A plant area approximately 800 by 1000 feet in plan and at the proper elevation as balanced by storm protection, earth work, and pumping charges, etc., was laid out and the costs of site preparation, the condenser cooling water system, access roads, and railroad or shipping requirements were estimated. Costs for other site differentials such as incremental excavation required for optimum condenser elevation; on-site reactor vessel fabrication versus shipping and handling charges; relative ease or difficulty of general construction (especially excavations, water front work, and ground water control); labor availability and productivity; weather; architectural treatments; and the like were also factored into the estimates as appropriate.

Weather and labor were not considered to affect the cost difference between sites since they are all within ten miles of each other.

However, Gerrish and Odiornes may incur some small penalty on this account during the winter months because of their very exposed locations. Odiornes Point was assessed an architectural incremental cost because it was felt that a plant at this location would demand more costly architectural treatment than the other locations. Gerrish and Odiornes require underwater rock removal for water front and water intake developments. Odiornes and Gerrish also would incur incremental excavation to get comparable condenser elevations as the station ground elevations are kept higher to protect from storms but the basic pumping datum is the same. Development costs at these two locations, directly exposed to the open sea, might also suffer further significant increase, on the order of $500,000 to several million dollars, if it becomes necessary to further protect the water front work from storm damages. However, no cost penalties were assessed on this account for the purposes of this study.

Water control, miscellaneous excavations and foundations were considered more difficult at Hamptom, since even the smallest buildings and equipment will likely require piles or deep foundations to rock in wet excavations.

It was assumed that all four sites would be able to dispose of normal radioactive liquid wastes by dilution in the plant effluents and that there would be no incremental liquid waste treatments required for any of the sites. When comparing these coastal sites against an inland location where the supply of dilutent water is limited or otherwise restricted for such use, the incremental radioactive liquid waste treatment facilities could be significant - say $250,000 to $500,000. Meteorologically, all sites are considered normal and similar and therefore stack vent and gas treatment systems would be essentially the same for all sites and no differentials were assigned on this account.

All four sites are close together and near the center of a large Zone 2 on the U. S. Seismic Regionalization Chart as published in the Uniform Building Code. No features arousing caution or suspicion of earthquake damages were observed or are known for any site. Therefore, no distinction was made between sites on account of seismicity. However, attention is directed to the further discussion of Section D and to Exhibits 8 through 10.

Access to all the sites for normal and special deliveries was considered equal except for Gerrish. The Hampton and Newington sites have railroad lines on the property. The railroad is about four miles from the Odiornes Point Site and extension to the site is considered feasible and economically reasonable and so is included in the development of this site. The railroad is also about four plus miles from Gerrish but access to it is over such difficult and costly terrain that railroad extension to the Gerrish site appears economically unattractive. The roads to Gerrish are not adequate for heavy construction and cross over bridges that will likely limit heavy trucking. To balance this access deficiency at Gerrish and put this site on a parallel with the others, the site development there includes a barge unloading facility. It is not suggested or to be inferred that such a facilitiy is the recommended answer to the access deficiency at Gerrish. This has not been studied. It is considered that this scheme does provide the minimum capital allotment that would make this site suitable and comparable with the others. Ocean barge shipping and receiving of a shop fabricated and assembled reactor vessel was considered feasible for each site. Unloading of same would be a construction expedient at each site and no cost differentials were estimated. For comparing these coastal sites against inland sites where barge shipment would not be available, one should consider an incremental cost of about $250,000 to $500,000 for each site fabricated reactor vessel.

All sites except Hampton are within a few miles of Portsmouth and all have approximately the same total population and type of dispersal within the area of concern - see Exhibits 1 and 2. Hampton on the other hand, would have very large summer beach and vacation population within a few miles. No site shows any distinct advantage or disadvantage from the population distribution standpoint that would affect the economics of plant selection or the containment safeguards required.

Cost evaluation of land, taxes and transmission were reserved for Public Service Company of New Hampshire.

Summations of the cost differences estimated in accordance with the foregoing discussion are summarized in the following table:

Site	Varying Cost 10^6\$	Differential 10^6\$
Rollins Fram, Newington	2.0	Base
Gerrish Island, Maine	3.3	1.3
Odiornes Point, Rye	4.6	2.6
Hampton Flats, Hampton	8.0	6.0

The figures show site differential costs for two 800 MWe units on each site exclusive of land, transmission and tax factors.

Costs for land, transmission and taxes evaluated in joint discussions indicated with Public Service Company of New Hampshire personnel that the net cost advantage of the Rollins Farm, Newington Site will be approximately 10 million dollars.

D. Seismicity

All of New Hampshire is in Zone 2 of the Seismic Probability Map of the United States compiled by the U. S. Coast and Geodetic Survey in 1947 and presently used in the nationally recognized Uniform Building Code as the basis for a seismic design. Zone 2 covers areas where quakes causing slight to moderate structural damage are expected to occur frequently, but intensities causing severe structural damage are to be expected only at very infrequent intervals. This regionalization map is very general and no real distinction between the final specific sites can be made on this basis. It does, however, say that earthquakes are an important factor to be considered in all of New Hampshire. Appended ~~on~~ as Exhibits 8 and 9 are more detailed seismic regionalization and tectonic (bedrock) maps compiled by Weston Geophysical Research, Inc., Weston, Mass. On the seismic map, Portsmouth is in the middle of a VI zone and Hampton is on the border between VI and VII. Exhibit 10 defines the zone classifications. On the tectonic map a geologic division or fault line runs through the Hampton area. This fault indication is not considered fatal to the Hampton area but it does indicate that this location would have to be very thoroughly researched and defended for licensing.

Even these maps are too general to finally distinguish between sites. They can serve well as a guide but specific sites require environment (bedrock, overburden and topology), and the approximate distance, intensity and attenuation characteristics of earthquakes that could affect the site. For the present purpose, Newington, Gerrish and Odiornes Point are judged equal and suitable. Hampton is left with questions on suitability that are deferred for later investigation if evaluation is required.

E. Meteorology

Local meteorological conditions are important to a nuclear plant site in two ways. During normal operations, with direct cycle plants, meteorological diffusion is relied upon to dilute and disperse harmlessly some slightly radioactive waste gases. In the event of an incident involving accidental release or radioactive materials the same air movement is a large factor in the transport of radioactivity to the surroundings, and meteorologic parameters enter into the calculations of exposure of the off site population. Local meteorology may, therefore, influence the need for the height of, and the size of a vent or stack. New England in general has favorable conditions and all four of the final sites are considered to be typical of New England with no discernable distinction between them.

F. Falling Aircraft

The possibility of damage to the reactor from falling aircraft, aircraft parts or cargo is a matter of concern in the design of nuclear plants. Since the probability of such an event is greater close to airports or air traffic lanes, such locations become subject to question. The Rollins Farm site is 9000 feet ($\pm$) at 90° from the Pease Air Force Base runway. Peace is judged to be rather inactive by comparison to other airports and it is expected that investigation of the air traffic picture over Rollins, at 1.7 miles laterally from this single runway at Pease, with those found at some licensed nuclear plant sites will show they are comparable. However, the type of aircraft and cargoes using this base bring up further questions. The future of Pease Air Base is unknown.

In the past, locations near other airports, commercial and military, have been defended by mathematical arguments showing that the containment structure would protect the reactor against all but the most highly improbable direct head-on impacts. In this respect, it makes no difference, costwise, whether a site is two, four or more miles from an airport. Therefore, we conclude that the Rollins Farm site is as suitable in this regard as any of the other final four sites. However, further investigation of this matter is appropriate as suggested in the summary of this report.

IV. SITES

For record and comparison purposes all of the sites considered are listed with pertinent data and conclusions for each.

NOTE: The Pontook and Gilead locations are contingent upon proposed hydro developments. It is not known that either of these are presently under active design or consideration.

Fox Point in Newington (Site 2 on Exhibit 11)

This small peninsula, varying from 1000 to 2000 feet wide by about 3000 feet long, projects into Little Bay near its outlet and is just big enough to accommodate a plant. Water for 3000 feet or more on three sides offers good isolation. The land side is very sparsely used with only about 15 small buildings shown within a 3000 foot radius. The cooling water situation is considered adequate by virtue of the large tidal flows required to produce the seven foot tides in Great and Little Bays. The question of direct recirculation at slack tides requires study but the peninsular arrangement and the deep channels not far from shore are plus factors in this regard.

The location is about 3 miles from the Portsmouth city boundary and about 4.5 miles from the dense population boundary.

A railroad line is about ten thousand feet away at the Rollins Farm area and extension to this site appears reasonable. Access to ocean shipping is also available via a thirty foot deep channel to the Piscataqua.

The reactor location on this site would be only about 1.5 miles from the end of and on a direct line with the Pease Air Base runway. Tall stacks and buildings would be definite hazards to aircraft, if permitted at all. This close location directly on the runway line is considered sufficiently serious to eliminate this otherwise potentially good site from further study. The prospective or projected life of Pease is not known.

Foundation conditions have not been investigated.

Transmission is considered to be similar to Rollins Farm.

Durham Point in Durham (Site 3 on Exhibit 11)

This site between the Oyster and Bellamy Rivers at their outlet on the north shore of Little Bay is about 1 mile further away from Pease and Portsmouth than Fox Point. About ten buildings are shown within a 3000 foot circle centered on the point.

A railroad line is about 5 miles away in Durham over unoccupied and rolling land. A good highway connector road is about 1500 feet from the point. Access to ocean shipping is available.

Transmission access to north is considerably easier than at either Rollins Farm or Fox Point for the water crossing problem at those sites is not present at the Durham location.

Cooling water access and direct recirculation considerations are not as favorable as at Rollins Farm or Fox Point but are judged to be tenable.

The location is again on a direct line with the Pease Air Base runway and only 2.5 miles from its end. This is considered sufficient to eliminate this otherwise possible site from further study.

<u>Littleton</u> at Moore Pond on the Connecticut River (Exhibit 12)

Moore Pond was investigated for an evaporative cooling scheme. The normal pond has surface area of about 3100 acres and gross volume of 9.7×10^9 cubic feet, about half of it dead storage. There is a possible drawdown or pond operating range of forty feet. Inflow has historically been less than 600 cfs for 5% of the time and outflow is not well regulated. The shape of the pond is not conducive to an arrangement that would effectively utilize the full surface area for cooling. Calculations,with many assumptions inherent therein, on the ponds heat dissipation capacity indicate that, strictly from plant operations and economics viewpoints, a cooling pond scheme adequate for 1600 MWe may be practical at Moore Pond. However, water temperatures could not practicably be regulated within the limits of the proposed water use regulations and at some times and places temperatures would be in ranges that are considered harmful to certain desirable gamefish species. This eliminated Moore Pond from further consideration.

The Littleton area is rural with no apparent problems from the population-safety-licensing aspects. Road access is good; rail access is at least 3½ miles distant over difficult mountainous terrain; an on-site assembled reactor vessel would be required; reasonable transmission access is contingent upon propose 345 kV loop routing. Plant site topography is classed as sloping to hilly with moderate tree cover and some boulders and exposed ledge.

<u>Sherburne</u> at proposed Gilead Dam Pond (Exhibit 12)

A proposed hydro development on the Androsogin in Gilead, Maine, with a pond backing up into Sherburne, New Hamsphire, was also studied for an evaporative cooling scheme. This pond will have a normal surface area of 2400 acres but only 1.9×10^9 cubic foot of gross storage and a small operating level range. The Androscogin flow is well regulated for a 1600 cfs minimum but flows of about half this amount have been recorded in drought years. Locations C and A on Exhibit 13 give fairly good control over direct recirculation and provide good surface cooling exposure.

