PERRY NUCLEAR POWER PLANT
UNITS 1 & 2

ENVIRONMENTAL REPORT

OPERATING

LICENSE STAGE

Volume 1

THE CLEVELAND ELECTRIC ILLUMINATING CO.

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CHAPTER 1

OBJECTIVES OF THE PROPOSED FACILITY

The following utility companies, owners of the Perry Nuclear Power Plant (PNPP), are joint Applicants for a license to operate the nuclear facility in accordance with the requirements of 10 CFR Part 50:

Cleveland Electric Illuminating Company (CEI)
Duquesne Light Company (DL)
Ohio Edison Company (OE) and its subsidiary, Pennsylvania Power Company (PP)
Toledo Edison Company (TE)

In the construction and operation of the PNPP, CEI will act as agent for all of the owner companies.

The objective of the facility is to provide economical electrical power to the service areas of the owner companies.

The PNPP consists of two units, each rated at an expected net demonstrated capability (winter rating) of 1205 megawatts (MWe). Construction of the PNPP commenced on October 21, 1974, upon receipt of the first Limited Work Authorization. The NRC Construction Permits were received on May 3, 1977. The scheduled dates for commercial service to start are May 1, 1984, and May 1, 1988, for PNPP Units 1 and 2, respectively.

The Applicants comprise the Central Area Power Coordination (CAPCO) group. CAPCO was formalized by a Memorandum of Understanding[1] that was executed on September 14, 1967. The planning of generating facilities by CAPCO has been done collectively on a "one-system" basis. The CAPCO companies are operating under an agreement that provides for several methods of mutual support through purchases, sales, and reserves sharing.

Since the formation of CAPCO, the Applicants have coordinated the planning of all additions of new generating capacity, of which the PNPP is a part.

All data on system loads and generating capacity included in these sections are shown individually for the Applicants, as well as collectively. Data for the Pennsylvania Power Company and the Ohio Edison Company are combined as data for the Ohio Edison system. Because the new generating-capacity additions have been planned collectively, reserve requirements are discussed on a collective basis. The load and capacity data contained in this report represent the most recent information available as of May 1980.

1.1 REQUIREMENT FOR POWER

1.1.1 DEMAND CHARACTERISTICS

CAPCO serves an area of approximately 14,000 square miles in northern and central Ohio and western Pennsylvania. The population of the area served is about 7 million, or about 3.2 percent of the total U.S. population. In 1979, CAPCO provided about 2.9 percent of the total U.S. electricity requirements.

The relative "sizes" of the CAPCO companies, as measured by electric energy sales to ultimate customers for the year 1979, are shown in Table 1.1-1.

While the four companies differ considerably in relative size, as measured by the electric energy they supply, the characteristics of their loads are similar. Each company serves a mix of cities of varying size and rural areas. Each service area contains areas of heavy industrialization in and near the urban areas. There are also several concentrations of industry in areas that are generally rural in nature. The industries served by each of the companies are well diversified and include practically all of the major Standard Industrial Classification categories.

The distribution of energy sales by customer class in the year 1979 for each of the CAPCO companies, for the entire U.S. electric utility industry, and for CAPCO is shown in Table 1.1-2. It can be observed that the ratio of residential sales to total sales is lower for the CAPCO companies than the national average and that industrial sales are significantly greater than the national average. Because of the high proportion of industrial load, the volume of sales is closely related to the national economy.

1.1.1.1 CAPCO Load Forecasting

Since the planning of generating capacity for CAPCO is done on a "one-system" basis, a CAPCO forecast of electric power demand and of energy input to the system is required for the planning studies. Each company prepares the demand and energy forecast for its own system. These forecasts are then combined to produce a forecast for CAPCO. The demand forecast is presented in megawatt values of 12 monthly peak loads for each year. The peak loads for the remaining days in each month are projected from an analysis of historic load characteristics in which the integrated hourly loads of the companies for each hour of the year are combined to develop historic CAPCO hourly loads.

1.1.1.2 Load-Forecasting Tec ques

Each company uses its own technique for load forecasting. The techniques are generally similar, but vary somewhat from company to company to account for variations in customers' load characteristics within type classes. These variations may be due to the nature of the industries served, the impacts of summer weather and space-heating requirements in the winter, the amounts of farm load included in the residential and commercial categories, variations in rates, and relative costs and availability of alternative types of energy in a particular area.

A discussion of the load-forecasting methods employed by each of the CAPCO companies may be found in each of the CAPCO companies' 1980 Ten-Year Forecast to the Ohio Department of Energy.[2-5]

1.1.1.3 System Peak Hour Demand, Energy, and Load Factors

The total coincident integrated peak hour demands of the CAPCO companies (actual for 1963 to 1979, forecast for 1980 to 1990) are shown in Table 1.1-3. The data represent service-area demands; that is, any sales to other power suppliers are omitted. Table 1.1-7 shows the net amount of purchase and sale contracts expected to be in effect at the time of the annual peak (1984 to 1988). Tables 1.1-3 and 1.1-4 show the individual company and CAPCO peak demands and net energy supplied to the service area, respectively, for the years 1963 through 1990. Historic load factors (1963 to 1979) on the days when the annual peak load occurred and load factors for the calendar year for the individual companies and for CAPCO are presented in Table 1.1-5.

1.1.1.4 Load-Duration Curves

Historic load-duration curves developed from the hour-by-hour sums of the integrated hourly loads of the CAPCO companies are shown in Figure 1.1-1. The data used in preparing Figure 1.1-1 are shown in Table 1.1-6. This table supplements Table 1.1-12 of the PNPP Environmental Report for the Construction Permit (ER/CP) to add data for the years 1972 to 1979. The annual coincident peak of the CAPCO companies is shown at the end of each year's data.

It should be noted that the hourly load data include interruptible load, but that the peak loads used in planning exclude interruptible load. Therefore, the peak figures presented in Table 1.1-6 may differ from those shown in other tables in this chapter.

1.1.2 POWER SUPPLY

1.1.2.1 Capacity Resources

The Applicants have been jointly planning their capacity resources since late 1967. This planning became effective in late 1971, when Sammis Unit 7 began commercial operation. Although all commitments for capacity have been made on the basis of the combined capacity resources of the Applicants, the capacity resources in Table 1.1-7 are shown for each CAPCO company individually, as well as presented in total. Tables are presented for the years 1984 through 1988, when the PNPP is scheduled to go in service.

Table 1.1-8 lists the generating capacity to which the CAPCO companies are jointly committed. This table shows the current schedule for capacity additions to start service and their actual or expected megawatt capability. Percentage ownership shares are also listed (the Ohio Edison and Pennsylvania Power Company shares are combined).

Changes in the individually owned generating capacity that have occurred since the ER/CP was prepared are shown in Tables 1.1-9 and 1.1-10. Table 1.1-9 shows capacity added to the individual systems and capacity uprated (1973 to 1980). Combustion turbines, diesels, and combined-cycle plants that were jointly committed are each owned 100 percent by an individual CAPCO company, but have not been included in Table 1.1-9 because they were committed by joint agreement. These combustion turbines, diesels, and combined-cycle plants are included in the individual company's capacity resources in Table 1.1-7. Table 1.1-10 lists reductions in capacity from that used in the generation planning model (1973 to 1988). The term "reduction" is used to indicate that the capacity has been removed from operation, but that the equipment may or may not have been physically removed.

1.1.2.2 Reserve Margin

The CAPCO companies collaborated on planning all currently committed generating capacity. The procedure employed was a probability method called the Daily Distribution of Capacity Margins Digital Program (DDCM). The planning criterion, specified by the CAPCO Memorandum of Understanding,[1] was that "sufficient capacity shall be provided so that the dependence on generation reserves outside the CAPCO Group shall not, unless unanimously otherwise agreed, exceed one day per calendar year. Such determination shall be made utilizing the Daily Distribution of Capacity Margins Digital Program." The technique is described in the Memorandum of Understanding[1] and in a report by Firestone, Monteith, and Masters.[6]

The process of planning generating capacity starts with the development of the overall load projection of CAPCO. Forecasts of load are made by the individual entities and combined to form a CAPCO total. Schedules for initial operation of previously committed generating capacity additions are reviewed. The maintenance requirements for all existing and planned capacity are also confirmed. Forced outage rates are reviewed and revised, if necessary, based on accumulated CAPCO and industry experience. Ratings of existing generating facilities are confirmed by test.

Utilizing all of this data and the DDCM Program, the ability of the existing and committed generating capacity to reliably supply future loads for each of the next 10 years or more is tested and compared with the CAPCO planning criterion. Such testing may reveal that changes in forecast loads or other parameters, or delays in the startup of capacity additions, result in capacity deficiencies during periods for which longer-range commitments have already been made or the need for additional generating-capacity commitments at the end of the current program. The testing must be carried out for 10 years or more to be compatible with the projected lead time for installing new generating capacity.

The most recent evaluation of the CAPCO generating-capacity program (May 1980), based on the availability of new units (Table 1.1-8) together with updated load forecasts and other pertinent information, resulted in the projections of dependence on supplemental capacity resources shown (Table 1.1-11). All values indicated for the additional firm capacity required to meet the CAPCO criterion are the amounts of firm capacity required throughout the entire year in question, not just on the peak day. The deficiencies in capacity indicated are predicated on the assumption that PNPP Unit 1, Beaver Valley Unit 2, and PNPP Unit 2 will be available for commercial operation on schedule, as shown in Table 1.1-8.

The main difference between the CAPCO DDCM Program and the widely used Loss of Load Probability (LOLP) Programs is in the form of the result. Rather than simply identifying the expected frequency of dependence on supplemental resources, as in LOLP, the CAPCO method calculates the expected frequency of possible dependence on different amounts of supplemental resources. Table 1.1-12 shows the calculated expected frequency of dependence on supplemental resources for CAPCO in 1984. These results are predicated on the assumption that PNPP Unit 1, Beaver Valley Unit 2, and PNPP Unit 2 will be in commercial operation as scheduled. Negative capacity margins would occur when all planned resources, taking into account maintenance, condition and seasonal derating, forced outage, and partial outage, fail to meet firm load requirements.

The negative capacity event for CAPCO would be compensated through emergency support from outside systems, reduced voltage, dropped firm load, or other measures. The extent to which the expected capacity deficiencies can be alleviated by emergency support from systems outside CAPCO will depend on the reserve level and the availability of generating capacity in the neighboring systems. The CAPCO companies have nine 345-kilovolt interconnections with four neighboring systems, and these interconnections serve many functions other than emergency support. However, the ability of the interconnections to transmit emergency support is of less concern than the ability of the generating capacity in neighboring systems to supply it.

The sophisticated analytical methods for generation planning by probability techniques require criteria that apparently are difficult for many observers to comprehend. The older techniques employing subjective criteria, such as percent reserve, are still used, however, to intuitively test the reasonableness of results obtained by the probabilistic analysis. In this chapter the CAPCO capacity situation will be presented in several tables in terms of megawatt and percent reserve over the annual peak load. These tables will be discussed in Section 1.1.3.

A basic weakness of the percent-reserve technique is that there is no conversion factor between percent reserve and a probabilistic statement of reliability, such as dependence on supplemental capacity resources, because the percent reserve technique does not take into consideration such important parameters as:

a. Characteristics of system load, since the load for only one hour in the year is used to compute percent reserve.
b. The range of capabilities of generating units that make up the system.
c. Scheduling of planned maintenance.
d. Expected forced-outage performance of individual generating units.
e. Partial outages and occasional derating of generating units.

1.1.3 CAPCO CONSTRUCTION SCHEDULE

When the ER/CP for the PNPP was prepared in 1973, the scheduled service dates for PNPP Units 1 and 2 were April 1, 1979, and April 1, 1980, respectively, and Beaver Valley Unit 2 was scheduled for March 1, 1978. In July 1973, commitments were made for five more generating units, with service dates as follows:

Bruce Mansfield 3	April 1978
Davis-Besse 2	June 1981
Erie Nuclear 1	January 1982
Davis-Besse 3	January 1983
Erie Nuclear 2	December 1983

In the period starting in late 1974, there have been several reviews and revisions of the CAPCO construction schedule. These reviews have resulted in the current schedule shown in Table 1.1-8.

The new target dates reflect a more realistic time frame for the construction and licensing of nuclear plants. The last four committed units (identified in Table 1.1-8) were terminated after an appraisal of political and regulatory uncertainties, which have intensified after the accident at Three Mile Island.

Generating units that were committed for service earlier in the program and are now in service also experienced delays in service dates, principally because of delays in licensing and construction which were beyond the control of the constructing CAPCO party. As a matter of interest, the experience to date has been as follows:

Unit	Service Date	
	Original Plan	Actual
Sammis 7	September 1971	September 1971
Eastlake 5	August 1972	September 1972
Beaver Valley 1	October 1973	April 1977
Davis-Besse 1	December 1974	December 1977
Bruce Mansfield 1	April 1975	June 1976
Bruce Mansfield 2	April 1976	October 1977

The CAPCO companies are mindful of their responsibilities for the penalties and burdens that might be suffered by customers, shareholders, and the public at large in the CAPCO area if a future shortage of generating capacity results from changes made in plant construction schedules at present. The owners are faced with great problems in financing the plant construction program in the face of ever-increasing costs of plants and costs of money. The financing problems are exacerbated by the heavy burden of financing the extensive programs for the control of air and water pollution that are required by regulation.

There is also uncertainty as to the future electric energy requirements in the CAPCO service area. After a long period of stable load growth, since 1973 the outlook for the future has been faced with varying degrees of optimism and pessimism. Since the ER/CP was prepared in 1973, the annual summer peak loads (excluding interruptible load) forecasted by and for CAPCO have changed as follows:

Year	PNPP ER/CP (1973)	Current Forecast (1980)	Change (MWe)
1980	15,607	11,327	-4,280
1981	16,524	11,877	-4,647
1982	17,493	12,334	-5,159
1983	18,529	12,768	-5,761

Problems in trying to match the plant construction schedule to changing load forecasts arise from the long lead time required for new generating capacity to be installed. The current schedule, through 1988, is deficient in meeting the CAPCO criterion in all years (Table 1.1-11).

The dependence on supplemental capacity resources has the potential of being greater than shown in Table 1.1-11 because of the uncertainties posed by the following factors:

a. Unexpected construction delays.

b. Economic recovery at a faster rate than that reflected in the current load forecast.

c. Conversion from gas or oil to electric energy at a greater rate than expected.

d. Possible increase in preventive maintenance as part of a program for improving the availability of generating equipment.

e. Possible reductions in generating plant capability due to environmental compliance measures.

f. The ability of customers to increase their electrical load in a shorter period than the lead time required to install new generating capacity.

g. Disruptions in fossil-fuel supply due to such factors as strikes and prolonged severe-weather conditions.

h. Interruption of nuclear plant construction or operation by edict because of a perceived generic problem.

REFERENCES FOR SECTION 1.1

1. CAPCO, Memorandum of Understanding, September 14, 1967.

2. The Cleveland Electric Illuminating Company, Ten Year Forecast Report to the Ohio Department of Energy-1980, pp. 2-01-13 to 2-01-42.

3. The Duquesne Light Company, Ten Year Forecast Report to the Ohio Department of Energy-1980, pp. 16 to 52.

4. The Ohio Edison System, Ten Year Forecast Report to the Ohio Department of Energy-1980, pp. 1-28 to 1-96.

5. The Toledo Edison Company, Ten Year Forecast Report to the Ohio Department of Energy-1980, pp. 14 to 66.

6. L. Firestone, A. H. Monteith, and W. D. Masters, "The CAPCO Group Probability Technique for Timing Capacity Additions & Allocations of Capacity Responsibility," IEEE Trans. Power Apparatus and Systems, Vol. PAS-88, August 1969, pp. 474-1180.

TABLE 1.1-1

SALES TO ULTIMATE CUSTOMERS FOR 1979

	% of Total Sales to Ultimate Customers
Cleveland Electric Illuminating Company (CEI)	30.1
Duquesne Light Company (DL)	22.6
Ohio Edison and Pennsylvania Power Company (OE)	35.4
Toledo Edison Company (TE)	11.9
Total CAPCO Pool	100.0

TABLE 1.1-2

DISTRIBUTION OF ELECTRIC ENERGY SALES TO ULTIMATE CUSTOMERS BY CLASS OF SERVICE FOR 1979

	CEI[(a)]	DL[(b)]	OE[(c)]	TE[(d)]	CAPCO[(e)]	U.S.[(f)]
Residential	24.0	22.2	32.2	27.0	26.5	34.5
Commercial and Industrial						
Commercial (or Small)	22.3	28.5	23.1	17.6	23.0	23.3
Industrial (or Large)	51.1	48.1	43.9	49.8	48.5	38.5
Street and Highway Lighting	0.8	0.8	0.8	0.8	0.8	0.8
Other	1.8	0.4	0	4.8	1.2	2.9
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

(a) Cleveland Electric Illuminating Company.
(b) Duquesne Light Company.
(c) Total Ohio Edison Company and Pennsylvania Power Company.
(d) Toledo Edison Company.
(e) Percentages computed from totals by classes for the CAPCO Companies.
(f) Includes sales of the total electric utility industry (Reference 2).

TABLE 1.1-3

ANNUAL PEAK ELECTRICAL DEMAND FOR 1963 TO 1990[a]
(Megawatts)

Historical Data 1963-1979
Forecast 1980-1990

Year	CEI	DL	OE	TE	CAPCO[b]
1963	1,609	1,306	2,058	568	5,497
1964	1,717	1,379	2,202	593	5,838
1965	1,883	1,443	2,305	653	6,153
1966	1,947	1,514	2,531	716	6,683
1967	2,086	1,563	2,612	763	6,876
1968	2,266	1,691	2,793	860	7,530
1969	2,411	1,781	3,002	897	7,876
1970	2,517	1,863	3,079	939	8,293
1971	2,750	2,015	3,328	1,054	9,139
1972	2,822	2,075	3,554	1,096	9,534
1973	3,119	2,296	3,796	1,246	10,432
1974	2,934	2,158	3,648	1,249	10,014
1975	2,937	2,230	3,623	1,256	9,906
1976	3,065	2,260	3,757	1,340	10,345
1977	3,350	2,371	4,088	1,393	11,164
1978	3,249	2,374	3,987	1,386	10,897
1979	3,097	2,296	4,020	1,395	10,435
1980	3,450	2,395	4,135	1,352	11,327
1981	3,600	2,485	4,300	1,497	11,877
1982	3,750	2,525	4,465	1,599	12,334
1983	3,850	2,610	4,650	1,663	12,768
1984	4,000	2,705	4,815	1,720	13,235
1985	4,100	2,780	4,985	1,783	13,643
1986	4,250	2,845	5,155	1,843	14,088
1987	4,350	2,940	5,315	1,905	14,505
1988	4,500	3,020	5,480	1,971	14,966
1989	4,600	3,085	5,640	2,037	15,357
1990	4,750	3,170	5,810	2,103	15,828

[a] Demand figures exclude interruptible loads; this is the basis of loads in generation planning.

[b] The CAPCO peak may not equal the sum of the individual company peaks because they may not all occur at the same hour.

TABLE 1.1-4

NET ENERGY SUPPLIED TO SERVICE AREA
FOR 1963 TO 1990[a]
(1000 Megawatt Hours)

Historical Data 1963-1979
Forecast 1980-1990

Year	CEI	DL	OE	TE	CAPCO[b]
1963	9,376	7,603	11,922	3,287	32,188
1964	10,000	8,411	12,952	3,479	34,842
1965	10,946	8,704	13,922	3,763	37,335
1966	11,858	9,263	14,803	4,203	40,127
1967	12,071	9,264	15,293	4,444	41,072
1968	13,296	10,007	16,687	4,955	44,945
1969	14,309	10,802	17,882	5,408	48,401
1970	14,799	11,041	18,515	5,515	49,870
1971	15,115	11,372	19,522	5,982	51,991
1972	16,102	12,281	21,180	6,585	56,148
1973	18,176	13,315	22,101	7,028	60,620
1974	17,818	13,365	21,942	6,967	60,092
1975	17,271	12,929	21,217	7,105	58,522
1976	18,331	13,228	22,524	7,805	61,888
1977	19,098	13,673	23,539	8,077	64,387
1978	19,255	13,341	23,469	8,144	64,208
1979	19,645	14,010	24,215	8,157	66,027
1980	19,643	14,300	25,529	8,352	67,823
1981	20,069	14,750	26,368	8,966	70,153
1982	21,134	15,070	27,262	9,346	72,811
1983	21,688	15,550	28,182	9,793	75,214
1984	22,277	16,130	29,102	10,189	77,698
1985	22,863	16,570	30,024	10,575	80,032
1986	23,492	17,010	30,960	10,882	82,343
1987	24,111	17,530	31,863	11,220	84,724
1988	24,775	18,030	32,811	11,654	87,269
1989	24,431	18,490	33,774	12,142	89,837
1990	26,106	18,970	34,744	12,641	92,461

[a] Includes interruptible load.
[b] Combined CAPCO figures may differ due to rounding.

TABLE 1.1-5

LOAD FACTORS FOR 1963 TO 1979[a]

Year	Peak Day Load Factor (%)					Annual Load Factor (%)				
	CEI	DL	OE	TE	CAPCO	CEI	DL	OE	TE	CAPCO
1963	72.6	83.6	81.8	82.3	82.1	62.7	66.5	66.1	66.1	66.1
1964	74.2	79.5	80.9	79.0	80.9	64.7	69.4	67.0	66.8	67.7
1965	78.7	81.1	80.5	78.9	79.7	66.3	68.9	69.0	65.8	68.8
1966	77.9	79.3	82.2	81.0	82.4	68.2	69.8	66.8	67.0	68.2
1967	83.0	81.9	81.4	81.0	81.0	64.5	67.7	66.8	66.5	67.8
1968	81.7	83.5	80.4	84.3	83.4	66.2	67.4	68.0	65.6	67.9
1969	82.9	84.6	82.4	82.9	83.7	66.5	69.2	68.0	68.8	69.7
1970	82.3	82.9	80.4	84.8	82.4	66.3	67.7	68.6	67.1	68.4
1971	80.9	81.7	81.8	83.7	81.8	61.8	64.4	67.0	64.8	64.6
1972	83.5	83.3	84.2	83.4	83.9	65.0	67.4	67.8	68.4	67.0
1973	81.3	86.5	84.7	82.7	82.7	64.0	66.2	66.5	64.4	65.5
1974	81.4	82.0	81.9	83.9	82.8	66.0	70.7	68.7	63.7	67.7
1975	79.8	79.7	84.3	82.1	80.8	65.2	66.2	66.8	64.6	67.0
1976	83.9	84.1	84.0	86.4	83.7	66.5	66.6	68.2	68.4	67.6
1977	82.3	81.7	84.5	85.8	85.5	64.5	65.8	65.7	66.2	65.8
1978	83.3	81.5	82.9	82.7	83.4	66.1	64.2	66.9	67.1	66.7
1979	83.0	81.9	87.1	88.3	87.9	69.4	69.6	68.5	66.8	71.1

[a] Includes interruptible load.

TABLE 1.1-6

ANNUAL CAPCO LOAD DURATION DATA FOR 1972 TO 1979 (INCLUDING INTERRUPTIBLE)
(Load Duration in Hours)

Percent of Peak Load	1972	1973	1974	1975	1976	1977	1978	1979
100	1	1	1	1	1	1	1	1
99.5	1	2	1	2	1	2	2	1
99	2	4	2	3	2	2	2	4
98.5	3	8	3	6	3	5	4	8
98	5	12	4	8	5	6	8	14
97.5	7	16	4	13	6	8	10	27
97	9	20	7	18	7	13	14	40
96.5	13	25	9	25	14	21	17	54
96	14	29	11	30	17	25	20	72
95.5	19	37	14	37	23	30	21	93
95	23	44	18	45	25	37	30	126
94.5	30	49	27	53	32	41	35	159
94	35	56	43	61	41	46	45	203
93.5	43	65	47	67	49	51	56	229
93	53	71	57	77	61	56	65	264
92.5	67	74	67	83	79	67	78	315
92	89	80	76	94	93	71	93	381
91.5	103	93	92	111	112	79	108	429
91	123	98	107	135	146	89	122	491
90.5	150	105	123	165	179	105	143	558
90	179	111	135	189	207	115	159	623
89	248	130	183	261	290	145	212	791
88	334	154	259	357	404	188	295	953
87	439	197	351	484	549	250	384	1,115
86	581	244	479	655	717	333	496	1,316
85	735	309	677	891	907	420	642	1,486
84	949	393	907	1,107	1,101	521	809	1,708
83	1,189	515	1,209	1,362	1,332	641	962	1,950
82	1,493	684	1,585	1,631	1,598	809	1,099	2,228
81	1,848	893	1,975	1,924	1,920	1,012	1,285	2,521
80	2,183	1,181	2,277	2,235	2,255	1,233	1,475	2,802

TABLE 1.1-6 (Continued)

ANNUAL CAPCO LOAD DURATION DATA FOR 1972 TO 1979 (INCLUDING INTERRUPTIBLE)
(Load Duration in Hours)

Percent of Peak Load	1972	1973	1974	1975	1976	1977	1978	1979
79	2,488	1,544	2,575	2,518	2,527	1,509	1,695	3,065
78	2,766	1,896	2,825	2,775	2,771	1,792	1,941	3,265
77	2,980	2,340	3,050	2,967	3,018	2,125	2,191	3,464
76	3,178	2,697	3,260	3,153	3,207	2,465	2,456	3,672
75	3,362	2,982	3,444	3,307	3,365	2,747	2,746	3,824
74	3,531	3,218	3,608	3,453	3,526	2,997	3,028	3,965
73	3,651	3,391	3,725	3,560	3,652	3,242	3,265	4,120
72	3,773	3,558	3,842	3,694	3,800	3,439	3,480	4,267
71	3,904	3,704	3,947	3,817	3,941	3,619	3,681	4,422
70	4,010	3,842	4,028	3,938	4,044	3,789	3,864	4,565
69	4,108	3,984	4,138	4,042	4,167	3,920	4,024	4,708
68	4,202	4,113	4,281	4,136	4,280	4,072	4,192	4,873
67	4,311	4,243	4,399	4,249	4,390	4,226	4,343	5,035
66	4,424	4,374	4,562	4,379	4,534	4,355	4,470	5,215
65	4,553	4,506	4,765	4,505	4,695	4,497	4,638	5,405
64	4,713	4,682	4,929	4,670	4,846	4,634	4,783	5,604
63	4,871	4,858	5,113	4,828	5,003	4,794	4,957	5,834
62	5,034	5,046	5,295	5,010	5,188	4,981	5,185	6,057
61	5,209	5,210	5,489	5,211	5,407	5,188	5,430	6,272
60	5,406	5,383	5,718	5,411	5,626	5,413	5,655	6,518
59	5,591	5,569	5,984	5,641	5,870	5,649	5,897	6,755
58	5,788	5,779	6,210	5,887	6,122	5,882	6,148	6,975
57	6,045	6,077	6,497	6,166	6,398	6,118	6,384	7,203
56	6,265	6,283	6,791	6,407	6,634	6,388	6,647	7,427
55	6,526	6,547	7,062	6,649	6,906	6,649	6,887	7,663
54	6,776	6,831	7,367	6,929	7,162	6,886	7,154	7,861
53	7,029	7,153	7,588	7,191	7,410	7,155	7,421	8,038
52	7,302	7,417	7,807	7,431	7,649	7,418	7,673	8,197
51	7,551	7,690	7,970	7,646	7,816	7,676	7,883	8,300
50	7,757	7,869	8,096	7,832	7,981	7,877	8,037	8,388

TABLE 1.1-6 (Continued)

ANNUAL CAPCO LOAD DURATION DATA FOR 1972 TO 1979 (INCLUDING INTERRUPTIBLE)
(Load Duration in Hours)

Percent of Peak Load	1972	1973	1974	1975	1976	1977	1978	1979
49	7,938	8,062	8,221	8,015	8,118	8,047	8,173	8,468
48	8,081	8,194	8,322	8,140	8,268	8,191	8,313	8,511
47	8,226	8,311	8,431	8,281	8,372	8,299	8,396	8,563
46	8,327	8,413	8,498	8,378	8,451	8,405	8,473	8,610
45	8,413	8,498	8,560	8,459	8,517	8,486	8,535	8,664
44	8,477	8,565	8,615	8,528	8,568	8,529	8,592	8,711
43	8,548	8,621	8,672	8,580	8,634	8,575	8,652	8,742
42	8,606	8,687	8,708	8,629	8,686	8,620	8,697	8,754
41	8,659	8,724	8,746	8,685	8,729	8,673	8,737	8,759
40	8,708	8,745	8,754	8,721	8,761	8,723	8,753	8,760
39	8,748	8,756	8,760	8,742	8,777	8,753	8,760	8,760
38	8,770	8,759	8,760	8,754	8,784	8,759	8,760	8,760
37	8,780	8,760	8,760	8,759	8,784	8,759	8,760	8,760
36	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
35	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
34	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
33	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
32	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
31	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
30	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
Date of Peak	July 21 (Fri.)	Sept 4 (Tues.)	July 9 (Tues.)	June 23 (Mon.)	June 15 (Tues.)	July 20 (Wed.)	July 21 (Fri.)	Jan. 3 (Wed.)
Hour of Peak	13	14	13	13	13	13	13	19
MWe	9,534	10,565	10,160	10,021	10,470	11,210	11,035	10,672

TABLE 1.1-7

PROJECTED GENERATING CAPACITY RESOURCES AT TIME OF ANNUAL COMBINED ANNUAL PEAK BY YEAR (1984 TO 1988)

a. 1984

Net Demonstrated Capacity (MWe)	Total	Coal	Nuclear	Oil Conversion	Peaking Mid-Range[c]	Pump Storage
CEI	3,488	2,412	--	637	74	365
DL	1,994	1,688	--	--	306	--
OE	3,662	3,298	--	--	364	--
TE	1,014	892	--	45	77	--
CAPCO Units[a]	6,547	3,590	2,957	--	--	--
Total Net Demonstrated Capability (MWe)	16,705	11,880	2,957	682	821	365
Seasonal Derating (MWe)	339					
Net Seasonal Capability at Peak (MWe)	16,366					
Purchase at Peak (MWe)[b]	57					
Total Capacity Resources at Peak (MWe)	16,423					

[a] PNPP Unit 1 scheduled to go in service May 1, 1984, prior to the annual peak.
[b] Includes entitlement of OVEC owners.
[c] Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.1-7 (Continued)

PROJECTED GENERATING CAPACITY RESOURCES AT TIME OF ANNUAL COMBINED ANNUAL PEAK BY YEAR (1984 TO 1988)

b. 1985

Net Demonstrated Capacity (MWe)	Total	Coal	Nuclear	Oil Conversion	Peaking Mid-Range[c]	Pump Storage
CEI	3,488	2,412	--	637	74	365
DL	1,994	1,688	--	--	306	--
OE	3,662	3,298	--	--	364	--
TE	1,014	892	--	45	77	--
CAPCO Units[a]	6,547	3,590	2,957	--	--	--
Total Net Demonstrated Capability (MWe)	16,705	11,880	2,957	682	821	365
Seasonal Derating (MWe)	339					
Net Seasonal Capability at Peak (MWe)	16,366					
Purchase at Peak (MWe)[b]	57					
Total Capacity Resources at Peak (MWe)	16,423					

(a) Includes PNPP Unit 1.

(b) Includes entitlement of OVEC owners.

(c) Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.1-7 (Continued)

PROJECTED GENERATING CAPACITY RESOURCES AT TIME OF ANNUAL COMBINED ANNUAL PEAK BY YEAR (1984 TO 1988)

c. 1986

Net Demonstrated Capacity (MWe)	Total	Coal	Nuclear	Oil Conversion	Peaking Mid-Range[c]	Pump Storage
CEI	3,488	2,412	--	637	74	365
DL	1,994	1,688	--	--	306	--
OE	3,662	3,298	--	--	364	--
TE	1,014	892	--	45	77	--
CAPCO Units[a]	7,380	3,590	3,790	--	--	--
Total Net Demonstrated Capability (MWe)	17,538	11,880	3,790	682	821	365
Seasonal Derating (MWe)	352					
Net Seasonal Capability at Peak (MWe)	17,186					
Purchase at Peak (MWe)[b]	57					
Total Capacity Resources at Peak (MWe)	17,243					

[a] Includes PNPP Unit 1.
[b] Includes entitlement of OVEC owners.
[c] Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.1-7 (Continued)

PROJECTED GENERATING CAPACITY RESOURCES AT TIME OF ANNUAL COMBINED ANNUAL PEAK BY YEAR (1984 TO 1988)

d. 1987

Net Demonstrated Capacity (MWe)	Total	Coal	Nuclear	Oil Conversion	Peaking Mid-Range[c]	Pump Storage
CEI	3,488	2,412	--	637	74	365
DL	1,994	1,688	--	--	306	--
OE	3,662	3,298	--	--	364	--
TE	1,014	892	--	45	77	--
CAPCO Units[a]	7,380	3,590	3,790	--	--	--
Total Net Demonstrated Capability (MWe)	17,538	11,880	3,790	682	821	365
Seasonal Derating (MWe)	352					
Net Seasonal Capability at Peak (MWe)	17,186					
Purchase at Peak (MWe)[b]	57					
Total Capacity Resources at Peak (MWe)	17,243					

[a] Includes PNPP Unit 1.
[b] Includes entitlement of OVEC owners.
[c] Combustion turbines, diesels, and combined-cycle plants.

1.1-25

TABLE 1.1-7 (Continued)

PROJECTED GENERATING CAPACITY RESOURCES AT TIME OF ANNUAL COMBINED ANNUAL PEAK BY YEAR (1984 TO 1988)

e. 1988

Net Demonstrated Capacity (MWe)	Total	Coal	Nuclear	Oil Conversion	Peaking Mid-Range[c]	Pump Storage
CEI	3,488	2,412	--	637	74	365
DL	1,994	1,688	--	--	306	--
OE	3,662	3,298	--	--	364	--
TE	1,014	892	--	45	77	--
CAPCO Units[a]	8,614	3,590	5,024	--	--	--
Total Net Demonstrated Capability (MWe)	18,772	11,880	5,024	682	821	365
Seasonal Derating (MWe)	377					
Net Seasonal Capability at Peak (MWe)	18,395					
Purchase at Peak (MWe)[b]	57					
Total Capacity Resources at Peak (MWe)	18,452					

[a] Includes PNPP Units 1 and 2 (in service May 1, 1984 and May 1, 1988, respectively).
[b] Includes entitlement of OVEC owners.
[c] Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.1-8

JOINTLY COMMITTED CAPCO GENERATING CAPACITY ADDITIONS

Element of Capacity	Type	Net Demonstrated Capability - MWe (Actual or Expected)	Date of Commercial Operation	Ownership - % CEI	DL	OE	TE
Sammis 7	Coal	600	9/71[a]	0	31.2	68.8	0
Eastlake 5	Coal	650	9/72[a]	68.8	31.2	0	0
Various	Comb. Turbines [b]	70	1973[a]	100.0	0	0	0
Various	Comb. Turbines [b]	75	1972[a]	0	100.0	0	0
Various	Comb. Turbines and Diesels [b]	158	1972-73[a]	0	0	100.0	0
Brunot Island	Combined Cycle [b]	333	1973-74[a]	0	100.0	0	0
West Lorain	Combined Cycle [b]	200	1973-75[a]	0	0	100.0	0
Beaver Valley 1	Nuclear	862[c]	4/77[a]	0	47.5	52.5	0
Davis-Besse 1	Nuclear	890[d]	12/77[a]	51.38	0	0	48.62
B. Mansfield 1	Coal	780	6/76[a]	6.5	29.3	64.2	0
B. Mansfield 2	Coal	780	10/77[a]	28.6	8.0	46.1	17.3
B. Mansfield 3	Coal	780	10/80	24.47	13.74	41.88	19.91
PNPP 1	Nuclear	1205	5/84	31.11	13.74	35.24	19.91
Beaver Valley 2	Nuclear	862[e]	5/86	24.47	13.74	41.88	19.91
PNPP 2	Nuclear	1205	5/88	31.11	13.74	35.24	19.91
Davis-Besse 2	Nuclear	906	Terminated	24.47	13.74	41.88	19.91
Erie 1	Nuclear	1260	Terminated	24.47	13.74	41.88	19.91
Davis-Besse 3	Nuclear	906	Terminated	24.47	13.74	41.88	19.91
Erie 2	Nuclear	1260	Terminated	24.47	13.74	41.88	19.91

[a] In service as of 12/31/78.

[b] Combustion turbines, diesels, and combined-cycle plants were committed by joint decision of the CAPCO members, but ownership of the individual units is not shared, and is included as individual Company capacity in other tables in this report.

[c] Beaver Valley 1 initial rating at 4/77 service date was 200 MWe; expected to be increased in steps to 862 MWe by 9/81.

[d] Davis-Besse 1 initial rating at 12/77 service was 362 MWe; increased in steps.

[e] Beaver Valley 2 initial rating at 5/86 service date expected to be 833 MWe; increased to 862 MWe in 3/88.

TABLE 1.1-9

INDIVIDUAL CAPCO COMPANY CAPACITY ADDED OR UP-RATED (1973 to 1988) INTO CAPACITY MODELS FOR GENERATION PLANNING

Company	Date	Plant and Unit No.	Type	MWe Increased
TE	12/74[(a)]	Front Street	Oil	20
OE	5/75[(b)]	East Palestine 3	Coal	5
OE	5/75[(b)]	East Palestine 5	Coal	7
DL	2/77[(c)]	Shippingport	Nuclear	60
TE	4/77[(b)]	Bryan 1	Comb. Turbine	15
TE	4/77[(b)]	Bryan 6	Comb. Turbine	5
DL	3/80	Elrama 1	Coal	1
DL	3/80	Phillips C.H.	Coal	11
DL	3/80	Shippingport	Nuclear	2
CEI	1/81	Avon Lake 6	Coal	25
CEI	1/81	Eastlake 2	Coal	8
CEI	1/81	Eastlake 3	Coal	12
CEI	1/81	Eastlake 4	Coal	4
DL	1/82	Cheswick	Coal	10

(a) Industrial Power Plant acquired December 31, 1974. This plant was the source of 4 MWe "industrial" shown in the PNPP ER/CP.

(b) Municipal Power Plants acquired.

(c) Shippingport was temporarily decommissioned in 1974 to install a new reactor core and returned to service in 1977 at 60-MWe rating.

TABLE 1.1-10

INDIVIDUAL CAPCO COMPANY CAPACITY DELETED OR RERATED (1973 to 1988) FROM CAPACITY MODELS FOR GENERATION PLANNING

Company	Date	Plant and Unit No.	MWe Reduced
OE	11/73	Hiram[b]	[illegible]
TE	12/74	Industrial[a]	4
DL	1/75	Shippingport[c]	90
CEI	1/80	Ashtabula B	45
CEI	1/80	Avon Lake B	16
CEI	1/80	Avon Lake 6	25
CEI	1/80	Eastlake 2	8
CEI	1/80	Eastlake 3	12
CEI	1/80	Eastlake 4	4
CEI	1/80	Lake Shore 14	4
TE	1/80	Front Street 1	10
TE	1/80	Front Street 2	10
OE	2/80	East Palestine 3	5
OE	3/80	East Palestine 4	7
OE	3/80	Mad River 1 Boiler	11
OE	3/80	Mad River 2 Boiler	11
OE	3/80	Norwalk 4 Boiler	9
OE	3/80	Norwalk 5	16
OE	3/80	Norwalk D	1
DL	3/80	Cheswick	15
DL	3/80	Elrama 2	5
DL	3/80	Elrama 3	2
DL	3/80	Elrama 4	1
DL	3/80	Phillips 4 T-G	63
DL	3/80	Brunot Island 1A	3
DL	3/80	Brunot Island 1B	3
DL	3/80	Brunot Island 1C	3
DL	3/80	Brunot Island 2A	31
DL	3/80	Brunot Island 2B	31
DL	3/80	Brunot Island 3	31
OE	3/80	Burger 5 Boiler	1
OE	3/80	Burger 6 Boiler	2
OE	3/80	Burger 4T-G	5
OE	3/80	Burger 5T-G	5
OE	3/80	Edgewater 11 Boiler	2
OE	3/80	Edgewater 12 Boiler	2
OE	3/80	New Castle 1	3

[a] Industrial Power Plant acquired December 31, 1974. This plant was the source of 4 MWe "industrial" shown in the PNPP ER/CP.

[b] Municipal Power Plants acquired.

[c] Shippingport was temporarily decommissioned in 1974 to install a new reactor core and returned to service in 1977 at 60-MWe rating.

TABLE 1.1-10 (Continued)

INDIVIDUAL CAPCO COMPANY CAPACITY DELETED OR RERATED (1973 to 1988) FROM CAPACITY MODELS FOR GENERATION PLANNING

Company	Date	Plant and Unit No.	MWe Reduced
OE	3/80	New Castle 2	2
OE	3/80	New Castle 3	1
OE	3/80	New Castle 4	2
OE	3/80	Sammis 1	8
OE	3/80	Sammis 2	8
OE	3/80	Sammis 3	13
OE	3/80	Sammis 4	13
OE	3/80	Sammis 5	30
OE	3/80	Sammis 6	50
OE	3/80	Niles A-CT	5
OE	3/80	Mad River A-CT	5
OE	3/80	Mad River B-CT	5
OE	3/80	Edgewater A-CT	4
OE	3/80	Edgewater B-CT	4
OE	3/80	West Lorain 1	15
OE	3/80	West Lorain 2	20
TE	3/80	Acme 2	1
TE	3/80	Acme 6	7
TE	3/80	Acme 5 & T	5
TE	3/80	Acme Low Pressure	3
TE	3/80	Bay Shore 4	5
TE	3/80	Richland	3
TE	3/80	Bay Shore CT	2
TE	3/80	Stryker CT	2
TE	4/80	Bryan 1	15
TE	4/80	Bryan 6	5
DL	6/82	Shippingport	62

(a) Industrial Power Plant acquired December 31, 1974. This plant was the source of 4 MWe "industrial" shown in the PNPP ER/CP.

(b) Municipal Power Plants acquired.

(c) Shippingport was temporarily decommissioned in 1974 to install a new reactor core and returned to service in 1977 at 60-MWe rating.

TABLE 1.1-11

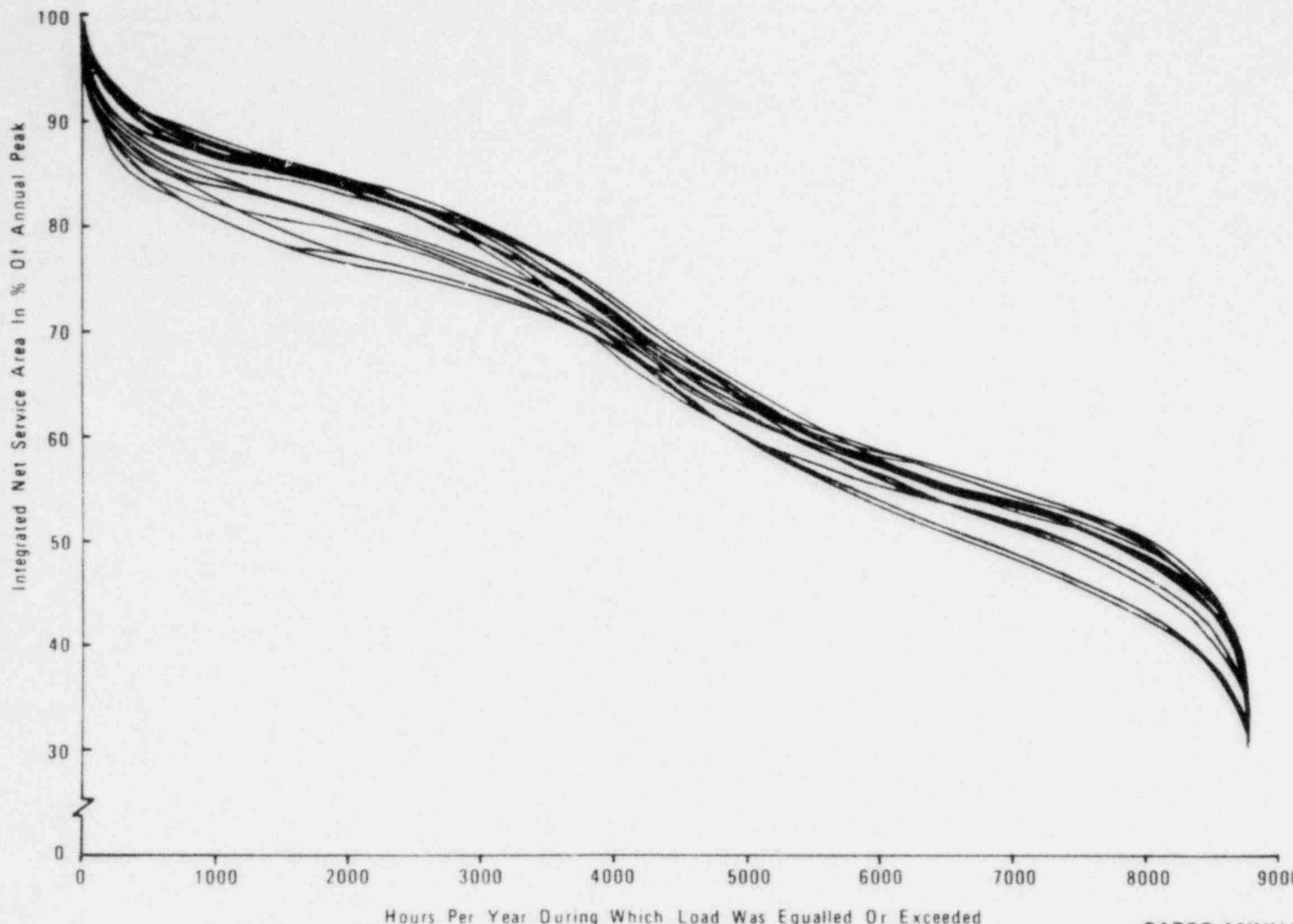
PROJECTION OF CAPCO DEPENDENCE ON SUPPLEMENTAL CAPACITY RESOURCES WITH PNPP ON SCHEDULE

Years	Dependence on Supplemental Capacity Resources (Days/Year)	Additional Firm Capacity Required to Meet CAPCO Criterion (MWe)
1984	12.7	1150
1985	22.8	1505
1986	14.3	1280
1987	21.7	1545
1988	17.3	1500
1989	21.4	1660
1990	30.3	1925
1991	58.0	2450
1992	83.4	2805

TABLE 1.1-12

EXPECTED DEPENDENCE ON SUPPLEMENTAL CAPACITY RESOURCES
IN 1984 WITH PNPP ON SCHEDULE

Capacity Margins (MWe)	Calculated Expected Frequency (Weekdays/Year)	Calculated Expected Frequency (% of Weekdays)
All Positive Capacity Margins	247.306	95.1177
Negative Capacity Margins:		
-1 to -200	3.998	1.5377
-201 to -400	3.036	1.1677
-401 to -600	1.936	0.7446
-601 to -800	1.407	0.5412
-801 to -1,000	0.847	0.3258
-1,001 to -1,200	0.596	0.2292
-1,201 to -1,400	0.339	0.1304
-1,401 to -1,600	0.231	0.0888
-1,601 to -1,800	0.124	0.0476
-1,801 to -2,000	0.082	0.0315
-2,001 to -2,200	0.042	0.0162
-2,201 to -2,400	0.027	0.0104
-2,401 to -2,600	0.013	0.0050
-2,601 to -2,800	0.008	0.0031
-2,801 to -3,000	0.004	0.0015
-3,001 to -3,200	0.002	0.0008
-3,201 to -3,400	0.001	0.0004
-3,401 to -3,600	0.001	0.0004
-3,601 to -3,800	0.000	0.0000
-3,801 to -4,000	0.000	0.0000
Total	260.000	100.0000
Total of Negative Capacity Margin Peak Periods	12.694	4.8823



CAPCO ANNUAL LOAD
DURATION CURVES
(1962–1978)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 1.1–1

1.2 OTHER OBJECTIVES

The generation of electrical energy at low cost remains the primary and only objective to be met by the PNPP.

1.3 CONSEQUENCES OF DELAY

1.3.1 SCOPE AND GENERAL CONSIDERATIONS

The effects of a 1-, 2-, and 3-year delay of PNPP Unit 1 were studied. Projected commercial service dates for the PNPP units in the delay cases were:

Unit	Base Case (No Delay)	1-Year Delay	2-Year Delay	3-Year Delay
1	5/1/84	5/1/85	5/1/86	5/1/87
2	5/1/88	5/1/88	5/1/88	5/1/88

There would be no other changes in the availability of new generating capacity because of the delay of the PNPP units. It would not be possible to advance the construction of any other units into the 1984 to 1988 period, and it seems extremely unlikely that a long-term oil supply could be ensured for capacity with a short lead time, such as combustion turbines.

Two aspects of the consequences of delay were studied:

a. Reliability of power supply.
b. Cost to customers expressed as differences in revenue requirements compared to the base case with no delay.

1.3.2 EFFECT OF DELAY ON RELIABILITY OF POWER SUPPLY

1.3.2.1 Dependence on Supplemental Capacity Resources (DSCR)

The effect of a delay in the availability of the PNPP was measured by means of the DDCM Program. Table 1.3-1 is a summary tabulation presenting a comparison of the results of running the DDCM Program with the only variation of the input data being the timing of the PNPP units. (The DSCR information in the columns labeled "no delay" is the same as that in Table 1.1-12 for 1984.) Starting with 1989, the projected DSCR and megawatt deficiency figures should be essentially the same for each case, except for minor variations arising from the current plan to refuel the PNPP reactors on an 18-month cycle.

Tables 1.3-2 and 1.3-3 illustrate the effect of the delay of the PNPP on the distribution of daily capacity margins in the period 1984 to 1988. After 1988, both units would be in service in each of the delay cases studied.

1.3.2.2 Capacity Mix and Percent Reserve

The projected mix of generating capacity by types for the years 1984 to 1991 is presented in Table 1.3-6 for the PNPP on schedule and for PNPP Unit 1 delayed 1, 2, and 3 years. Coal-fired plants will be the predominant type of capacity in CAPCO in the period considered. Delay of the PNPP will delay the shift of the mix from 11.26 percent nuclear in 1984 (with PNPP delayed) to 26.68 percent in 1988 with the PNPP and Beaver Valley Unit 2 in service. In all of the three cases, Beaver Valley Unit 2 is assumed to be in service as of May 1, 1986.

In Table 1.3-6 the capacity mix is stated in terms of net demonstrated capability (NDC), which is the winter rating of generating equipment; the bottom-line capability has been adjusted for seasonal derating in the month of the annual peak. The annual peak is forecasted to occur in the summer. Purchase is the projected entitlement of Ohio Valley Electric Corporation (OVEC) surplus capacity to OVEC sponsors who are mem' [illegible] of CAPCO.

System demand and capability resource comparisons are shown in Table 1.3-4. This table shows the historic system peak demand and historic capability resources at the time of the annual peak for the years 1968 to 1979 and projected values for 1980 to 1989 based on current scheduling of future generating capacity. Reserve margins are the differences between capability resources and peak load expressed as a percentage of peak load. The impact of PNPP delay is shown for delaying Unit 1 for 1, 2, and 3 years.

Tables 1.3-5 and 1.3-6 expand the information in Table 1.3-4 for the years 1984 to 1988, during which the reserve situation would be affected by a 1-, 2-, and 3-year delay, respectively, of PNPP Unit 1. The summer and winter reserves are compared in these tables.

1.3.2.3 Effect of PNPP Delay on Reserves in the ECAR Region

All of the CAPCO utilities are members of the regional council named East Central Area Reliability (ECAR). Figure 1.3-1 illustrates the geographical coverage of this council. ECAR, an organization whose primary objective is reliability of bulk power supply, consolidates regional information, prepares various reports, and makes analyses designed to enhance coordination of bulk power supply. Part II of the 1970 National Power Survey, published by the Federal Power Commission, discusses the coordination of bulk power supply and includes a description of ECAR, along with its role in regional coordination.[1]

Since its inception, ECAR has functioned to compile and appraise, on a regional basis, the bulk power system expansion plans of its bulk power members. These members are the entities responsible for the selection, construction, and operation of specific facilities. While these reports provide a broad overview of the area and demonstrate how specific facilities fit into the total, they cannot and should not be used to indicate whether or not a specific facility is required. ECAR has not established a minimum reserve criterion for the members or for the regional council overall. It has been concluded that certain conditions relating to the timely installation of new generating facilities and the operation of existing ones are presently beyond the control of the parties responsible, thereby making compliance with an installed generating reserve criterion moot at this time. This has been borne out by events of recent years, when the financial plight of the electric utility industry introduced a new compelling restraint that caused many utilities to delay or cancel committed generating-capacity additions. However, future plans for generating reserves are appraised annually, with periodic updates between submittal of the annual report to advise of significant changes in load and capacity projections. A probability-based technique is used to relate the magnitude and characteristics of generating capacity and load and to present the results of the analysis in terms of magnitude, frequency, and aggregate megawatt-days per year of dependence on supplemental capacity resources (DSCR).

There are two reports prepared annually by ECAR that are especially relevant to this discussion. One is the Report to the U.S. Department of Energy,[2] submitted as of April 1 of each year (this formerly was the response to Federal Power Commission Docket R-362, Order 383). The second is the Appraisal of ECAR-Wide Installed Reserves, which is prepared annually by the ECAR Generation Reserve Panel; the most recent edition of this report covers the period 1979 to 1988.[3]

Tables 1.3-7 and 1.3-8 are derived from the exhibit titled Estimated Resources, Demand and Margin for the 1 to 10 Year Period - ECAR Region Summary, page 3-A-1 of the Department of Energy report.[2] Tables were also prepared for a 1-, 2-, or 3-year delay of PNPP Unit 1. Reserve in percent of peak load has been calculated and is shown as the last line in each of the tables.

The Appraisal of ECAR-Wide Installed Reserves - 1979-1988[3] reached several conclusions with regard to the ECAR load/capacity situation, from which portions relevant to this report are quoted below. It should be borne in mind that the ECAR analysis reflected the service dates of PNPP as presently scheduled:

> The calculated "Dependence on Supplemental Capacity Resources" (DSCR) in this appraisal is based on an average generating-unit unavailability rate of 30 percent, which is better than the ECAR unavailability rate of 32.0 percent experienced in 1978 and essentially the same as the 30.2 percent unavailability rate experienced during the 24-month period ending November 30, 1978. The recent 24-month unavailability rate of 30.2 percent is 1.1 percentage points greater than the 29.1 percent value -- applicable to the 24-month period ending May 31, 1978 -- reported in the 1978 appraisal and 2.7 percentage points greater than the 27.5 percent experienced in the 24-month period ending November 30, 1977. This reflects a worsening trend in availability performance, and it appears that it will be some time before programs to improve generating availability performance within ECAR will produce substantive results.
>
> The uncertainties associated with the load forecasts, coupled with the increasing probabilities of generating unit delays, increase the uncertainty associated with the reported reserves. Increasing difficulties regarding site acquisition and the likelihood of additional site-related and regulatory delays--beyond that already reflected in the forecasted capability additions--compound the concerns relative to planned generation resources. In this regard, it is important to note that about one-third of the approximately 40,000 MW of the capacity additions projected for the reporting period is planned but not yet under construction. Based on an unavailability rate of 30 percent and a one-year delay of the units that are planned but not now under construction, the ECAR DSCR value will exceed 50 weekdays per year after 1985. With a two-year delay of these same units, and a 30-percent unavailability rate, ECAR will experience a DSCR performance level exceeding 100 days per year from 1987 on. An indefinite extension of the current nuclear licensing moratorium would have an even greater impact on overall reliability. The criticality of the timely additions of generating resources is clearly evident along with the necessity for improved availability.
>
> Based on an assessment of the foregoing conditions as documented in this report, the following has been concluded:
>
> (1) The overall reserve situation projected for the ECAR region throughout the 1979-1988 period will be at a level which is less than desired if generating unit unavailability continues at the current level

and the load and capacity conditions reported in the 1979 ECAR response to DOE/ERA materialize.

(2) Additional capacity of 9,000 MWe or more--i.e., above that already projected--would be required by the early 1980's and thereafter to supply the projected load requirements in a reliable manner. Conversely, the projected ECAR load exceeds that which can be supported in a reliable manner during each year of the period. This analysis shows that the projected ECAR annual peak load will exceed the supportable annual peak load by approximately 8,000 MWe in 1983 and by approximately 10,000 MWe in 1988.

(3) The calculated DSCR levels associated with projected generating capacity reserves are more sensitive to capacity unavailability than to any other factor. In 1983, for example, if the average generating unit unavailability rate continues at the recent rate of 30 percent, a capacity deficiency would be expected to occur on 39 of the 252 weekdays during the year. Should the average unavailability rate worsen to 35 percent, capacity deficiencies could be expected to occur, on the average, about three out of five weekdays each week during the year. However, should the average unavailability rate improve to 25 percent, a DSCR value of about one day per year could be expected.

(4) The need for timely completion of scheduled generation additions has been demonstrated by an assessment of the effect of delays in generating unit additions. This assessment shows that the reliability performance of ECAR will deteriorate to more than 100 capacity deficient days per year:

    (a) by 1987 if the units which are not yet under construction are delayed two years, and

    (b) by 1982 if the present nuclear licensing moratorium is extended indefinitely.

(5) The extent to which the expected capacity deficiencies--i.e., the Dependence on Supplemental Capacity Resources--can be alleviated by emergency capacity receipts from neighboring reliability regions will depend upon the reserve level and the generation availability in each of the neighboring regions. Such considerations will determine whether or not the neighboring regions have capacity surpluses which are sufficient in terms of both magnitude and availability to offset the expected capacity deficiencies in ECAR. In the event that the available capacity surpluses

are insufficient to satisfy ECAR deficiencies, then extraordinary operating procedures, including firm load curtailment, will be necessary within ECAR. If the reliability situations in the neighboring regions are no better than that projected for ECAR, the likelihood of obtaining the needed assistance from them will be minimal.

1.3.2.4 Conclusions on Effect of Delay on Reliability

With the present schedule, the dependence on supplemental capacity resources (DSCR) exceeds the CAPCO criterion in each of the years 1984 to 1987 (Table 1.1-11). With delays of PNPP Unit 1 for 1, 2, or 3 years (Table 1.3-1), the DSCR climbs to much higher levels, which will necessitate substantial calls on generating capacity in areas outside CAPCO if adequate service to the customer is to be maintained.

Although the predicted percent reserves will be in excess of 20 percent for 1984 to 1988 (Table 1.3-4), it has been found that CAPCO will not meet the CAPCO criterion for DSCR. The reason lies in the full and partial outages of generating units, which have resulted in availability rates well below those needed to support a minimum reserve level of 15 percent--a level that may have been considered adequate in the past. There are extensive programs under way to improve the availability of generating units, but their effects may be blunted by continuing degradation of coal quality, escalating demands for improvements in air quality, imposed limitations on the output of nuclear units, and an extension of outages of nuclear units to obtain regulatory approval of maintenance work and modifications.

It is of interest to examine statistics on one measure of dependence on supplemental resources: the purchase of power to maintain the spinning reserve criterion of 3 percent of daily peak load. Table 1.3-9 shows the number of days in the years 1975 through April 1980 when such purchases were made. The actual percent reserves for 1975 to 1979 from Table 1.3-4 are shown. The information is not fully consistent with the DSCR projections, because spinning reserve is not recognized in the DSCR computations.

The ECAR Appraisal of ECAR-Wide Installed Reserve 1979-1988 (3) projected DSCR for the base case of 30-percent average unavailability as follows:

Year	DSCR (Days per Year)
1983	39
1984	28
1985	17
1986	21
1987	37

Delay of the PNPP will exacerbate the reserve deficiency problem in the ECAR region. The effect of the delay, measured in percent reserve, is shown in Tables 1.3-7 and 1.3-8.

The supplemental resources for the ECAR region would be largely in the generating capacity of other regions. A rough evaluation of the load vs. capacity situation in the adjacent regions relative to that in the ECAR region was developed from information in the 1979 Summary of Projected Peak Load, Generating Capability and Fossil Fuel Requirements published by the National Electric Reliability Council (NERC). (4)

Projections of future peak loads and generating capability were compared for three groupings of NERC regions identified in Figure 1.3-1, which was taken from the NERC report. (4) The three groupings are:

- o ECAR region only
- o Four regions adjacent to ECAR:
  - a) Mid-American Interpool Network (MAIN)
  - b) Southeastern Electric Reliability Council (SERC)

c) Mid-Atlantic Area Council (MAAC)

d) Northeast Power Coordinating Council (NPCC) (United States only)

o Total NERC (contiguous United States)

Tables 1.3-10 and 1.3-11 present the projected peak loads, generating capacity resources, and computed summer and winter reserves, respectively, for ECAR, the four adjacent NERC regions, and for all of the NERC regions in the contiguous United States. It will be noted that the summer percent reserves of the four regions adjacent to ECAR are considerably lower than the reserves of the ECAR region.

It might be inferred that the generating capacity of ECAR and the adjacent regions are of the same general characteristics with regard to the distribution of generating unit sizes in megawatts and to availability. Under these conditions, the lower percent reserves in the regions from which ECAR would draw its supplemental resources would limit the ability of ECAR to make up its capacity deficiencies.

The NERC report[(4)] reveals another rather disturbing projection regarding the four regions adjacent to ECAR. In 1984 and 1988, the percentage of total generating capacity that will be oil fired is expected to be as follows:

Region	Percentage of Total Capacity Expected To Be Oil Fired	
	1984	1988
MAAC	42.5	37.0
MAIN	14.3	13.6
NPCC	57.7	48.0
SERC	19.9	16.3
Total (four regions)	29.4	24.7

By comparison, ECAR is expected to have 8.6 and 7.8 percent of its capacity oil fired in 1984 and 1988, respectively. A recent study by the U.S. General Accounting Office (GAO)[5] developed a scenario in which "oil and gas generation of electricity remains at 1976 levels through 1985, and decrease one-third every five years until phased out in 2000. Legislation mandates the phase-out of natural gas to generate electricity in 1990."

The following conclusions might therefore be drawn for the 1984 to 1988 period:

a. There will be significant amounts of oil-fired capacity in the regions adjacent to ECAR, as compared to the proportion of oil-fired capacity in the ECAR region, for which adequate fuel supplies may or may not be available.

   Gas-fired capacity will make up less than 1.0 percent of the total generating capacity in ECAR and less than 0.2 percent of the capacity of the four adjacent regions.

b. The average percent reserves, assuming that the oil-fired capacity will be operable, are projected to be significantly lower in the regions surrounding ECAR than in the ECAR region.

c. Rather than being a source from which large amounts of emergency support may be drawn frequently to supplement capacity deficiencies in ECAR, the adjacent regions may be frequently seeking emergency assistance from ECAR.

d. Delay of the PNPP will magnify capacity deficiencies for the ECAR region--deficiencies that are already a cause for concern if the PNPP units are installed as scheduled.

1.3.2.5 Effects of Inadequate Reserve Capacity

Planned generating reserves are subject to two broad categories of potential utilization:

a. The committed uses of installed reserve, which include:

   (1) Provision for carrying load during planned shutdowns for maintenance or major modifications of generating equipment, and

   (2) An amount of unloaded but operating capacity sufficient to maintain scheduled power flow on tie lines and to permit satisfactory regulation of system frequency.

b. The uncommitted portions of installed reserve that provide protection against combinations of events whose total magnitude is both variable and uncertain. These events include:

   (1) Loss of capacity due to slippage of the installation dates of new generating capacity,

   (2) Weather with a severity in excess of that envisioned in the load forecast,

   (3) Reductions in system generating capacity due to unplanned outages of generating units or a reduction in their output as a result of equipment conditions or outage of auxiliaries,

(4) Reduction imposed by lack of fuel or by air and water quality conditions, and

(5) Unexpected load increases due to other factors such as customer fuel conversion and fluctuations in economic activity.

The effect of inadequate reserve capacity, if the inadequacy cannot be made up from supplemental resources, is degradation in reliability. Degradation in reliability is an insidious and subtle condition. If it progresses to the point that customer service is curtailed, it achieves a state of distinct visibility and concern to all, with obvious negative consequences. If, however, its progress stops short of that point, problems will arise that are not nearly so visible but serious nonetheless. For example, degradation of reliability arising from usually high unavailability will result in higher operating costs, which have a negative effect on both consumers and stockholders. This unavailability in turn will reduce the ability to remove capacity from service to perform necessary preventive maintenance. The ability to perform preventive maintenance will also be impaired if insufficient capacity is installed. Either situation produces a snowballing effect. If preventive maintenance cannot be performed, forced outages and capacity curtailments will increase, with the very real possibility of further degradation of reliability. The degradation thus has a tendency to feed on itself and increase.

Another very real concern is the negative impact on the future expansion plans of industrial users who are supplied from a power system projected to have a deteriorating or uncertain level of reliability over the long term. An inadequate energy supply discourages existing industry from remaining in the area or expanding, and it discourages new industry from locating in the area. Concerns have been expressed that Ohio is suffering an industrial decline. If projections of that decline are used as an excuse to install less future capacity, it becomes a self-fulfilling prophecy.

If reliability is degraded to the point that electric service must be interrupted, the resultant direct and immediate impact on employment and production is obvious. Lost wages and lost production may never be recovered. It would also impose enormous inconvenience to the public, as vital services would have to be curtailed, possibly jeopardizing health and safety.

Yet another effect is that a deteriorating and uncertain level of reliability, along with the resultant customer attitude, affects the attitude of investors, resulting in a perception on their part of an increased risk in the securities of the utility. This increases the cost to the utility (and customers) of the money that must be obtained to support construction programs.

1.3.3 ECONOMIC COST OF DELAY.NG THE PNPP

1.3.3.1 Introduction

The cost of providing electric service is comprised of many elements: fuel, wages, taxes, materials, services, and compensation to investors in the securities sold by the owner companies. The cost must be recovered through the revenue obtained through the sales of electric power. Economic studies generally refer to such recovering of cost as "revenue requirements." In evaluating the cost of delaying the PNPP, the costs of providing service have been classified into three major components:

a. Fixed Charges (on plant investment)
b. Energy Cost (consisting of the cost of fuel and purchased power)
c. Operation and Maintenance Expenses (other than purchased power)

The evaluation has been made on the basis of considering the CAPCO owners of the PNPP as a single system for estimating the impact of PNPP delay on fixed charges, on energy cost, and on operation and maintenance expenses other than fuel and purchased power. Results of the evaluation are presented as the difference in revenue requirements for the "delay" cases reflecting a delay of PNPP Unit 1 for 1, 2, and 3 years and for the base case with no delay.

1.3.3.2 Period of Study

The period of the study is the projected operating life of the PNPP. The years of economic life are tied to the period of the Operating License, which is understood to be 40 years from the issuance of the Construction Permit in May 1977. Thus, the economic life of the individual units will vary with the commercial service date as follows:

	Unit 1		Unit 2	
Years Delay	Service Date (May 1)	Economic Life (Years)	Service Date (May 1)	Economic Life (Years)
0	1984	33	1988	29
1	1985	32		
2	1986	31		
3	1987	30		

1.3.3.3 Plant Cost Estimates

A delay in the commercial operation of the PNPP will result in an increase in the cost of the plant. The magnitude of the cost increase varies with the length of the delay. The cost estimates for the four cases studied are shown in Table 1.3-12. The costs include allowance for funds used during construction (AFUDC). AFUDC charges through 1979 are historic accounting values. For the remaining years, AFUDC was computed with a composite of the rates used by the individual CAPCO companies.

1.3.3.4 Annual Fixed Charges on Investment

The increase in the cost of the plant due to delay (Table 1.3-12) will be reflected in revenue requirements as an increase in total lifetime fixed charges (Table 1.3-13) on investment compared to the "no-delay" case. The increase in total fixed charges with delay is also caused in part by an increase in the fixed charge rates that occurs when the economic life is shortened by the delay. The annual differences in fixed charges between the delay cases relative to the no-delay case are given in Tables 1.3-14, 1.3-15, and 1.3-16.

Composite fixed charge rates for the PNPP were developed to reflect joint ownership by the CAPCO companies. Rates were developed for each PNPP unit for each year of economic life. The annual rates for 0-, 1-, 2-, and 3-year delay of Unit 1 are summarized in Table 1.3-13. The following assumptions were used in developing the annual fixed charge rates:

a. Cost of Money. A composite rate (to the nearest 0.25 percent) was made up as follows:

Component	Structure	Cost
Debt	50%	10.5%
Preferred Stock	15%	11.0%
Common Stock	35%	15.5%
Composite	100%	12.25%

b. Salvage. To include an allowance for plant decommissioning, a negative salvage of 20 percent was assumed.

c. Depreciation
   (1) Book depreciation used the straight-line method and 30-year average life.
   (2) Tax depreciation was normalized to guideline life (20 years) using accelerated depreciation on the short end of the accelerated depreciation range (16 years).

d. Investment Tax Credit. An investment tax credit of 10 percent was normalized over the life of the project.

e. Income Tax. The fixed charge rates reflect the 10.5-percent Pennsylvania income tax and the 46-percent Federal income tax.

f. Property Tax and Insurance. A constant 2.5 percent was included for property tax and insurance.

1.3.3.5 Fuel Cost

Fuel costs for CAPCO were estimated with a computer program that treated CAPCO as a single system. The cost of emergency power purchase was treated as a "fuel" cost.

Tables 1.3-14, 1.3-15, and 1.3-16 show the difference in annual fuel cost between the delay cases and the base no-delay case. The large increases in fuel cost in the years 1984 to 1990, which result from the delay of PNPP Unit 1, represent the estimated cost of shifting energy generation from the PNPP to other sources. It has been assumed that the same amount of customer load will be served in all cases. The pattern of generation shifting is projected to be as follows:

(a) No generation will be shifted to other nuclear units, as they will be base loaded in all cases.

(b) About 75 percent of the generation will be shifted to coal-fired capacity; the remainder will be shifted to oil-fired capacity and other sources.

Table 1.3-17 shows the projected annual oil consumption for the years 1984 to 1988 for CAPCO. The table is broken down between distillate oil (No. 2 oil used by gas turbines and diesels) and residual oil (No. 6 oil used in steam plants).

The differences in oil consumption caused by a delay of the PNPP are also shown.

1.3.3.6 Operation and Maintenance Excluding Fuel

In order that a full operating crew will be on hand and trained when the two units of the plant are scheduled to go into service, staffing for the PNPP was begun during the engineering design phase. The costs thus incurred (salaries, benefits, training costs, etc.) before the start of commercial service are capitalized as part of the cost of the unit.

The labor component of operation and maintenance cost is based on a total manpower requirement of 235 persons, when PNPP Unit 1 goes into service, which increases to an ultimate 317 persons for the complete two-unit plant. The annual differences in operation and maintenance cost between the delay cases and the no-delay case are summarized in Tables 1.3-14, 1.3-15, and 1.3-16.

1.3.3.7 Summary of Economic Analysis of Delaying the PNPP

The results of the economic analysis of delaying the PNPP are shown in Tables 1.3-14, 1.3-15, and 1.3-16 for 1-, 2-, and 3-year delay, respectively, of PNPP Unit 1. The results are presented as annual cost differences between the no-delay and the delay cases for the components of revenue requirements (and total revenue requirements) for each year of the projected economic life. The tables also show the totals of the annual figures and the total present value to year 1984 of the stream of annual figures. Present value was computed at a 12.75 percent interest rate.

The yearly total cost has also been presented graphically in Figure 1.3-2. The short-range reduction in cost is due to the deferral of starting to charge fixed charges and the deferral of starting to charge operating and maintenance costs (excluding fuel) as an operating expense in the delay cases. The net effect of delay over the life of the plant, however, is to increase the total costs of providing electric service, which must be borne by the consumers.

REFERENCES FOR SECTION 1.3

1. The 1970 National Power Survey, Part II, Federal Power Commission, pp. II-2-49 through II-2-53 and pp. II-2-57 through II-2-59.

2. ECAR Regional Reliability Council Coordinated Bulk Power Supply Program ERA-411, Report to U.S. Department of Energy, Economic Regulatory Administration, April 1, 1980.

3. Appraisal of ECAR-Wide Installed Reserves for the Period 1979-1978, Report 79-GRP-57, July 1979.

4. Summary of Projected Peak Load, Generating Capability, and Fossil Fuel Requirements for the Regional Reliability Councils of NERC, National Electric Reliability Council, July 1979.

5. Questions on the Future of Nuclear Power: Implications and Tradeoffs, United States General Accounting Office, May 21, 1979.

TABLE 1.3-1

EFFECT OF DELAY OF PNPP 1 ON THE DEPENDENCE ON SUPPLEMENTAL CAPACITY RESOURCES

	No Delay PNPP 1--5/84 PNPP 2--5/88		1-Year Delay PNPP 1--5/85 PNPP 2--5/38		2-Year Delay PNPP 1--5/86 PNPP 2--5/88		3-Year Delay PNPP 1--5/87 PNPP 2--5/88	
Year	DSCR[a]	Megawatt Deficiency[b]	DSCR[a]	Megawatt Deficiency[b]	DSCR[a]	Megawatt Deficiency[b]	DSCR[a]	Megawatt Deficiency[b]
1984	12.7	1,150	38.3	1,690	38.3	1,690	38.3	1,690
1985	22.8	1,505	28.0	1,625	73.7	2,125	73.7	2,125
1986	14.3	1,280	15.2	1,315	19.6	1,440	51.5	1,945
1987	21.7	1,545	26.3	1,675	27.8	1,700	33.7	1,825
1988	17.3	1,500	13.9	1,370	17.3	1,500	18.3	1,535

[a] Dependence on supplemental capacity resources in days per year.
[b] Additional firm capacity required for each day in the year to meet the CAPCO planning criterion of one day per year DSCR.

