access and toll rates, and the need for reasonable local rates, as well as other issues. Furthermore, this NPRM/NOI proposal encroaches on a state's authority to assign costs between the state toll and local jurisdictions in a manner that properly balances the state's needs, given that the proposal could easily provide inadequate support if the state retains separations procedures that conflict with the FCC assumptions.

As a last point, this proposal cannot be quantitatively analyzed until the term "local minute" is defined and the FCC identifies which of the various Option One-A or One-B proposals would be used in conjunction with Option One-C.

(Paragraph 55) III C: Option Two: Use Proxy Factors to Compute High-Cost Assistance

Under Option Two, actual reported costs would no longer be used to compute high-cost assistance; instead, support would be provided using proxy factors designed to predict the costs of service in each CBG. The APUC believes that it will be extremely difficult to make a proxy system consistently work well. Trying to predict telephone costs at any particular location using a model is somewhat like trying to predict the weather. Once you evaluate all the *presumed* critical factors and the degree to which each factor *might* influence the process, the results are still at best a guess. The type of proxy model that has the potential to work will be complex and detailed, leading to difficulties in development, administration, and model update. Its very complexity could make the model prone to error. At the same time,

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incentives as effective competition is not available in all locations.

Given the above, the APUC has serious reservations that a proxy model will be developed that will accurately and consistently predict the need for high-cost support nationwide. The APUC suggests that if the FCC adopts a proxy model approach, it do so on a trial basis in order to allow evaluation of the system under actual conditions prior to broader application.

(Paragraph 64) Proxy Factor One: Subscriber Density per Square Mile

(Paragraph 65) Proxy Factor Two: Average Distance from Nearest Wire Center

The NPRM/NOI identifies subscriber density (Proxy One) and CBG to wire center distance (Proxy Two) as two key factors that influence LEC cost. While these two elements are important considerations to include in any cost model they do not represent the only facts that determine areas of high cost. For example, much of Alaska's rural areas are typified by remote and isolated villages where the villagers live fairly close together. As a result, household density at the village might be (relatively) high, loop lengths short, and the central office nearby. If only subscriber density per village and wire center mileage factors were considered, areas of Alaska could be perceived to be low cost to serve when in actuality the opposite is true.

In addition, use of CBGs in relation to these two proxies will cause problems. Proxy Two's underlying assumption that there

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construction, the presence or absence of different types of frost features (eg, ice wedges, frost mounds), and a variety of other factors.[15] Clearly, a proxy representing permafrost will not be a simple matter of whether or not there is permafrost in the CBG area. As a second example, a proxy for mountainous terrain will be inadequate unless it takes into consideration the particular characteristics at the actual site of construction (eg, susceptibility to avalanches, rock slides, actual placement of plant). It is also unclear how a proxy model will account for all possible terrain and surface effects in cases where the CBGs are large and encompass a variety of slopes and terrain characteristics.

(Paragraph 67) Proxy Factor Four: Climate

The APUC agrees that the effect of climate must be included in any proxy model. Evaluating how climate will affect costs, however, is not a simple matter. It will not be sufficient for the proxy to merely evaluate rainfall and average low temperature. Costs will also be affected by several other climatic factors including a) the duration of the winter as it affects and limits construction;[16] b) snow effects (eg, snow cover,

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[15]See Cold Region Structural Engineering, E. Eranti and G. C. Lee, McGraw-Hill Book Company, at 186 -- 341 (1986).

[16]For example, there are some locations in Alaska where excavating and earthwork is limited to July and August. See Appendix E at 154.

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com-parable in size to Texas, California, Oregon, and Washington combined, Alaska has about the same number of miles of road as Vermont.[21] In Alaska, lack of surface transportation makes aviation the prime mode of transportation in rural areas.[22] Costs increase when virtually every piece of plant and all work equipment must either be flown in or, if delay is not a problem, delivered by seasonal barge (for those places with water access). Major work project at a remote Alaska village can require crews to be flown in over one hundred miles,[23] which further increases costs due to increased travel time and the actual expense of obtaining the air travel. The logistics necessary to organize and provide service and work crews under these conditions adds to the costs of service. Clearly, it would not be equitable to create a proxy that treats a utility that has ready transportation throughout its service area the same as a utility that must rely on plane access to its customer base.

b) Scale Economies: Scale economies are a well recognized, undisputed economic fact and must be included in any proxy model. The cost patterns for an efficient small company

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[21]Alaska has a total land area of 570,000 square miles, but has only 13,600 miles of road. Vermont has 9,600 square miles and has 14,100 miles of road. Statistical Abstract of the United States 1994, U.S. Department of Commerce, at 223, 624 (September 1994).

[22]*See* Appendix E at 23 and 164.

[23]Due to the size and sparse population of the state, it is not uncommon for a utility to base its operation from a regional urban hub that is far from the individual rural locations served by the utility.

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CBGs will be less costly to serve than others depending upon the existing network topography (eg, location of main distribution lines). Proxies should take into account both network topography effects and the number of exchanges per CBG or the proxy will likely not provide an accurate cost surrogate.

e) Major Acts of Nature: Construction and maintenance costs may increase in areas prone to earthquakes, floods, volcanos, tornados, and hurricanes.[25] Any proxy model should take into account these natural events.

f) Technological Neutrality: Whatever cost model is adopted, it should not make presumptions regarding what technology works best and is most efficient for a region. What works in Florida may not be practical in Alaska or Maine and vice-versa. The model must, therefore, be able to adapt to regional differences and not dictate the technology involved.

g) Regional Effects: The proxy model should also take into account that each area of the nation may have regional peculiarities that increase cost. For example, most areas of Alaska have limited hours of sunlight and civil twilight during the fall and winter seasons. Decreased daylight makes all construction and maintenance tasks more difficult. Many areas of the nation may have other regional peculiarities that effect costs that are not directly contemplated under the proxy model. The model should, therefore, include a proxy-adjustment mechanism to

[25] *See* Appendix E at 64, 102.

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place the FCC can judge whether any caps are necessary and act accordingly.

(Paragraph 76) III D Option Three: Commission certified state plans for distribution of high-cost assistance

Under Option Three, support would be allocated between states based on a limited number of proxy factors that were perceived to be readily verifiable and relatively easy to administer. Once support was allocated, the state commissions would have the option of designing the plan for distributing the support dollars.

As previously stated, the APUC has serious reservations that a proxy model will be developed that will accurately and consistently predict the need for high-cost support nationwide. The APUC would, therefore, hesitate to accept responsibility of planning or organizing the disbursement of support funds unless it can be shown that there will be adequate and reliable funding provided under Option Three.

As a last point, the NPRM/NOI has not addressed how the state commissions would be compensated for any costs of administration and planning associated with Option Three.

(Paragraph 83) IV Notice of Inquiry: comment requested regarding the need for further rulemaking

(Paragraphs 83 -- 87) A Market-based incentives to reduce the USF through least-cost bidding

The FCC is also seeking comment on the concept of having carriers bid for support in each CBG, with the lowest bid setting

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c) The mechanism may fail in markets where all carriers would rather share in a guaranteed revenue source than engage in a bidding war to try to reduce the support level.

Before further comments are sought on this plan, information is needed as to whether carriers can bid higher than the existing support level.

Conclusion

In conclusion, the APUC believes that many of the proposals identified in the NPRM/NOI require further refinement before they should be applied nationwide and can be relied upon to support the goal of universal service in a competitive market. The APUC requests that the FCC fully evaluate any proposal in light of existing conditions prior to adoption.

RESPECTFULLY SUBMITTED this 9th day of October, 1995.

BY DIRECTION OF THE COMMISSION

Sincerely,

ALASKA PUBLIC UTILITIES COMMISSION

By: Commissioner Don Schröer
Chairman of the Alaska Public
Utilities Commission
1016 West Sixth Avenue, Suite 300
Anchorage, Alaska 99501
1-907-276-6222

cc: William F. Caton
Acting Secretary
Federal Communications Commission

Attached List

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REPORT FOR THE STATE OF ALASKA

ZIP CODE	CITY	COUNTY	NUMBER OF HOUSES	NUMBER OF PEOPLE	AVERAGE INCOME	PERCENTAGE OF HOUSES WITH A TELEPHONE	PERCENTAGE OF URBANIZATION	NUMBER OF WHITES	NUMBER OF BLACKS	NUMBER OF ASIANS	NUMBER OF NATIVE AMERICANS	NUMBER OF HISPANICS	NUMBER OF OTHE
98791			1017	5345	29250	0.99310	0.86062	4297	587	342	65	303	104
99501	ANCHORAGE	ANCHORAGE	6769	14670	30258	0.93044	1.00000	10406	1312	830	1603	804	339
99502	ANCHORAGE	ANCHORAGE	5765	15721	49697	0.98797	0.99358	13007	617	1108	866	476	123
99503	ANCHORAGE	ANCHORAGE	5657	12455	29038	0.90941	1.00000	9027	555	1152	1457	738	264
99504	ANCHORAGE	ANCHORAGE	11808	32303	45703	0.97962	1.00000	25359	5179	1129	2206	1352	518
99505	FORT RICHARDSON	ANCHORAGE	1836	7979	24299	0.99726	1.00000	6515	1799	224	96	674	345
99506	ELMENDORF AFB	ANCHORAGE	2019	8035	26071	0.98888	1.00000	6285	954	420	193	449	183
99507	ANCHORAGE	ANCHORAGE	7534	20052	45517	0.97852	1.00000	16650	1087	898	1311	677	197
99508	ANCHORAGE	ANCHORAGE	11638	29664	35001	0.92763	1.00000	20859	2901	1523	3766	1402	617
99515	ANCHORAGE	ANCHORAGE	6041	17210	56214	0.99100	1.00000	14922	529	708	840	723	281
99516	ANCHORAGE	ANCHORAGE	5953	16304	79425	0.99561	0.94751	17365	188	488	363	451	62
99517	ANCHORAGE	ANCHORAGE	6140	15203	48249	0.96040	1.00000	12351	389	1251	1089	531	283
99518	ANCHORAGE	ANCHORAGE	3308	8215	46295	0.97574	1.00000	6707	483	604	327	242	94
99549	PORT MOLLER	LAKE AND PENINSULA	32	111	35000	1.00000	0.00000	27	0	0	84	0	0
99551	AKIACHAK	BETHEL	114	452	23750	0.42653	0.00000	42	0	4	406	0	0
99552	AKIAK	BETHEL	66	285	13571	0.46269	0.00000	13	0	0	272	0	0
99553	AKUTAN	ALEUTIANS EAST	27	608	27813	0.59259	0.00000	250	7	237	81	51	30
99554	ALAKANUK	WADE HAMPTON	277	1158	22549	0.34196	0.00000	76	3	12	1056	6	3
99555	ALEKNAGIK	DILLINGHAM	59	194	21875	0.85185	0.00000	19	0	0	175	0	0
99556	ANCHOR POINT	KENAI PENINSULA	525	1694	36645	0.87827	0.00000	1532	0	20	42	0	0
99557	ANIAK	BETHEL	119	575	9640	0.41880	0.00000	57	0	0	318	0	0
99558	ANVIK	YUKON-KOYUKUK	86	295	17500	0.62353	0.00000	16	0	0	279	0	0
99559	BETHEL	BETHEL	2054	7219	35700	0.81447	0.50720	1615	55	70	5258	81	21
99561	CHEFORNAK	BETHEL	78	318	20278	0.59375	0.00000	8	0	0	302	0	0
99563	CHEVAK	WADE HAMPTON	0	0	0	0.00000	0.00000	0	0	0	0	0	0
99564	CHIGNIK	LAKE AND PENINSULA	48	171	34875	0.69565	0.00000	98	0	3	78	27	0
99565	CHIGNIK LAGOON	LAKE AND PENINSULA	64	203	20833	0.88333	0.00000	51	0	0	152	0	0
99567	CHUGIAK	ANCHORAGE	2348	6858	49243	0.98965	0.99096	6387	52	102	264	228	53
99568	CLAM GULCH	KENAI PENINSULA	64	147	60414	0.75610	0.00000	136	0	0	11	0	0
99569	CLARKS POINT	DILLINGHAM	27	66	15417	0.65385	0.00000	28	0	0	46	0	0
99571	COLD BAY	ALEUTIANS EAST	160	473	44063	0.95833	0.00000	173	0	1	296	3	3
99572	COOPER LANDING	KENAI PENINSULA	112	278	40750	0.66019	0.00000	256	0	12	10	0	0
99573	COPPER CENTER	VALDEZ-CORDOVA	478	1339	27826	0.69474	0.00000	1097	1	7	234	18	0
99574	CORDOVA	VALDEZ-CORDOVA	21	94	22083	0.63158	0.00000	32	0	0	62	0	0
99575	CROOKED CREEK	BETHEL	1	1	5360	0.00000	0.00000	0	0	0	1	0	0
99576	DILLINGHAM	DILLINGHAM	840	2678	37589	0.88377	0.00000	934	2	53	1678	24	11
99577	EAGLE RIVER	ANCHORAGE	5767	18481	53535	0.90225	0.07852	16461	448	407	592	595	173
99578	EEK	BETHEL	72	264	21000	0.68056	0.00000	10	0	0	254	0	0
99579	EGEGIK	LAKE AND PENINSULA	51	120	29625	0.48816	0.00000	36	0	0	84	0	0
99580	EKWOK	DILLINGHAM	28	73	18833	0.68571	0.00000	8	0	0	65	0	0
99581	ELIM	WADE HAMPTON	0	0	0	0.00000	0.00000	0	0	0	0	0	0
99583	FALSE PASS	ALEUTIANS EAST	22	67	21667	0.56000	0.00000	8	0	0	59	0	0
99585	MARSHALL	WADE HAMPTON	141	534	25568	0.53493	0.00000	42	5	6	481	0	0
99586	GAKONA	VALDEZ-CORDOVA	173	413	14135	0.21579	0.00000	328	0	0	85	5	0
99588	GLENNALLEN	VALDEZ-CORDOVA	406	1059	32222	0.79625	0.00000	852	0	1	206	0	0
99589	GOODNEWS BAY	BETHEL	89	299	14886	0.48889	0.00000	17	0	0	282	0	0
99590	GRAYLING	YUKON-KOYUKUK	0	0	0	0.00000	0.00000	0	0	0	0	0	0
99591	SAINT GEORGE ISLAND	ALEUTIAN ISLANDS	43	143	25250	0.69565	0.00000	5	0	0	138	0	0
99602	HOLY CROSS	YUKON-KOYUKUK	78	270	13750	0.66667	0.00000	17	4	0	254	3	3
99603	HOMER	KENAI PENINSULA	2954	8275	40234	0.87769	0.44230	7632	61	74	593	222	15
99604	HOOPER BAY	WADE HAMPTON	340	1443	17632	0.38576	0.00000	63	0	4	1376	2	0
99606	ILIAMNA	LAKE AND PENINSULA	105	570	25114	0.72340	0.00000	45	0	0	323	6	2
99607	KALSKAG	BETHEL	44	163	14250	0.56063	0.00000	26	1	0	136	0	0
99618	KASILOF	KENAI PENINSULA	360	906	38864	0.86196	0.00000	899	0	0	7	6	0