Again here, as at Moore, the total heat dissipation capacity is probably adequate for a 1600 MWe plant when considering only the plant operation and economics. The resulting water temperatures, however, at times and places, would exceed the proposed water use regulations and be in ranges considered harmful to certain gamefish species. This eliminated Gilead from further consideration.

The Sherburne sites are in rural to virgin territory and there are no apparent population-safety-licensing problems. The preferred plant locations are on the north side in hilly, tree covered terrain. The main highway and the only railroad are on the south side but these are not judged to be critical factors for this location. An on-site-assembled reactor vessel will be required. Transmission is considered long but not unreasonable contingent upon proposed loop routing.

Drummer at proposed Pontook Dam (Exhibit 14)

A cooling pond scheme was also studied for the pond to be created by a proposed new high dam (pond elevation 1218 feet) just below the present Pontook Dam. Pontook is a few miles upstream on the Androscogin from the Sherburne site and stream flow is essentially the same; namely, well regulated for a 1600 cfs minimum but recorded at about half this value at critical times during long groughts. The proposed high dam pond will have a surface area of approximately 6500 acres and a gross volume of about 9.5×10^9 cubic feet with an operating level range of 18 feet. The plant location selected for terrain and elevation will also effectively use a large portion of the total surface for cooling. Total heat dissipation capacity is assessed as a little greater than at either Moore or Gilead but still not adequate for a 1600 MWe plant in the light of the proposed water use regulations. Also it was noted that public reactions to a new dam and to thermal use of the pond at Pontook may be much more severe than at the other locations of Moore and Gilead. Consequently, the water use regulations imposed may also be much more severe. This water and land is upstream of any present significant industrial development and the area is practically a wildlife preserve.

The land around Pontook is quite rough and mountainous and access is difficult. Only one suitable plant location is found on the pond. The pond would flood the only road to this site and considerable new road construction would be required to develop this site. Railroad access is considered impractical and transmission would be long and difficult.

Hillsborough at Jacksman Reservoir

An existing hydro plant at this ideal central location is scheduled to be closed out and the existing dam and reservoir were suggested as a possible "closed circuit" cooling pond. Closed circuit means the condenser cooling water is drawn from and returned to the pond and there is no return of heated water to the stream. The stream is used to make up evaporation only. In this way the downstream temperatures and fishlife are not affected. The water storage is only about 0.65 x 10^9 cubic feet with a surface of about 500 acres. Calculations show heat transfer of 500 Btu/square foot/hour with a surface temperature elevation of at least 40F would be required. No such extreme conditions are known to have been used. The forced evaporation for 1600 MWe is about 50 cfs. This is more than stream flow during summer months and could seriously deplete the storage under a long dry spell. At best the temperature of water going to the condensers would be about 110 F in the summer months.

These conditions are not considered satisfactory. No suitable means were found for expanding the facilities to adequate size.

Gerrish Island, Maine (Exhibit 1)

This island of about a thousand acres is on the northeast side of the entrance to Portsmouth Harbor. The east coast has direct ocean frontage and storm exposure. Portsmouth is about 5 miles (straight line) to the west. The island is very sparsely settled and land availability, population distribution and cooling water supply present no apparent problems. Access to the island, however, is dificient. Only two small secondary roads join the island to the mainland. Both pass over small and old bridges. The railroad is about $4\frac{1}{2}$ miles away in Kittery but through such a difficult route that railroad extension to the island is considered economically unattractive. Transmission connections would also require a circuituous routing to avoid water crossings and developed areas. The island is serviced by Public Service Company of New Hampshire and is in their franchised territory. Maine taxes and the possible public reactions inherent in this situation are negative factors for this site.

Odiornes Point in Rye (Exhibit 5)

Odiornes Point is the southeastern point of land at the entrance of Portsmouth Harbor and has open exposure to northeast storms. The point is about 4 miles from Portsmouth center. Exclusion land is extremely tight at this location. The suggested and most economic development requires the purchase of about a dozen residential properties at the south edge and the use of public land (the former Fort Dearborn) in the north to attain adequate exclusion. The main coastal highway (Route 1A) runs very close to the reactor location.

A railroad line is about 4 miles to the west and the access route is considered very reasonable. Transmission access could also follow this same routing.

However, without acquisition of some of the Fort Dearborn property and possible re-routing of Route 1A to get adequate exclusion and direct ocean access this site is not attractive. Public reaction also is thought to be a possible negative factor here for the area is more residential than industrial.

Hampton Flats at Hampton (Exhibits 6 and 15)

This site, by virtue of very extensive salt water marshes surrounding three sides, has good immediate exclusion. However, there are in summer, very large bathing populations at Hampton Beach, about a mile and a half to two miles from the proposed reactor location.

Two schemes for developing the required heat disposal capacity on this site were studied. The plan on Exhibit 15 shows the condenser water being drawn from and returned to the barbor with as large a separation as practical between the intake and discharge points. The harbor is very shallow; at low tides only 5-6 feet of water are in the deeper channels and only 2-3 feet cover most of the area. At low tide there is less than six hour supply of condenser cooling water in the harbor. The tidal range is about 7 feet but only about 1.3 times the condenser through-put enters and leaves the harbor on a tidal cycle. Obviously some of this is recirculated from the beach and there is not a complete change of harbor water with each tide. The streams flowing into the harbor are negligible. The surface area of the harbor varies between 300 and 600 acres. This surface with a heat transfer of 200 Btu/sq. ft/hr. (a recommended maximum value equal to a surface temperature rise of 20F) will dissipate only about 1/3 of the plants heat rejection. With the very shallow depth noted it is anticipated that the summertime natural harbor temperature is in the 70-80F range. With a plant discharging into the harbor this temperature could rise 40 to 50F, thus the water to the condensers could be in the 110 to 120F range. The conclusion is that the quantity of condenser cooling water and the heat dissipation capacity are both inadequate with the scheme.

The plan on Exhibit 6 shows development of this site with another connection to the ocean (other than the harbor inlet). With such a scheme a very long canal is required and there are additional heavy expenses incurred in draining the cut-off land and in getting under the highway to the ocean. This scheme is not economically attractive.

Railroad access to this site is good and barge shipment access may be possible along one of the canals. Transmission connections are very good. Foundation conditions, from surface observations only, are judged to be reasonable.

Rollins Farm in Newington on the Piscataqua. (Exhibit 3 and Site 1 on Exhibit 11)

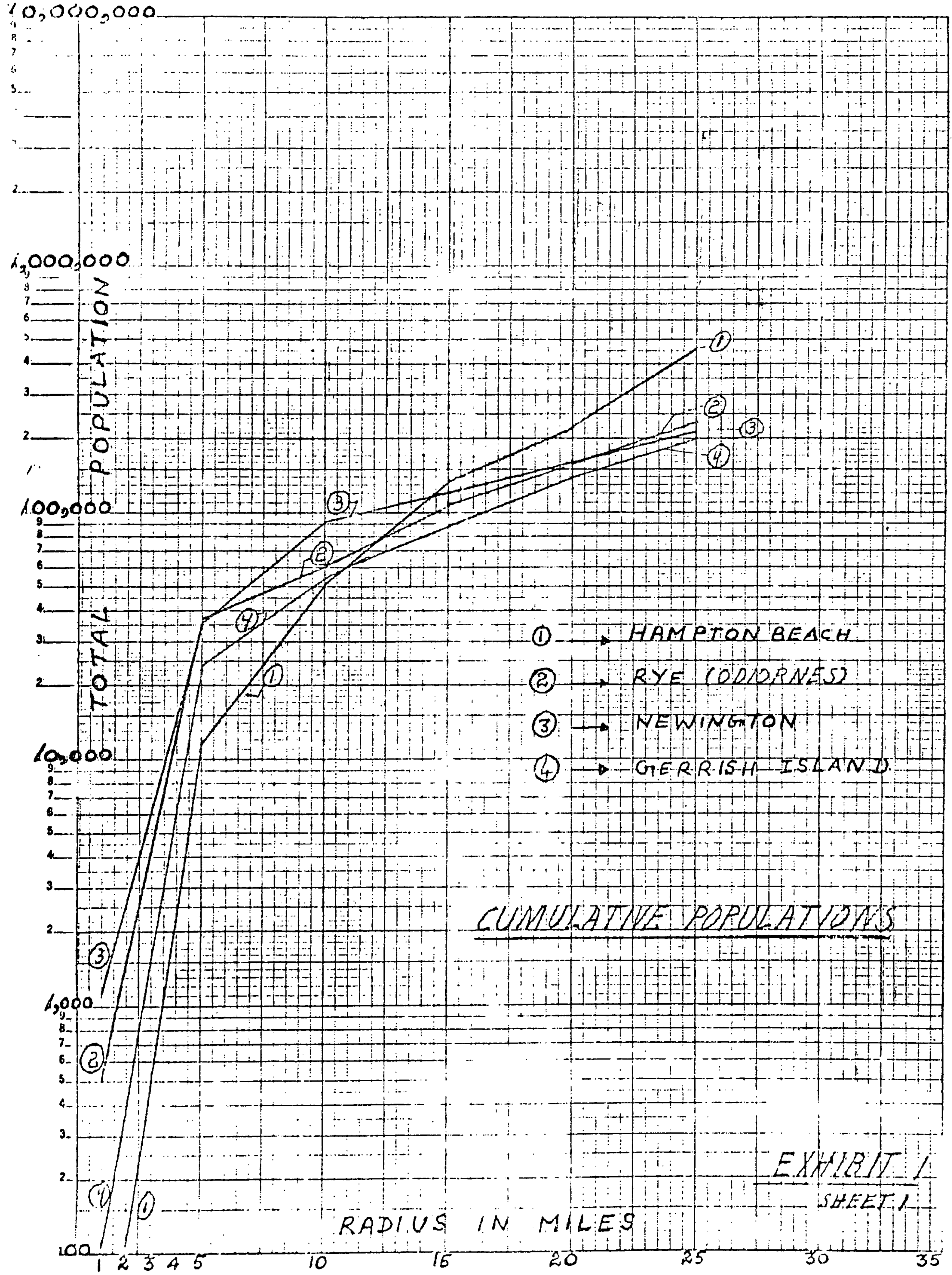
At Rollins Farm the plant location will be about 1 mile north of the Portsmouth city line and about $2\frac{1}{2}$ miles from the city's dense, population border. An exclusion zone of 2000 to 2400 feet appears to be reasonably attainable. The area surrounding this radius has mostly well scattered light industrial and commercial buildings. The reactor location will be about 9000 feet laterally from Pease Air Base runway.

Cooling water and waste heat disposal are considered very adequate by virtue of the very large tidal flows to and from Little and Great Bays. About fifteen times the condenser through-put flows up and down the Piscataqua on each tidal cycle. The theoretical temperature rise in the river is only 1.3F.

Main highways are at the site boundary and a railroad line runs through the site. Ocean shipping uses the Piscataqua up to this point.

Site development poses no serious or costly problems. Foundation conditions, from surface observations and nearby experience, are expected to be suitable.