TABLE 1.3-2

CAPCO CAPACITY MIX (1984 TO 1988) AS A FUNCTION OF PNPP SCHEDULE

a. PNPP 1 on schedule (1984)

Type of Capacity Resource	CAPCO Capacity Resources at Time of Annual Peak									
	1984		1985		1986		1987		1988	
	MWe	%	MWe	%	MWe	%	MWe	%	MWe	%
Nuclear (Steam)	2,957	17.64	2,957	17.64	3,790	21.54	3,790	21.54	5,024	26.68
Coal (Steam)	11,880	70.87	11,880	70.87	11,880	67.52	11,880	67.52	11,880	63.09
Oil (Steam)	682	4.07	682	4.07	682	3.88	682	3.88	682	3.62
Peaking, Mid-Range[(a)]	821	4.90	821	4.90	821	4.67	821	4.67	821	4.36
Pumped Storage Hydro	365	2.18	365	2.18	365	2.07	365	2.07	365	1.95
Subtotal	16,705	99.66	16,705	99.66	17,538	99.68	17,538	99.68	18,772	99.70
Purchase	57	0.34	57	0.34	57	0.32	57	0.32	57	0.30
Total (NDC)	16,762	100.00	16,762	100.00	17,595	100.00	17,595	100.00	18,829	100.00
Minus Seasonal Derating	339		339		352		352		377	
Capability at Annual Peak	16,423		16,423		17,243		17,243		18,452	

(a) Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.3-2 (Continued)

CAPCO CAPACITY MIX (1984 TO 1938) AS A FUNCTION OF PNPP SCHEDULE

b. PNPP 1 delayed 1 year

Type of Capacity Resource	CAPCO Capacity Resources at Time of Annual Peak									
	1984		1985		1986		1987		1988	
	MWe	%	MWe	%	MWe	%	MWe	%	MWe	%
Nuclear (Steam)	1,752	11.26	2,957	17.64	3,790	21.54	3,790	21.54	5,024	26.68
Coal (Steam)	11,880	76.36	11,880	70.87	11,880	67.52	11,880	67.52	11,880	63.09
Oil (Steam)	682	4.38	682	4.07	682	3.88	682	3.88	682	3.62
Peaking, Mid-Range[(a)]	821	5.28	821	4.90	821	4.67	821	4.67	821	4.36
Pumped Storage Hydro	365	2.35	365	2.18	365	2.07	365	2.07	365	1.95
Subtotal	15,500	99.63	16,705	99.66	17,538	99.68	17,538	99.68	18,772	99.70
Purchase	57	0.37	57	0.34	57	0.32	57	0.32	57	0.30
Total (NDC)	15,557	100.00	16,762	100.00	17,595	100.00	17,595	100.00	18,829	100.00
Minus Seasonal Derating	313		339		352		352		377	
Capability at Annual Peak	15,244		16,423		17,243		17,243		18,452	

[(a)]Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.3-2 (Continued)

CAPCO CAPACITY MIX (1984 TO 1988) AS A FUNCTION OF PNPP SCHEDULE

c. PNPP 1 delayed 2 years

Type of Capacity Resource	CAPCO Capacity Resources at Time of Annual Peak									
	1984		1985		1986		1987		1988	
	MWe	%	MWe	%	MWe	%	MWe	%	MWe	%
Nuclear (Steam)	1,752	11.26	1,752	11.26	3,790	21.54	3,790	21.54	5,024	26.68
Coal (Steam)	11,880	76.36	11,880	76.36	11,880	67.52	11,880	67.52	11,880	63.09
Oil (Steam)	682	4.38	682	4.38	682	3.88	682	3.88	682	3.62
Peaking, Mid-Range[a]	821	5.28	821	5.28	821	4.67	821	4.67	821	4.36
Pumped Storage Hydro	365	2.35	365	2.35	365	2.07	365	2.07	365	1.95
Subtotal	15,500	99.63	15,500	99.63	17,538	99.68	17,538	99.68	18,772	99.70
Purchase	57	0.37	57	0.37	57	0.32	57	0.32	57	0.30
Total (NDC)	15,557	100.00	15,557	100.00	17,595	100.00	17,595	100.00	18,829	100.00
Minus Seasonal Derating	313		313		352		352		377	
Capability at Annual Peak	15,244		15,244		17,243		17,243		18,452	

[a] Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.3-2 (Continued)

CAPCO CAPACITY MIX (1984 TO 1988) AS A FUNCTION OF PNPP SCHEDULE

d. PNPP 1 delayed 3 years

Type of Capacity Resource	CAPCO Capacity Resources at Time of Annual Peak									
	1984		1985		1986		1987		1988	
	MWe	%	MWe	%	MWe	%	MWe	%	MWe	%
Nuclear (Steam)	1,752	11.26	1,752	11.26	2,585	15.77	3,790	21.54	5,024	26.68
Coal (Steam)	11,880	76.36	11,880	76.36	11,880	72.48	11,880	67.52	11,880	63.09
Oil (Steam)	682	4.38	682	4.38	682	4.16	682	3.88	682	3.62
Peaking, Mid-Range[(a)]	821	5.28	821	5.28	821	5.01	821	4.67	821	4.36
Pumped Storage Hydro	365	2.35	365	2.35	365	2.23	365	2.07	365	1.95
Subtotal	15,500	99.63	15,500	99.63	16,333	99.65	17,538	99.68	18,772	99.70
Purchase	57	0.37	57	0.37	57	0.35	57	0.32	57	0.30
Total (NDC)	15,557	100.00	15,557	100.00	16,390	100.00	17,595	100.00	18,829	100.00
Minus Seasonal Derating	313		313		326		352		377	
Capability at Annual Peak	15,244		15,244		16,064		17,243		18,452	

(a) Combustion turbines, diesels, and combined-cycle plants.

TABLE 1.3-3

CAPCO SYSTEM DEMAND AND RESOURCE CAPABILITY COMPARISON (1968 TO 1988)
SHOWING PROJECTED EFFECT OF CHANGE IN PNPP SCHEDULE

(Capability Resources at Time of Annual Peak)

Year	Annual System Peak Demand[a] (MWe)	Resources With PNPP As Scheduled[a] (MWe)	Resources With PNPP 1 Delayed 1 Year (MWe)	Resources With PNPP 1 Delayed 2 Years (MWe)	Resources With PNPP 1 Delayed 3 Years (MWe)
1968	7,530	8,526			
1969	7,876	9,029			
1970	8,293	10,081			
1971	9,139	10,300			
1972	9,534	10,864			
1973	10,432	11,963			
1974	10,014	12,157			
1975	9,906	12,074			
1976	10,345	12,809			
1977	11,164	13,357			
1978	10,897	14,893			
1979	10,435	15,448			
1980	11,327	14,671			
1981	11,877	15,523			
1982	12,334	15,500			
1983	12,768	15,500			
1984	13,235	16,705	15,500		
1985	13,643	16,705	16,705	15,500	
1986	14,088	17,538	17,538	17,538	16,333
1987	14,505	17,538	17,538	17,538	17,538
1988	14,966	18,772	18,772	18,772	18,772

[a] Actual through 1979.

TABLE 1.3-4

CAPCO SYSTEM RESERVE MARGINS (1968 TO 1988)
SHOWING PROJECTED EFFECT OF CHANGE IN PNPP SCHEDULE
(Reserve Margin as Percent of Annual Peak)

Year	Reserve Margin With PNPP As Scheduled[a] (%)	Reserve Margin With PNPP 1 Delayed 1 Year (%)	Reserve Margin With PNPP 1 Delayed 2 Years (%)	Reserve Margin With PNPP 1 Delayed 3 Years (%)
1968	13.2			
1969	14.6			
1970	21.6			
1971	12.7			
1972	14.0			
1973	14.7			
1974	21.4			
1975	21.9			
1976	23.8			
1977	19.6			
1978	36.7			
1979	48.0			
1980	29.8			
1981	29.[illegible]			
1982	23.[illegible]			
1983	19.[illegible]			
1984	24.1	15.2		
1985	20.4	20.4	11.7	
1986	22.4	22.4	22.4	14.0
1987	18.9	18.9	18.9	18.9
1988	23.3	23.3	23.3	23.3

[a]Actual through 1979.

TABLE 1.3-5

CAPCO SUMMER RESERVES (1984 TO 1988)
SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

a. PNPP on schedule

	1984	1985	1986	1987	1988
Net Demonstrated Capability (MWe)	16,705	16,705	17,538	17,538	18,772
Net Seasonal Capability (MWe)	16,366	16,366	17,186	17,186	18,395
Purchase (MWe)	57	57	57	57	57
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	16,423	16,423	17,243	17,243	18,452
Native Load (MWe)	13,235	13,643	14,088	14,505	14,966
Available Reserve (MWe)	3,188	2,780	3,155	2,738	3,486
Available Reserve (%)	24.1	20.4	22.4	18.9	23.3

b. PNPP 1 delayed 1 year

	1984	1985	1986	1987	1988
Net Demonstrated Capability (MWe)	15,500	16,705	17,538	17,538	18,772
Net Seasonal Capability (MWe)	15,187	16,366	17,186	17,186	18,395
Purchases (MWe)	57	57	57	57	57
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,244	16,423	17,243	17,243	18,452
Native Load (MWe)	13,235	13,643	14,088	14,505	14,966
Available Reserve (MWe)	2,009	2,780	3,155	2,738	3,486
Available Reserve (%)	15.2	20.4	22.4	18.9	23.3

c. PNPP 1 delayed 2 years

	1984	1985	1986	1987	1988
Net Demonstrated Capability (MWe)	15,500	15,500	17,538	17,538	18,772
Net Seasonal Capability (MWe)	15,187	15,187	17,186	17,186	18,395
Purchases (MWe)	57	57	57	57	57
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,244	15,244	17,243	17,243	18,452
Native Load (MWe)	13,235	13,643	14,088	14,505	14,966
Available Reserve (MWe)	2,009	1,601	3,155	2,738	3,486
Available Reserve (%)	15.2	11.7	22.4	18.9	23.3

TABLE 1.3-5 (Continued)

CAPCO REGION SUMMER RESERVES (1984 TO 1988) SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

d. PNPP 1 delayed 3 years

	1984	1985	1986	1987	1988
Net Demonstrated Capability (MWe)	15,500	15,500	16,333	17,538	18,772
Net Seasonal Capability (MWe)	15,187	15,187	16,007	17,186	18,395
Purchases (MWe)	57	57	57	57	57
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,244	15,244	16,064	17,243	18,452
Native Load (MWe)	13,235	13,643	14,088	14,505	14,966
Available Reserve (MWe)	2,009	1,601	1,976	2,738	3,486
Available Reserve (%)	15.2	11.7	14.0	18.9	23.3

TABLE 1.3-6

CAPCO WINTER RESERVES (1984 TO 1989)
SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

	1984-85	1985-86	1986-87	1987-88	1988-89
a. PNPP on schedule					
Net Demonstrated Capability (MWe)	16,705	16,705	17,538	17,538	18,772
Net Seasonal Capability (MWe)	16,705	16,705	17,538	17,538	18,772
Purchase (MWe)	74	74	74	74	74
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	16,779	16,779	17,612	17,612	18,846
Native Load (MWe)	12,381	12,764	13,133	13,526	13,904
Available Reserve (MWe)	4,398	4,015	4,479	4,086	4,942
Available Reserve (%)	35.5	31.5	34.1	30.2	35.5
b. PNPP 1 delayed 1 year					
Net Demonstrated Capability (MWe)	15,500	16,705	17,538	17,538	18,772
Net Seasonal Capability (MWe)	15,500	16,705	17,538	17,538	18,772
Purchase (MWe)	74	74	74	74	74
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,574	16,779	17,612	17,612	18,846
Native Load (MWe)	12,381	12,764	13,133	13,526	13,904
Available Reserve (MWe)	3,193	4,015	4,479	4,086	4,942
Available Reserve (%)	25.8	31.5	34.1	30.2	35.5
c. PNPP 1 delayed 2 years					
Net Demonstrated Capability (MWe)	15,500	15,500	17,538	17,538	18,772
Net Seasonal Capability (MWe)	15,500	15,500	17,538	17,538	18,772
Purchase (MWe)	74	74	74	74	74
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,574	15,574	17,612	17,612	18,846
Native Load (MWe)	12,381	12,764	13,133	13,526	13,904
Available Reserve (MWe)	3,193	2,810	4,479	4,086	4,942
Available Reserve (%)	25.8	22.0	34.1	30.2	35.5

TABLE 1.3-6 (Continued)

CAPCO WINTER RESERVES (1984 TO 1989)
SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

d. PNPP 1 delayed 3 years

	1984-85	1985-86	1986-87	1987-88	1988-99
Net Demonstrated Capability (MWe)	15,500	15,500	16,333	17,538	18,772
Net Seasonal Capability (MWe)	15,500	15,500	16,333	17,538	18,772
Purchase (MWe)	74	74	74	74	74
Sales (MWe)	0	0	0	0	0
Available Capability (MWe)	15,574	15,574	16,407	17,612	18,846
Native Load (MWe)	12,381	12,764	13,133	13,526	13,904
Available Reserve (MWe)	3,193	2,810	3,274	4,086	4,942
Available Reserve (%)	25.8	22.0	24.9	30.2	35.5

TABLE 1.3-7

ECAR REGION SUMMER RESERVES (1984 TO 1988) SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

a. PNPP on schedule

	1984	1985	1986	1987	1988
Net Capability (MWe)	103,207	107,711	111,274	114,647	119,361
Imports (MWe)	271	289	286	283	280
Exports (MWe)	915	920	624	628	632
Total Resources (MWe)	102,563	107,080	110,936	114,302	119,009
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	102,563	107,080	110,936	114,302	119,009
Peak Hour Demand (MWe)	77,404	80,246	83,177	86,056	89,012
Interruptible Demand (MWe)	621	621	621	621	621
Native Load (MWe)	76,783	79,625	82,556	85,435	88,391
Reserve (MWe)	25,780	27,455	28,380	28,867	30,618
Reserve (%)	33.6	34.5	34.4	33.8	34.6

b. PNPP 1 delayed 1 year

	1984	1985	1986	1987	1988
Net Capability (MWe)	102,002	107,711	111,274	114,647	119,361
Imports (MWe)	271	289	286	283	280
Exports (MWe)	915	920	624	628	632
Total Resources (MWe)	101,358	107,080	110,936	114,302	119,009
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	101,358	107,080	110,936	114,302	119,009
Peak Hour Demand (MWe)	77,404	80,246	83,177	86,056	89,012
Interruptible Demand (MWe)	621	621	621	621	621
Native Load (MWe)	76,783	79,625	82,556	85,435	88,391
Reserve (MWe)	24,575	27,455	28,380	28,867	30,618
Reserve (%)	32.0	34.5	34.4	33.8	34.6

c. PNPP 1 delayed 2 years

	1984	1985	1986	1987	1988
Net Capability (MWe)	102,002	106,506	111,274	114,647	119,361
Imports (MWe)	271	289	286	283	280
Exports (MWe)	915	920	624	628	632
Total Resources (MWe)	101,358	105,875	110,936	114,302	119,009
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	101,358	105,875	110,936	114,302	119,009
Peak Hour Demand (MWe)	77,404	80,246	83,177	86,056	89,012
Interruptible Demand (MWe)	621	621	621	621	621
Native Load (MWe)	76,783	79,625	82,556	85,435	88,391
Reserve (MWe)	24,575	26,250	28,380	28,867	30,618
Reserve (%)	32.0	33.0	34.4	33.8	34.6

TABLE 1.3-7 (Continued)

ECAR REGION SUMMER RESERVES (1984 TO 1988) SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

d. PNPP 1 delayed 3 years

	1984	1985	1986	1987	1988
Net Capability (MWe)	102,002	106,506	110,069	114,647	119,361
Imports (MWe)	271	289	286	283	280
Exports (MWe)	915	920	624	628	632
Total Resources (MWe)	101,358	105,875	109,731	114,302	119,009
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	101,358	105,875	109,731	114,302	119,009
Peak Hour Demand (MWe)	77,404	80,246	83,177	86,056	89,012
Interruptible Demand (MWe)	621	621	621	621	621
Native Load (MWe)	76,783	79,625	82,556	85,435	88,391
Reserve (MWe)	24,575	26,250	27,175	28,867	30,618
Reserve (%)	32.0	33.0	32.9	33.8	34.6

TABLE 1.3-8

ECAR REGION WINTER RESERVES (1984 TO 1989) SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

a. PNPP on schedule

	1984-85	1985-86	1986-87	1987-88	1988-89
Net Capability (MWe)	108,181	111,729	115,415	117,601	122,321
Imports (MWe)	571	589	286	283	280
Exports (MWe)	619	622	625	628	320
Total Resources (MWe)	108,133	111,696	115,076	117,256	122,281
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	108,133	111,696	115,076	117,256	122,281
Peak Hour Demand (MWe)	79,414	82,534	85,655	88,704	92,234
Interruptible Demand (MWe)	571	571	571	571	571
Native Load (MWe)	58,843	81,963	85,084	88,133	91,663
Reserve (MWe)	29,290	29,733	29,992	29,123	30,618
Reserve (%)	49.8	36.3	35.2	33.0	33.4

b. PNPP 1 delayed 1 year

	1984-85	1985-86	1986-87	1987-88	1988-89
Net Capability (MWe)	106,976	111,729	115,415	117,601	122,321
Imports (MWe)	571	589	286	283	280
Exports (MWe)	619	622	625	628	320
Total Resources (MWe)	106,928	111,696	115,076	117,256	122,281
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	106,928	111,696	115,076	117,256	122,281
Peak Hour Demand (MWe)	79,414	82,534	85,655	88,704	92,234
Interruptible Demand (MWe)	571	571	571	571	571
Native Load (MWe)	58,843	81,963	85,084	88,133	91,663
Reserve (MWe)	28,085	29,733	29,992	29,123	30,618
Reserve (%)	47.7	36.3	35.2	33.0	33.4

c. PNPP 1 delayed 2 years

	1984-85	1985-86	1986-87	1987-88	1988-89
Net Capability (MWe)	106,976	110,524	115,415	117,601	122,321
Imports (MWe)	571	589	286	283	280
Exports (MWe)	619	622	625	628	320
Total Resources (MWe)	106,928	110,491	115,076	117,256	122,281
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	106,928	110,491	115,076	117,256	122,281
Peak Hour Demand (MWe)	79,414	82,534	85,655	88,704	92,234
Interruptible Demand (MWe)	571	571	571	571	571
Native Load (MWe)	58,843	81,963	85,084	88,133	91,663
Reserve (MWe)	28,085	28,528	29,992	29,123	30,618
Reserve (%)	47.7	34.8	35.2	33.0	33.4

TABLE 1.3-8 (Continued)

ECAR REGION WINTER RESERVES (1984 TO 1989) SHOWING EFFECT OF CHANGE IN PNPP SCHEDULE

d. PNPP 1 delayed 3 years

	1984-85	1985-86	1986-87	1987-88	1988-89
Net Capability (MWe)	106,976	110,524	114,210	117,601	122,321
Imports (MWe)	571	589	286	283	280
Exports (MWe)	619	622	625	628	320
Total Resources (MWe)	106,928	110,491	113,871	117,256	122,281
Inoperable Capability (MWe)	0	0	0	0	0
Operable Resources (MWe)	106,928	110,491	113,871	117,256	122,281
Peak Hour Demand (MWe)	79,414	82,534	85,655	88,704	92,234
Interruptible Demand (MWe)	571	571	571	571	571
Native Load (MWe)	58,843	81,963	85,084	88,133	91,663
Reserve (MWe)	28,085	28,528	28,787	29,123	30,618
Reserve (%)	47.7	34.8	33.8	33.0	33.4

TABLE 1.3-9

HISTORY OF CAPCO POOL POWER PURCHASE TO MAINTAIN SPINNING RESERVE OF 3 PERCENT OF PEAK LOAD FROM JANUARY 1, 1975 TO APRIL 30, 1980

	Purchase Days					
	1975	1976	1977	1978	1979	1980
January	9	4	26	21	17	3
February	9	2	12	13	16	1
March	5	9	4	1	8	0
April	9	10	5	2	11	0
May	5	6	14	5	11	-
June	9	9	6	8	20	-
July	7	7	14	4	6	-
August	4	4	10	6	1	-
September	0	1	6	8	1	-
October	0	2	11	9	8	-
November	0	8	13	8	8	-
December	1	17	13	16	4	-
Total	58	79	134	101	111	4
Percent Reserve (Historical)	21.9	23.8	19.6	36.7	45.7	-

TABLE 1.3-10

SUMMER SEASON PROJECTED PEAK LOAD, GENERATING CAPACITY RESOURCES, AND COMPUTED SUMMER RESERVES OF ECAR AND FOUR ADJACENT NERC REGIONS WITH PNPP ON SCHEDULE

	1984	1985	1986	1987	1988
ECAR Region Only					
Resources (MWe)	102,563	107,080	110,936	114,302	119,009
Peak Load (MWe)	76,783	79,625	82,556	85,435	88,391
Reserve (%)	33.6	34.5	34.4	33.8	34.6
Four Regions Adjacent to ECAR					
Resources (MWe)	307,289	324,060	332,953	344,821	356,261
Peak Load (MWe)	243,432	253,666	263,830	274,367	285,097
Reserve (%)	26.2	27.8	26.2	25.7	25.0
Total NERC (Contiguous U.S.)					
Resources (MWe)	683,419	717,868	744,097	769,087	795,738
Peak Load (MWe)	537,611	562,053	586,758	612,289	638,816
Reserve (%)	27.1	27.7	26.8	25.6	24.6

TABLE 1.3-11

WINTER SEASON PROJECTED PEAK LOAD, GENERATING CAPACITY RESOURCES, AND COMPUTED WINTER RESERVES OF ECAR AND FOUR ADJACENT NERC REGIONS WITH PNPP ON SCHEDULE

	1984-85	1985-86	1986-87	1987-88	1988-89
ECAR Region Only					
Resources (MWe)	108,133	111,696	115,076	117,256	122,281
Peak Load (MWe)	58,843	81,963	85,084	88,133	91,663
Reserve (%)	49.8	36.3	35.2	33.0	33.4
Four Regions Adjacent to ECAR					
Resources (MWe)	321,870	335,956	340,867	355,698	365,132
Peak Load (MWe)	236,373	246,644	257,020	267,830	278,782
Reserve (%)	36.2	36.2	32.6	32.8	31.0
Total NERC (Contiguous U.S.)					
Resources (MWe)	706,633	736,955	760,831	787,080	815,787
Peak Load (MWe)	502,115	525,135	548,857	573,559	598,796
Reserve (%)	40.7	40.3	38.6	37.2	36.2

TABLE 1.3-12

PLANT COST ESTIMATES USED IN COMPUTING COST OF DELAY OF PNPP

Unit 1 Delay	Unit 1		Unit 2		Total Plant
Years	Service Date	Total Cost ($1000)	Service Date	Total Cost ($1000)	Total Cost ($1000)
0	5/1/84	1,654,048	5/1/88	2,287,797	3,941,845
1	5/1/85	1,809,899	5/1/88	2,287,797	4,097,696
2	5/1/86	1,981,840	5/1/88	2,287,797	4,269,637
3	5/1/87	2,067,089	5/1/88	2,287,797	4,354,886

TABLE 1.3-13

YEARLY FIXED CHARGE RATES (PERCENT) USED IN PNPP DELAY STUDY, BY SERVICE DATE

Year	No Delay Unit 1 5/1/84	No Delay Unit 2 5/1/88	1-Year Delay Unit 1 5/1/85	2-Year Delay Unit 1 5/1/86	5-Year Delay Unit 1 5/1/87
1984	22.58	--	--	--	--
1985	21.49	--	23.14	--	--
86	20.49	--	22.06	23.69	--
87	19.58	--	21.07	22.62	24.04
88	18.74	24.26	20.16	21.63	22.95
89	17.97	23.15	19.31	20.72	21.95
1990	17.25	22.11	18.53	19.86	21.02
91	16.59	21.16	17.80	19.06	20.15
92	15.96	20.26	17.11	18.31	19.32
93	15.38	19.41	16.46	17.60	18.55
94	14.79	18.62	15.85	16.93	17.82
1995	14.20	17.87	15.24	16.29	17.12
96	13.62	17.15	14.63	15.66	16.47
97	13.03	16.46	14.01	15.01	15.80
98	12.45	15.77	13.40	14.37	15.13
99	11.86	15.08	12.79	13.74	14.47
2000	11.27	14.40	12.18	13.09	13.80
01	10.95	13.71	11.57	12.46	13.15
02	10.63	13.02	11.20	11.82	12.48
03	10.31	12.34	10.83	11.41	11.82
04	13.13	11.65	10.46	10.99	11.37
2005	12.50	11.18	13.01	10.58	10.93
06	11.87	10.72	12.29	12.87	10.48
07	11.24	10.26	11.70	12.19	12.67
08	10.61	12.43	11.05	11.50	11.96
09	9.98	11.70	10.40	10.83	11.26
2010	9.35	10.97	9.74	10.15	10.57
11	8.72	10.25	9.09	9.48	9.86
12	8.09	9.52	8.44	8.80	9.27
13	7.47	8.80	7.79	8.13	8.46
14	6.84	8.09	7.14	7.45	7.76
2015	6.21	7.36	6.48	6.78	7.07
2016	-7.06	-3.91	-5.81	-4.67	-4.11

TABLE 1.3-14

DIFFERENCE IN ANNUAL PNPP REVENUE REQUIREMENTS BETWEEN 1-YEAR DELAY AND NO-DELAY CASES[a]
(In Million Dollars)

Year	PNPP Fixed Charges	CAPCO[b] Fuel	CAPCO[b] Operation and Maintenance	Total
1984	-248.9	263.5	6.0	20.6
1985	-76.2	50.1	2.0	-24.1
1986	60.4	27.5	1.2	89.1
1987	57.4	101.9	3.5	162.8
1988	54.8	-85.2	-6.8	-37.2
1989	52.3	3.8		56.1
1990	49.9	154.2		204.1
1991	47.8			47.8
1992	45.6			45.6
1993	43.6			43.6
1994	42.3			42.3
1995	40.9			40.9
1996	39.5			39.5
1997	38.1			38.1
1998	36.7			36.7
1999	35.3			35.3
2000	33.9			33.9
2001	28.2			28.2
2002	26.9			26.9
2003	25.5			25.5
2004	-27.8			-27.8
2005	28.6			28.6
2006	26.1			26.1
2007	25.9			25.9
2008	24.5			24.5
2009	23.1			23.1
2010	21.7			21.7
2011	20.3			20.3
2012	18.9			18.9
2013	17.4			17.4
2014	16.0			16.0
2015	14.7			14.7
2016	11.7			11.7
Total Annual Cost	655.1	515.8	5.9	1176.8
Present Value (1984 Dollars)	-11.2	425.1	6.9	420.8

[a] For no delay PNPP Unit 1 is in service May 1984. For 1-year delay PNPP Unit 1 is in service May 1985.
[b] CAPCO system costs.

TABLE 1.3-12

DIFFERENCE IN ANNUAL PNPP REVENUE REQUIREMENTS
BETWEEN 2-YEAR DELAY AND NO-DELAY CASES[a]
(In Million Dollars)

Year	PNPP Fixed Charges	CAPCO[b] Fuel	CAPCO[b] Operation and Maintenance	Total
1984	-248.9	263.5	6.0	20.6
1985	-355.4	414.0	1.3	59.9
1986	-25.9	91.8	2.1	68.0
1987	124.4	130.0	4.9	259.3
1988	118.7	14.9		133.6
1989	113.4	-107.2		6.2
1990	108.2	158.3		266.5
1991	103.4			103.4
1992	98.9			98.9
1993	94.5			94.5
1994	90.9			90.9
1995	87.9			87.9
1996	85.2			85.2
1997	82.0			82.0
1998	79.0			79.0
1999	76.1			76.1
2000	72.9			72.9
2001	65.8			65.8
2002	58.5			58.5
2003	55.6			55.6
2004	.6			.6
2005	2.9			2.9
2006	58.7			58.7
2007	55.7			55.7
2008	52.4			52.4
2009	49.5			49.5
2010	46.5			46.5
2011	43.6			43.6
2012	40.5			40.5
2013	37.6			37.6
2014	34.5			34.5
2015	31.7			31.7
2016	24.2			24.2
Total Annual Cost	1363.6	965.3	14.3	2343.2
Present Value (1984 Dollars)	-25.5	821.1	20.3	815.9

[a] For no delay PNPP Unit 1 is in service May 1984. For 2-year delay PNPP Unit 1 is in service May 1986.
[b] CAPCO system costs.

TABLE 1.3-16

DIFFERENCE IN ANNUAL PNPP REVENUE REQUIREMENTS
BETWEEN 3-YEAR DELAY AND NO-DELAY CASES[a]
(In Million Dollars)

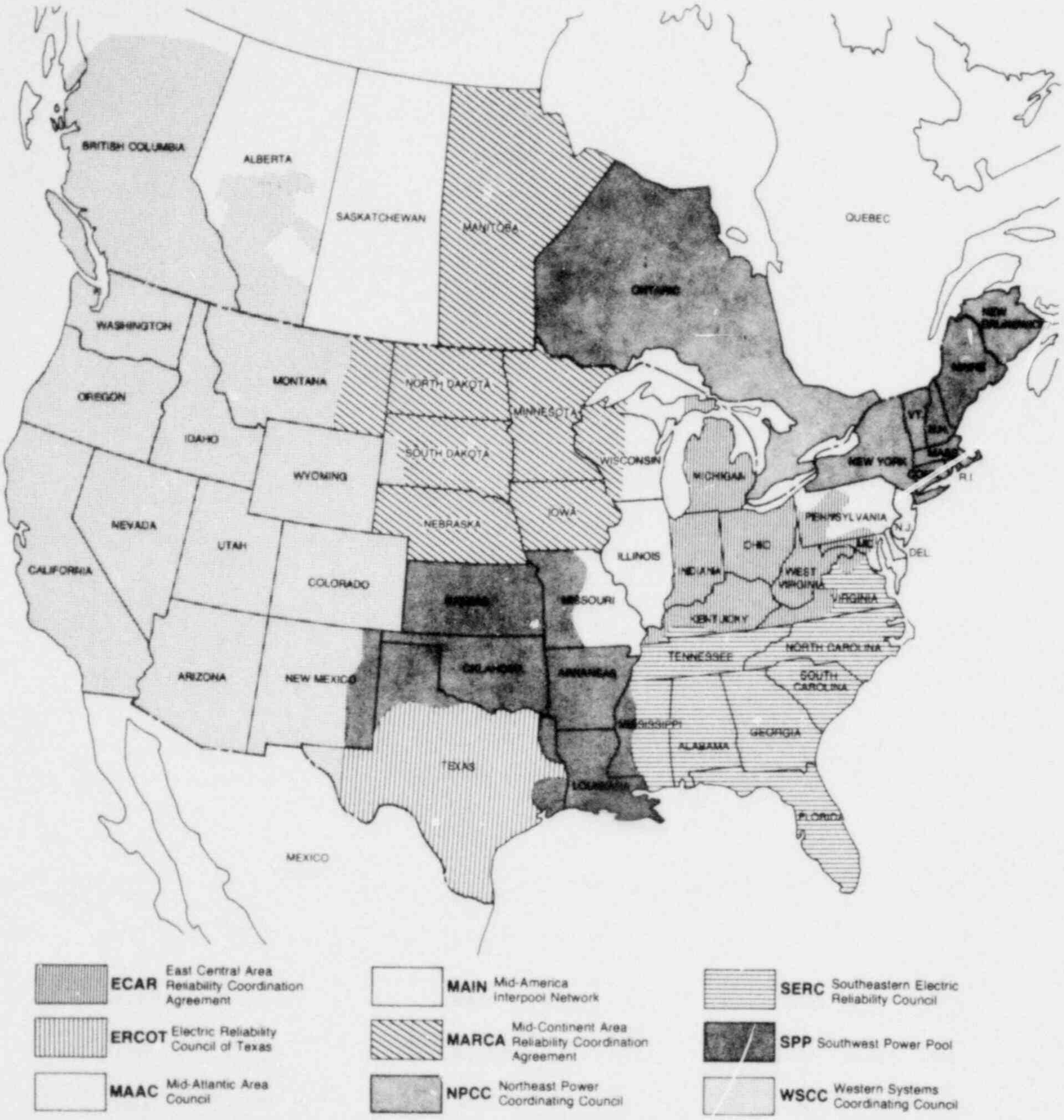
Year	PNPP Fixed Charges	CAPCO[b] Fuel	CAPCO[b] Operation and Maintenance	Total
1984	-248.9	263.5	6.0	20.6
1985	-355.4	414.0	1.3	59.9
1986	-338.9	458.1	2.1	121.3
1987	7.4	199.1	7.6	214.1
1988	164.4	43.2	2.8	210.4
1989	156.5	19.9		176.4
1990	149.1	9.2		158.3
1991	142.2			142.2
1992	135.4			135.4
1993	129.1			129.1
1994	123.8			123.8
1995	119.0			119.0
1996	115.2			115.2
1997	111.1			111.1
1998	107.0			107.0
1999	102.9			102.9
2000	98.8			98.8
2001	90.7			90.7
2002	82.2			82.2
2003	73.8			73.8
2004	17.8			17.8
2005	19.1			19.1
2006	20.2			20.2
2007	76.0			76.0
2008	71.7			71.7
2009	67.7			67.7
2010	63.8			63.8
2011	59.5			59.5
2012	57.7			57.7
2013	51.4			51.4
2014	47.3			47.3
2015	43.4			43.4
2016	31.8			31.8
Total Annual Cost	1592.8	1407.0	19.8	3019.6
Present Value (1984 Dollars)	-179.9	1172.1	15.8	1008.0

[a] For no delay PNPP Unit 1 is in service May 1984. For 3-year delay PNPP Unit 1 is in service May 1987.
[b] CAPCO system costs.

TABLE 1.3-17

IMPACT OF PNPP DELAY ON OIL CONSUMPTION
FOR CAPCO PROJECTED ON A SINGLE-SYSTEM BASIS
(In Million Gallons)

Year	1984	1985	1986	1987	1988
No Delay of PNPP (Base)					
#2 Oil	74.7	109.5	79.5	83.8	74.7
#6 Oil	45.7	72.5	49.7	53.9	48.6
Total	120.4	182.0	129.2	137.7	123.3
1-Year Delay of Unit 1					
#2 Oil	179.4	123.6	82.9	106.3	60.2
#6 Oil	131.4	85.5	53.0	71.0	38.0
Total	310.8	209.1	135.9	177.3	98.2
(Total - Base)	190.4	27.1	6.7	39.6	-25.1
2-Year Delay of Unit 1					
#2 Oil	179.4	237.5	100.7	110.3	74.7
#6 Oil	131.4	183.7	67.0	76.1	48.6
Total	310.8	421.2	167.7	186.4	123.3
(Total - Base)	190.4	239.2	38.5	48.7	0
3-Year Delay of Unit 1					
#2 Oil	179.4	237.5	203.6	125.7	78.2
#6 Oil	131.4	183.7	151.7	89.7	50.1
Total	310.8	421.2	355.3	215.4	128.3
(Total - Base)	190.4	239.2	226.1	77.7	5.0



The National Electric Reliability Council (NERC) was formed in 1968 with the stated purpose: "...further to augment the RELIABILITY and ADEQUACY of bulk power supply in the electric utility systems of North America." It consists of nine Regional Reliability Councils and encompasses essentially all of the power systems of the United States and Canadian systems in Ontario, British Columbia, Manitoba, New Brunswick and Alberta.

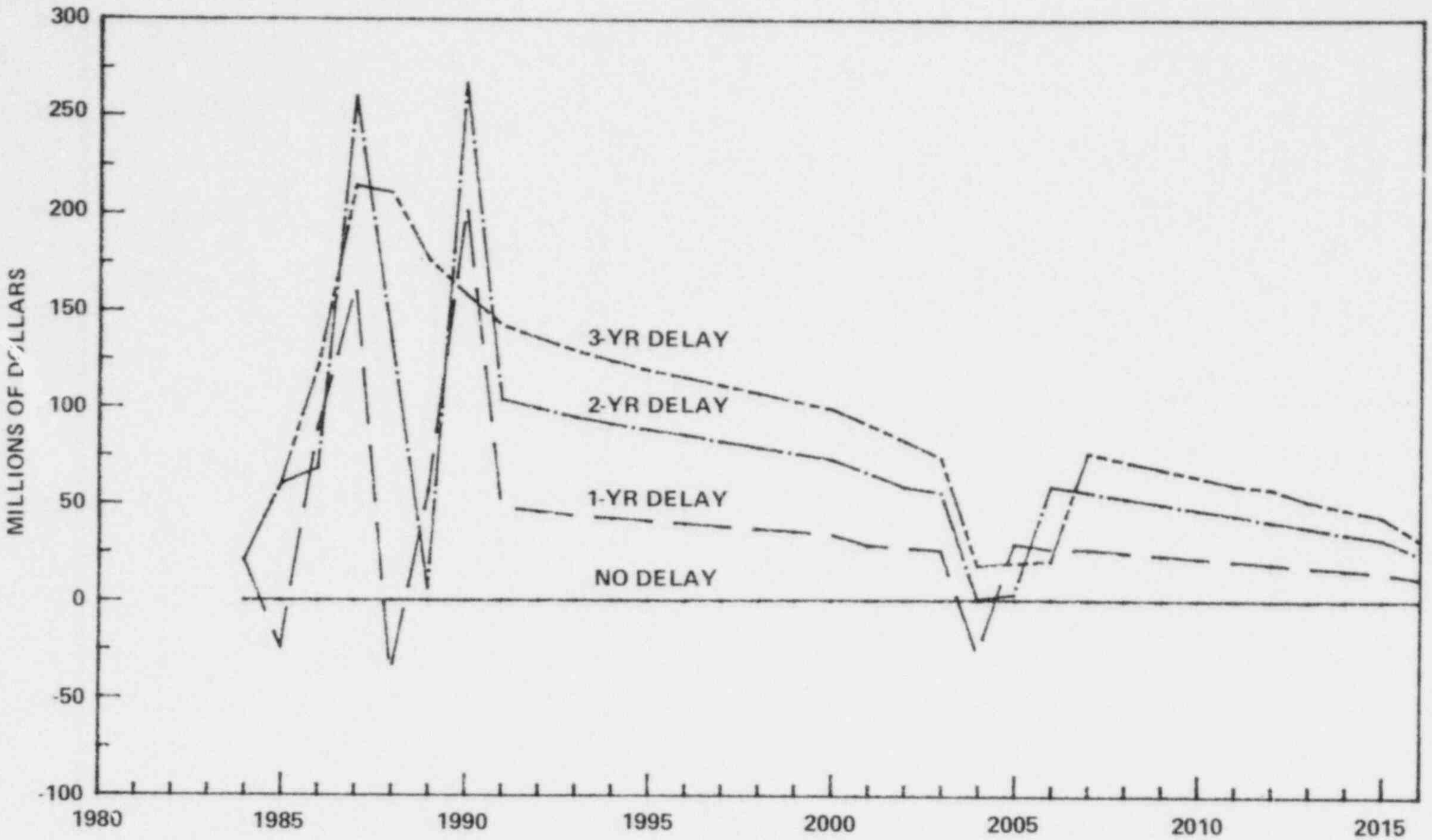
RELIABILITY and ADEQUACY are two separate but interdependent aspects relating to the bulk power supply system of the electric utility industry in North America. RELIABILITY involves the security of the interconnected transmission network and the avoidance of uncontrolled cascading tripouts which may result in widespread power outages. ADEQUACY refers to having sufficient generating capability to be able at all times to meet the aggregate electric peak loads of all customers and supply all their electric energy requirements.

MAP OF NATIONAL ELECTRIC RELIABILITY COUNCIL (NERC)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 1.3-1



ANNUAL COST OF DELAY OF PNPP
COMPARED TO BASE (NO DELAY) CASE

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 1.3-2

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACES

This chapter presents the basic relevant information concerning those physical, biological, and human characteristics of the area environment that might be affected by the operation of the Perry Nuclear Power Plant (PNPP). To the extent possible, the information presented reflects observations and measurements made over a period of years.

2.1 GEOGRAPHY AND DEMOGRAPHY

This section has been completely updated to reflect changes in population and land use that have occurred since the submittal of the ER/CP.

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 Specification of Location

Located in a rural part of Lake County, Ohio, the site is approximately 7 miles northeast of Painesville, the county seat, and approximately 35 miles northeast of Cleveland, the nearest large city. The eastern two-thirds of the site is within the boundaries of North Perry Village, and the western third is within Perry Township. Lake Erie borders the site to the north. Figures 2.1-1 and 2.1-2 show the location of the plant site with respect to Lake Erie, nearby roads, highways, communities, cities, and various topographic features.

The centerline of the reactor for Unit 1 is located at north latitude 41° 48' 04.2" and west longitude 81° 08' 36.6"; under the Universal Transverse Mercator (UTM) grid, it is located in zone 17 at coordinates 4,627,498 meters north and 488,079 meters east. The centerline of the Unit 2 reactor is at north latitude 41° 48' 02.3" and west longitude 81° 08' 35.6"; under the UTM grid, it is at coordinates 4,627,437 meters north and 488,100 meters east.

2.1.1.2 Site Area Maps

The plant site is located along the southeastern shoreline of Lake Erie on an ancient lake plain approximately 50 feet above lake low water datum. It is approximately 1,100 acres in size and relatively flat. The land has a very gentle slope toward the lake and is incised by small streams which drain into the lake. About 45 percent of its area is covered with light to heavy woodland with the remainder consisting mostly of farmland and nursery stock.

Figure 2.1-3 shows the topographic features of the plant site in relation to the approximate location of the plant facilities. Figure 2.1-4 is an aerial photograph of the site showing the site boundaries, exclusion area, location of the plant, and the general character of the immediate surroundings.

The entire site, as shown in Figure 2.1-4, is owned by CEI except for the right-of-ways for public township and village roads which traverse the area just outside the exclusion area boundary. A right-of-way easement was granted to the East Ohio Gas Company for rerouting their gas line through the site as shown in Figure 2.1-3.

2.1.1.3 Boundaries for Establishing Effluent Release Limits

CEI purchased all land within the site boundary except for the right-of-ways of public township and village roads outside the exclusion area boundary. Additionally, the mineral rights of one parcel outside the site boundary in Lake Erie is controlled by CEI. This parcel (Figure 2.1-5) encompasses the cooling water tunnel facilities that project into Lake Erie. CEI entered into a contract with the State of Ohio for this area, delineated as "Limits of Mineral Rights" in Figure 2.1-5, wherein the State of Ohio agreed not to exercise their right to lease for salt mining the offshore area within the "Limit of Mineral Rights" for the life of the plant (46 years). No domestic residences exist within the site boundaries; however, certain areas of farmland and nursery within the site may continue to be used after the plant is constructed.

The exclusion area is that area which is situated inside 2,900-foot radii centered on the Unit 1 and Unit 2 reactors. Except for Lake Erie, the exclusion area is completely within site boundaries. The minimum distances from the plant effluent release points to the exclusion area boundary are shown in Figure 2.1-4. CEI controls the mineral rights, both within the exclusion boundary on land and within 1,800 feet of all safety-related structures in Lake Erie, to preclude subsidence as a detrimental effect on safety structures.

Those portions of Center Road and Lockwood Road within the exclusion area have been withdrawn from public use, and gates have been installed across these roads to discourage public access to the area. No public road traverses the exclusion area.

2.1.2 POPULATION DISTRIBUTION

2.1.2.1 Population Within 10 Miles

Figure 2.1-6 shows the locations of nearby cities and towns within a 10-mile radius of the Perry Nuclear Power Plant. Table 2.1-1 presents these population groupings and their associated 1975 population estimates[1] according to distance and direction from the plant site.

The 1978 estimated population within 10 miles of the station is 73,134 persons; within 5 miles the estimate is 16,875 people.

As shown in Figure 2.1-6, the following municipalities are located either totally or partially within 10 miles of the plant.

Municipality	1975 Estimated Population	Approximate Distance (Miles) and Direction from Plant to Center of Incorporated Areas
North Perry	872	1.5 - SW
Perry	1,005	3.0 - S
Madison	1,774	5.5 - ESE
Painesville	17,407	7.0 - SW
Fairport Harbor	3,287	7.0 - WSW
Grand River	599	8.0 - WSW
Geneva	7,167	10.0 - E
Geneva-on-the-Lake	980	10.0 - ENE
Mentor	39,523	15.0 - SW

The 0 to 5-mile population distribution was determined from a physical house count conducted in July 1978. Referenced from the U.S. Bureau of the Census[2] housing unit factors of 3.60, 3.68, and 3.11 people per housing unit for the townships of Madison, Perry, and Painesville, respectively, were applied to the survey results to determine the 1978 population. Estimates of population for the years 1980, 1983, 1984, 1985, 1986, 2000, 2010, and 2020 were calculated by applying the Lake County growth rates[3] to the 1978 population.

Population distributions between 5 and 10 miles of the PNPP were based on the 1970 census data. Numerical centroids (population totals at concentration centers) were assigned to geographical areas across the continental United States by the U.S. Census Bureau. Population totals per segment were calculated based on the location of the centroids relative to the reactor location. Population estimates to the year 2020 were projected by applying the decennial growth rates of pertinent counties in Ohio[3] to the 1970 population distribution results. Decennial growth rates past the year 2000 were assumed to be equivalent to those of 1990 to 2000. Figures 2.1-8 through 2.1-

16 show the projected populations from the year 1978 through 2020.

The population estimates for the first year of operation are reflected in Figure 2.1-9. In the event of construction delays, population estimates for 1984, 1985, and 1986 are included in Figures 2.1-10 through 2.1-12.

2.1.2.2 Population Betweeen 10 and 50 Miles

Figure 2.1-7 shows the locations of significant population concentrations within 50 miles of the plant. The population-distribution estimates for the area between 10 and 50 miles were calculated by methods similar to those used in estimating the 5- to 10-mile populations. As in Ohio, pertinent Pennsylvania county growth rates[4] were factored into calculations where appropriate.

The influence of Canadian populations on the totals within 50 miles of the plant is minimal. The town of Erieau in Harwich Township, Kent County, is located in the northwestern sector, approximately 45 miles from the plant. Utilizing the 1971 and 1976 population figures for Erieau,[5] the population estimates for 1978, 1980, 1983, 1984, 1985, and 1986 were calculated. It was assumed that the decennial growth rates of Kent County were applicable to Erieau. Since population predictions for Kent County were available only to the year 2000,[6] decennial growth rates to the year 2020 were based on the rate for the decade from 1990 to 2000.

Figures 2.1-8 through 2.1-17 show the projected population distribution for the years 1978 to 2020 for the areas between 10 and 50 miles of the plant.

2.1.2.3 Transient Population

Transient populations within 10 miles of the plant are primarily the result of local, seasonal fluctuations of people at various parks and camps. Large recreational areas such as Township Park, near Madison, and Headlands State Park, 7.5 miles west-southwest of the plant, offer a variety of facilities that also attract visitors from outside the 10-mile radius. Table 2.1-2 gives the annual attendance figures for significant parks and camps near the site.[7]

Most of the summer cottages in both Lake and Ashtabula Counties have been converted to permanent residences.[8,9] Lake County has approximately 275 vacant and seasonal cottages, 189 of which are located west of the site.[8] No data are available for cottages and transient populations in Geneva-on-the-Lake in Ashtabula County.[9,10]

Manufacturing facilities that have a total work force exceeding 100 people and are located in close proximity to the plant are the Neff-Perkins Corporation and the IRC Fibers Company. The Neff-Perkins Corporation, located 3,000 feet west-southwest of the plant, has a work force of 175 persons[11]; the IRC Fibers Company, 3.5 miles west-southwest, employs 400.[12] For both firms, the average time at work is 45 hours per week for each employee. This includes a 40-hour work week[13,14] and approximately 5 hours per week for lunch and miscellaneous time at the work site.

2.1.3 USES OF ADJACENT LANDS AND WATERS

2.1.3.1 Use of Land Immediately Adjacent to the PNPP

This section describes land and water uses adjacent to the PNPP. Figure 2.1-3 is a topographic map of the site and adjacent area. It shows key water- and land-use features, the boundaries of the site, the exclusion area, and the locations of the principal PNPP structures.

The site is comprised of approximately 1,100 acres owned by the applicant. Some 250 acres are devoted to the main physical structure complex in the northern portion of the site near Lake Erie. Most of the remainder of the site consists of natural grassland and forested areas. (Information on the ecological aspects of the lands within and adjacent to the site is presented in Section 2.2.) Some onsite land is used for pasture and for growing nursery stock.

Figure 2.1-18 shows present land uses at the site and in the adjacent and nearby environs. Most of the land along the boundaries of the site is forestland, grassland, or vacant - as are the lands immediately adjacent to the site, with the exception of small residential areas near Camp Roosevelt on the west and near North Perry Park to the northeast. Landscaped berms have been constructed by CEI along Parmly Road to the east and west of Center Road. Mature and seral forests in the eastern and western portions of the site provide a natural buffer between natural, park, residential, and agricultural land uses.

The PNPP buildings are located on the northern portion of the site. The exclusion area, therefore, includes the nearby waters of Lake Erie, but no land area outside of the site boundary. Onsite activities will be limited to the generation of electrical power.

2.1.3.2 Nearest Meat and Milk Animals, Gardens, and Residences

Table 2.1-3 provides data[15] on the nearest meat and milk animals, gardens over 500 square feet in area, and residences for each of the 16 sectors surrounding the plant. Minimum distances to site boundary points are given in Table 2.1-4.

Most of the milk produced within 5 miles of the PNPP is used for home consumption. Table 2.1-5 lists tne locations, owners, and uses of the milk produced by dairy cows within 5 miles of the plant. There is one commercial dairy within the 5-mile radius.(16)

The residence nearest to the reactor containment area is approximately 3,750 feet northeast of the center of Units 1 and 2 (specifically, the midpoint on a line between the centers of the two units). This residence is adjacent to the vehicle turnaround loop on Lockwood Road. Several dwellings are located along Lockwood Road in this area.

2.1.3.3 Present and Future Use of Land Within 5 Miles of the PNPP

Figure 2.1-19 shows present land uses within 5 miles of the plant. Aside from forestland, most of the land is used for agriculture and pasture. Residential, industrial, commercial, utility, recreational, and other uses are scattered throughout the area.

A great number of nurseries are located in the vicinity of the plant; most of these are in Perry and Madison Townships to the south and east. Favorable conditions along Lake Erie have encouraged the growth of a highly productive nursery industry - one that is today a multimillion dollar business.(16) Major highways in the area, including U.S. Route 20, are dotted with retail outlets offering nursery stock. Other agricultural activities are small in comparison. Grapes, vegetables, and fruit are some of the agricultural products of the area. Wheat, oats, rye, corn, and other feed grains are of minor importance. There are also many open fields that have gone fallow.(16)

The major residential areas are the small villages of Perry, North Perry, and Madison. New single-family developments are sprouting to the east of the site in Madison Township, in the Narrows Road area and Perry Township, and to the west in Painesville Township. Continued urban pressure from the west is expected to influence land use and land values in the vicinity of the plant.

Most of the land west of the site (north of U.S. Route 20) is zoned for industrial use. Most of this land is now used for agriculture. Some land is forested, and some is open fields not presently used for agriculture. The major industrial establishments are the Neff-Perkins Corporation and the IRC Fibers Company. Parmly and Perry Township Parks, located adjacent to the western boundary of the site near Lake Erie, are two of the three recreational parks in the nearby vicinity.

South of U.S. Route 20, the land is also characteristically agricultural, with interspersed open, wooded, and residential areas. The Route 20 corridor, although largely zoned for commercial use through the 5-mile radius, contains many residential, agricultural, and open areas; there are scattered commercial areas as well. The small communities of North Perry and Perry use land in a variety of ways, generally in accordance with existing zoning. The land surrounding these towns (as well as Madison) is primarily agricultural, forested, or open-field land.(17)

At present, housing in the area is limited to single family dwellings. Several developments of low-density housing are being built 2 to 4 miles east and east-northeast of the site. The land east of the site along U.S. Route 20 is primarily zoned for commercial use. Some of it is zoned for residential use; the remainder is undeveloped. Along the Conrail railroad corridor, which traverses the area in a southwest-northeast orientation, there are several scattered industrial parks.

Additional fallow or otherwise open land along the corridor is zoned for future industrial use.[17]

The Grand River runs through a natural area between Painesville and Ashtabula. The river has been officially designated a "wild river" in this area south of the PNPP. Although it is not an officially designated wildlife sanctuary, the area supports many wildlife species rarely seen in other parts of Ohio. The river is within 4 miles of the site at its closest point.[17]

The region around the site, from Painesville to Madison, has experienced steady growth over the past several decades. The influencing factor has been the continued exodus of people from the Cleveland urban area. This trend is expected to continue to influence land-use patterns, concentrations, and values for years to come. Land uses projected for the 5-mile area are shown in Figure 2.1-20.

2.1.3.4 Agricultural Activities

2.1.3.4.1 Area Within 10 Miles of the PNPP

The area within 10 miles of the PNPP is located almost entirely within Lake County and Lake Erie. It is predominantly agricultural, with interspersed grassland and forestland. To the west, more residential and industrial use is evident. The percentage of land used for agriculture in Lake County is approximately 16.4 percent.[18]

There is very little cattle grazing in Lake County[16,19] and only one commercial dairy, Green Farms, approximately 4 miles east of the PNPP main building complex. Green Farms has about 75 head (calves, heifers, cows).[16]

2.1.3.4.2 Area Within 50 Miles of the PNPP

The 13-county area within 50 miles of the plant consists of all or part of Lorain, Cuyahoga, Medina, Summit, Lake, Geauga, Portage, Ashtabula, Trumbull, and Mahoning Counties in Ohio and Erie, Crawford, and Mercer Counties in Pennsylvania. Generally, there is a clear delineation between the agricultural activities associated with the Lake Erie shoreline and those of areas about 5 to 50 miles inland. The soils and climatic conditions have encouraged the establishment of a nursery stock industry along the lake - the highest income-producing agricultural activity of the southern shoreline of Lake Erie. Interspersed with the nurseries, but much less dominant, are orchards producing tree fruits, small fruits, and grapes. Some vegetable farms, growing mainly tomatoes, complement the intensive pockets of nurseries (notably in Erie County, Pennsylvania).[20]

Dairy farming is the leading source of agricultural income in the region. Livestock is important, particularly in the Ohio counties. Moreover, the area is generally known as an excellent forage-producing region. The primary forage crops are grasses and legumes (including alfalfa, clover, and birdsfoot treefoil).[20] In northeastern Ohio and northwestern Pennsylvania, the grazing season lasts from approximately May 15 to October 15 or November 1.[15,20,21] There is some variation in the dairy animal feeding regimes used throughout the 50-mile area; however, some general practices are employed in nearly all counties. Most of the silage, especially corn silage that is used for feed, is grown by the farmer or else raised nearby.[20] A large proportion of the remaining hay and silage is grown in the immediate area. Some protein supplements are fed to the dairy cattle. The dairy cattle within the 50-mile area are pastured approximately half the time during the summer months, but stored feed (mostly corn silage and hay) is also used. Stored feed is used during the winter months. For beef cattle, pasture may supply as little as 25 percent of the food.[20] Green chop feeding, the practice of feeding chopped field crops directly to livestock (omitting the use of silage), is not common. It is estimated that very little green chop feeding is used within 50 miles of the site.[20]

Agricultural production statistics for 1974 and 1977 are given in Table 2.1-6. The data are presented by sectors derived from the 16 points of the compass and radii of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles.

2.1.3.5 Commercial and Recreational Fishing and Hunting

2.1.3.5.1 Commercial Fishing

In the area within 50 miles of the PNPP, the water body that will be predominantly affected by plant discharges is Lake Erie. Both commercial and sport fishing all over Lake Erie has been erratic because of pollution; however, the total U.S. commercial catch, as reported by the National Marine Fisheries Service, has increased in recent years. From an all-time low of 8.8 million pounds in 1971, the harvest rose to 9.8 million pounds in 1974. Since 1954, Canada has outproduced the U.S. fishermen on Lake Erie: in 1974 the Canadian catch was 38.6 million pounds.[22]

The principal commercial species harvested from Lake Erie are carp (32 percent of total), white bass (30 percent of total), and yellow perch (24 percent of total). Several other species account for the remaining 14 percent of U.S. commercial fishing in Lake Erie. The leading species in the Canadian catch is smelt.[22]

Detailed catch figures for the statistical grid delineations closest to the site show a reported harvest in 1977 of 352,651 pounds - an increase of 14 percent over the preceding year.[23]

The grid area lying offshore of Fairport Harbor and extending approximately from Mentor Headlands to North Perry was the second highest for all grid areas along the lakeshore from the western Cleveland area to the Pennsylvania border. The major species fished in this region are yellow perch and freshwater drum, which account for about 90 and 10 percent, respectively, of the total catch.[23]

The Ohio Department of Natural Resources estimates that future harvests of perch, drum, and gizzard shad will increase from present levels, while the catch of walleye, white bass, and channel catfish is estimated to remain constant or fall below present levels.[23]

Principal ports for the lakeshore region of Lake, Cuyahoga, and Ashtabula Counties include Cleveland, Fairport Harbor, Ashtabula, and Conneaut. The principal species harvested at these points are yellow perch and freshwater drum. It is estimated that 90 to 95 percent of the total fish harvested at these ports are shipped out of the port city and that generally 40 percent of all Ohio-produced fish are sold out of the State.[23]

2.1.3.5.2 Recreational Fishing

Recreational fishing in the three-county lakeshore area has been declining in recent years. In 1977 the total catch was 106,836 pounds[23]; the major recreational fish species are drum (45 percent of the total), followed by yellow perch (37 percent) and white bass (16 percent). Most of the recreational fishing is from shore locations at Cleveland, Mentor, Fairport Harbor, Ashtabula, and Conneaut.[23] There are many public fishing areas along the Erie lakeshore within 50 miles of the plant. (See Table 2.1-7 and Figure 2.1-21 for listing and location of shoreline recreational water-use areas.) It is assumed that all fish caught for pleasure are consumed locally. No species currently or historically indigenous to the lake waters in this region have been used as stock for fish farms.[23]

The nearest publicly accessible point to the plant discharge is the open water of Lake Erie above the discharge on the lake bottom. However, most Lake Erie fishing is done from the shore. From the lakeshore it would be possible to fish from a location at the northeastern site boundary approximately 3700 to 4000 feet from the discharge. To the southwest of the site, the nearest publicly accessible point is just beyond the Neff-Perkins plant site - approximately 4400 to 4900 feet from the discharge. However, there is no evidence of fishing success at these particular points; the best lakeshore fishing points are considered to be along the breakwaters at the harbors on the lake.

2.1.3.5.3 Hunting

The area within 50 miles of the PNPP includes 10 counties in Ohio and three in Pennsylvania. The Ohio counties are generally developed; Lake and Cuyahoga Counties in particular are highly urbanized. These counties are not major hunting areas, as shown by the deer-kill figures in Table 2.1-8. In fact, the two state hunting zones in which these counties are located had the lowest total kills for the State, excluding zone 2, where only bow hunting was permitted.[34]

A moderate amount of hunting activity occurs in the Pennsylvania counties (and Ashtabula and Trumbull Counties, Ohio). It is quite probable that these counties are major hunting areas for portions of the urban hunters of Cleveland, Pittsburgh, Erie, and Youngstown. A current evaluation of recreational facilities for Ohio shows that most counties within the 50-mile area have a surplus of hunting land that will remain through 1990.[35]

Big-game kill data are quite accurate and extensive for both states (Table 2.1-9). However, there is no information on where the game is consumed. It is assumed that most game harvested within 50 miles of the plant is consumed within the region.

2.1.3.6 Coordination of Plant Activities with Uses of Adjacent Lands and Water

The plant is sited for a functional and safe operation and compatibility with the natural environment of the surrounding area and communities. To this end, it was decided to keep the outer areas of the site in their present natural state and to provide landscaping and screening devices.

The plant is well situated for access by road, water, and rail. A railroad spur to the plant was built from the IRC Fibers Company approximately 3 miles west. It is owned by the applicant and operated by the Fairport, Painesville, and Eastern Railroad. The line extends through a large area, west of the plant and north of U.S. Route 20, which is zoned for industrial use. Most of the rail line has been routed through an existing transmission right-of-way.

The barge slip, used to deliver heavy equipment, will be allowed to fill with silt. No future use is planned for it; however, if needed, the applicant may redredge the slip for future use. The intake and discharge structures have been constructed according to U.S. Army Corps of Engineers specifications and, as such, have been built so as not to interfere with shipping or boating.

Major roads in the area (Interstate 90, Ohio Route 2, U.S. Route 20) provide good access to the PNPP. Center and Parmly Roads provide access to the site; Center Road is the main entrance to the major facilities area. Center Road north of the intersection of Center and Parmly Roads, and Lockwood Road on the northeastern site boundary are controlled entrances. All local east-west traffic is handled by Parmly Road and U.S. 20.

The site is traversed by the Eastlake-Ashtabula (345-kV) transmission line and a 20-inch, 150-psi gas line. Proposed new transmission-line alignments are discussed in Section 3.9.

The area in the vicinity of the plant has experienced steady growth over the past several decades. The influencing factor has been the exodus of people from the Cleveland urban area. This trend is expected to continue to influence land-use patterns, concentrations, and property values for years to come. Figure 2.1-19 shows projected land use by 5-year intervals to the year 2000.

In the nearby vicinity of the PNPP, the areas to the east in Madison Township are those experiencing the most growth. Since the ER/CP submittal, the township's population has increased from 12,455 inhabitants to 15,236 - an increase of approximately 22 percent.(17) By the year 2000, the township's population will have more than doubled. Growth rates in Perry and Painesville Townships will be similar.(17) Figure 2.1-20 depicts, by land-use type, the areas most likely to exhibit growth in future years.

2.1.3.7 <u>Uses of Water Within 50 Miles of the PNPP</u>

The PNPP is located along the southern shoreline of Lake Erie. Its cooling system is a closed-loop cooling-tower system, and hence the effects on the lake will be minimized. However, a certain amount of blowdown from the towers will be continuously discharged to the lake.

The potential uses of water that could be impacted by plant effluents are addressed in the subsections that follow. The area evaluated is within a radius of 50 miles and encompasses parts of Lorain, Cuyahoga, Lake, and Ashtabula Counties in Ohio, and Erie County in Pennsylvania.

2.1.3.7.1 Water Supplies

Lake Erie is directly or indirectly the source of most of the potable-water supplies within 5 miles of the plant. Fairport Harbor and Painesville rely on Lake Erie to provide water to an estimated 30,000 persons.(36) Potable water is supplied to approximately 1,700 persons in Perry by the Ohio Water Service via Painesville (Lake Erie).(36) To the east of the plant, Madison relies on three wells and two ponds to serve 2,000 inhabitants.(36) In addition, 4,900 residential wells serve the inhabitants of Lake County.(37)

Fairport Harbor, Madison, and Painesville anticipate operational changes in the near future: Fairport Harbor is updating its treatment facilities; Madison will add additional wells, update its pumping equipment, and add additional (0.375 million gallon daily) elevated storage; and Painesville will increase its distribution system and add an additional Lake Erie intake with a capacity of 12 million gallons per day.(36)

Among the municipal water-supply systems, the intake that is closest to the plant is at Fairport Harbor, approximately 7 miles southwest (see Table 2.1-10 and Figure 2.1-20 for a listing and map of the locations of Lake Erie potable water intakes in the region).

2.1.3.7.2 Irrigation Uses

Little or no water from Lake Erie is used for irrigation in the nearby Ohio counties: Lake, Ashtabula, Cuyahoga, and Lorain.[38] The nursery business and other agriculture activities that require supplemental water generally rely on water drawn from small ponds and small streams. Wells are generally not a practical source of irrigation water.

2.1.3.7.3 Recreational Uses

Lake Erie is a major center of recreational activities, with many public and private recreational facilities along the shore within 150 miles. Campsites, boat docks, and small beaches are located along the shoreline. Boating, sailing, and fishing account for much of the recreational use (see Table 2.1-7 and Figure 2.1-21). With the water quality of Lake Erie improving, the demand for recreational water use within 50 miles of the plant will increase. Demand for all water-based recreational activities will increase in all Ohio counties that abut Lake Erie within 50 miles of the plant.[40]

2.1.3.7.4 Transportation Uses

Lake Erie has long been an important transportation link for many of the economic centers in the Great Lakes region since it is part of the Saint Lawrence Seaway System. In 1976, 129.8 million freight tons of U.S. traffic were carried on Lake Erie (including the upper Niagara River).[41]

2.1.3.7.5 Wells

Within 50 miles of the PNPP there are many locations where residential water supplies are drawn from wells. Most of the area is underlain by Ohio shale, which is very dense and does not transmit water well. The only inland areas where there is a likelihood of recharge are in the several buried valleys of the region.[42]

2.1.3.7.6 Regional Consumptive Uses of Water

Under normal operating conditions, the PNPP will require approximately 69,400 gallons of water per minute (155 cubic feet per second). All water required for plant operation will be taken from Lake Erie. Approximately 65 percent of the water will pass through service-water heat exchangers and return to the lake via a diffuser pipe. The balance will be required for cooling-tower makeup and will be evaporated. It is not anticipated that the plant's use of lake water will have any effect on other regional uses of lake water.

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TABLE 2.1-1

TOWNS AND CITIES WITHIN FIFTY MILES OF THE PNPP

Town/City (Ohio)	Estimated 1975 Population[a]	Distance (miles) From Plant Site	Direction From Plant Site
0-5 MILES FROM PNPP			
North Perry	872	1	E
Perry	1,005	3	S
5-10 MILES FROM PNPP			
Madison	1,774	6	ESE
Painesville City	17,407	7	SW
Fairport Harbor	3,287	8	WSW
Grand River	599	9	WSW
10-20 MILES FROM PNPP			
Geneva-on-the-Lake	980	11	ENE
Geneva	7,167	11	E
Mentor-on-Lake	7,585	14	WSW
Kirtland Hills	468	15	SW
Mentor	39,523	15	SW
Chardon	4,397	16	SSW
Aquilla	457	18	S
Ashtabula City	24,264	18	ENE
Rock Creek	765	18	SE
Willoughby City	19,896	18	SW
Waite Hill	534	18	SW
Eastlake	21,805	19	SW
Lakeline	217	19	WSW
Timberlake	1,085	19	WSW
20-30 MILES FROM PNPP			
Jefferson	2,629	20	ESE
Willowick City	19,614	21	SW
Willoughby Hills	6,842	22	SW
Burton	1,253	23	S
Kirtland	6,063	23	SW
Wickliffe	18,365	23	SW
Gates Mills	2,252	24	SW
Kingsville Township	1,921	24	ENE
Middlefield	1,907	24	S
Orwell	1,130	24	SE

TABLE 2.1-1 (Continued)

TOWNS AND CITIES WITHIN FIFTY MILES OF THE PNPP

Town/City (Ohio)	Estimated 1975 Population[a]	Distance (miles) From Plant Site	Direction From Plant Site
20-30 MILES FROM PNPP			
Euclid City	63,307	25	SW
Highland Heights	6,702	25	SW
Richmond Heights City	10,175	25	SW
Mayfield	4,542	26	SW
North Kingsville	2,648	26	ENE
Hunting Valley	830	27	SSW
Chagrin Falls City	4,839	28	SSW
Lyndhurst	19,564	28	SW
Moreland Hills	3,652	28	SSW
Pepper Pike	5,788	28	SW
South Euclid	28,590	28	SW
South Russell	2,897	28	SSW
Beachwood City	10,908	29	SW
Bratenahl	1,656	29	SW
East Cleveland City	38,144	29	SW
University Heights	17,672	29	SW
Woodmere	1,141	29	SW
30-40 MILES FROM PNPP			
Bentleyville	379	31	SSW
Cleveland Heights	51,141	31	SW
Shaker Heights	34,759	31	SW
West Farmington	782	31	SSE
Andover	1,424	33	ESE
Cleveland	638,793	33	SW
North Randall	1,199	33	SW
Warrensville Heights	17,787	33	SW
Bedford Heights	12,741	34	SW
Hiram	1,688	34	S
Solon City	12,617	34	SSW
Bedford City	16,302	36	SW
Glenwillow	538	36	SSW
Maple Heights	31,434	36	SW
Reminderville	518	36	SSW
Garfield Heights	38,206	37	SW
Garrettsville	2,289	37	S
Newburgh Heights	3,425	37	SW
Oakwood	4,429	37	SSW
Cuyahoga Heights	781	38	SW
Macedonia	6,057	38	SSW
Mantua	1,228	38	S
Twinsburg	6,959	38	SSW

TABLE 2.1-1 (Continued)

TOWNS AND CITIES WITHIN FIFTY MILES OF THE PNPP

Town/City (Ohio)	Estimated 1975 Population[a]	Distance (miles) From Plant Site	Direction From Plant Site
30-40 MILES FROM PNPP			
Walton Hills	2,937	38	SW
Valley View	1,466	38	SW
Brooklyn Heights	1,723	39	SW
Cortland	3,379	39	SE
Independence	6,565	39	SW
Windham	3,595	39	S
Town/City (Pa.)			
30-40 MILES FROM PNPP			
Linesville	1,179	39	ESE
Town/City (Ohio)			
40-50 MILES FROM PNPP			
Streetsboro	8,084	41	SSW
Seven Hills	13,999	41	SW
Linndale	163	41	SW
Brooklyn	13,805	42	SW
Lakewood	65,395	42	WSW
Warren	60,486	43	SSE
Boston Heights	926	43	SSW
Brecksville	8,410	43	SW
Newton Falls	5,069	44	SSE
Sugar Bush Knolls	124	44	SSW
Hudson	4,614	44	SSW
Broadview Heights	12,938	44	SW
Parma	98,883	44	SW
Parma Heights	25,080	44	SW
Rocky River	22,726	44	WSW
Orangeville	294	46	SE
Ravenna	12,212	46	S
Brady Lake	356	46	SSW
Peninsula	675	46	SSW
North Royalton	13,649	47	SW
Fairview Park	20,609	47	WSW
Niles City	23,246	48	SSE
Craig Beach	1,512	48	S
Silver Lake	3,369	48	SSW

TABLE 2.1-1 (Continued)

TOWNS AND CITIES WITHIN FIFTY MILES OF THE PNPP

Town/City (Ohio)	Estimated 1975 Population[(a)]	Distance (miles) From Plant Site	Direction From Plant Site
40-50 MILES FROM PNPP			
Richfield	3,237	48	SW
Middleburg Heights	15,177	48	SW
Brook Park	30,132	48	SW
Westlake	16,871	48	WSW
North Olmsted	37,420	48	WSW
Bay Village	18,969	48	WSW
Yankee Lake	43	49	SE
Munroe Falls	4,091	49	SSW
Berea City	21,360	49	SW
McDonald	3,498	50	SSE
Strongsville	20,781	50	SW
Avon Lake	12,387	50	WSW
Town/City (Pa.)			
40-50 MILES FROM PNPP			
Springboro	643	41	E
Conneautville	1,082	41	E
Albion	1,744	42	E
Cranesville	765	43	E
Jamestown	1,039	43	ESE
Platea	320	44	ENE
Lake City	2,214	45	ENE
Girard	3,212	45	ENE
Conneaut Lake	771	46	ESE
Greenville	8,595	48	SE
Fairview	2,363	49	ENE

(a) From Reference 1.

TABLE 2.1-2

MAJOR CAMPS AND PARKS WITHIN 10 MILES OF THE PNPP[a]

Park or Camp	Annual Attendance	Distance (miles) and Direction from Site
CYO Camp Isaac	4,120[b]	2.5, ENE
Camp Wingfoot	175[b]	2.5, ENE
Township Park	60,000[b]	6.0, ENE
Headlands State Park	704,383 (1977)	7.5, WSW

[a] Data from Ref. 8.
[b] Estimated.

TABLE 2.1-3

NEAREST MILK AND MEAT ANIMALS, RESIDENCES, AND GARDENS[a]

	Distance (meters)							
	Residence		Garden		Milk Cow		Beef	
Direction	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
N	--	--	--	--	--	--	--	--
NNE	--	--	--	--	--	--	--	--
NE	1009	961	1009	961	--	--	--	--
ENE	1273	1850	1273	1850	3058	3058	--	--
E	1777	1729	1777	1729	5940	5940	--	--
ESE	1850	1826	1850	1826	6920	6920	--	--
SE	1922	1850	1922	1850	5955	5955	5955	5955
SSE	1369	1297	1369	1297	--	--	--	--
S	1273	1249	1273	1249	--	--	--	--
SSW	985	1057	985	1057	8047	8047	8047	8047
SW	1970	1946	1970	1946	--	--	--	--
WSW	1681	1729	1681	1729	--	--	--	--
W	--	--	--	--	--	--	--	--
WNW	--	--	--	--	--	--	--	--
NW	--	--	--	--	--	--	--	--
NNW	--	--	--	--	--	--	--	--

(a) Data from Ref. 15.

TABLE 2.1-4

DISTANCES TO SITE BOUNDARY POINTS FROM UNITS 1 AND 2

Direction	Distance (meters)	
	Unit 1	Unit 2
*N	294	427
*NNE	402	495
*NE	678	800
ENE	1079	1079
E	1104	1072
ESE	1130	1083
SE	1345	1269
SSE	1445	1316
S	1420	1298
SSW	1452	1284
SW	1047	1563
WSW	900	893
*W	430	610
*WNW	283	455
*NW	273	409
*NNW	280	409

* Site boundary to Lake Erie.