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99689	YAKUTAT	SKAGWAY-YAKUTAT-ANGOON	233	783	40781	0.79237	0.00000	388	0	13	380	9	2
99691	NIKOLAI	YUKON-KOYUKUK	40	113	11250	0.61364	0.00000	9	0	0	104	0	0
99692	DUTCH HARBOR	ALEUTIAN ISLANDS	0	0	0	0.00000	0.00000	0	0	0	0	0	0
99701	FAIRBANKS	FAIRBANKS NORTH STAR	7583	19207	32761	0.99174	0.97126	13974	1922	570	2332	655	409
99702	EIELSON AFB	FAIRBANKS NORTH STAR	1285	3251	23924	1.00000	1.00000	4363	642	154	74	381	38
99703	FORT WAINWRIGHT	FAIRBANKS NORTH STAR	1346	6255	25625	0.99329	1.00000	4200	1510	238	74	559	225
99704	CLEAR	DENALI	158	402	50572	0.89262	0.00000	418	2	0	58	23	4
99705	NORTH POLE	FAIRBANKS NORTH STAR	4919	14733	43341	0.95950	0.00000	13195	496	203	663	466	96
99709	FAIRBANKS	FAIRBANKS NORTH STAR	8603	23529	41811	0.93019	0.72999	20047	913	670	1711	364	188
99712	FAIRBANKS	FAIRBANKS NORTH STAR	2793	7906	49234	0.94069	0.00000	7354	13	87	438	92	14
99714	SALCHA	FAIRBANKS NORTH STAR	316	873	34474	0.85942	0.00000	841	0	23	0	30	9
99720	ALLAKAKET	YUKON-KOYUKUK	61	166	11477	0.45902	0.00000	12	0	0	154	0	0
99721	ANAKTUVUK PASS	NORTH SLOPE	73	272	37292	0.66234	0.00000	34	0	0	238	13	0
99722	ARCTIC VILLAGE	YUKON-KOYUKUK	42	189	18000	0.18919	0.00000	7	0	0	182	0	0
99723	BARROW	NORTH SLOPE	1116	3685	56664	0.87624	0.02984	924	27	279	2421	74	34
99724	BEAVER	YUKON-KOYUKUK	35	96	20313	0.44186	0.00000	3	0	0	93	0	0
99726	BETTLES FIELD	YUKON-KOYUKUK	65	146	34306	0.41667	0.00000	112	0	2	32	0	0
99727	BUCKLAND	NORTHWEST ARCTIC	69	517	18906	0.60116	0.00000	2	0	0	315	0	0
99729	CANTWELL	DENALI	112	231	33759	0.75833	0.00000	190	2	0	39	0	0
99730	CENTRAL	YUKON-KOYUKUK	68	122	8996	0.29091	0.00000	118	0	0	0	4	4
99733	CIRCLE	YUKON-KOYUKUK	23	73	17083	0.41667	0.00000	12	0	0	58	0	3
99734	PRUDHOE BAY	NORTH SLOPE	2	151	102264	1.00000	0.00000	122	13	0	16	0	0
99736	DEERING	NORTHWEST ARCTIC	53	166	16042	0.40816	0.00000	9	0	0	157	0	0
99737	DELTA JUNCTION	SOUTHEAST FAIRBANKS	1254	4137	32909	0.87200	0.00000	3485	280	60	186	168	98
99739	ELIM	NOME	78	269	16250	0.43243	0.00000	21	0	0	248	0	0
99740	FORT YUKON	YUKON-KOYUKUK	237	639	14297	0.42373	0.00000	98	0	0	541	2	0
99741	GALENA	YUKON-KOYUKUK	392	811	28611	0.72254	0.00000	493	38	10	368	2	0
99742	GAMBELL	NOME	124	548	15938	0.73354	0.00000	6	0	0	542	0	0
99743	HEALY	DENALI	465	1095	50068	0.77889	0.00000	1624	3	25	43	13	0
99744	ANDERSON	DENALI	30	284	52357	0.88645	0.00000	254	24	0	6	21	0
99745	HUGHES	YUKON-KOYUKUK	27	71	14583	0.25926	0.00000	9	0	0	62	0	0
99746	HUSLIA	YUKON-KOYUKUK	66	192	13333	0.65079	0.00000	16	0	0	176	0	0
99747	KAKTOVIK	NORTH SLOPE	78	257	44250	0.86076	0.00000	61	0	2	194	0	0
99748	KALTAG	YUKON-KOYUKUK	72	241	15500	0.53425	0.00000	20	0	0	221	0	0
99749	KIANA	NORTHWEST ARCTIC	87	364	21250	0.65000	0.00000	25	0	2	337	0	0
99750	KIVALINA	NORTHWEST ARCTIC	147	600	29375	0.47260	0.00000	17	0	0	671	0	0
99751	KOBUK	NORTHWEST ARCTIC	81	311	29219	0.47561	0.00000	33	0	0	278	12	0
99752	KOTZEBUE	NORTHWEST ARCTIC	893	3330	40070	0.76207	0.02372	658	10	42	2628	31	0
99753	KOYUK	NOME	62	240	10750	0.66667	0.00000	8	0	0	232	0	0
99755	DENALI NATIONAL PARK	DENALI	7	20	44375	0.85714	0.00000	20	0	0	0	0	0
99756	MANLEY HOT SPRINGS	YUKON-KOYUKUK	52	124	31250	0.64815	0.00000	85	0	0	39	0	0
99757	LAKE MINCHUMINA	YUKON-KOYUKUK	15	29	75222	0.60000	0.00000	22	0	0	7	0	0
99758	MINTO	YUKON-KOYUKUK	65	222	16563	0.16418	0.00000	16	0	0	206	0	0
99759	POINT LAY	NORTH SLOPE	49	146	49583	0.51163	0.00000	27	0	0	121	7	0
99760	NENANA	YUKON-KOYUKUK	137	377	27292	0.72727	0.00000	206	12	3	156	6	0
99761	NOATAK	NORTHWEST ARCTIC	93	367	28125	0.62637	0.00000	28	0	0	339	0	0
99762	NOME	NOME	1229	3710	43980	0.85834	0.94340	1641	0	12	1983	105	74
99763	NORVIK	NORTHWEST ARCTIC	117	559	32656	0.59649	0.00000	35	0	0	524	0	0
99765	NULATO	YUKON-KOYUKUK	138	524	16111	0.60345	0.00000	9	0	0	515	0	0
99764	POINT HOPE	NORTH SLOPE	143	629	47788	0.53147	0.00000	39	2	3	585	0	0
99767	RAMPART	YUKON-KOYUKUK	30	72	15000	0.48000	0.00000	0	0	0	72	0	0
99768	RUBY	YUKON-KOYUKUK	50	175	15000	0.68052	0.00000	44	0	2	129	0	0
99769	SAVOONGA	NOME	125	514	11339	0.60345	0.00000	19	0	0	495	1	0
99770	SELAWIK	NORTHWEST ARCTIC	0	0	0	0.00000	0.00000	0	0	0	0	0	0

ATTACHMENT A

ANALYSIS OF USF NPRM SCENARIOS
IMPACT OF FCC USF OPTION 1 AND ELIMINATION OF DEM WEIGHTING

COMPANY NAME	STATE	SAR ID	12/31/93 USF LOOP	ANNUAL USF EXPENSE ADJ.	REVISED EXP ADJ FOR FCC OPTION 1 *	$ DIFFERENCE	$ IMPACT /LOOP/MO	LOSS OF Estimated 1993 DEM WTG	$ IMPACT /LOOP/MO	COMBINED USF + DEM WT CHANGE	TOTAL $ IMPACT /LOOP/MO
ANCHORAGE TEL UTIL	AK	613000	142,271	$0	$0	$0	$0.00	$0	$0.00	$0	$0.00
ARCTIC SLOPE TEL	AK	613001	1,684	$655,825	$246,300	($409,525)	($20.27)	($680,470)	($33.67)	($1,089,995)	($53.94)
BRISTOL BAY TEL COOP	AK	613003	1,511	$341,255	$124,938	($216,317)	($11.93)	($275,513)	($15.19)	($491,830)	($27.12)
BUSH-TELL INC.	AK	613004	673	$162,070	$80,985	($81,085)	($10.04)	($258,173)	($31.97)	($339,258)	($42.01)
COPPER VALLEY TEL	AK	613006	4,264	$1,075,327	$736,725	($338,602)	($6.62)	($720,404)	($14.08)	($1,059,006)	($20.70)
CORDOVA TEL COOP	AK	613007	1,555	$200,668	$92,356	($108,332)	($5.81)	($328,887)	($17.63)	($437,219)	($23.43)
FAIRBANKS MUNICIPAL	AK	613008	29,789	$2,155,751	$2,630,743	$474,992	$1.33	($1,144,809)	($3.20)	($669,817)	($1.87)
GTE ALASKA INC.	AK	613009	15,247	$0	$0	$0	$0.00	($782,216)	($4.28)	($782,216)	($4.28)
KETCHIKAN PUBLIC UT	AK	613013	9,008	$493,696	$493,258	($438)	($0.00)	($815,506)	($7.54)	($815,944)	($7.55)
MATANUSKA TEL ASSOC	AK	613015	34,860	$9,592,072	$7,635,044	($1,957,029)	($4.68)	($1,147,370)	($2.74)	($3,104,399)	($7.42)
NUSHAGAK TEL COOP	AK	613016	1,783	$300,306	$142,018	($158,288)	($7.40)	($185,213)	($8.66)	($343,501)	($16.05)
OTZ TEL COOPERATIVE	AK	613019	2,354	$176,497	$98,117	($78,379)	($2.77)	($302,688)	($10.72)	($381,067)	($13.49)
UNITED UTILITIES INC	AK	613023	4,208	$1,603,658	$1,375,290	($228,368)	($4.52)	($685,294)	($13.57)	($913,662)	($18.09)
YUKON TEL CO INC	AK	613025	371	$134,500	$23,967	($110,534)	($24.83)	($247,186)	($55.52)	($357,720)	($80.35)
SUMMIT TEL & TEL -AK	AK	613028	88	$117,727	$76,347	($41,381)	($39.19)	($26,347)	($24.95)	($67,727)	($64.14)
GLACIER STATE TEL CO	AK	613010	38,786	$10,944,919				($931,864)	($2.00)		
JUNEAU & DOUGLAS TEL	AK	613012	18,700	$261,479				($825,887)	($3.68)		
SITKA TELEPHONE CO	AK	613020	10,529	$1,837,609				($1,646,397)	($13.03)		
TEL UTIL OF ALASKA	AK	613022	4,819	$0				($319,749)	($5.53)		
PTI - AK	AK	619001	72,834	$13,064,207	$10,694,076	($2,370,131)	($2.71)	($3,723,677)	($4.26)	($6,093,808)	($6.97)
INTERIOR TEL CO INC	AK	613011	3,739	$1,108,351				($643,173)	($14.33)		
MUKLUK TEL CO INC	AK	613016	852	$424,583				($137,633)	($13.46)		
TELALASKA - AK	AK	619002	4,591	$1,532,935	$1,012,672	($520,263)	($9.44)	($780,807)	($14.17)	($1,301,069)	($23.62)
Cost Company Total			327,091	$31,608,515	$25,462,835	($6,143,680)		($12,104,560)		($18,248,240)	
Estimated Average Schedule Total			2,963	$253,849	$188,225	($65,624)	($2.41)	($232,149)	($6.53)	($317,773)	($8.94)
State Total	AK		330,054	$31,860,364	$25,631,060	($6,229,304)		($12,336,709)		($18,566,013)	