Transmission access involves highway and/or water crossings but is not considered to be unreasonable.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1,000,000
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TOTAL POPULATION
RADIUS IN MILES
1 2 3 4 5 10 15 20 25 30 35
① HAMPTON BEACH
② RYE (ODIORNES)
③ NEWINGTON
④ GERRISH ISLAND
CUMULATIVE POPULATIONS
EXHIBIT I
SHEET 1

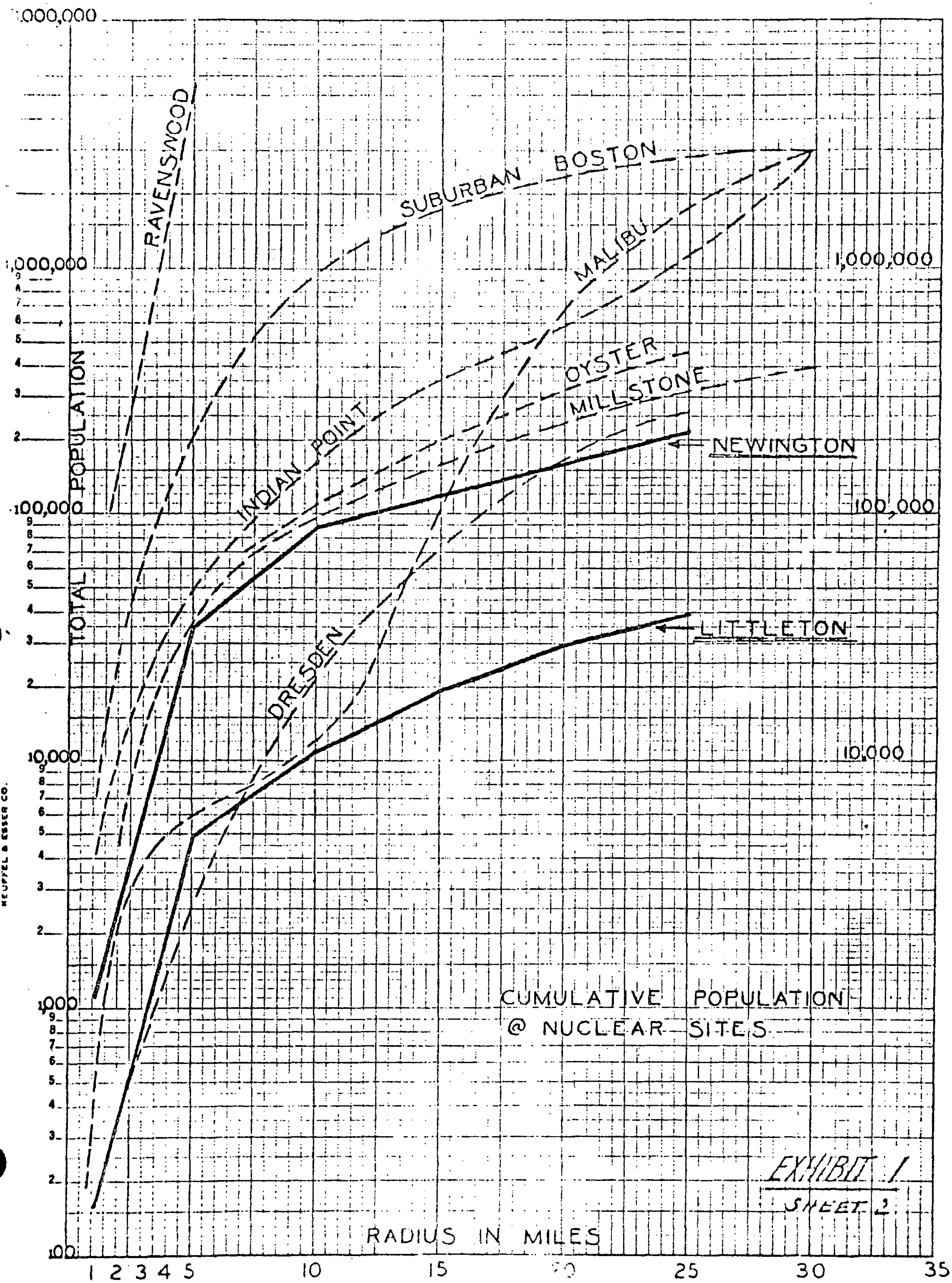
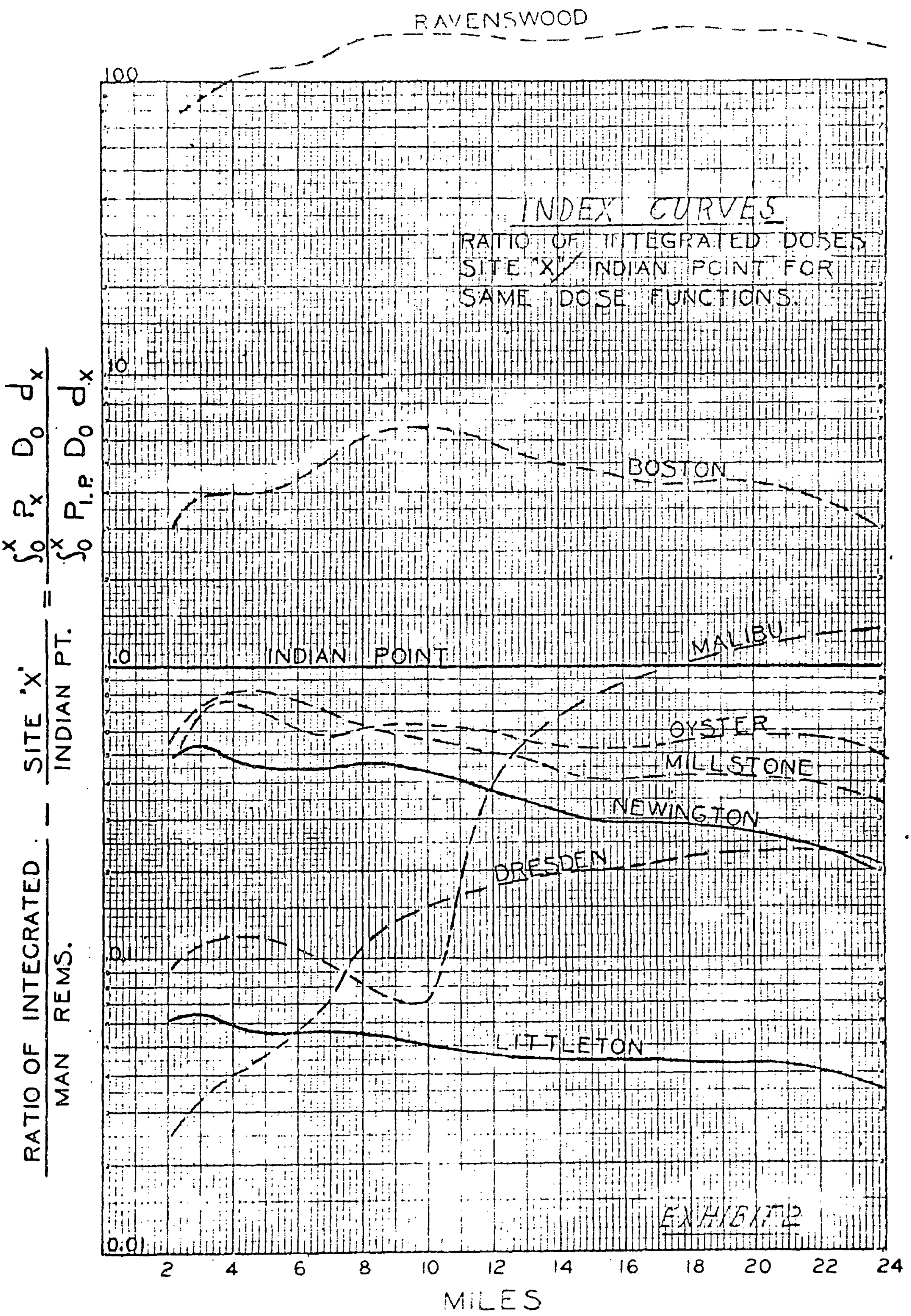