TABLE 2.1-5

MILK COWS WITHIN 5 MILES OF THE PNPP[a]

Distance (miles) and Direction from Plant	Number of Cows	Owner	Address	Use of Milk
1.9, ENE	1	Farone	Lockwood Rd.	Personal - adult
1.9, ENE	1	Oneil	Townline Rd.	Personal - adult and occasional infant
3.7, SE	50-60	Brewster	South Ridge Rd.	Personal - adult and children; predominantly used for breeding and sale
5.0, SSW	2	Colburn	Lane Rd.	Personal - adult
4.3, ESE	11	Quayle	South Ridge Rd.	Sale as replacement for other dairies
3.7, E	40	Green Farms	Green Rd. and U.S. Route 20	Commercial

[a]Data from Ref. 15.

TABLE 2.1-6

MEAT, MILK, AND VEGETABLE PRODUCTION STATISTICS FOR THE AREA WITHIN 50 MILES OF THE PNPP

MILK PRODUCTION, (l/yr)

DIRECTION	DISTANCE									
	0-1 mi	1-2 mi	2-3 mi	3-4 mi	4-5 mi	5-10 mi	10-20 mi	20-30 mi	30-40 mi	40-50 mi
N	--	--	--	--	--	--	--	--	--	--
NNE	--	--	--	--	--	--	--	--	--	--
NE	--	--	--	--	--	--	--	--	--	--
ENE	--	1.00E 04	--	--	--	4.07E 05	3.80E 06	5.43E 06	7.41E 06	1.09E 07
E	--	--	--	--	--	8.14E 05	5.43E 06	9.05E 06	1.31E 07	1.75E 07
ESE	--	--	--	--	5.51E 04	5.43E 05	5.43E 06	9.05E 06	1.25E 07	1.58E 07
SE	--	--	--	3.01E-05	--	2.69E 05	5.06E 06	8.03E 06	8.39E 06	1.20E 07
SSE	--	--	--	--	--	5.39E 05	3.23E 06	5.22E 06	7.90E 06	1.01E 07
S	--	--	--	--	--	--	3.23E 06	5.98E 06	7.81E 06	9.96E 06
SSW	--	--	--	--	1.00E 04	--	2.51E 06	4.19E 06	2.39E 06	9.96E 05
SW	--	--	--	--	--	--	--	--	--	3.61E 06
WSW	--	--	--	--	--	--	--	--	--	1.14E 06
W	--	--	--	--	--	--	--	--	--	--
WNW	--	--	--	--	--	--	--	--	--	--
NW	--	--	--	--	--	--	--	--	--	--
NNW	--	--	--	--	--	--	--	--	--	--
Totals	--	1.00E 04	--	3.01E 05	6.51E 04	2.57E 06	2.87E 07	4.70E 07	5.95E 07	8.20E 07

Note: 1. -- Means value is zero or less than 0.00E-01.
2. 5.32E 04 means 5.32 x 10^4.

TABLE 2.1-6 (Continued)

MEAT, MILK, AND VEGETABLE PRODUCTION STATISTICS FOR THE AREA WITHIN 50 MILES OF THE PNPP

VEGETABLE PRODUCTION, (kg/yr)

DIRECTION	DISTANCE									
	0-1 mi	1-2 mi	2-3 mi	3-4 mi	4-5 mi	5-10 mi	10-20 mi	20-30 mi	30-40 mi	40-50 mi
N	--	--	--	--	--	--	--	--	--	--
NNE	--	--	--	--	--	--	--	--	--	--
NE	--	--	--	--	--	--	--	--	--	--
ENE	7.71E 03	2.28E 04	3.40E 04	4.23E 04	4.78E 04	2.39E 05	6.42E 05	9.17E 05	4.17E 06	.13E 06
E	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	3.65E 05	9.17E 05	1.53E 06	3.01E 06	2.93E 06
ESE	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	4.33E 05	9.17E 05	1.53E 06	5.34E 06	9.39E 06
SE	7.71E 03	2.28E 04	3.78E 04	5.29E 04	6.83E 04	4.37E 05	8.39E 05	1.32E 06	1.27E 06	1.31E 06
SSE	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	3.06E 05	7.01E 05	7.69E 05	1.41E 06	2.23E 06
S	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	5.68E 05	7.01E 05	8.78E 05	3.37E 06	4.64E 06
SSW	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	5.68E 05	1.05E 06	1.22E 06	2.58E 06	3.17E 06
SW	7.71E 03	2.28E 04	3.78E 04	5.28E 04	6.83E 04	5.68E 05	2.27E 06	2.00E 06	2.56E 06	3.17E 06
WSW	7.71E 03	1.37E 04	7.56E 03	1.06E 04	1.37E 04	1.70E 05	2.27E 05	--	--	1.32E 06
W	--	--	--	--	--	--	--	--	--	--
WNW	--	--	--	--	--	--	--	--	--	--
NW	--	--	--	--	--	--	--	--	--	--
NNW	--	--	--	--	--	--	--	--	--	--
Totals	6.94E 04	1.96E 05	3.06E 05	4.23E 05	5.40E 05	3.65E 06	8.26E 06	1.02E 07	2.37E 07	3.73E 07

Note: 1. -- Means value is zero or less than 0.00E-01.

2. 5.32E 04 means 5.32×10^4.

TABLE 2.1-6 (Continued)

MEAT, MILK, AND VEGETABLE PRODUCTION STATISTICS FOR THE AREA WITHIN 50 MILES OF THE PNPP

MEAT PRODUCTION, (kg/yr)

DIRECTION	DISTANCE									
	0-1 mi	1-2 mi	2-3 mi	3-4 mi	4-5 mi	5-10 mi	10-20 mi	20-30 mi	30-40 mi	40-50 mi
N	--	--	--	--	--	--	--	--	--	--
NNE	--	--	--	--	--	--	--	--	--	--
NE	--	--	--	--	--	--	--	--	--	--
ENE	--	--	--	--	--	2.27E 04	2.12E 05	3.03E 05	4.58E 05	7.20E 05
E	--	--	--	--	--	4.55E 04	3.03E 05	5.05E 05	7.87E 05	1.09E 06
ESE	--	--	--	--	--	3.03E 04	3.03E 05	5.05E 05	7.44E 05	1.17E 06
SE	--	--	--	--	--	1.29E 04	2.77E 05	4.40E 05	4.33E 05	8.12E 05
SSE	--	--	--	--	--	2.58E 04	1.55E 05	2.59E 05	4.14E 05	5.76E 05
S	--	--	--	--	--	--	1.55E 05	2.87E 05	5.10E 05	6.71E 05
SSW	--	--	--	--	--	--	1.21E 05	2.01E 05	1.94E 05	1.81E 05
SW	--	--	--	--	--	--	--	--	--	2.13E 05
WSW	--	--	--	--	--	--	--	--	--	8.82E 04
W	--	--	--	--	--	--	--	--	--	--
WNW	--	--	--	--	--	--	--	--	--	--
NW	--	--	--	--	--	--	--	--	--	--
NNW	--	--	--	--	--	--	--	--	--	--
Totals	--	--	--	--	--	1.37E 05	1.53E 06	2.50E 06	3.54E 06	5.52E 06

Note: 1. -- Means value is zero or less than 0.00E-01.
2. 5.32E 04 means 5.32×10^4.

TABLE 2.1-7

MAJOR SHORELINE RECREATIONAL WATER AREAS WITHIN 50 MILES OF THE PNPP[a]

Name of Area	Location	Distance (miles) and Direction from Site
North Perry Park	Lake County	1, ENE
Perry Township Park	Lake County	1, WSW
Parmly Park	Perry, Ohio	1, WSW
Camp Roosevelt	Lake County	1.5, WSW
Lake Shore Park	Lake County	2, ENE
Tuttle Park	Lake County	4, ENE
Madison Township Park	Lake County	5, ENE
Painesville Township Park	Lake County	5, WSW
Cummings Beach	Lake County	6, ENE
Rowland Beach	Lake County	6, ENE
Fairport Harbor Beach	Lake County	7, WSW
Fairport Harbor Park	Lake County	7, WSW
Headland's Beach State Park	Lake County	7, WSW
Helen Hazen Wyman Metropolitan Park	Lake County	7, WSW
Murphy Beach	Lake County	7, ENE
Aero Marina	Grand River, Ohio	7, WSW
Garrett's Landing	Grand River, Ohio	7, WSW
Rutherford's Landing	Grand River, Ohio	7, WSW
Fairport Harbor Yachting Club	Fairport, Ohio	7, WSW
Fairport Boat Landing	Painesville, Ohio	7, WSW
Arcola Creek	Lake County	8, ENE
Grand River Yachting Club	Lake County	8, WSW
Mentor Marsh Nature Reserve	Lake County	8, WSW
Municipal Beach	Lake County	8, WSW
Geneva-on-the-Lake State Park	Geneva-on-the-Lake, Ohio	9, ENE
Mentor Lagoons Pheasant Preserve	Lake County	11, WSW
Mentor Marsh Beach Club	Lake County	12, WSW
Mentor Harbor Yachting Club	Lake County	12, WSW
Mentor Lagoons Marina	Lake County	12, WSW
Mentor Beach Park	Lake County	13, WSW
Lobo Beach	Lake County	14, WSW
Arrowhead Shore Club	Lake County	14, WSW
Lake County Yachting Club	Willoughby, Ohio	15, WSW
Willoway A Park	Lake County	16, WSW
Chagrin Marina	Lake County	17, WSW
Bolton's Marina	Lake County	17, WSW
Walnut Beach	Ashtabula, Ohio	18, ENE
Lakeshore Park	Ashtabula, Ohio	18, ENE

TABLE 2.1-7 (Continued)

MAJOR SHORELINE RECREATIONAL WATER AREAS WITHIN 50 MILES OF THE PNPP[(a)]

Name of Area	Location	Distance (miles) and Direction from Site
Jack's Automarine	Ashtabula, Ohio	18. ENE
Chagrin Lagoons Yachting Club	Eastlake, Ohio	19, WSW
Chagrin River Yachting Club	Eastlake, Ohio	19, WSW
Lakeshore Marina	Eastlake, Ohio	19, WSW
Private park	Lake County	20, WSW
Willow Beach Park	Lake County	21, SW
Euclid Park	Euclid, Ohio	26, SW
Sims Park	Euclid, Ohio	26, SW
City of Conneaut Public Docks	Conneaut	33, ENE
Wildwood Yachting Club	Cleveland, Ohio	35, SW
Forest City Yachting Club	Cleveland, Ohio	36, SW
Gordon Shore Yachting Club	Cleveland, Ohio	36, SW
Lakeside Yachting Club	Cleveland, Ohio	36, SW
Northeast Yachting Club	Cleveland, Ohio	36, SW
Wildwood Park	Cleveland, Ohio	36, SW
White City Park	Cleveland, Ohio	36, SW
Gordon Park	Cleveland, Ohio	36, SW
East 55th St. Municipal Marina	Cleveland, Ohio	36, SW
East 9th St. Pier	Cleveland, Ohio	36, SW
Edgewater Municipal Park	Cleveland, Ohio	36, SW
Edgewater Yachting Club	Cleveland, Ohio	36, SW
Edgewater Marina	Cleveland, Ohio	36, SW
Lakewood Park access	Lakewood, Ohio	40, WSW
Lake Edge Park	Rocky River, Ohio	42, WSW
Rocky River Park	Rocky River, Ohio	42, WSW
Racoon Creek	Springfield Township, Erie County, PA	42, ENE
Cleveland Yachting Club	Rocky River, Ohio	42, WSW
Westlake Yachting Club	Rocky River, Ohio	42, WSW
Bay Yachting Club	Bay Village, Ohio	45, WSW
Cahoon Park	Bay Village, Ohio	45, WSW
Columbia Park	Bay Village, Ohio	45, WSW
Huntington Park	Bay Village, Ohio	45, WSW
Walnut Creek	Fairview Township, Erie County, PA	46, ENE

[(a)]Data from References 24 through 33.

TABLE 2.1-8

OHIO HUNTING HARVEST DATA FOR 1977-1978[a]

County	Number of Animals Harvested	
	Deer	Beaver
Ashtabula	458	235
Cuyahoga	4	NA
Geauga	126	193
Lake	26	11
Lorain	35	NA
Mahoning	79	NA
Medina	39	NA
Portage	72	38
Summit	31	7
Trumbull	409	189

[a]Data from Refs. 34 and 39.

Note: NA = not available.

TABLE 2.1-9

PENNSYLVANIA BIG-GAME HARVEST IN 1976[a]

County	Number of Deer Harvested[b]
Crawford	2002
Erie	1260
Mercer	755

[a] Data from Ref. 23.
[b] Hunting was limited to deer; there was no hunting season for bears in 1976.

TABLE 2.1-10

LAKE ERIE POTABLE WATER FACILITIES AND INTAKES WITHIN 50 MILES OF THE PNPP[a,b]

Owner and Location	Estimated Population Served	Surface Safe Yield (mgd)	Plant System Capacity (mgd)	Distance (miles) and Direction from PNPP	Intake
		LAKE COUNTY, OHIO			
Eastlake	(20,300)[c]	--	--	(See Cleveland)	(See Cleveland)
Lakeline	(305)	--	--	--	--
Timberline	(970)	--	--	--	--
Fairport Harbor	3,805	4.0	1.0	7, WSW	Lake Erie
Grand River	(1,200)	--	--	(See Painesville)	(See Painesville)
Ohio Water Service Co.					
East System (Green Rd. plant)	9,128	1.3	1.0	4.2, ENE	Lake Erie
West System (Mentor-on-the-Lake plant)	65,000	15.0	8.0	10, WSW	Lake Erie
Concord Township (part)	(2,737)	--	--	--	--
Kirtland Township (part)	(2,499)	--	--	--	--
Mentor	(44,173)	--	--	--	--
Mentor Headlands	NA	--	--	--	--
Mentor-on-the-Lake	(7,102)	--	--	--	--
Mentor Township	NA	--	--	--	--
Painesville Township (part)	(2,891)	--	--	--	--
Waite Hill	(308)	--	--	--	--
Willoughby (part)	NA	--	--	--	--
Painesville	26,000	12.0	8.0	7.5, WSW	Lake Erie
Perry	1,680	--	--	(See Painesville and Ohio Water Service Co.)	(See Ohio Water Service Co.)
Wickliffe	(23,000)	--	--	(See Cleveland)	(See Cleveland)
Willoughby[d]	(9,100)	--	--	(See Cleveland)	(See Cleveland)
Willoughby Hills	(8,600)	--	--	(See Cleveland)	(See Cleveland)
Willowick	(23,000)	--	--	(See Cleveland)	(See Cleveland)

TABLE 2.1-10 (Continued)

LAKE ERIE POTABLE WATER FACILITIES AND INTAKES WITHIN 50 MILES OF THE PNPP[a,b]

Owner and Location	Estimated Population Served	Surface Safe Yield (mgd)	Plant System Capacity (mgd)	Distance (miles) and Direction from PNPP	Intake
ASHTABULA COUNTY, OHIO					
Ashtabula Water Works Co.	36,150	12.0	12.0	20, ENE	Lake Erie
Conneaut	15,500	3.0	3.0	33, ENE	Lake Erie
CUYAHOGA COUNTY, OHIO					
Cleveland	2,000,000	(500.0)	(500.0)	35, SW	Lake Erie
Baldwin plant	--	170.0	170.0	--	--
Crown plant	--	50.0	50.0	--	--
Division plant	--	180.0	180.0	--	--
Nottingham plant	--	100.0	100.0	--	--
LORAIN COUNTY, OHIO					
Avon	(7,216)	--	--	(See Avon Lake)	(See Avon Lake)
Avon Lake	30,000	15.0	6.0	50, WSW	Lake Erie
Sheffield[e]	(1,887)	--	--	(See Avon)	(See Avon)

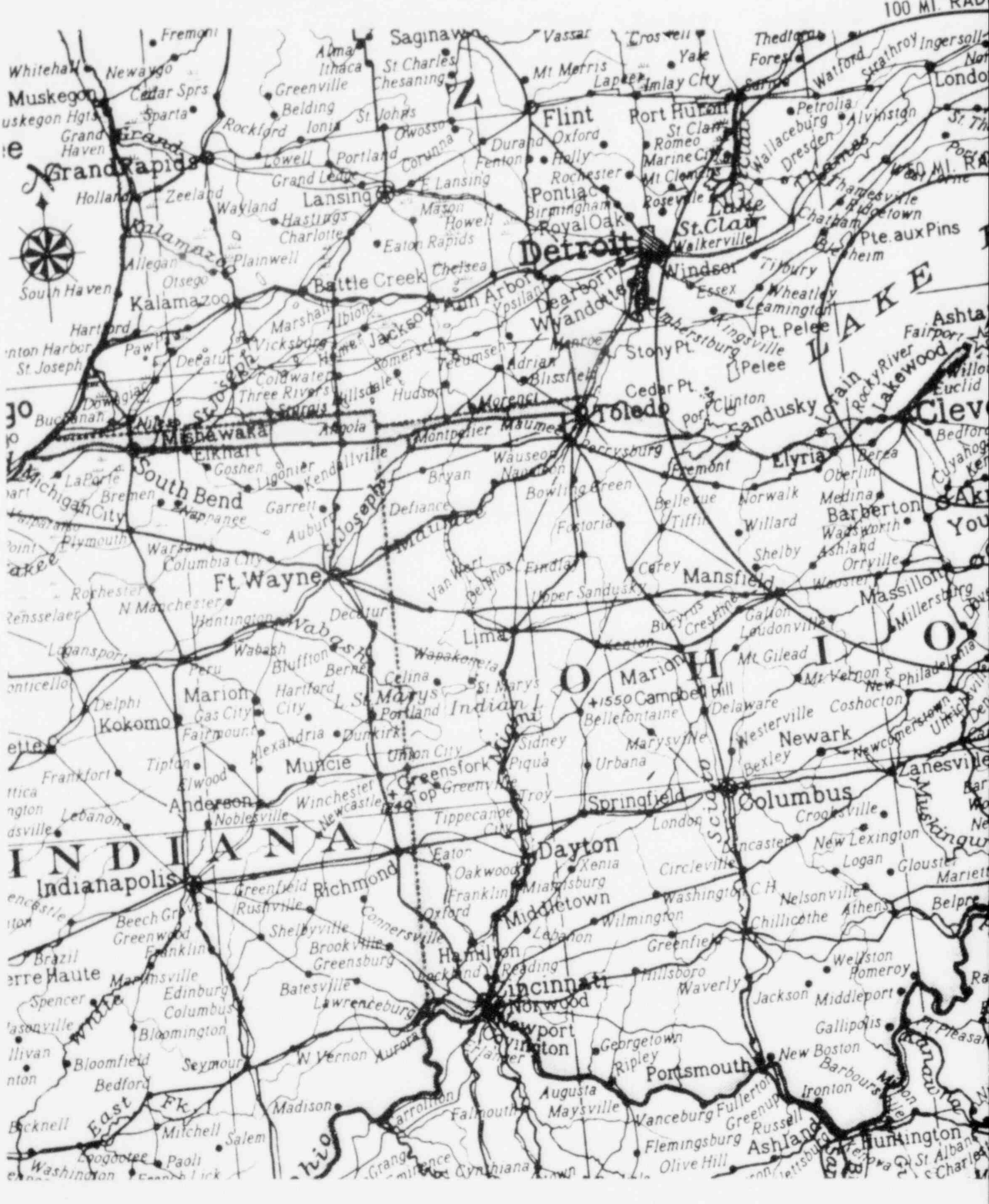
[a] Data from Refs. 33 through 35. No intakes within 50 miles of the site exist in Erie County, PA (See Reference 39).

[b] Key: mgd, million gallons per day; NA, not available; dashes indicate that data are not applicable or forementioned.

[c] Reported total population served by water facility. Estimated population is generally based on three to five people per service tap. Population served by secondary supplier is enclosed in parentheses and subtracted from the total figure reported by the prime supplier.

[d] Total population served in Willoughby amounts to 19,600: 10,500 residents served by the Willoughby system and 9100 residents served by Cleveland and the Ohio Water Service Company.

[e] Has standby emergency tie-in with 8-inch line from Avon.

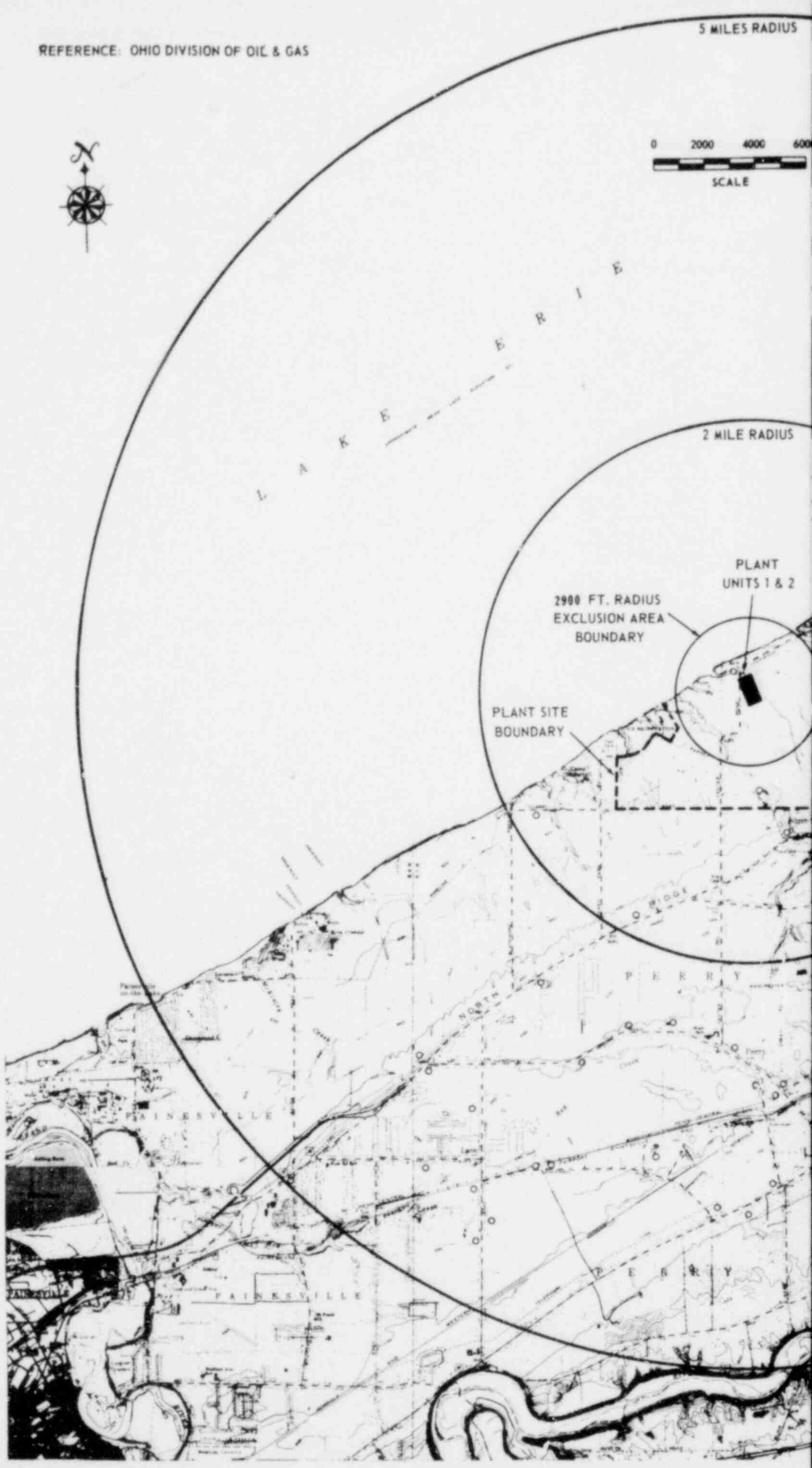

100 MI. RAD
Saginaw
Muskegon
Grand Rapids
Lansing
Flint
Port Huron
Detroit
Windsor
Battle Creek
Kalamazoo
Jackson
Ann Arbor
Dearborn
Wyandotte
Toledo
Sandusky
Lorain
Elyria
Lakewood
South Bend
Mishawaka
Elkhart
Ft. Wayne
Mansfield
Lima
Marion
Kokomo
Muncie
Anderson
Columbus
Newark
Zanesville
Springfield
Dayton
Middletown
Hamilton
Richmond
Indianapolis
Terre Haute
Cincinnati
Norwood
Newport
Covington
Portsmouth
Ashland
Huntington
LAKE
INDIANA
OHIO
Barberton
Massillon
Ft. Wayne
Michigan City
Bloomington
Chillicothe
Circleville
Lancaster
Athens
Ironton
Gallipolis
Pte. aux Pins
Pt. Pelee
Stony Pt.
Cedar Pt.
St. Clair
Walkerville

GENERAL AREA MAP

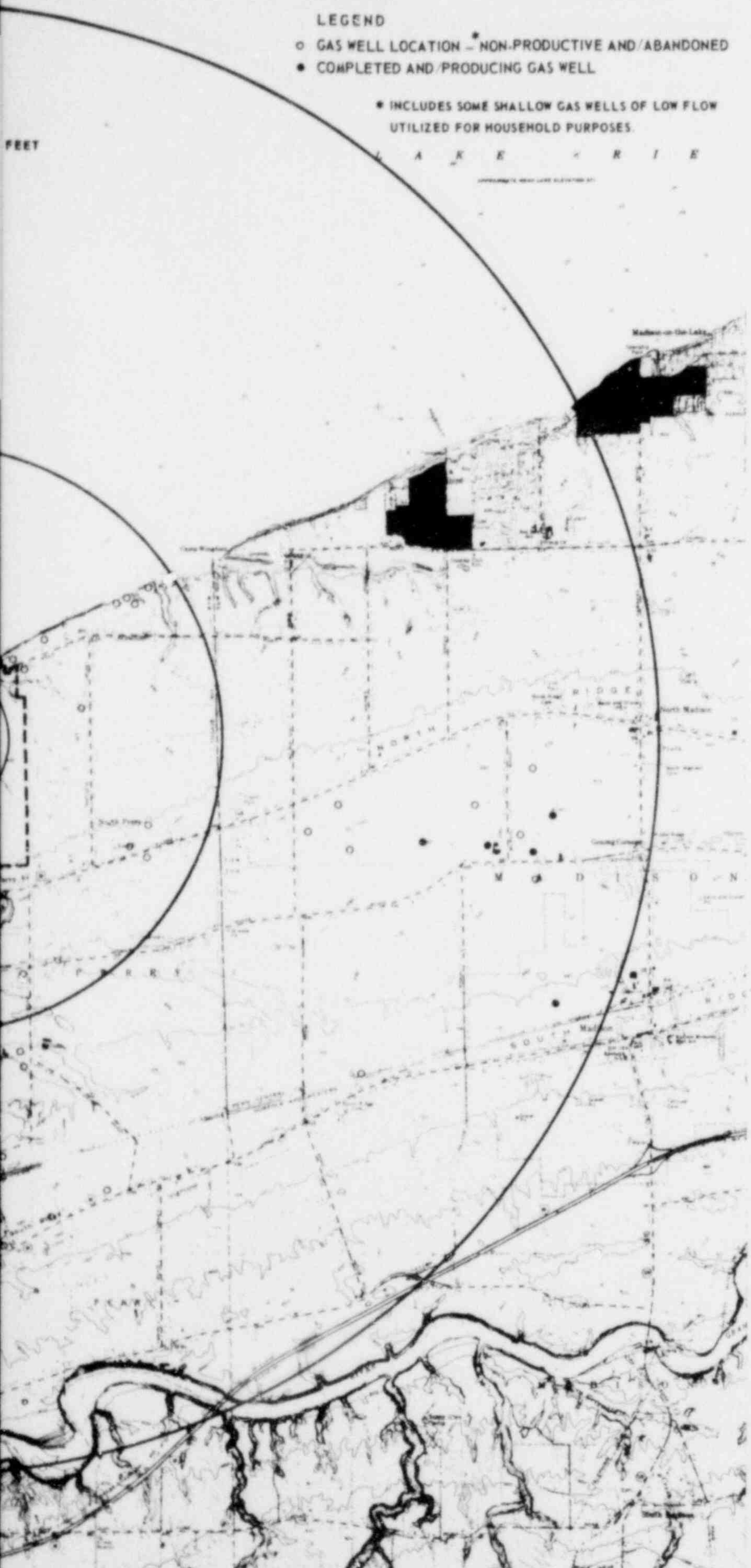
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-1



REFERENCE: OHIO DIVISION OF OIL & GAS
5 MILES RADIUS
0 2000 4000 6000
SCALE
L A K E E R I E
2 MILE RADIUS
PLANT UNITS 1 & 2
2900 FT. RADIUS EXCLUSION AREA BOUNDARY
PLANT SITE BOUNDARY
PERRY
PAINESVILLE
PAINESVILLE
PERRY



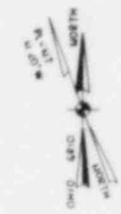
AREA TOPOGRAPHY WITHIN 5 MILE RADIUS

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-2


LAKE ERIE
INTAKE STRUCTURES
DISCHARGE STRUCTURE
SITE NO. 3
MAJOR STREAM DIVERSION
SEDIMENT CONTROL DAM
SITE NO. 2
NORTHWEST STORM DRAINAGE
SEDIMENT CONTROL DAM
SITE NO. 1
MAJOR STREAM SEDIMENT
CONTROL DAM
TRANSMISSION STATION
PLANT SITE BOUNDARY LI



TOPOGRAPHIC CONTOURS ARE IN FEET

NOTES:

1. COORDINATES SHOWN ON THIS DRAWING ARE BASED ON THE OHIO STATE COORDINATE SYSTEM
2. REACTOR COORDINATES

	OHIO GRID	PLANT GRID
UNIT 1	[illegible]	[illegible]
UNIT 2	[illegible]	[illegible]

NOTE:
ALL BACKGROUND CONTOURS SUPPLIED BY AERIAL SURVEYS INC.

TOPOGRAPHY WITHIN THE PLANT SITE BOUNDARY

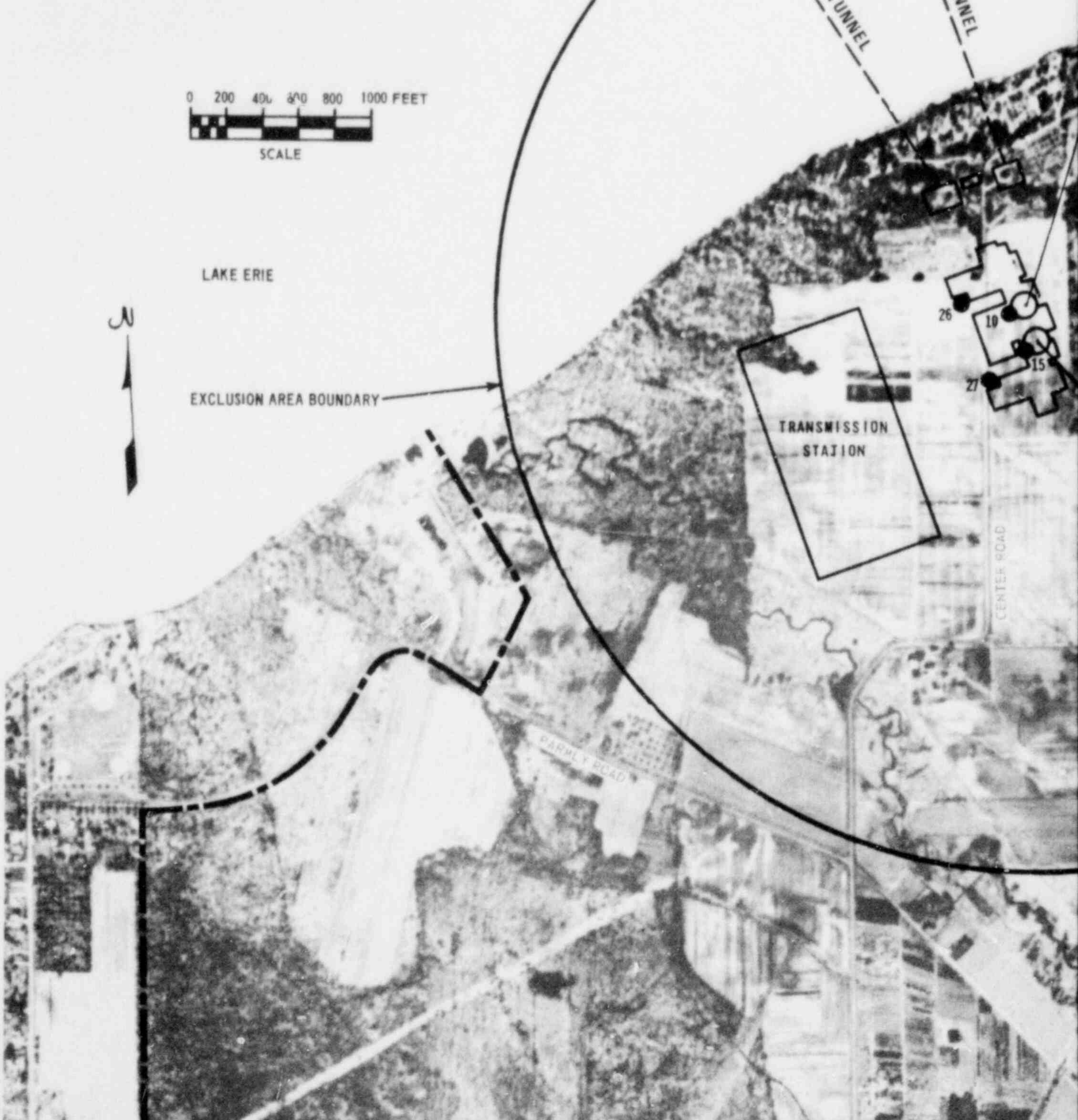
PERRY NUCLEAR POWER PLANT 1 & 2

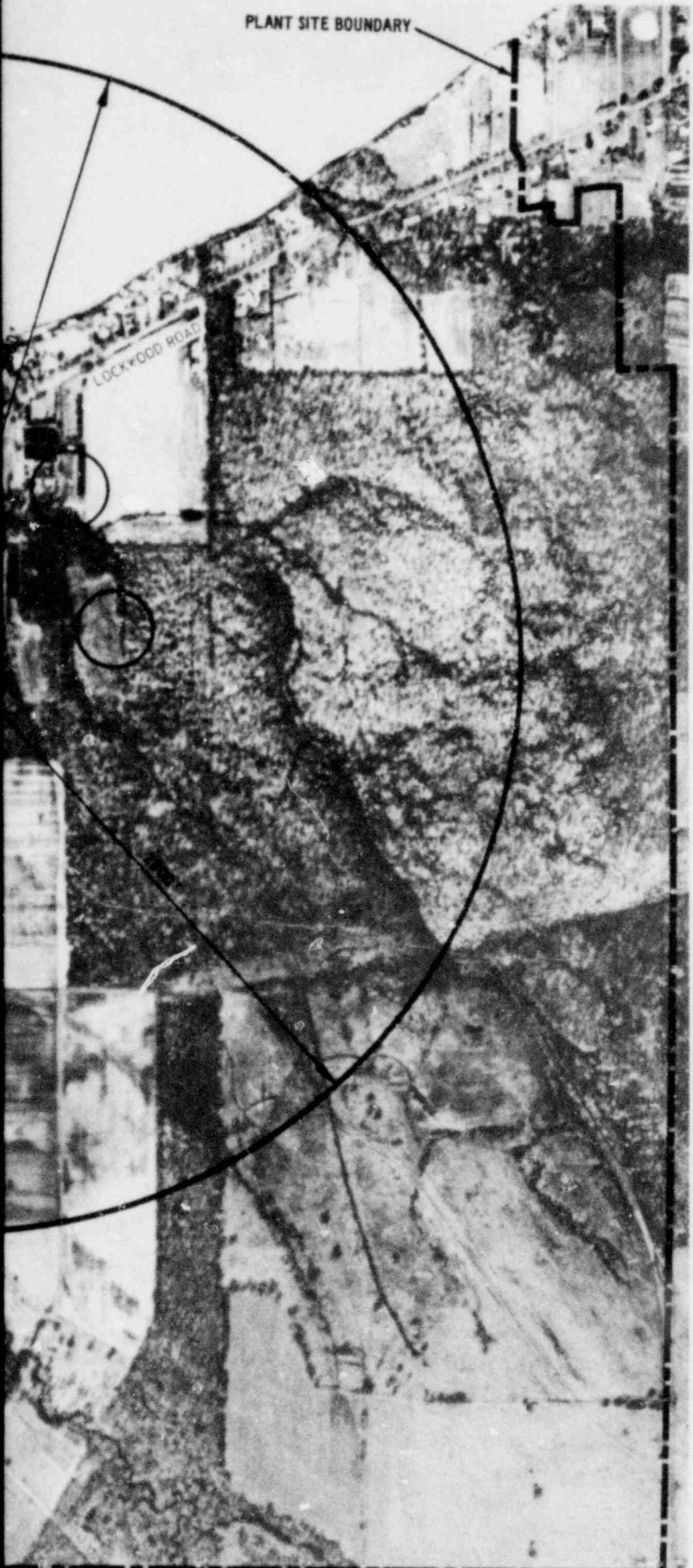
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-3

LEGEND

RELEASE POINT NUMBER	DESCRIPTION	MINIMUM DISTANCE TO EXCLUSION AREA BOUNDARY
10	PLANT VENT. - UNIT 1	2800 FT.
15	PLANT VENT. - UNIT 2	2800 FT.
26	OFF-GAS RELEASE - UNIT 1	2600 FT.
27	OFF-GAS RELEASE - UNIT 2	2600 FT.
32	LIQUID RADWASTE DISCHARGE	240 FT.



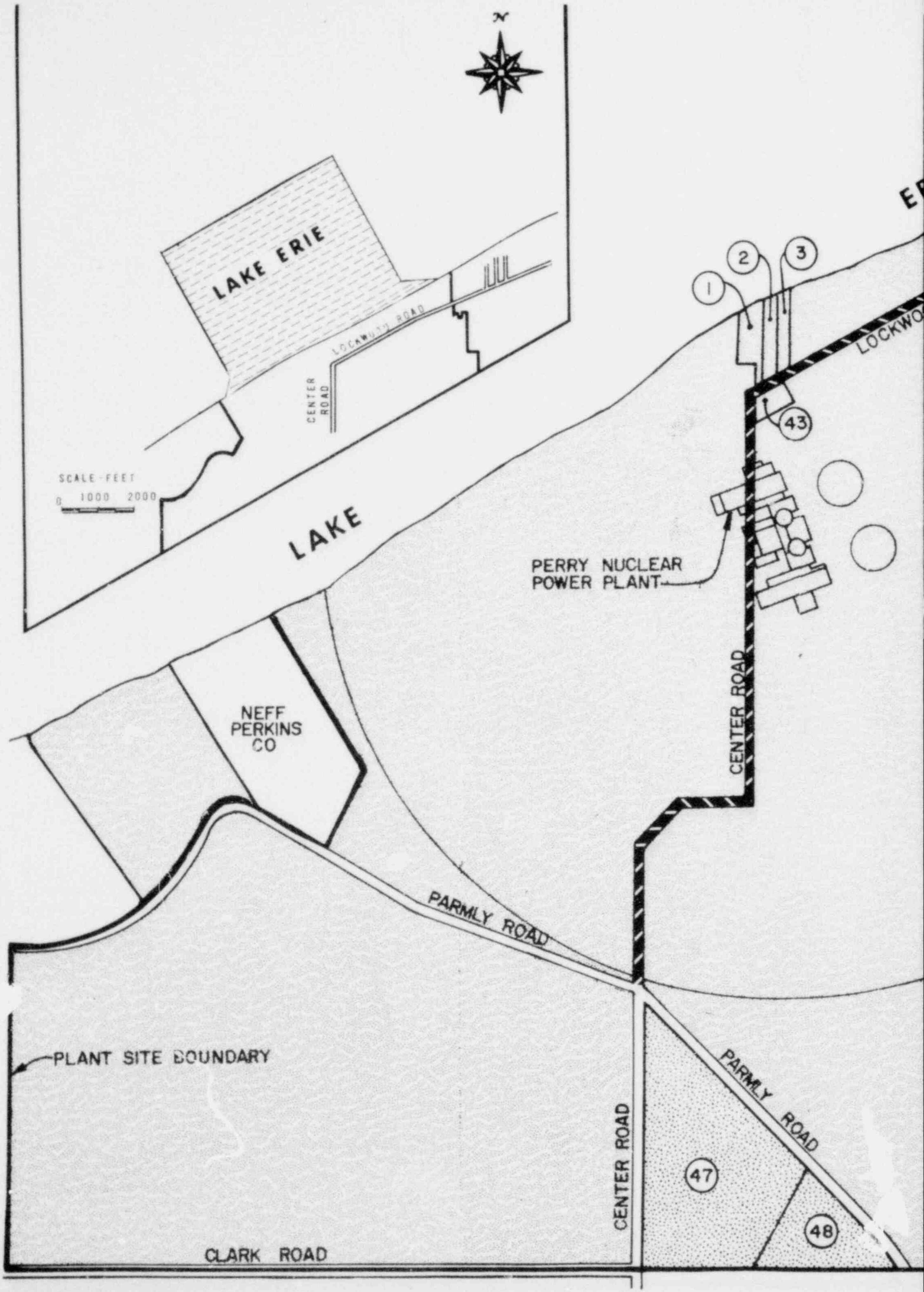


PLANT SITE AERIAL PHOTOGRAPH

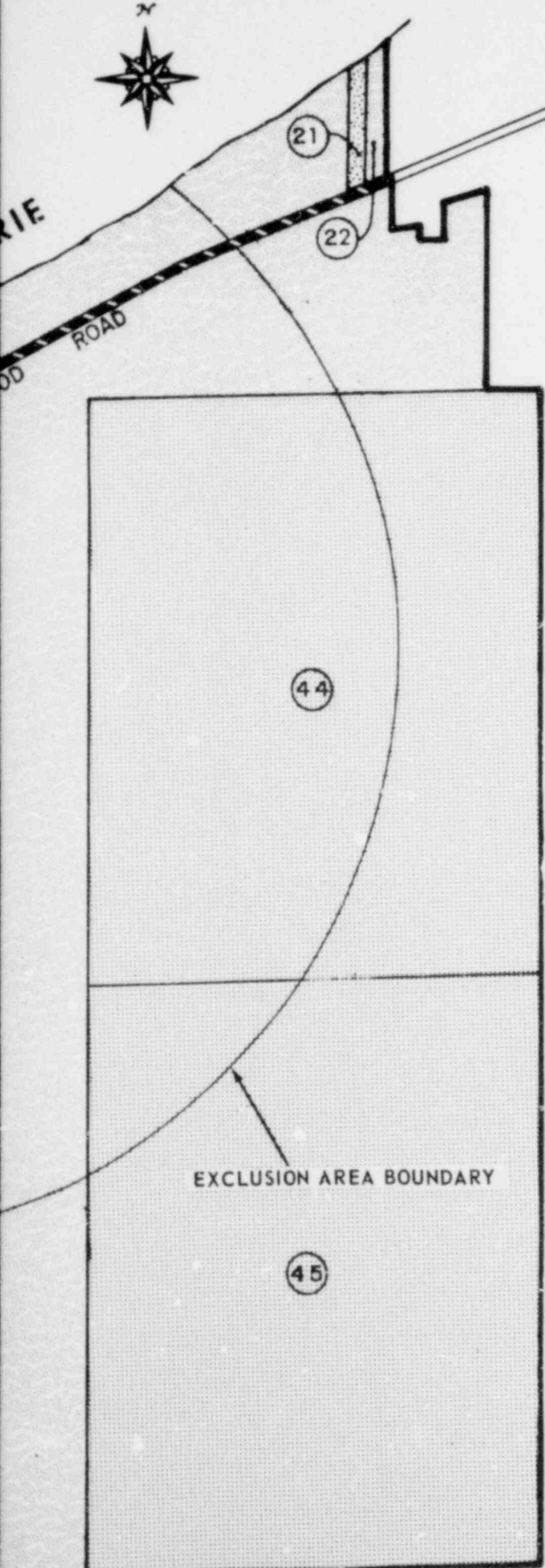
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-4



N
LAKE ERIE
LOCKWOOD ROAD
CENTER ROAD
SCALE-FEET
0 1000 2000
LAKE
ER
1
2
3
LOCKWO
43
PERRY NUCLEAR POWER PLANT
CENTER ROAD
NEFF PERKINS CO
PARMLY ROAD
PLANT SITE BOUNDARY
PARMLY ROAD
CENTER ROAD
47
48
CLARK ROAD



LEGEND

PROPERTY OUTSIDE EXCLUSION BOUNDARY NOT UNDER CEI CONTROL

ACQUIRED 11/74

CURRENT LAND AND MINERAL RIGHTS OWNED BY CEI 1/1/75

"LIMITS OF MINERAL RIGHTS" ACQUIRED BY FORMAL LEASE AGREEMENT COMPLETED BETWEEN CEI AND THE STATE OF OHIO FOR A 46 YEAR PERIOD (5/14/1976 TO 5/14/2022) DATED 6/8/76

(44) PARCEL NUMBER

GAS AND OIL RIGHTS ACQUIRED 10/25/76

PUBLIC RIGHT OF WAY

PUBLIC RIGHT OF WAY VACATED BY A RESOLUTION ADOPTED BY THE BOARD OF LAKE COUNTY COMMISSIONERS ON 6/16/75

SCALE-FEET

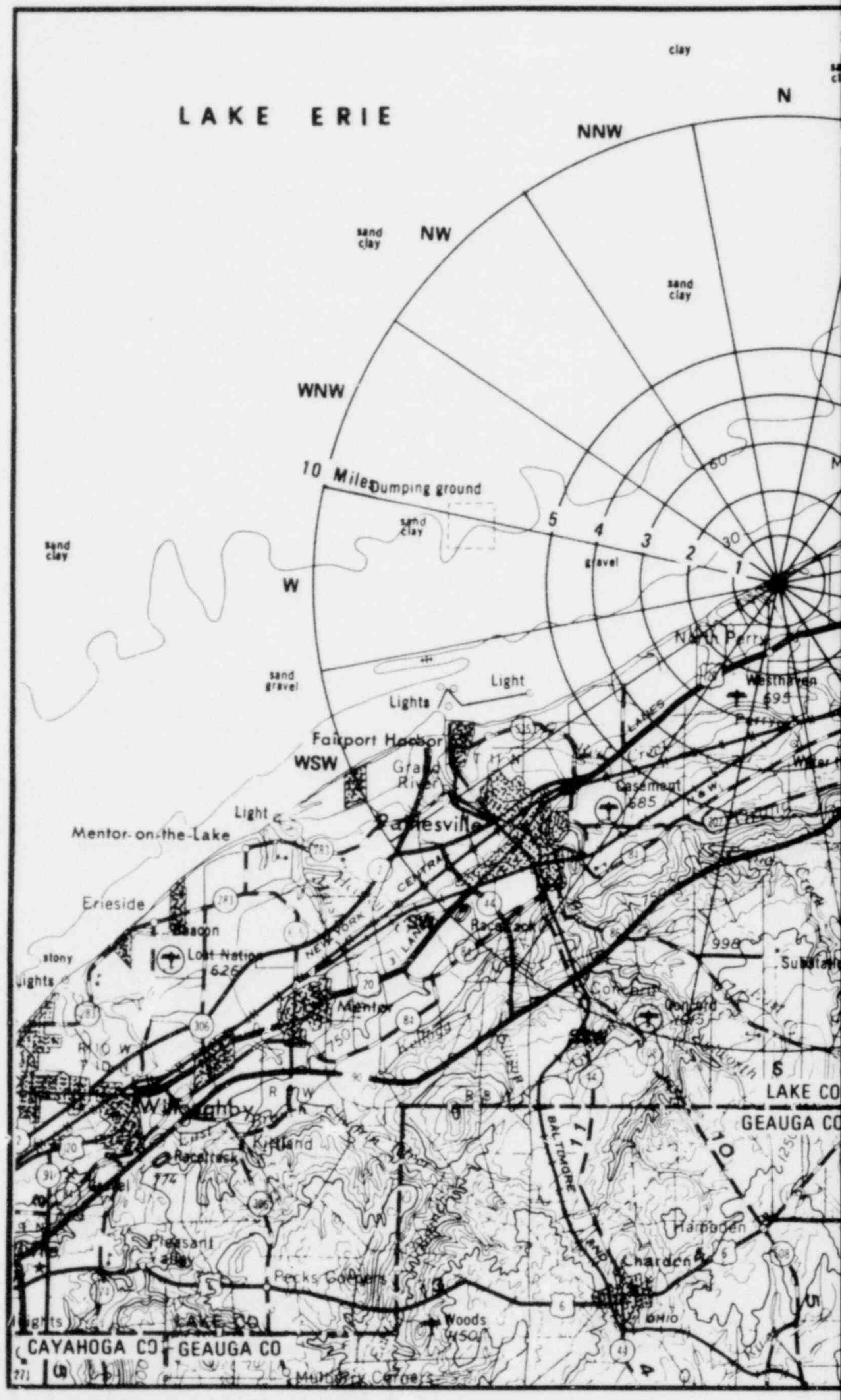
800 400 0 400 800

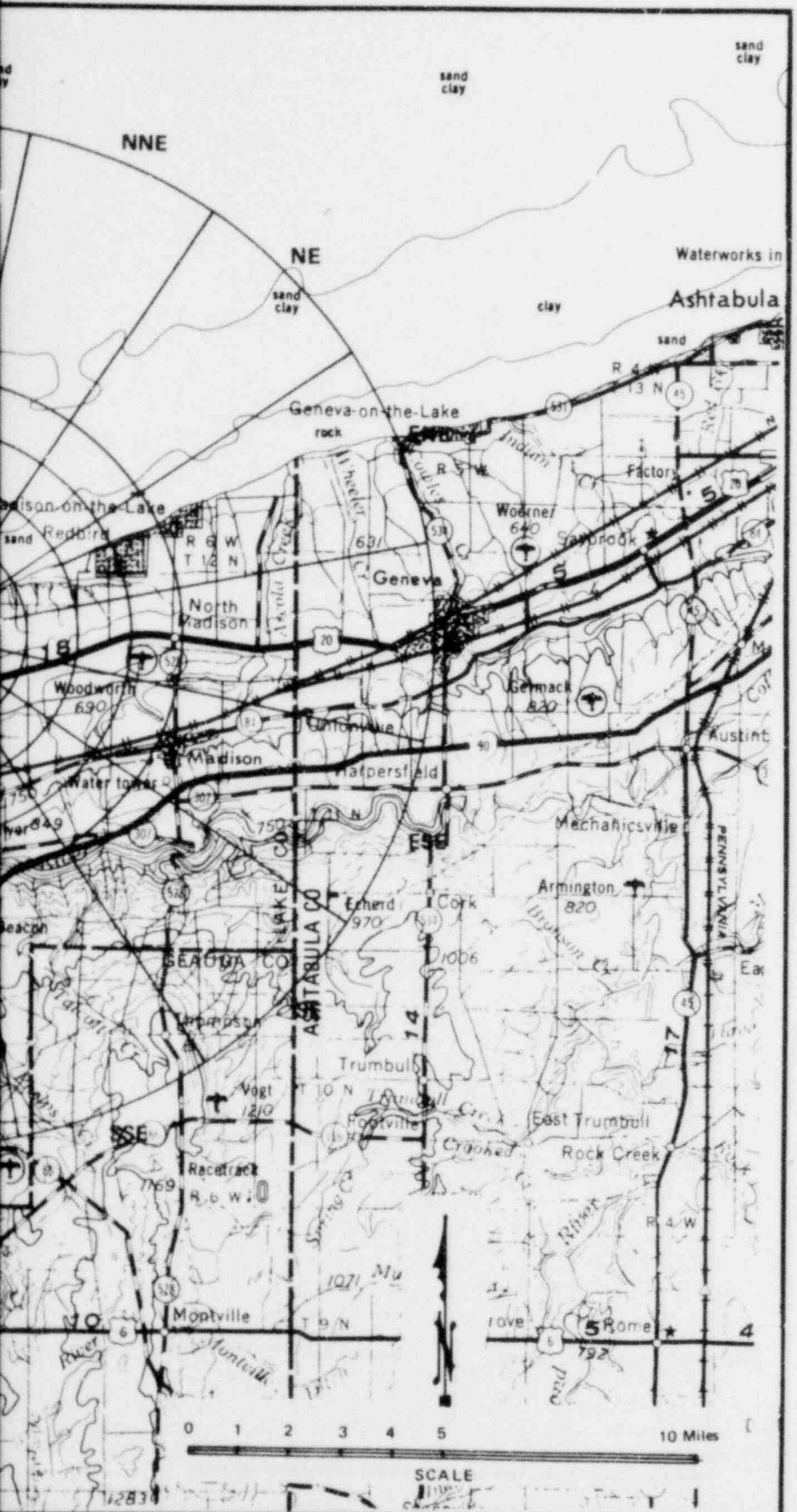
ACQUISITION OF LAND AND MINERAL RIGHTS

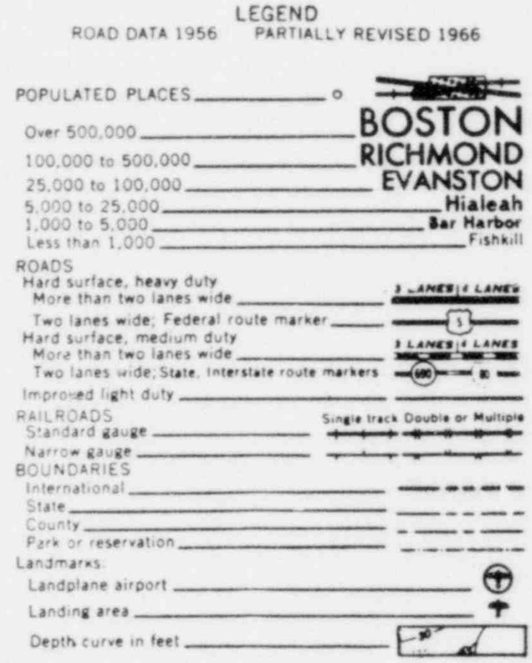
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-5


LAKE ERIE
N
NNW
NW
WNW
W
WSW
10 Miles
Dumping ground
5
4
3
2
1
sand clay
gravel
sand gravel
stony
North Perry
Westhaven
Light
Lights
Fairport Harbor
Grand River
Painesville
Casement
Mentor-on-the-Lake
Erieside
Lost Nation
Mentor
Concord
Willoughby
Kirtland
Pleasant Valley
Pecks Corners
Woods
Chardon
Hampden
LAKE CO
GEAUGA CO
CAYAHOGA CO
Mulberry Corners



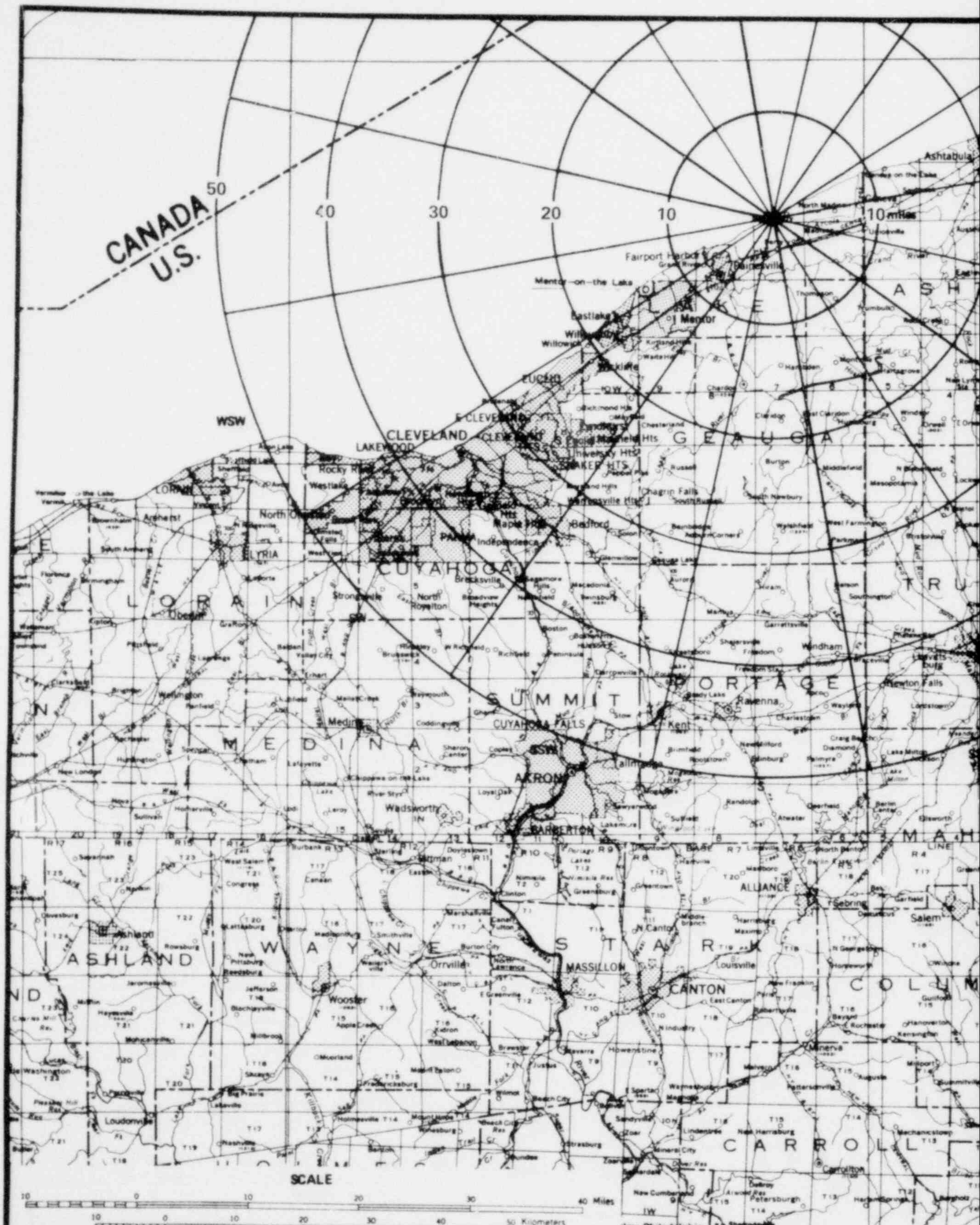


AREA WITHIN 10 MILES OF PNPP

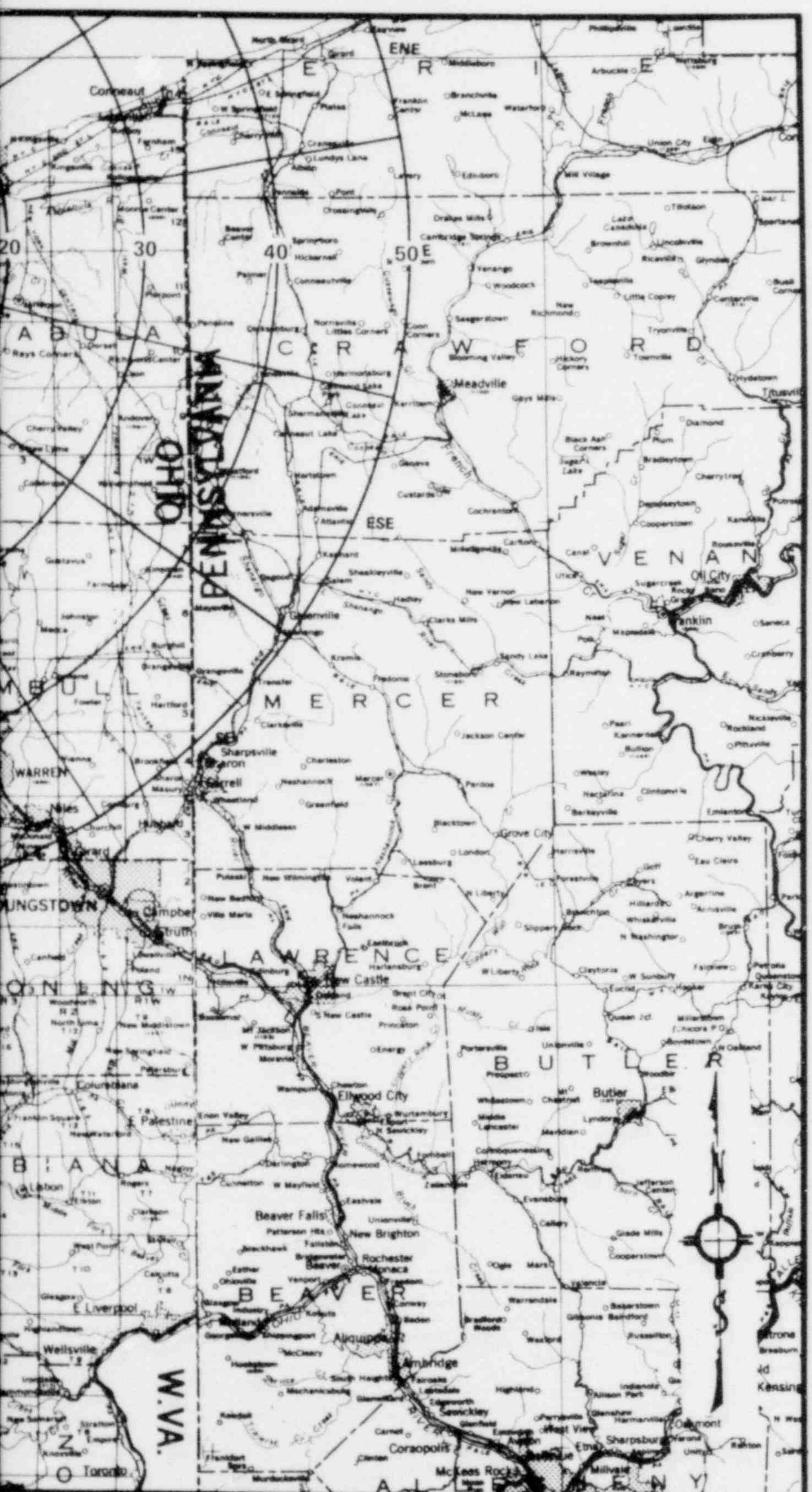
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-6



CANADA
U.S.
50
40
30
20
10
10 miles
Ashtabula
Fairport Harbor
Painesville
Mentor-on-the Lake
Eastlake
Mentor
Willowick
EUCLID
WSW
E CLEVELAND
CLEVELAND
LAKEWOOD
Rocky River
Westlake
LORAIN
Amherst
North Olmsted
ELYRIA
CUYAHOGA
Brecksville
North Royalton
Independence
Bedford
Chagrin Falls
G E A U G A
L O R A I N
Oberlin
Strongsville
S U M M I T
CUYAHOGA FALLS
AKRON
BARBERTON
Wadsworth
M E D I N A
Medina
P O R T A G E
Ravenna
Kent
Windham
Newton Falls
T R U
ALLIANCE
Sebring
Salem
A S H L A N D
Ashland
W A Y N E
Wooster
Orrville
S T A R K
MASSILLON
CANTON
Louisville
C O L U M
Loudonville
C A R R O L L
Carrollton
New Philadelphia
SCALE
10
0
10
20
30
40 Miles
10
0
10
20
30
40
50 Kilometers



LEGEND

POPULATION KEY

PHILADELPHIA	more than 500,000
SCRANTON	50,000 to 500,000
Uniontown	10,000 to 50,000
Gettysburg	5,000 to 10,000
Nicholson	less than 5,000

- State Capital
- County Seat
- Cities, towns, or villages
- Corporate boundary shown for towns over 10,000 population

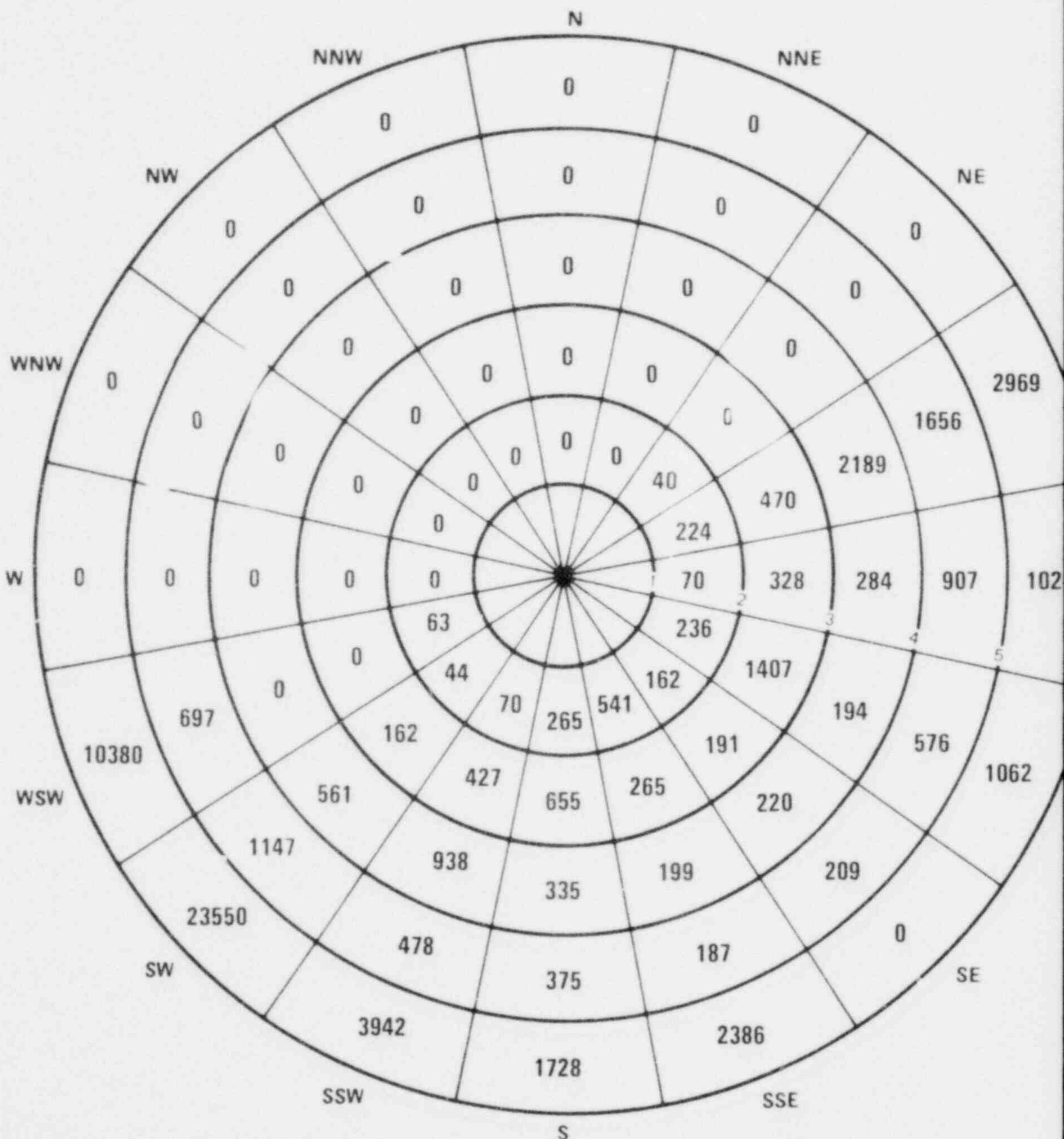
AREA WITHIN 50 MILES OF PNPP

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-7

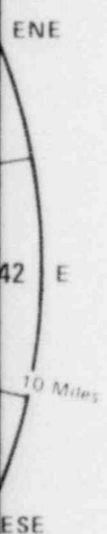
						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1715	3905	4920	6232	16875	56259

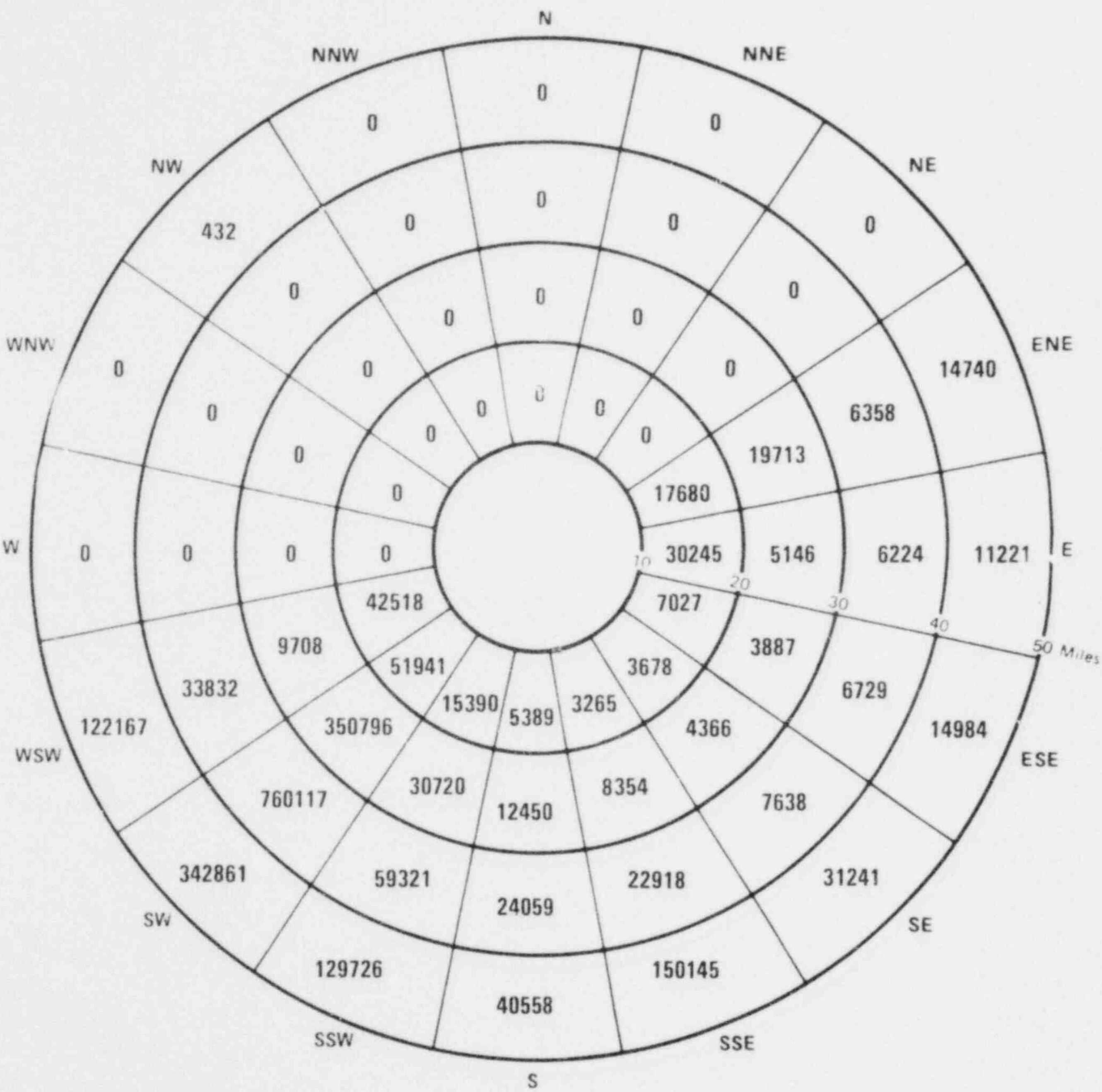


Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	177133	445140	927196	858075	2407544	2480678