Data Sources: NECA USF Data Submission (9/30/94)
FCC USF Data Collection (2/95, 3/95)

Compilation Source: K. Falk, NECA, 9/95

Expense adjustment amounts calculated based on 1993 data for 1995 payout, prior to application of Interim USF cap.

ATTACHMENT A

Analysis of Category 3 Costs based on Switch Size Using only Single Switch Study Areas:

Number of Study Areas	# of Loops Per Switch	'93 Cat.3 Investment	1993 Lines	Total DEM (000)	Cat 3 Invest Per Line	Ratio of Relative Cost Per Line	Invest Per 1000 DEM	Ratio of Relative Cost per DEM
3	100-199	$505,965	411	4,328	$1,231	3.03	$117	4.08
5	200-299	1,527,216	1,205	14,349	$1,267	3.12	$106	3.71
3	300-399	925,460	1,004	15,361	$922	2.27	$60	2.10
4	400-499	1,032,714	1,768	29,635	$584	1.44	$35	1.22
7	500-599	2,726,195	3,856	52,061	$707	1.74	$52	1.83
11	600-699	4,762,785	7,037	93,790	$677	1.67	$51	1.77
7	700-799	2,808,962	5,275	83,459	$533	1.31	$34	1.17
7	800-899	3,494,546	5,937	74,146	$589	1.45	$47	1.64
6	900-999	2,740,518	5,630	66,374	$487	1.20	$41	1.44
30	1000-1999	19,265,645	40,455	504,814	$476	1.17	$38	1.33
8	2000-2999	7,705,975	18,876	215,136	$408	1.00	$36	1.25
5	3000-4999	7,639,819	18,804	266,379	$406	1.00	$29	1.00

Analysis of Category 3 Costs Based on Study Area Size:

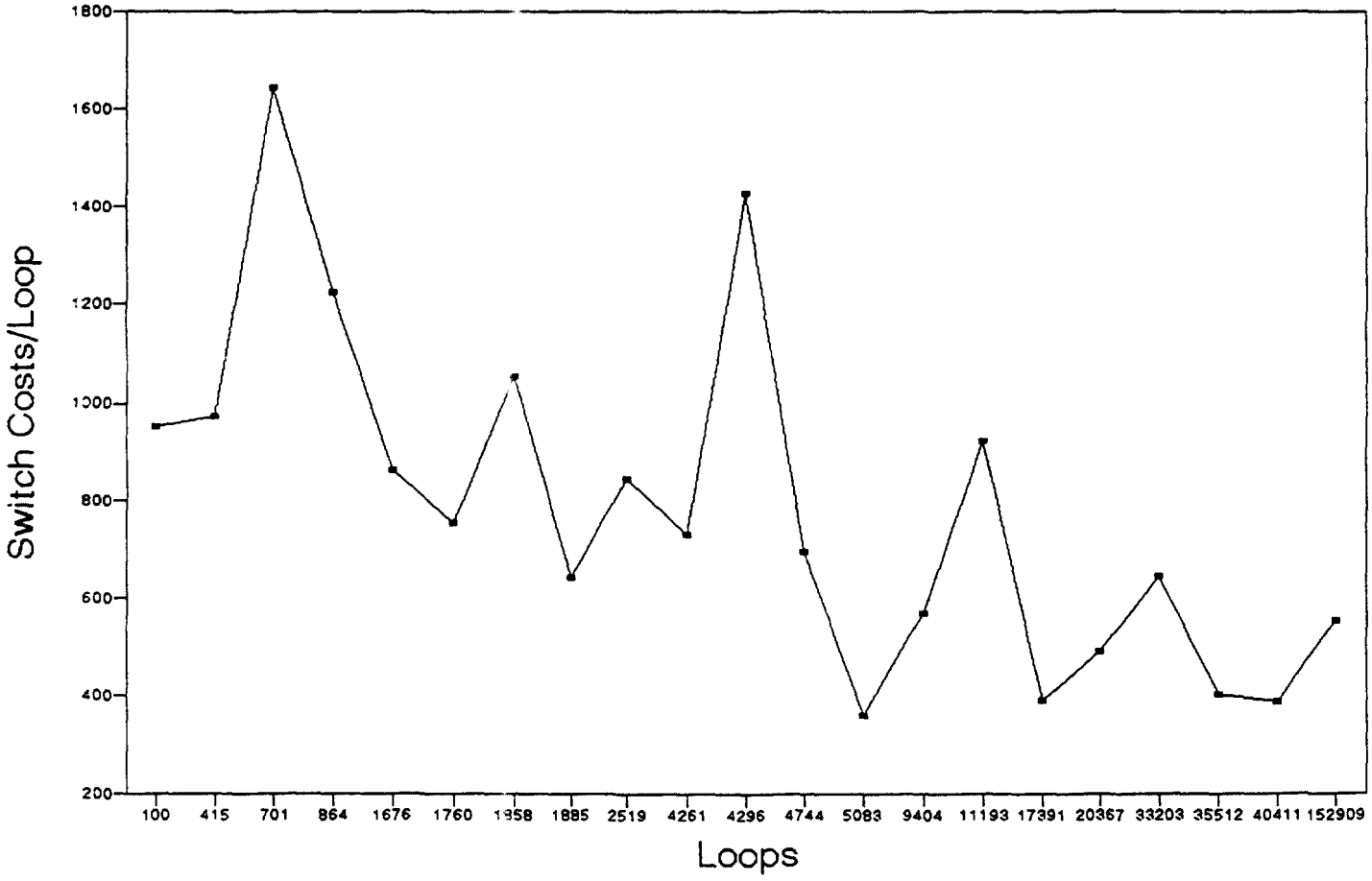
Number of Study Areas	# of Loops Per Study Area	'93 Cat.3 Investment	1993 Lines	Total DEM (000)	Cat 3 Invest Per Line	Ratio of Relative Cost Per Line	Invest Per 1000 DEM	Ratio of Relative Cost per DEM
42	<500	$18,170,582	11,815	178,644	$1,538	3.87	$102	4.10
72	500-1,000	$41,156,291	55,481	717,808	$742	1.86	$57	2.31
259	1,000-5,000	$353,235,513	644,528	8,593,644	$548	1.38	$41	1.66
86	5,000-10,000	$277,831,845	605,603	8,597,064	$459	1.15	$32	1.30
66	10,000-20,000	$458,790,705	887,528	12,749,652	$517	1.30	$36	1.45
54	20,000-50,000	$785,512,362	1,797,915	25,818,615	$437	1.10	$30	1.23
30	50,000-100,000	$850,436,891	2,137,657	34,272,992	$398	1.00	$25	1.00

Source: Data from the Response to FCC NOI Data Request; Excludes 19 SAC's with missing data
Compilation provided by United Utilities, Inc.

ATTACHMENT A

Switching Plant/Loop vs. Total Loops

Alaska Data 1993



WKS: CBG

Various statistics for three Alaskan Census Block Groups

Census Statistics Census Block Group (CBG)	Locations in CBG	Population	Total Area (sq. m.)	Land Area (sq. m.)	Population Density (sq. m.)	Housing Unit Density (sq. m.)
BNA 9514.98, CBG 4	Chefornak	320	36.2	32.1	10.0	2.5
	Kipnuk	470	30.2	29.5	15.9	4.3
	Kongiganak	294	12.2	11.4	25.8	5.9
	Kwigillingok	278	20.7	15.7	17.7	5.0
	Tuntutuliak	300	27.2	26.9	11.2	2.8
BNA 9709, CBG 4	Buckland	318	1.4	1.4	227.1	50
	Deering	157	5.3	5.3	29.6	10.2
BNA 9709, CBG 9	Ambler	311	13.1	11.6	26.8	6.8
	Kobuk	69	17.1	16.4	4.2	1.5
	Shungnak	223	9.7	8.5	26.2	8

Appendix D

ATTACHMENT A

APPENDIX E

Appendix E to the Comments of the Alaska Public Utilities Commission, in CC Docket No. 80-286, October 9, 1995.

Appendix E contains this cover page and 27 pages of extracts from the Alaska Regional Profiles, Arctic Region.

Contents:

Title Sheet	Not numbered
Climate	5-8, 10-11, 13, 15-20, 23, 28-29, 164
Geology	64
Permafrost	65, 71-73
Floods	102-103
Transportation	189, 191

Note: This Appendix contains only those specified pages listed above. Pages from the Alaska Regional Profiles not included in Appendix E may be made available on request.

Sponsored by

The State of Alaska.
Office of the Governor

in cooperation with

The Joint Federal-State Land Use Planning Commission for Alaska

Coordinated and Prepared by
Lidia L. Selkregg

The University of Alaska.
Arctic Environmental Information and Data Center

Alaska Regional Profiles

Arctic Region

State of Alaska

Jay S. Hammond
Governor

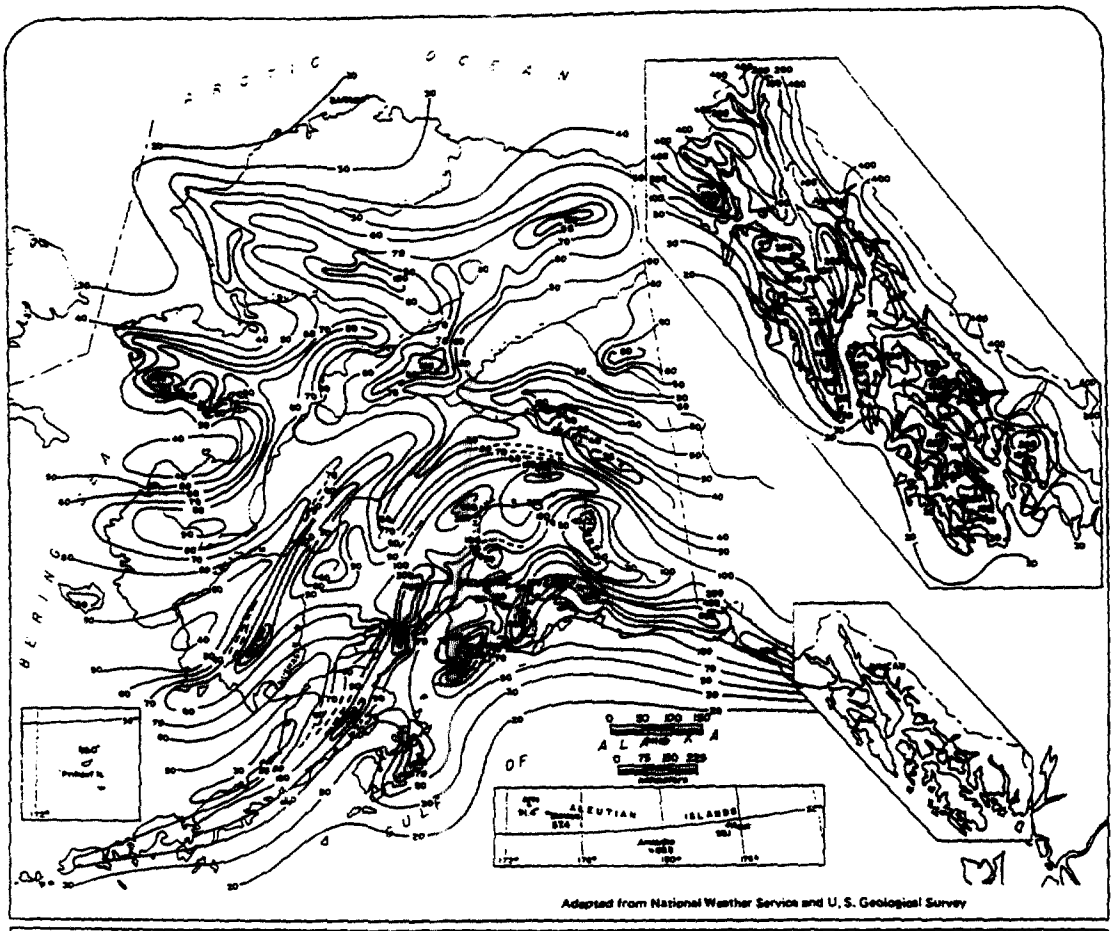


Figure 5

Snowfall Distribution in Inches

Precipitation values include the water equivalent of the snow.