EXHIBIT I
SHEET 2



RAVENSWOOD
INDEX CURVES
RATIO OF INTEGRATED DOSES
SITE "X"/ INDIAN POINT FOR
SAME DOSE FUNCTIONS.
BOSTON
MALIBU
INDIAN POINT
OYSTER
MILLSTONE
NEWINGTON
DRESDEN
LITTLETON
EXHIBIT 2
100
10
1.0
0.1
0.01
2
4
6
8
10
12
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18
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22
24
MILES
RATIO OF INTEGRATED MAN REMS.
SITE 'X' / INDIAN PT.
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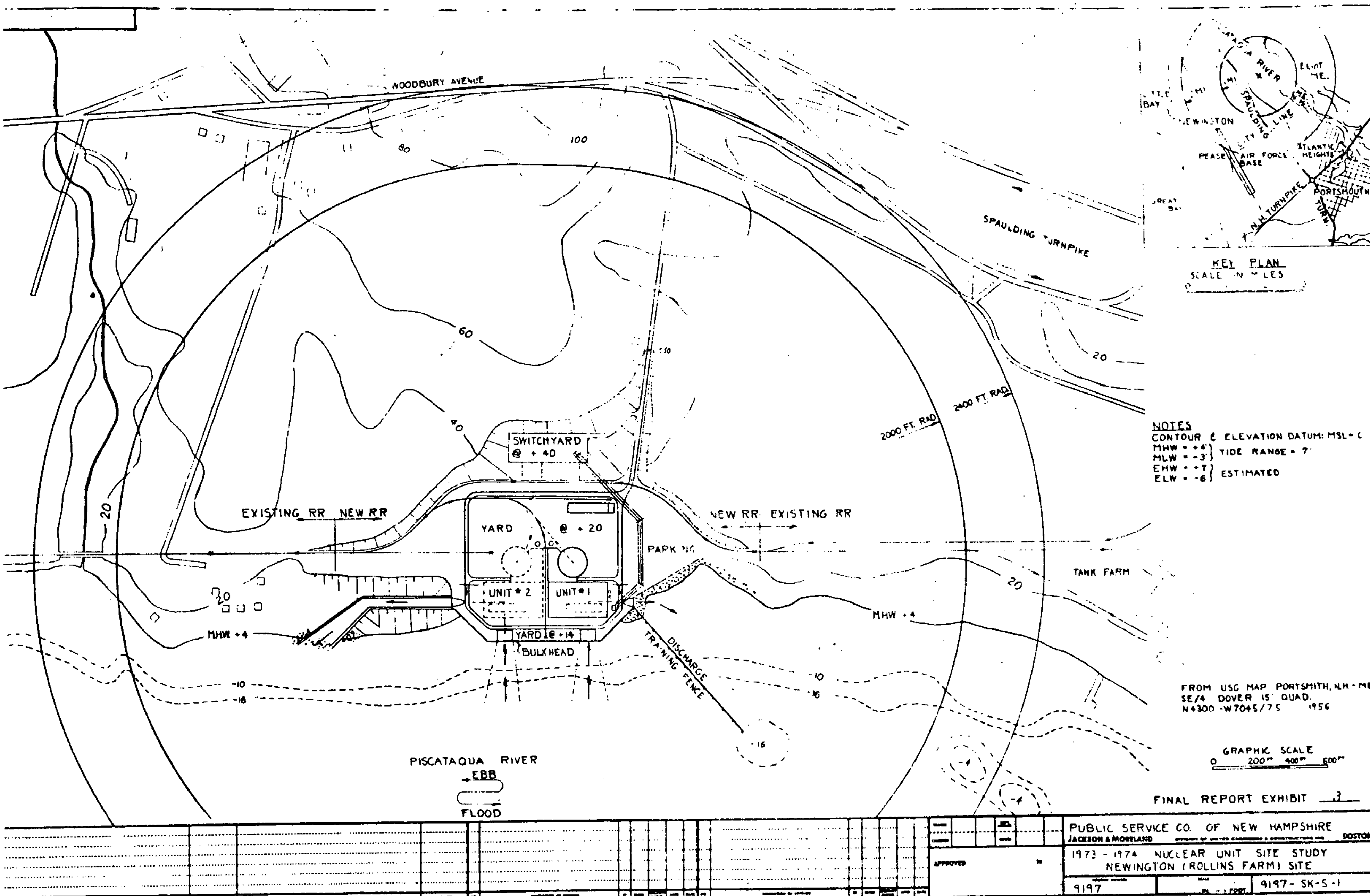
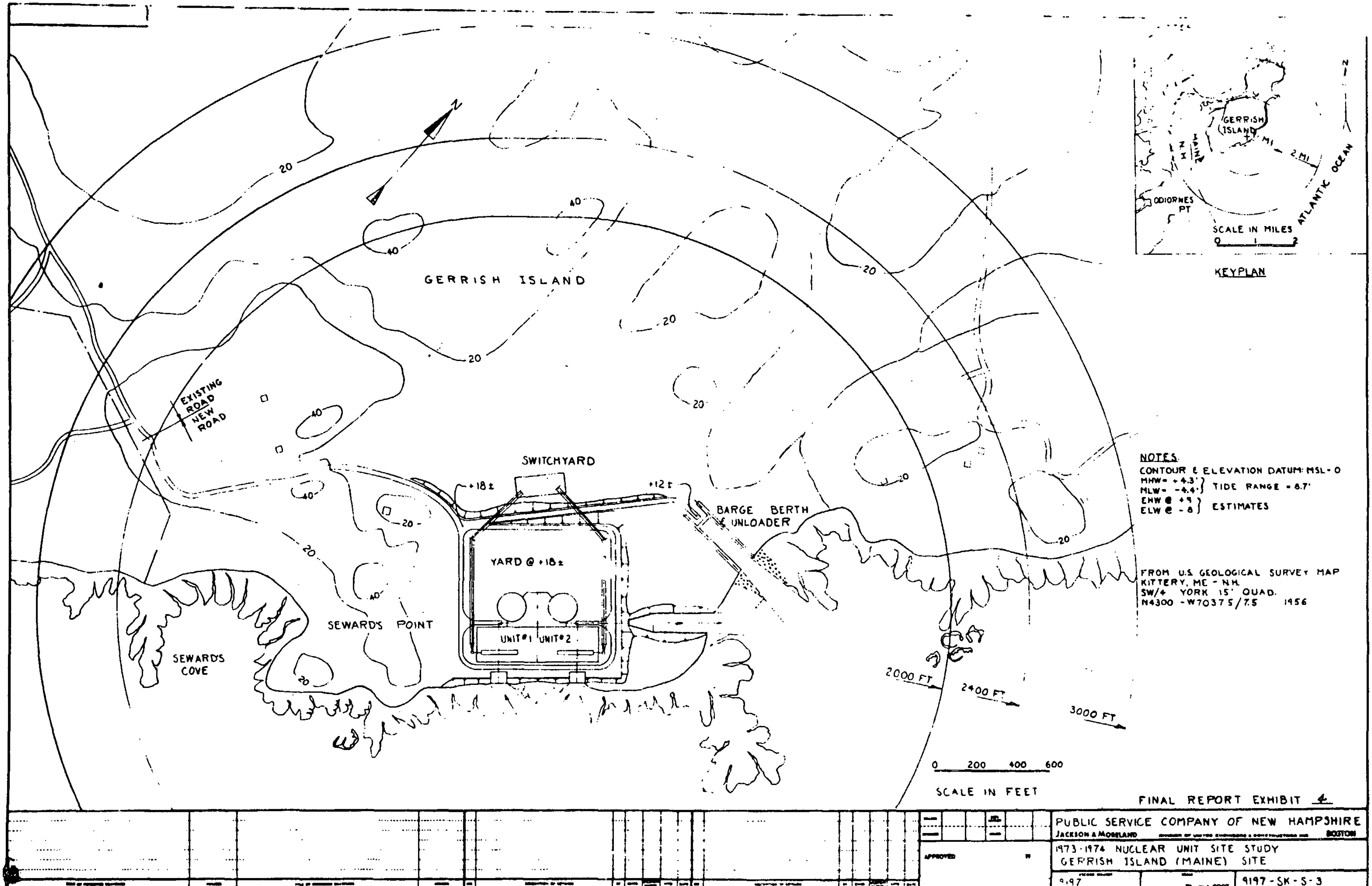
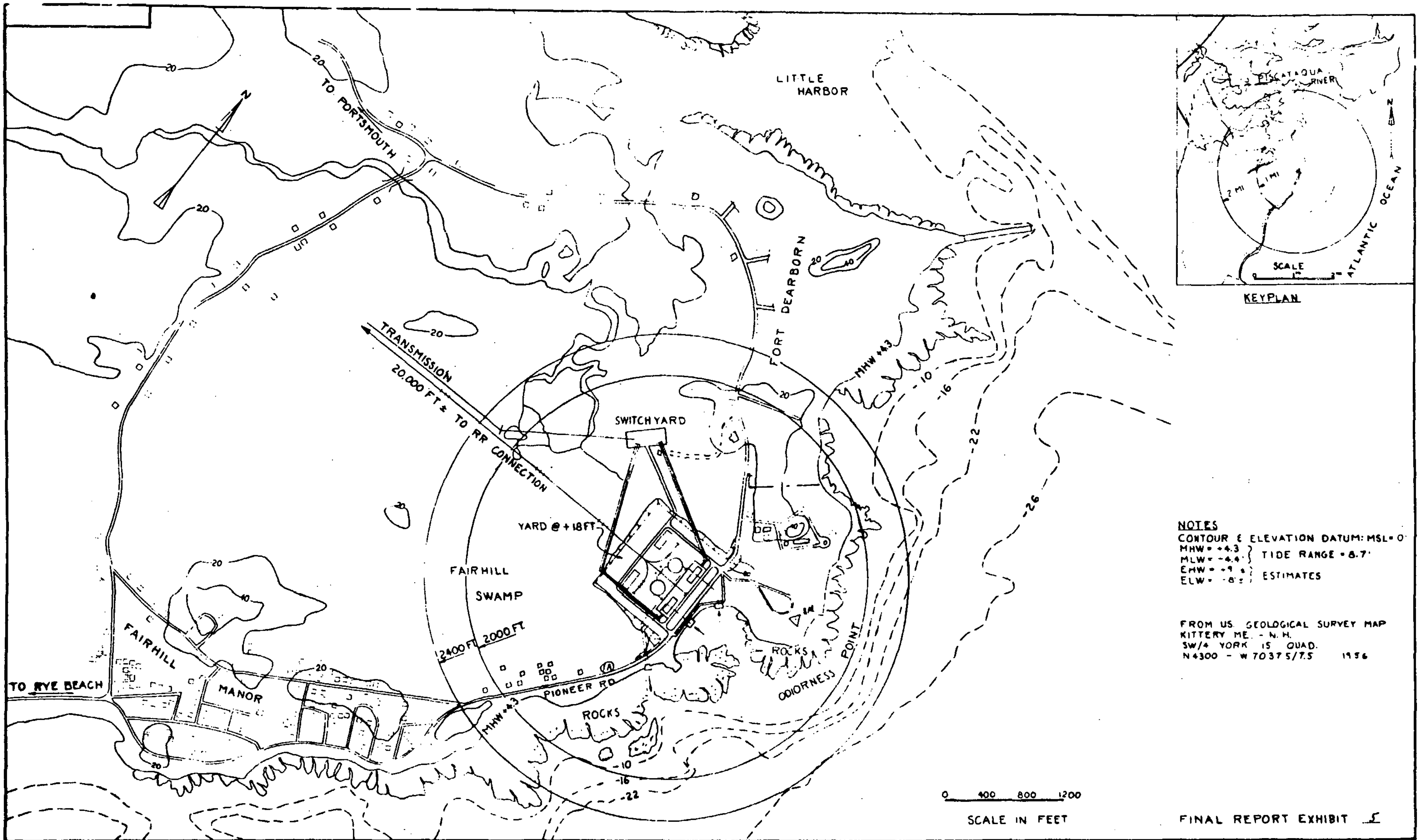
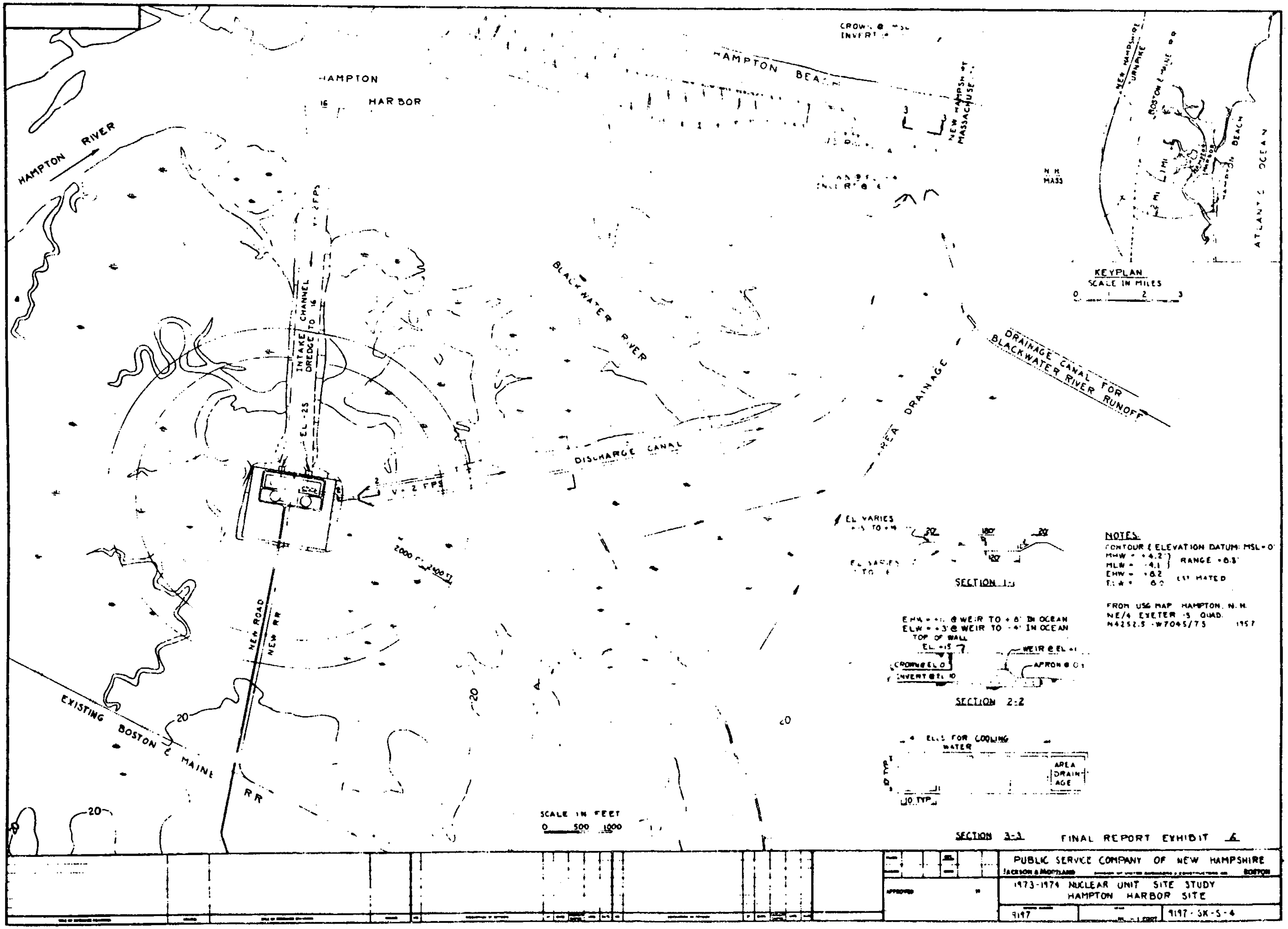