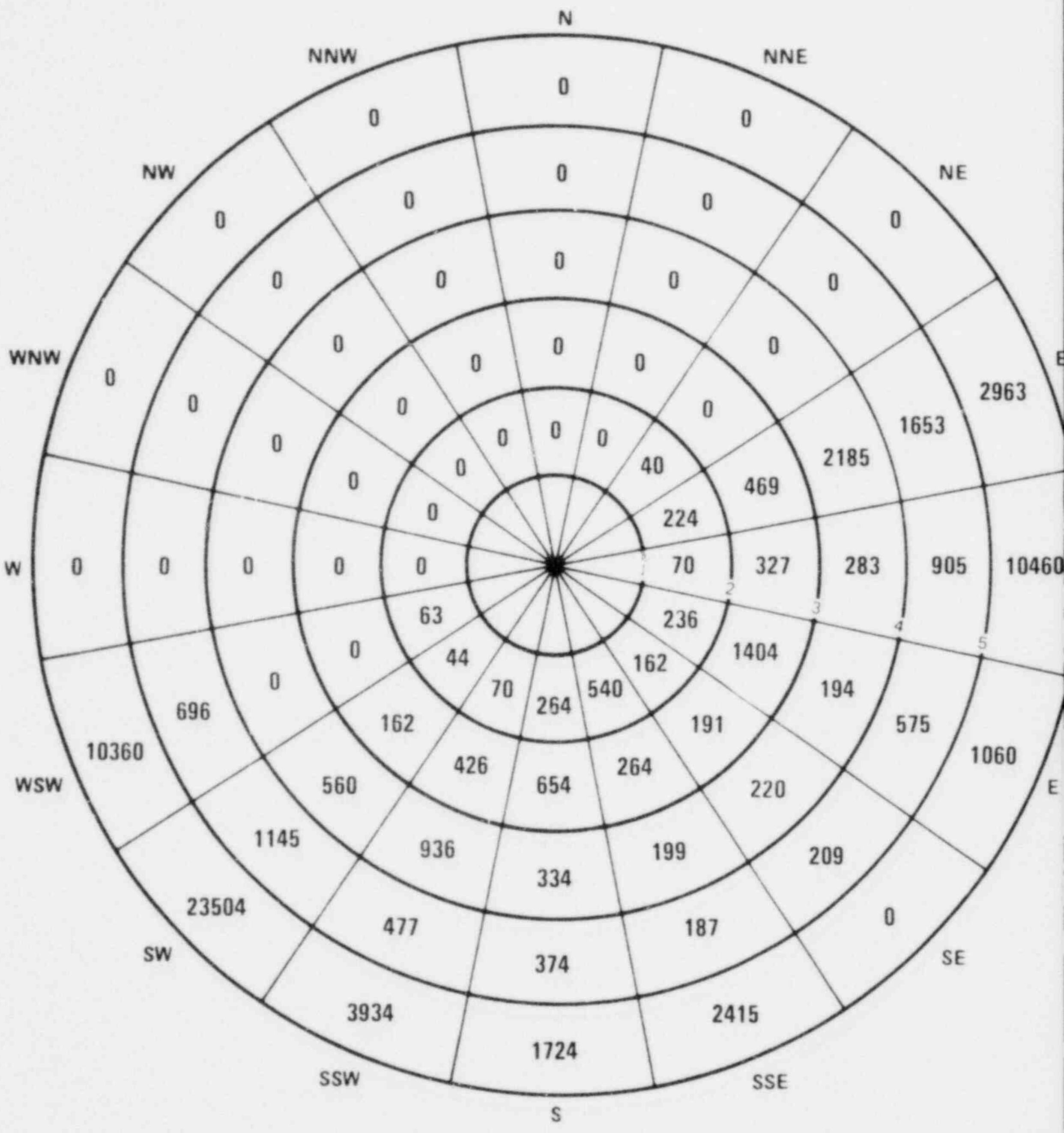
1978 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.1-8

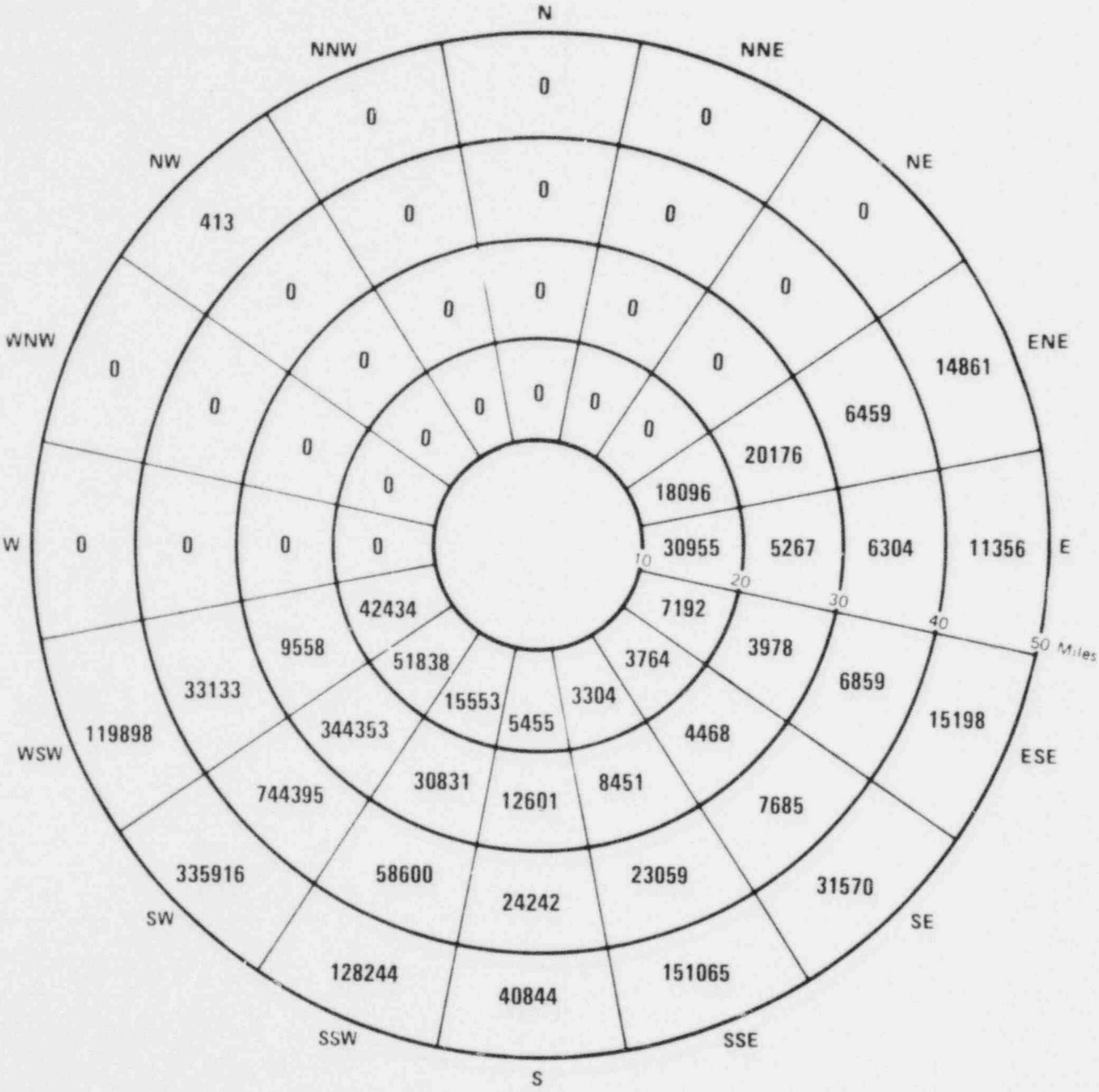
						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1713	3897	4911	6221	16845	56420



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	178591	439683	910736	849365	2378375	2451640



1980 PERMANENT RESIDENT POPULATION

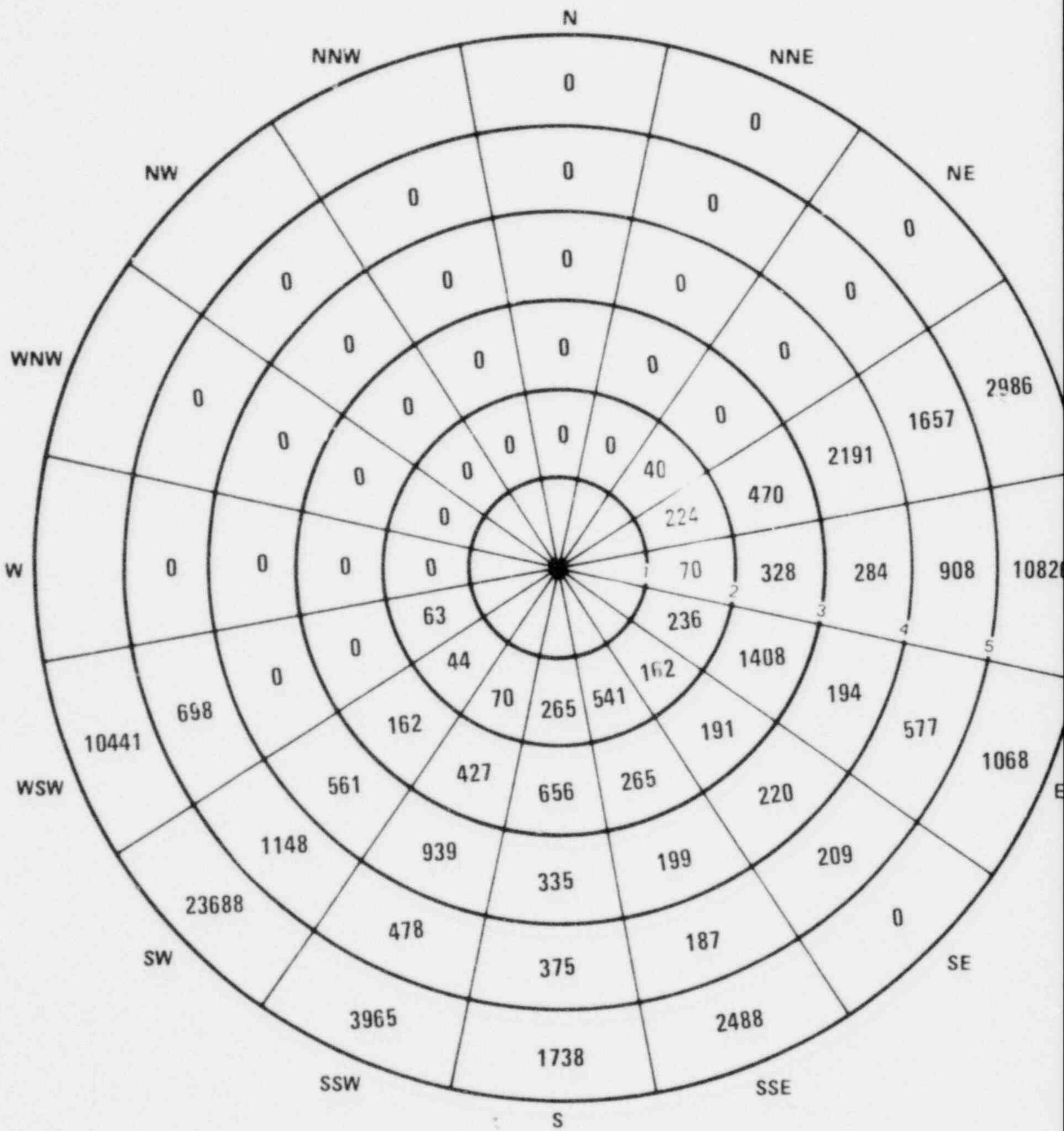
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.1-9

TOTALS

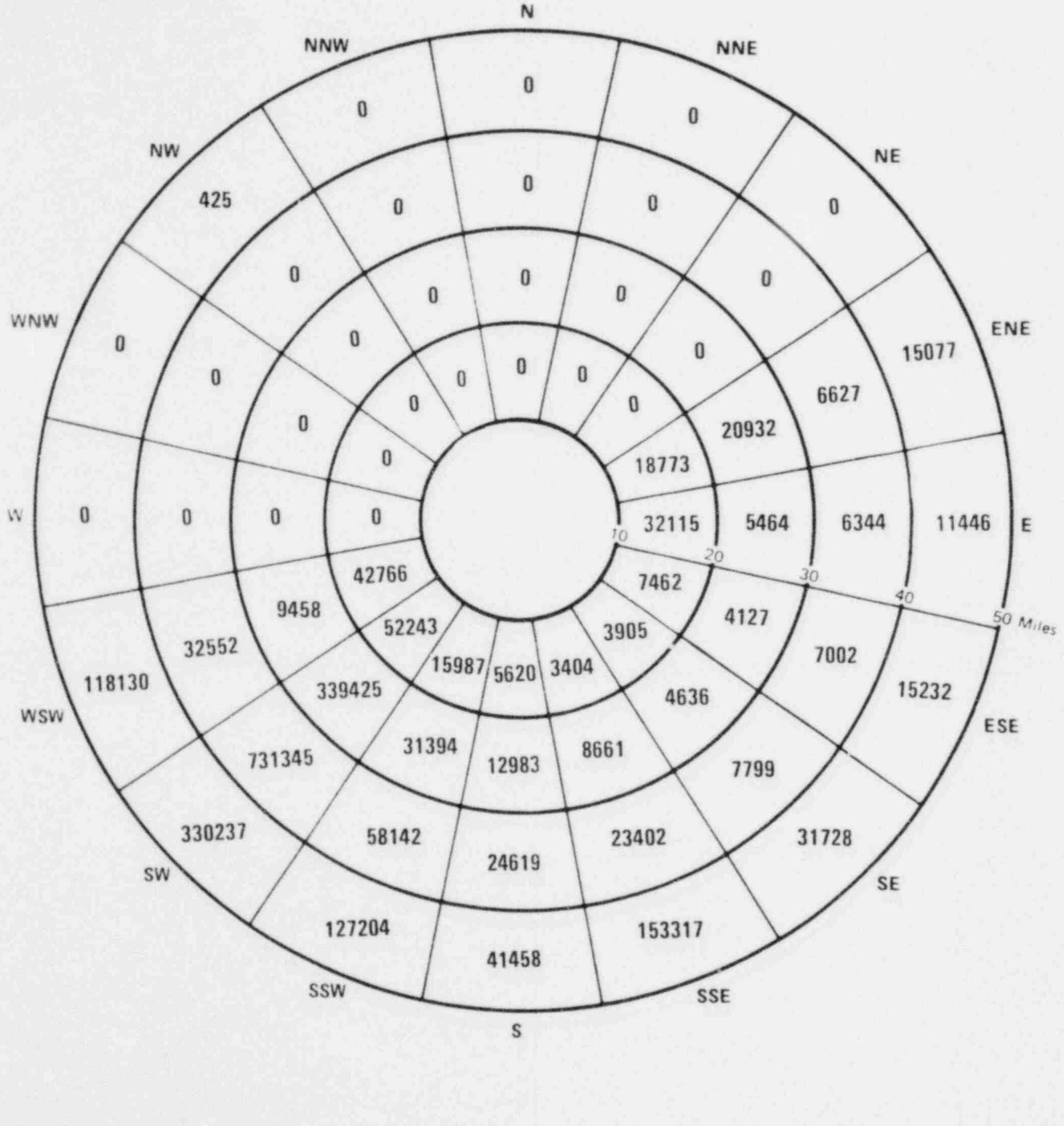
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1715	3907	4923	6237	16885	57200



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	182275	437080	897832	844254	2361441	2435526



1983 PERMANENT RESIDENT POPULATION

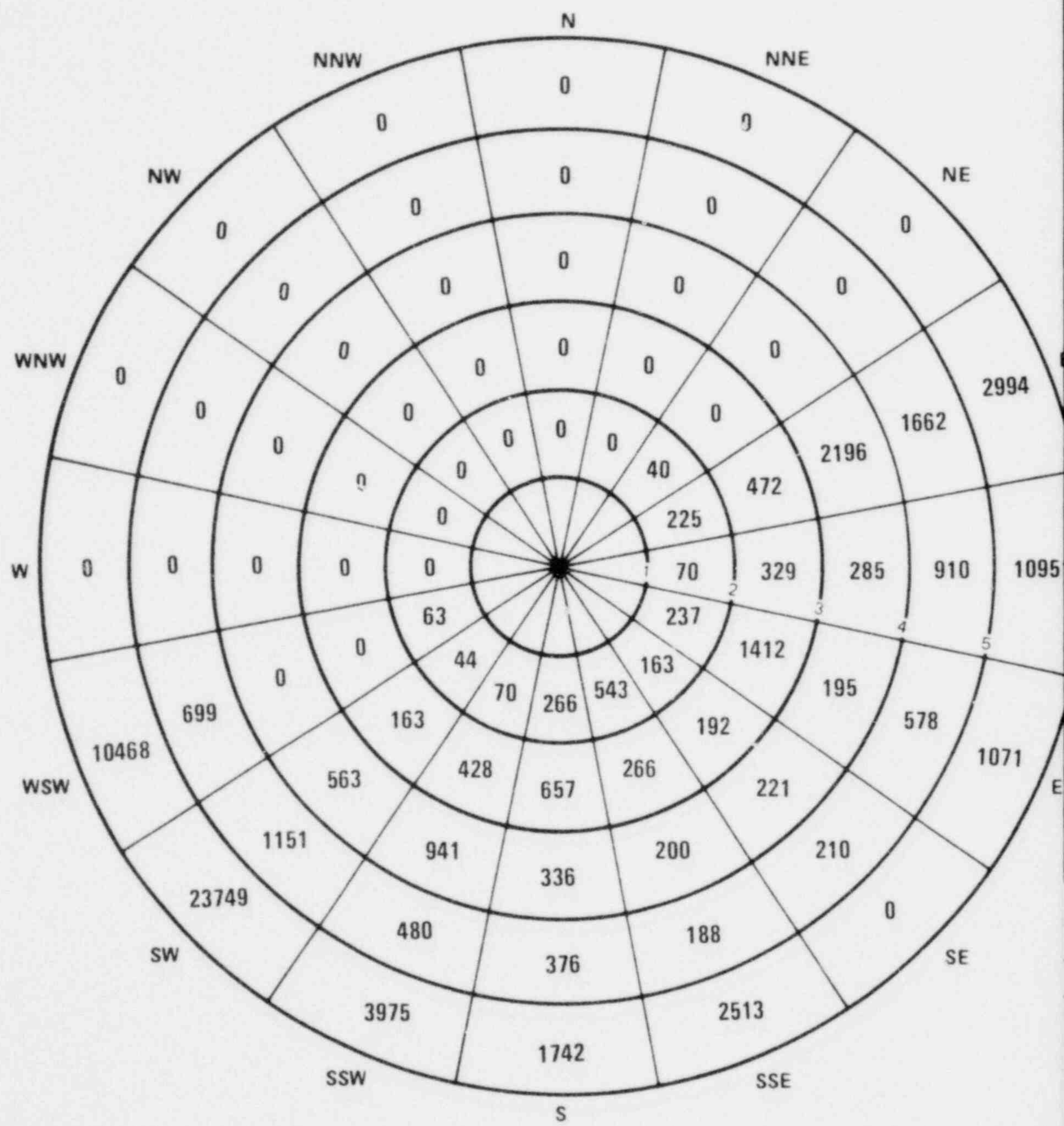
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-10

TOTALS

ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1721	3919	4937	6254	16934	57463

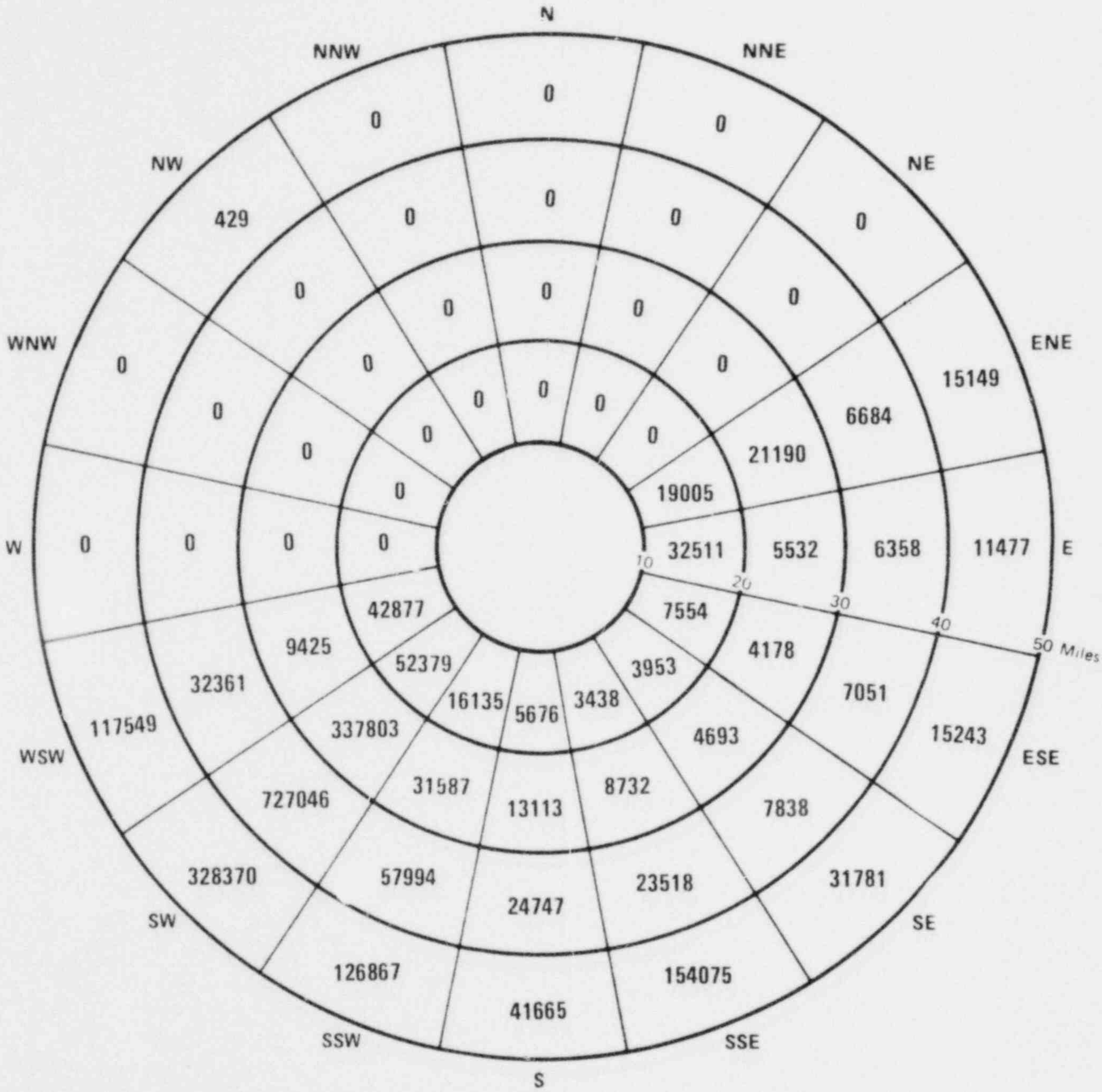


Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

TOTALS

ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	183528	436253	893579	842425	2355983	2430380



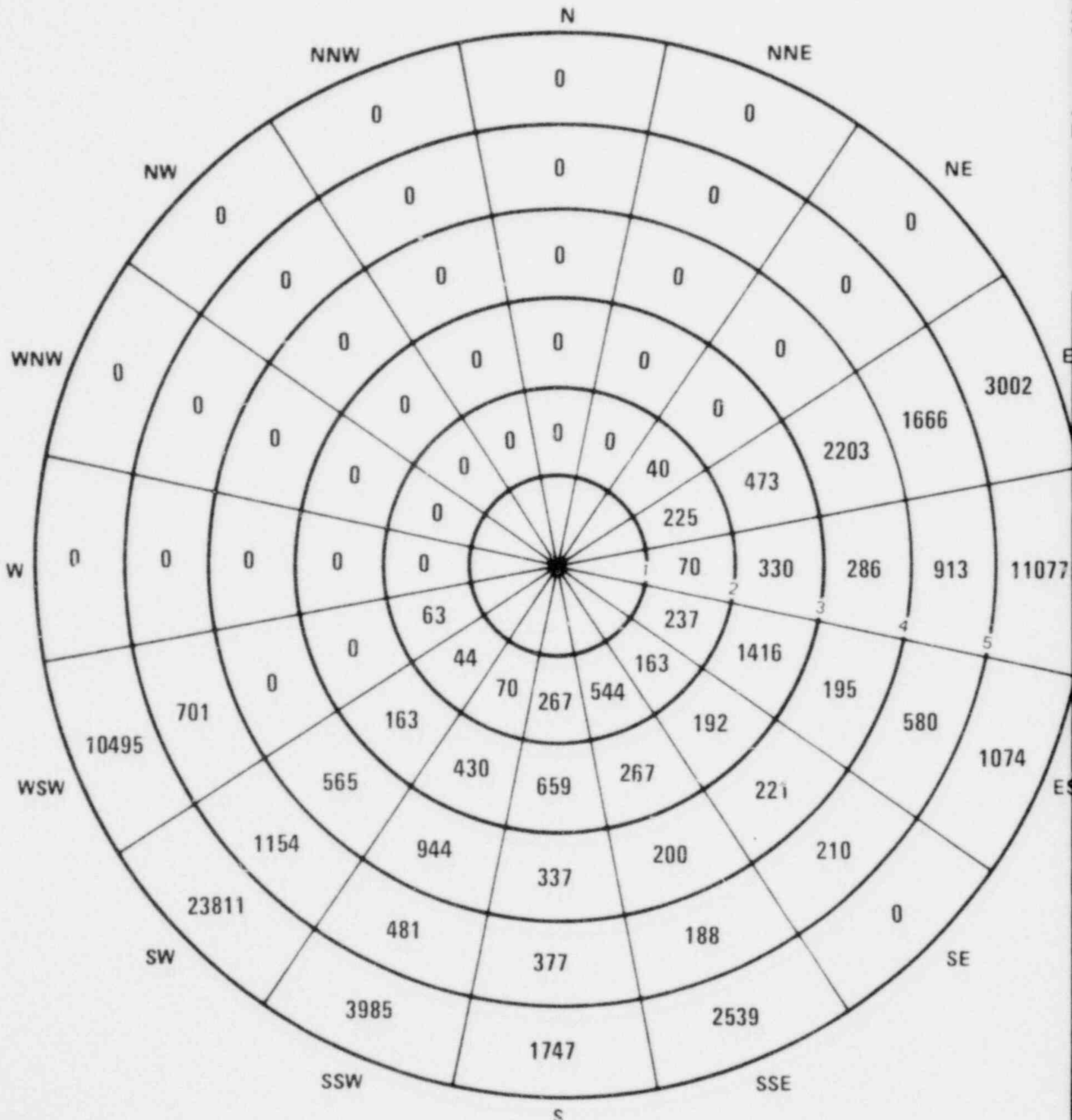
1984 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-11

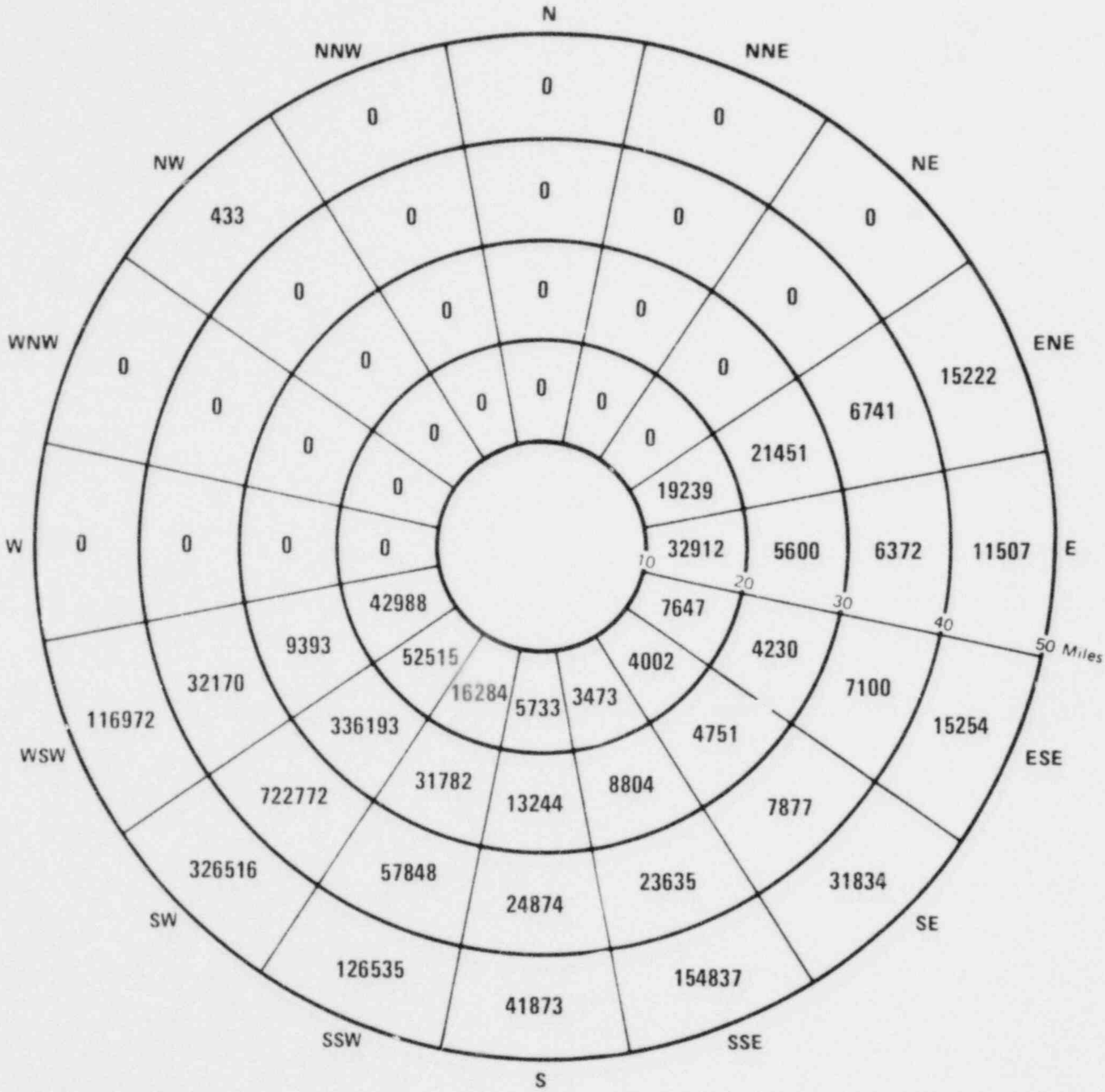
						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1723	3930	4951	6270	16977	57730



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	184793	435448	889389	840983	2350613	2425320



1985 PERMANENT RESIDENT POPULATION

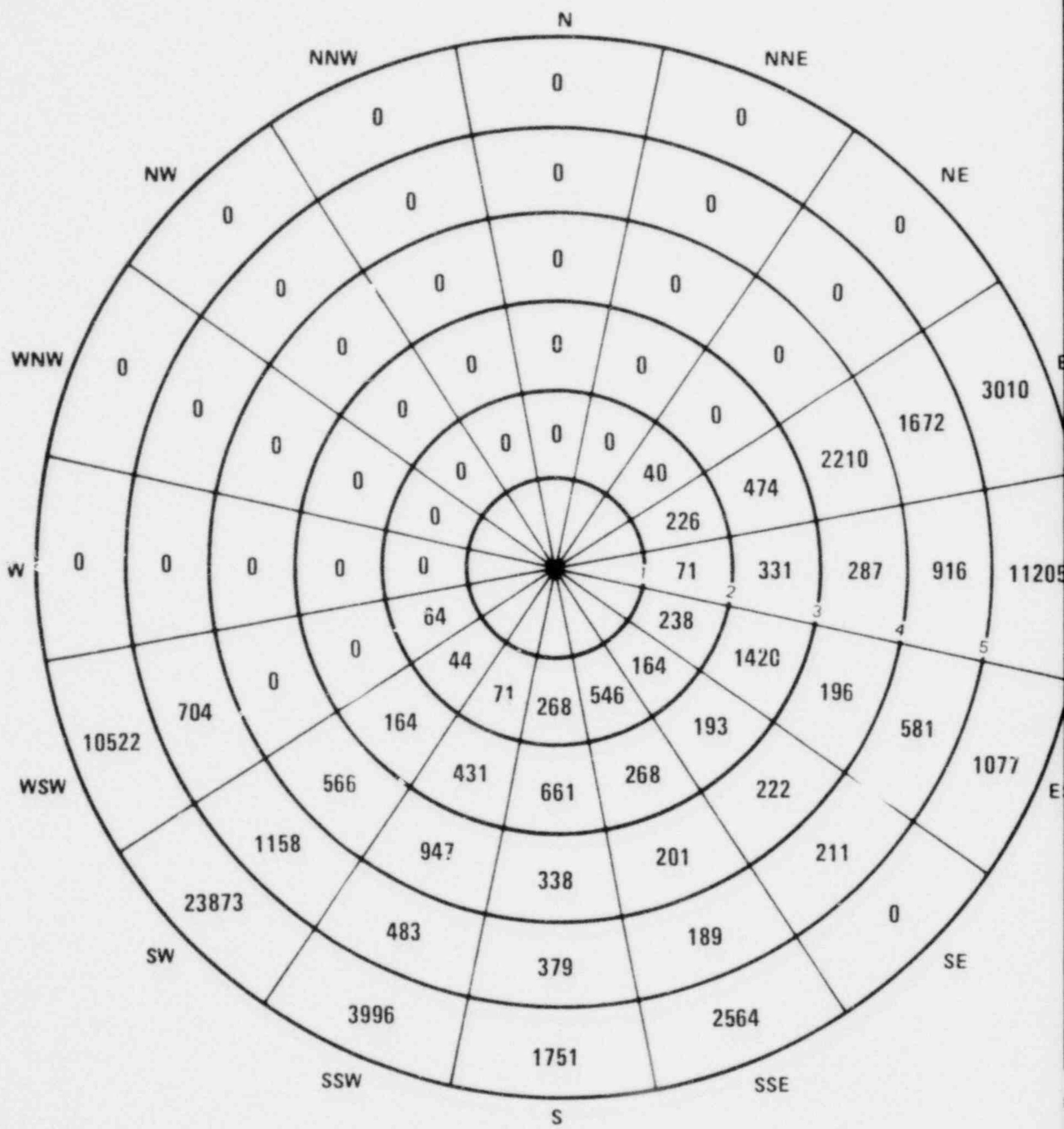
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-12

TOTALS

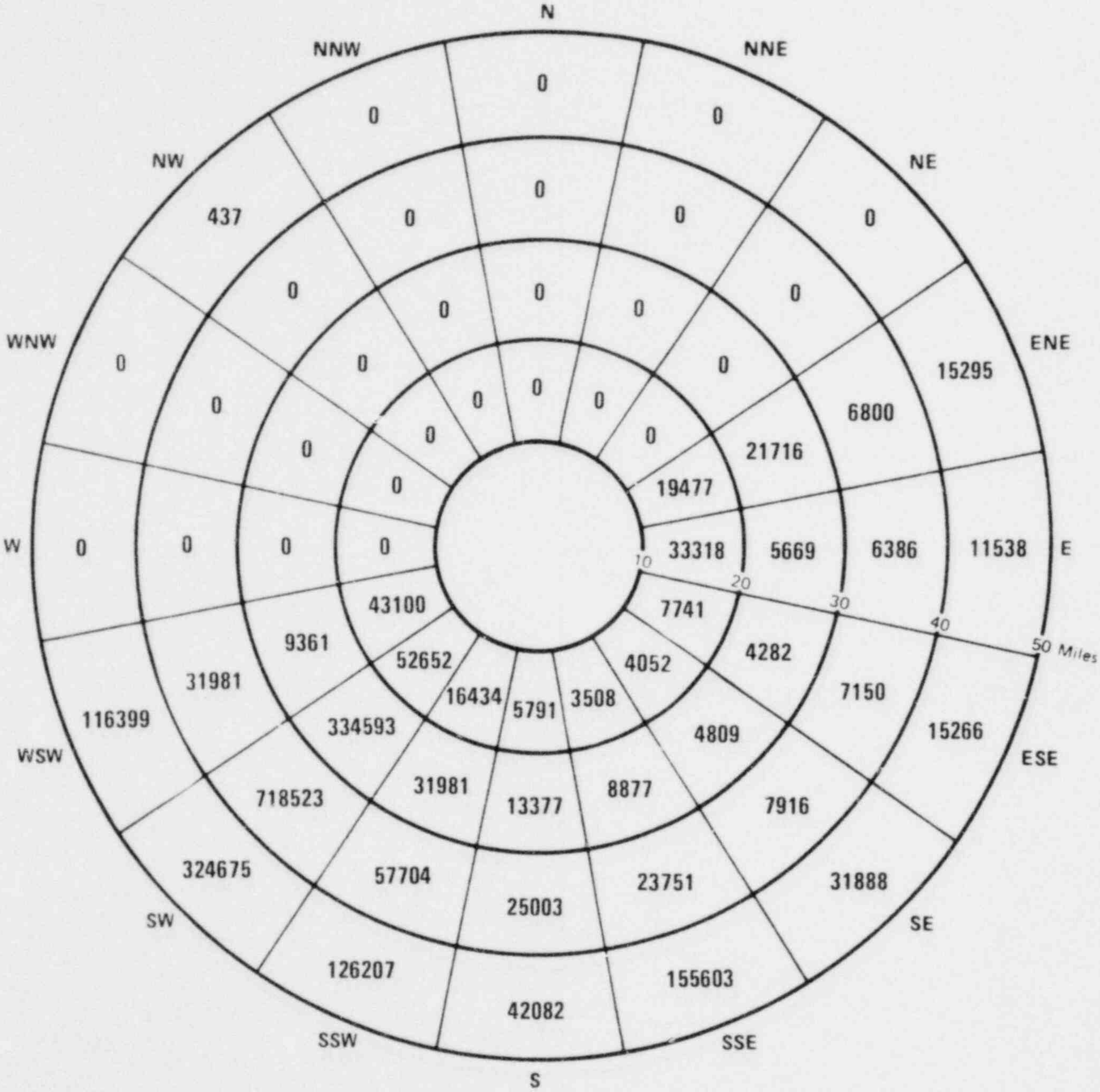
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1732	3942	4967	6293	17037	57998



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	186073	434665	885214	839390	2345342	2420377



1986 PERMANENT RESIDENT POPULATION

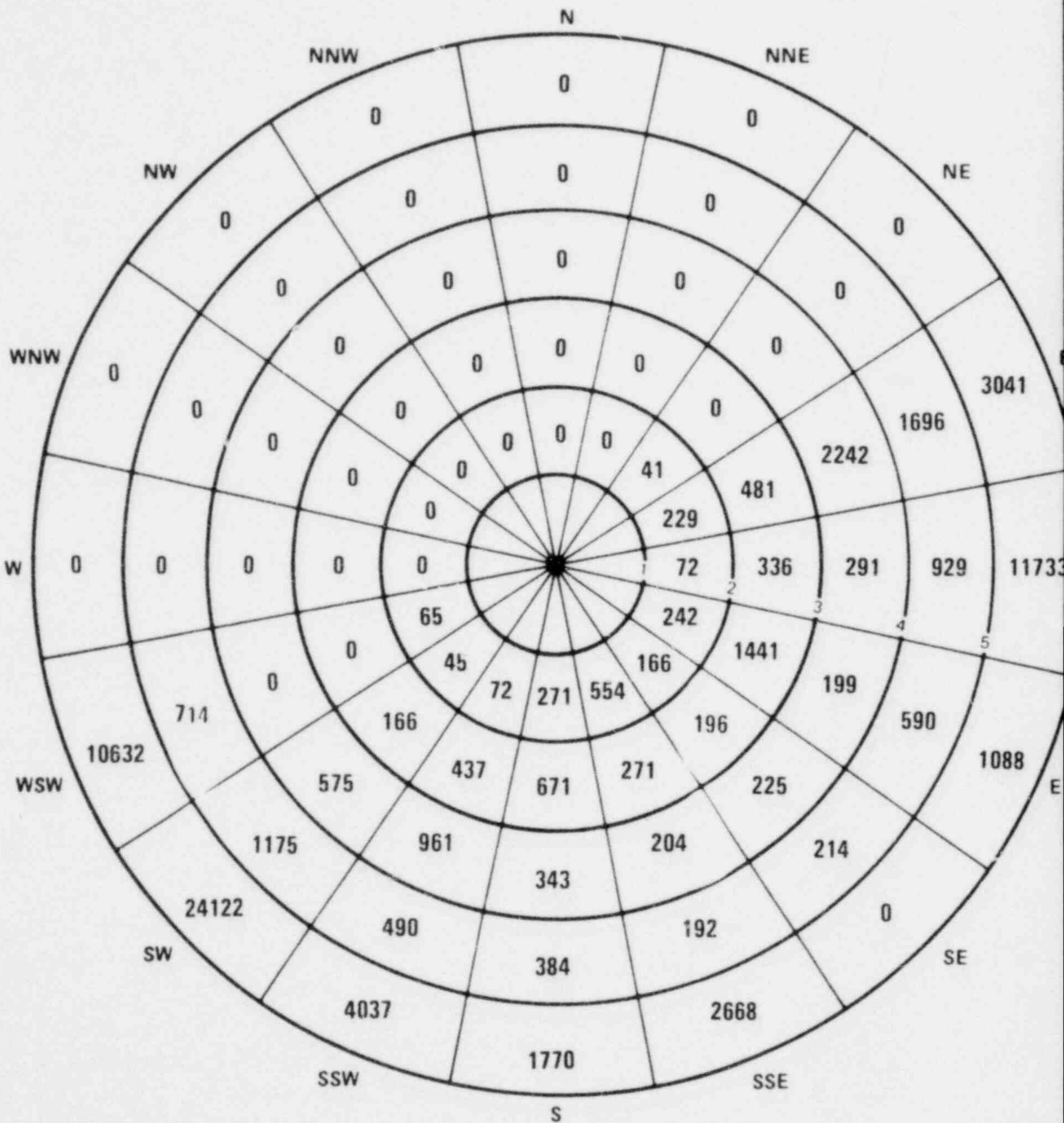
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-13

TOTALS

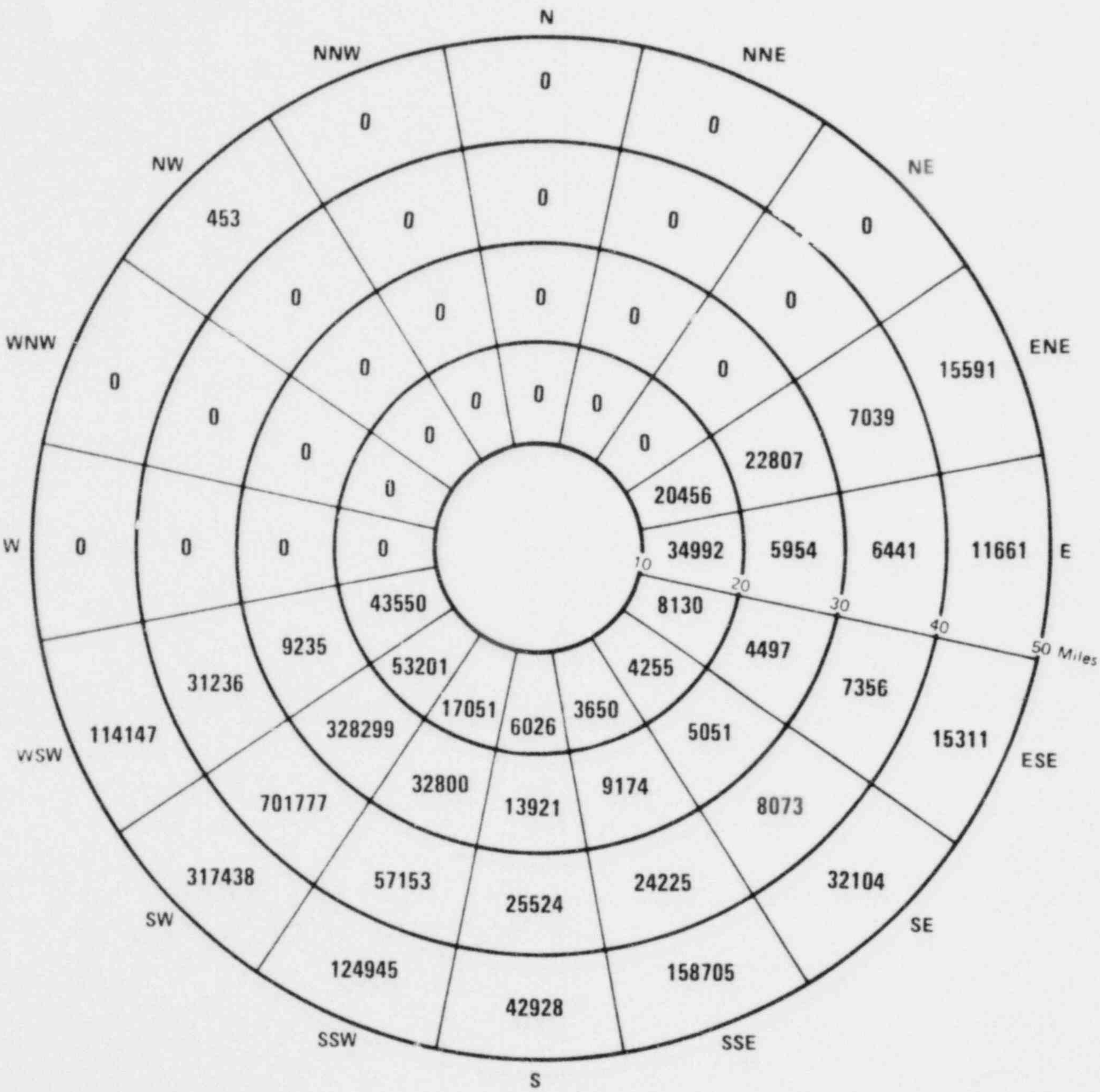
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	103	1757	3999	5040	6384	17279	59091



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	37	11	0	0	0	7
18	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	191311	431738	868824	833283	2325156	2401526



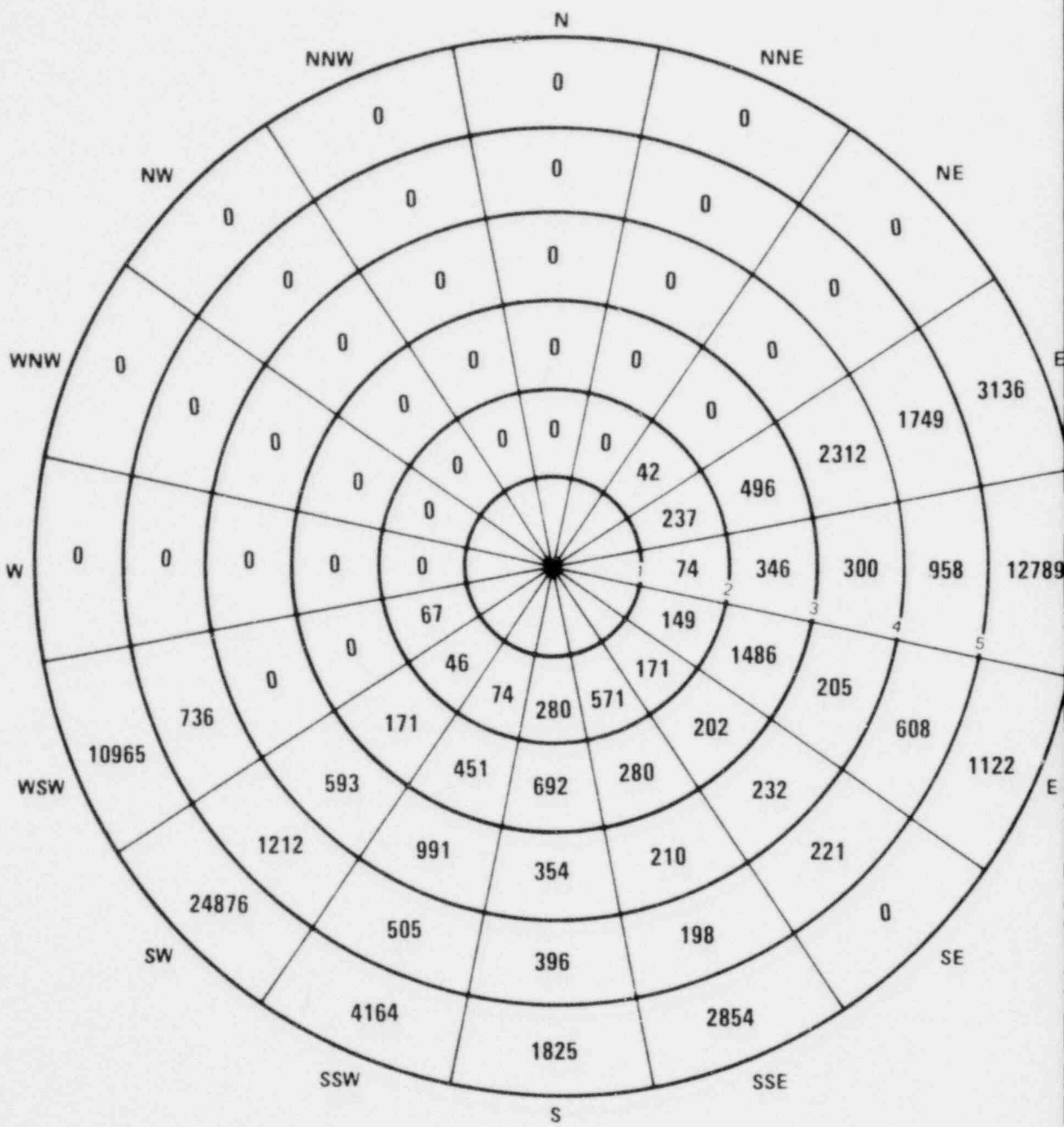
1990 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-14

						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	108	1711	4124	5197	6583	17823	61731

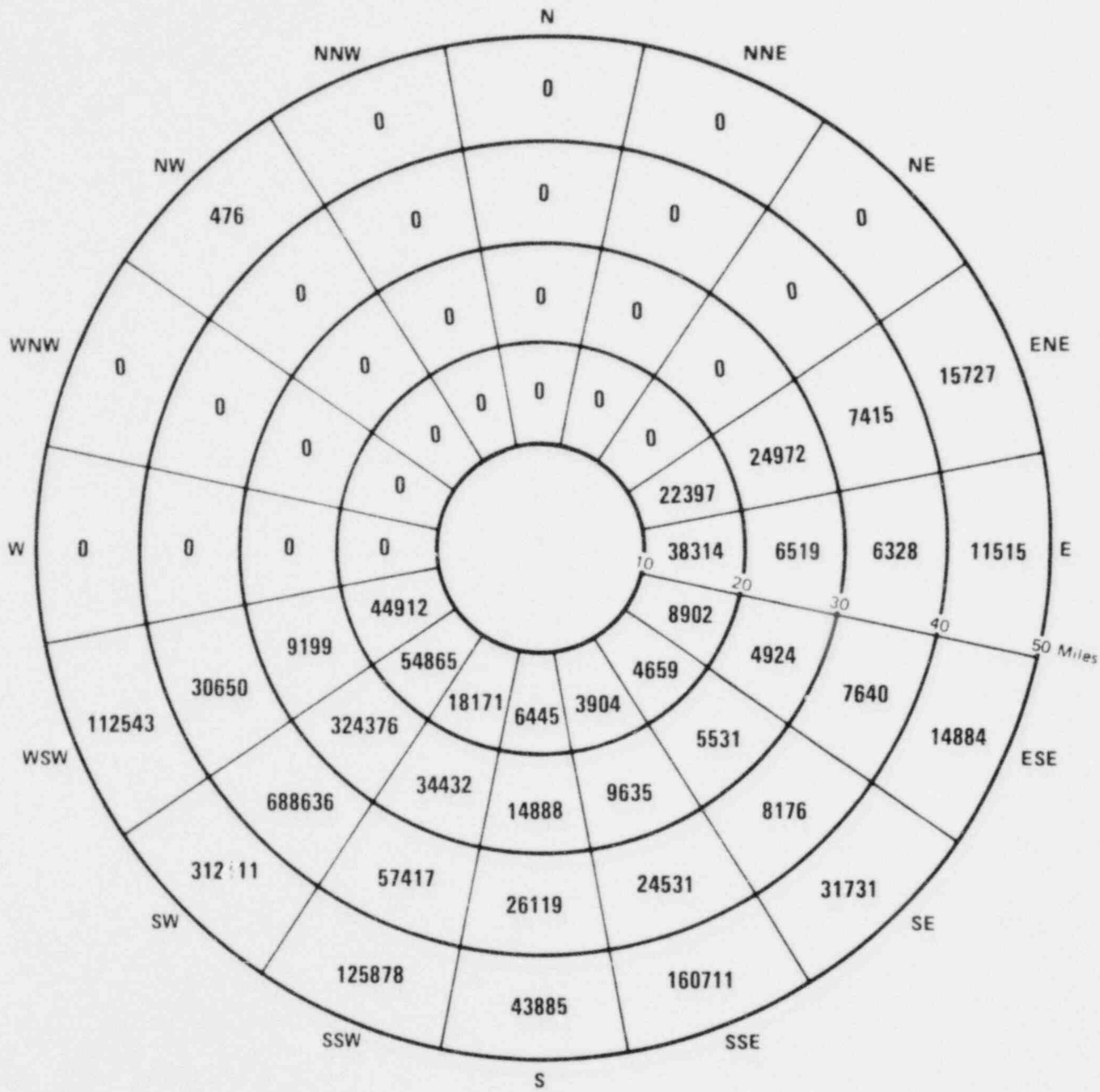


Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	39	12	0	0	0	7
19	27	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

TOTALS

ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	202569	434476	856912	829461	2323418	2402972



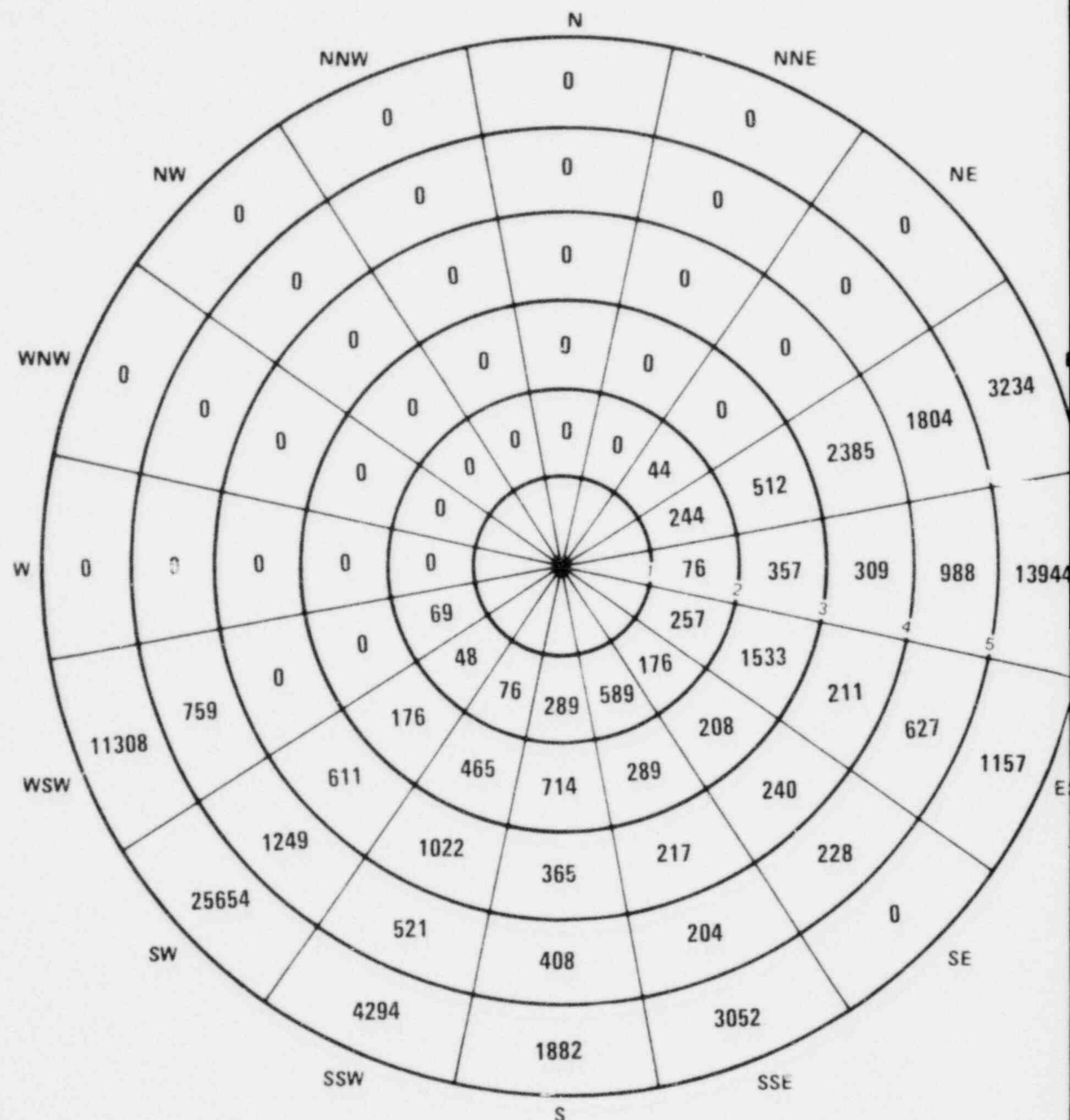
2000 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.1-15

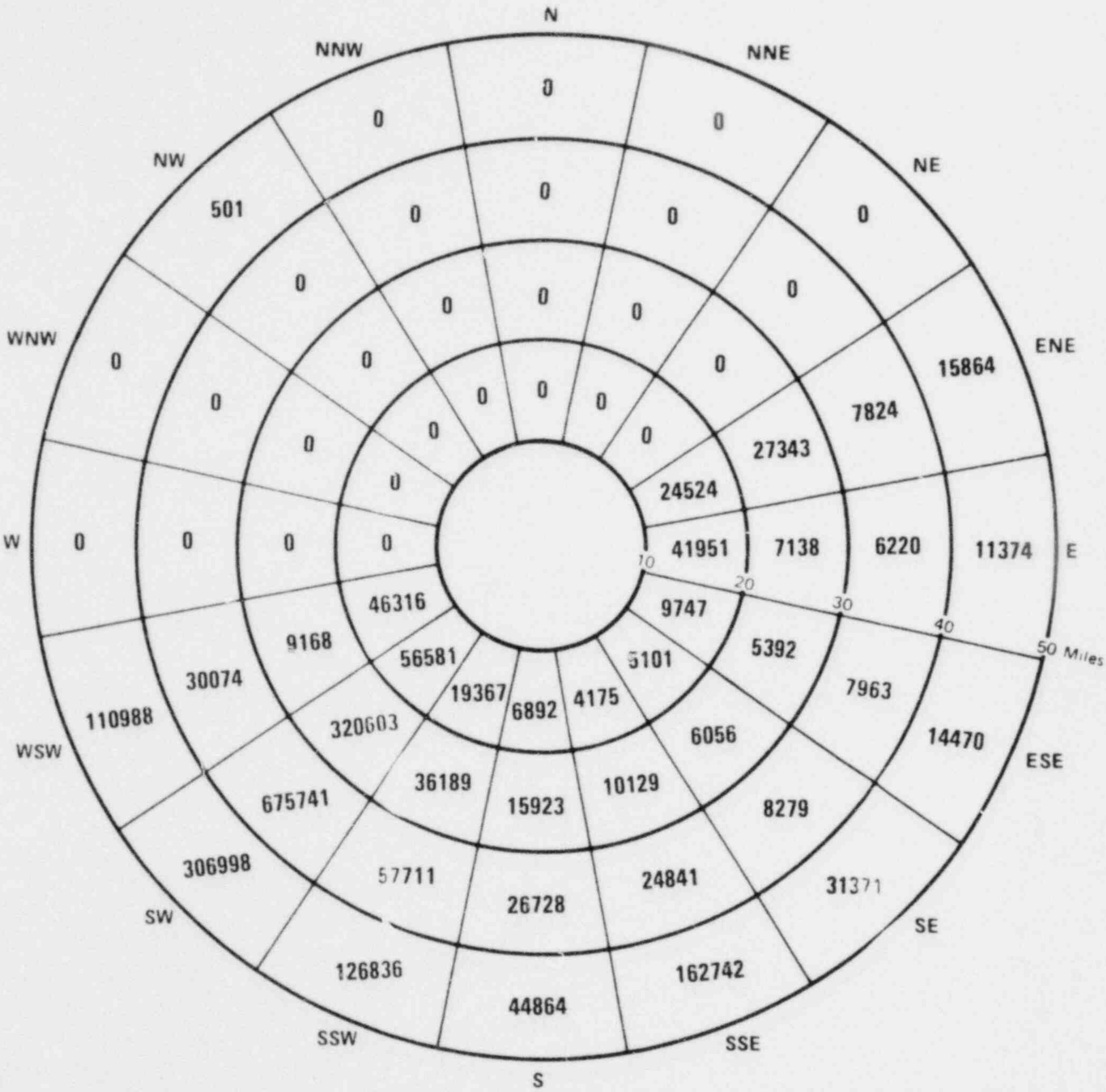
						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	112	1868	4254	5360	6788	18382	64525



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	40	12	0	0	0	8
20	26	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	214654	437941	845381	826008	2323984	2406891



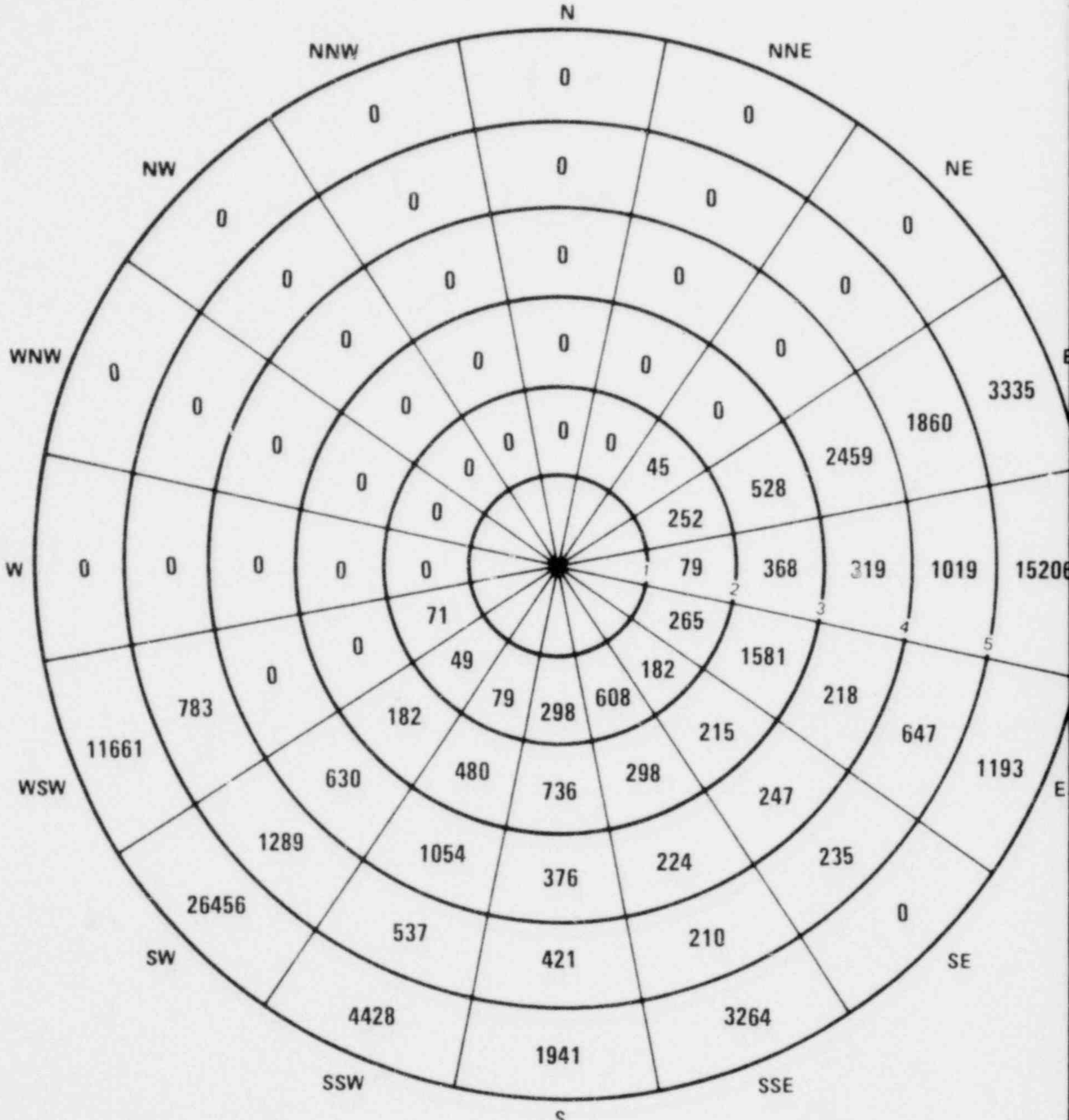
2010 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.1-16

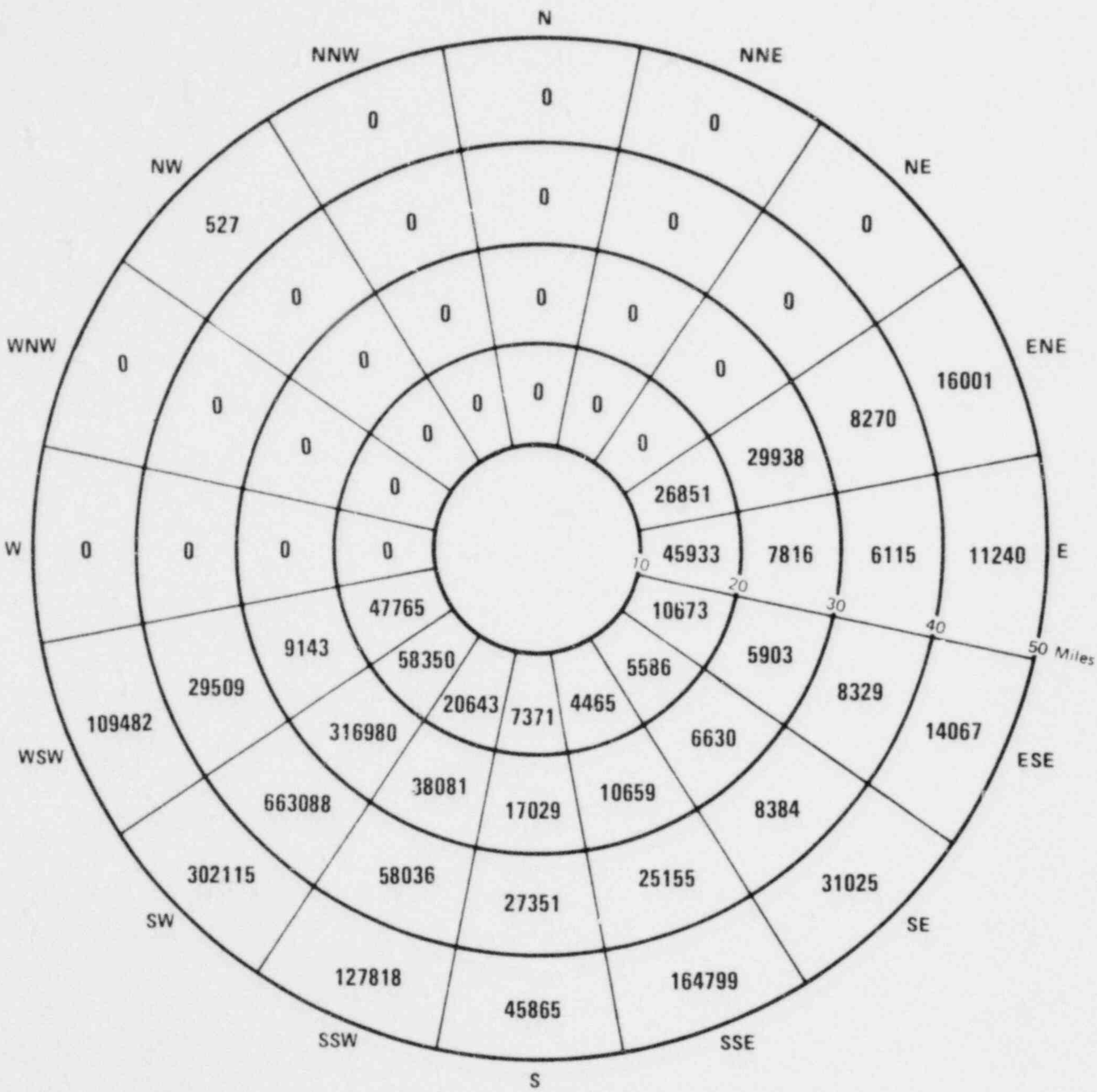
						TOTALS	
ANNULUS	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	0-5 Miles	5-10 Miles
POPULATION	115	1928	4388	5527	7001	18959	67484



Values For 0 - 1 Mile Annulus

N	NNE	NE	ENE	E	ESE	SE	SSE
0	0	42	12	0	0	0	8
20	29	0	4	0	0	0	0
S	SSW	SW	WSW	W	WNW	NW	NNW

					TOTALS	
ANNULUS	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	10-50 Miles	0-50 Miles
POPULATION	227637	442179	834237	822939	2326992	2413435

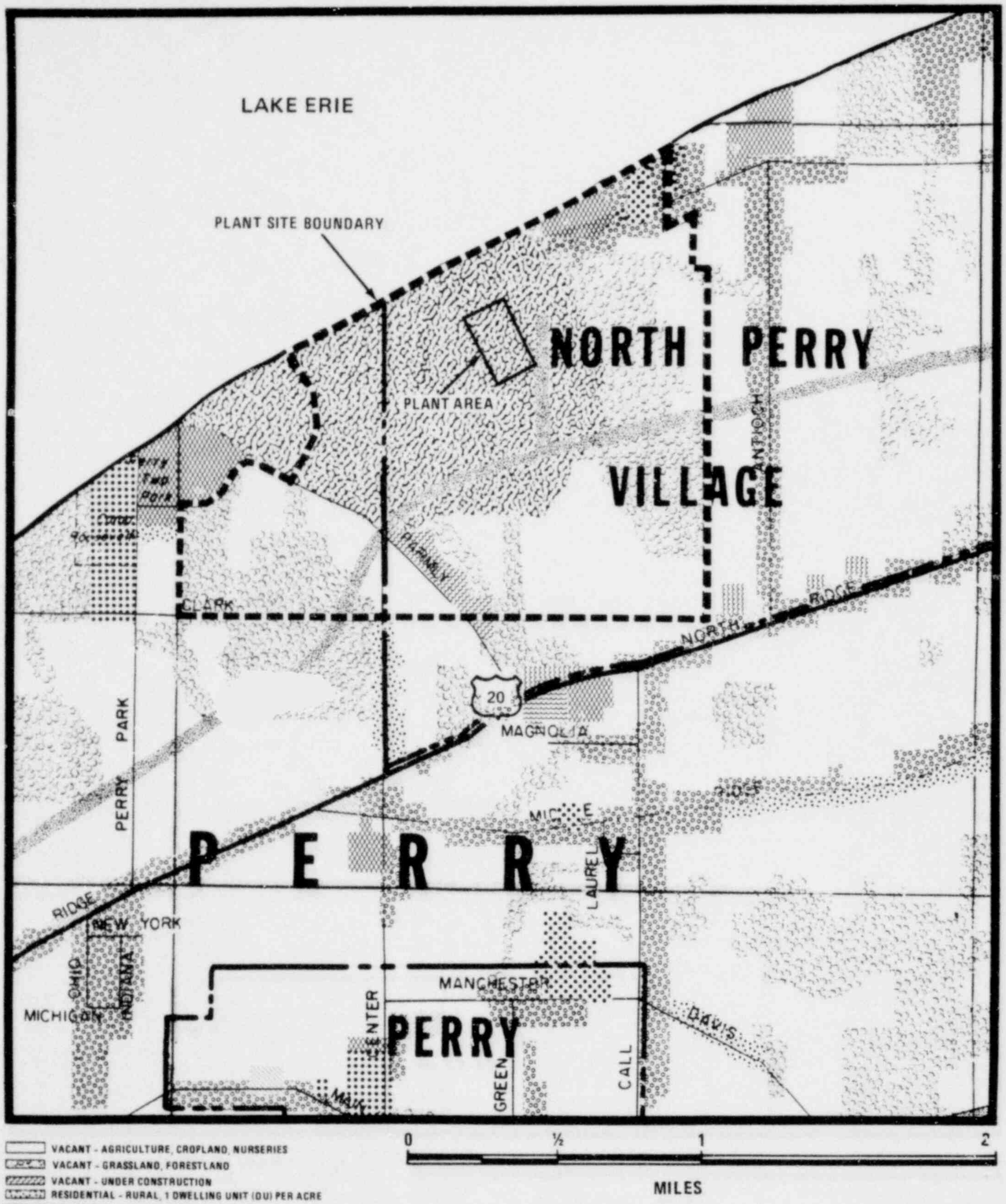


2020 PERMANENT RESIDENT POPULATION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-17



- VACANT - AGRICULTURE, CROPLAND, NURSERIES
- VACANT - GRASSLAND, FORESTLAND
- VACANT - UNDER CONSTRUCTION
- RESIDENTIAL - RURAL, 1 DWELLING UNIT (DU) PER ACRE
- RESIDENTIAL - SINGLE FAMILY 1 - 4 DU/ACRE
- RESIDENTIAL - SINGLE FAMILY - TWO FAMILY >4 DU/ACRE
- PUBLIC/PRIVATE - PARKS, INCLUDING CEMETERIES
- PUBLIC/PRIVATE - INSTITUTIONAL, MUNICIPAL FACILITY, MILITARY
- INDUSTRY - WHOLESALE & STORAGE
- INDUSTRY - UTILITIES & COMMUNICATION
- INDUSTRY - INDUSTRIAL FACILITIES
- OTHER - ABANDONED MINES & QUARRIES, ACTIVE & INACTIVE LANDFILLS
- OTHER - UTILITIES R. O. W. RAIL
- OTHER - MINING & QUARRIES
- BUSINESS/OFFICE - GREENHOUSES
- BUSINESS/OFFICE - ALL OTHER RETAIL & OFFICES

SOURCE: Lake County Planning Commission, 1977
"Lake County, Perry Township Land Use" (Computer generated).