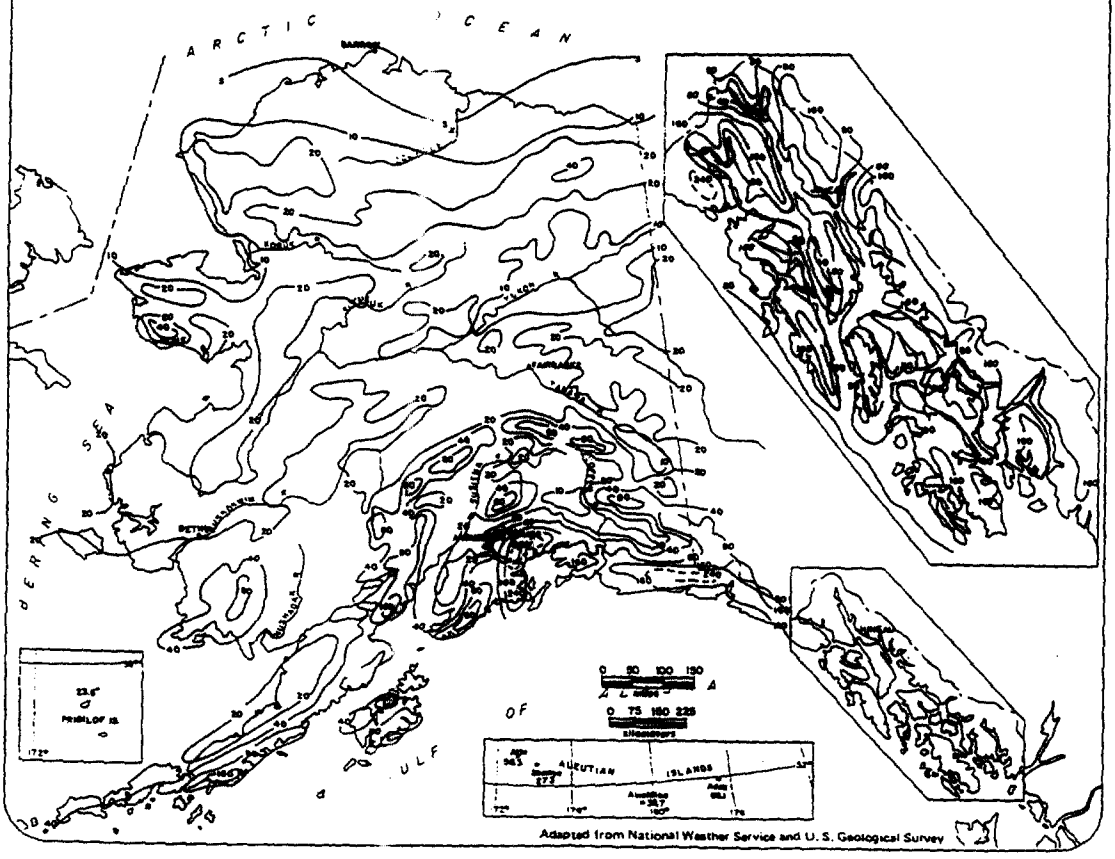


Figure 6

Mean Annual Precipitation Distribu
in Inches

Degree Days

Degree days measure the departure of mean daily temperature from a given standard, one degree day for each degree of departure above or below the standard during the day. The standard for heating degree days is 65 degrees F, for freezing and thawing, 32 degrees F. Degree days are usually accumulated over a period of time or season.

By using the temperature pattern data of an area, thermal loads can be measured over a period of time, usually one year. Heating, freezing, and thawing loads are often measured in degree days per year.

Heating degree days measured below 65 degrees F provide information for calculating the annual fuel requirement for a heated building. The freezing degree days measured below 32 degrees F provide a basis for calculating the depth of annual ground freezing or ice thickness, while the thawing degree days measured above 32 degrees F provide a measure of ground thaw during spring.

Freezing Degree Days

For design purposes, freezing degree days of 1,000 more than the mean (Figure 11) will approximate an extreme that can be expected once in a 10-year period (Johnson, Hartman 1969). North of the Bering Strait, lines of equal freezing degree days at the coast are linear with values farther inland reflecting winter conditions. A curved pattern shows the influence of the unfrozen sea in the central and southern Bering Sea. The southern limit of isolated permafrost falls close to 2,000 freezing degree days on the Alaska Peninsula. A general relationship is not apparent between freezing degree days and other permafrost conditions.

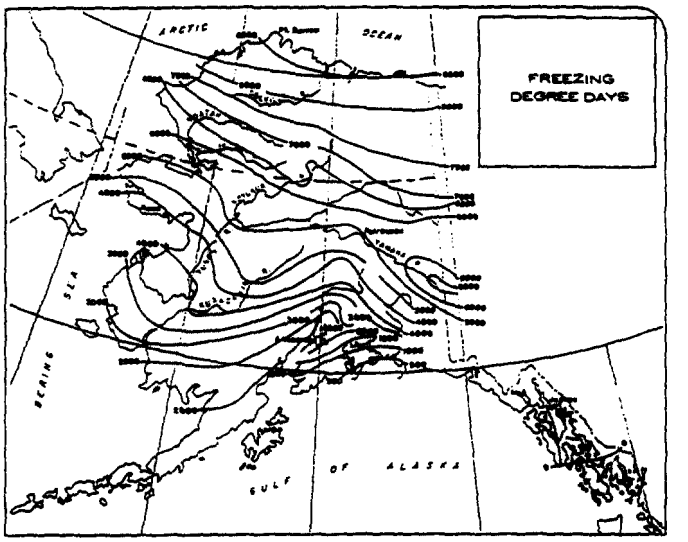
Thawing Degree Days

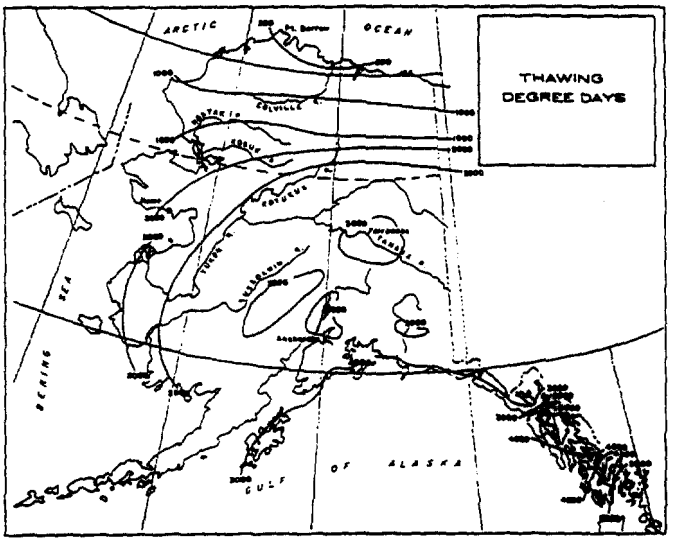
The presence of permafrost depends on thawing as well as freezing. Thawing degree days (Figure 12) also measure summer duration and temperatures. Areas with lower values of thawing degree days than freezing degree days tend to have some permafrost. Areas with low thawing degree days and high freezing degree days are candidates for continuous permafrost.

The uniformity of thawing degree days in interior Alaska is caused by higher summer temperatures, which compensate for longer thawing seasons farther south. It results in a fairly uniform type of forest cover, except where altitude reduces the length of the growing season for forest species. For design purposes in Alaska, thawing degree days which are 300 degrees greater than shown will occur approximately once every 10 years.

Heating Degree Days

Home heating begins when the air temperature is near 65 degrees F. Mean temperatures below 65 degrees accumulate heating degree days (Figure 13). When the mean temperature for a particular day is above 65 degrees, cooling degree days are measured. For design purposes the addition of 500 heating degree days for the Aleutian Islands and Southeast Alaska and 1,000 for the remainder of the state to the values shown on the chart for these areas will approximate one occurrence every 10 years.





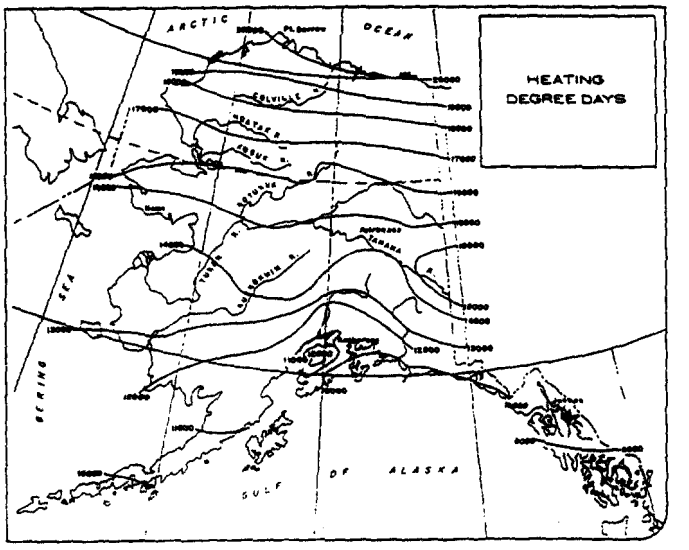
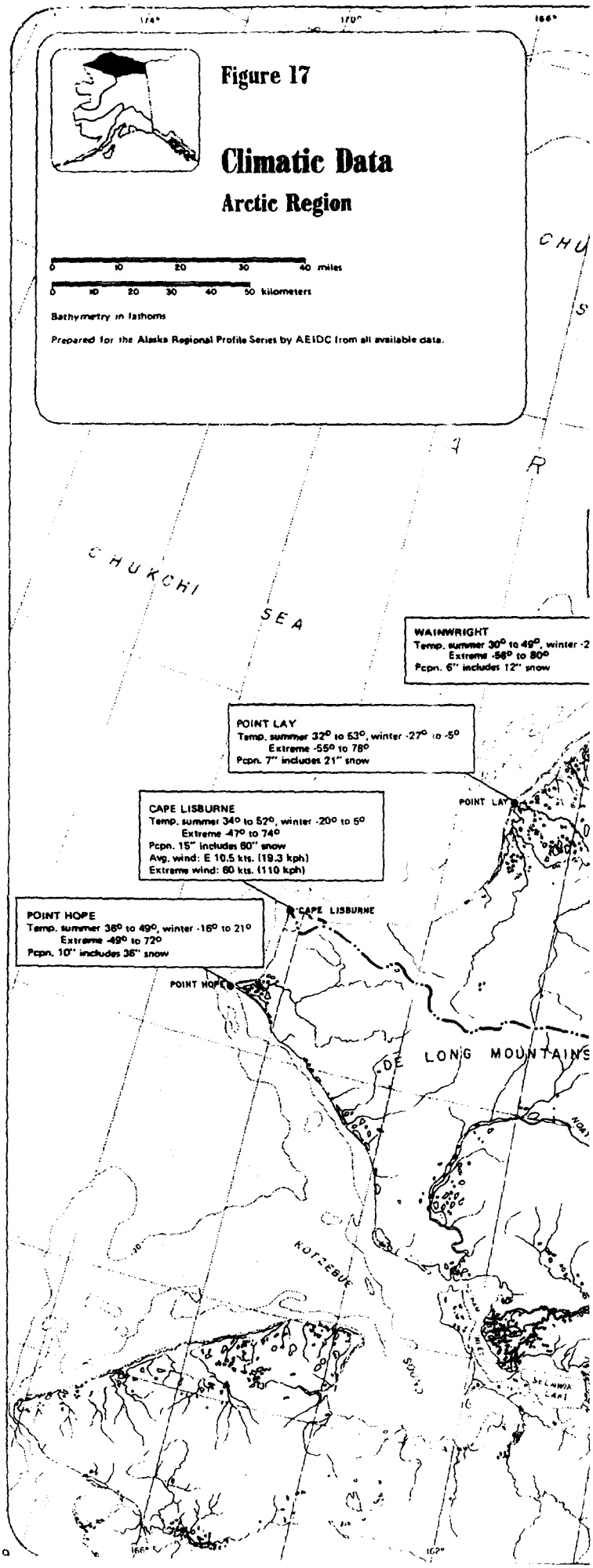