WOODBURY AVENUE
SPAULDING TURNPIKE
100
80
60
40
20
2000 FT. RAD.
2400 FT. RAD.
SWITCHYARD
@ + 40
EXISTING RR
NEW RR
YARD
@ + 20
PARK NG
NEW RR
EXISTING RR
UNIT # 2
UNIT # 1
YARD @ + 14
BULKHEAD
DISCHARGE
TRAINING FENCE
TANK FARM
MHW + 4
-10
-16
PISCATAQUA RIVER
EBB
FLOOD
KEY PLAN
SCALE IN MILES
NEWINGTON
ELIOT ME.
PEASE AIR FORCE BASE
ATLANTIC HEIGHTS
PORTSMOUTH
N.H. TURNPIKE
NOTES
CONTOUR & ELEVATION DATUM: MSL
MHW = +4'
MLW = -3' } TIDE RANGE = 7'
EHW = +7
ELW = -6 } ESTIMATED
FROM USG MAP PORTSMITH, N.H.-ME.
SE/4 DOVER IS QUAD.
N4300-W7045/7.5 1956
GRAPHIC SCALE
0 200 400 600
FINAL REPORT EXHIBIT 3
PUBLIC SERVICE CO. OF NEW HAMPSHIRE
JACKSON & MORELAND
BOSTON
APPROVED
1973 - 1974 NUCLEAR UNIT SITE STUDY
NEWINGTON (ROLLINS FARM) SITE
9197
9197- SK-S-1


GERRISH ISLAND
N
20
40
EXISTING ROAD
NEW ROAD
SWITCHYARD
+18±
+12±
BARGE BERTH
& UNLOADER
YARD @ +18±
UNIT #1
UNIT #2
SEWARD'S POINT
SEWARD'S COVE
2000 FT
2400 FT
3000 FT
GERRISH ISLAND
ODIORNES PT
1 MI
2 MI
ATLANTIC OCEAN
SCALE IN MILES
0 1 2
KEYPLAN
NOTES
CONTOUR & ELEVATION DATUM: MSL - 0
MHW = +4.3'
MLW = -4.4'
TIDE RANGE = 8.7'
EHW @ +9
ELW @ -8
ESTIMATES
FROM U.S. GEOLOGICAL SURVEY MAP
KITTERY, ME - N.H.
SW/4 YORK 15' QUAD.
N4300 - W7037.5/7.5 1956
0 200 400 600
SCALE IN FEET
FINAL REPORT EXHIBIT 4
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
JACKSON & MORELAND
BOSTON
APPROVED
1973-1974 NUCLEAR UNIT SITE STUDY
GERRISH ISLAND (MAINE) SITE
9197
9197-SK-S-3



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
JACKSON & MORELAND BOSTON
1973-1974 NUCLEAR PLANT SITE STUDY
ODIORNESS POINT (RYE) SITE
9197
9197-SK-S-2



HAMPTON
HARBOR
HAMPTON RIVER
HAMPTON BEACH
NEW HAMPSH RE
MASSACHUSE
INTAKE CHANNEL
DREDGE TO 16
EL -25
V = 2 FPS
DISCHARGE CANAL
BLACKWATER RIVER
AREA DRAINAGE
DRAINAGE CANAL FOR
BLACKWATER RIVER RUNOFF
NEW ROAD
NEW RR
EXISTING BOSTON & MAINE RR
20
KEYPLAN
SCALE IN MILES
0 1 2 3
NEW HAMPSHIRE TURNPIKE
BOSTON & MAINE RR
ATLANTIC OCEAN
N.H.
MASS
NOTES:
CONTOUR & ELEVATION DATUM: MSL=0'
FROM USG MAP HAMPTON, N.H.
NE/4 EXETER 15 QUAD.
1957
SECTION 1-1
SECTION 2-2
TOP OF WALL
WEIR @ EL
APRON @
AREA DRAINAGE
10 TYP
SECTION 3-3
SCALE IN FEET
0 500 1000
FINAL REPORT EXHIBIT 6
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
JACKSON & MORELAND
BOSTON
1973-1974 NUCLEAR UNIT SITE STUDY
HAMPTON HARBOR SITE
9197
9197-SK-5-4

Jackson & Moreland
Division of
United Engineers & Constructors Inc.
Boston

Form No. 541…

ESTIMATE

PREPARED VMW DATE 4/6/67
CHECKED DATE
RECORD NO. 9197

CLIENT P.S. of N.H.
PROJECT Nuclear Site Study
DESCRIPTION OF WORK Site Development @ Rollins Farm

SHEET NO. ____ OF ____

ACCOUNT CODE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR & CONSTR. EQUIP. UNIT COST	LABOR & CONSTR. EQUIP. TOTAL	TOTAL UNIT COST	TOTAL
	Clearing		L.S.						$ 13 000
	Gen. Exc + Gr.	200 000	C.Y.					$ 0.50	100 000
	Relocate R.R.	1000	L.F.					10.	10 000
	New R.R.	800	L.F.					22.	17 000
	Access Road	700	L.F.					12	9 000
	Sheet Pile Bulkhead	750	Ton	(1000 LF)				300	225 000
	Intake Structure	145 000	C.F.	each	x 2	(no ledge)		3.50	1,020 000
	Intake Tunnels	120	L.F.		2 @ 60' x	4 @ 6'x7'		1200.	144 000
	Discharge Tunnels	400	L.F.		2 @ 200 x	2 @ 8x10		825.	330 000
	Discharge Structures	2	ea					30 M	60 000
	Dredge @ Intake	15 00	CY					1	15 000
	Discharge Canal	800	L.F.		2400 LF			3	24 000
	Discharge Training Barrier	800	L.F.					4	32 000
	Rip Rap + Misc	LS							10 000
									$ 2,005 000
								Say	2 million

@ Rollins Farm Site

Exhibit 7
Sheet 1

JACKSON & MORELAND
DIVISION OF
UNITED ENGINEERS & CONSTRUCTORS INC.
BOSTON

ESTIMATE

FORM NO. 5414.2

PREPARED VMW DATE 4/8/67
CHECKED DATE
RECORD NO. 9197

CLIENT P.S. of N.H.
PROJECT Nuclear Site Study
DESCRIPTION OF WORK Site Development @ Gerrish Island

SHEET NO. ____ OF ____

ACCOUNT CODE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR & CONSTR. EQUIP. UNIT COST	LABOR & CONSTR. EQUIP. TOTAL	TOTAL UNIT COST	TOTAL
	Clearing								$ Nil
	Access Road - New	2000	LF					$10	20 000
	Maint + Refurb Exist	2000	L.F					4	8 000
	Rail Roads	—		None on Site					—
	Rough Grade incl. fill	—		Incl with excavations					—
	Dredge Intake Chanel	15 000	CY	Say 50% Rock				6	90 000
	Intake Structures	172 000	CF	each x 2			% rock	3.75	1300 000
	Intake Tunnels	120	L.F		2 @ 60 LF each			1200.	144 000
	Discharge Tunnels	900	L.F					900.	810 000
	Discharge Structs (2)	600	CY					120	72 000
	Dredge Disch. Canal	18 000	CY					3	54 000
	Diff Turb Rm Ex	13 000	CY.					3	39 000
					Sub Total without Unloading -				2,537 000
	Barge Dock - Excav	25 000	CY					4	100 000
	- Conc	4 000	CY					100	400 000
	Gantry - 100 T	1							300 000
							Sub		800 000
							Total		3,337 000

Say 3.3 million for Gerrish

Exhibit 7
sheet 2

JACKSON & MORELAND
Division of
United Engineers & Constructors Inc.
Boston

FORM NO. 5414.2

ESTIMATE

PREPARED UMd DATE 2/8/67
CHECKED DATE
RECORD NO. 9197

CLIENT P.S. of N.H.
PROJECT Nuclear Plant Site Study
DESCRIPTION OF WORK Site Development @ Odiorne's Pt

SHEET NO. ____ OF ____

ACCOUNT CODE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR & CONSTR. EQUIP. UNIT COST	LABOR & CONSTR. EQUIP. TOTAL	TOTAL UNIT COST	TOTAL
	Clearing	About	15 houses						15 000
	Site Fill	100 000	CY					2	200 000
	Relocate Rt 1A	1600	LF					30	48 000
	Dredge Intake	18 000	CY					3	54 000
	Intake Structures (2)	172 000	CF	each				3.65	1260 000
	Intake Tunnels	420	LF					1200	504 000
	Discharge Tunnels	1750	LF					900	1580 000
	Disch. Struct	600	CY					150	90 000
	Dredge Disch.		LS						10 000
	Δ Turb Rm Excav								20 000
	Δ Architecture								100 000
									3,881 000
	Railroad to Site	22 000	LF			incl roadbed		$25	550 000
									4,431 000
	Add for difficulties in handling reactor + other water shippments across highway + road maint etc								150 000
									4,581 000