EXISTING LAND USE IN NEARBY ENVIRONS

PERRY NUCLEAR POWER PLANT 1 & 2

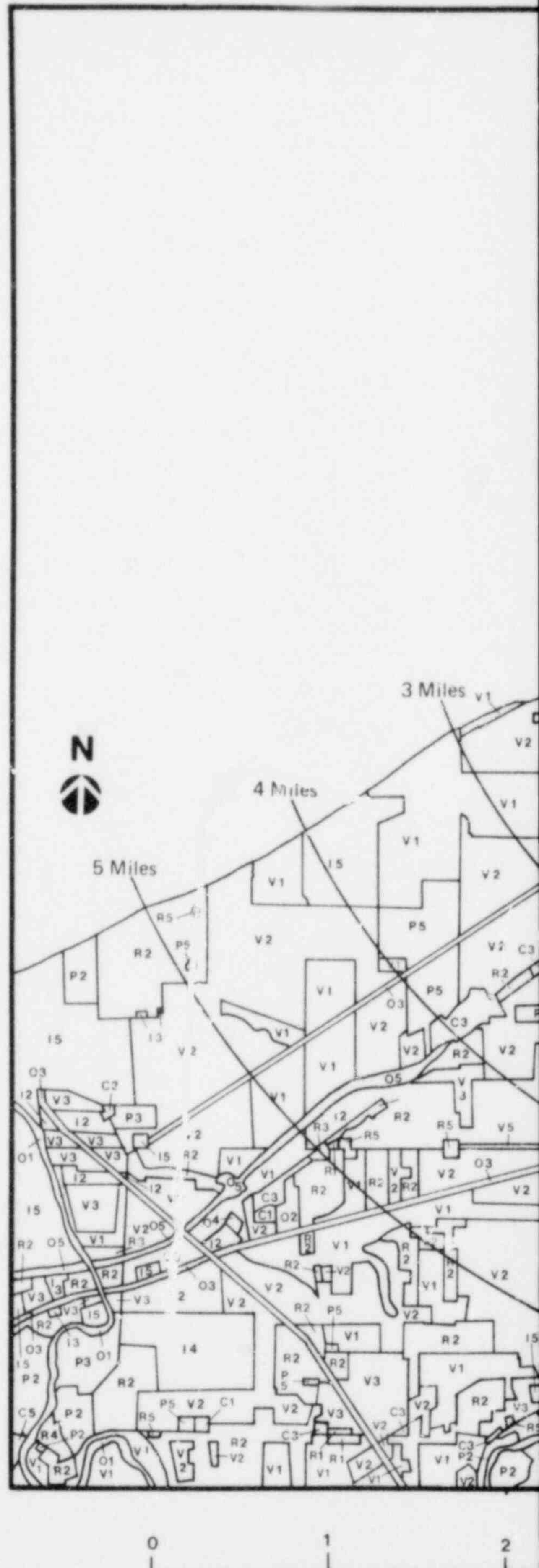
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

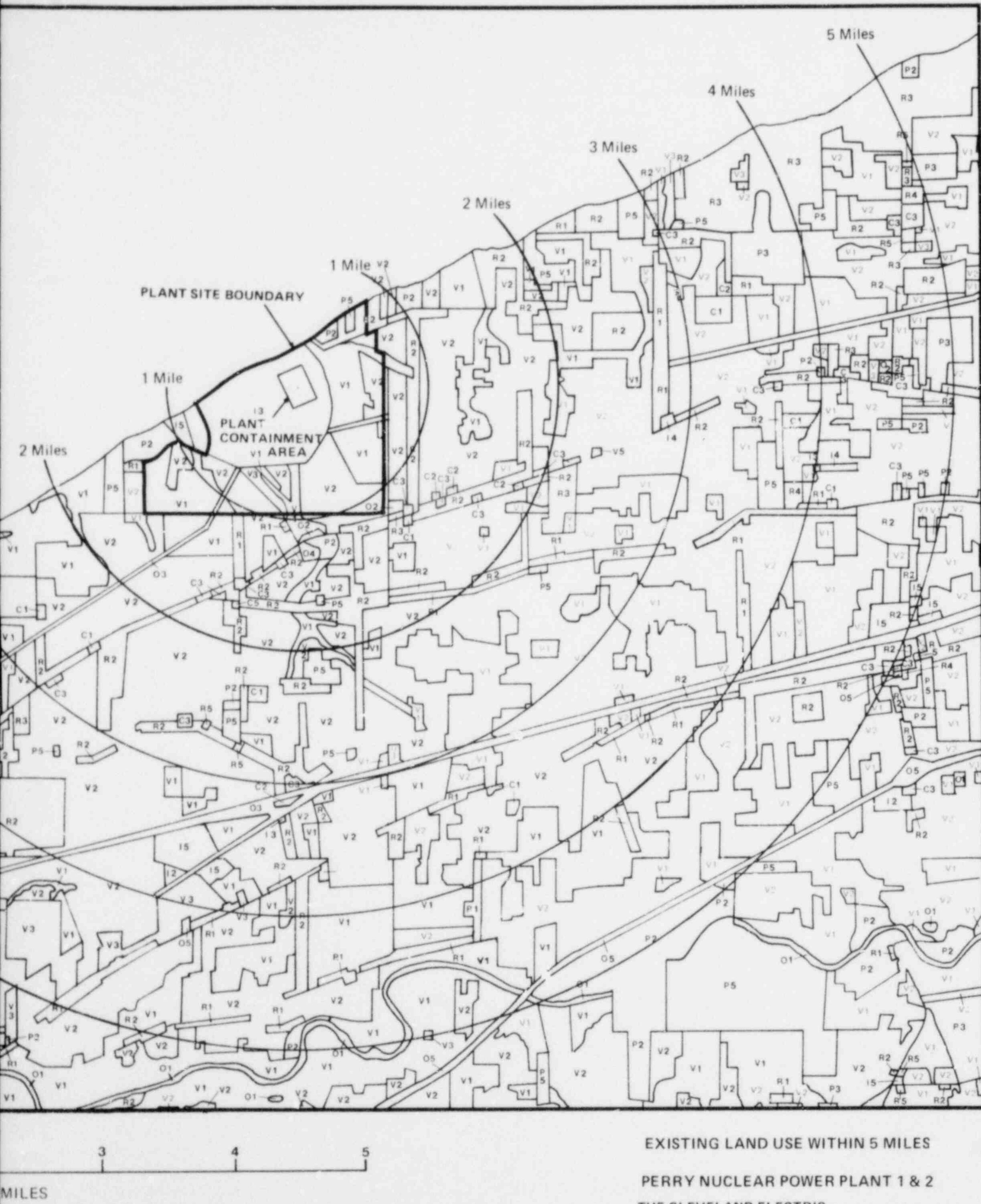
FIGURE 2.1-18

LEGEND:

LAND USES	CATEGORIES/ SYMBOLS	5	4	3	2	1
RESIDENTIAL	R	HIGH DE[illegible]Y 29DU/AC	MULTIPLE FAMILY (MORE THAN TWO LESS THAN 29 DU/AC	SINGLE FAMILY-TWO FAMILY 4 DU/AC	SINGLE FAMILY 1-4 DU/AC	RURAL 1 DU/AC
BUSINESS/OFFICE	C	CBD	REGIONAL OF PLANNED SHOPPING CENTERS (GENERALLY 10 ACRES)	ALL OTHER RETAIL AND OFFICES	LOCAL OPTION	GREENHOUSES
INDUSTRY	I	INDUSTRY	TRANSPORTATION & TERMINALS	UTILITIES & COMMUNICATIONS	WHOLESALE & STORAGE	
PUBLIC/PRIVATE	P	INSTITUTIONAL MUNI[illegible]PAL FACILITIES	INDOOR RECREATION	OUTDOOR RECREATION	PARKS INCLUDING CEMETERIES	
VACANT	V	UNDER CONSTRUCTION	INTENSIVE LIVESTOCK & FEEDLOTS	URBAN VACANT AND ABANDONED	AGRICULTURE CROPLAND NURSERIES	GRASSLAND FORESTLAND
OTHER	O	STREET R.O.W. SURFACE PRIMARY PARKING LOTS	MINING AND QUARRIES	UTILITY R.O.W. RAIL	ABANDONED MINES AND QUARRIES: ACTIVE & INACTIVE LANDFILLS	WATER INCLUDING FISHERIES MAR[illegible]

SOURCE: Lake County Land Use Map
Lake County Planning Department, 1977





EXISTING LAND USE WITHIN 5 MILES

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

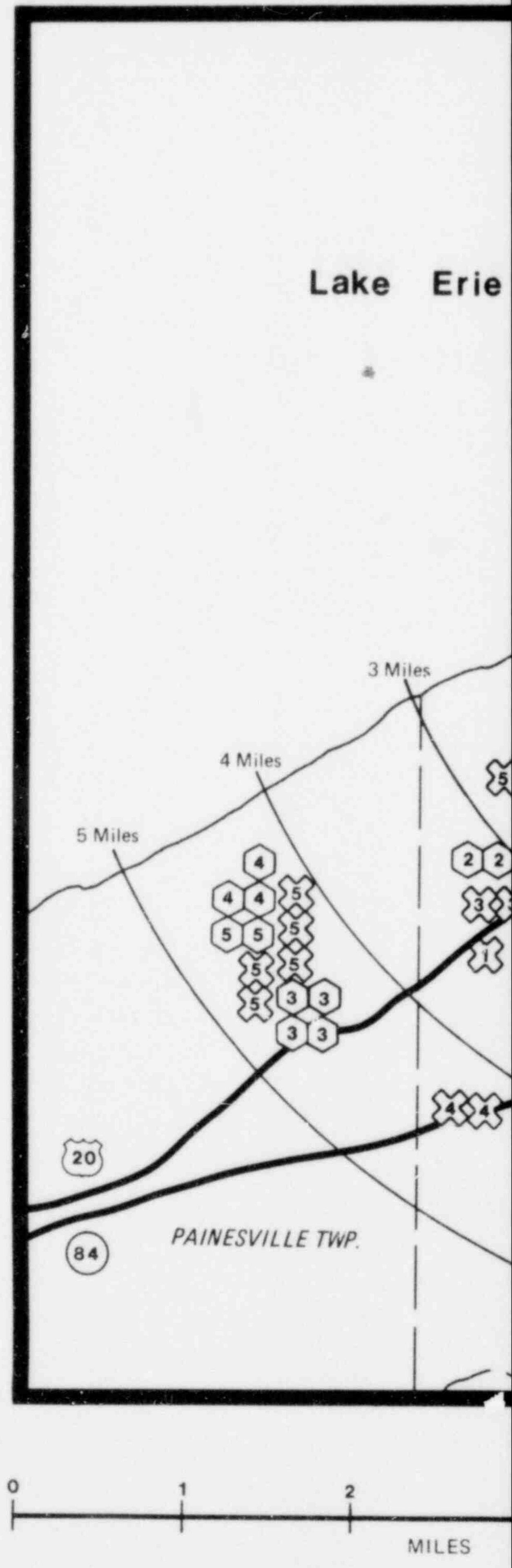
FIGURE 2.1-19

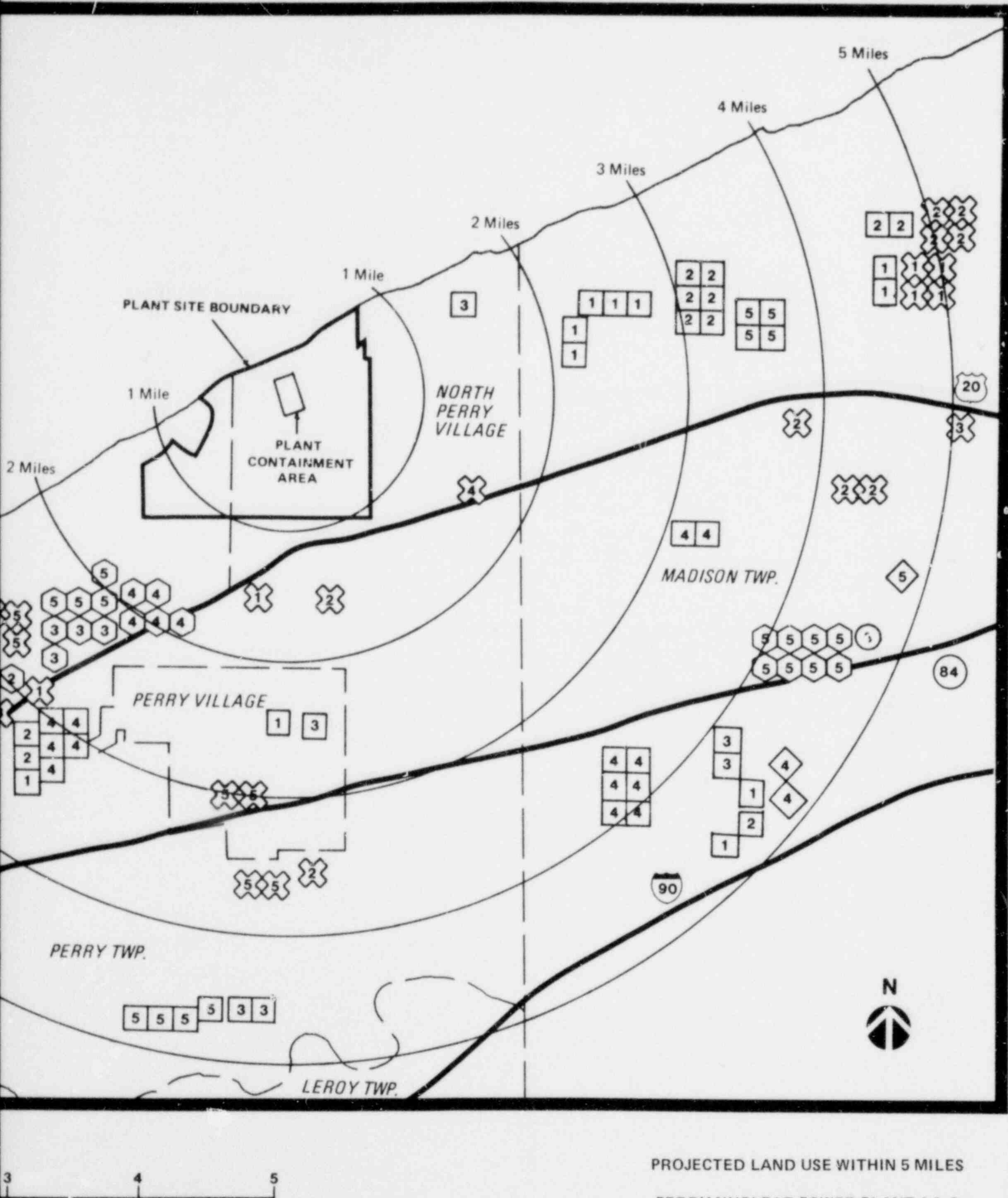
LAND USE ALLOCATION/YEAR	1980	1985	1990	1995	2000
HIGH-DENSITY RESIDENTIAL	1	2	3	4	5
LOW-DENSITY RESIDENTIAL	1	2	3	4	5
RURAL RESIDENTIAL	1	2	3	4	5
HEAVY INDUSTRY	1	2	3	4	5
LIGHT INDUSTRY	1	2	3	4	5
COMMERCIAL	1	2	3	4	5

SOURCE: Northeast Ohio Areawide Coordinating Agency, 1977

LAKE COUNTY BASELINE ALLOCATION – 2000

LAND USE/SERVICE AREAS



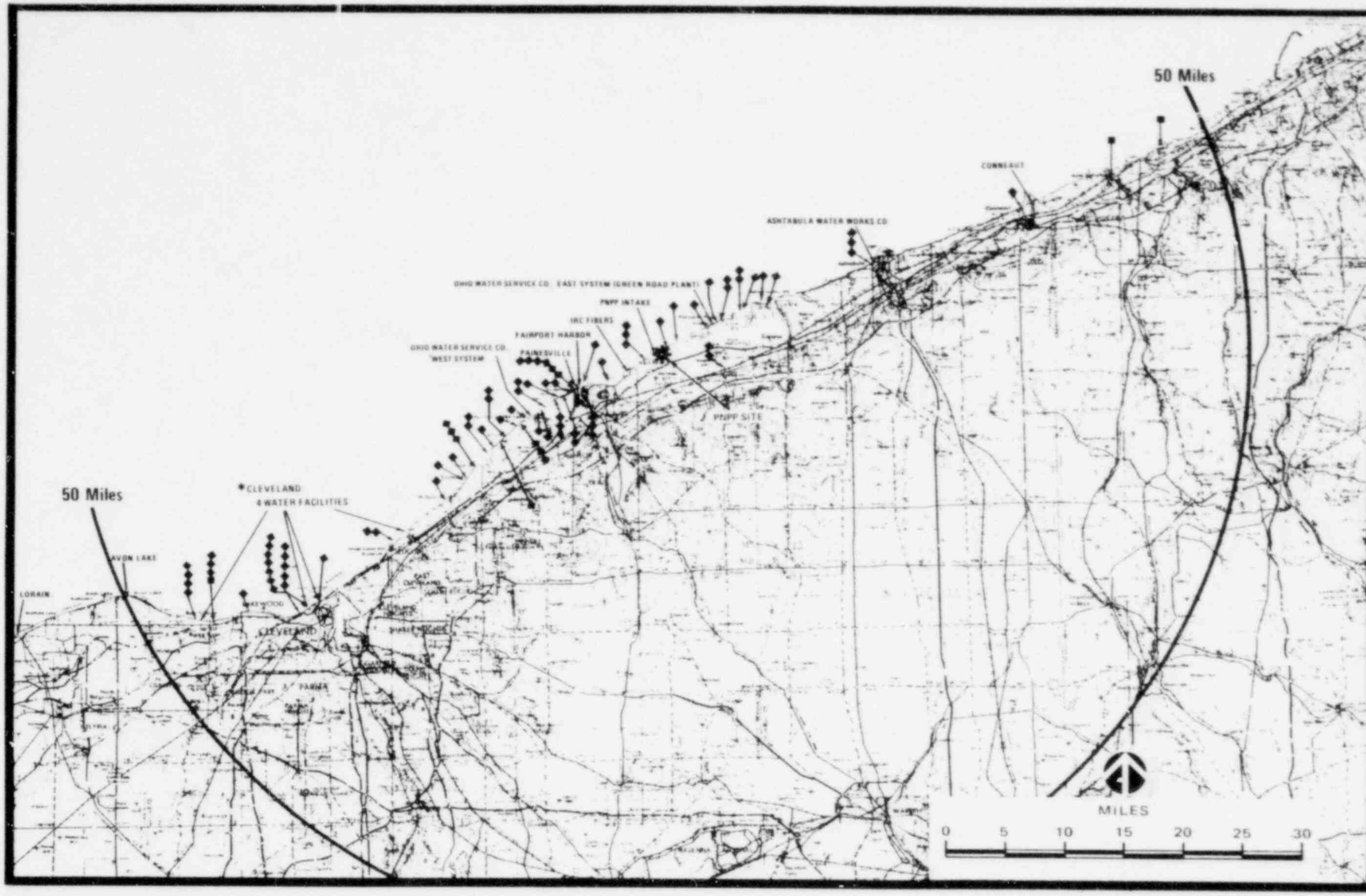


PROJECTED LAND USE WITHIN 5 MILES

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-20



* Cleveland distribution system consists of 6 master-meter service areas and 65 direct service areas which are interconnected.

† West System (Mentor-on-the-Lake plant) services all or part of nine nearby communities and townships.

◆ Shoreline recreational water-use areas.

Water intakes are called out by name.

SOURCES: Inventory of Municipal Water Supply Systems by County, Ohio, 1975.
PNPP Application to Ohio Power Siting Commission, 1974.

INTAKES AND SHORELINE RECREATION AREAS WITHIN 50 MILES OF PNPP

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.1-21

2.2 ECOLOGY

Since the submittal of the ER/CP, the construction monitoring program has provided additional information about the ecosystems of the PNPP site. These data are therefore summarized and compared with the data presented in the ER/CP.

2.2.1 AQUATIC ECOLOGY

2.2.1.1 Water Chemistry

The results of the analyses of water samples collected monthly at transects 1, 5, and 9 in 1977 are presented in Tables 2.2-1 through 2.2-4; transects 1, 5, and 9 are shown in Figure 2.2-1. The yearly means and ranges of the results for transect 5 during 1975-1977 are presented in Table 2.2-4 to permit comparisons of data for these years with similar data for 1971-1974, summarized in Tables 2.2-5 and 2.2-6. The various parameters are discussed in the following sections.

2.2.1.2 Temperature, Dissolved Oxygen, and pH

Water temperatures recorded at the PNPP in 1977 ranged from freezing in December to 79°F in July at all transects. These values are similar to those recorded for previous years. Dissolved-oxygen concentrations at the PNPP in 1977 generally reflected the seasonal cycle of water temperature. Minimum dissolved-oxygen concentrations were observed during the summer, when maximum water temperatures occurred, and maximum dissolved-oxygen levels were observed in winter, when minimum temperatures were recorded. In 1977 the concentrations of dissolved oxygen ranged from 7.6 ppm in samples from transects 5 and 9 in July to 15.3 ppm in samples from transect 1 in February. With the exception of slightly lower concentrations in July samples (see Tables 2.2-1 to 2.2-3), these values were similar to those found in previous years. The lower dissolved-oxygen values in July were probably associated with the temporarily high concentrations of suspended solids resulting from dredging the barge slip.

Values for pH ranged from 7.4 to 8.5 for laboratory analyses and from 6.8 to 8.2 for field analyses on all three transects. These values are similar to those recorded in previous years at the site.

2.2.1.3 Biochemical Oxygen Demand

Biochemical oxygen demand values, which ranged from 1 to 4 ppm in 1977, were in general similar to values from previous years. The highest values for 1977 (4 ppm) were observed in samples from transects 5 and 9 in July. Suspended solids were high in samples from transect 5 in that month, probably as a temporary effect of dredging the barge slip. The suspended solids undoubtedly included biologically oxidizable organic matter usually buried under surface sediments and not usually available in the water column.

2.2.1.4 Nitrate

The concentrations of nitrate (as nitrogen) were low in 1977 samples (from less than 0.2 to 3.8 ppm) and were within the range of concentrations for this form of nitrogen found in samples taken at the site in previous years. The 3.8-ppm value at transect 1 in February 1977 slightly exceeded levels previously recorded at the site.

2.2.1.5 Total Phosphorus

The concentration of total phosphorus recorded at transect 5 in July 1977 (0.59 mg per liter) was higher than concentrations previously reported at the PNPP. This value was probably associated with the resuspension of phosphorus-containing material from sediments disturbed by the temporary dredging operations. Other total phosphorus concentrations were within the range reported from the site in previous years (Table 2.2-4).

2.2.1.6 Solids

The means and ranges of concentrations of dissolved solids have remained similar in samples taken at the site from 1971 to 1977 (Tables 2.2-4 and 2.2-5). The concentrations of suspended solids were higher in samples taken during the construction phase (1975-1977, see Table 2.2-4) than in preconstruction samples (1971-1974, see Table 2.2-5), probably because of earth-moving activities at the site. The mean of suspended solids concentrations in 1977 was higher than in 1975 or 1976 (Table 2.2-4), primarily because of the extremely high value (2281 ppm) recorded for transect 5 in July 1977 as a temporary result of dredging the barge slip. Excluding this value, the 1977 mean for suspended solids at transect 5 was 106 ppm, a value similar to those for 1975 and 1976.

2.2.1.7 Oils

Oil concentrations at the PNPP site in 1977 were within the ranges of the data recorded in previous years.

2.2.1.8 Turbidity

Like suspended-solids concentrations, a few turbidity values were higher in construction-phase samples (1975-1977, see Table 2.2-4) than in samples taken earlier (1971-1974, see Table 2.2-5), probably as a temporary result of runoff from the construction site. The mean turbidity for 1977 was higher than the 1976 mean and slightly lower than the 1975 mean. If the high turbidity value recorded in December were excluded, the 1977 mean would be only 61 Jackson turbidity units. High turbidities observed previously at the PNPP site have been associated with wave action and surface runoff during winter and, occasionally, with periods of earth-moving operations at the site.

2.2.1.9 Bacteria

The standard plate counts at the PNPP site were slightly higher in 1977 than in previous years (Tables 2.2-4 and 2.2-6), primarily because of a high value at transect 5 in July, when the concentration of suspended solids was also high, a phenomenon attributed to dredging. The count of fecal coliform bacteria at transect 5 in July was also higher than the previously reported values.

2.2.2 TERRESTRIAL ECOLOGY

This section summarizes the results of terrestrial ecology studies conducted on the site between March and October 1972 and compares these results with those performed as part of construction monitoring.

The PNPP site encompasses about 1,100 acres of land of Perry Township and North Perry Village, and includes about 2.5 miles of the Lake Erie shoreline. This segment of shoreline consists of wave-washed, vertical bluffs (up to 40 feet above the water level) that are eroded and unstable; there are no marshlands along the shore. Approximately 48 percent of the site supported woodlands, 44 percent was devoted to dwellings or was cultivated for crops and nursery stock, and the remaining 8 percent was pasture land for cattle (Figure 2.2-2).

2.2.2.1 Vegetation

Forest formations in the area of the site are included in the Beech-Maple Forest Region.[1,2] Braun[2] has noted also that elements of the Hemlock-White Pine-Northern Hardwoods

Forest are evident in small areas of northeastern Ohio. Gordon[3,4] mapped most of the original forest associations in the Perry region as mixed oak and, to a lesser extent, mixed mesophytic. Segregates of all the above forest types were observed on the site.

The structure and composition of natural vegetation types at the site have been greatly modified by man-induced perturbations: logging, cultivation, and maintenance of pipeline and transmission corridors. For the most part, these cultural activities have enhanced the diversity of floral and faunal species by increasing the area of edge habitat (ecotone). The most notable natural perturbation affecting the floral community of the site is Dutch elm disease, particularly in poorly drained areas, where elm was once a dominant constituent of the canopy.

The distribution of forest types at the site are largely controlled by soil moisture and aeration gradients (relative to the terrain, slope exposure, degree of dissection, hydrologic features, underlying substrate, and history of land use). With the exception of a deep ravine in the extreme northeastern sector, the terrain of most of the study area is flat to gently undulating, and minor differences in elevation contribute to the formation of a mosaic of forest associations.

The ravine is populated by a mature stand that is considered to be a segregate of the Hemlock-Northern Hardwoods forest type; hemlock, birch, beech, and tuliptree are major stand components. Forest associations occupying flatter portions of the site include, along a continuum of increasing soil moisture, sugar maple-red oak, beech-maple, mixed mesophytic (dominants are beech, sugar maple, tuliptree, red oak, ash, and black cherry); swamp forest (dominants are ash, both dead and alive American elm, spicebush, tuliptree, beech, and red and sugar maple), and a floodplain association (dominants are sycamore and willow).

Other small portions of the site support early stages of woody succession and will probably develop into second-growth beech-maple, mixed mesophytic, or swamp forest stands. Common trees and shrubs in these areas include spicebush, red osier, wild black cherry, tuliptree, and ash.

Several areas of the site display floral characteristics that may be noteworthy. The eastern hemlock stand occupying the ravine in the northeastern portion of the site is relatively mature and is a substantial distance from the nearest large area of Hemlock-Northern Hardwoods Forest in northwestern Pennsylvania. The occurrence of hemlock elsewhere in Ohio is confined almost exclusively to stream gorges in the Allegheny Plateau.

Many individuals of Tipularia discolor (crane-fly orchid) are found in several wooded areas at the site. Although not listed as threatened or endangered,[5,6] this orchid had been considered rare by the State of Ohio. However, as of May 1980 it was not included on the federal list of threatened or endangered species, and it was anticipated that it would not be in the new Ohio list. Crane-fly orchid populations at the site (Figure 2.2-3) have been monitored yearly since 1974 to better understand the phenology and habitat requirements of this orchid and to detect any possible stresses on the populations from facility construction and operation. No significant change in the number of plants has been observed since the monitoring studies were begun.

2.2.2.2. Fauna

2.2.2.2.1 Mammals

Forty-seven species of mammals have ranges that include the PNPP site: 1 marsupial, 6 insectivores, 10 bats, 10 carnivores, 19 rodents, and 1 deer.[7] Several of these species would not be expected at the site because the site is near the periphery of the species range or specific habitat requirements are not met on the site.

Eleven mammalian species were reported at the site during surveys in 1972, and 10 species have been reported since 1976 (Table 2.2-7). Seventeen different species of mammals have been observed at the site since 1972. The species are typical of broken agriculture, old field, shrubland, and woodland communities in northern Ohio. Typical nongame mammals include short-tailed shrews, starnose moles, white-footed mice, and meadow voles.

About 15 species of mammals that could occur at the site are classified as game species or furbearers; of these, eight species have been reported at the site. Species typical of the region are the opossum, raccoon, striped skunk, gray and red fox, woodchuck, fox squirrel, eastern cottontail, and white-tailed deer.

One species included in the federal list of endangered and threatened wildlife,[8] the Indiana myotis, could occur at the site, but has not been observed there. This bat could occur in the region as a migrant or breeder, although breeding areas are largely unknown.[9] It is most vulnerable during hibernation in wintering caves. No wintering colonies are known in northern Ohio.

2.2.2.2.2 Birds

Approximately 330 species of birds have been reported from the Toledo region of northwestern Ohio.[10] These include 35 permanent residents, 92 summer residents and visitors, 28 winter visitors, 125 migrants, and 50 accidentals or hypotheticals. A similar species diversity could be expected in the region of the PNPP site.

Seventy-two species were reported at the site in 1972, and 129 species have been reported since 1976 (Table 2.2-8). A total of 140 species of birds have been observed at the site since 1972. This list is based mostly on observations made from late winter through early summer.

Most of the species reported are typical of broken agriculture, woodland, shrubland, and old field communities in northern Ohio. About 20 species of ducks and geese, all of which are considered game species, could occur at the site.

Several species of waterfowl (e.g., wood duck, mallard) may breed on the site. There is little marsh habitat on the site, and species restricted to this habitat are not common. The woodcock is the most abundant game bird on the site. Onsite habitat for this species is excellent. The ruffed grouse and ring-necked pheasant have been observed at the site, but are not common. The bobwhite could occur in the region.

Kirtland's warbler, the peregrine falcon, and the bald eagle are the only federally protected species that could occur at the site,[11] but then only as rare migrants.

Raptors (hawks and owls) are being monitored on the PNPP site to determine whether they are being affected by construction. Approximately 10 to 18 pairs of raptors breed annually on the site. Two pairs of American kestrels, two pairs of great horned owls, one pair of barred owls, one pair of red-tailed hawks, and five to seven pairs of screech owls were believed to have bred on the PNPP site in 1978 (Figure 2.2-4). Changes in the raptors at the PNPP have corresponded to statewide variations from year to year.

2.2.2.2.3 Reptiles and Amphibians

Six species of amphibians, two species of turtles, and two species of snakes have been reported from the PNPP site since 1972 (Table 2.2-9). These species are typical of the region.

The spotted turtle (*Clemmys guttata*) was observed at the site in 1972 and 1977. In 1977, two were found in the marshy pasture near the reinforcement bar storage area, and one was found in the transmission corridor in the southeastern part of the site. This species is listed as "endangered" in Ohio by the State.[11] The spotted turtle inhabits shallow, clear waters, such as roadside ditches, small ponds, and slow streams.[12]

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TABLE 2.2-1

WATER CHEMISTRY, FEBRUARY THROUGH DECEMBER
Transect 1 (Composite Surface Samples) 1977

Parameter	Sampling Date									
	2/24	3/28	4/28	6/7	7/21	8/25	9/29	10/20	11/30	12/28
TEMPERATURE AND CHEMICAL CONSTITUENTS										
Temperature, °F	(a)	39	46	52	79	73	66	56	40	32
Dissolved oxygen, ppm	15.3	13.0	11.2	11.0	8.0	8.8	9.4	(a)	12.4	13.4
pH (laboratory analysis)	6.3	8.0	8.0	7.9	8.2	8.4	8.1	8.3	7.1	7.8
pH (field analysis)	7.0	6.9	7.5	7.8	7.4	8.0	7.9	7.4	7.4	7.4
Biochemical oxygen demand, ppm	2	<1	3	2	2	<1	1	3	3	<1
Nitrate (N), ppm	3.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	0.4
Phosphorus, total (P), ppm	0.1	0.03	0.10	0.16	0.04	0.01	0.05	0.03	0.09	0.12
Dissolved solids, ppm	148	182	259	190	194	204	246	178	212	205
Suspended solids, ppm	11	69	184	339	65	5	72	29	88	146
Total solids, ppm	159	251	443	529	259	209	318	201	300	351
Oil, ppm	0.251	0.034	0.016	<0.003	<0.003	<0.003	<0.003	0.010	0.292	<0.003
Turbidity, Jackson turbidity units	6.7	40	95	84	43	6.7	64	49	73	475
BACTERIA (counts per 100 ml)										
Standard plate count	8×10^3	2.7×10^4	3.7×10^4	2.8×10^5	2.9×10^5	1.4×10^4	1.4×10^4	3.4×10^3	1.2×10^5	3.1×10^4
Coliform	< 1	43	5.7×10^3	2.1×10^2	7.5×10^3	<1	3.8×10^2	16	3.1×10^2	3.2×10^2
Fecal coliform	< 1	15	2.8×10^2	< 1	1.2×10^4	<1	50	13	2.2×10^2	1.8×10^3
Fecal streptococcus	< 1	1.3×10^2	74	1.4×10^2	59	26	10	<1	1.4×10^2	3.1×10^2

(a)Not determined.

TABLE 2.2-2

WATER CHEMISTRY, FEBRUARY THROUGH DECEMBER
Transect 5 (Composite Surface Samples) 1977

Parameter	Sampling Date									
	2/24	3/28	4/28	6/7	7/21	8/25	9/29	10/20	11/30	12/28
TEMPERATURE AND CHEMICAL CONSTITUENTS										
Temperature, °F	(a)	38	46	53	79	71	66	56	39	32
Dissolved oxygen, ppm	13.4	11.9	10.7	10.3	7.6	8.6	9.9	(a)	12.6	13.8
pH (laboratory analysis)	7.4	7.9	8.0	8.0	8.0	8.5	8.9	8.3	7.5	7.9
pH (field analysis)	7.0	6.8	7.5	7.9	7.4	7.8	7.9	8.2	7.1	7.1
Biochemical oxygen demand, ppm	2	2	2	3	4	<1	<1	<1	1	<1
Nitrate (N), ppm	0.19	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	0.5
Phosphorus, total (P), ppm	0.15	0.05	0.09	0.08	0.59	0.01	0.04	0.06	0.09	0.15
Dissolved solids, ppm	203	235	242	190	199	200	220	176	176	196
Suspended solids, ppm	59	101	183	147	2082	6	58	63	149	190
Total solids, ppm	262	336	425	337	2281	206	278	231	325	386
Oil, ppm	0.034	0.083	0.055	<0.003	0.278	<0.003	<0.003	<0.003	0.118	0.093
Turbidity, Jackson turbidity units	25	40	95	15	170	6.4	53	55	88	650
BACTERIA (counts per 100 ml)										
Standard plate count	$2x10^4$	$5.5x10^5$	$3.5x10^4$	$6.5x10^4$	$8.1x10^6$	$2.1x10^4$	$3.4x10^5$	$8.3x10^3$	$9.8x10^4$	$4.2x10^4$
Coliform	90	64	$3.8x10^3$	$1x10^2$	$5.0x10^3$	<1	$1.1x10^2$	58	$3.9x10^2$	$2.1x10^3$
Fecal coliform	<1	11	$2.8x10^2$	<1	$1.5x10^4$	<1	27	$2.2x10^2$	93	$8.1x10^2$
Fecal streptococcus	3	15	52	67	$1.7x10^2$	27	15	<1	14	$3.7x10^2$

(a)Not determined.

TABLE 2.2-3

WATER CHEMISTRY, FEBRUARY THROUGH DECEMBER
Transect 9 (Composite Surface Samples) 1977

Parameter	Sampling Date									
	2/24	3/28	4/28	6/7	7/21	8/25	9/29	10/20	11/30	12/28
TEMPERATURE AND CHEMICAL CONSTITUENTS										
Temperature, °F	(a)	34	46	52	79	71	66	56	39	32
Dissolved oxygen, ppm	14.7	12.6	10.8	10.5	7.6	9.5	9.5	(a)	12.7	14.0
pH (laboratory analysis)	7.5	7.9	8.1	7.9	8.2	8.5	7.9	8.3	7.7	7.9
pH (field analysis)	7.5	6.8	7.5	7.8	7.8	8.0	8.0	8.1	7.4	7.3
Biochemical oxygen demand, ppm	1	1	2	4	2	<1	<1	1	<1	<1
Nitrate (N), ppm	0.11	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	0.6
Phosphorus, total (P), ppm	0.19	0.04	0.09	<0.01	0.04	0.01	0.02	0.05	0.06	0.15
Dissolved solids, ppm	177	201	161	181	201	212	220	171	163	202
Suspended solids, ppm	90	51	183	90	74	4	52	38	72	224
Total solids, ppm	267	252	344	271	275	216	272	221	235	426
Oil, ppm	0.119	0.075	0.063	<0.003	<0.003	<0.003	<0.003	0.012	0.006	0.053
Turbidity, Jackson turbidity units	36	25	80	35	57	6.7	57	52	70	710
BACTERIA (counts per 100 ml)										
Standard plate count	$5x10^3$	$6.7x10^4$	$5.9x10^4$	$1.2x10^4$	$9.7x10^4$	$1.6x10^4$	$9.2x10^3$	$5.8x10^3$	$1.1x10^5$	$3.7x10^4$
Coliform	60	39	$2.3x10^3$	$2x10^2$	$1.2x10^3$	<1	$1.2x10^2$	8	39	$3.7x10^2$
Fecal coliform	1	9	$3.7x10^2$	<1	$1.0x10^2$	<1	10	12	21	$1.7x10^3$
Fecal streptococcus	4	7	61	14	72	33	17	<1	5	$4.5x10^2$

(a) Not determined.

TABLE 2.2-4

WATER QUALITY AND BACTERIA IN SAMPLES FROM TRANSECT 5

Parameter	1975 Mean	1975 Range	1976 Mean	1976 Range	1977 Mean	1977 Range
TEMPERATURE AND CHEMICAL CONSTITUENTS						
Temperature, °F	53.9	31-80	51.5	32-74.6	53.3	32-79
Dissolved oxygen, ppm	11.1	8.5-14.5	11.0	8.4-14.0	11.0	7.6-13.8
pH (laboratory analysis)	(a)	7.5-8.6	(a)	7.6-8.8	(a)	7.4-8.5
pH (field analysis)	(a)	7.0-8.5	(a)	7.3-8.6	(a)	6.8-8.2
Biochemical oxygen demand, ppm	1	<1-3	1	<1-3	1.4	<1-4
Nitrate (N), ppm	0.5	<0.2-1.8	<0.2	<0.2-0.5	0.11	<0.2-0.5
Phosphorus, total (P), ppm	0.06	0.01-0.17	0.07	0.01-0.25	0.13	0.01-0.59
Dissolved solids, ppm	220	186-270	207	183-258	204	176-242
Suspended solids, ppm	98	2-482	110	2-544	304	6-2082
Total solids, ppm	317	203-684	318	185-802	507	206-2281
Oil, ppm	0.023	<0.003-0.199	0.571	<0.003-4.90	0.066	<0.003-0.278
Turbidity, Jackson turbidity units	122	1.4->1000	55.0	1.2-275	119.7	6.4-650
BACTERIA (counts per 100 ml)						
Standard plate count(a)		$2.1\times10^{3}-3.9\times10^{4}$		$4.2\times10^{2}-3.2\times10^{4}$		$8.3\times10^{3}-8.1\times10^{6}$
Coliform(a)		$<1-6\times10^{3}$		$1-1.0\times10^{3}$		$<1-5.0\times10^{3}$
Fecal coliform(a)		$0-8.1\times10^{2}$		$<1-2.2\times10^{2}$		$<1-1.5\times10^{4}$
Fecal streptococcus(a)		$0-1.6\times10^{2}$		1-48		$<1-3.7\times10^{2}$

(a) Mean not given: logarithmic function.

TABLE 2.2-5

WATER QUALITY IN SAMPLES FROM TRANSECT 5

Constituent	Concentration[a,b]						
	1971[c]	1972		1973		1974	
		Mean	Range	Mean	Range	Mean	Range
pH	8.0		7.7-8.5		7.8-8.6		8.0-8.2
Alkalinity	95	82	80-92	86	78-92	97	83-112
Hardness	136	131	116-143	124	109-134	140	130-151
Calcium	40	40	35-45	37	32-39	43	38-48
Magnesium	8.6	7.7	6.9-8.7	8.4	7.0-9.1	7.8	7.7-8.0
Sulfate	23.4	23.8	18.2-36.6	29.1	22.9-57.0	9.0	9.0
Total phosphate (PO_4)	0.28	0.32	0.07-1.21	0.13	0.03-0.35	0.09	0.01-0.18
Nitrate	0.3	1.16	0.02-2.50	1.79	0-3.30	0.5	0.2-0.8
Nitrite	0.24	0.07	0.0-0.32	0.26	0.07-0.61	0.01	0.01
Nitrogen (Kjeldahl)	0.26	0.46	0.19-0.62	0.47	0.29-0.73	0.3	0.2-0.4
Ammonia	0.4	0.16	0.07-0.23	0.14	0.05-0.28	0.18	0.07-0.3
Total organic carbon	5.5	7.5	4.4-10.7	4.4	1.1-8.4	7.4	6.2-8.6
Aluminum	ND	0.2	0.1-0.4	ND	ND	0.6	0.3-0.9
Total chromium	1.0	0.35	0.03-1.3	ND	ND	0.03	0.03
Copper	0.01	0.02	0.02-0.04	0.04	0.02-0.10	0.02	0.02
Iron	0.11	0.[illegible]	0.05-1.14	0.12	0.07-0.23	0.67	0.05-1.3
Mercury	0.00	0.0[illegible]	0.00	0.00	0.00	0.00	0.00
Zinc	0.008	0.017	0.02-0.007	0.026	0.02-0.04	0.02	0.02
Silica (total)	0.4	2.5	0.05-4.0	2.3	0.4-12.5	2.5	0.3-4.8
Dissolved solids	211	240	190-296	210	191-225	ND	279
Suspended solids	4.1	13.2	3-7	14.5	0-83	23	2-44
Turbidity	ND	6.8	0.7-2.6	5.0	2.2-175	28	7.7-49
Biological oxygen demand	ND	1	1-2	1	0-20	1	1
Specific conductivity	311	370	285-433	333	304-374	354	325-383

[a] All values in milligrams per liter except turbidity (Jackson turbidity units), conductivity (μmho/cm), and pH.

[b] ND = not determined.

[c] One sample.

TABLE 2.2-6

MEAN BACTERIA CONCENTRATIONS IN SAMPLES FROM TRANSECT 5

Type	Concentration (colonies per 100 ml)							
	Nov. 1971	Apr. 1972	June 1972	Sept. 1972	June 1973	Sept. 1973	March 1974	Aug. 1974
Plate count	3.5×10^5	1×10^4	1.8×10^4	2.7×10^3	4×10^3	8.5×10^4	1.2×10^3	8.4×10^4
Total coliform	2×10^2	1	24	1	18	3	3.3×10^3	1.6×10^2
Fecal coliform	30	1	0	0	1	1	20	40
Fecal Streptococcus	0	0	0	3	1	1	12	0

TABLE 2.2-7

MAMMALS OR THEIR SIGN OBSERVED AT THE PNPP SITE
1972 AND 1976-1978

Common Name[a]	Scientific Name	1972	1976-1978
Virginia opossum	*Didelphis virginiana*	X	X
Short-tailed shrew	*Blarina brevicauda*		X
Hairy-tailed mole	*Parascalops breweri*		X
Star-nosed mole	*Condylura cristata*		X
Eastern cottontail	*Sylvilagus floridanus*	X	X
Eastern chipmunk	*Tamias striatus*	X	
Woodchuck	*Marmota monax*	X	X
Fox squirrel	*Sciurus niger*	X	X
Red squirrel	*Tamiasciurus hudsonicus*	X	
Deer mouse	*Peromyscus maniculatus*	X	X[b]
White-footed mouse	*Peromyscus leucopus*	X	
Meadow vole	*Microtus pennsylvanicus*		X
Muskrat	*Ondatra zibethicus*		X
Red fox	*Vulpes vulpes*		X[c]
Gray fox	*Urocyon cinereoargenteus*		
Raccoon	*Procyon lotor*	X	X
Striped skunk	*Mephitis mephitis*	X	X
White-tailed deer	*Odocoileus virginianus*	X	X
Total		11	14
Total number of species		17	

[a] Nomenclature from J. K. Jones, Jr., D. C. Carter, and H. H. Genoways, "Revised Checklist of North American Mammals North of Mexico," Occas. Papers Mus., Texas Tech. Univ., Vol. 28, pp. 1-14, (1975).

[b] Could be deer mouse or white-footed mouse.

[c] Could be red fox or gray fox.

TABLE 2.2-8

BIRDS OBSERVED AT THE PNPP SITE, 1972 AND 1976-1978

Common Name[(a)]	Scientific Name	1972	1976-1978
Horned grebe	Podiceps auritus	X	X
Pied-billed grebe	Podilymbus podiceps		X
Great blue heron	Ardea herodias	X	X
Green heron	Butorides striatus		X
Least bittern	Ixobrychus exilis		X
Whistling swan	Olor columbianus	X	
Canada goose	Branta canadensis		X
Mallard	Anas platyrhynchos	X	X
Blue-winged teal	Anas discors		X
Wood duck	Aix sponsa	X	X
Redhead	Aythya americana		X
Ring-necked duck	Aythya collaris		X
Lesser scaup	Aythya affinis	X	X
Common goldeneye	Bucephala clangula	X	
Hooded merganser	Lophodytes cucullatus		X
Red-breasted merganser	Mergus serrator	X	X
Turkey vulture	Cathartes aura	X	X
Sharp-shinned hawk	Accipiter striatus	X	X
Cooper's hawk	Accipiter cooperii	X	X
Red-tailed hawk	Buteo jamaicensis	X	X
Red-shouldered hawk	Buteo lineatus		X
Broad-winged hawk	Buteo platypterus		X
Rough-logged hawk	Buteo lagopus		X
Marsh hawk	Circus cyaneus		X
Merlin	Falco columbarius	X	
Kestrel	Falco tinnunculus	X	X
Ruffed grouse	Bonasa umbellus	X	X
Ring-necked pheasant	Phasianus colchicus	X	X
Virginia rail	Rallus limicola		X
American coot	Fulica americana	X	X
Killdeer	Charadrius vociferus	X	X
American woodcock	Philohela minor	X	X
Common snipe	Capella gallinago	X	
Spotted sandpiper	Actitis macularia		X
Great black-backed gull	Larus marinus	X	
Herring gull	Larus argentatus	X	X
Ring-billed gull	Larus delawarensis	X	X
Bonaparte's gull	Larus philadelphia	X	X
Common tern	Sterna hirundo		X
Caspian tern	Sterna caspia		X
Rock dove	Columba livia		X
Mourning dove	Zenaida macroura	X	X
Screech owl	Otus asio	X	X
Great horned owl	Bubo virginianus	X	X
Barred owl	Strix varia	X	X
Whip-poor-will	Caprimulgus vociferus	X	
Common nighthawk	Chordeiles minor		X
Chimney swift	Chaetura pelagica	X	X

TABLE 2.2-8 (Continued)

BIRDS OBSERVED AT THE PNPP SITE, 1972 AND 1976-1978

Common Name[a]	Scientific Name	1972	1976-1978
Ruby-throated hummingbird	*Archilochus colubris*		X
Belted kingfisher	*Megaceryle alcyon*	X	X
Common flicker	*Colaptes auratus*	X	X
Pileated woodpecker	*Dryocopus pileatus*	X	X
Red-bellied woodpecker	*Melanerpes carolinus*	X	X
Yellow-bellied sapsucker	*Sphyrapicus varius*		X
Hairy woodpecker	*Picoides villosus*	X	X
Downy woodpecker	*Picoides pubescens*	X	X
Eastern kingbird	*Tyrannus tyrannus*		X
Great crested flycatcher	*Myiarchus crinitus*		X
Eastern phoebe	*Sayornis phoebe*	X	X
Acadian flycatcher	*Empidonax virescens*		X
Willow flycatcher	*Empidonax traillii*		X
Least flycatcher	*Empidonax minimus*	X	X
Eastern wood pewee	*Contopus virens*		X
Olive-sided flycatcher	*Nuttallornis borealis*		X
Horned lark	*Eremophila alpestris*		X
Tree swallow	*Iridoprocne bicolor*	X	X
Bank swallow	*Riparia riparia*		X
Rough-winged swallow	*Stelgidopteryx ruficollis*		X
Barn swallow	*Hirundo rustica*	X	X
Purple martin	*Progne subis*	X	X
Blue jay	*Cyanocitta cristata*	X	X
Common raven[b]	*Corvus corax*	X	
Common crow	*Corvus brachyrhynchos*	X	X
Black-capped chickadee	*Parus atricapillus*	X	X
Tufted titmouse	*Parus bicolor*	X	X
White-breasted nuthatch	*Sitta carolinensis*	X	X
Brown creeper	*Certhia familiaris*	X	X
House wren	*Troglodytes aedon*	X	X
Winter wren	*Troglodytes troglodytes*	X	
Gray catbird	*Dumetella carolinensis*		X
Brown thrasher	*Toxostoma rufum*	X	X
American robin	*Turdus migratorius*	X	X
Wood thrush	*Hylocichla mustelina*		X
Hermit thrush	*Catharus guttatus*		X
Swainson's thrush	*Catharus ustulatus*	X	X
Gray-cheeked thrush	*Catharus minimus*		X
Veery	*Catharus fuscescens*		X
Eastern bluebird	*Sialia sialis*	X	
Blue-gray gnatcatcher	*Polioptila caerulea*		X
Golden-crowned kinglet	*Regulus satrapa*	X	X
Ruby-crowned kinglet	*Regulus calendula*	X	X
Cedar waxwing	*Bombycilla cedrorum*	X	X
Loggerhead shrike	*Lanius ludovicianus*		X
Starling	*Sturnus vulgaris*	X	X
Red-eyed vireo	*Vireo olivaceus*		X
Warbling vireo	*Vireo gilvus*		X

TABLE 2.2-8 (Continued)

BIRDS OBSERVED AT THE PNPP SITE, 1972 AND 1976-1978

Common Name[a]	Scientific Name	1972	1976-1978
Blue-winged warbler	Vermivora pinus		X
Tennessee warbler	Vermivora peregrina		X
Nashville warbler	Vermivora ruficapilla	X	
Northern parula	Parula americana		X
Yellow warbler	Dendroica petechia		X
Magnolia warbler	Dendroica magnolia		X
Black-throated green warbler	Dendroica virens		X
Chesnut-sided warbler	Dendroica pensylvanica		X
Bay-breasted warbler	Dendroica castanea		X
Ovenbird	Seiurus aurocapillus		X
Mourning warbler	Oporornis philadelphia		X
Common yellowthroat	Geothlypis trichas		X
Yellow-breasted chat	Icteria virens		X
Wilson's warbler	Wilsonia pusilla		X
Canada warbler	Wilsonia canadensis		X
American redstart	Setophaga ruticilla		X
House sparrow	Passer domesticus		X
Bobolink	Dolichonyx oryzivorus		X
Eastern meadowlark	Sturnella magna	X	X
Red-winged blackbird	Agelaius phoeniceus	X	X
Orchard oriole	Icterus spurius		X
Northern oriole	Icterus galbula		X
Rusty blackbird	Euphagus carolinus	X	X
Boat-tailed grackle[b]	Quiscalus major	X	
Common grackle	Quiscalus quiscula	X	X
Brown-headed cowbird	Molothrus ater	X	X
Scarlet tanager	Piranga olivacea		X
Cardinal	Cardinalis cardinalis	X	X
Rose-breasted grosbeak	Pheucticus ludovicianus		X
Indigo bunting	Passerina cyanea		X
Evening grosbeak	Hesperiphona vespertina		X
Purple finch	Carpodacus purpureus		X
Pine siskin	Carduelis pinus		X
American goldfinch	Carduelis tristis		X
Rufous-sided towhee	Pipilo erythrophthalmus	X	X
Savannah sparrow	Passerculus sandwichensis		X
Dark-eyed junco	Junco hyemalis	X	X
Tree sparrow	Spizella arborea	X	X
Chipping sparrow	Spizella passerina		X
Field sparrow	Spizella pusilla		X
White-throated sparrow	Zonotrichia albicollis	X	X
Fox sparrow	Passerella iliaca	X	X
Swamp sparrow	Melospiza georgiana		X
Song sparrow	Melospiza melodia	X	X
Total number of species		72	129
Total		140	

TABLE 2.2-8 (Continued)

BIRDS OBSERVED AT THE PNPP SITE, 1972 AND 1976-1978

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[a] Nomenclature from the following sources:

1. American Ornithologists' Union, Checklist of North American Birds, fifth edition, 1961.

2. "Thirty-Second Supplement to the American Ornithologists' Union Checklist of North American Birds," Auk, Vol. 90, pp. 411-419 (1973).

3. Corrections and additions to the "Thirty-Second Supplement to the Checklist of North American Birds," Auk, Vol. 90, p. 887 (1973).

4. "Thirty-Third Supplement to the American Ornithologists' Union Checklist of North American Birds," Auk, Vol. 93, pp. 875-879 (1976).

5. Corrections to the "Thirty-Third Supplement to the American Ornithologists' Union Checklist of North American Birds," Auk, Vol. 94, p. 190 (1977).

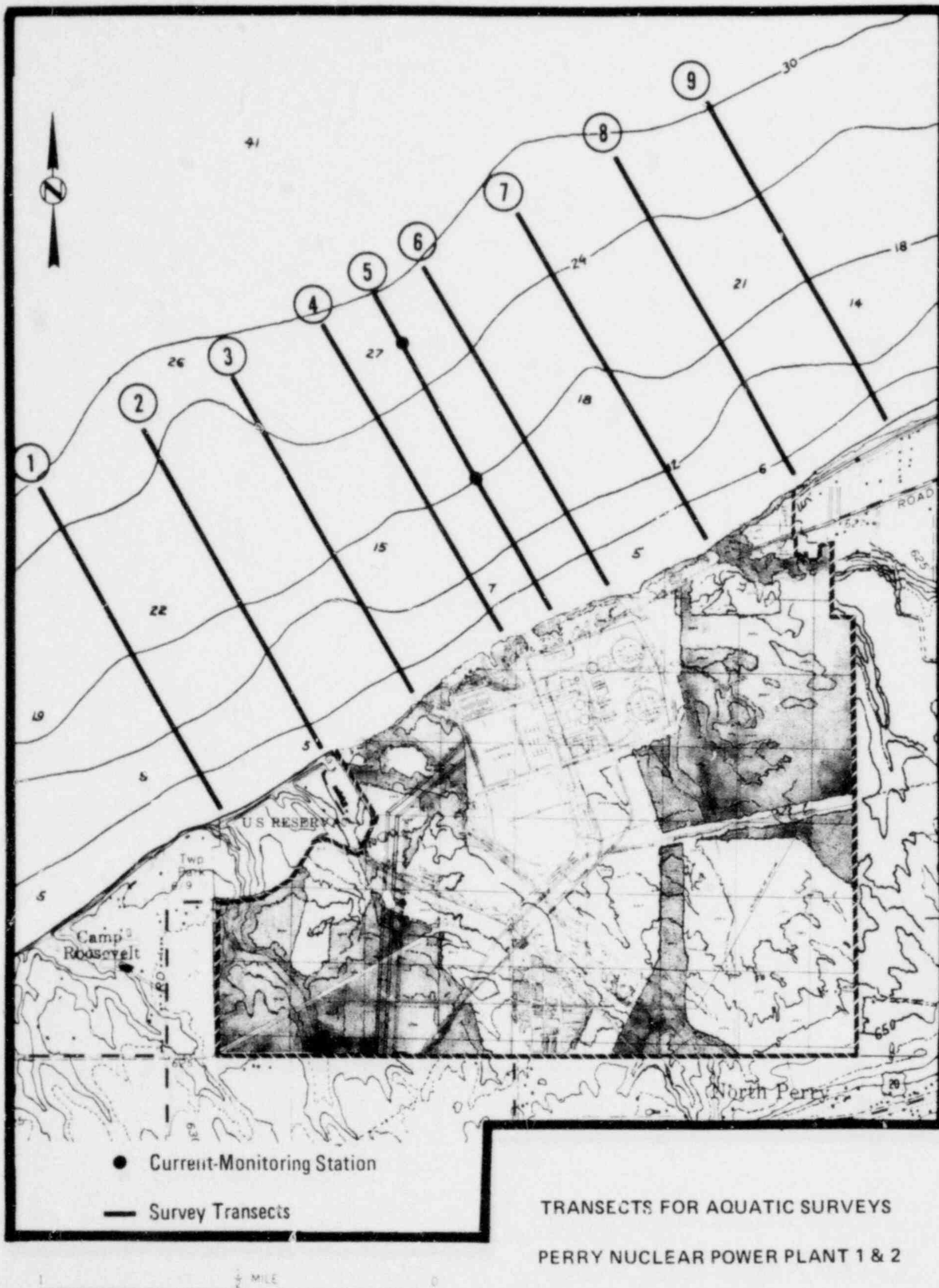
[b] Although raven and boat-tailed grackle were reported in 1972, it is unlikely that these species occurred at the site.

TABLE 2.2-9

REPTILES AND AMPHIBIANS OBSERVED ON THE PNPP SITE, 1972 AND 1976-1978

Common Name[a]	Scientific Name	1972	1976-1978
Northern dusky salamander	Desmognathus fuscus	X	
Blanchard's cricket frog	Acris crepitans	X	
Spring peeper	Hyla crucifer	X	X
Western chorus frog	Pseudacris triseriata	X	
Green frog	Rana clamitans	X	
Northern leopard frog	Rana pipiens	X	
Snapping turtle	Chelydra serpentina	X	X
Spotted turtle	Clemmys guttata	X	X
Racer (blue)	Coluber constrictor		X
Eastern garter snake	Thamnophis sirtalis	X	X
Total number of species		9	5
Total		10	

(a) Nomenclature from Society for the Study of Amphibians and Reptiles, "Standard Common and Current Scientific Names for North American Amphibians and Reptiles," Herpetological Circular No. 7, 1978.



TRANSECTS FOR AQUATIC SURVEYS

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.2-1


N
SUBSTATION
ORC
ORC
NUR
ABANDONED
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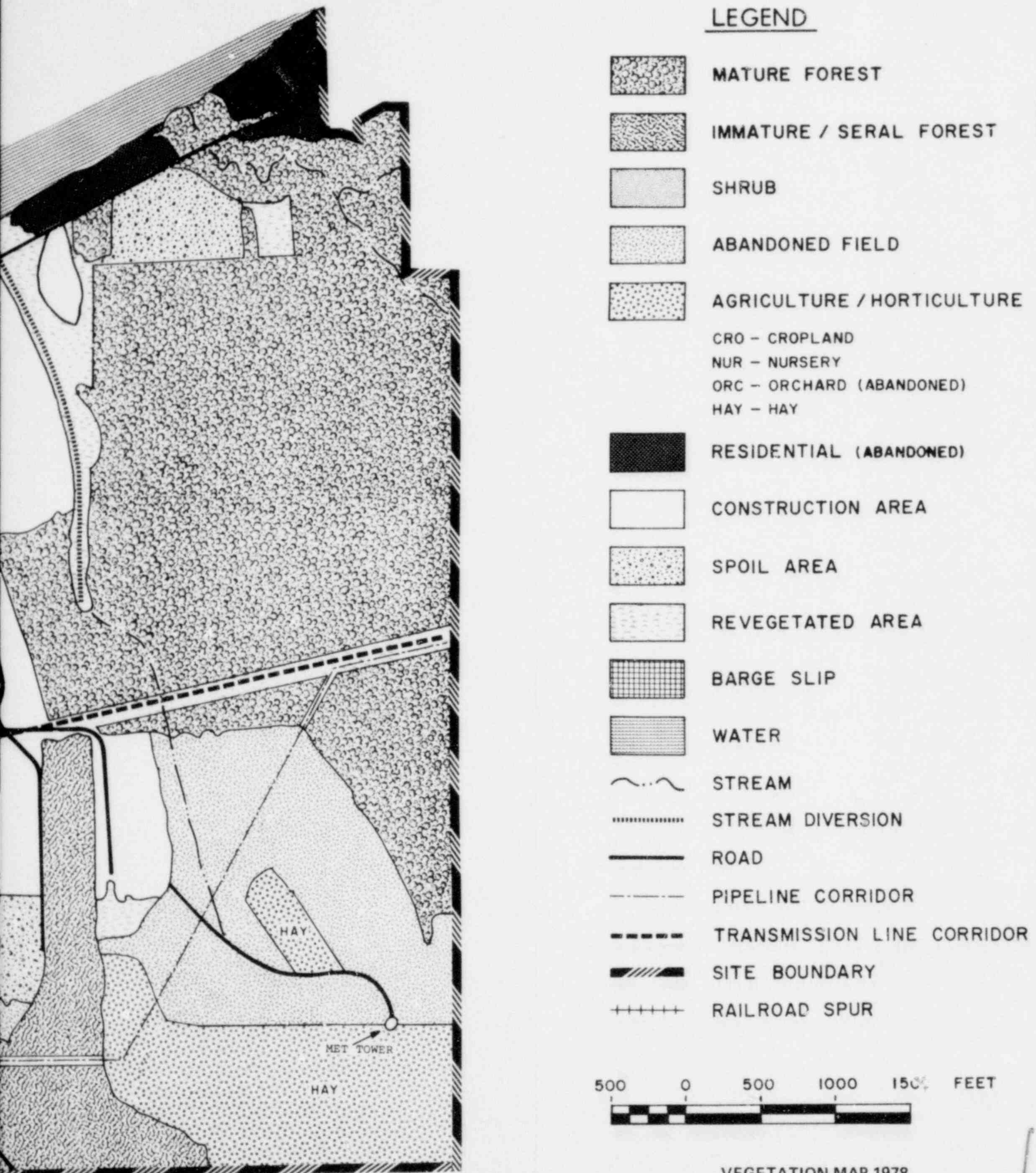
ABANDONED



VEGETATION MAP 1978

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.2-2


N
SUBSTATION
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ORC
NUR
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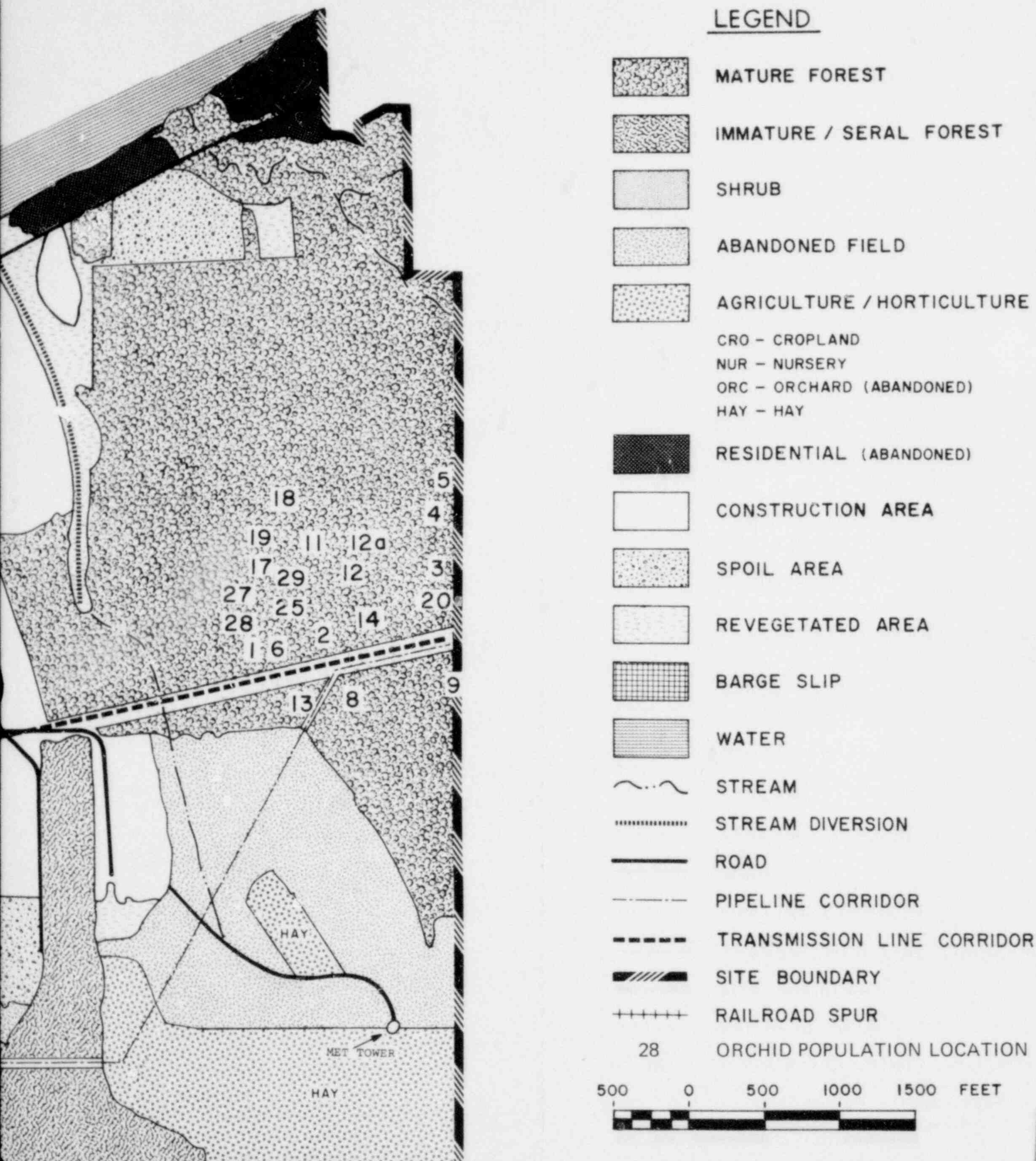
ABANDONED

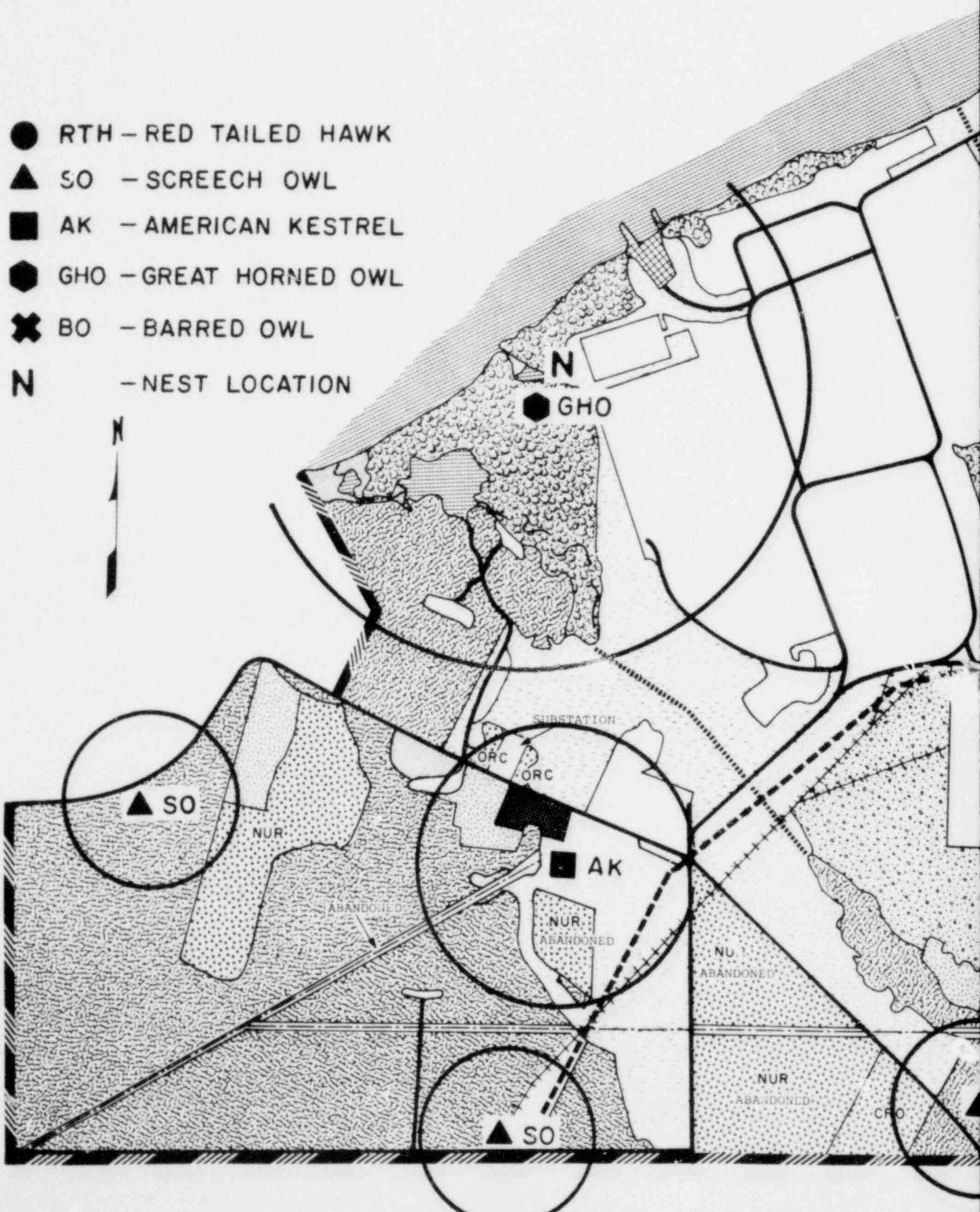


LOCATION OF CRANE-FLY ORCHID POPULATION, 1978

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.2-3


RTH - RED TAILED HAWK
SO - SCREECH OWL
AK - AMERICAN KESTREL
GHO - GREAT HORNED OWL
BO - BARRED OWL
N - NEST LOCATION
N
N
GHO
SUBSTATION
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NUR
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ABANDONED
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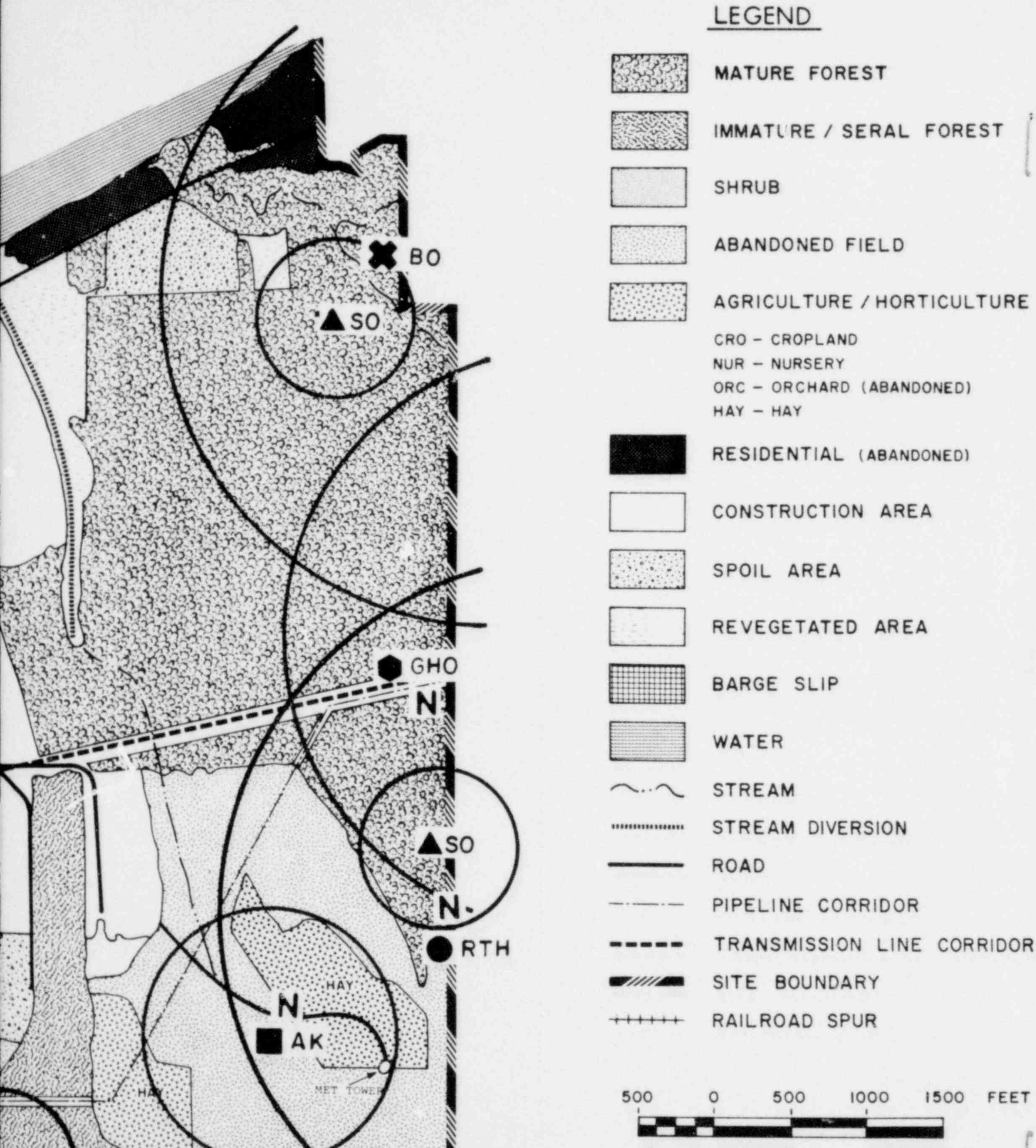
SO



RAPTOR SURVEY, 1978

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.2-4

2.3 METEOROLOGY

This section is partially updated from the ER/CP. Additional data on the local meteorology are presented and summarized.