Figure 11 Annual Freezing Degree Day Distribution

Figure 12 Annual Thawing Degree Day Distribution

Figure 13 Annual Heating Degree Day Distribution



ATTACHMENT A

Courtesy of Naval Arctic Research Laboratory

Arctic Climate

Arctic weather sharply contrasts with weather in other parts of Alaska. Average temperatures are cold, and persistently strong winds blow over the northern half of the area. Although the terrain is continuously wet in summer and dotted with lakes, the amount of precipitation is low. Therefore, except at higher elevations, the region is classified as a desert—a desert of frozen land.

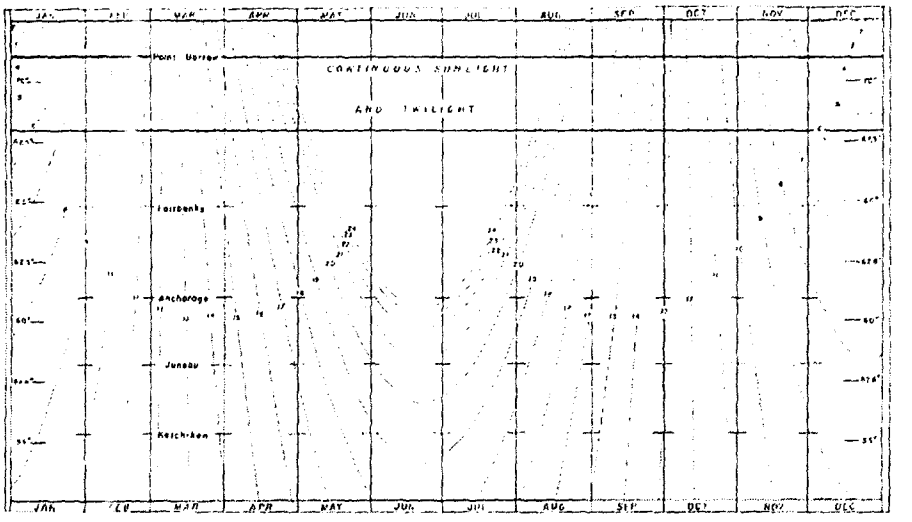
In the Arctic weather is critically important to man. At times, wind and temperature make outdoor activities difficult or impossible. The primary mode of transportation, flying, depends heavily on weather conditions. Surface transportation is restricted to a limited road system during warm months but increases when the tundra is frozen and snow-covered.

The Arctic Region and the Arctic Climatic Zone are geographically the same. Despite the proximity of the offshore icepack to land for at least 10 months of the year, the Arctic Ocean and Beaufort Sea have a modifying effect on coastal temperatures. On the southern extremity of the region the Brooks Range affects both temperature and precipitation. Surface winds are relatively strong along the coast but weaken and become more variable further inland. In the mountains wind speeds accelerate as they are channeled through north-south oriented passes (Figure 15).

The nine locations shown in Figure 17 are the only stations that provide weather data for the immense Arctic Region. Only at these locations have temperature and precipitation data been consistently recorded and summarized. Wind data are available only for Barrow, Umiat, Cape Lisburne, and Kaktovik (Barter Island). Because of the small amount of usable data for Oliktok, the figures shown for that station do not necessarily represent average conditions.

During exploratory oilwell drilling, observations were made at a number of locations near Prudhoe Bay. These records, which included information relating to aviation weather, did not include daily values of high and low temperature and precipitation. The data were not routinely summarized, therefore, although the locations of the observation points are shown on Figure 17, basic weather data are not shown for these sites. With the exception of Oliktok, a military Dewline station, data from the weather stations shown in Figure 17 are available from the National Climatic Center, Federal Building, Asheville, North Carolina 28801 and the Arctic Environmental Information and Data Center, University of Alaska, Anchorage.

Five stations on the coast from Barrow southeastward provide adequate data coverage for that portion of the coastal region. The remainder of the region is inadequately covered by weather reporting stations. Therefore, the sparsity of data stations requires that a great deal of subjective analysis be used to portray regional climatic patterns.



The curved lines are labeled in hours and represent the combined hours of sunlight and civil twilight for different latitudes and months of the year. Hours of darkness can be estimated by computing the difference between the value of the line and the total of 24 hours. The latitude locations of the villages in the Arctic are indicated by a solid horizontal line.

Source: Environmental Atlas of the Greater Anchorage Area Borough, Alaska. L. Selkregg et al. 1972.

Figure 20 Sunlight and Darkness

Solar Radiation of Sunlight and Heat

Latitude and the season of the year determine the length of each day at a particular location (Figure 20). In the north days are longer in summer and shorter in winter than at more southerly latitudes. Twilight marks the beginning of darkness or sunlight.

The three twilight terms in use are civil, nautical, and astronomical. **Civil twilight**, the term most frequently used, is the time of day when the sun is below the horizon by 6 degrees or less. **Nautical twilight** represents the range between 6 and 12 degrees below the horizon, and **astronomical twilight** is between 12 and 18 degrees below the horizon (American Meteorological Society 1959). Beyond 18 degrees sunlight no longer results from bending the sun's rays, but is reflected light such as from the moon. At the end of civil twilight visibility is drastically reduced affecting most outdoor activities.

The sun rises at Barrow at 1:06 a.m. on May 10th and does not set again until August 2nd at 11:51 p.m. with an elapsed time of 84 days, 21 hours, and 3 minutes (U. S. Naval Observatory). Actually, darkness ceases with the beginning of civil twilight at 1:03 a.m. on April 23rd and does not begin again until the end of twilight at 11:59 p.m. on August 19th. The total elapsed time without complete darkness is 118 days, 22 hours, and 56 minutes. The sun sets in Barrow at 12:50 p.m. on November 18th and does not rise again until January 24th at 11:51 a.m. with an elapsed time of 66 days, 23 hours, and 1 minute. However, a short period of twilight or indirect sunlight occurs during each of these days, ranging from 2 hours and 58 minutes in December to slightly more than 6 hours in November and January. Although the sun does not appear above the horizon for almost 67 days, approximately 12½ days of twilight occur at daily intervals of varying length.

Summer in the arctic foothills.

Courtesy of ARCO

Figure 24 Cooling Power of Wind Expressed as "Equivalent Chill Temperature"

LITTLE DANGER — INCREASING DANGER

Wind	Temperature 0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20	-21	-22	-23	-24	-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35
5	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20	-21	-22	-23	-24	-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-38	-39	-40
6	-8	-9	-10	-11	-12	-13	-14	-15	-17	-18	-19	-20	-21	-22	-23	-24	-26	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-39	-40	-41	-42	-43	-44	-45
7	-11	-12	-13	-14	-15	-16	-17	-19	-20	-22	-23	-24	-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-38	-39	-41	-42	-43	-45	-46	-47	-48	-49	-50
8	-14	-15	-16	-17	-18	-19	-21	-22	-23	-25	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-38	-39	-40	-41	-42	-43	-45	-47	-48	-50	-51	-52	-53	-54	-55
9	-17	-18	-19	-20	-21	-22	-24	-26	-27	-29	-31	-32	-33	-34	-35	-36	-37	-38	-39	-40	-41	-42	-43	-44	-45	-46	-47	-49	-51	-53	-55	-56	-57	-58	-59	-60
10	-20	-21	-22	-23	-24	-25	-27	-29	-31	-33	-35	-36	-37	-38	-39	-40	-41	-42	-43	-44	-45	-46	-47	-48	-49	-50	-52	-54	-56	-58	-60	-61	-62	-63	-64	-65
11	-22	-23	-24	-25	-26	-28	-30	-32	-34	-35	-37	-38	-39	-40	-41	-42	-43	-44	-45	-47	-48	-49	-50	-51	-52	-53	-55	-57	-59	-61	-62	-63	-64	-65	-66	-66
12	-24	-25	-26	-27	-29	-31	-33	-34	-35	-37	-39	-40	-41	-42	-43	-44	-45	-47	-48	-50	-51	-52	-53	-54	-55	-56	-58	-59	-61	-63	-64	-65	-66	-67	-69	-71
13	-26	-27	-28	-30	-32	-34	-36	-37	-38	-39	-41	-42	-43	-44	-45	-46	-47	-50	-52	-53	-54	-55	-56	-57	-58	-59	-61	-62	-63	-65	-66	-67	-68	-70	-72	-74
14	-28	-29	-30	-33	-35	-37	-39	-40	-41	-42	-43	-44	-45	-46	-47	-48	-49	-52	-54	-56	-57	-58	-59	-60	-61	-62	-63	-64	-65	-66	-68	-69	-71	-73	-76	-77
15	-30	-32	-34	-36	-38	-40	-41	-42	-43	-44	-45	-46	-47	-48	-49	-50	-52	-54	-56	-58	-60	-61	-62	-63	-64	-65	-66	-67	-68	-69	-70	-73	-74	-76	-78	-80
16	-31	-33	-35	-37	-39	-41	-42	-43	-44	-45	-46	-47	-49	-50	-51	-52	-54	-56	-58	-59	-61	-62	-64	-65	-66	-67	-68	-69	-70	-71	-72	-74	-75	-77	-78	-81
17	-32	-34	-36	-38	-40	-42	-43	-44	-45	-46	-47	-48	-50	-52	-53	-54	-56	-58	-60	-61	-62	-64	-66	-67	-68	-69	-70	-71	-73	-74	-76	-77	-79	-80	-82	-82
18	-33	-35	-37	-39	-41	-43	-44	-45	-46	-47	-48	-49	-51	-52	-54	-56	-58	-60	-61	-62	-63	-65	-67	-68	-70	-71	-72	-74	-75	-76	-78	-79	-80	-82	-83	-83
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22	-39	-40	-42	-44	-46	-47	-48	-49	-50	-52	-54	-56	-57	-59	-61	-62	-63	-64	-66	-68	-69	-70	-72	-73	-74	-76	-77	-79	-80	-81	-82	-83	-84	-85	-86	-88
23	-41	-42	-43	-45	-47	-48	-49	-50	-52	-54	-56	-58	-59	-60	-62	-63	-64	-66	-68	-70	-71	-73	-74	-76	-77	-78	-79	-81	-82	-83	-84	-85	-86	-88	-90	-91
24	-43	-44	-45	-47	-48	-49	-50	-52	-54	-56	-58	-60	-61	-62	-63	-65	-67	-69	-71	-73	-74	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90
25	-45	-46	-47	-48	-49	-50	-52	-54	-56	-58	-60	-61	-62	-63	-64	-65	-67	-69	-71	-73	-75	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-90	-92
26	-46	-47	-48	-49	-50	-51	-53	-55	-57	-59	-61	-62	-63	-64	-65	-66	-68	-70	-72	-74	-75	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-89	-90	-92
27	-47	-48	-49	-50	-51	-52	-54	-56	-58	-60	-62	-63	-64	-65	-66	-67	-69	-71	-73	-75	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-92
28	-48	-49	-50	-51	-52	-53	-55	-57	-59	-61	-63	-64	-65	-66	-67	-68	-70	-72	-74	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-91	-93
29	-49	-50	-51	-52	-53	-54	-56	-58	-60	-62	-64	-65	-66	-67	-68	-69	-71	-73	-75	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-91	-92	-94
30	-50	-51	-52	-53	-54	-55	-57	-59	-61	-63	-65	-66	-67	-68	-69	-70	-72	-74	-76	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-91	-92	-93	-100
31	-51	-52	-53	-54	-55	-56	-58	-60	-62	-64	-65	-66	-68	-69	-70	-71	-73	-75	-76	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-91	-92	-100	-101
32	-52	-53	-54	-55	-56	-57	-59	-60	-62	-64	-65	-67	-69	-70	-71	-72	-74	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-100	-101	-101	-102
33	-53	-54	-55	-56	-57	-58	-60	-61	-62	-64	-66	-67	-69	-71	-72	-73	-75	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-100	-101	-102	-102	-103
34	-54	-55	-56	-57	-58	-59	-60	-62	-63	-64	-66	-67	-69	-71	-73	-74	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-100	-101	-102	-103	-103	-104
35	-55	-56	-57	-58	-59	-60	-61	-62	-63	-64	-66	-67	-69	-71	-73	-75	-76	-77	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-100	-101	-102	-103	-104	-105	-105
36	-56	-57	-58	-59	-60	-61	-62	-63	-64	-66	-66	-68	-70	-71	-73	-75	-76	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-100	-101	-102	-103	-104	-105	-106	-106
37	-57	-58	-59	-60	-61	-62	-63	-64	-65	-66	-67	-68	-70	-72	-74	-75	-76	-78	-79	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-100	-102	-103	-104	-105	-106	-107
38	-58	-59	-60	-61	-62	-63	-64	-65	-66	-67	-68	-69	-71	-73	-74	-75	-76	-80	-81	-82	-83	-84	-85	-86	-87	-88	-89	-101	-103	-104	-105	-106	-107	-108	-108	-109
39	-59	-60	-61	-62	-63	-64	-65	-66	-67	-68	-69	-70	-71	-73	-74	-75	-76	-81	-82	-83	-84	-85	-86	-87	-88	-89	-90	-101	-102	-104	-105	-106	-107	-108	-109	-109
40	-60	-61	-62	-63	-64	-65	-66	-67	-68	-69	-70	-71	-72	-73	-74	-75	-76	-79	-82	-83	-84	-85	-86	-87	-88	-89	-90	-91	-102	-104	-105	-106	-107	-108	-109	-110