Say 4.6 million @ Odiorness

Exhibit 7
Sheet 3

JACKSON & MORELAND
Division of
United Engineers & Constructors Inc.
Boston

Form No. 5414.2

ESTIMATE

PREPARED VMW DATE 7/8/67
CHECKED DATE
RECORD NO. 9197

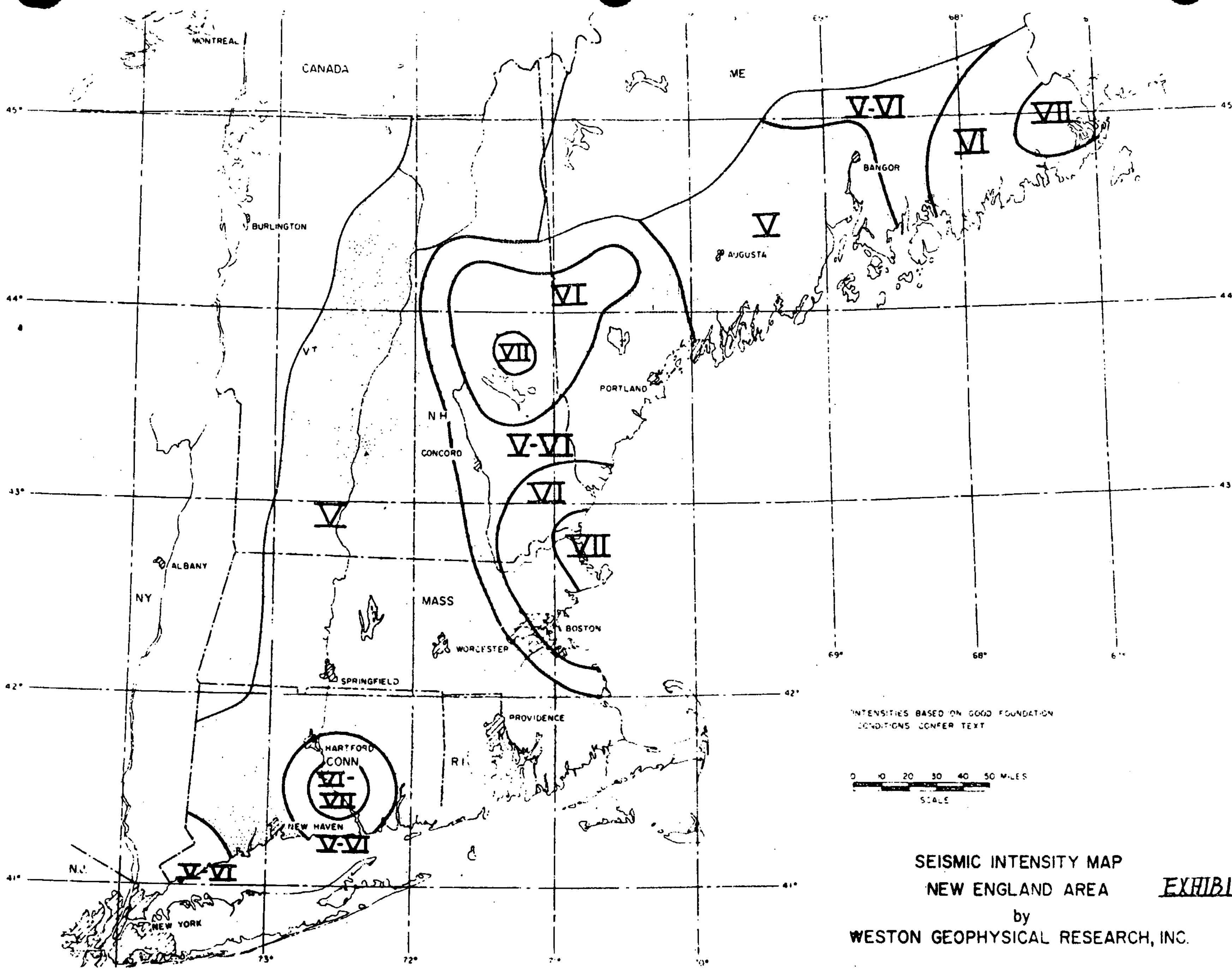
CLIENT P.S. of N.H.
PROJECT Nuclear Plant Site Study
DESCRIPTION OF WORK Site Development @ Hampton Flats

SHEET NO. ____ OF ____

ACCOUNT CODE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR & CONSTR. EQUIP. UNIT COST	LABOR & CONSTR. EQUIP. TOTAL	TOTAL UNIT COST	TOTAL	
	Clearing								[illegible]	
	Access Roads - New	3400	LF					10	34	000
	Maint + Refurb. Exist	3000	LF					4	12	000
	Rail Road Spur	3500	LF					20	70	000
	Dredge Intake	500 000	CY					2	1 000	000
	Intake Structs (2)	156 000	CF	each				3.60	1125	000
	Intake Tunnel	120	LF					1200	144	000
	Disch. Tunnels	900	LF					900	810	000
	Disch. Struct	600	CY					132	80	000
	Disch. Cannel	700 000	CY					1.50	1050	000
	Tunnel Under Rt 1A	2000	LF					1350	2700	000
	Drainage Ditch + Tunnel		LS						500	000
	Disch. Protection		LS						20	000
	Sheet Piling	500	Ton					300	150	000
	Site Fill			from dredging					—	
	do - Gravel Surf	60 000	CY					2	120	000
	Δ Foundations + Excavation	%		piles, piers, cofferdams + dewatering etc.					250	000
									8 065	000

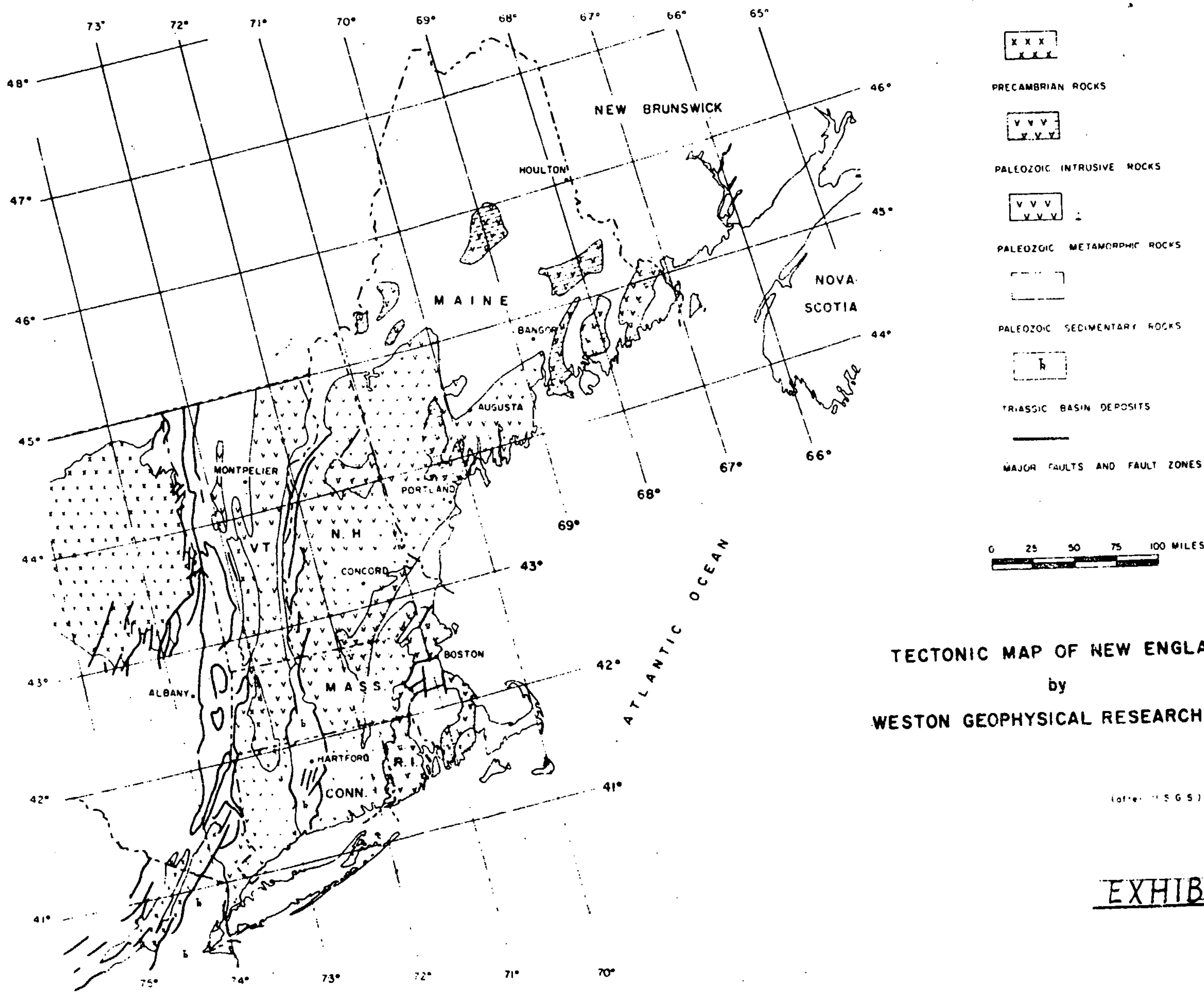
Say 8 million @ Hampton

Exhibit 7
Sheet 4



SEISMIC INTENSITY MAP
NEW ENGLAND AREA
by
WESTON GEOPHYSICAL RESEARCH, INC.

EXHIBIT 8



TECTONIC MAP OF NEW ENGLAND
by
WESTON GEOPHYSICAL RESEARCH, INC.

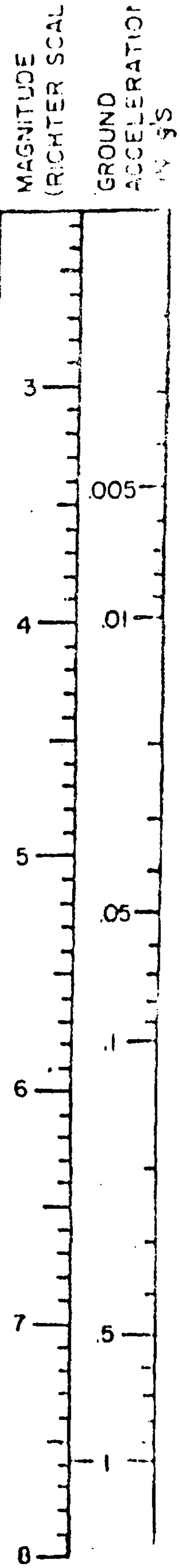
(after U.S.G.S.)