2.3.1 REGIONAL CLIMATOLOGY

Data are, of course, available relative to the regional climatology during the period since the submittal of the ER/CP. However, these data do not significantly affect average or extreme values of meteorological parameters from those reported in the ER/CP; therefore regional climatology is not discussed. An update of climatological discussions is, however, reported in the FSAR.

2.3.2 LOCAL METEOROLOGY

The ER/CP provided onsite data for a period of 1 year (May 1, 1972, through April 30, 1973) and available pertinent offsite data. Onsite data are now available for 2 additional years (May 1, 1973, through April 30, 1974, and September 1, 1977, through August 31, 1978). Other data are available from surface observations supplied by the National Climatic Center on magnetic tape[1,2] in addition to the Local Climatologic Data (LCDs)[3,4] and Climatological Summaries.[5,6]

These data are summarized in this section. The location of the onsite meteorological data-collection system is shown in Figure 2.3-1.

2.3.2.1 Wind Direction and Speed

Monthly and annual wind roses for the 10-meter and 60-meter levels are presented in Figures 2.3-2 through 2.3-5 for the 3 PNPP site years (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; and September 1, 1977, through

August 31, 1978). The prevailing winds usually blow from the east-southeast through west-southwest directions. In general, higher speeds are associated with winds from the southwest through northwest directions.

As shown in Figure 2.3-5, the annual wind roses for the individual and combined years exhibit the tendency for prevailing wind to occur in the southwest quadrant. The wind roses for Cleveland and Erie (Figure 2.3-6) exhibit similar patterns for the 3 site years. In comparison to the 3 site years, the 10-year wind roses for these two stations are not very different. Therefore, it is concluded that the 3 site years are representative of the long term.

Monthly and annual average wind speeds are presented in Tables 2.3-1 through 2.3-2 for both onsite and offsite comparative data. The average wind speed at the 10-meter level for the PNPP was 8.2 miles per hour for the 3 site years. The 60-meter-level wind speed was higher, as expected. The Erie and Cleveland 3-year averages were generally in good agreement with the long-term averages.

The frequency of calm winds is reported in Figures 2.3-5 and 2.3-6. The 3-site-year composite for PNPP indicated 0.41 percent and 0.12 percent calms at 10 and 60 meters, respectively. For the same 3-year period, Cleveland and Erie reported a higher the frequency of calms than for the 10-year period. The difference in the frequency of calms between PNPP and Erie and Cleveland is attributed primarily to differences in speed-sensor thresholds and exposure.

Wind direction persistence is defined as the number of hours of continuous air flow within a 22½-degree sector. For computation purposes, calms were also considered a direction category. The probability of occurrence of wind flow persistence for various durations is presented in Figure 2.3-7 for the PNPP, Erie, and Cleveland. Based on the 3 site years at the PNPP, there is only a 5 percent probability that the persistence will be greater than about 8 hours at 10 meters and about 9 hours at 60 meters. As shown in Figure 2.3-7, the probabilities for PNPP, Erie, and Cleveland are similar, particularly at the 1-percent level.

Maximum wind direction persistence occurrences by direction are presented in Figure 2.3-8. Persistence periods at the PNPP are fairly well distributed across the direction sectors, being somewhat more frequent for winds from the southwest quadrant. The maximum wind direction persistence event at the 10-meter level for the PNPP during the period of record was 36 hours for a wind from the southeast. The maximum 60-meter wind persistence event was 35 hours for a wind from the south-southeast. The maximum event for Erie during the February 1959 to January 1964 period was 41 hours from the northeast, and the maximum event for Cleveland during the same period was 50 hours from the south.

The persistence of calms at the 10-meter level at the PNPP has been limited to 5 hours or less in duration for the 3 site years.

2.3.2.2 Ambient Temperature

Monthly and annual means and extremes of temperature are presented in Table 2.3-3 for the PNPP, Erie, and Cleveland for the 3 site years (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; September 1, 1977, through August 31, 1978). The monthly PNPP temperatures agree well with the concurrent offsite values. Table 2.3-4 presents long-term annual means and extremes of temperature for area stations. The similarity of the long-term means to the 3-year means indicates that the 3 years were representative of the long term.

The highest monthly mean maximum temperature at the PNPP occurred in July and August (76°F for the three site years). The lowest monthly mean minimum temperature at the PNPP occurred in February (16°F for the 3 site years). This 3-year monthly mean minimum may be somewhat lower than the long-term minimum since February 1978 was one of the coldest Februarys on record for much of the eastern United States,[7] averaging about 11°F below normal in the site region.[3,4,7]

The diurnal pattern of temperature at the PNPP for the 3 site years is described in Table 2.3-5 on an annual average basis. It indicates that the warmest part of the day usually occurs between 2 PM and 5 PM EST; the coolest, at about 6 AM EST. The highest hourly 10-meter temperature recorded at the PNPP during the period was 90°F; the lowest, -12°F (Table 2.3-3).

2.3.2.3 Atmospheric Water Vapor

Monthly and annual means of humidity and dewpoint for the PNPP and for Erie and Cleveland are presented in Table 2.3-6 for the 3 site years (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; September 1, 1977, through August 31, 1978). The PNPP data are similar to those of the offsite locations.

Table 2.3-7 describes the long-term monthly means and extremes of humidity and dewpoint for Erie and Cleveland, based on a 10-year data period. These long-term annual means are similar to the 3-year values. Therefore, the 3 site years are considered representative of the long term.

The annual average diurnal variation of humidity and dewpoint at PNPP is presented in Table 2.3-5 for the 3 site years. It indicates that the highest relative humidities occurred between 5 AM and 7 AM EST during the cool part of the day and that the highest absolute humidities occurred generally during the warm part of the day.

2.3.2.4 Precipitation

Monthly and annual greatest precipitation by time interval are presented in Table 2.3-8 for the PNPP for the 3 site years (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; September 1, 1977, through August 31, 1978). It indicates that for the 3 years the greatest 1-hour precipitation was 1.00 inch and occurred in both July and August. The greatest 24-hour precipitation was 2.39 inches and occurred in September. Additional information on rainfall rate distribution for the PNPP is presented on an annual basis in Table 2.3-9(a-c).

In Table 2.3-10 the greatest 24-hour precipitation for the PNPP is compared to the offsite locations of Erie, Cleveland, Painesville, and Geneva for the same 3 years. The PNPP values are closest to those for Painesville, most likely because of proximity and the similar position relative to the lake. In Table 2.3-11 the monthly and annual average total precipitation for the three years and the same sites are compared. The PNPP totals are generally lower than those for the offsite locations.

The long-term total precipitation values for offsite locations are presented in Table 2.3-12. The agreement of the long-term totals with the 3-year totals indicates that the 3 site years are representative of the long term.

Monthly and annual precipitation wind roses are presented in Figures 2.3-9 through 2.3-12 for the 3 site years combined. These show the average speed by direction of winds during precipitation events and the percentage of total hours that precipitation occurs with each wind direction. Seasonal variations are apparent. On an annual basis, precipitation frequencies are fairly evenly distributed for winds from the northeast through south to west and are less frequent for winds out of the west-northwest through north-northeast.

Snowfall is not directly measured at the site; all PNPP precipitation values described so far in this section were for melted precipitation since the rain gauge is equipped with a heater.

2.3.2.5 Fog

The PNPP site is located in a region in which heavy fog occurs about 13 days per year.

2.3.2.6 Atmospheric Stability

Monthly and annual stability class distribution based on ΔT (60-10m) are presented in Table 2.3-13 for the 3 site years (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; September 1, 1977, through August 31, 1978).

Table 2.3-14 presents annual stability class distributions based on National Weather Service data and the Pasquill-Turner[8] classification method for Erie and Cleveland. The similarity shown in Table 2.3-14 of the three-year period to the 10-year period indicates that the 3 site years are representative of the long term.

The onsite PNPP data in Table 2.3-13 indicate that very unstable (A) conditions are most frequent during the summer months of maximum solar heating. Neutral (D) and slightly stable (E) conditions predominate throughout the year. The annual average stability distributions by hour of the day (Table 2.3-15) demonstrate that stable conditions are commonly associated with the nighttime, and unstable conditions with the daytime.

Table 2.3-16 presents for each stability class the number of occurrences of stability class persistence for a given time period for the 3-year period. The longest persistence during the 3 years occurred for D conditions for 148 hours. The longest persistence period for stable (E, F, and G) conditions was 44 hours.

Additional stability distribution information in the form of joint frequency distributions for Cleveland, Erie, and PNPP (onsite) have been reported.[9]

2.3.3 ATMOSPHERIC DISPERSION ESTIMATES

Onsite meteorological data for a 3-year period (May 1, 1972, through April 30, 1973; May 1, 1973, through April 30, 1974; September 1, 1977, through August 31, 1978) were analyzed to determine the atmospheric diffusion characteristics representative of the PNPP site region. Dilution factors (χ/Q values) were calculated for input into dose computations for analysis of the environmental effects of accidents (See Chapter 7). Estimates of χ/Q values and relative deposition (D/Q) values, were provided for dose calculations for determining the environmental effects of plant operation (see Chapter 5). These calculations are based on the meteorological models discussed in Section 6.1.3.

Table 2.3-17 presents short-term (50th percentile) χ/Q values for the Exclusion Area Boundary (EAB) for the periods of interest. Table 2.3-18 presents site-specific terrain adjustment factors,[10] developed to incorporate the effects of spatial and temporal variations in air flow due to terrain in the long-term estimates of atmospheric dispersion. Annual average undepleted and depleted χ/Q values and D/Q values at the PNPP site boundary are presented in Table 2.3-19.

Tables 2.3-20 to 2.3-22 present annual average undepleted and depleted χ/Q and D/Q values for standard population distances. Average χ/Q (undepleted and depleted) and D/Q values for the May to October grazing season are shown in Tables 2.3-23 to 2.3-25 for standard population distances. PNPP short-term accident χ/Q values by sector, based on the 3 site years of data for standard population distances, are shown in Table 2.3-26.

REFERENCES FOR SECTION 2.3

1. NOAA: Surface Observations for Erie, Pennsylvania, February 1959 to January 1964 and September 1968 to August 1978, National Weather Service TDF-14. NOAA, EDS, NCC, Asheville, North Carolina.

2. NOAA: Surface Observations for Cleveland, Ohio, February 1959 to January 1964 and September 1968 to August 1978, National Weather Service TDF-14. NOAA, EDS, NCC, Asheville, North Carolina.

3. NOAA: Local Climatological Data, Cleveland, Ohio, 1948-August 1978, Annual and Monthly Summaries. NOAA, EDS, NCC, Asheville, North Carolina.

4. NOAA: Local Climatological Data, Erie, Pennsylvania, 1972-August 1978, Annual and Monthly Summaries. NOAA, EDS, NCC, Asheville, North Carolina.

5. ESSA, 1969: Climatological Summary, Painesville, Ohio. U.S. Department of Commerce, ESSA, Climatography of the United States No. 20-33-69.

6. ESSA, 1968: Climatological Summary, Geneva, Ohio. U.S. Department of Commerce, ESSA, Climatography of the United States No. 20-33-63.

7. NOAA, March 7, 1978: Weekly Weather and Crop Bulletin. NOAA, EDS, Asheville, North Carolina.

8. Turner, D. B., 1964: A Diffusion Model for an Urban Area. J. of Appl. Met; 3, Feb. 1964, pp. 83-91.

9. NUS Corporation, Joint Frequency Distributions for the Perry Nuclear Power Plant, Erie and Cleveland, NUS-3455, October 1979

10. Davidson, D. R., July 2, 1976, Perry Nuclear Power Plant Docket Nos. 50-440, 50-441. Terrain-Corrected Atmospheric Dispersion Factors. Letter to Director of Nuclear Reactor Regulation from Vice President, Engineering, The Cleveland Electric Illuminating Company.

TABLE 2.3-1

MONTHLY AND ANNUAL AVERAGE WIND SPEED (MPH)
FOR PNPP REGION (SITE YEARS AND LONG-TERM)

	PNPP		ERIE[a]		CLEVELAND[b]	
	3 years*		3 years	1/1/54 -	3 years	1/1/.2 -
	10m	60m	*	12/31/77[4]	*	12/31/77[3]
January	10.1	13.9	13.9	13.4	12.3	12.5
February	8.1	11.1	11.2	12.6	10.4	12.4
March	9.5	13.6	12.4	12.4	11.6	12.5
April	9.5	12.9	12.4	11.8	11.9	11.8
May	7.6	11.3	10.3	10.2	9.6	10.3
June	7.0	11.3	9.6	9.6	9.0	9.4
July	6.1	9.4	8.8	9.1	8.3	8.7
August	5.7	9.7	8.6	9.1	7.7	8.3
September	6.8	11.4	9.9	10.1	8.6	9.1
October	8.2	13.2	11.1	11.4	9.3	10.0
November	10.0	15.1	13.1	13.2	11.0	12.1
December	9.8	14.4	13.4	13.6	12.2	12.3
Annual	8.2	12.4	11.3	11.4	10.2	10.8

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

a. 30 ft for 1/1/54 - 1/31/60; 55 ft for 2/01/60 - 9/28/65; 20 ft for 9/29/65 - 12/31/77

b. 56 ft for 1/1/42 - 1/30/56; 88 ft for 1/30/56 - 6/25/59; 20 ft for 6/26/59 - 12/31/77

TABLE 2.3-2

ANNUAL AVERAGE WIND SPEEDS (MPH) FOR PNPP REGION

	PNPP		Erie [4]	Cleveland [3]
	10 m	60 m	6.1 m	6.1 m
May 1, 1972 - April 30, 1973	8.0	12.0	11.0	10.1
May 1, 1973 - April 30, 1974	8.4	13.0	11.9	10.2
September 1, 1977 - August 31, 1978	8.3	12.4	10.9	10.2
Combined Period	8.2	12.5	11.3	10.2

TABLE 2.3-3

PNPP AREA MONTHLY AND ANNUAL MEANS AND EXTREMES
OF TEMPERATURE FOR THREE SITE YEARS*

	PNPP					ERIE					CLEVELAND				
		Maximum		Minimum			Maximum		Minimum			Maximum		Minimum	
	Mean	Mean	Extreme	Mean	Extreme	Mean	Mean	Extreme	Mean	Extreme	Mean	Mean	Extreme	Mean	Extreme
January	27	34	67	22	5	26	32	59	21	4	27	34	62	21	0
February	22	28	57	16	-12	21	27	55	15	-12	24	31	56	18	-1
March	37	44	74	31	2	35	42	74	29	-3	39	47	73	33	0
April	47	55	78	40	26	45	52	75	38	22	49	58	80	42	26
May	56	63	82	50	33	54	61	80	48	29	58	66	86	50	32
June	65	73	87	58	43	63	71	86	56	34	65	76	90	59	33
July	70	76	90	63	47	69	76	89	62	48	71	80	93	64	45
August	70	76	89	63	49	68	75	90	62	45	70	80	93	63	47
September	65	71	88	58	37	62	69	86	55	38	64	73	91	57	40
October	52	59	79	47	28	49	56	73	44	27	51	60	78	46	28
November	42	48	73	38	21	41	46	70	37	22	41	48	75	38	14
December	31	37	63	26	3	30	36	60	26	2	33	38	62	27	1
Annual	49	55	90	42	-12	47	54	90	41	-12	52	58	93	43	-1

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

TABLE 2.3-4

PNPP AREA LONG-TERM ANNUAL MEANS AND EXTREMES OF TEMPERATURE (^{o}F)

	Mean	Mean Maximum	Extreme Maximum (and year)	Mean Minimum	Extreme Minimum (and year)	Period of Record
Erie[4]	47.1	55.0	94(7/68)	39.2	-15(1/63)	9/53-8/78
Cleveland[3]	49.7	58.5	103(7/41)	40.8	-19(1/63)	6/41-8/78
Painesville[5]	49.9	58.4	96(6/53)	41.5	-15(1/63)	1/50-12/65
Geneva[6]	49.3	58.2	98(9/54)	40.3	-17(1/63)	1/44-12/65

TABLE 2.3-5

ANNUAL PNPP DIURNAL VARIATIONS OF TEMPERATURE, DEW POINT, RELATIVE HUMIDITY, AND ABSOLUTE HUMIDITY FOR THREE SITE YEARS*

Hour	10-m LEVEL				60-m LEVEL			
	Temp. (°F)	Dew Pt. (°F)	Rel Hum (%)	ABS Hum (gm/m^3)	Temp. (°F)	Dew Pt. (°F)	Rel Hum (%)	ABS Hum (gm/m^3)
1	47	39	77	7	48	37	74	7
2	46	39	78	7	47	37	75	7
3	46	39	78	7	47	37	75	7
4	46	39	78	7	47	36	76	7
5	46	38	79	7	46	36	76	7
6	45	38	79	7	46	36	77	7
7	46	38	79	7	46	36	78	7
8	47	39	77	7	46	37	78	7
9	48	39	75	7	47	38	76	7
10	49	40	72	7	48	38	74	7
11	50	40	70	7	49	38	73	7
12	51	40	69	7	50	39	72	7
13	51	41	69	8	50	39	71	7
14	52	41	68	8	51	39	70	8
15	52	41	68	8	51	40	70	8
16	52	41	68	8	51	39	70	7
17	52	41	69	8	51	39	70	7
18	51	41	70	8	50	39	70	7
19	50	41	72	8	50	38	70	7
20	49	41	74	8	50	38	71	7
21	49	40	76	8	49	38	71	7
22	48	40	77	7	49	38	72	7
23	47	40	77	7	48	37	73	7
24	47	39	77	7	48	37	73	7
Mean	49	40	74	7	49	38	73	7

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

TABLE 2.3-6

MONTHLY AND ANNUAL MEANS OF RELATIVE HUMIDITY, ABSOLUTE HUMIDITY, AND DEW POINT FOR PNPP AREA FOR THREE SITE YEARS*

	PNPP			ERIE			CLEVELAND		
	Relative Humidity (%)	Absolute Humidity (gm/m³)	Dew Point (°F)	Relative Humidity (%)	Absolute Humidity (gm/m³)	Dew Point (°F)	Relative Humidity (%)	Absolute Humidity (gm/m³)	Dew Point (°F)
January	75	3	20	77	3	19	75	3	20
February	76	2	13	75	2	14	72	2	16
March	72	4	24	75	4	27	72	5	30
April	66	5	36	69	5	34	67	6	38
May	74	9	48	75	8	45	72	9	48
June	75	12	58	76	11	55	73	11	56
July	76	14	62	74	13	60	73	14	62
August	79	14	62	76	13	60	75	14	61
September	73	11	55	82	11	56	76	12	56
October	71	7	43	77	7	42	74	7	43
November	73	5	32	77	5	34	77	5	35
December	78	3	23	80	3	25	78	4	26
Annual	74	7	40	76	7	39	74	8	43

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

TABLE 2.3-7

LONG-TERM VALUES OF RELATIVE HUMIDITY, ABSOLUTE HUMIDITY, AND DEW POINT FOR PNPP AREA

E = Erie[1] C = Cleveland[2] Period of Record = September 1, 1968 to August 31, 1978

		Mean			Maximum						Minimum					
					Mean			Extreme			Mean			Extreme		
		RH (%)	AH (g/m^3)	DP ($^\circ$F)	RH (%)	AH (g/m^3)	DP ($^\circ$F)	RH (%)	AH (g/m^3)	DP ($^\circ$F)	RH (%)	AH (g/m^3)	DP ($^\circ$F)	RH (%)	AH (g/m^3)	DP ($^\circ$F)
January	E	76	2	16	78	3	17	100	11	54	73	2	15	27	0	-23
	C	72	3	16	76	3	19	100	11	55	65	2	15	28	0	-24
February	E	75	3	17	78	3	19	100	11	55	71	2	15	33	0	-22
	C	70	3	18	75	3	20	100	11	55	60	2	15	25	1	-17
March	E	73	3	25	78	4	26	100	13	59	66	3	23	23	1	-10
	C	67	4	25	75	4	28	100	14	63	57	3	20	21	1	- 5
April	E	67	5	33	75	5	34	100	15	64	59	5	31	20	1	5
	C	64	5	35	75	6	37	100	17	68	53	5	33	19	2	10
May	E	71	8	45	80	8	47	100	19	71	60	7	43	22	2	10
	C	67	8	47	80	9	49	100	19	72	54	7	44	21	3	17
June	E	74	11	55	84	12	57	100	21	75	63	10	53	32	4	28
	C	71	12	56	83	12	58	100	24	79	59	10	52	28	4	27
July	E	74	13	59	84	14	61	100	23	77	63	12	58	32	6	37
	C	71	14	61	85	14	63	100	23	78	57	13	59	30	5	36
August	E	77	13	60	87	14	61	100	22	76	64	12	58	35	5	35
	C	73	13	60	86	14	62	100	24	79	57	12	57	29	6	41
September	E	78	11	54	86	11	55	100	22	75	66	10	52	35	3	24
	C	75	11	54	85	12	56	100	20	73	62	10	53	31	3	24
October	E	74	7	42	79	8	44	100	17	67	66	7	40	26	2	16
	C	72	7	43	81	8	45	100	16	66	61	6	39	26	3	18
November	E	76	5	33	78	5	34	100	15	63	72	5	32	34	2	4
	C	74	5	33	80	5	35	100	15	64	67	5	32	29	1	- 2
December	E	77	3	23	78	3	24	100	11	55	75	3	22	32	1	- 7
	C	73	3	23	75	3	24	100	12	58	70	3	21	27	1	-17
Annual	E	74	7	39	80	7	40	100	23	77	66	7	37	20	0	-23
	C	71	7	39	79	8	41	100	24	79	62	7	37	19	0	-24

TABLE 2.3-8

PNPP MONTHLY AND ANNUAL GREATEST PRECIPITATION
BY TIME INTERVAL FOR THREE SITE YEARS*
(Inches)

	Time Interval (h)				
	1	6	12	18	24
January	0.15	0.36	0.45	0.61	0.85
February	0.16	0.25	0.32	0.32	0.32
March	0.40	0.56	0.81	0.83	0.83
April	0.27	0.57	0.68	0.95	1.11
May	0.42	0.66	0.78	0.83	0.95
June	0.64	1.19	1.19	1.22	1.30
July	1.00	1.51	1.51	1.51	1.51
August	1.00	1.16	1.55	1.55	1.55
September	0.85	1.85	2.20	2.20	2.39
October	0.32	0.50	0.55	0.73	0.80
November	0.33	0.95	1.14	1.30	1.31
December	0.22	0.58	0.90	1.00	1.18
Annual	1.00	1.85	2.20	2.20	2.39

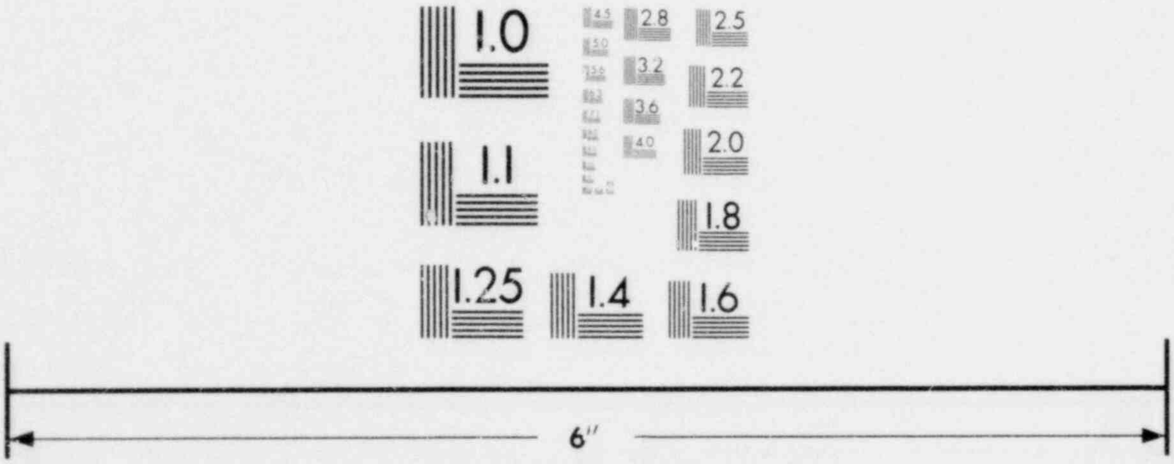
* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

TABLE 2.3-9a

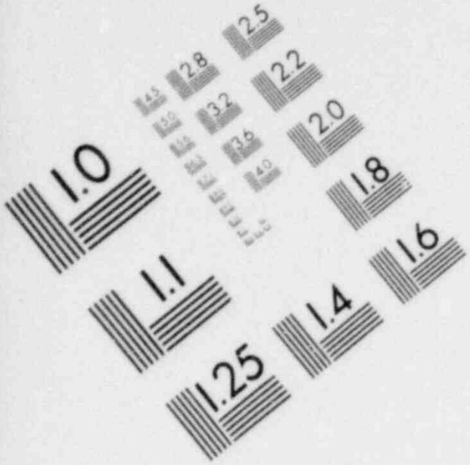
ANNUAL PRECIPITATION INTENSITY-DURATION FOR PNPP
(NUMBER OF OCCURRENCES)
MAY 1, 1972 - APRIL 30, 1973

Amount Inches	DURATION (HOURS) 1	6	12	18	24
0.01	545	1406	2142	2781	3342
0.02	405	1183	1881	2497	3038
0.03	329	1049	1692	2263	2789
0.04	276	957	1567	2127	2641
0.05	206	877	1452	1970	2450
0.07	141	752	1293	1783	2250
0.10	86	578	1062	1516	1962
0.15	41	403	769	1116	1452
0.20	21	294	609	916	1209
0.25	17	218	474	728	965
0.30	13	164	369	568	771
0.35	11	135	325	513	694
0.40	7	103	279	448	620
0.45	5	82	213	324	429
0.50	4	64	170	276	373
0.60	4	46	134	230	316
0.70	3	27	99	181	257
0.80	3	22	65	120	175
0.90	2	21	55	104	158
1.00	2	18	49	86	139
1.10	0	10	28	66	105
1.20	0	10	23	46	76
1.30	0	10	23	39	58
1.40	0	10	22	34	47
1.50	0	9	21	33	46
1.60	0	4	10	16	24
1.70	0	4	10	16	23
1.80	0	3	9	15	23
1.90	0	0	4	10	22
2.00	0	0	4	10	20

IMAGE EVALUATION TEST TARGET (MT-3)



MICROCOPY RESOLUTION TEST CHART



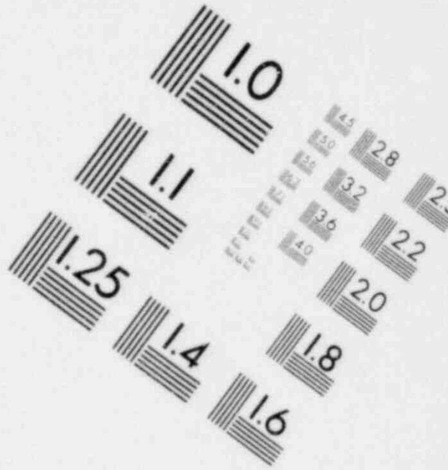
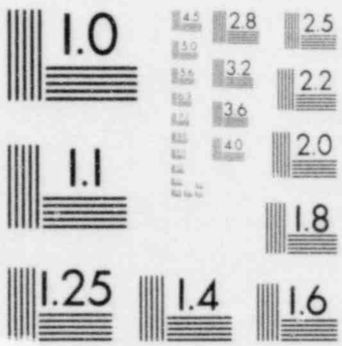
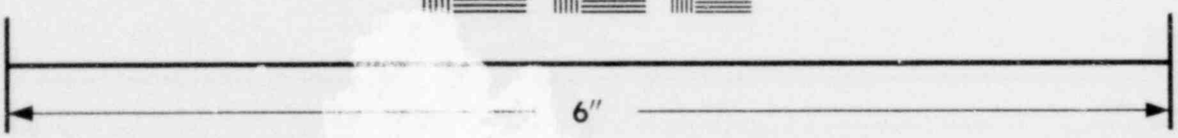
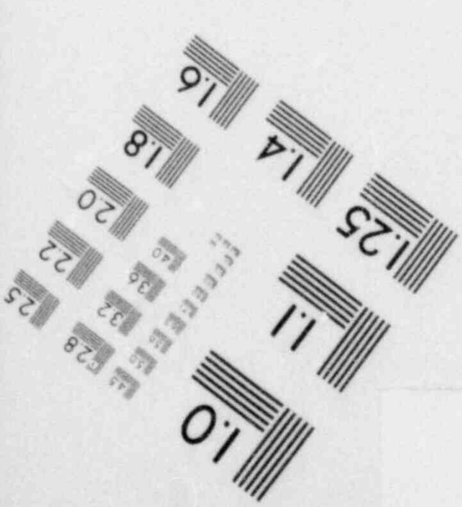


IMAGE EVALUATION
TEST TARGET (MT-3)





MICROCOPY RESOLUTION TEST CHART



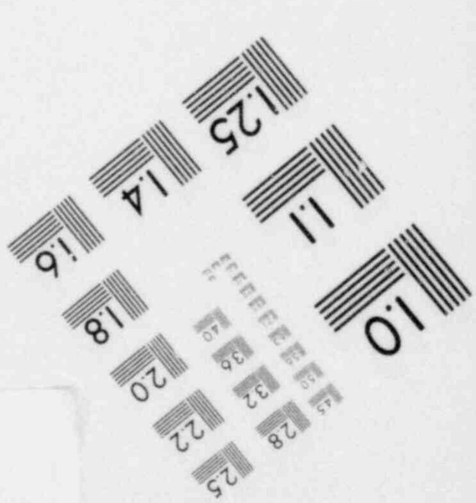


TABLE 2.3-9b

ANNUAL PRECIPITATION INTENSITY-DURATION FOR PNPP
(NUMBER OF OCCURRENCES)
MAY 1, 1973 - APRIL 30, 1974

Amount Inches	DURATION (HOURS) 1	6	12	18	24
0.01	512	1317	1996	2582	3082
0.02	410	1188	1853	2436	2941
0.03	316	1039	1680	2233	2725
0.04	252	960	1578	2139	2638
0.05	218	890	1500	2063	2566
0.07	146	742	1278	1780	2249
0.10	88	618	1120	1558	1983
0.15	41	430	877	1268	1648
0.20	25	307	646	951	1242
0.25	17	212	463	711	939
0.30	11	152	361	586	817
0.35	6	118	307	512	720
0.40	4	95	254	435	610
0.45	3	64	185	326	485
0.50	2	49	152	268	400
0.60	2	25	82	161	251
0.70	1	19	63	121	196
0.80	1	13	45	89	134
0.90	0	10	27	48	72
1.00	0	10	26	47	65
1.10	0	9	21	34	55
1.20	0	0	5	11	23
1.30	0	0	5	11	22
1.40	0	0	5	11	17
1.50	0	0	0	0	0
1.60	0	0	0	0	0
1.70	0	0	0	0	0
1.80	0	0	0	0	0
1.90	0	0	0	0	0
2.00	0	0	0	0	0

TABLE 2.3-9c

ANNUAL PRECIPITATION INTENSITY-DURATION FOR PNPP
(NUMBER OF OCCURRENCES)
SEPTEMBER 1, 1977 - AUGUST 31, 1978

Amount Inches	DURATION (HOURS) 1	6	12	18	24
0.01	575	1373	2041	2608	3104
0.02	394	1151	1786	2345	2832
0.03	283	1011	1589	2102	2567
0.04	213	907	1473	1951	2398
0.05	159	795	1336	1796	2216
0.07	97	652	1136	1564	1939
0.10	53	497	936	1316	1672
0.15	18	331	713	1055	1367
0.20	14	230	575	897	1206
0.25	8	145	354	580	826
0.30	6	99	274	450	646
0.35	4	72	200	365	519
0.40	4	55	142	265	392
0.45	4	41	111	205	309
0.50	3	33	79	146	223
0.60	2	17	61	101	151
0.70	0	15	48	81	118
0.80	0	6	29	60	89
0.90	0	4	19	51	78
1.00	0	0	7	15	40
1.10	0	0	4	10	28
1.20	0	0	3	9	15
1.30	0	0	3	9	15
1.40	0	0	3	9	15
1.50	0	0	2	8	14
1.60	0	0	0	0	0
1.70	0	0	0	0	0
1.80	0	0	0	0	0
1.90	0	0	0	0	0
2.00	0	0	0	0	0

TABLE 2.3-10

PNPP AREA GREATEST 24-H PRECIPITATION FOR THREE SITE YEARS*
(Inches)

	PNPP	Erie[4]	Cleveland[3]	Painesville[5]**	Geneva[6]**
January	0.85	1.08	1.10	0.88	0.55
February	0.32	0.70	0.72	0.36	0.46
March	0.83	1.12	1.07	0.80	0.82
April	1.11	1.06	1.53	0.97	1.13
May	0.95	1.72	1.06	0.87	2.01
June	1.30	2.51	4.00	1.69	2.40
July	1.51	1.46	2.00	1.56	1.59
August	1.55	1.91	1.53	1.78	2.80
September	2.39	2.03	1.81	2.26	2.81
October	0.80	1.36	1.16	0.80	0.96
November	1.31	1.12	1.19	1.69	1.13***
December	1.18	2.31	1.41	1.62	1.45
Annual	2.39	2.51	4.00	2.26	2.81

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978.

** Values for Painesville and Geneva are for "greatest day of precipitation."

*** Only two years of data available, 1972 and 1973.

TABLE 2.3-11

PNPP AREA AVERAGE TOTAL PRECIPITATION FOR THREE SITE YEARS*

	PNPP	Erie[4]	Cleveland[3]	Painesville[5]	Geneva[6]
January	1.[illegible]	2.59	2.62	2.93	2.18
February	0.40	1.50	1.77	1.20	1.41
March	2.84	3.33	3.18	3.60	3.74
April	2.75	3.35	3.35	3.43	4.25
May	2.61	4.01	3.85	3.69	4.68
June	3.53	5.49	6.36	4.53	4.89
July	1.55	1.70	3.26	2.56	2.97
August	2.62	3.84	4.36	4.52	2.98
September	4.24	6.08	3.37	4.96	5.25
October	2.14	2.88	2.51	2.61	3.01
November	2.51	4.15	3.61	4.11	3.87
December	2.56	4.26	3.43	3.76	3.45
Annual	29.07	43.18	41.67	41.90	42.68

*May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978.

TABLE 2.3-12

LONG-TERM TOTAL PRECIPITATION VALUES FOR PNPP AREA
(Inches)

	Erie[4]			Cleveland[3]			Painesville[5]	
	Normal	Maximum Monthly	Minimum Monthly	Normal	Maximum Monthly	Minimum Monthly	Mean	Greatest Monthly
January	2.47	4.59	0.90	2.56	7.01	0.36	2.95	6.56
February	2.12	5.01	0.73	2.18	4.64	0.73	2.41	4.94
March	2.75	6.78	0.63	3.05	6.07	0.78	2.90	5.50
April	3.55	7.11	1.63	3.49	6.61	1.18	3.47	6.49
May	3.63	5.59	1.45	3.49	6.04	1.00	2.80	6.43
June	3.50	7.74	0.85	3.28	9.06	1.17	2.97	7.17
July	3.52	7.70	1.11	3.45	6.47	1.23	3.30	6.65
August	3.35	11.06	0.58	3.00	8.96	0.53	3.16	9.53
September	3.56	10.65	1.45	2.80	6.37	0.74	2.71	5.61
October	3.24	9.87	1.13	2.57	9.50	0.61	3.17	11.33
November	3.70	6.25	1.95	2.76	6.44	0.80	3.46	7.05
December	2.81	5.63	1.38	2.36	5.60	0.71	2.38	4.06
Annual	38.20	11.06	0.58	34.99	9.50	0.36	35.68	11.33
Period of	1941-70	1954-77	1954-77	1941-70	1942-77	1942-77	1950-65	1950-65

TABLE 2.3-13

PNPP STABILITY CLASS DISTRIBUTIONS BY MONTH
FOR THREE SITE YEARS*
(%)

	Stability Class Based on ΔT(60-10m)						
	A	B	C	D	E	F	G
January	0.09	0.09	0.73	66.70	26.22	3.86	2.32
February	1.16	1.63	2.05	55.04	25.58	6.67	7.88
March	4.57	3.53	5.28	55.86	20.54	6.36	3.86
April	7.19	5.40	7.88	42.68	23.77	6.95	6.13
May	6.67	4.26	6.39	47.16	19.63	6.43	9.46
June	6.89	4.56	4.95	36.19	25.87	9.84	11.70
July	7.70	5.17	7.85	28.37	26.48	10.78	13.66
August	9.72	7.97	5.96	22.46	22.09	11.18	20.62
September	5.94	3.48	3.86	33.38	33.48	8.94	10.92
October	2.55	3.55	4.56	45.24	27.47	7.74	8.88
November	0.43	1.72	2.59	70.79	19.68	4.02	0.77
December	0.20	0.10	0.44	68.18	28.40	2.44	0.24
Annual							
1972-1973	4.81	3.57	4.76	47.81	24.65	7.34	7.05
1973-1974	4.69	3.88	4.32	46.66	25.01	7.01	8.43
1977-1978	3.81	2.95	4.06	48.48	25.06	6.96	8.67
Combined	4.44	3.47	4.38	47.64	24.91	7.10	8.06

* May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978 and associated with valid 10 m wind data.

TABLE 2.3-14

PNPP AREA ANNUAL STABILITY CLASS DISTRIBUTIONS

	Stability Class Based on Pasquill-Turner Method[8]						
	A	B	C	D	E	F	G
ERIE[1]							
10 years*	0.08	3.27	9.04	71.63	7.76	6.66	1.55
3 site years**	0.09	3.07	8.79	72.39	7.12	6.71	1.83
CLEVELAND[2]							
10 years*	0.27	3.47	9.52	66.74	9.74	7.74	2.52
3 site years**	0.31	3.26	9.54	67.67	9.06	7.44	2.72

* Based on NWS data: September 1, 1968 to August 31, 1978

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

TABLE 2.3-15

PNPP STABILITY DISTRIBUTIONS BY HOUR OF DAY FOR THREE SITE YEARS*

(Number of Occurrences)

STABILITY INDEX

HR. OF DAY	A	B	C	D	E	F	G	TOTAL	FG	EFG
1	1	2	4	374	366	119	200	1066	319	685
2	0	4	2	387	361	133	181	1068	314	675
3	0	1	3	392	370	134	167	1067	301	671
4	2	0	3	382	382	123	176	1068	299	681
5	0	1	0	384	400	110	172	1067	282	682
6	0	1	1	386	397	118	164	1067	282	679
7	0	2	3	473	357	114	116	1065	230	587
8	3	6	27	620	306	60	43	1065	103	409
9	20	32	56	748	181	16	9	1062	25	206
10	64	69	117	700	99	8	4	1061	12	111
11	99	117	140	610	83	5	2	1062	7	90
12	173	114	142	556	74	7	1	1067	8	82
13	205	97	124	567	63	6	2	1064	8	71
14	184	115	119	562	70	4	1	1055	5	75
15	156	103	109	602	70	3	0	1049	3	79
16	118	87	91	677	76	10	1	1060	11	87
17	65	64	71	680	161	15	4	1060	19	180
18	31	33	51	635	260	38	10	1058	48	308
19	2	4	21	551	383	72	23	1061	95	478
20	2	3	4	410	442	141	60	1062	201	643
21	1	3	4	374	379	164	138	1063	302	681
22	1	3	6	369	364	133	187	1063	320	684
23	0	4	4	362	373	135	186	1064	321	694
24	0	3	5	363	369	133	192	1065	325	694
ALL	1127	873	1113	11668	6392	1801	2039	25509	3840	10232

***May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978**

TABLE 2.3-16

PNPP STABILITY PERSISTENCE FOR THREE SITE YEARS*

(Number of Occurrences)

PERSISTENCE PERIODS (HOURS)	STABILITY INDEX A	B	C	D	E	F	G	TOTAL	FG	EFG
1	162	445	570	625	762	456	88	3108	168	329
2	54	112	154	378	317	178	67	1260	79	162
3	36	38	46	268	170	73	35	666	59	91
4	33	14	10	154	122	45	35	413	37	69
5	26	3	9	111	86	32	22	289	43	53
6	22	2	2	75	77	21	19	218	25	59
7	22	1	0	70	50	14	25	182	19	35
8	16	0	0	37	50	8	20	131	28	42
9	7	0	0	46	28	3	17	101	19	33
10	1	0	0	47	41	7	31	127	47	37
11	0	0	0	30	25	3	29	87	56	48
12	0	0	0	24	23	1	8	56	41	114
13	0	0	0	15	17	0	6	38	33	105
14	0	0	0	26	15	0	3	44	13	79
15	0	0	0	17	9	0	1	27	5	67
16	0	0	0	20	7	0	0	27	2	35
17	0	0	0	13	9	0	0	22	0	28
18	0	0	0	13	4	0	0	17	0	15
19	0	0	0	12	1	0	0	13	0	4
20	0	0	0	13	0	0	0	13	0	1
21 - 25	0	0	0	34	7	0	0	41	0	9
26 - 30	0	0	0	14	1	0	0	15	0	1
31 - 35	0	0	0	16	1	0	0	17	0	2
36 - 40	0	0	0	8	0	0	0	8	0	0
41 - 45	0	0	0	5	0	0	0	5	0	2
46 - 50	0	0	0	8	0	0	0	8	0	0
51 - 55	0	0	0	6	0	0	0	6	0	0
56 - 60	0	0	0	2	0	0	0	2	0	0
GT 60	0	0	0	12	0	0	0	12	0	0
TOTAL	379	615	791	2099	1822	841	406	6953	674	1420
MAXIMUM NO. HOURS	10	7	6	148	53	12	15	148	16	44

***May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974;** September 1, 1977 to August 31, 1978

TABLE 2.3-17

PNPP SHORT-TERM (ACCIDENT) χ/Q VALUES* AT THE EXCLUSION AREA BOUNDARY (863m)
BASED ON THREE SITE YEARS**

Accident Period	Realistic χ/Q Values (sec/m^3)***
2 hours	3.8E-5
8 hours	3.1E-5
16 hours	2.8E-5
72 hours (3 days)	2.3E-5
624 hours (26 days)	1.7E-5

Note: 6.7E-4 = 6.7×10^{-4}

* From a ground-level release to a ground-level receptor.

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978.

*** Calculated from the 50th percentile overall 2-hour value and the maximum sector annual average by logarithmic interpolation. (See Section 6.1-3).

TABLE 2.3-18

PNPP TERRAIN ADJUSTMENT FACTORS[10]

Distance in Meters

Receptor Direction	805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	1.8	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
NNE	1.6	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
NE	1.6	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ENE	1.6	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
E	1.6	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ESE	1.6	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SE	2.0	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
SSE	4.0	1.6	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
S	4.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SSW	2.2	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SW	2.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
WSW	1.9	1.1	1.7	1.4	1.2	1.0	1.0	1.0	1.0	1.0
W	1.8	1.1	1.7	1.6	1.2	1.0	1.0	1.0	1.0	1.0
WNW	1.7	1.1	1.6	1.8	1.4	1.0	1.0	1.0	1.0	1.0
NW	1.7	1.1	1.1	1.2	1.2	1.0	1.0	1.0	1.0	1.0
NNW	1.7	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-19

PNPP ANNUAL AVERAGE SITE BOUNDARY X/Q AND D/Q VALUES*
FOR THREE SITE YEARS**

UNIT 1: Maximum X/Q is to the receptor direction NW

Wind Direction	Receptor Direction	Minimum Distance	Undepleted X/Q (s/m^3)	Depleted X/Q (s/m^3)	D/Q (m^{-2})
NNE	SSW	1452	1.0E-6	9.0E-7	5.3E-9
NE	SW	1047	2.6E-6	2.2E-6	1.3E-8
ENE	WSW	900	4.4E-6	4.0E-6	1.4E-8
E	W	430	3.2E-5	3.1E-5	5.4E-8
ESE	WNW	283	6.0E-5	5.8E-5	8.5E-8
SE	NW	273	6.8E-5	6.6E-5	1.3E-7
SSE	NNW	280	6.0E-5	5.8E-5	1.2E-7
S	N	294	5.9E-5	5.8E-5	1.6E-7
SSW	NNE	402	1.8E-5	1.6E-5	7.5E-8
SW	NE	678	6.1E-6	5.6E-6	3.4E-8
WSW	ENE	1079	2.1E-6	1.8E-6	1.6E-8
W	E	1104	2.1E-6	1.9E-6	1.6E-8
WNW	ESE	1130	1.4E-6	1.3E-6	1.0E-8
NW	SE	1345	1.2E-6	1.1E-6	8.2E-9
NNW	SSE	1445	1.9E-6	1.7E-6	1.2E-8
N	S	1420	2.3E-6	2.0E-6	1.4E-8

UNIT 2: Maximum X/Q is to the receptor direction NW

Wind Direction	Receptor Direction	Minimum Distance	Undepleted X/Q (s/m^3)	Depleted X/Q (s/m^3)	D/Q (m^{-2})
NNE	SSW	1284	1.3E-6	1.1E-6	6.4E-9
NE	SW	1563	1.4E-6	1.2E-6	6.6E-9
ENE	WSW	893	4.4E-6	4.0E-6	1.5E-8
E	W	610	1.8E-5	1.6E-5	3.1E-8
ESE	WNW	455	2.6E-5	2.6E-5	4.1E-8
SE	NW	409	3.4E-5	3.2E-5	7.0E-8
SSE	NNW	409	3.1E-5	2.9E-5	7.0E-8
S	N	427	3.1E-5	3.1E-5	9.4E-8
SSW	NNE	495	1.2E-5	1.2E-5	5.4E-8
SW	NE	800	4.8E-6	4.3E-6	2.6E-8
WSW	ENE	1079	2.1E-6	1.8E-6	1.6E-8
W	E	1072	2.2E-6	2.1E-6	1.8E-8
WNW	ESE	1083	1.5E-6	1.4E-6	1.1E-8
NW	SE	1269	1.3E-6	1.2E-6	9.0E-9
NNW	SSE	1316	2.2E-6	1.9E-6	1.4E-8
N	S	1298	2.7E-6	2.3E-6	1.6E-8

* From a ground-level release to a ground-level receptor.

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978.

TABLE 2.3-20

PNPP ANNUAL AVERAGE χ/Q (s/m^3) VALUES (UNDEPLETED) FOR
A GROUND LEVEL RELEASE FOR THREE SITE YEARS
(May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters: 805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	1.1E-5	1.4E-6	6.7E-7	4.3E-7	2.8E-7	1.4E-7	5.7E-8	2.9E-8	1.9E-8	1.4E-8
NNE	5.8E-6	7.8E-7	3.8E-7	2.3E-7	1.5E-7	7.4E-8	2.9E-8	1.5E-8	9.4E-9	6.8E-9
NE	4.7E-6	6.2E-7	2.7E-7	1.6E-7	1.1E-7	5.5E-8	2.1E-8	1.1E-8	6.7E-9	4.8E-9
ENE	3.2E-6	4.1E-7	1.9E-7	1.1E-7	7.8E-8	3.3E-8	1.2E-8	6.0E-9	3.8E-9	2.7E-9
E	3.5E-6	4.4E-7	1.8E-7	1.1E-7	7.6E-8	3.6E-8	1.3E-8	6.5E-9	4.1E-9	2.9E-9
ESE	2.4E-6	3.0E-7	1.4E-7	7.4E-8	5.1E-8	2.4E-8	8.6E-9	4.2E-9	2.6E-9	1.8E-9
SE	2.7E-6	2.6E-7	1.2E-7	7.2E-8	4.5E-8	2.1E-8	7.6E-9	3.7E-9	2.3E-9	1.6E-9
SSE	4.7E-6	3.4E-7	1.1E-7	6.4E-8	4.4E-8	1.9E-8	6.9E-9	3.4E-9	2.1E-9	1.5E-9
S	5.6E-6	4.5E-7	1.0E-7	6.3E-8	4.3E-8	2.1E-8	7.6E-9	3.7E-9	2.4E-9	1.7E-9
SSW	2.6E-6	3.0E-7	9.9E-8	6.0E-8	4.1E-8	2.0E-8	7.2E-9	3.5E-9	2.2E-9	1.6E-9
SW	3.8E-6	3.9E-7	1.8E-7	1.1E-7	7.5E-8	3.3E-8	1.2E-8	6.0E-9	3.8E-9	2.7E-9
WSW	5.2E-6	5.8E-7	4.3E-7	2.2E-7	1.3E-7	5.4E-8	2.1E-8	1.1E-8	6.8E-9	4.9E-9
W	1.1E-5	1.3E-6	1.0E-6	6.2E-7	3.3E-7	1.4E-7	5.9E-8	3.1E-8	2.0E-8	1.5E-8
WNW	9.9E-6	1.3E-6	9.4E-7	6.8E-7	3.8E-7	1.4E-7	5.9E-8	3.1E-8	2.1E-8	1.5E-8
NW	1.1E-5	1.4E-6	6.8E-7	4.8E-7	3.5E-7	1.5E-7	6.2E-8	3.3E-8	2.2E-8	1.6E-8
NNW	9.3E-6	1.3E-6	6.3E-7	4.1E-7	2.7E-7	1.4E-7	5.7E-8	3.0E-8	2.0E-8	1.5E-8
Note: 2.2E-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-21

PNPP ANNUAL AVERAGE χ/Q (s/m^3) VALUES (DEPLETED) FOR
A GROUND LEVEL RELEASE FOR THREE SITE YEARS
(May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters 805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	1.0E-5	1.2E-6	5.5E-7	3.3E-7	2.1E-7	9.9E-8	3.5E-8	1.6E-8	9.7E-9	6.5E-9
NNE	5.3E-6	6.6E-7	3.0E-7	1.8E-7	1.1E-7	5.2E-8	1.8E-8	8.1E-9	4.7E-9	3.2E-9
NE	4.3E-6	5.3E-7	2.2E-7	1.3E-7	8.6E-8	3.9E-8	1.3E-8	5.8E-9	3.4E-9	2.2E-9
ENE	3.0E-6	3.5E-7	1.5E-7	8.8E-8	5.9E-8	2.4E-8	7.7E-9	3.3E-9	1.9E-9	1.2E-9
E	3.2E-6	3.7E-7	1.5E-7	8.6E-8	5.7E-8	2.5E-8	8.2E-9	3.6E-9	2.0E-9	1.3E-9
ESE	2.2E-6	2.5E-7	1.1E-7	5.8E-8	3.8E-8	1.7E-8	5.4E-9	2.3E-9	1.3E-9	8.5E-10
SE	2.5E-6	2.2E-7	9.7E-8	5.6E-8	3.4E-8	1.5E-8	4.7E-9	2.0E-9	1.2E-9	7.6E-10
SSE	4.3E-6	2.9E-7	8.7E-8	5.0E-8	3.3E-8	1.3E-8	4.3E-9	1.9E-9	1.1E-9	6.9E-10
S	5.2E-6	3.9E-7	8.5E-8	4.9E-8	3.3E-8	1.5E-8	4.8E-9	2.1E-9	1.2E-9	7.8E-10
SSW	2.4E-6	2.5E-7	8.0E-8	4.7E-8	3.1E-8	1.4E-8	4.5E-9	2.0E-9	1.1E-9	7.4E-10
SW	3.5E-6	3.3E-7	1.4E-7	8.5E-8	5.7E-8	2.3E-8	7.6E-9	3.3E-9	1.9E-9	1.3E-9
WSW	4.8E-6	4.9E-7	3.5E-7	1.7E-7	9.9E-8	3.8E-8	1.3E-8	5.9E-9	3.4E-9	2.3E-9
W	1.0E-5	1.1E-6	8.4E-7	4.9E-7	2.5E-7	1.0E-7	3.7E-8	1.7E-8	[illegible]0E-8	6.9E-9
WNW	9.1E-6	1.1E-6	7.6E-7	5.3E-7	2.9E-7	9.9E-8	3.6E-8	1.7E-8	1.0E-8	7.1E-9
NW	9.8E-6	1.2E-6	5.6E-7	3.8E-7	2.6E-7	1.1E-7	3.9E-8	1.8E-8	1.1E-8	7.4E-9
NNW	9.0E-6	1.1E-6	5.1E-7	3.2E-7	2.0E-7	9.7E-8	3.5E-8	1.7E-8	1.0E-8	6.8E-9
Note: 2.2 E-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-22

PNPP ANNUAL AVERAGE D/Q (m^{-2}) VALUES FOR
A GROUND LEVEL RELEASE FOR THREE SITE YEARS
(May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters: 805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	3.5E-8	3.3E-9	1.4E-9	7.6E-10	4.4E-10	1.8E-10	5.6E-11	2.3E-11	1.2E-11	7.7E-12
NNE	2.6E-8	2.8E-9	1.1E-9	6.2E-10	3.6E-10	1.5E-10	4.6E-11	1.9E-11	1.0E-11	6.3E-12
NE	2.5E-8	2.7E-9	1.0E-9	5.5E-10	3.5E-10	1.4E-10	4.5E-11	1.8E-11	9.9E-12	6.2E-12
ENE	2.6E-8	2.8E-7	1.2E-9	6.4E-10	4.1E-10	1.5E-10	4.8E-11	1.9E-11	1.1E-11	6.5E-12
E	2.7E-8	2.9E-9	1.1E-9	6.0E-10	3.9E-10	1.6E-10	5.0E-11	2.0E-11	1.1E-11	6.7E-12
ESE	1.8E-8	1.9E-9	8.0E-10	4.0E-10	2.5E-10	1.0E-10	3.3E-11	1.3E-11	7.1E-10	4.4E-12
SE	1.9E-8	1.6E-9	6.7E-10	3.7E-10	2.2E-10	8.7E-11	2.8E-11	1.1E-11	6.1E-10	3.8E-12
SSE	3.2E-8	2.0E-9	5.6E-10	3.1E-10	2.0E-10	7.3E-11	2.3E-11	9.4E-12	5.1E-12	3.1E-12
S	3.5E-8	2.5E-9	5.0E-10	2.8E-10	1.8E-10	7.2E-11	2.3E-11	9.3E-12	5.0E-12	3.1E-12
SSW	1.4E-8	1.4E-9	4.1E-10	2.2E-10	1.4E-10	5.8E-11	1.8E-11	7.4E-12	4.0E-12	2.5E-12
SW	2.0E-8	1.7E-9	7.0E-10	3.9E-10	2.5E-10	9.0E-11	2.9E-11	1.2E-11	6.3E-10	3.9E-12
WSW	1.7E-8	1.6E-9	1.0E-9	4.5E-10	2.5E-10	8.4E-11	2.7E-11	1.1E-11	5.8E-12	3.6E-12
W	2.0E-8	1.9E-9	1.2E-9	6.3E-10	3.0E-10	1.0E-10	3.2E-11	1.3E-11	7.0E-12	4.4E-12
WNW	1.7E-8	1.7E-9	1.0E-9	6.4E-10	3.2E-10	9.2E-11	2.9E-11	1.2E-11	6.3E-12	3.9E-12
NW	2.4E-8	2.5E-9	1.0E-9	6.1E-10	3.9E-10	1.3E-10	4.2E-11	1.7E-11	9.1E-12	5.7E-12
NNW	2.4E-8	2.5E-9	1.0E-9	5.5E-10	3.2E-10	1.3E-10	4.1E-11	1.7E-11	9.0E-12	5.6E-12
Note: 2.2E-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-23

PNPP ANNUAL AVERAGE X/Q (s/m^3) VALUES (UNDEPLETED) FOR A GROUND LEVEL RELEASE FOR THE GRAZING SEASON, MAY-OCTOBER, FOR THREE SITE YEARS (May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters									
	805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	1.4-5	1.7-6	8.3-7	5.3-7	3.4-7	1.8-7	7.1-8	3.7-8	2.4-8	1.8-8
NNE	6.4-6	8.8-7	4.2-7	2.6-7	1.7-7	8.4-8	3.3-8	1.7-8	1.1-8	7.8-9
NE	4.5-6	6.0-7	2.6-7	1.6-7	1.1-7	5.4-8	2.1-8	1.0-8	6.6-9	4.7-9
NNE	2.7-6	3.4-7	1.6-7	9.4-8	6.5-8	2.8-9	1.0-8	5.1-9	3.2-9	2.3-9
E	3.4-6	4.2-7	1.8-7	1.1-7	7.3-8	3.5-8	1.3-8	6.3-9	4.0-9	2.8-9
ESE	2.5-6	3.0-7	1.4-7	7.5-8	5.1-8	2.4-8	8.8-9	4.3-9	2.7-9	1.9-9
SE	2.6-6	2.5-7	1.1-7	6.8-8	4.2-8	2.0-8	7.3-9	3.6-9	2.2-9	1.6-9
SSE	5.2-6	3.7-7	1.2-7	7.0-8	4.8-8	2.1-8	7.6-9	3.7-9	2.3-9	1.7-9
S	6.2-6	4.9-7	1.1-7	6.8-8	4.7-8	2.2-8	8.2-9	4.0-9	2.5-9	1.8-9
SSW	2.8-6	3.2-7	1.1-7	6.3-8	4.4-8	2.1-8	7.8-9	3.9-9	2.5-9	1.7-9
SW	3.8-6	3.9-7	1.8-7	1.1-7	7.6-8	3.3-8	1.3-8	6.3-9	4.0-9	2.8-9
WSW	4.9-6	5.4-7	4.1-7	2.1-7	1.3-7	5.3-8	2.1-8	1.1-8	7.0-9	5.0-9
W	1.3-5	1.6-6	1.3-6	7.7-7	4.1-7	1.8-7	7.5-8	4.0-8	2.6-8	1.9-8
WNW	1.4-5	1.7-6	1.3-6	9.4-7	5.3-7	2.0-7	8.4-8	4.5-8	3.0-8	2.2-8
NW	1.5-5	1.9-6	9.5-7	6.7-7	4.8-7	2.1-7	8.8-8	4.7-8	3.1-8	2.3-8
NNW	1.4-5	1.8-6	9.0-7	5.8-7	3.8-7	2.0-7	8.3-8	4.4-8	2.9-8	2.2-8
Note: 2.2-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-24

PNPP ANNUAL AVERAGE χ/Q (s/m^3) VALUES (DEPLETED) FOR A GROUND LEVEL RELEASE FOR THE GRAZING SEASON, MAY-OCTOBER, FOR THREE SITE YEARS (May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters 805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	1.3-5	1.4-6	6.7-7	4.1-7	2.6-7	1.2-7	4.4-8	2.1-8	1.2-8	8.3-9
NNE	5.9-6	7.4-7	3.4-7	2.1-7	1.3-7	5.9-8	2.1-8	9.3-9	5.5-9	3.7-9
NE	4.1-6	5.1-7	2.1-7	1.2-7	8.4-8	3.8-8	1.3-8	5.7-9	3.3-9	2.2-9
ENE	2.5-6	2.9-7	1.3-7	7.4-8	4.9-8	2.0-8	6.4-9	2.8-9	1.6-9	1.1-9
E	3.1-6	3.5-7	[illegible]4-7	8.2-8	5.5-8	2.4-8	8.0-9	3.5-9	2.0-9	1.3-9
ESE	2.3-6	2.6-7	1.1-7	5.8-8	3.9-8	1.7-8	5.5-9	2.4-9	1.4-9	9.0-10
SE	2.4-6	2.1-7	9.2-8	5.3-8	3.2-8	1.4-8	4.5-9	2.0-9	1.1-9	7.4-10
SSE	4.8-6	3.2-7	9.4-8	5.5-8	3.6-8	1.5-8	4.7-9	2.1-9	1.2-9	7.8-10
S	5.6-6	4.2-7	9.1-8	5.3-8	3.5-8	1.6-8	5.1-9	2.2-9	1.3-9	8.4-10
SSW	2.5-6	2.7-7	8.5-8	4.9-8	3.3-8	1.5-8	4.9-9	2.1-9	1.2-9	8.1-10
SW	3.5-6	3.3-7	1.5-7	8.6-8	5.8-8	2.4-8	7.8-9	3.5-9	2.0-9	1.3-9
WSW	4.4-6	4.6-7	3.3-7	1.6-7	9.6-8	3.7-8	1.3-8	5.9-9	3.5-9	2.4-9
W	1.2-5	1.4-6	1.0-6	6.0-7	3.1-7	1.[illegible]7	4.7-8	2.2-8	1.3-8	9.0-9
WNW	1.2-5	1.5-6	1.1-6	7.4-7	4.0-7	1.4-7	5.2-8	2.5-8	1.5-8	1.0-8
NW	1.3-5	1.6-6	7.7-7	5.2-7	3.7-7	1.5-7	5.5-8	2.6-8	1.6-8	1.1-8
NNW	1.3-5	1.5-6	7.3-7	4.5-7	2.9-7	1.4-7	5.2-8	2.4-8	1.5-8	1.0-8
Note: 2.2-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

TABLE 2.3-25

PNPP ANNUAL AVERAGE D/Q (s/m^2) VALUES FOR A GROUND LEVEL RELEASE FOR THE GRAZING SEASON, MAY-OCTOBER, FOR THREE SITE YEARS
(May 1, 1972 to April 30, 1974 and September 1, 1977 to August 31, 1978)

Receptor Direction	Distance in Meters 805	2414	4023	5633	7242	12070	24140	40234	56327	72420
N	3.9-08	3.7-09	1.5-09	8.4-10	4.9-10	2.0-10	6.3-11	2.5-11	1.4-11	8.5-12
NNE	2.5-08	2.7-09	1.1-09	6.1-10	3.5-10	1.4-10	4.5-11	1.8-11	9.9-12	6.1-12
NE	2.0-08	2.2-09	8.3-10	4.5-10	2.9-10	1.2-10	3.7-11	1.5-11	8.1-12	5.1-12
ENE	2.0-08	2.2-09	9.0-10	5.0-10	3.2-10	1.2-10	3.7-11	1.5-11	8.1-12	5.0-12
E	2.5-08	2.7-09	1.0-09	5.5-10	3.5-10	1.4-10	4.5-11	1.8-11	9.9-12	6.1-12
ESE	1.7-08	1.9-09	7.7-10	3.9-10	2.5-10	1.0-10	3.2-11	1.3-11	6.9-12	4.3-12
SE	2.0-08	1.8-09	8.0-10	4.0-10	2.3-10	9.4-11	3.0-11	1.2-11	6.5-12	4.0-12
SSE	3.8-08	2.4-09	6.7-10	3.7-10	2.4-10	8.7-11	2.8-11	1.1-11	6.1-12	3.8-12
S	4.3-08	3.0-09	6.1-10	2.4-10	2.1-10	8.7-11	2.8-11	1.1-11	6.0-12	3.7-12
SSW	1.5-08	1.5-09	4.4-10	2.4-10	1.6-10	6.3-11	2.0-11	8.1-12	4.4-12	2.7-12
SW	1.7-08	1.5-09	6.0-10	3.3-10	2.1-10	7.8-11	2.5-11	1.0-11	5.4-12	3.3-12
WSW	1.2-08	1.1-09	7.0-10	3.2-10	1.7-10	5.9-11	1.9-11	7.6-12	4.1-12	2.5-12
W	2.0-08	1.9-09	1.2-09	6.3-10	3.0-10	1.0-10	3.2-11	1.3-11	7.0-12	4.4-12
WNW	2.0-08	2.0-09	1.2-09	7.4-10	3.7-10	1.1-10	3.4-11	1.4-11	7.3-12	4.6-12
NW	2.7-08	2.8-09	1.1-09	6.8-10	4.3-10	1.5-10	4.6-11	1.9-11	1.0-11	6.3-12
NNW	2.9-08	3.0-09	1.2-09	6.8-10	3.9-10	1.6-10	5.0-11	2.0-11	1.1-11	6.8-12
Note: 2.2-8= 2.2×10^{-8}	0.5 mi	1.5 mi	2.5 mi	3.5 mi	4.5 mi	7.5 mi	15.0 mi	25.0 mi	35.0 mi	45.0 mi

PNPP REALISTIC SHORT-TERM ACCIDENT X/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

X/Q (sec/m^3) by Accident Period at a Distance of 805m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	6.9E-05	5.7E-05	3.9E-05	2.2E-05
NNE	4.1E-05	3.4E-05	2.3E-05	1.3E-05
NE	3.3E-05	2.7E-05	1.8E-05	1.0E-05
ENE	2.6E-05	2.1E-05	1.4E-05	7.3E-06
E	2.5E-05	2.1E-05	1.4E-05	7.6E-06
ESE	2.2E-05	1.8E-05	1.1E-05	5.8E-06
SE	2.6E-05	2.1E-05	1.3E-05	6.6E-06
SSE	2.0E-05	1.8E-05	1.3E-05	8.4E-06
S	1.2E-05	1.1E-05	9.6E-06	7.7E-06
SSW	2.8E-06	2.8E-06	2.8E-06	2.8E-06
SW	2.4E-05	2.0E-05	1.4E-05	7.9E-06
WSW	2.9E-05	2.4E-05	1.7E-05	1.0E-05
W	6.5E-05	5.5E-05	3.8E-05	2.3E-05
WNW	5.7E-05	4.9E-05	3.5E-05	2.1E-05
NW	6.6E-05	5.6E-05	4.0E-05	2.4E-05
NNW	6.3E-05	5.3E-05	3.6E-05	2.1E-05

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour X/Q values and logarithmic interpolation between the 2-hour X/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour X/Q values.

TABLE 2.3-26

PNPP REALISTIC SHORT-TERM ACCIDENT χ/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

χ/Q (sec/m^3) by Accident Period at a Distance of 2414m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	1.8E-05	1.4E-05	8.1E-06	3.7E-06
NNE	9.3E-06	7.3E-06	4.4E-06	2.1E-06
NE	7.1E-06	5.6E-06	3.4E-06	1.7E-06
ENE	5.0E-06	3.9E-06	2.3E-06	1.1E-06
E	5.1E-06	4.1E-06	2.4E-06	1.2E-06
ESE	4.2E-06	3.2E-06	1.9E-06	8.4E-07
SE	4.5E-06	3.4E-06	1.9E-06	8.2E-07
SSE	3.3E-06	2.7E-06	1.7E-06	8.4E-07
S	2.2E-06	1.9E-06	1.4E-06	8.6E-07
SSW	3.3E-07	3.3E-07	3.3E-07	3.3E-07
SW	4.4E-06	3.5E-06	2.1E-06	1.0E-06
WSW	5.6E-06	4.5E-06	2.8E-06	1.4E-06
W	1.7E-05	1.3E-05	7.8E-06	3.7E-06
WNW	1.4E-05	1.1E-05	7.0E-06	3.5E-06
NW	1.7E-05	1.3E-05	8.1E-06	3.9E-06
NNW	1.6E-05	1.3E-05	7.4E-06	3.4E-06

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour χ/Q values and logarithmic interpolation between the 2-hour χ/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour χ/Q values.

PNPP REALISTIC SHORT-TERM ACCIDENT χ/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

χ/Q (sec/m^3) by Accident Period at a Distance of 4023m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	9.9E-06	7.6E-06	4.3E-06	1.9E-06
NNE	4.7E-06	3.7E-06	2.2E-06	1.0E-06
NE	3.5E-06	2.7E-06	1.6E-06	7.5E-07
ENE	2.5E-06	1.9E-06	1.1E-06	5.1E-07
E	2.4E-06	1.9E-06	1.1E-06	5.1E-07
ESE	2.0E-06	1.5E-06	8.7E-07	3.9E-07
SE	2.5E-06	1.8E-06	9.9E-07	4.0E-07
SSE	1.4E-06	1.1E-06	6.2E-07	2.9E-07
S	7.0E-07	5.8E-07	3.9E-07	2.2E-07
SSW	1.1E-07	1.1E-07	1.1E-07	1.1E-07
SW	2.0E-06	1.6E-06	9.7E-07	4.7E-07
WSW	2.8E-06	2.4E-06	1.6E-06	9.3E-07
W	9.9E-06	8.0E-06	5.0E-06	2.6E-06
WNW	8.1E-06	6.7E-06	4.4E-06	2.4E-06
NW	9.2E-06	7.2E-06	4.3E-06	2.1E-06
NNW	9.1E-06	7.1E-06	4.0E-06	1.8E-06

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour χ/Q values and logarithmic interpolation between the 2-hour χ/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour χ/Q values.

TABLE 2.3-26

PNPP REALISTIC SHORT-TERM ACCIDENT χ/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

χ/Q (sec/m^3) by Accident Period at a Distance of 5633m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	6.7E-06	5.1E-06	2.8E-06	1.2E-06
NNE	3.0E-06	2.4E-06	1.4E-06	6.5E-07
NE	2.2E-06	1.7E-06	1.0E-06	4.7E-07
ENE	1.5E-06	1.2E-06	6.8E-07	3.1E-07
E	1.5E-06	1.1E-06	6.7E-07	3.1E-07
ESE	1.2E-06	9.1E-07	5.1E-07	2.2E-07
SE	1.5E-06	1.1E-06	5.9E-07	2.4E-07
SSE	8.0E-07	6.3E-07	3.7E-07	1.8E-07
S	4.2E-07	3.5E-07	2.4E-07	1.3E-07
SSW	6.6E-08	6.6E-08	6.6E-08	6.6E-08
SW	1.2E-06	9.8E-07	6.0E-07	2.9E-07
WSW	1.7E-06	1.4E-06	9.1E-07	5.0E-07
W	6.5E-06	5.2E-06	3.2E-06	1.6E-06
WNW	5.4E-06	4.5E-06	3.0E-06	1.6E-06
NW	6.1E-06	4.9E-06	3.0E-06	1.4E-06
NNW	6.1E-06	4.7E-06	2.6E-06	1.2E-06

Note: $6.7E-5 = 6.7X10^{-5}$

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour χ/Q values and logarithmic interpolation between the 2-hour χ/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour χ/Q values.

TABLE 2.3-26

PNPP REALISTIC SHORT-TERM ACCIDENT X/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

X/Q (sec/m^3) by Accident Period at a Distance of 7242m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	4.7E-06	3.6E-06	1.9E-06	8.1E-07
NNE	2.1E-06	1.7E-06	9.5E-07	4.3E-07
NE	1.6E-06	1.2E-06	7.1E-07	3.3E-07
ENE	1.1E-06	8.2E-07	4.8E-07	2.2E-07
E	1.0E-06	8.0E-07	4.7E-07	2.1E-07
ESE	8.5E-07	6.5E-07	3.6E-07	1.5E-07
SE	9.9E-07	7.4E-07	3.9E-07	1.6E-07
SSE	5.2E-07	4.1E-07	2.5E-07	1.2E-07
S	2.3E-07	2.0E-07	1.4E-07	8.6E-08
SSW	4.6E-08	4.6E-08	4.6E-08	4.6E-08
SW	8.6E-07	6.8E-07	4.1E-07	2.0E-07
WSW	1.2E-06	9.6E-07	6.1E-07	3.2E-07
W	4.5E-06	3.5E-06	2.0E-06	9.4E-07
WNW	3.8E-06	3.1E-06	1.9E-06	1.0E-06
NW	4.5E-06	3.6E-06	2.1E-06	1.0E-06
NNW	4.4E-06	3.4E-06	1.9E-06	7.9E-07

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour X/Q values and logarithmic interpolation between the 2-hour X/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour X/Q values.

PNPP REALISTIC SHORT-TERM ACCIDENT χ/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

χ/Q (sec/m^3) by Accident Period at a Distance of 12070m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	2.6E-06	1.9E-06	1.0E-06	4.2E-07
NNE	1.1E-06	8.7E-07	4.9E-07	2.2E-07
NE	8.0E-07	6.2E-07	3.6E-07	1.6E-07
ENE	5.2E-07	4.0E-07	2.2E-07	9.8E-08
E	5.0E-07	3.9E-07	2.2E-07	1.0E-07
ESE	4.0E-07	3.0E-07	1.7E-07	7.3E-08
SE	4.7E-07	3.5E-07	1.9E-07	7.4E-08
SSE	2.2E-07	1.8E-07	1.1E-07	5.1E-08
S	9.7E-08	8.4E-08	6.1E-08	3.9E-08
SSW	2.2E-08	2.2E-08	2.2E-08	2.2E-08
SW	4.1E-07	3.2E-07	1.9E-07	9.0E-08
WSW	5.6E-07	4.5E-07	2.8E-07	1.4E-07
W	2.4E-06	1.8E-06	1.0E-06	4.3E-07
WNW	1.9E-06	1.5E-06	9.0E-07	4.2E-07
NW	2.5E-06	1.9E-06	1.1E-06	4.7E-07
NNW	2.4E-06	1.8E-06	1.0E-06	4.1E-07

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour χ/Q values and logarithmic interpolation between the 2-hour χ/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour χ/Q values.

TABLE 2.3-26

PNPP REALISTIC SHORT-TERM ACCIDENT X/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

X/Q (sec/m^3) by Accident Period at a Distance of 24140m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	1.2E-06	8.7E-07	4.5E-07	1.8E-07
NNE	4.9E-07	3.8E-07	2.1E-07	8.9E-08
NE	3.3E-07	2.5E-07	1.4E-07	6.4E-08
ENE	2.0E-07	1.6E-07	8.7E-08	3.8E-08
E	2.0E-07	1.6E-07	9.0E-08	4.0E-08
ESE	1.6E-07	1.2E-07	6.6E-08	2.8E-08
SE	1.6E-07	1.2E-07	6.5E-08	2.7E-08
SSE	8.2E-08	6.5E-08	3.9E-08	1.9E-08
S	4.6E-08	3.9E-08	2.7E-08	1.6E-08
SSW	8.3E-09	8.3E-09	8.3E-09	8.3E-09
SW	1.6E-07	1.2E-07	7.3E-08	3.4E-08
WSW	2.2E-07	1.7E-07	1.1E-07	5.4E-08
W	1.0E-06	7.8E-07	4.3E-07	1.8E-07
WNW	8.4E-07	6.6E-07	3.8E-07	1.7E-07
NW	1.1E-06	8.7E-07	4.8E-07	2.0E-07
NNW	1.1E-06	8.1E-07	4.3E-07	1.7E-07

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour X/Q values and logarithmic interpolation between the 2-hour X/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour X/Q values.