INCREASING DANGER
Exposed flesh may freeze within one minute.

GREAT DANGER
Exposed flesh may freeze within thirty seconds.

The chill temperature for each Fahrenheit degree and mile per hour of wind was interpolated from the Equivalent Wind Chill Temperature Chart, Figure 16. Temperatures of zero and colder are critical in the Arctic because of moderately strong surface winds.

Wind speeds are in MPH. Temperature °F.

Adapted from U.S. Air Force, Arctic Aeromedical Laboratory and Scientific Services, 11th Weather Squadron

Grossmann-Granger Productions, Courtesy of AHCO

Precipitation

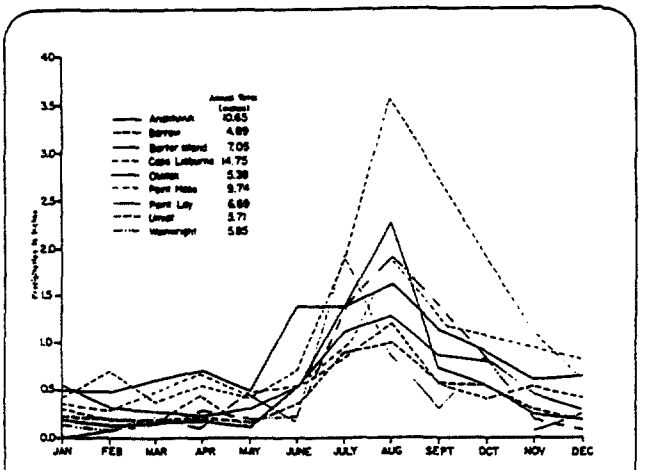
Annual precipitation amounts depend on many climatic interrelationships such as global weather patterns, terrain of the surrounding area, and air temperature. Annual precipitation amounts in the Arctic are generally low (Environmental Data Service, U. S. Department of Commerce, various dates). Any exception can be explained by special conditions affecting one or more of the three factors mentioned above.

Global weather patterns, partially presented in Figure 18, show major storm tracks. During all months except August the major storm track in Alaska is along and to the south of the Aleutian Island chain, Alaska Peninsula, and into the Gulf of Alaska. There are many minor storm tracks. One pushes storms in a west to east movement along the Alaskan coastal Arctic from the Soviet Arctic or north through the Bering Sea to the Alaskan Arctic. During August the south to north movement of storms through the Bering Sea becomes a major storm track producing the Arctic's largest monthly precipitation amounts.

Terrain can increase precipitation amounts whenever moist air is forced up a mountain slope. The moisture in the air cools and condenses and then falls to earth as rain or snow. Without this mechanical lift precipitation may not develop.

Air temperature controls how much moisture the air holds as a vapor or gas. Regardless of other factors, extremely cold air can contain only very small amounts of water vapor. The result is low precipitation.

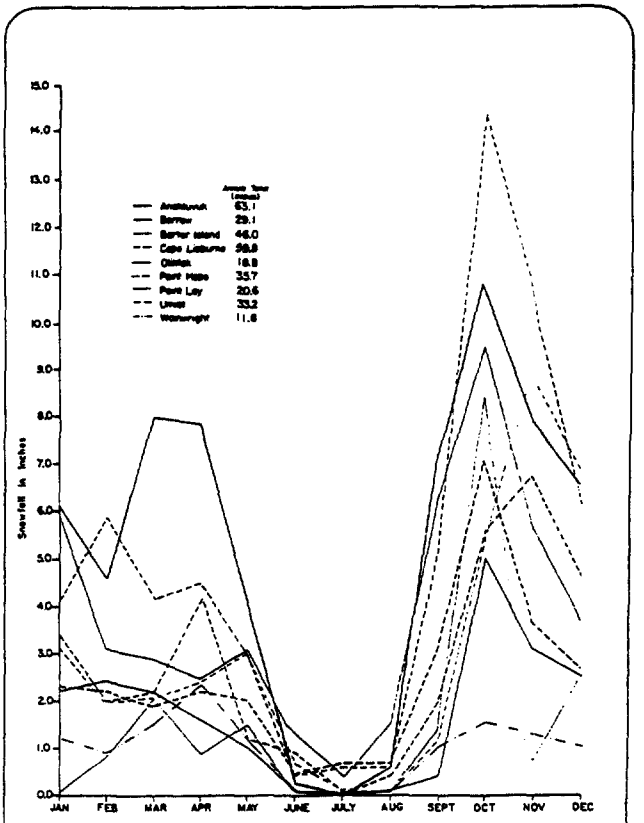
Precipitation in the Alaskan Arctic varies considerably with location. Heaviest amounts occur in the highest elevations of the Brooks Range where the average annual amounts vary from 40 or more inches in the eastern glacial area to about 10 inches in parts of the central portion. In the coastal and foothill areas amounts range from 7 to less than 5 inches. Most precipitation occurs during summer as rain (Figure 26). Areas with the heaviest snowfall correspond to those with the most total precipitation. Average annual snowfall amounts range from an estimated 100 inches in the eastern Brooks Range to only 12 inches along the northwest coast (Figure 27). The two data stations with the heaviest annual precipitation are both influenced by terrain. Figure 28 shows the frequency of occurrence of precipitation.



The line graph plot of the nine data stations shows the distribution of precipitation through the year, showing clearly the comparatively heavy precipitation that occurs in late summer and early fall. Period of record is 8 to 20 years.

Adapted from the National Oceanic and Atmospheric Administration Environmental Data Service.

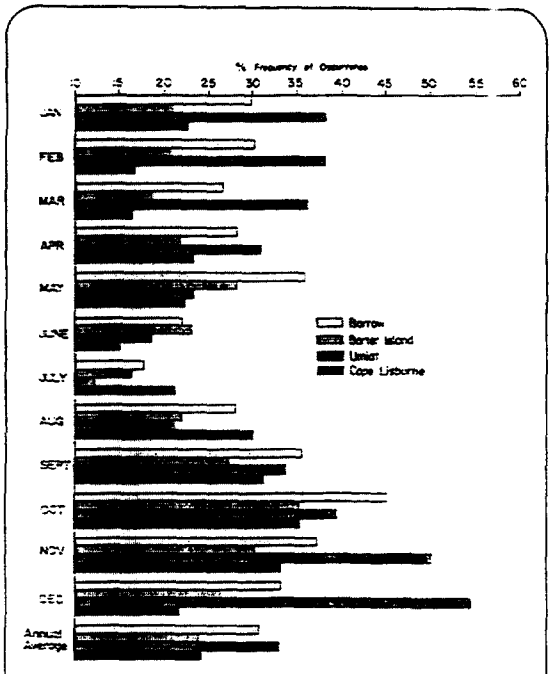
Figure 26 Average Monthly and Annual Precipitation



In contrast to the single period in August when most precipitation occurs, the snowfall pattern shows a primary peak in October and a secondary peak in spring which varies from February to May. Period of record is 8 to 20 years.

Adapted from the National Oceanic and Atmospheric Administration Environmental Data Service.

Figure 27 Average Monthly and Annual Snowfall



Precipitation data are available for only the four locations shown. Without regard to intensity or rate of fall, this chart gives the frequency of occurrence of any type of precipitation. For example, the value of 30 for Barrow in January means that 30 percent of the time, some type of precipitation was occurring. Period of record is 8 to 20 years.

Adapted from the U.S. Air Force, Air Weather Service.

Figure 28 Percentage Frequency of Occurrence of Precipitation

Detailed Weather Conditions

Average annual sky cover conditions differ only slightly between the four data locations (Air Weather Service, U. S. Air Force, various dates). Divided into monthly increments, these differences become slightly more significant. Seasonal trends are similar for all stations. Where total cloudiness influences operational planning, the data in Figure 31 will be useful.

Snow depth data must be applied with caution. Even though these data are compiled and presented in Figure 32, their value is greatly reduced since wind continuously moves the snow from one area to another. Also, there are areas where snow is packing and developing a hard crust. Measurements made at a single or even several locations will not necessarily give an accurate picture of general conditions.

Obstructions to vision are yet another planning consideration (Figure 33). An obstruction to vision is a condition that reduces visibility to six miles or less. In the Arctic, particularly along the coast, the most persistent and significant of these is fog, which occurs often enough to be a hazard. Along the coast the occurrence of fog increases drastically as soon as open water begins to appear in May or June and continues into early October. Statistics on heavy fog, a reduction to visibility of one-quarter mile or less, are available for Barrow and Barter Island (Figure 34). In the interior portion of the Arctic, fog occurs most frequently in winter. Warm summer temperatures in this area reduce fog occurrences. Smoke and haze occur so infrequently that they have a negligible effect on visibility. Blowing snow, however, is a serious hazard.

Wind flows across a mountain ridge. The lenticular cloud appears to be stationary, but it is actually dissipating on the leeward side at the same time it is forming on the windward side. Joseph C. LaBelle

March occurrence of fog over an open lead.