EXHIBIT 9

APPROXIMATE RELATIONSHIP WITH MAGNITUDE AND GROUND ACCELERATION

ABRIDGED MODIFIED MERCALLI INTENSITY SCALE

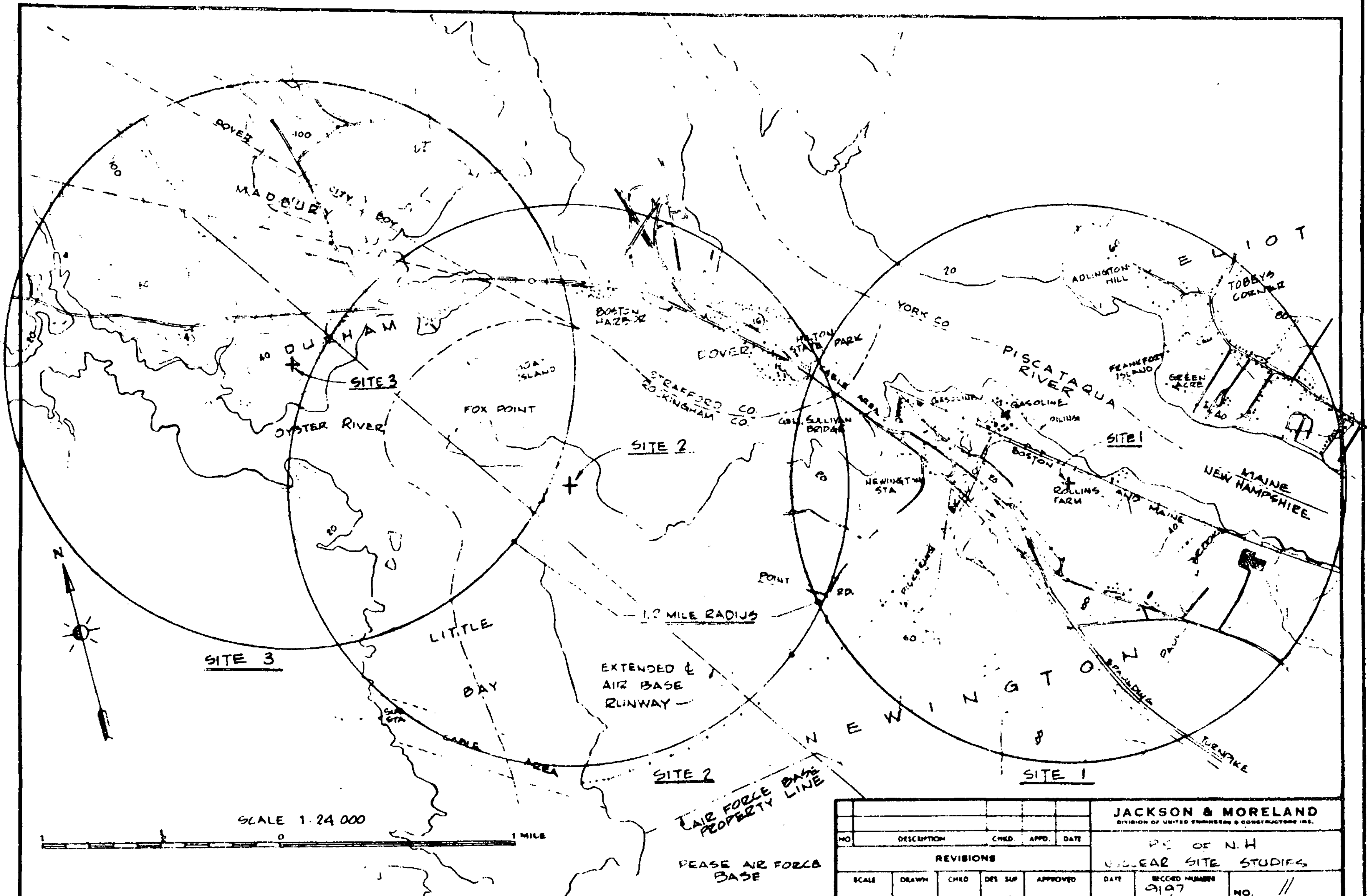
I	Not felt except by a very few under especially favourable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage **negligible** in buildings of good design and construction; **slight** to moderate in well-built ordinary structures; **considerable** in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	Damage **slight** in specially designed structures; **considerable** in ordinary substantial buildings with partial collapse; **great** in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	Damage **considerable** in specially designed structures; well designed frame structures thrown out of plumb; **great** in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations, ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.



Modified Mercalli Intensity Scale after Wood and Neumann, 1931 (Intensities XI and XII not included).

Magnitude and acceleration values taken from Nuclear Reactors and Earthquakes, TID-7024, United States Atomic Energy Commission.

EXHIBIT 10



NO	DESCRIPTION	CHKD	APPD.	DATE

REVISIONS

SCALE	DRAWN	CHKD	DES SUP	APPROVED

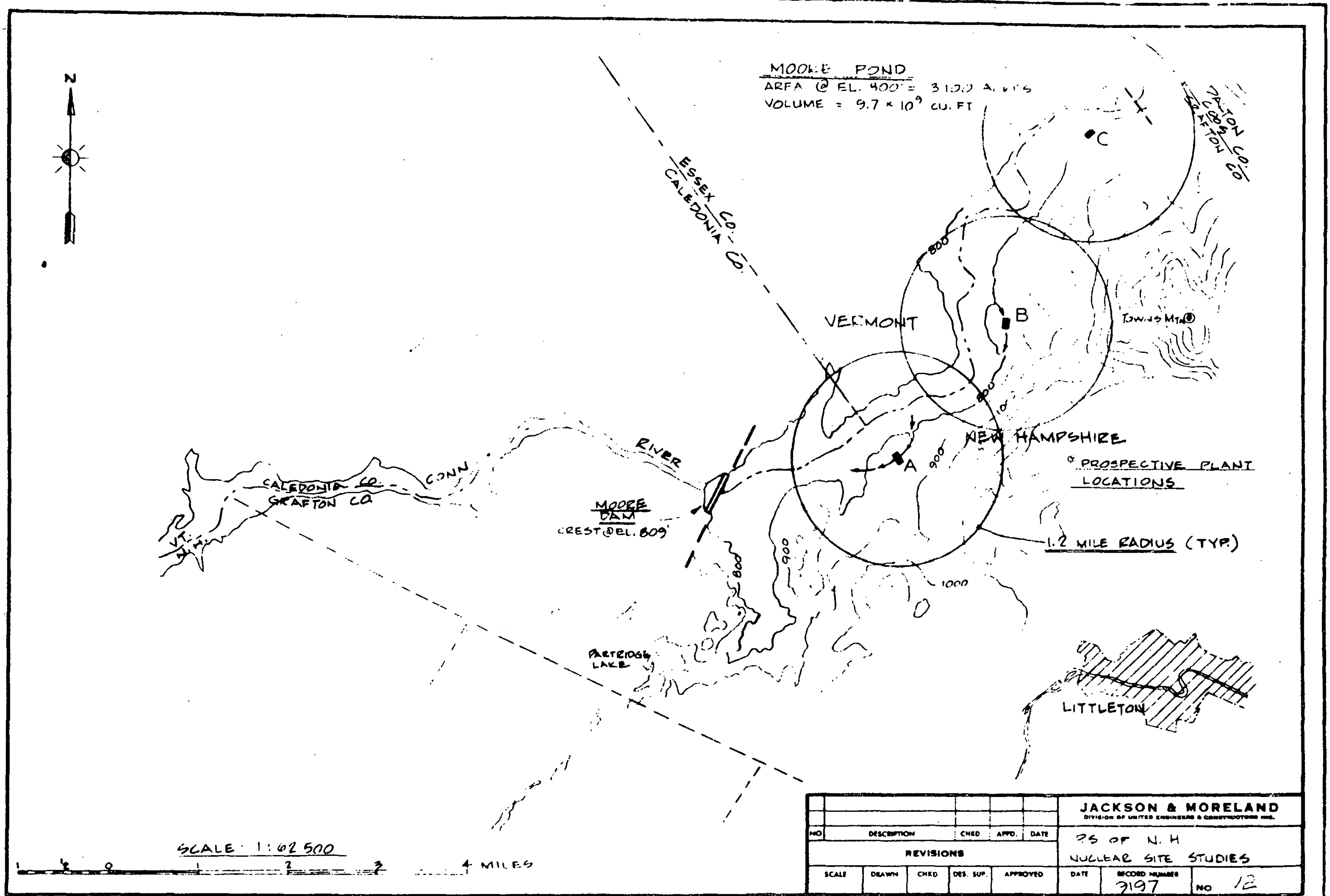
JACKSON & MORELAND
DIVISION OF UNITED ENGINEERS & CONSTRUCTORS INC.