PNPP REALISTIC SHORT-TERM ACCIDENT χ/Q VALUES* BY SECTOR BASED ON THREE SITE YEARS**

χ/Q (sec/m^3) by Accident Period at a Distance of 40234m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	6.6E-07	4.9E-07	2.5E-07	9.5E-08
NNE	2.7E-07	2.0E-07	1.1E-07	4.7E-08
NE	1.7E-07	1.3E-07	7.5E-08	3.3E-08
ENE	1.0E-07	8.0E-08	4.4E-08	1.9E-08
E	1.0E-07	7.8E-08	4.4E-08	2.0E-08
ESE	8.0E-08	6.0E-08	3.3E-08	1.4E-08
SE	7.6E-08	5.7E-08	3.1E-08	1.3E-08
SSE	4.4E-08	3.5E-08	2.1E-08	9.7E-09
S	2.9E-08	2.4E-08	1.6E-08	8.8E-09
SSW	4.2E-09	4.2E-09	4.2E-09	4.2E-09
SW	7.8E-08	6.2E-08	3.6E-08	1.7E-08
WSW	1.1E-07	8.8E-08	5.5E-08	2.8E-08
W	5.7E-07	4.3E-07	2.3E-07	9.6E-08
WNW	4.6E-07	3.6E-07	2.0E-07	9.2E-08
NW	6.2E-07	4.7E-07	2.6E-07	1.1E-07
NNW	6.1E-07	4.5E-07	2.4E-07	9.4E-08

Note: 6.7E-5 = 6.7×10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 8.125 percentile of the total observations), 2-hour χ/Q values and logarithmic interpolation between the 2-hour χ/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour χ/Q values.

PNPP REALISTIC SHORT-TERM ACCIDENT X/Q VALUES* BY SECTOR BASED ON THREE SITE YEARS**

X/Q (sec/m^3) by Accident Period at a Distance of 56327m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	4.6E-07	3.3E-07	1.7E-07	6.4E-08
NNE	1.8E-07	1.3E-07	7.3E-08	3.1E-08
NE	1.2E-07	8.9E-08	5.0E-08	2.2E-08
ENE	6.9E-08	5.3E-08	2.9E-08	1.2E-08
E	6.3E-08	4.8E-08	2.8E-08	1.3E-08
ESE	4.9E-08	3.8E-08	2.1E-08	8.7E-09
SE	5.5E-08	4.1E-08	2.2E-08	8.7E-09
SSE	3.2E-08	2.5E-08	1.4E-08	6.5E-09
S	2.1E-08	1.7E-08	1.1E-08	5.9E-09
SSW	2.7E-09	2.7E-09	2.7E-09	2.7E-09
SW	5.0E-08	3.9E-08	2.3E-08	1.1E-08
WSW	7.1E-08	5.7E-08	3.5E-08	1.8E-08
W	3.9E-07	2.9E-07	1.6E-07	6.4E-08
WNW	3.1E-07	2.4E-07	1.4E-07	6.1E-08
NW	4.2E-07	3.2E-07	1.7E-07	7.2E-08
NNW	4.2E-07	3.1E-07	1.6E-07	6.3E-08

Note: 6.7E-5 = 6.7X10^{-5}

* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour X/Q values and logarithmic interpolation between the 2-hour X/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour X/Q values.

PNPP REALISTIC SHORT-TERM ACCIDENT X/Q VALUES*
BY SECTOR BASED ON THREE SITE YEARS**

X/Q (sec/m^3) by Accident Period at a Distance of 72420m***

Receptor Direction	8 hours	16 hours	72 hours	624 hours
N	3.6E-07	2.6E-07	1.3E-07	4.8E-08
NNE	1.3E-07	1.0E-07	5.4E-08	2.3E-08
NE	8.6E-08	6.6E-08	3.7E-08	1.6E-08
ENE	4.9E-08	3.7E-08	2.1E-08	8.8E-09
E	4.6E-08	3.6E-08	2.0E-08	9.1E-09
ESE	3.6E-08	2.7E-08	1.5E-08	6.3E-09
SE	3.6E-08	2.7E-08	1.5E-08	6.0E-09
SSE	2.7E-08	2.1E-08	1.2E-08	5.0E-09
S	1.6E-08	1.3E-08	8.5E-09	4.4E-09
SSW	1.9E-09	1.9E-09	1.9E-09	1.9E-09
SW	3.5E-08	2.8E-08	1.7E-08	7.9E-09
WSW	5.0E-08	4.0E-08	2.5E-08	1.3E-08
W	2.9E-07	2.2E-07	1.2E-07	4.7E-08
WNW	2.3E-07	1.8E-08	1.0E-07	4.6E-08
NW	3.2E-07	2.4E-07	1.3E-07	5.4E-08
NNW	3.2E-07	2.3E-07	1.2E-07	4.7E-08

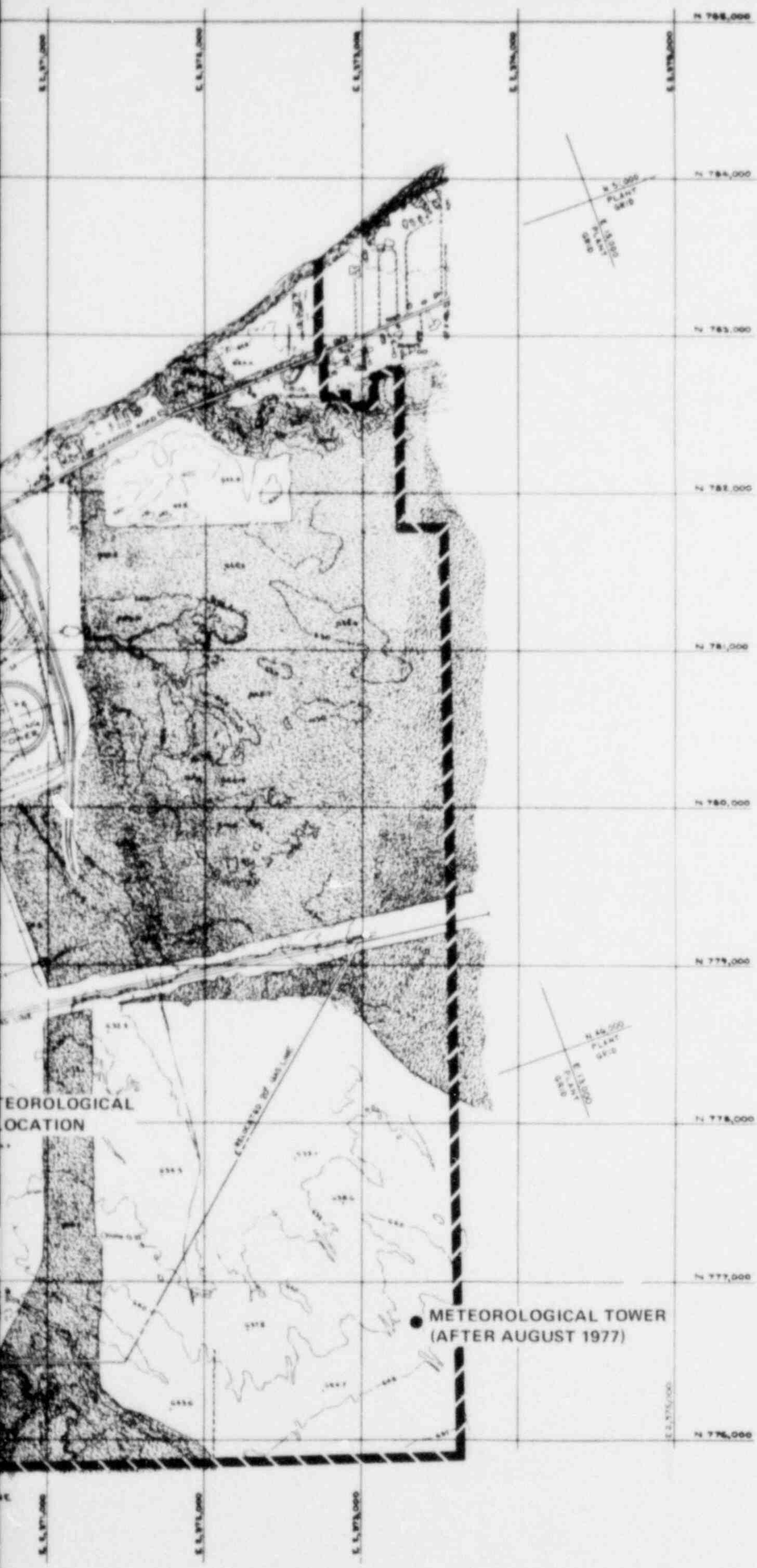
Note: 6.7E-5 = 6.7×10^{-5}

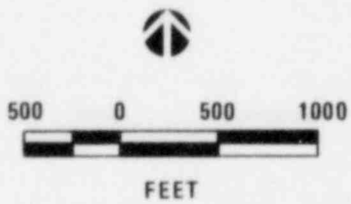
* From a ground level release to a ground level receptor

** May 1, 1972 to April 30, 1973; May 1, 1973 to April 30, 1974; September 1, 1977 to August 31, 1978

*** Calculated by a sector dependent model, modified to obtain the 50th percentile (by keying in each sector on the 3.125 percentile of the total observations), 2-hour X/Q values and logarithmic interpolation between the 2-hour X/Q value and the sector annual average to obtain 8-hour, 16-hour, 72 hour and 624-hour X/Q values.

LAKE ERIE
INTAKE STRUCTURES
DISCHARGE STRUCTURE
SITE NO. 3
MINOR STREAM DIVERSION
SEDIMENT CONTROL DAM
SITE NO. 2
NORTHWEST STORM DRAINAGE
SEDIMENT CONTROL DAM
SITE NO. 1
MAJOR STREAM SEDIMENT
CONTROL DAM
TRANSMISSION STATION
OLD MET
TOWER L
PLANT SITE
BOUNDARY LI
N 784,000
N 780,000
N 776,000





CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

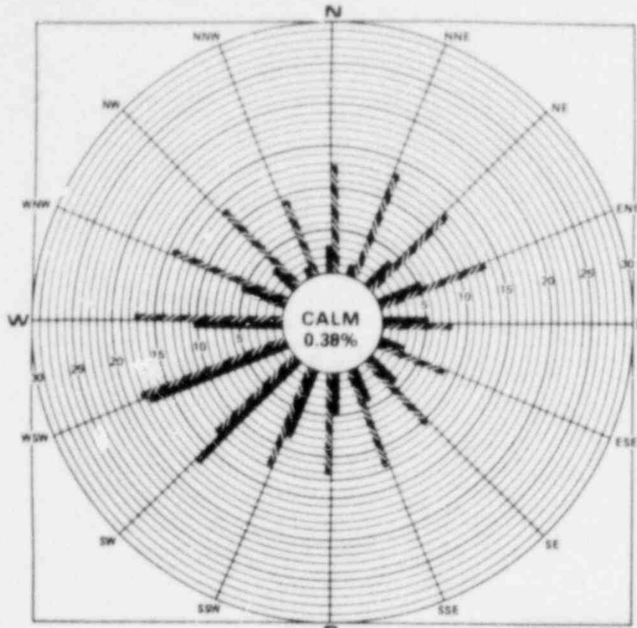
NOTE:
ALL BACKGROUND CONTOURS SUPPLIED BY AERIAL SURVEYS INC.

PLANT SITE AND METEOROLOGICAL TOWER LOCATION

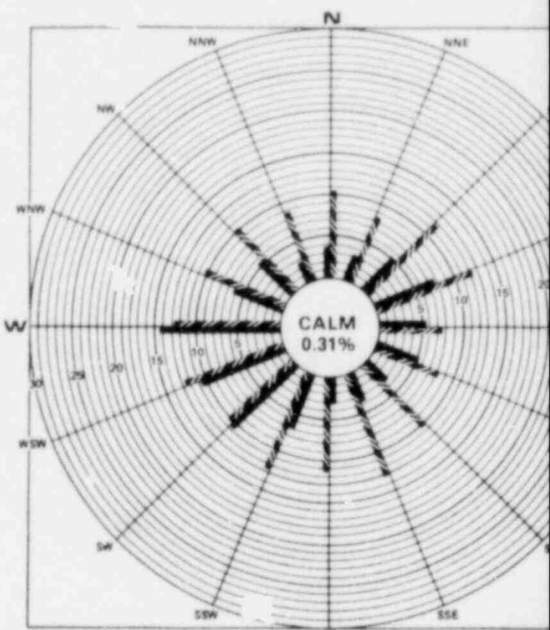
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

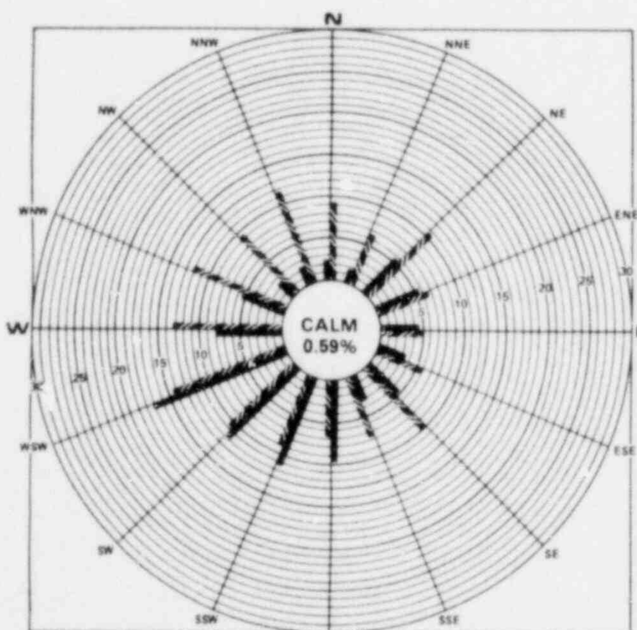
FIGURE 2.3-1



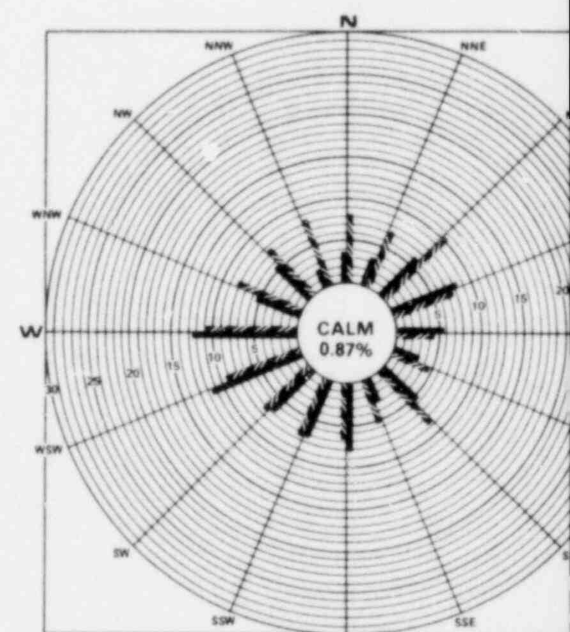
JANUARY



FEBI

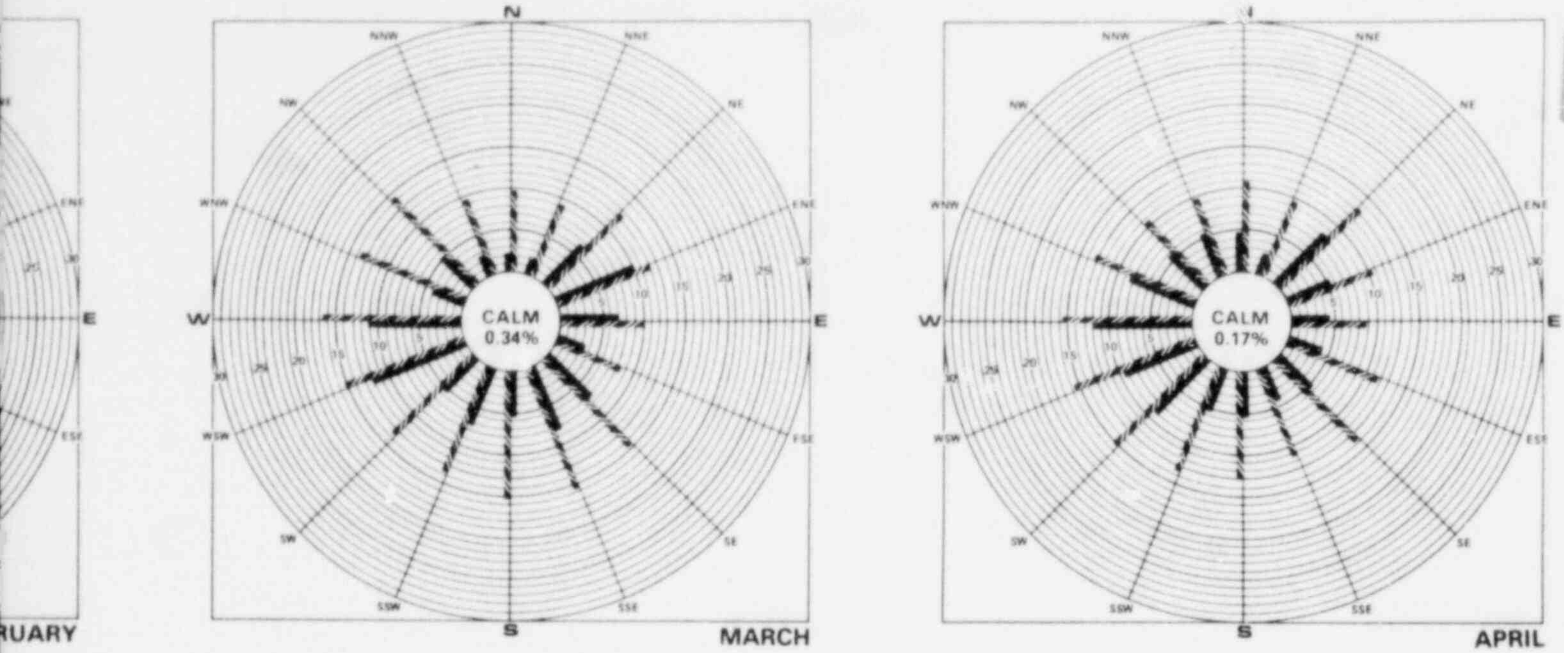


JANUARY

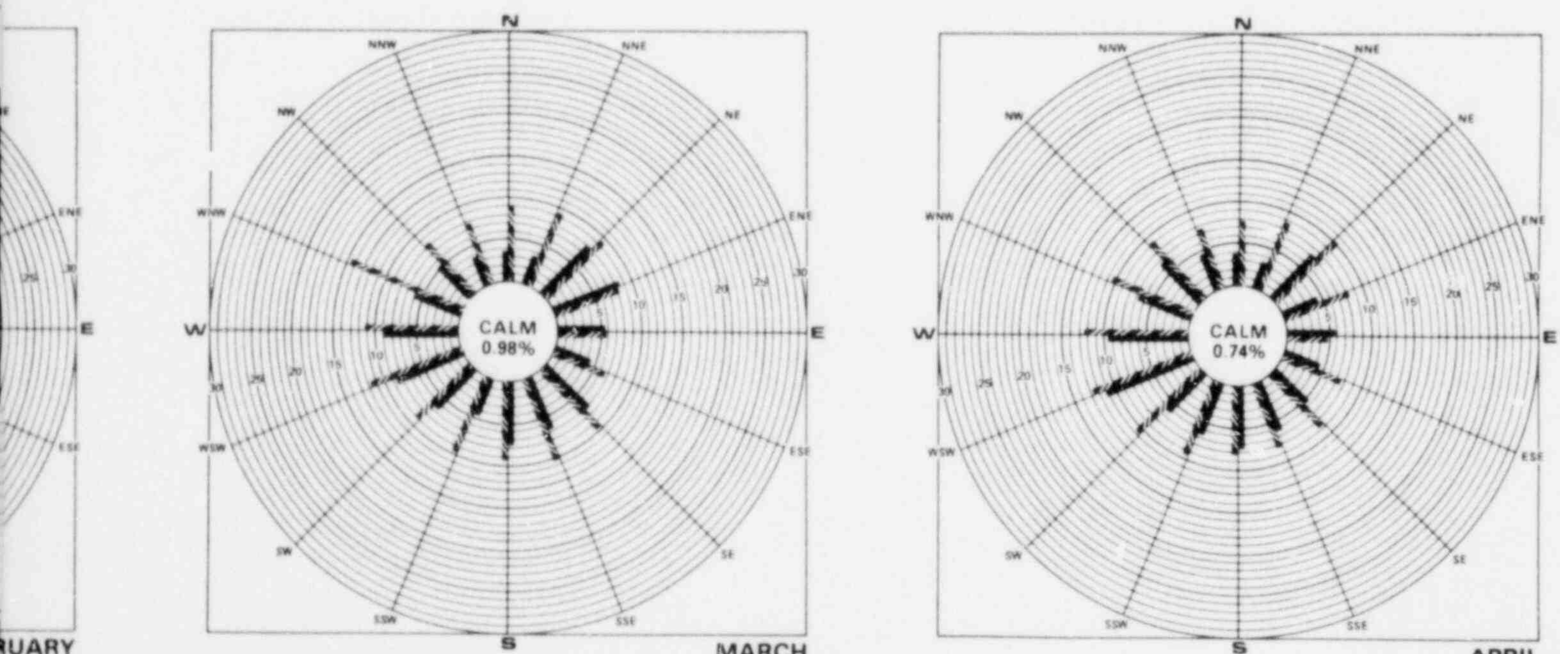


FEBI

WIND DIRECTION (%)
WIND SPEED (MPH)



60 METER



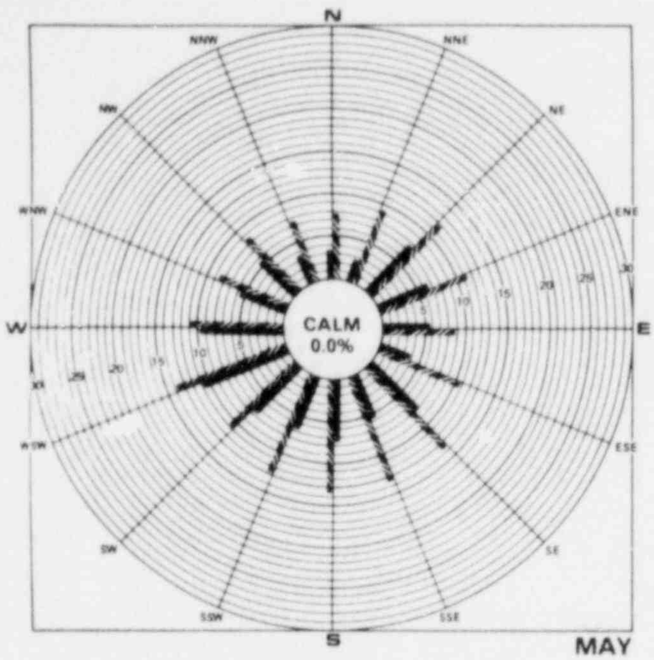
10 METER

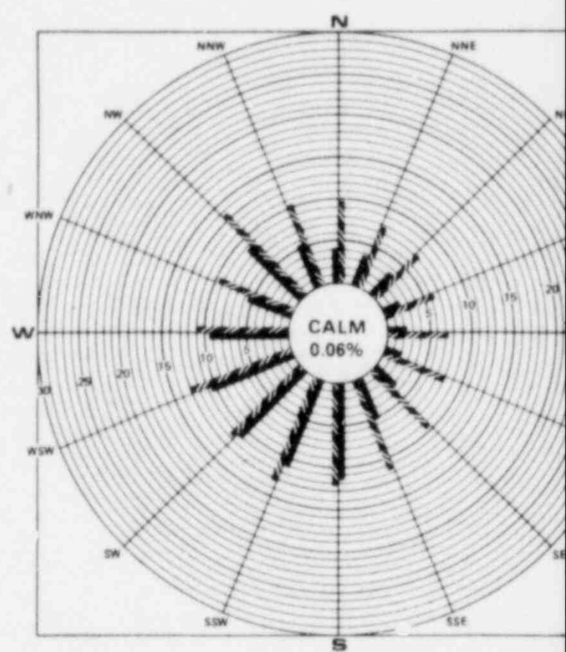
JANUARY TO APRIL MONTHLY WIND ROSES
FOR THE PERRY SITE-10m AND 60m LEVELS
(5/1/72-4/30/74; 9/1/77-8/31/78)

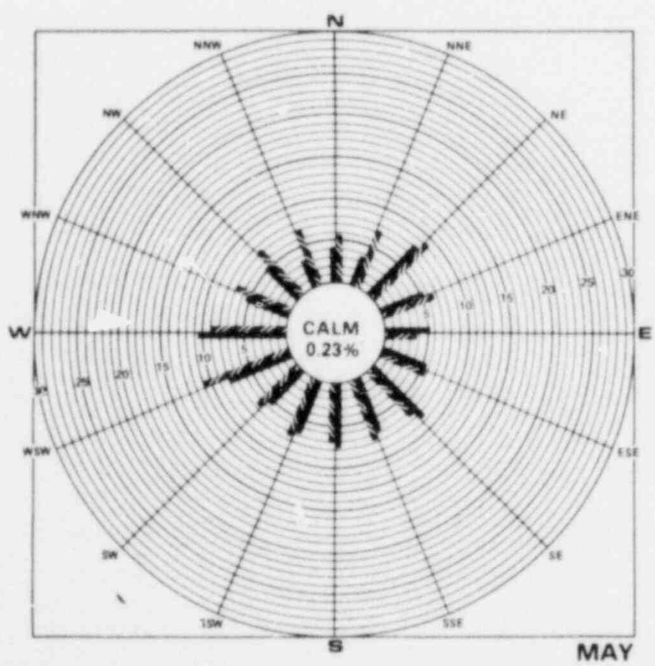
PERRY NUCLEAR POWER PLANT 1 & 2

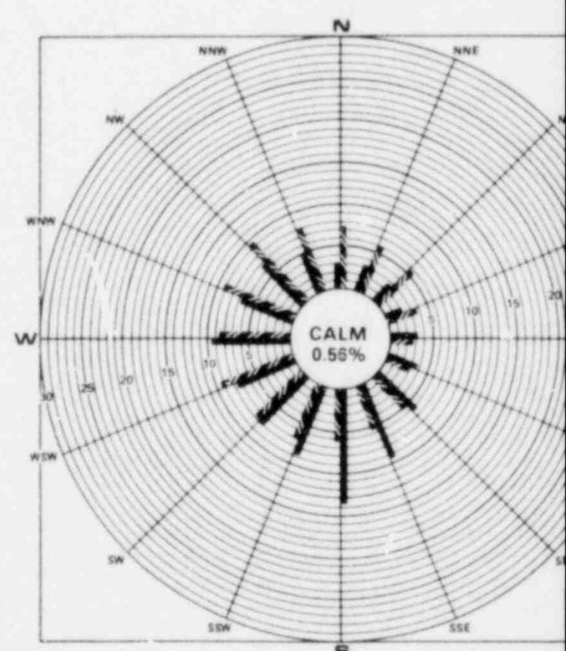
THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.3-2



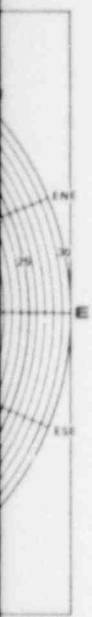




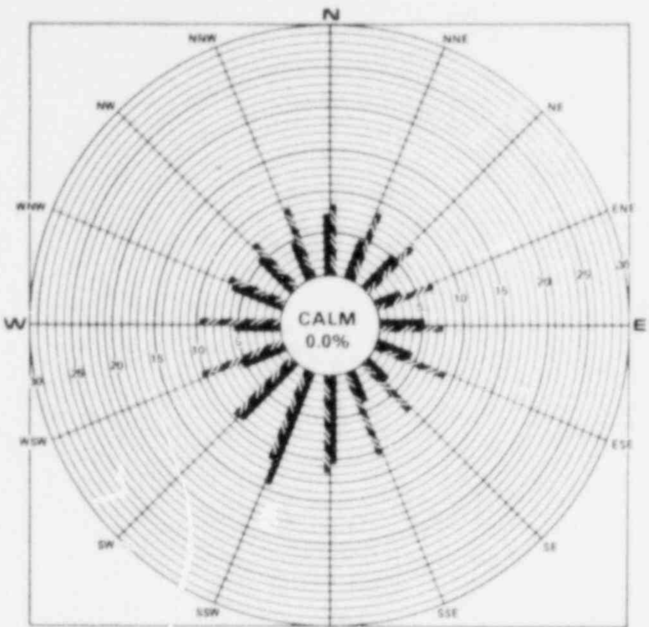


WIND DIRECTION (%)

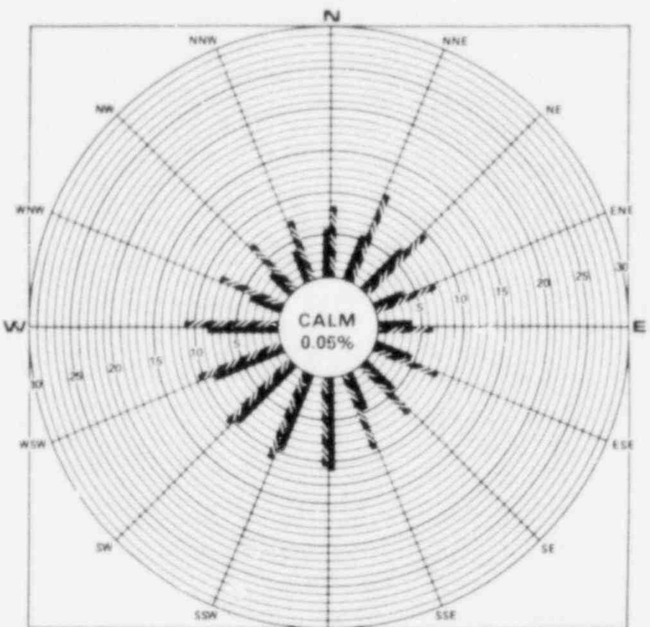
WIND SPEED (MPH)



JUNE

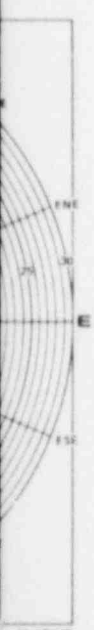


JULY

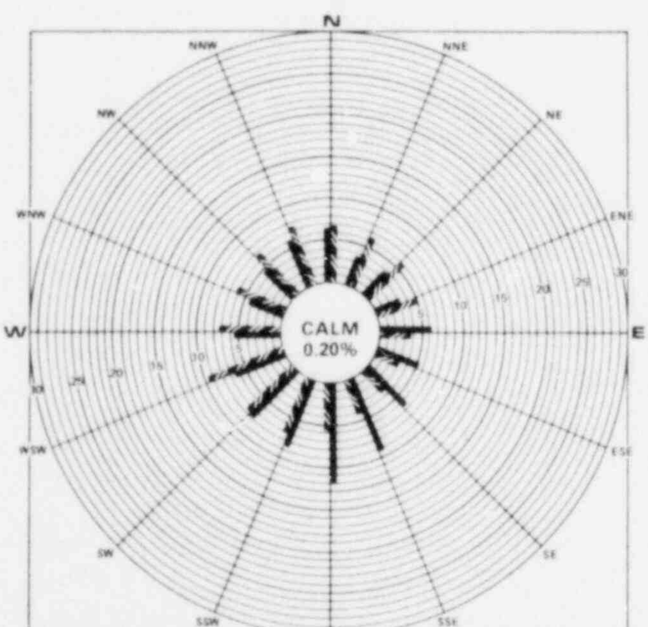


AUGUST

60 METER



JUNE



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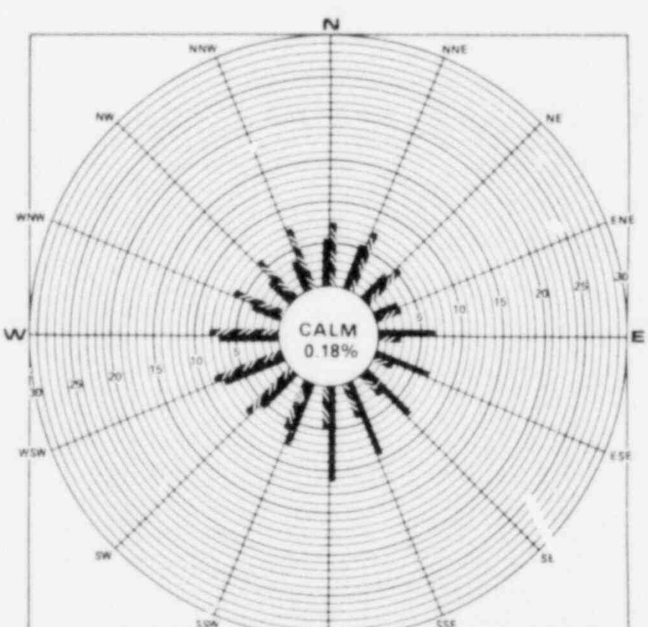


AUGUST

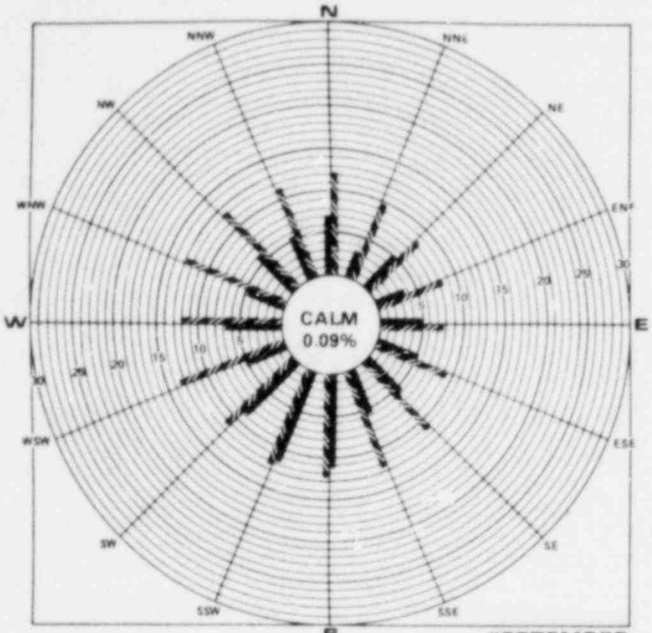
10 METER

MAY TO AUGUST MONTHLY WIND ROSES
FOR THE PERRY SITE-10m AND 60m LEVELS
(5/1/72-4/30/74; 9/1677-8/31/78)

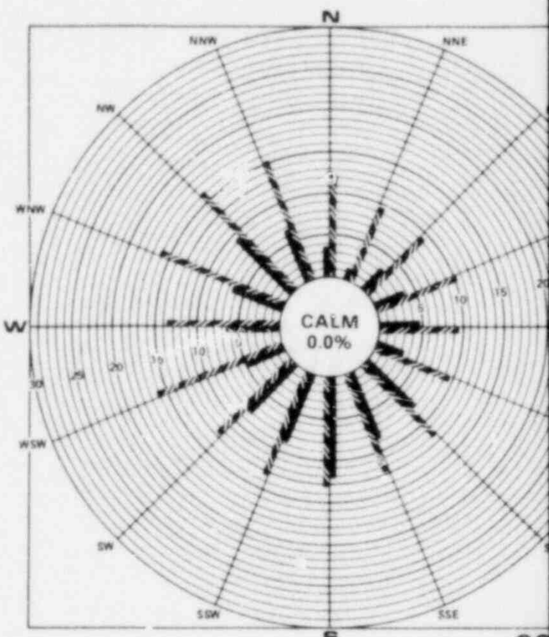
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

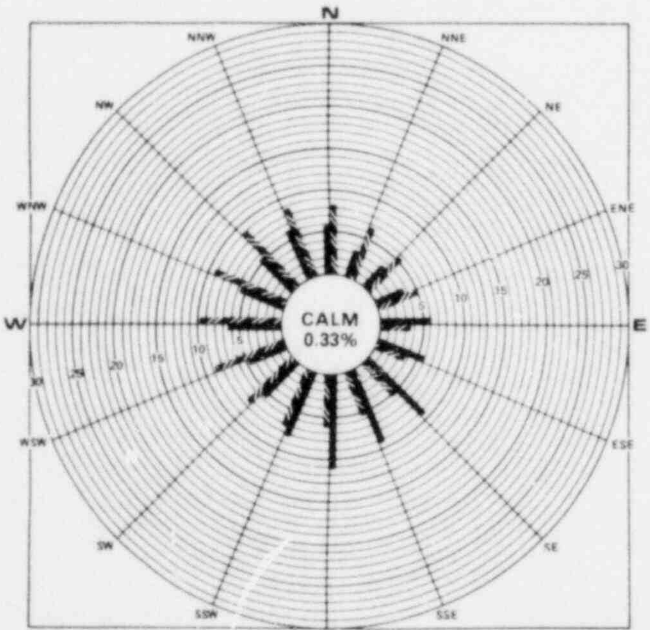
FIGURE 2.3-3



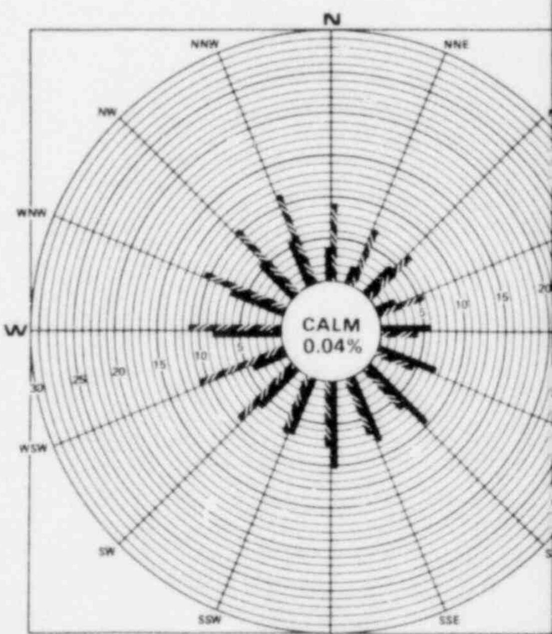
SEPTEMBER



OC



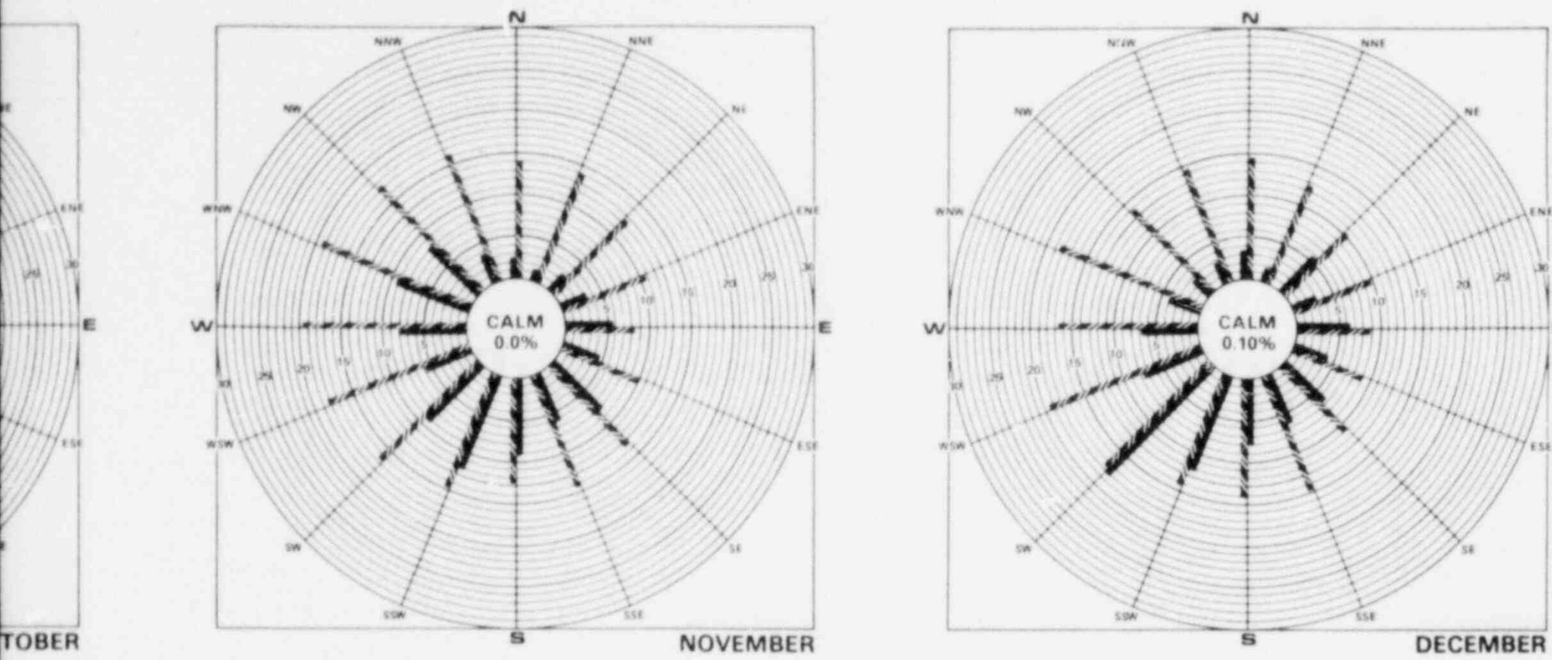
SEPTEMBER



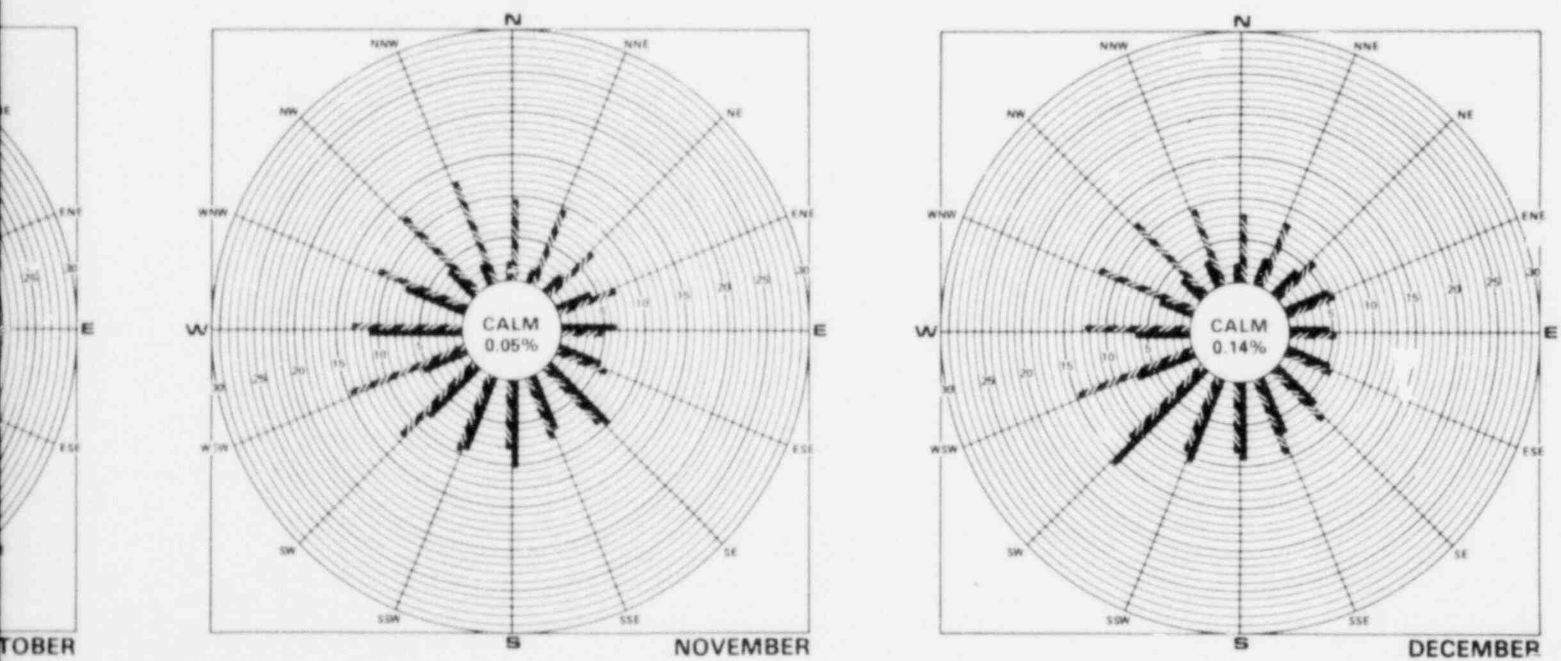
OC

WIND DIRECTION (%)

WIND SPEED (MPH)



60 METER



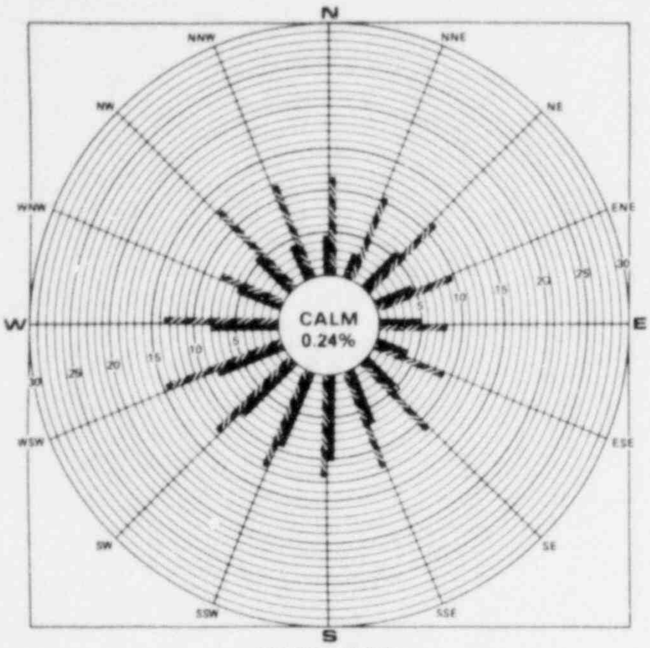
10 METER

SEPTEMBER TO DECEMBER MONTHLY WIND ROSES
FOR THE PERRY SITE-10m AND 60m LEVELS
(5/1/72-4/30/74; 9/1/77-8/31/78)

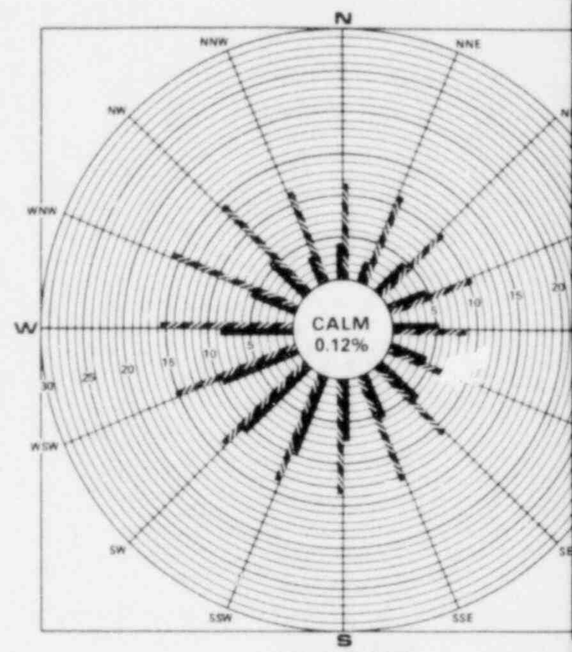
PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

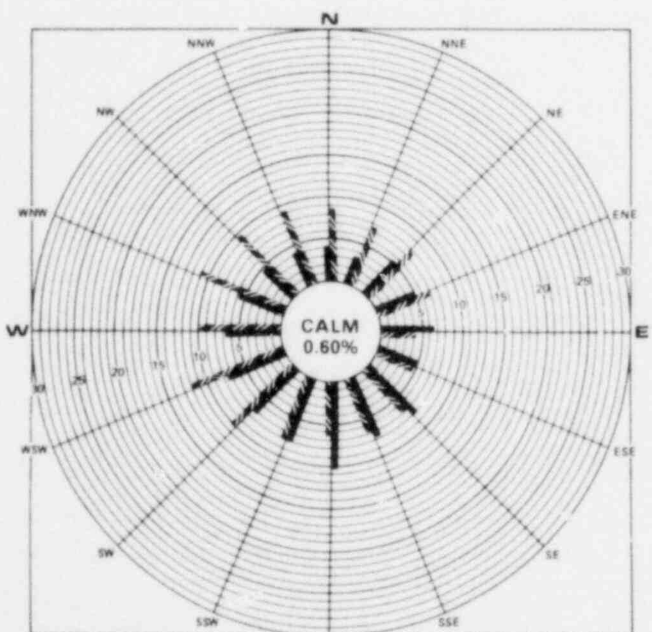
FIGURE 2.3-4



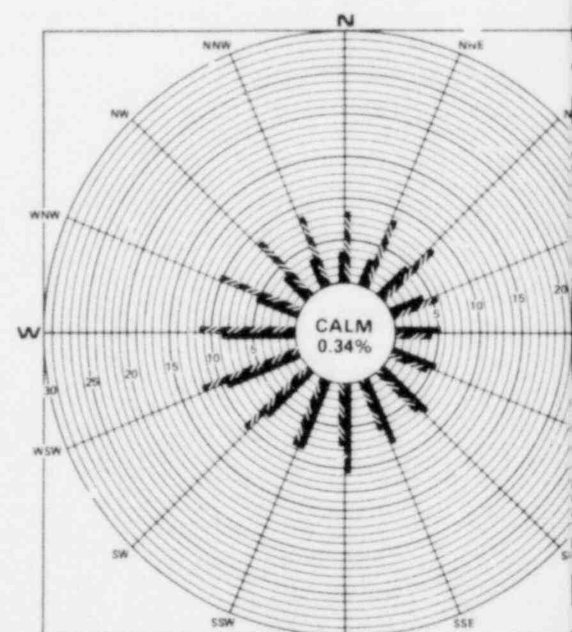
5/1/72-4/30/73



5/1/73-4/30/74



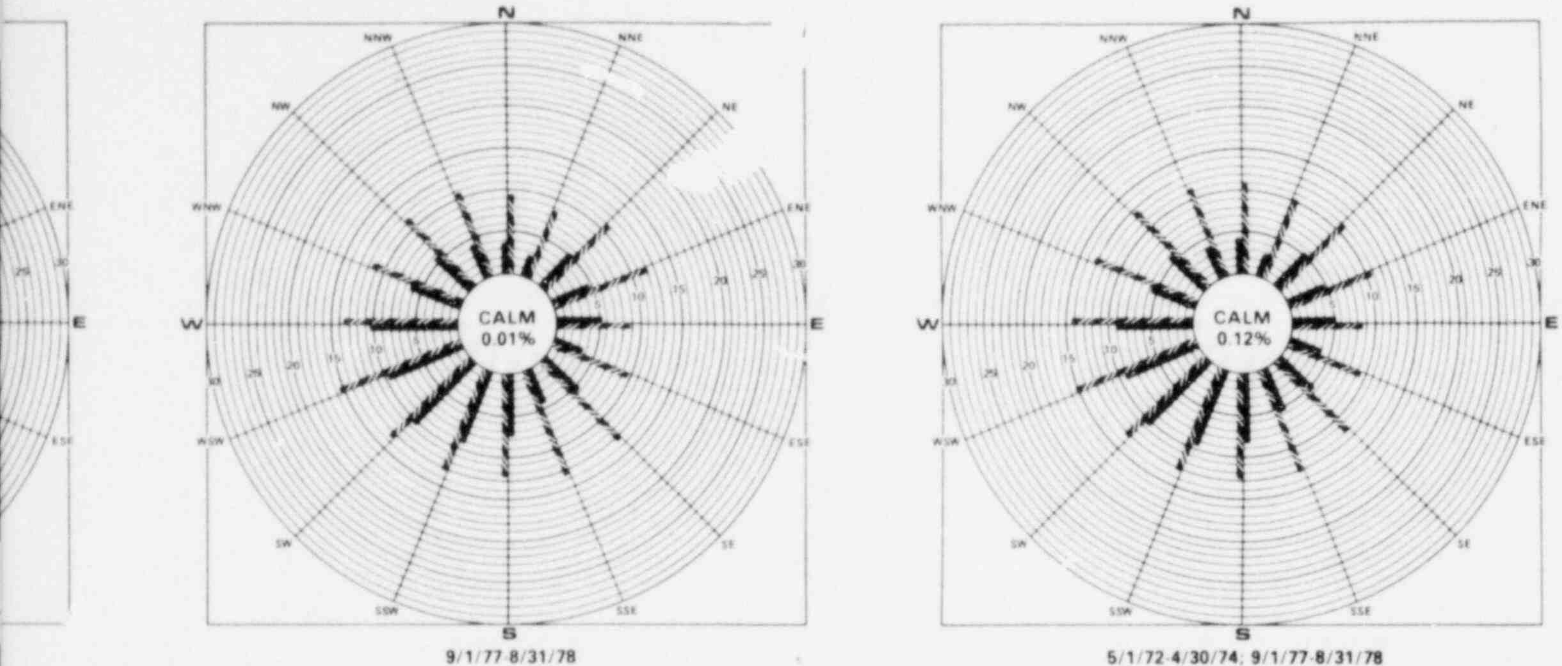
5/1/72-4/30/73



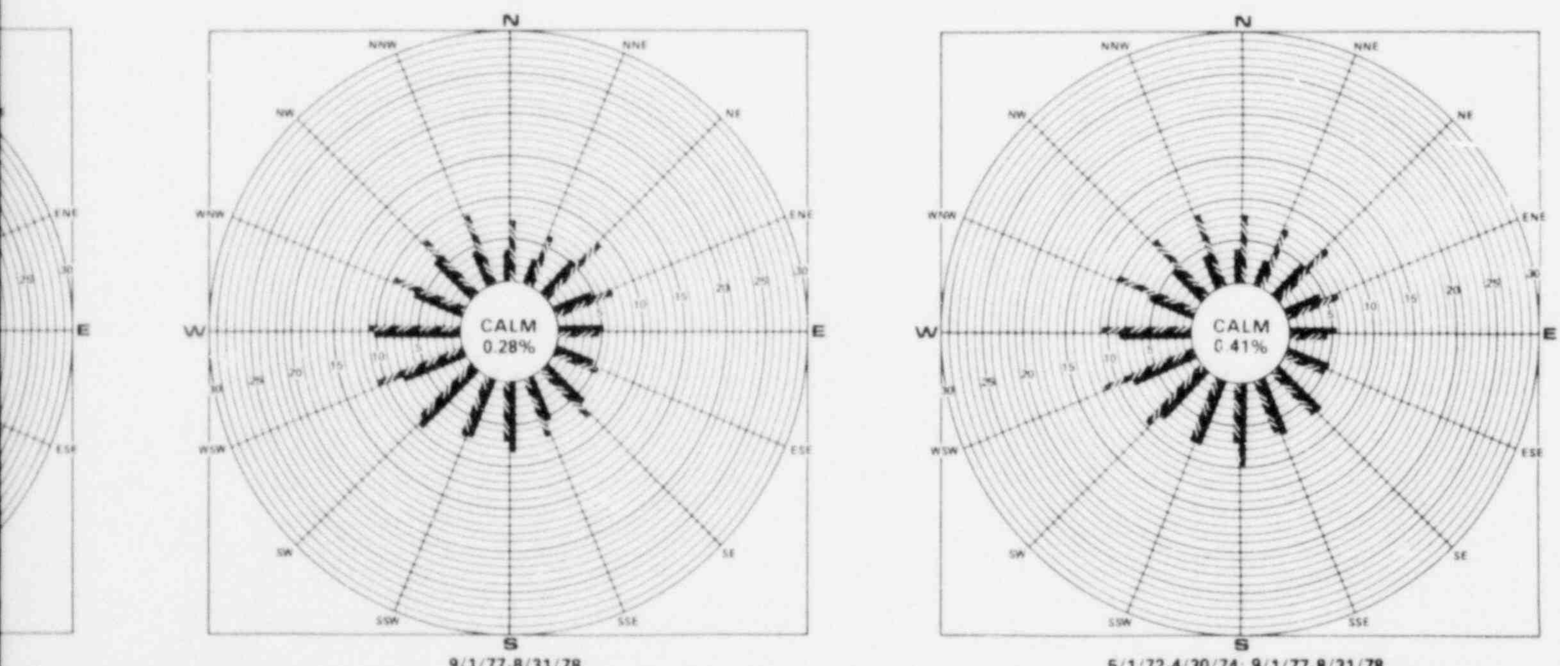
5/1/73-4/30/74

WIND DIRECTION (%)

WIND SPEED (MPH)



60 METER



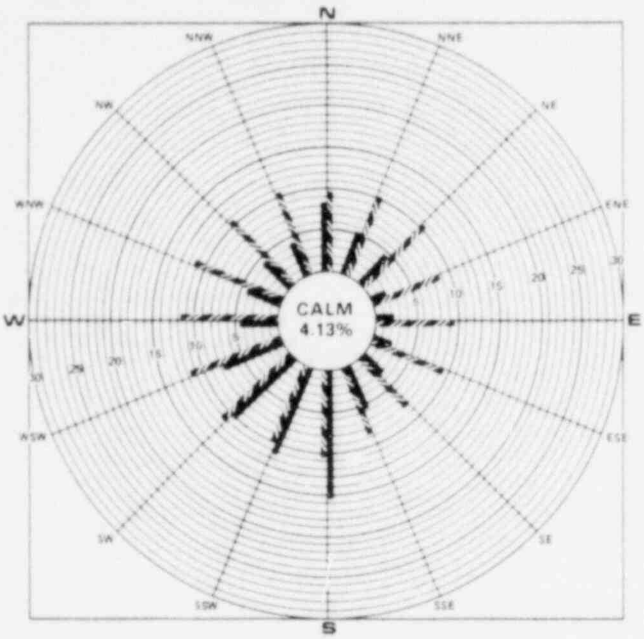
10 METER

ANNUAL WIND ROSES FOR THE PERRY SITE
(10m AND 60m LEVELS)
(5/1/72-4/30/73, 5/1/73-4/30/74; 9/1/77-8/31/78;
3-YR. COMBINED

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELCTRIC
ILLUMINATING COMPANY

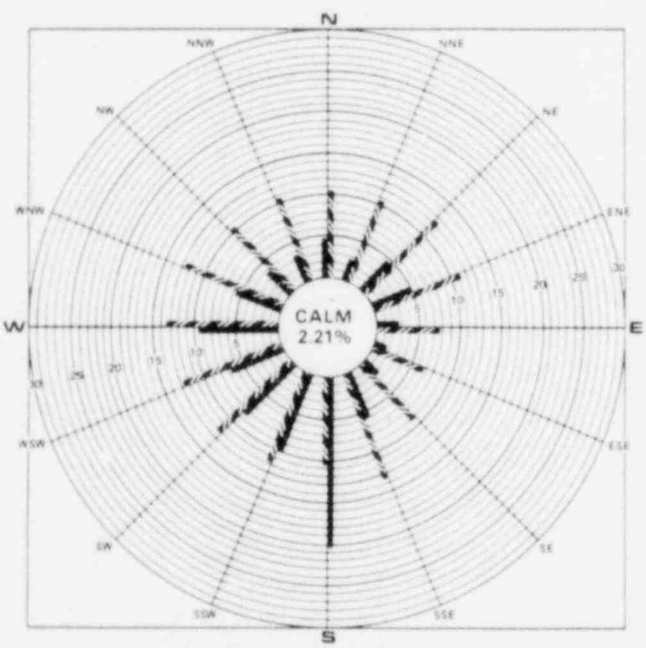
FIGURE 2.3-5



5/1/72-4/30/74; 9/1/77-8/31/78

9/1/68-8/31/78

CLEVELAND - 6.1 METERS



5/1/72-4/30/74 ; 9/1/77-8/31/8

9/1/68-8/31/78

ERIE - 6.1 METERS

WIND DIRECTION (%)

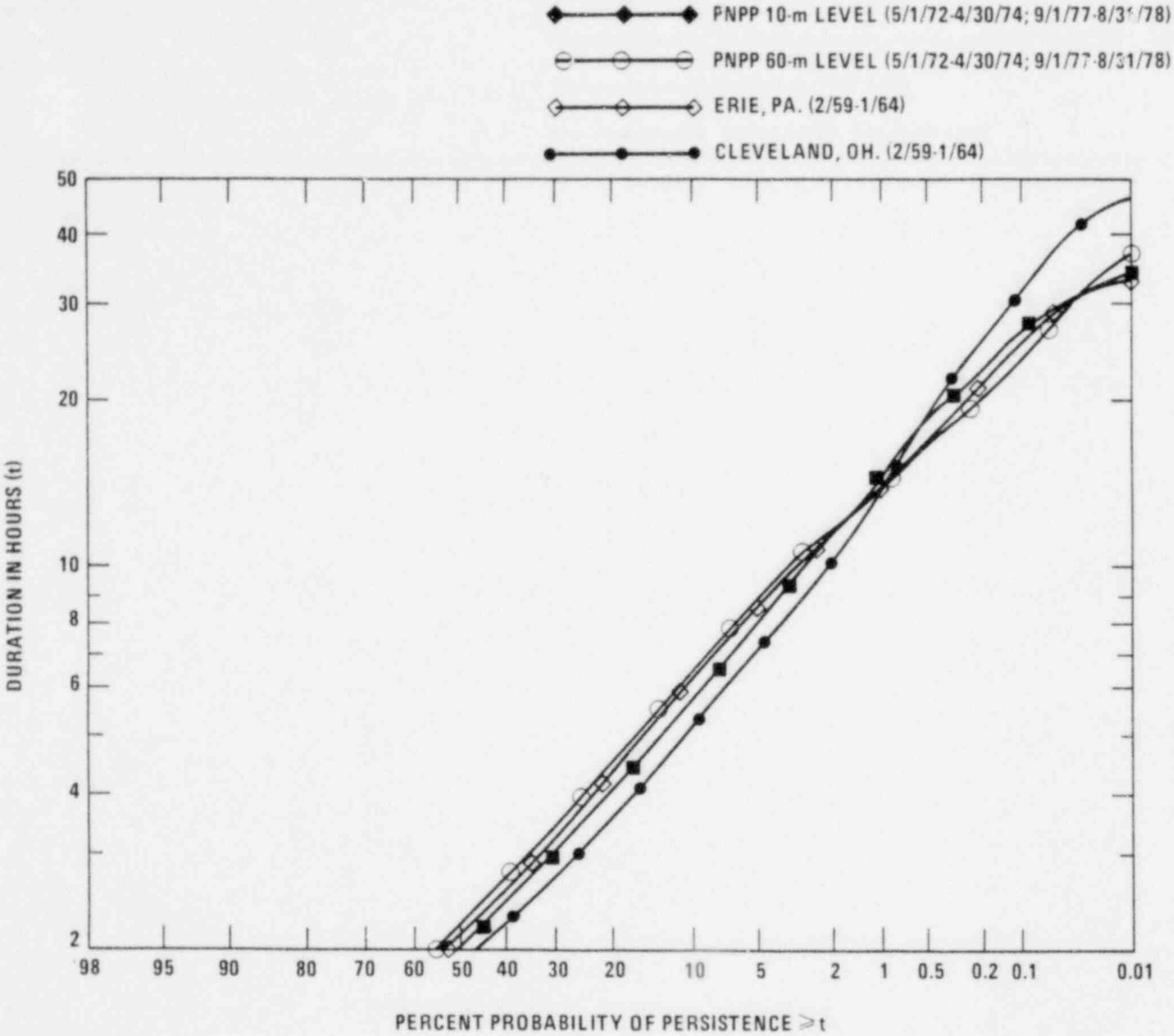
WIND SPEED (MPH)

CLEVELAND AND ERIE ANNUAL WIND ROSES

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.3-6



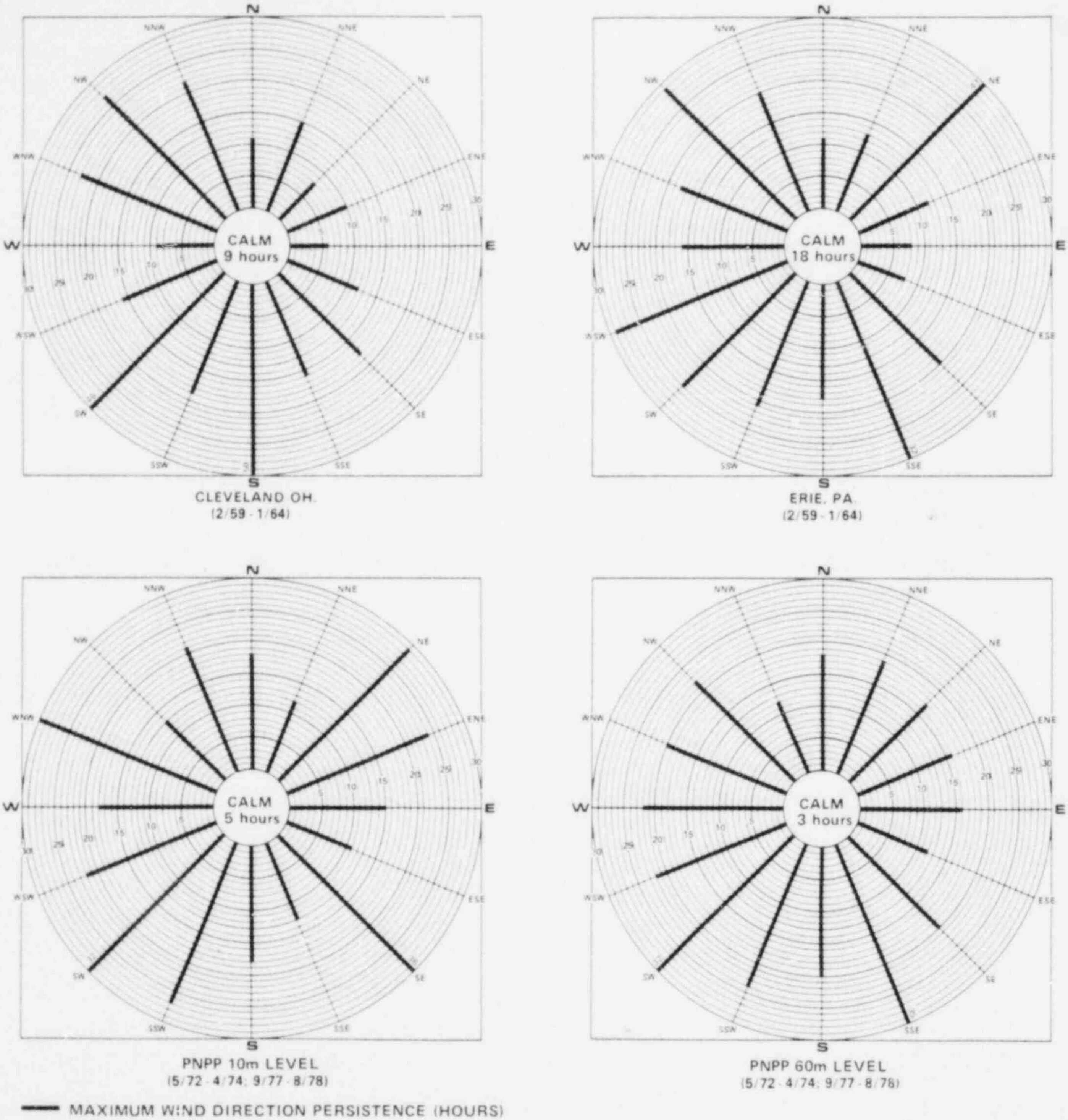
WIND DIRECTION PERSISTENCE PROBABILITY FOR ONE 22½° SECTOR FOR PNPP REGION

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.3-7

1164

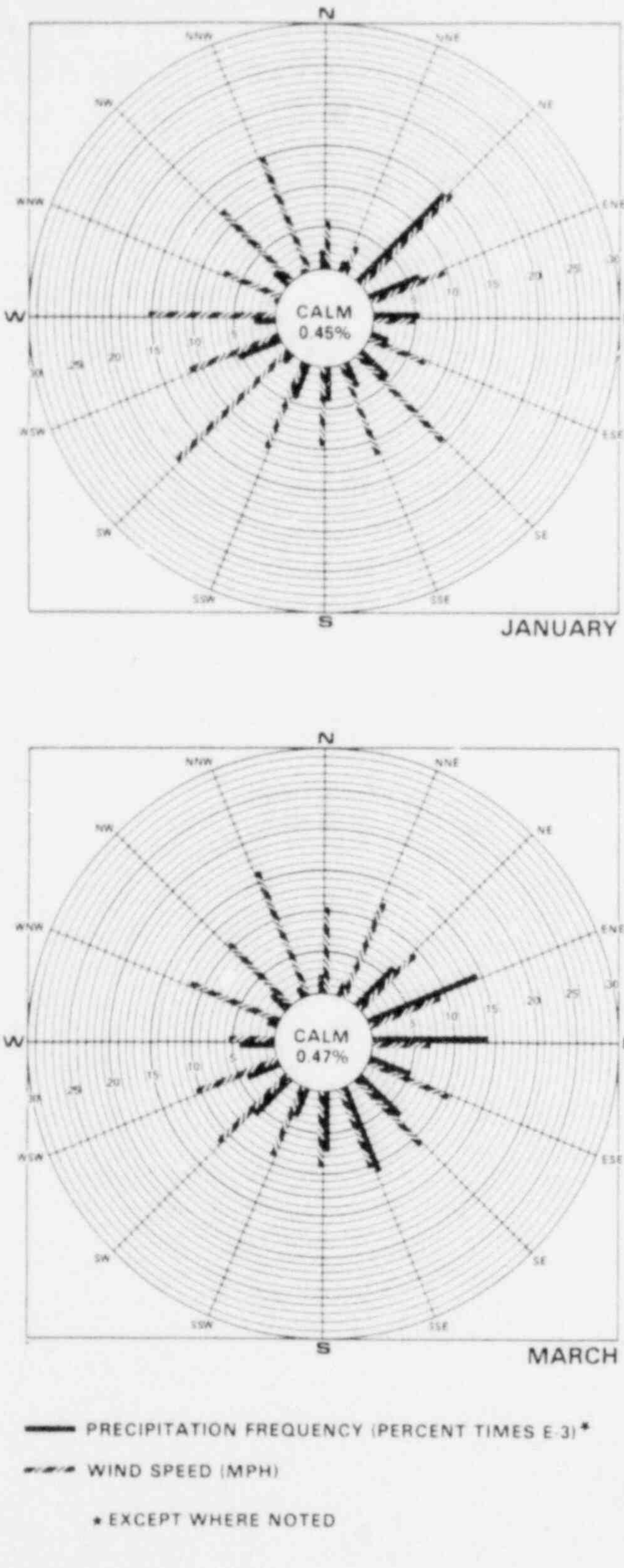


OFFSITE AND ONSITE MAXIMUM
DIRECTIONAL WIND PERSISTENCE ROSES

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.3-8



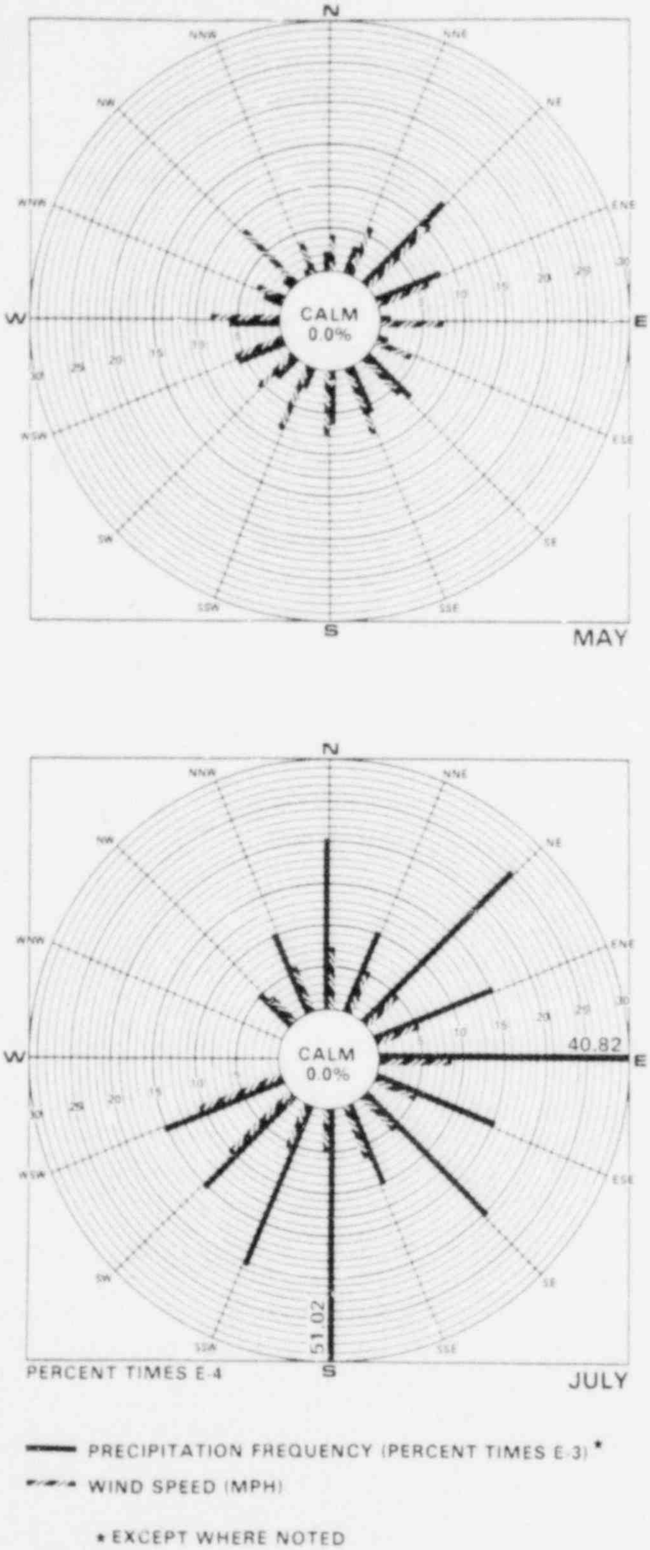
JANUARY TO APRIL MONTHLY PRECIPITATION
WIND ROSES FOR THE PERRY SITE (10m)
(5/1/72-4/30/74; 9/1/77-8/31/78)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.3-9

NOTE: E-3 = 10^{-3}



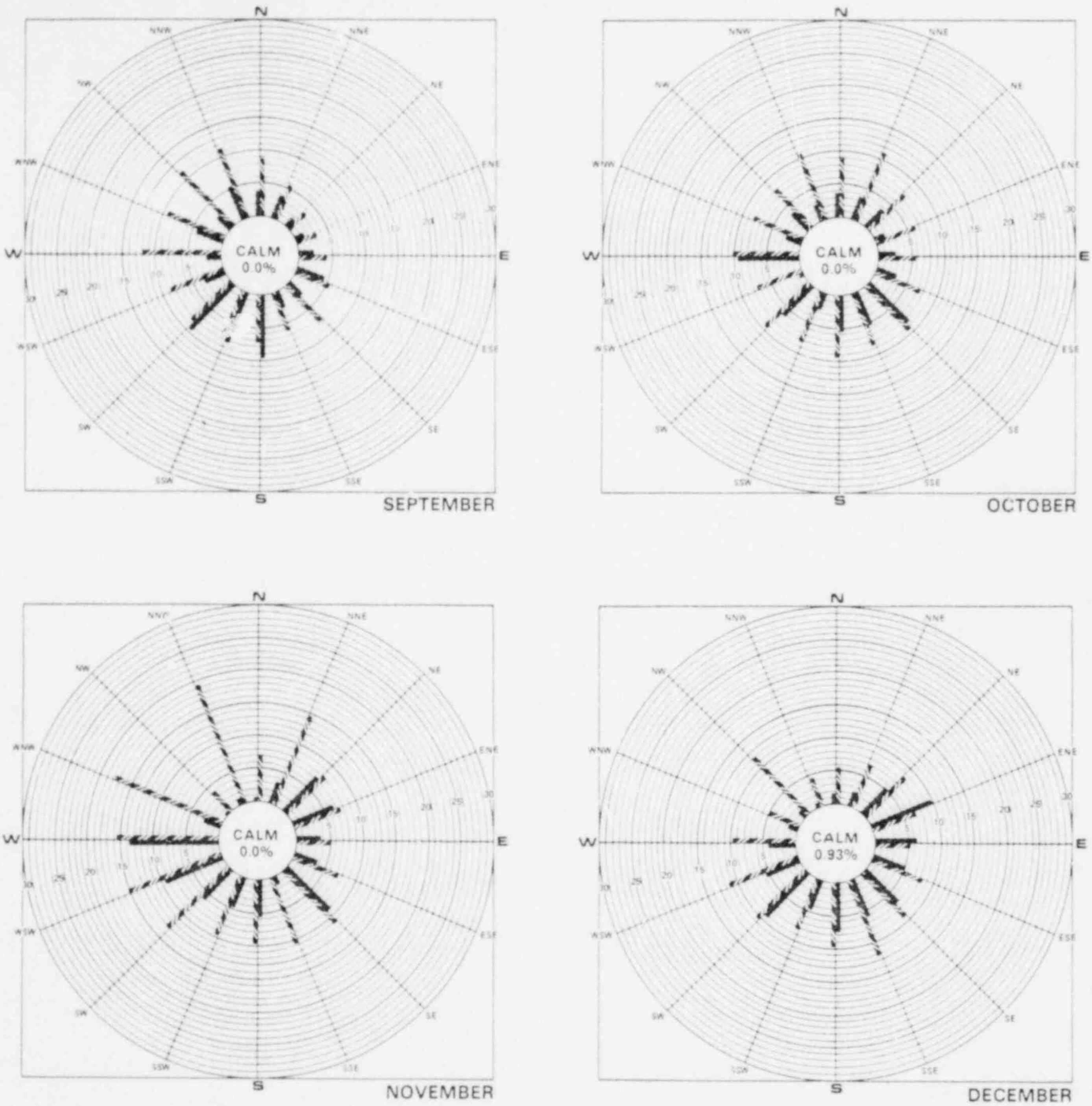
MAY TO AUGUST MONTHLY PRECIPITATION WIND ROSES FOR THE PERRY SITE (10m) (5/1/72-4/30/74; 9/1/77-8/31/78)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.3-10

NOTE: E-3 = 10^{-3}



PRECIPITATION FREQUENCY (PERCENT TIMES E-3)*

WIND SPEED (MPH)

* EXCEPT WHERE NOTED

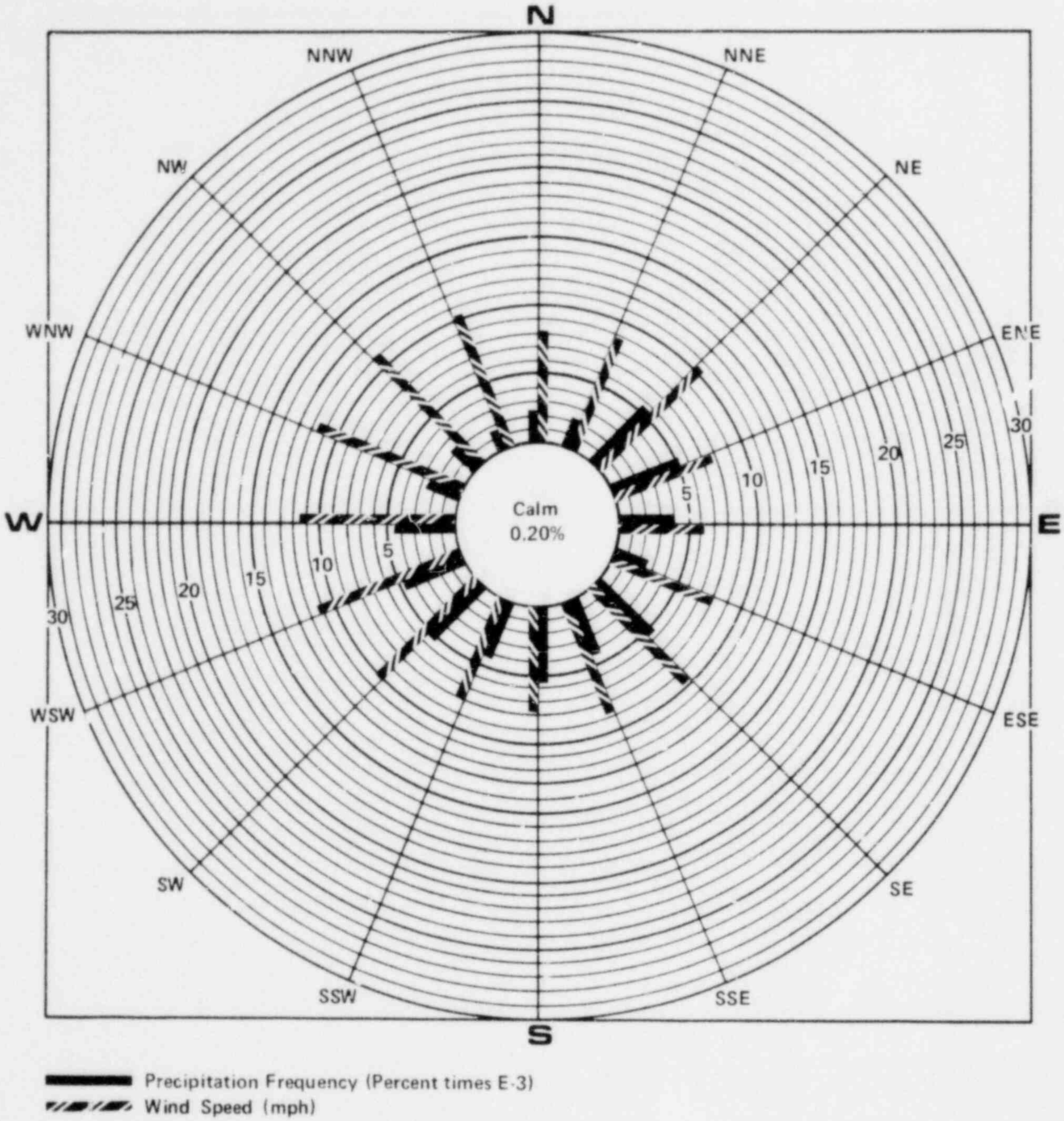
SEPTEMBER TO DECEMBER MONTHLY PRECIPITATION WIND ROSES FOR THE PERRY SITE (10m)
(5/1/72-4/30/74; 9/1/77-8/31/78)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.3-11

NOTE: E-3 = 10^{-3}



ANNUAL PRECIPITATION WIND ROSE
FOR THE PERRY SITE (10m)
(5/1/72-4/30/74; 9/1/77-8/31/78)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.3-12

NOTE: E-3 = 10^{-3}

2.4 HYDROLOGY

The hydrologic description of the site and environs in the ER/CP is still generally applicable. Some additional onsite data were acquired; these are presented below.