Joseph C. LaBelle, AEIDC

Figure 31 Sky Cover

Month	Barter Island 0-3	4-6	6-7	8-9	10	Barrow 0-3	4-6	6-7	8-9	10	Umiat 0-3	4-6	6-7	8-9	10	Cape Lisburne 0-3	4-6	6-7	8-9	10
J	42	5	7	8	38	53	4	4	5	34	43	5	5	6	41	36	7	9	9	3
F	44	6	6	7	37	50	4	5	6	35	44	5	6	7	38	46	7	8	9	28
M	42	6	7	10	35	46	5	6	9	34	50	6	7	10	27	45	7	9	10	29
A	35	5	7	10	43	41	4	5	8	42	51	5	8	10	46	29	8	8	12	43
M	14	3	4	8	71	14	2	3	6	75	19	3	5	8	65	19	4	6	10	61
J	15	5	6	13	61	13	4	5	10	68	18	6	9	15	52	18	6	9	17	50
J	16	6	7	15	56	13	5	6	14	62	19	6	10	17	48	12	5	8	17	58
A	10	4	6	14	66	5	2	3	8	82	11	4	7	13	65	7	3	6	15	69
S	12	4	5	10	69	5	2	2	6	85	11	3	5	8	72	8	3	5	13	71
O	15	4	4	8	69	11	3	4	8	74	18	5	6	7	64	9	4	7	12	68
N	27	4	5	8	56	21	4	5	7	63	30	5	5	7	53	18	6	9	10	57
D	39	5	6	7	43	40	4	4	6	46	36	5	5	6	48	37	6	7	8	42
YR	25	5	6	10	54	26	4	4	8	58	26	5	6	9	54	23	6	8	12	51

Categories Below Are Tenths of Total Sky Cover

Figure 32 Depth of Snow on Ground

Month	Barter Island Trace or less	1-3 inches	4-6 inches	7-12 inches	13-24 inches	25-36 inches	37-48 inches	Barrow Trace or less	1-3 inches	4-6 inches	7-12 inches	13-24 inches	25-36 inches	37-48 inches	Umiat Trace or less	1-3 inches	4-6 inches	7-12 inches	13-24 inches	25-36 inches	37-48 inches	Cape Lisburne Trace or less	1-3 inches	4-6 inches	7-12 inches	13-24 inches	25-36 inches	37-48 inches	Month
J			9	31	37	21	2			20	68	25						49	51			3	3	5	37	54	1		J
F			2	17	56	18	7			2	48	50						18	82			1	6	4	23	46	18	3	F
M			1	19	47	20	13				50	50						50	50				4	5	29	36	26		M
A			6	29	29	28	10				50	50					7	49	32	12			2	12	27	40	21		A
M		8	14	25	38	13	2		1	14	56	30			13	4	32	38	13			23	24	9	24	13	7		M
J	48	26	7	10	6	2	1	51	30	6	11	2			79	18	3					83	14	2	1				J
J	99	1						94	6						100							100							J
A	88	2						90	10						100							99	1						A
S	79	15	2	2	3			62	38	10					86	14						88	10	4					S
O	18	20	34	20	8			12	51	34	13				12	42	44	2				24	29	20	18	8	1		O
N		4	28	48	24				9	44	43	4				13	30	57	8				9	25	31	32	1	2	N
D			18	40	35	9				33	57	10					11	49	40				9	9	41	38	34		D
YR	29	6	10	20	23	9	3	29	9	12	32	18			32	7	11	26	23	1		35	9	8	19	22	7	*	YR

*Less than .5

Figure 33 Obstructions to Vision

	Fog: Barter Is.	Barrow	Umiat	Cape Lisburne	Blowing Snow: Barter Is.	Barrow	Umiat	Cape Lisburne	Smoke and/or Haze: Barter Is.	Barrow	Umiat	Cape Lisburne	Percentage Observations with Obstructions to Vision: Barter Is.	Barrow	Umiat	Cape Lisburne
J	6.9	12.5	14.5	8.1	20.2	13.7	6.2	15.9	.1	.5	.8	.0	25.6	24.7	19.8	21.9
F	6.0	13.1	16.7	10.6	22.3	12.6	8.7	11.3	.1	.3	.7	.1	29.2	26.3	22.2	20.0
M	9.7	7.9	12.4	11.7	16.8	10.0	2.0	10.6	.1	.2	.0	.2	24.9	17.3	14.3	20.5
A	11.8	9.3	13.7	13.6	11.5	7.8	3.6	9.9	.2	.2			22.7	16.7	17.2	20.9
M	26.1	17.4	14.1	16.6	3.3	4.0	.4	2.1	.0	.0		.0	27.5	21.0	14.3	17.9
J	26.6	26.4	8.3	22.8	.1	.5			.1	.0	.0	.1	26.7	26.9	8.3	22.8
J	26.3	26.3	6.5	18.8					.0		1.0	.3	26.3	26.3	7.6	18.9
A	11.8	25.6	8.5	18.8		.0			.1	.0		.3	11.6	25.5	9.8	18.9
S	26.6	17.7	13.4	11.3	1.9	.7	.3	.5	.0		.0	.0	28.3	18.2	13.7	11.8
O	13.5	13.0	16.9	5.3	10.4	7.7	1.9	7.8	.2	.0			22.6	20.9	18.1	12.7
N	8.8	10.5	15.0	4.4	17.6	16.3	5.1	14.3	.1	.0	.0	.2	26.0	26.0	19.6	18.5
D	8.0	10.4	13.4	6.1	16.6	13.5	5.8	13.0	.1	.1	.5	.1	21.7	22.5	18.4	18.2
Yr	17.0	15.8	12.7	12.3	9.9	7.2	2.8	7.1	.1	.1	.3	.1	26.1	22.6	16.3	18.6

Note: The detailed weather conditions presented in Figures 31, 32, and 33 are all average percentage frequency of occurrence values, based on hourly observations. A particular value represents the amount of the total time during that month that an event occurred. For example, in August on Barter Island fog is present as an obstruction to vision 31.5 percent of the time, or out of 744 total hours, fog was present for 234 hours. To qualify as an obstruction to vision, visibility must be reduced to six miles or less. Period of record is 8 to 20 years.

Adapted from U.S. Air Force, Air Weather Service.

Figure 34 Days with Heavy Fog

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annl
Barrow	2	2	1	3	8	12	13	12	5	4	3	2	65
Barter Island	2	1	1	3	7	12	15	16	10	4	2	1	75

Note: The statistics for this chart were compiled by noting the occurrence of heavy fog on a daily rather than hourly basis. Heavy fog, defined as fog reducing visibility to one-quarter mile or less, must occur at some time during a day to establish a day with heavy fog. Period of record is 25 years.

Source: National Oceanic and Atmospheric Administration, Environmental Data Service.

National Marine Fisheries Service

Lakes and streams provide food year-round. Here a woman of Lapp ancestry fishes through a hole in the ice. Laplanders were originally brought to Alaska to develop reindeer herding as a source of food and income and many intermarried with Alaska Natives.

Lake and River Ice

Observation and recording of freezeup and breakup dates on rivers and lakes in the region began more than 20 years ago. Although there are some gaps in these data, Figures 34 and 35 present all that are available. Since river water moves, river freezeup dates are later than those of lakes, breakup dates are earlier, and the days that ice is safe for men and vehicles are fewer. The ice-free season falls approximately between these dates. As soon as the temperature remains above freezing, ice melts much more quickly than it forms when the temperature drops below freezing.

Figure 35 gives average beginning and ending freezeup dates of the ice season for selected lakes and rivers. Locations of these observational sites are found in Figure 18. Ice observations are not available for other locations in this region.

Alaska's lakes and rivers are important transportation and recreation resources year-round. In summer a high percentage of airplanes is equipped with floats, which allows them to land close to most otherwise inaccessible areas. Floats are exchanged for skis in winter. For surface transportation, these water bodies often must be bridged, which requires knowledge of ice conditions for engineering design and construction.

Figure 34
Freezing Temperatures for Selected Locations

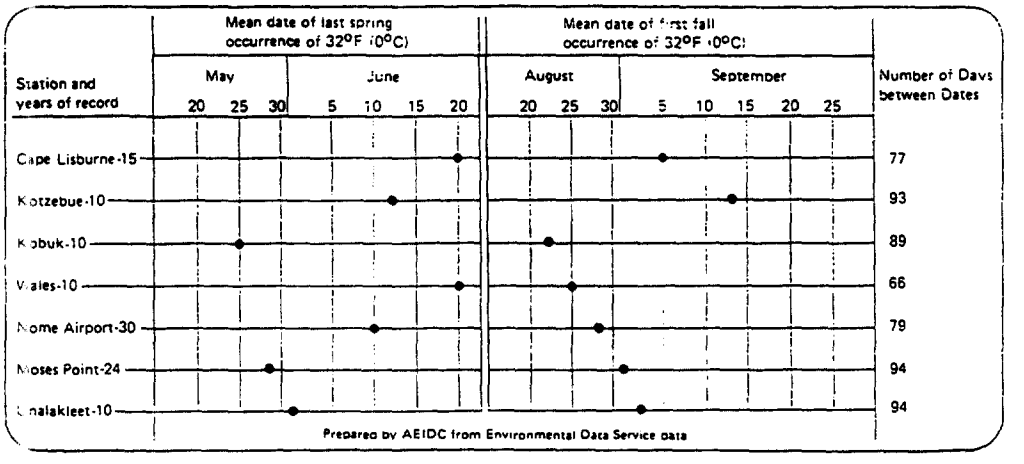
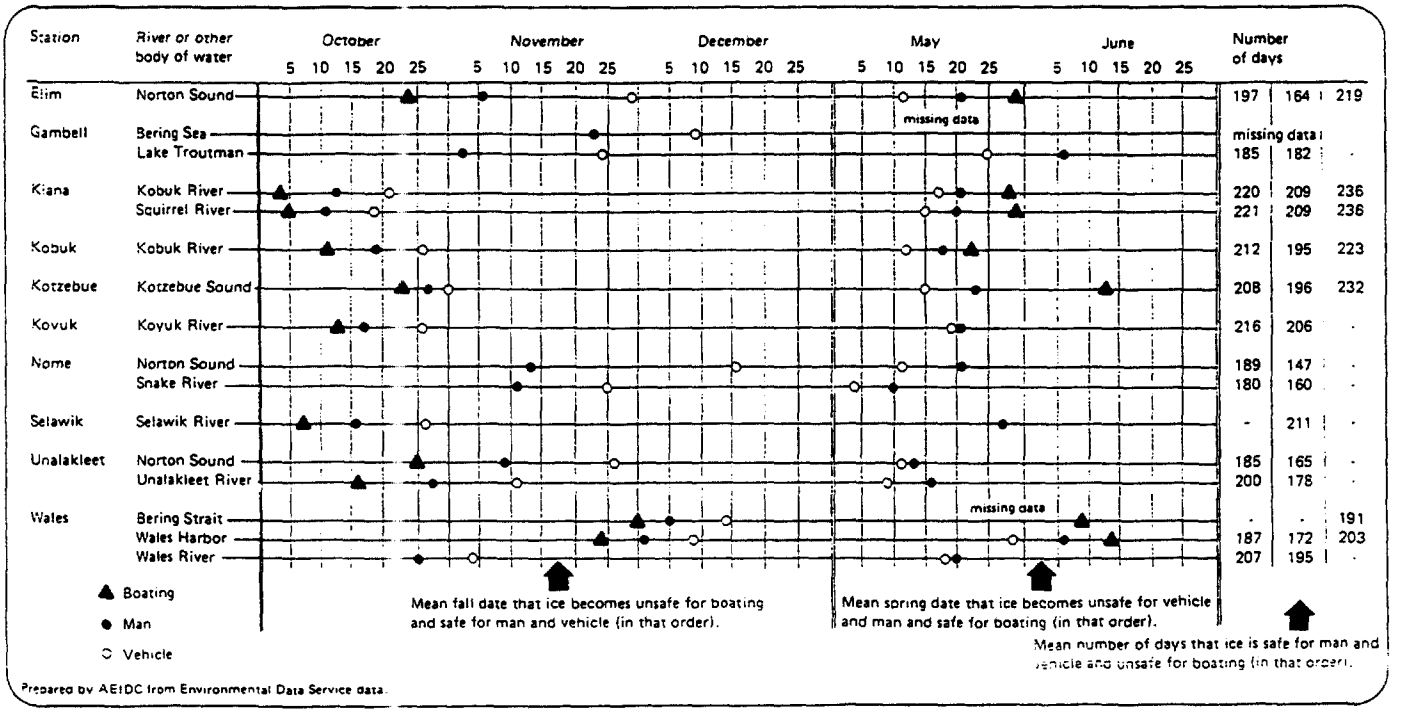


Figure 35
Freezeup and Breakup Dates for Selected Rivers and Other Water Bodies



and after melting, leaves behind irregular mounds or ridges of sediments extending along the beach as much as several miles. Some of those with ice cores may originally be up to six feet high but shrink to two feet when the core melts. Others have been observed up to five feet high with no ice cores.

Deposits are often destroyed by the first storm waves. In some cases they persist by being pushed above the normal reach of waves, by growth of the beach, or because close pack ice retards wave erosion. Deposition from ice push probably never amounts to more than 10 percent of the sediments above sea level, generally ranging between 1 and 2 percent. Ice carries sediments and drops them when it melts, possibly accounting for up to 3 percent of the deposition near shore.