PS OF N.H
NUCLEAR SITE STUDIES

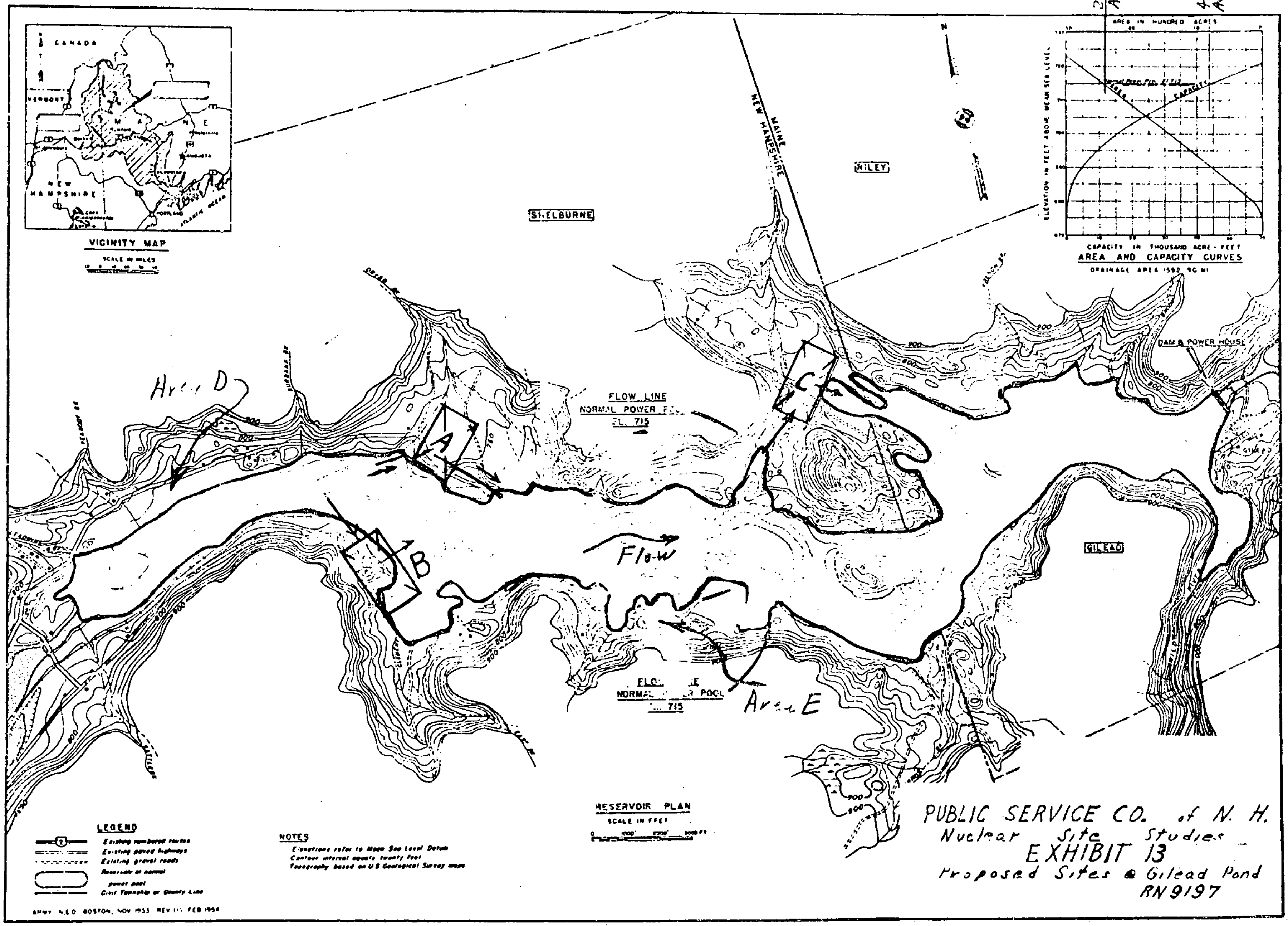
DATE | RECORD NUMBER 9197 | NO. 11

EXHIBIT 11

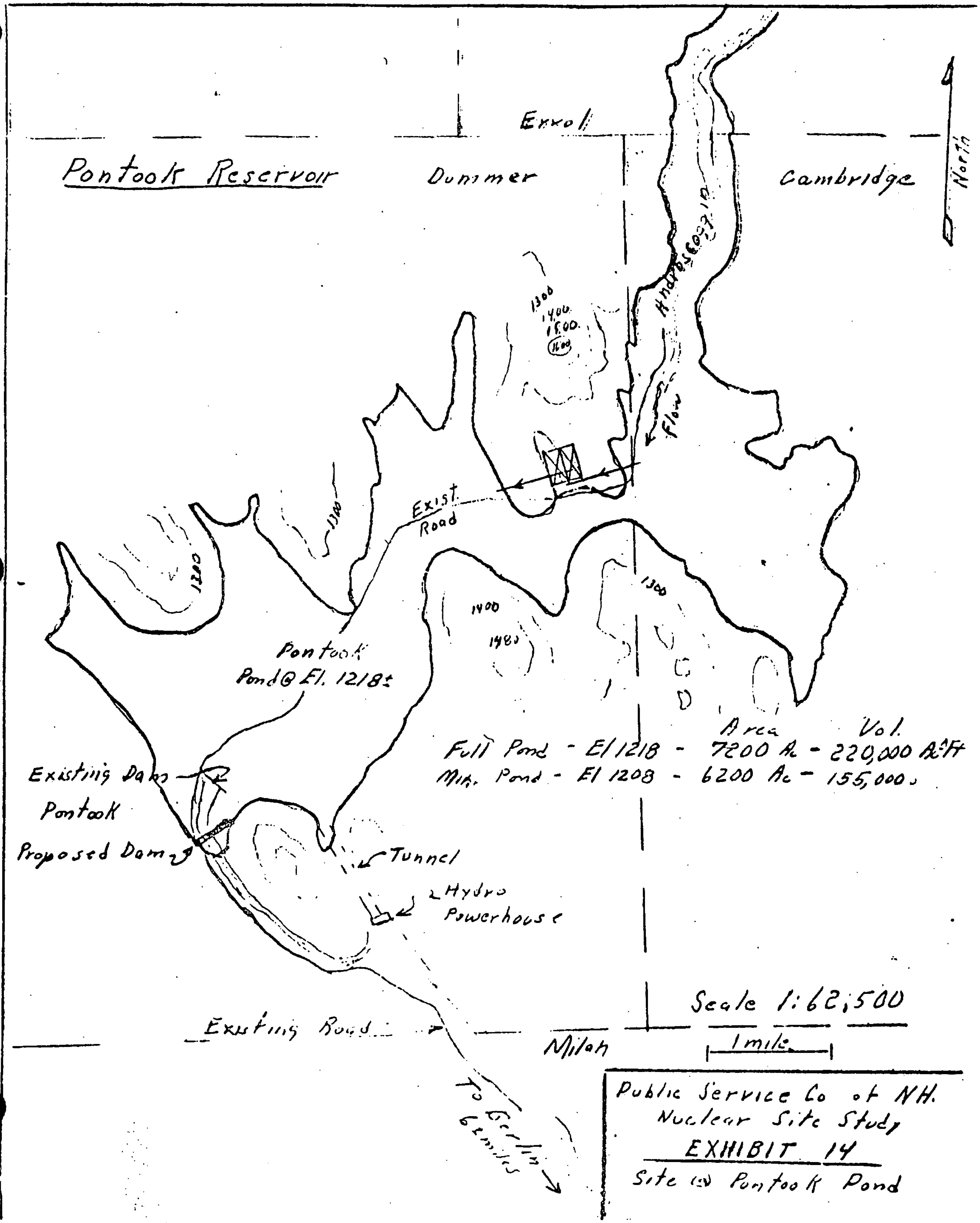
J. & M. Form No. 900.1

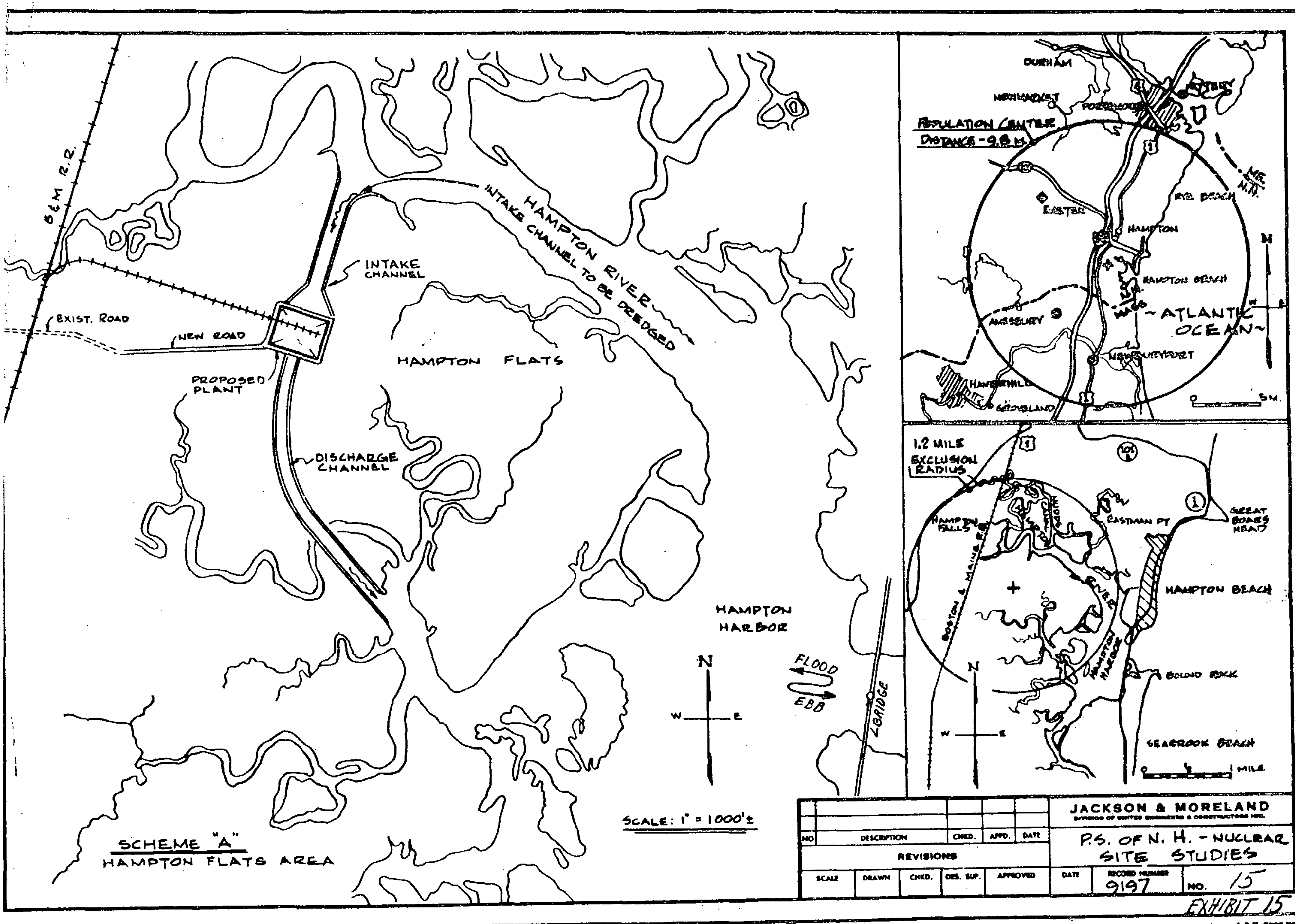


N
MOORE POND
AREA @ EL. 800' = 3100 ACRES
VOLUME = 9.7 × 10⁹ CU. FT
DALTON CO.
COOS
GRAFTON CO
C
ESSEX CO.
CALEDONIA CO.
VERMONT
B
TOWNS MTN
800
A
900
NEW HAMPSHIRE
PROSPECTIVE PLANT LOCATIONS
1.2 MILE RADIUS (TYP.)
1000
RIVER
CONN.
CALEDONIA CO
GRAFTON CO
VT.
N.H.
MOORE DAM
CREST @ EL. 809'
PARTRIDGE LAKE
LITTLETON
SCALE 1:62 500
1 ½ 0 1 2 3 4 MILES
JACKSON & MORELAND
DIVISION OF UNITED ENGINEERS & CONSTRUCTORS INC.
NO
DESCRIPTION
CHKD
APPD.
DATE
REVISIONS
SCALE
DRAWN
CHKD
DES. SUP.
APPROVED
25 OF N. H
NUCLEAR SITE STUDIES
DATE
RECORD NUMBER
3197
NO 12
J & M. Form No. 900.



CANADA
VERMONT
MAINE
NEW HAMPSHIRE
ATLANTIC OCEAN
VICINITY MAP
SCALE IN MILES
SHELBURNE
RILEY
MAINE
NEW HAMPSHIRE
GILEAD
DAM & POWER HOUSE
FLOW LINE
NORMAL POWER POOL
EL. 715
Area D
A
B
C
Flow
Area E
AREA IN HUNDRED ACRES
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
AREA
CAPACITY
CAPACITY IN THOUSAND ACRE-FEET
AREA AND CAPACITY CURVES
DRAINAGE AREA 1392 SQ MI
2400 Acre
4400 Ac-Ft
RESERVOIR PLAN
SCALE IN FEET
LEGEND
Existing numbered routes
Existing paved highways
Existing gravel roads
Reservoir at normal power pool
Civil Township or County Line
NOTES
Elevations refer to Mean Sea Level Datum
Contour interval equals twenty feet
Topography based on U.S. Geological Survey maps
ARMY N.E.D. BOSTON, NOV 1953 REV (1) FEB 1954
PUBLIC SERVICE CO. of N. H.
Nuclear Site Studies
EXHIBIT 13
Proposed Sites @ Gilead Pond
RN 9197


Pontook Reservoir
Errol
Dummer
Cambridge
North
Androscoggin R.
Flow
1300
1400
1500
1600
1300
1200
Exist. Road
1400
1480
1300
Pontook Pond @ El. 1218±
Area Vol.
Full Pond - El 1218 - 7200 Ac - 220,000 Ac Ft
Min. Pond - El 1208 - 6200 Ac - 155,000
Existing Dam
Pontook
Proposed Dam
Tunnel
Hydro Powerhouse
Existing Road
Milan
Scale 1:62,500
1 mile
To Berlin 6 miles
Public Service Co of N.H.
Nuclear Site Study
EXHIBIT 14
Site (?) Pontook Pond



B&M R.R.
EXIST. ROAD
NEW ROAD
PROPOSED PLANT
INTAKE CHANNEL
HAMPTON RIVER
INTAKE CHANNEL TO BE DREDGED
HAMPTON FLATS
DISCHARGE CHANNEL
HAMPTON HARBOR
FLOOD
EBB
BRIDGE
N
W
E
SCALE: 1" = 1000'±
SCHEME "A"
HAMPTON FLATS AREA
DURHAM
NEWMARKET
PORTSMOUTH
KITTERY
POPULATION CENTER
DISTANCE - 9.8 M.
ME.
N.H.
RYE BEACH
EXETER
HAMPTON
HAMPTON BEACH
AMESBURY
MASS.
N.H.
~ ATLANTIC OCEAN ~
NEWBURYPORT
HAVERHILL
GEORGETOWN
5 M.
1.2 MILE EXCLUSION RADIUS
HAMPTON FALLS
BOSTON & MAINE R.R.
EASTMAN PT
GREAT BOARS HEAD
HAMPTON BEACH
RIVER
HAMPTON HARBOR
BOUND ROCK
SEABROOK BEACH
1 MILE
NO
DESCRIPTION
CHKD.
APPD.
DATE
REVISIONS
SCALE
DRAWN
CHKD.
DES. SUP.
APPROVED
DATE
RECORD NUMBER
9197
NO. 15
JACKSON & MORELAND
DIVISION OF UNITED ENGINEERS & CONSTRUCTORS INC.
P.S. OF N. H. - NUCLEAR SITE STUDIES
EXHIBIT 15