Two underwater instrument towers were installed offshore of the PNPP site in July 1972; data collection was terminated in December 1973. The nearshore tower, designated M1, was placed in the region of the proposed discharge structure, approximately 2500 feet away from the shore. Water depth at mean low water (MLW) is about 22 feet. Three water temperature sensors, designated T6, T7, and T8, were located 1, 5, and 8 feet above the lake bottom, respectively. A water current direction sensor (designated M1-1) was mounted 7 feet above the lake bottom. During the data collection period, the lake level was about 4 feet above the mean low water; the water current measurements were, therefore, made at a depth of about 19 feet and the temperature measurements were made at depths of approximately 18, 21, and 24 feet.

The second tower, designated M2, was placed in the region of the proposed intake structure, approximately 3500 feet away from the shore. Water depth at mean low water is about 26 feet. Three temperature sensors, designated T2, T3, and T4, were mounted on the tower 1, 8, and 13 feet above the bottom, respectively. Two current direction meters, designated M2-1 and M2-2, were mounted 8 and 12 feet above the bottom, respectively. At 1972 to 1973 lake levels, the temperature readings were at depths of about 29, 22, and 17 feet, and the current measurements were at depths of about 22 and 18 feet.

Data collection began on July 20, 1972. From July 20 to July 26, data were collected every 30 minutes. Thereafter, data were collected at 15-minute intervals, 24 hours a day.

Monthly average temperature values for the entire data collection period appear in Table 2.4-1. Current direction roses for each sensor are presented in Table 2.4-2.

TABLE 2.4-1

MONTHLY AVERAGE WATER TEMPERATURES[(a)]

Month	Temperature (°F)
January	35
February	34
March	37
April	44
May	51
June	67
July	71
August	74
September	70
October	61
November	47
December	38

(a) Average of values from sensors T2, T3, T4, T6, T7, and T8 during the period August 1972 through December 1973.

TABLE 2.4-2

LAKE ERIE CURRENT ROSES AT THE PERRY SITE
(Direction to Which Current Flows)

FREQUENCY DISTRIBUTION OF CURRENTS AT THE PNPP SITE, SENSOR M1-1, JULY 20, 1972 TO DEC., 31, 1973

DIRECTION (DEG. M)	SPEED RANGE (FT/SEC) 0.-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	GT 0.9	ROW TOTAL	ROW MEAN	ROW S.D.
N	128.	172.	70.	24.	8.	7.	4.	2.	1.	107.	528.	0.81	5.66
	0.39	0.52	0.21	0.09	0.02	0.02	0.01	0.01	0.00	0.33	1.60		
NNE	177.	361.	201.	112.	31.	26.	13.	8.	4.	11.	944.	24.01	6.09
	0.54	1.10	0.61	0.34	0.09	0.08	0.04	0.02	0.01	0.03	2.87		
NE	430.	922.	756.	499.	205.	97.	56.	21.	19.	39.	3044.	46.85	6.31
	1.31	2.80	2.30	1.52	0.62	0.29	0.17	0.06	0.06	0.12	9.25		
ENE	1144.	1266.	794.	513.	253.	111.	84.	41.	30.	78.	4314.	67.27	5.81
	3.48	3.85	2.41	1.56	0.77	0.34	0.26	0.12	0.09	0.24	13.11		
E	1096.	725.	499.	372.	197.	98.	81.	56.	25.	97.	3246.	89.08	6.30
	3.33	2.20	1.52	1.13	0.60	0.30	0.25	0.17	0.08	0.29	9.87		
ESE	779.	560.	414.	228.	200.	117.	77.	79.	45.	100.	2599.	112.40	6.17
	2.37	1.70	1.26	0.69	0.61	0.36	0.23	0.24	0.14	0.30	7.90		
SE	793.	514.	373.	264.	191.	134.	97.	74.	56.	89.	2585.	134.65	6.19
	2.41	1.56	1.13	0.80	0.58	0.41	0.29	0.22	0.17	0.27	7.86		
SSE	859.	458.	337.	222.	137.	108.	88.	49.	38.	92.	2388.	157.63	5.98
	2.61	1.39	1.02	0.67	0.42	0.33	0.27	0.15	0.12	0.28	7.26		
S	886.	450.	346.	233.	130.	114.	82.	56.	41.	70.	2408.	179.86	5.97
	2.69	1.37	1.05	0.71	0.40	0.35	0.25	0.17	0.12	0.21	7.32		
SSW	911.	630.	31.	265.	183.	115.	65.	67.	51.	83.	2801.	202.98	5.65
	2.77	1.91	1.31	0.81	0.56	0.35	0.20	0.20	0.16	0.25	8.51		
SW	617.	628.	425.	328.	203.	134.	69.	54.	31.	93.	2582.	224.27	6.16
	1.88	1.91	1.29	1.00	0.62	0.41	0.21	0.16	0.09	0.28	7.85		
WSW	284.	496.	352.	272.	195.	128.	87.	83.	50.	88.	2035.	247.01	5.64
	0.86	1.51	1.07	0.83	0.59	0.39	0.26	0.25	0.15	0.27	6.19		
W	188.	298.	258.	191.	142.	104.	82.	55.	34.	77.	1429.	269.06	6.01
	0.57	0.91	0.78	0.58	0.43	0.32	0.25	0.17	0.10	0.23	4.34		
WNW	313.	188.	130.	112.	97.	66.	41.	36.	27.	47.	1057.	291.01	5.25
	0.95	0.57	0.40	0.34	0.29	0.20	0.12	0.11	0.08	0.14	3.21		
NW	256.	107.	72.	49.	45.	20.	17.	11.	10.	24.	611.	313.18	5.97
	0.78	0.33	0.22	0.15	0.14	0.06	0.05	0.03	0.03	0.07	1.86		
NNW	147.	93.	31.	14.	17.	5.	2.	3.	1.	16.	329.	336.02	5.73
	0.45	0.28	0.09	0.04	0.05	0.02	0.01	0.01	0.00	0.05	1.00		
COLUMN TOTALS	9008.	7868.	5489.	3703.	2234.	1384.	945.	695.	463.	1111.	32900.		
	27.38	23.91	16.68	11.26	6.79	4.21	2.87	2.11	1.41	3.38	100.00		
MEAN	0.04	0.14	0.24	0.34	0.44	0.54	0.64	0.74	0.84	1.15			
S.D.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.22			

TABLE 2.4-2 (Continued)

LAKE ERIE CURRENT ROSES AT THE PERRY SITE
(Direction to Which Current Flows)

FREQUENCY DISTRIBUTION OF CURRENTS AT THE PNPP SITE, SENSOR M2 1, JULY 20, 1972 TO DEC. 31, 1973

DIRECTION (DEG. N)	SPEED RANGE (FT/SEC) 0.-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	GT 0.9	ROW TOTAL	ROW MEAN	ROW S.D.
N	99.	101.	57.	17.	6.	4.	3.	3.	1.	8.	299.	2.29	6.24
	0.41	0.42	0.24	0.07	0.02	0.02	0.01	0.01	0.00	0.03	1.25		
NNE	215.	375.	170.	87.	61.	14.	6.	2.	4.	3.	937.	24.77	6.26
	0.90	1.56	0.71	0.36	0.25	0.06	0.02	0.01	0.02	0.01	3.90		
NE	822.	1325.	1073.	668.	338.	156.	56.	26.	8.	19.	4491.	46.85	6.13
	3.42	5.52	4.47	2.78	1.41	0.65	0.23	0.11	0.03	0.08	18.70		
ENE	449.	979.	699.	341.	151.	90.	51.	22.	11.	16.	2809.	66.12	6.05
	1.87	4.08	2.91	1.42	0.63	0.37	0.21	0.09	0.05	0.07	11.70		
E	267.	535.	337.	179.	97.	55.	40.	25.	8.	18.	1561.	88.97	6.53
	1.11	2.23	1.40	0.75	0.40	0.23	0.17	0.10	0.03	0.07	6.50		
ESE	177.	300.	198.	98.	76.	53.	30.	28.	9.	17.	986.	111.45	6.63
	0.74	1.25	0.82	0.41	0.32	0.22	0.12	0.12	0.04	0.07	4.11		
SE	169.	212.	178.	124.	71.	47.	30.	16.	7.	11.	865.	134.38	6.82
	0.70	0.88	0.74	0.52	0.30	0.20	0.12	0.07	0.03	0.05	3.60		
SSE	197.	183.	148.	102.	50.	32.	18.	12.	9.	20.	771.	158.05	6.33
	0.82	0.76	0.62	0.42	0.21	0.13	0.07	0.05	0.04	0.08	3.21		
S	227.	188.	116.	97.	48.	39.	23.	14.	9.	11.	772.	180.18	6.31
	0.95	0.78	0.48	0.40	0.20	0.16	0.10	0.06	0.04	0.05	3.21		
SSW	507.	362.	231.	143.	82.	46.	13.	13.	4.	7.	1408.	203.73	5.49
	2.11	1.51	0.96	0.60	0.34	0.19	0.05	0.05	0.02	0.03	5.86		
SW	818.	511.	249.	144.	54.	31.	29.	15.	10.	15.	1876.	225.22	6.30
	3.41	2.13	1.04	0.60	0.22	0.13	0.12	0.06	0.04	0.06	7.81		
WSW	1665.	1002.	442.	256.	183.	139.	51.	26.	14.	16.	3794.	247.56	5.43
	6.93	4.17	1.84	1.07	0.76	0.58	0.21	0.11	0.06	0.07	15.80		
W	767.	590.	292.	166.	69.	56.	41.	27.	7.	13.	2028.	267.63	6.01
	3.19	2.46	1.22	0.69	0.29	0.23	0.17	0.11	0.03	0.05	8.45		
WNW	296.	248.	100.	57.	41.	13.	14.	8.	3.	5.	785.	290.66	5.79
	1.23	1.03	0.42	0.24	0.17	0.05	0.06	0.03	0.01	0.02	3.27		
NW	172.	113.	58.	31.	12.	9.	6.	4.	1.	9.	415.	314.10	6.48
	0.72	0.47	0.24	0.13	0.05	0.04	0.02	0.02	0.00	0.04	1.73		
NNW	97.	67.	29.	10.	4.	4.	0.	3.	1.	1.	216.	336.27	6.11
	0.40	0.28	0.12	0.04	0.02	0.02	0.0	0.01	0.00	0.00	0.90		
COLUMN	6944.	7091.	4377.	2520.	1343.	788.	411.	244.	106.	189.	24013.		
TOTALS	28.92	29.53	18.23	10.49	5.59	3.28	1.71	1.02	0.44	0.79	100.00		
MEAN	0.04	0.14	0.24	0.34	0.44	0.54	0.64	0.74	0.84	1.10			
S.D.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.18			

TABLE 2.4-2 (Continued)

LAKE ERIE CURRENT ROSES AT THE PERRY SITE

(Direction to Which Current Flows)

FREQUENCY DISTRIBUTION OF CURRENTS AT THE PNPP SITE, SENSOR M2-2, JULY 20, 1972 TO DEC. 31, 1973

DIRECTION (DEG. M)	SPEED RANGE (FT/SEC) 0.-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	GT 0.9	ROW TOTAL	ROW MEAN	ROW S.D.
N	89.	41.	39.	8.	8.	2.	0.	5.	1.	36.	229.	0.20	6.32
	0.34	0.16	0.15	0.03	0.03	0.01	0.0	0.02	0.00	0.14	0.89		
NNE	168.	191.	90.	37.	26.	18.	6.	7.	3.	9.	555.	25.17	5.88
	0.65	0.74	0.35	0.14	0.10	0.07	0.02	0.03	0.01	0.03	2.15		
NE	780.	912.	575.	367.	186.	115.	57.	40.	30.	42.	3104.	47.19	6.14
	3.02	3.53	2.23	1.42	0.72	0.45	0.22	0.15	0.12	0.16	12.02		
ENE	882.	1144.	768.	595.	364.	211.	106.	70.	41.	98.	4279.	66.85	5.95
	3.42	4.43	2.97	2.30	1.41	0.82	0.41	0.27	0.16	0.38	16.57		
E	567.	679.	492.	371.	214.	151.	80.	56.	41.	88.	2739.	88.40	6.36
	2.20	2.63	1.91	1.44	0.83	0.58	0.31	0.22	0.16	0.34	10.61		
ESE	254.	315.	238.	191.	116.	78.	65.	30.	53.	67.	1407.	111.47	6.48
	0.98	1.22	0.92	0.74	0.45	0.30	0.25	0.12	0.21	0.26	5.45		
SE	171.	226.	196.	160.	84.	68.	54.	29.	32.	57.	1077.	134.72	6.61
	0.66	0.88	0.76	0.62	0.33	0.26	0.21	0.11	0.12	0.22	4.17		
SSE	149.	174.	147.	111.	73.	52.	36.	37.	23.	52.	854.	157.19	6.43
	0.58	0.67	0.57	0.43	0.28	0.20	0.14	0.14	0.09	0.20	3.31		
S	183.	160.	138.	103.	73.	55.	34.	39.	14.	33.	832.	180.07	6.30
	0.71	0.62	0.53	0.40	0.28	0.21	0.13	0.15	0.05	0.13	3.22		
SSW	441.	281.	205.	123.	80.	49.	25.	28.	13.	48.	1293.	203.64	5.57
	1.71	1.09	0.79	0.48	0.31	0.19	0.10	0.11	0.05	0.19	5.01		
SW	779.	446.	206.	120.	78.	46.	37.	24.	20.	63.	1819.	225.70	5.94
	3.02	1.73	0.80	0.46	0.30	0.18	0.14	0.09	0.08	0.24	7.04		
WSW	1077.	764.	366.	243.	137.	117.	49.	33.	24.	65.	2875.	248.10	5.49
	4.17	2.96	1.42	0.94	0.53	0.45	0.19	0.13	0.09	0.25	11.13		
W	1297.	699.	427.	250.	128.	78.	51.	36.	26.	45.	3037.	268.67	5.59
	5.02	2.71	1.65	0.97	0.50	0.30	0.20	0.14	0.10	0.17	11.76		
WNW	327.	288.	149.	86.	61.	48.	21.	15.	6.	21.	1022.	290.32	5.53
	1.27	1.12	0.58	0.33	0.24	0.19	0.08	0.06	0.02	0.08	3.96		
NW	160.	133.	63.	35.	13.	14.	10.	1.	4.	11.	444.	313.27	6.33
	0.62	0.51	0.24	0.14	0.05	0.05	0.04	0.00	0.02	0.04	1.72		
NNW	134.	60.	38.	10.	6.	6.	3.	0.	0.	3.	260.	336.87	5.89
	0.52	0.23	0.15	0.04	0.02	0.02	0.01	0.0	0.0	0.01	1.01		
COLUMN	7458.	6513.	4137.	2810.	1647.	1108.	634.	450.	331.	738.	25826.		
TOTALS	28.88	25.22	16.02	10.88	6.38	4.29	2.45	1.74	1.28	2.86	100.00		
MEAN	0.04	0.14	0.24	0.34	0.44	0.54	0.64	0.74	0.84	1.14			
S.D.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.20			

2.5 GEOLOGY

The pertinent geology of the site and region are as described in the ER/CP.

2.6 REGIONAL HISTORIC, ARCHAEOLOGICAL, ARCHITECTURAL, SCENIC, CULTURAL, AND NATURAL FEATURES

The descriptive information on the regional historic, archaeologic, architectural, scenic, cultural, and natural features is the same as that presented in the ER/CP. Information on local historic sites and landmarks is updated in accordance with changes in the pertinent official lists.

The National Register of Historic Places,[1] as of February 6, 1979, listed 32 places in Lake County (see Table 2.6-1). Two of these places are within 5 miles of the PNPP site: the Lucius Green House, at 4160 Main Street in Perry, is approximately 3 miles south of the main building complex. A significant portion of the cooling towers will be seen from the house and intermittently from the vicinity of the house. Ladd's Tavern, at 5466 South Ridge Road in Madison Township, is about 4.7 miles east-southeast of the facility.

A complete inventory of historic buildings in the Perry area has not been made. However, there are probably other dwellings in Perry that equal the Green House in quality.[2]

Natural landmarks in Lake County are listed in Table 2.6-2.[3,4] Two of these features are within 5 miles of the PNPP site. Daykin Swamp is just south of Route 20, about 3.6 miles south-southeast of the plant. Kimball Woods is southwest of the center of Madison Village about 5 miles east-southeast of PNPP. As of April 27, 1978, two of these landmarks were listed in the National Registry of Natural Landmarks: the Mentor Marsh, near Painesville in Lake County; and the Holden Natural Areas, in Lake and Geauga Counties, about 30 miles east of Cleveland.

REFERENCES FOR SECTION 2.6

1. U.S. Department of the Interior, Heritage Commission and Recreation Service, cumulative revision of the National Register of Historic Places, published in the Federal Register, Vol. 44, No. 26, February 6, 1979.

2. Personal communication, Eric Johannesen, Ohio Historic Regional Preservation Officer--Northeast Ohio, October 23, 1978.

3. A. Herrick, "Natural Areas--Ohio Biological Survey," January 1965.

4. U.S. Department of the Interior, Heritage Commission and Recreation Service, cumulative revision of the National Registry of Natural Landmarks, published in the Federal Register, Vol. 44, No. 82, April 27, 1978.

TABLE 2.6-1

HISTORIC PLACES IN LAKE COUNTY[a]

Fairport Marine Museum, Fairport Harbor
Kirtland Temple, Kirtland
Old South Church, Kirtland
Addison Kimball House, Madison
Lemuel Kimball House, Madison
David R. Paige House, Madison
Judge David Paige House, Madison
Dr. J. C. Winans House, Madison
Ladd's Tavern, Madison (Vicinity)
Madison Fort,, Madison (Vicinity) SE
Corning White House, Mentor
James A. Garfield Home (Lawnfield), Mentor
Gray-Coulton House, Mentor
Lake Shore and Michigan Southern Railroad Depot and Freight House, Mentor
James Mason House, Mentor
Sawyer-Wayside House, Mentor (Vicinity)
Administration Building, Lake Erie College (College Hall) Painesville
Casement House, Painesville
Lutz's Tavern (Rider Tavern), Painesville
Mathews House, Painesville
Mentor Avenue District, Painesville
Morley Lewis House, Painesville
Painesville City Hall (Old Lake County Court House), Painesville
Uri Seeley House, Painesville
Sessions House (Tuscan House), Painesville
Smead House, Painesville
St. James Episcopal Church, Painesville
Indian Point Fort, E of Painesville
Lucius Green House, Perry
Connecticut Land Company Office, Unionville
Unionville District School, Unionville
Unionville Tavern, Union

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[a] Listed in the National Register of Historic Places, as of February 6, 1979.

TABLE 2.6-2

NATURAL LANDMARKS IN LAKE COUNTY[a]

	Description
Mentor Marsh	Listed in National Registry of Natural Landmarks. Located near Painesville in Lake County. Marsh is old bed of Grand River and parallels the lake just south of Mentor Headlands. Several hundred acres of virgin swamp forest, marsh, and open water.
Holden Natural Areas	Listed in National Registry of Natural Landmarks. Located in Lake and Geauga counties.
Cascade Falls	Scenic falls on shale. Vegetation typical of region.
Chapin State Forest	An impressive forest of mature red oak, cucumber, tulip, etc.
Daykin Swamp	Stream in ten-ft gorge cut into sand and gravel. Either side is 10-20 acres of swamp kept wet by seepage. Alder, cornus, poison sumac, skunk cabbage, royal and cinnamon fern. Large sycamores, four-foot white oak, tulip, etc., on rim of basin. Essentially virgin.
Hell's Hollow	200-300-ft deep narrow valley which appears to have been undisturbed for many years.
Indian Point	A high, flat-topped point between Paine Creek and Grand River. Slopes are too steep to have been disturbed much, hence essentially virgin. Indian earthworks on top.
Kimball Woods	About 50 acres of rolling terrain. Mature beech-maple forest, second growth elm swamp forest, and old fields. Rich spring flora.
Kitts Gully	The Chagrin River makes a small loop into W edge of Twp. This gully extends from river for 1-1/4 miles to Hobard Rd. Gorge 100-200 ft deep, stream falls several hundred ft. Many strata exposed. Due to rough terrain, the vegetation

TABLE 2.6-2 (Continued)

NATURAL LANDMARKS IN LAKE COUNTY[a]

	Description
Kitts Gully (Cont'd)	has been little disturbed. White pine, hemlock, and Canada honeysuckle noted.
Mill Creek Hogback	Hogback, slopes, and flood plain between Grand River and Mill Creek near their junction. Steep shale and clay N-facing slope; more gradual S-slope. Wide variety of habitats. Species include: roundleaf dogwood, hemlock, white pine, buffalo berry, and rich spring flora.
Paine Hollow	Paine Creek gorge is deep and wild. Hardwood, pine, hemlock. No cutting in past 50 years.
Penitentiary Gulch	Gorge parallels road for 1/2 mile.
Taxus Habitat	South wall of Grand River gorge about 1/4 mile west of Ledge Rd. Steep slope with mature hemlock and dense stands of Taxus.
Wickliffe High School	Large woods and swamp behind Wickliffe High School on Rockefeller Rd. just south of Route 84.

[a]Data from Refs. 3 and 4.

2.7 NOISE

Information provided here relative to background noise was not provided in the ER/CP.

Background sound-level surveys were conducted in the vicinity of the PNPP site under environmental conditions representative of the summer season (July 19-20, 1974) and the winter season (November 20-23, 1974). These two surveys bracketed the range in sound levels that reflect the effects of extremes in environmental conditions. Sound-level measurements were made at the 10 sampling points shown in Figure 2.7-1, using the methods described in Section 6.1. As shown, sampling point 2 was moved for the winter survey because of the inaccessibility of the original location.

The L_{50} sound levels (sound levels equaled or exceeded 50 percent of the time) for each sampling point for the daytime (0700-2200 hours) and the nighttime (2200-0700 hours) are shown for each survey in Tables 2.7-1 and 2.7-2, respectively. The L_{50} sound levels for each sampling point were used to construct A-weighted sound-level isopleths on a site map for daytime and nighttime periods. These isopleths are shown for the summer-season survey in Figures 2.7-2 and 2.7-3 and for the winter-season survey in Figures 2.7-4 and 2.7-5.

The principal sources of noise recorded during the surveys were traffic along U.S. Route 20 and wave action along the shore of Lake Erie; the noise generated by wave action was, however, dependent on wind speed and direction. Additional noise came from the operation of the Neff-Perkins plant at the west boundary of the PNPP site. This noise was generated by the plant exhaust fans and traffic during work-shift changes. Other noise sources included wind, distant trains, and activities such as lawn mowing; birds and insects were contributors as well.

The surveys showed that the area around the site had slightly higher sound levels in the winter than during the summer. The increase can be attributed to the absence of foliage and crops, which absorb some of the road and rail traffic noise during the summer. However, the winter survey indicated that the residential area to the northeast of the site, near the intersection of Antioch and Lockwood Roads, had slightly lower sound levels than those measured during the summer survey. This difference can be partially attributed to the decrease in residential outdoor activity in that area during the winter months.

The observed 1974 sound levels in the vicinity of the site met the U.S. Department of Housing and Urban Development (HUD) "acceptable" criterion of less than 45 dBA for 24-hour exposure[1] and were below the U.S. Environmental Protection Agency (EPA) time weighted day/night average sound level (L_{dn}) guideline of 55 dBA[2] in most areas (see Section 6.1). However, sound levels near U.S. Route 20 exceeded the EPA guideline and were in the HUD "normally acceptable" range because of traffic noise. Other roads in the area may also have had areas immediately adjacent to them with sound levels in the HUD "normally acceptable" range due to traffic noise. The wave-action-related sound levels along the shoreline are dependent on wind speed and wind direction and will, at times, exceed the EPA guideline and be in the HUD "normally acceptable" range.

REFERENCES FOR SECTION 2.7

1. U.S. Department of Housing and Urban Development, Noise Abatement and Control, Department Policy, Implementation Responsibilities and Standards, Circular 1390.2, July 16, 1971.

2. U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite To Protect the Public Health and Welfare with an Adequate Margin of Safety, EPA 550/9-74-004, March 1974.

TABLE 2.7-1

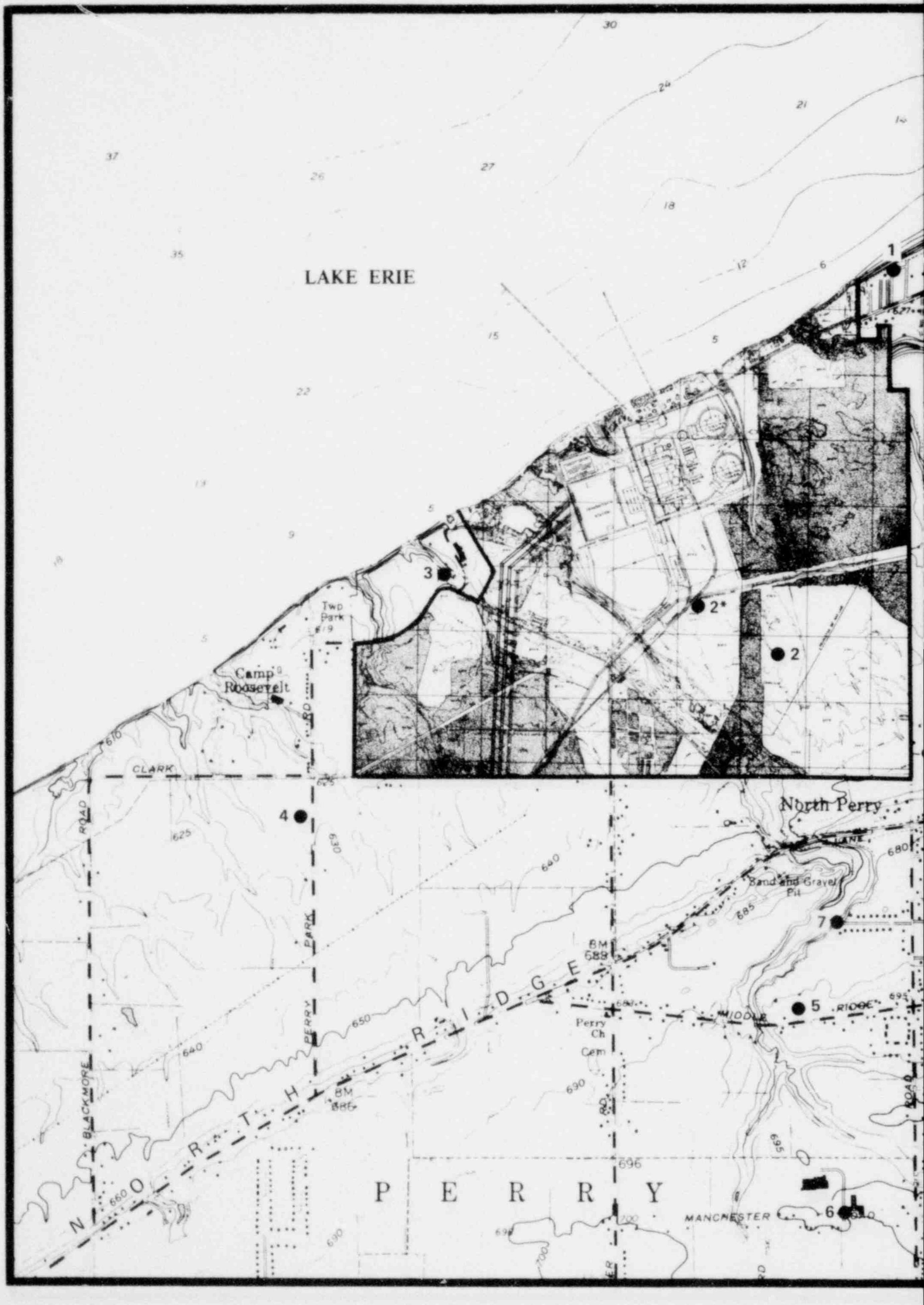
SOUND-PRESSURE LEVEL MEASUREMENTS
AT THE PNPP SITE, JULY 19-20, 1974

Sampling Point	Sound-Pressure Level (L_{50}, dBA) Daytime	Nighttime
1	48	48
2	36	37
3	42	44
4	37	40
5	46	40
6	39	39
7	46	44
8	54	54
9	51	50
10	39	37

TABLE 2.7-2

SOUND-PRESSURE LEVEL MEASUREMENTS AT THE PNPP SITE, NOVEMBER 22-23, 1974

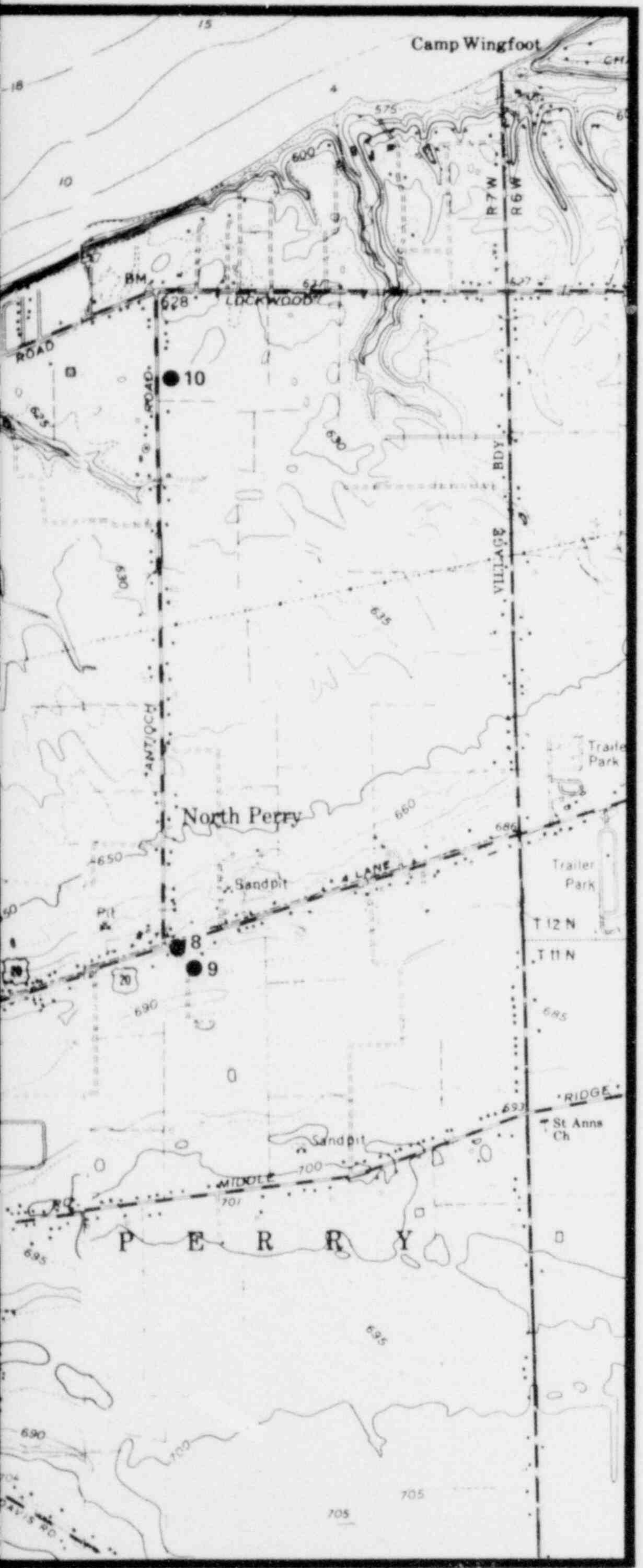
Sampling Point	Sound-Pressure Level (L_{50}, dBA)	
	Daytime	Nighttime
1	48	43
2	47	38
3	48	41
4	46	45
5	47	41
6	48	54
7	46	40
8	62	56
9	51	50
10	41	35



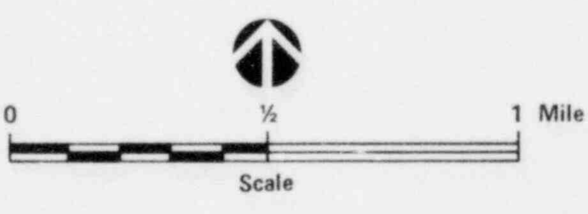
LAKE ERIE
1
2*
2
3
4
5
6
7
Two Park
Camp Roosevelt
North Perry
Sand and Gravel Pit
CLARK
BLACKMORE ROAD
PERRY PARK RD
NORTH RIDGE
MIDDLE RIDGE
MANCHESTER
LANE
Perry Ch Cem
BM 688
BM 686
P E R R Y

LEGEND:

● SAMPLING STATIONS



* WINTER SAMPLING POINT 2

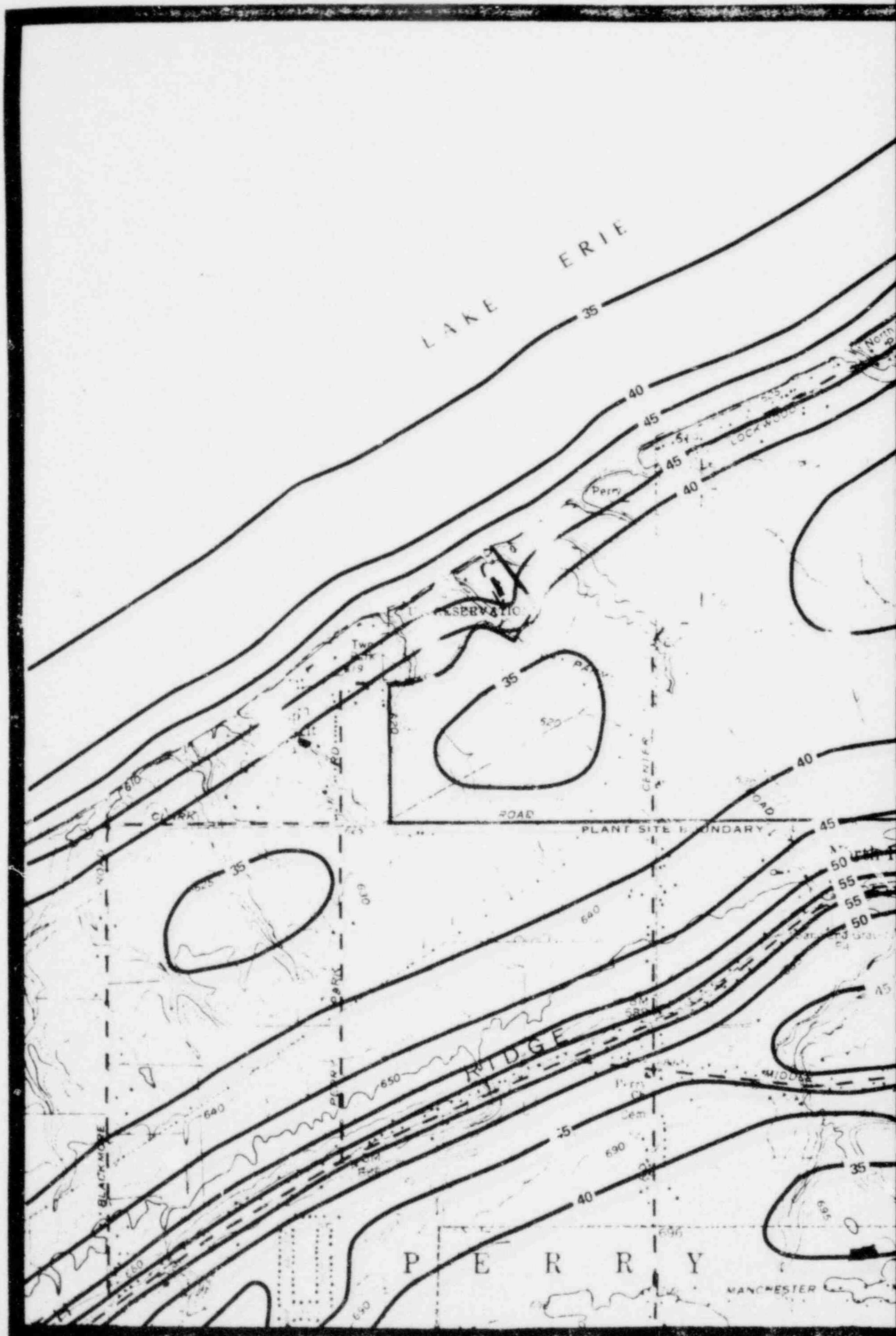


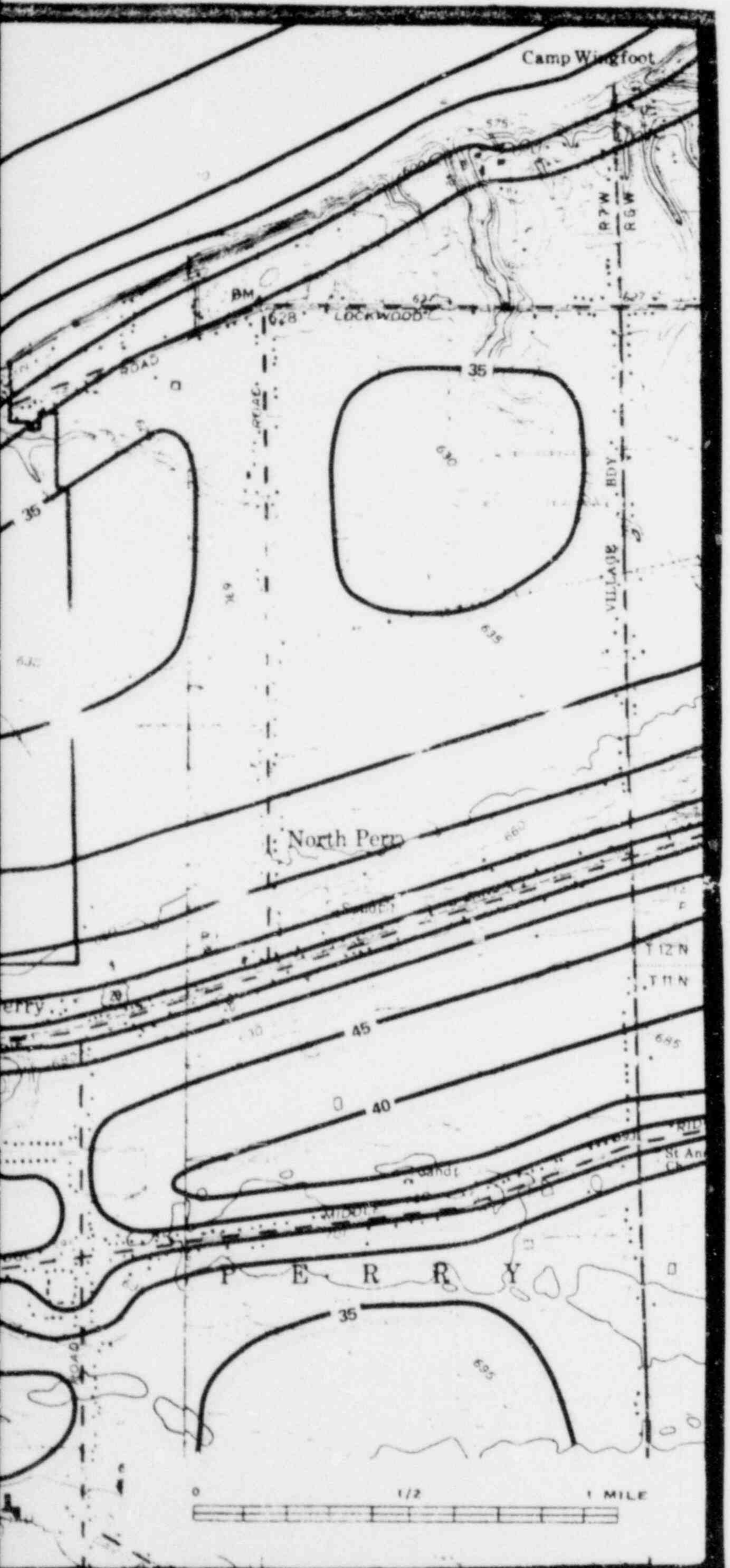
BACKGROUND SOUND LEVEL
SURVEY SAMPLING POINTS

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC
ILLUMINATING COMPANY

FIGURE 2.7-1


LAKE ERIE
35
40
45
PLANT SITE BOUNDARY
CLARK
ROAD
CENTER
RIDGE
PERRY
BLACKMORE
MANCHESTER
MIDDLE
LOCKWOOD
50
55

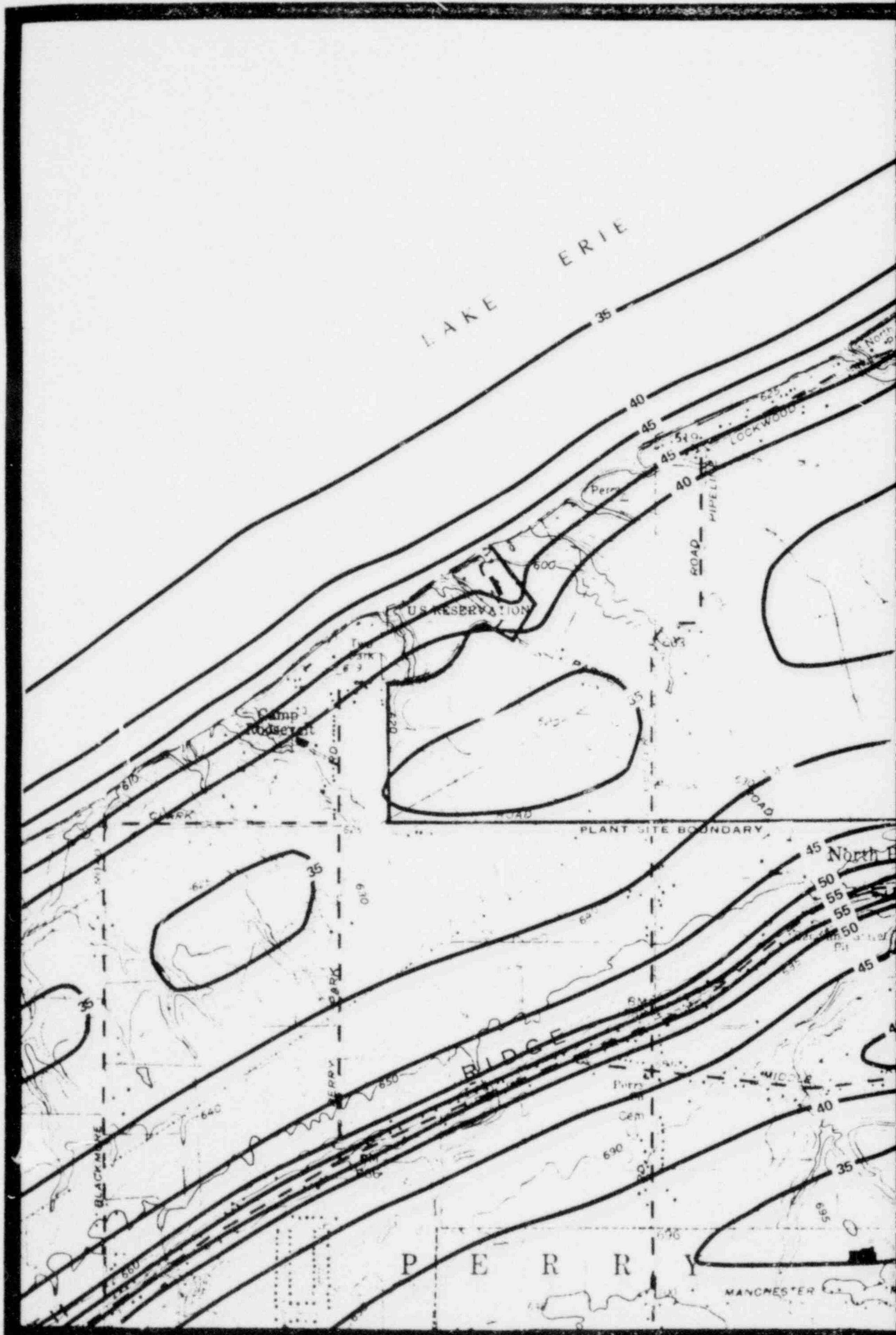


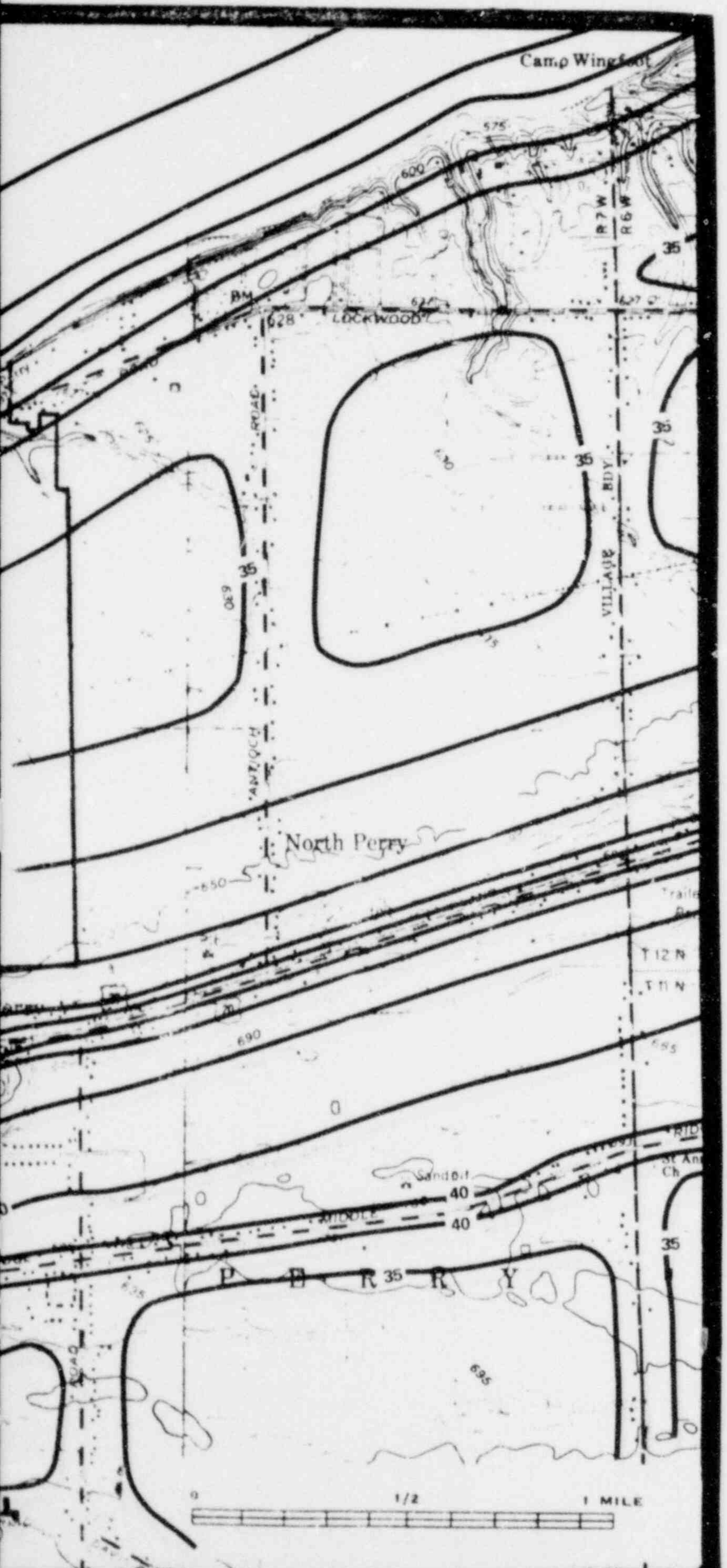
SUMMER DAYTIME BACKGROUND
L_{50} SOUND LEVEL ISOPLETHS (dBA)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.7-2


LAKE ERIE
U.S. RESERVATION
Camp Roosevelt
PLANT SITE BOUNDARY
RIDGE
PERRY
LOCKWOOD
PIPELINE ROAD
CLARK
BLACKMORE
MANCHESTER
MIDDLE
35
40
45
50
55

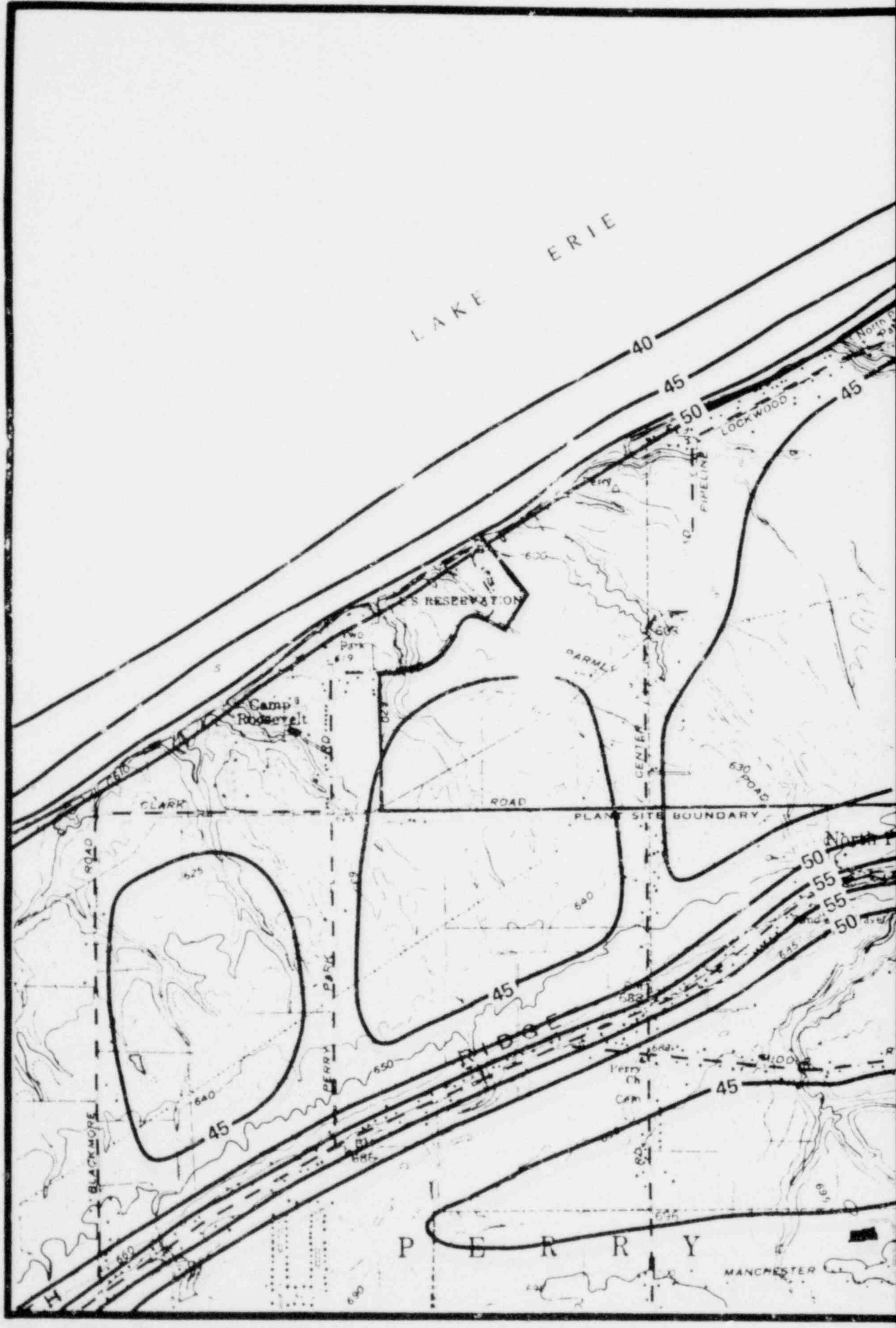


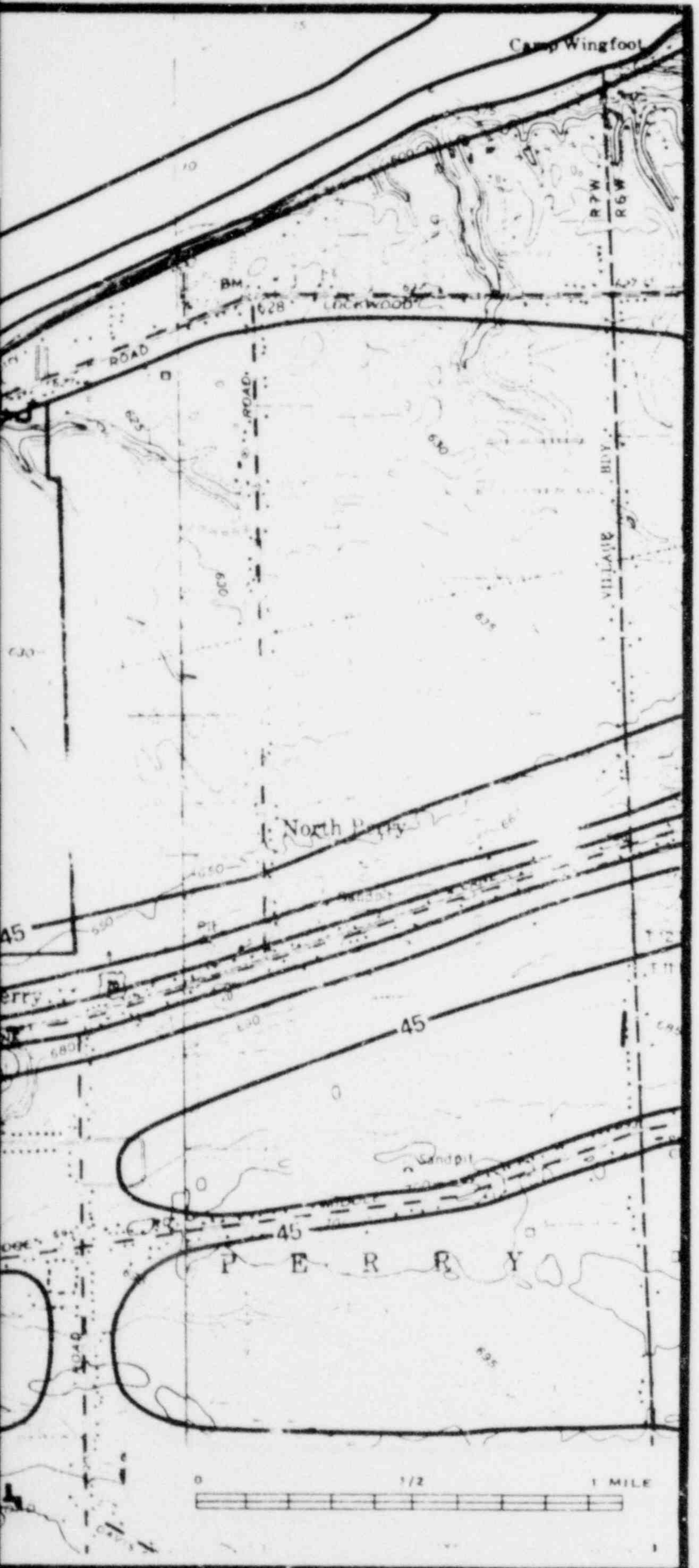
SUMMER NIGHTTIME BACKGROUND
L_{50} SOUND LEVEL ISOPLETHS (dBA)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

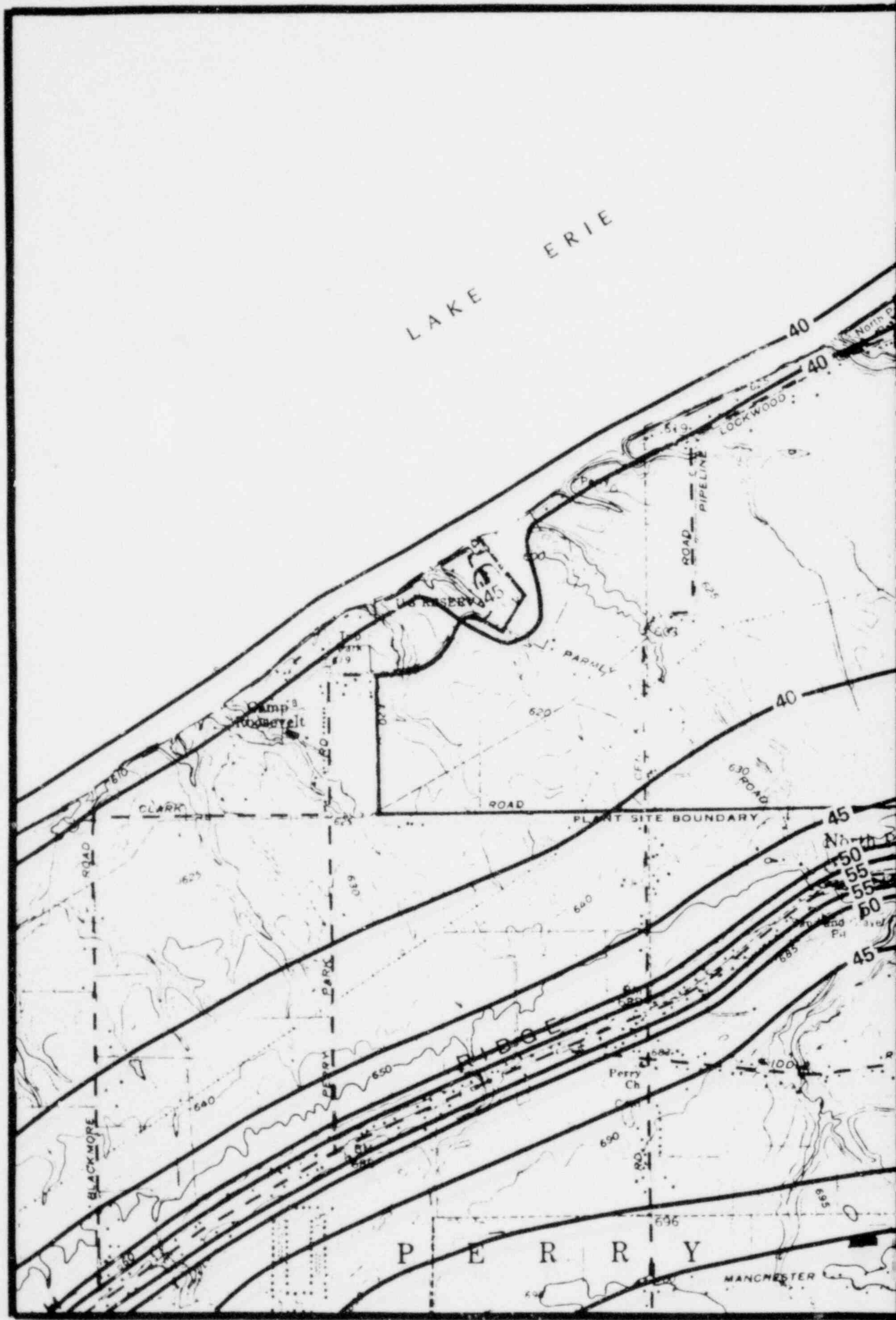
FIGURE 2.7-3


LAKE ERIE
40
45
50
LOCKWOOD
PIPELINE
U.S. RESERVATION
Camp Roosevelt
PARMLY
CLARK
ROAD
PLANT SITE BOUNDARY
CENTER
ROAD
BLACKMORE
PARK
PERRY
RD
RIDGE
55
PERRY
MANCHESTER
630
640
625
650
600

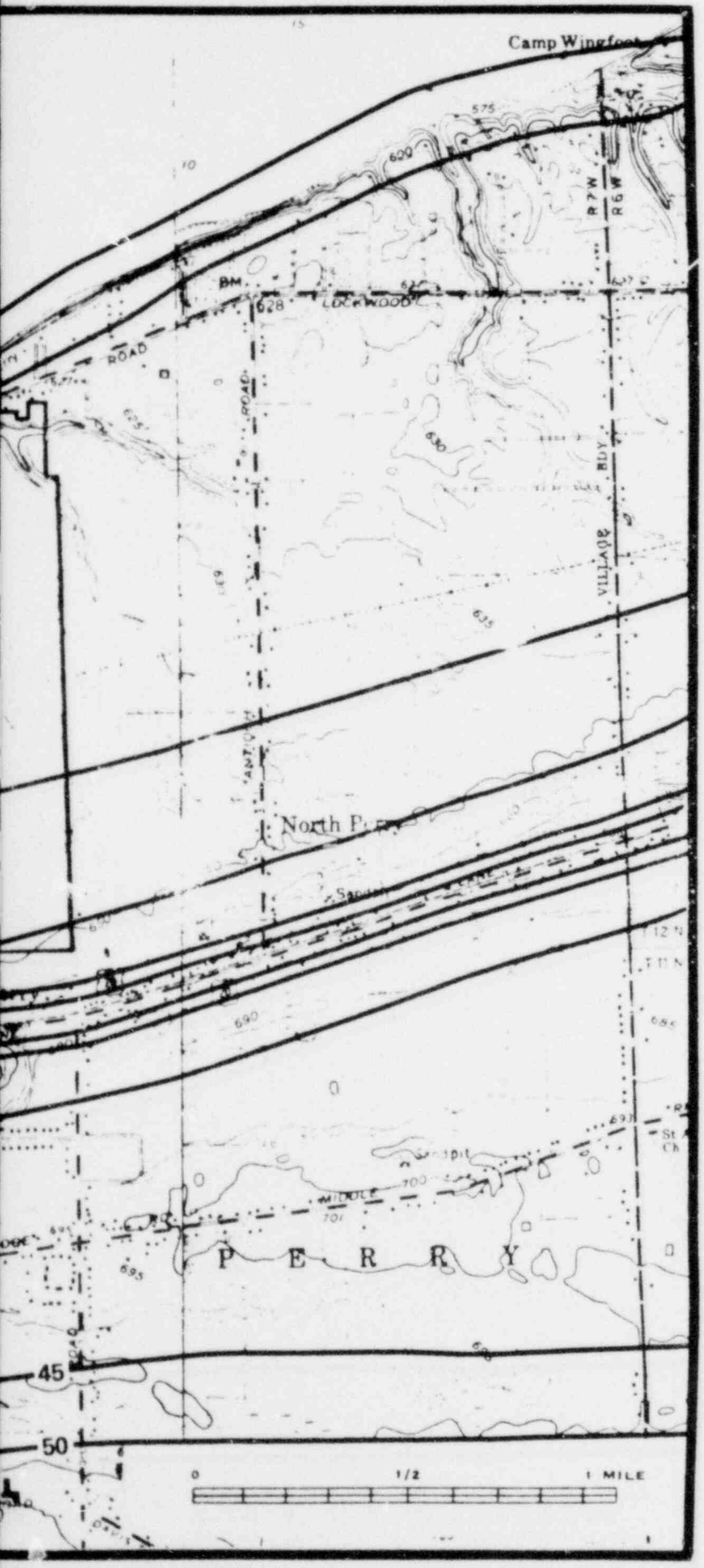


WINTER DAYTIME BACKGROUND
L_{50} SOUND LEVEL ISOPLETHS (dBA)

PERRY NUCLEAR POWER PLANT 1 & 2
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
FIGURE 2.7-4



LAKE ERIE
LOCKWOOD
PIPELINE
ROAD
US RESERV
PARMLY
Camp Roosevelt
CLARK
ROAD
PLANT SITE BOUNDARY
BLACKMORE
PARK
PERRY
RIDGE
Perry Ch
RD
PERRY
MANCHESTER
40
45
50
55
60
620
625
630
640
650
690
695
696



WINTER NIGHTIME BACKGROUND
L_{50} SOUND LEVEL ISOPLETHS (dBA)

PERRY NUCLEAR POWER PLANT 1 & 2

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2.7-5