Though not quantitatively significant, sand and pebbles up to 0.4 inches long have been observed floating freely in the sea. Only flat, tabular particles float; spherical particles sink. The floating particles commonly gather in patches or rafts, although they also float singly. Surface tension has been described as the mechanism of floating. At most, only 20 to 25 pounds of material per hour has been observed passing any given point.

Applied Geology

Geologic maps serve as a basis for describing the origin, age, and physical character of earth materials; they also can show the application of geologic knowledge to man's use of the land. Applied geology maps are designed to show many different land characteristics, such as type and distribution of foundation material, gravel resources, mineral resources, and location of potential energy sources. The applied geology chart (Figure 70), when used in conjunction with the geologic map (Figure 65), reflects the basic engineering characteristics of each geologic unit. It can serve as a guide to planners and developers as to what types of problems to expect and what types of investigations should be carried out to insure safe and economical development.

The chart or the geologic map is not intended to serve as a source for estimating reserves or detailing the precise uses for which particular deposits are most suited. More detailed site investigations, such as are found in studies done by LaBelle (1973, 1974), Davidson, Roy and Associates (1959), and Lounsbury and Associates (1973), are required. The chart and map serve primarily as guides so planners can determine which areas deserve further consideration and study.

Special Geologic Conditions Affecting the Arctic Region

Permafrost and erosion are primary geologic phenomena to be considered in the development of the Arctic Region. Their effects have far-reaching impact on man's occupancy and use of land. Earthquakes and volcanism are insignificant processes in the Arctic Region.

Figure 71 shows the seismic zones of Alaska as interpreted by the U.S. Army Corps of Engineers. The only seismic activity reported in the Arctic between 1955 and 1964 occurred in the Chukchi Sea, where four earthquakes with a magnitude greater than 6.0 were recorded.

Figure 70 Generalized Engineering Characteristics of Surficial Deposits

Qs, Qf – **Sand and gravel—coarse-grained deposits**
- Good foundation material
- Relatively easy to excavate
- Generally well-drained
- Source of sand and gravel for construction
- Not frost susceptible

Qm – **Mixed coarse- and fine-grained deposits—Till**
- Generally high in silt content, especially near surface
- Generally poor foundation material, except where locally high in gravel and sand content
- Poorly drained
- High in ice content, especially in silts
- Often becomes unstable if thawed; may cause differential settlement of foundations
- Difficult to excavate
- Frost susceptible

Qc, Qe – **Sand—medium-grained deposits**
- Fair to good foundation material
- Relatively easy to excavate
- Generally well-drained
- Source of sand for construction
- Not seriously frost susceptible

Qe, Ql – **Silt and Clay—fine-grained deposits**
- Generally poor foundation material
- If thin, it can be removed or filled over prior to construction
- Poorly drained
- Unstable during earthquakes; may cause landslides along bluffs or differential settlement.
- High ice/water content
- Will become unstable if thawed; may cause differential settlement of foundations
- Generally poor fill material
- Frost susceptible

– **Peat—organic surface material**
- Poor foundation material
- Poorly drained
- Commonly removed or filled over prior to construction
- Contains high percentage of ice/water

– **Bedrock**
- Generally suitable for foundations
- Somewhat difficult to excavate
- Hard and resistant but commonly fractured
- Generally steep slopes in mountains make development difficult
- Can be quarried and crushed for construction material

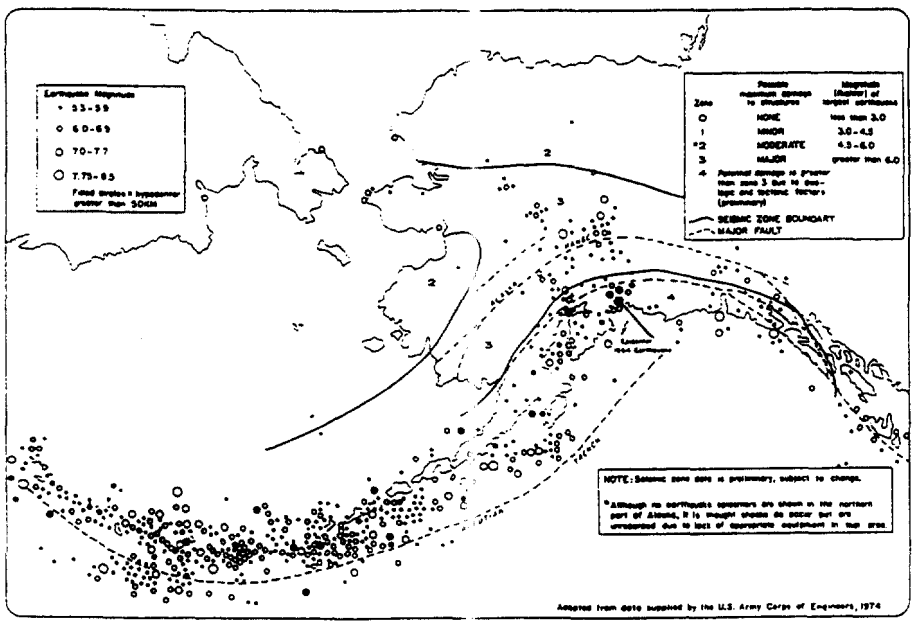


Figure 71 Seismic Zone Map of Alaska

Appendix E

Engineering Considerations

The widespread occurrence of permafrost requires special engineering considerations for the design, construction, and maintenance of structures and facilities. Permafrost degradation is primarily related to the insulation qualities of the surface layers and the ice content of the frozen ground beneath. Sensitivity is great in the north, where the surface organic layer is thinnest and soil ice content is highest.

The engineering limitations associated with permafrost are not the same for rock type or sediment. Frozen bedrock with ice in its crevices will present few, if any, construction or maintenance problems. Well-drained, coarse sediments such as gravel, may contain little or no ice, even though they are frozen. Here again, few, if any problems occur. Although saline water in sediments may be below 32 degrees F (0 degrees C), it may remain liquid because of its lower freezing point.

Major engineering problems arise when permafrost occurs in poorly drained, fine-grained sediments. These sediments contain large amounts of ice. Disruption of these deposits results in a change in the thermal balance which causes the ice to melt (Figure 77). Thawing produces excessive wetting and plasticity which makes the sediments unstable. This results in icings, frost heaves, slumping and subsidence of the ground surface, and in many cases, the sediments flow laterally or downslope. During winter the active layer freezes downward from the ground surface to the permafrost table. In fine-grained materials especially, the formation and resulting expansion of ice causes frost heaving. Thawing of permafrost and cycles of freezing and thawing in the active layer causes extensive damage to highways, railroads, airstrips, and other facilities. Computer models are being used to predict the interaction of permafrost and man-made structures. This may reduce construction and maintenance costs.

Lack of sufficient insulation below this utilities building at Barrow allowed heat from the structure to thaw the permafrost below. Slumping resulted in severe damage to the structure.

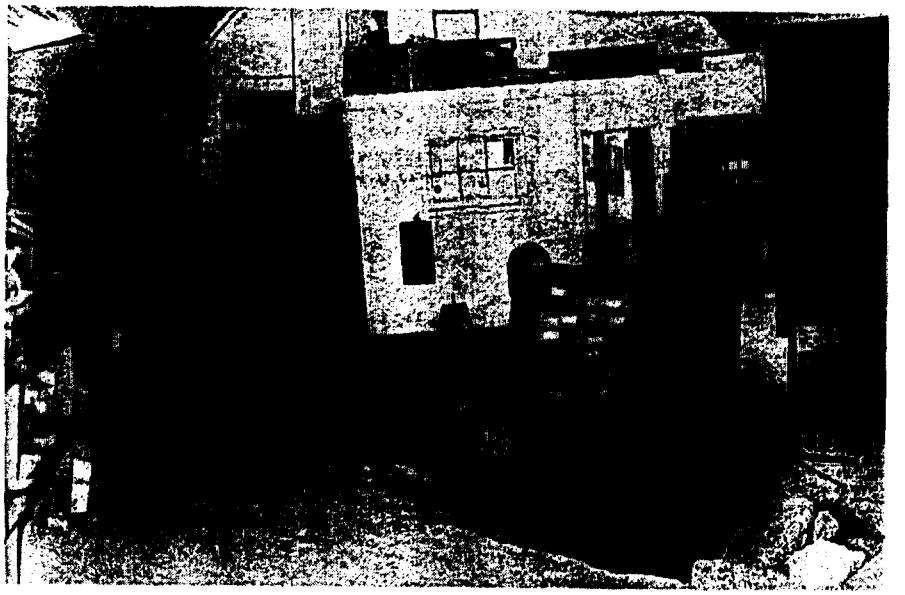


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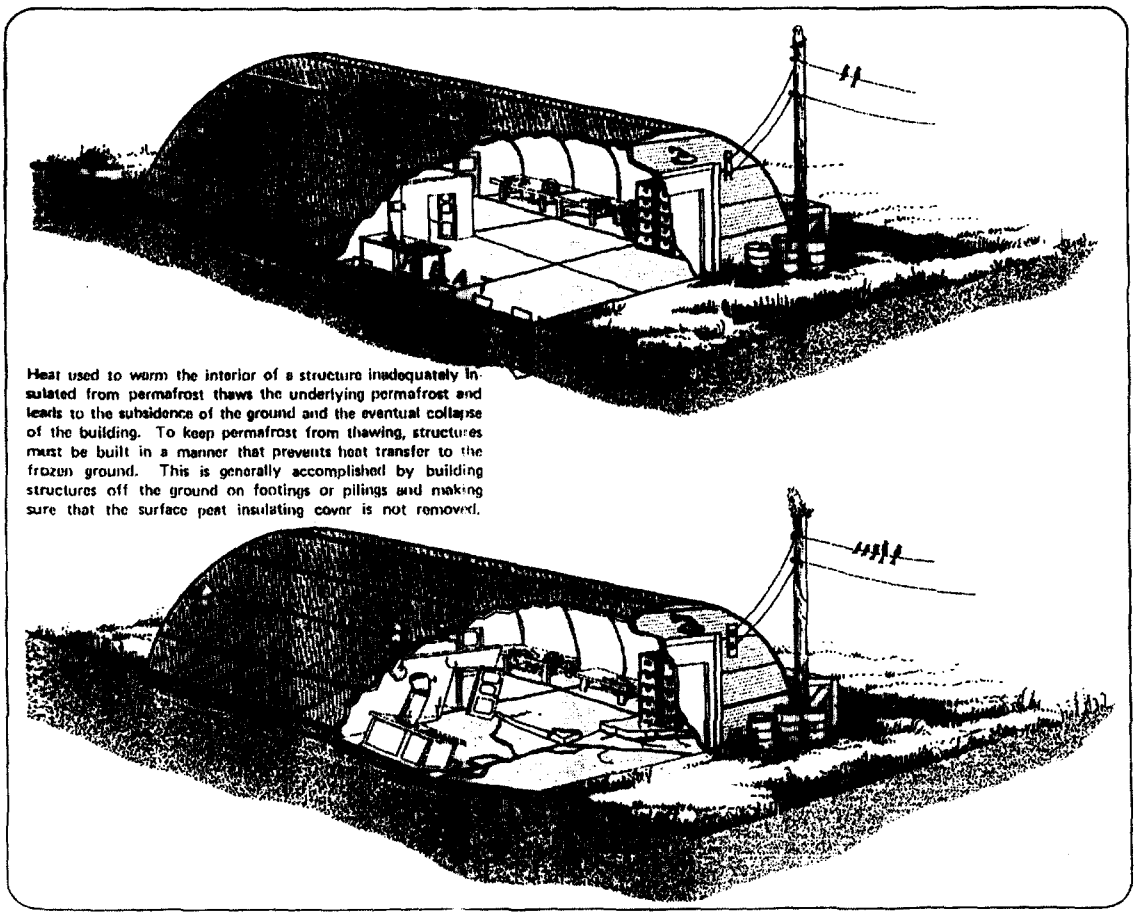
Figure 77 Thaw-Slumping in Permafrost Below a Heated Building



Heat used to warm the interior of a structure inadequately insulated from permafrost thaws the underlying permafrost and leads to the subsidence of the ground and the eventual collapse of the building. To keep permafrost from thawing, structures must be built in a manner that prevents heat transfer to the frozen ground. This is generally accomplished by building structures off the ground on footings or pilings and making sure that the surface peat insulating cover is not removed.

Appendix E