SUSITNA HYDROELECTRIC PROJECT

FIELD DATA
COLLECTION AND PROCESSING
VOLUME 1

FEBRUARY 1982

Prepared by:

R&M CONSULTANTS, INC.

Prepared for:

ACRES

ALASKA POWER AUTHORITY

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SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING
VOLUME 1

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SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING

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1 - INTRODUCTION

The objective of the Hydrologic Field Data Collection and Processing was to supplement available streamflow and climatologic data within the Susitna River Basin. Specifically, the existing data base was augmented to meet the requirements of the FERC license application and to fill other data gaps that were present in the flow forecasting network for future project operation.

Collection and processing of the field data was performed by R&M Consultants and reviewed by Acres American. Portions of the field effort were done cooperatively with other data collection agencies, such as the U.S. Geological Survey, the U.S. Soil Conservation Service, and the Alaska Geophysical Institute, as is detailed in the following sections.

This Closeout Report presents an overview of the data-collection program and a general description of the field work undertaken relative to each of the hydrologic parameters. Each section of the main report briefly discusses what was done and why with reference to each parameter. The five appendices detail the locations of the data collection sites (Attachment A), the equipment and techniques used (Attachment B), the dates of field observations (Attachment C), pertinent letters and comments received (Attachment D), and they also give summaries of the data collected (Attachment E). Attachment F presents summaries of historical data collected through the present by other agencies.

The numbering system used herein deserves some explanation. The main sections of the report are identified by Arabic numerals, 1 through 14. The attachments are named by letters, as described above. Ordering of figures and tables in Attachments A, C, and D is fairly straightforward, but figures, tables and subsections in Attachments B and E follow a specific system. The first letter of each (B or E) identifies the attachment, which is followed by a number to denote the applicable parameter. (The table of contents lists parameters and sections).

The final number is merely a sequence number. Thus, Table B.5.2 would be the second table for Section 5 (Climate) of Attachment B. Finally, Attachment F presenting historical data collected by other agencies proceeds sequentially, with no numbering relationship to Attachments B or E, as detailed in the contents.

2 - SUMMARY

The hydrologic field data collection and processing program consisted of observation, sampling, and measurement of eleven basic parameters: streamflow (continuous), streamflow (partial or miscellaneous), water quality, sediment discharge, climate, atmospheric icing, snow depth and density, glacial characteristics, snow creep, river ice processes, and evaporation. The purpose of the present effort was to add to the previous data that had been collected by the U.S. Geological Survey (USGS), the National Weather Service, the U.S. Soil Conservation Service (SCS), the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and various other state and federal agencies.

The extent of the data collection program under the present study is summarized below for each major hydrologic parameter.

Streamflow (Continuous). A continuously-recording manometer streamgage was installed in the Susitna River about two miles downstream from the proposed Watana Damsite. The installation was made after spring breakup in 1980, and the recorder was made operational in early July. Stage records were obtained through freeze-up in 1980 and again in 1981 for the open-water period. Eight discharge measurements were made at the site to permit construction of a stage-discharge rating curve.

Streamflow (Partial). Crest-stage recorders were established at seven sites in the Devil Canyon-Talkeetna reach, three in the Deadman Creek-Devil Creek reach, and one in between these two reaches. Water surface elevation data were needed to calibrate the HEC-2 hydraulic model for the two reaches, so sequential observations were made at various flow levels to determine stage-discharge relationships. Data were also collected at three staff gages along the river, one on the extreme upper river at the Denali Highway bridge and one downstream of each of the proposed damsites.

Water Quality. A water quality sampling and analysis program was initiated at two sites: the USGS gaging stations "Susitna River near Cantwell" and "Susitna River at Gold Creek". Some parameters were measured directly in the field, while most concentrations were determined on samples brought back to Anchorage for laboratory analysis. The sampling period extended from the summer of 1980 to the winter of 1981-82. Most sampling times were selected to coincide with certain hydrologic events (i.e. low flow, freeze-up, break-up, rising/falling limbs and peak of a flood hydrograph, and ice cover), in order to try to estimate these conditions' effects on the water chemistry.

In addition, a continuous monitor was installed in the fall of 1980 one mile downstream from the proposed Watana Damsite. Water quality parameters recorded were water temperature, pH, dissolved oxygen concentration, oxidation-reduction potential, conductivity, and temperature-corrected conductivity. The plan had been to observe changes in the parameters with time and with discharge level. Several operational problems were encountered with the equipment, primarily related to operation through the winter and break-up periods.

Sediment Discharge. Suspended sediment samples were collected at the same sites and times as were water quality samples. A depth-integrating sampler was used at several points across the cross-section at each of the two locations. In addition, a bedload-sampling program was begun in 1981 in cooperation with the USGS. Sampling was done at one site each on the Chulitna and Talkeetna Rivers and above and below the Chulitna-Susitna-Talkeetna confluence on the Susitna River. Each of the four sites was visited three times, at various flow levels, to estimate the ranges in bedload.

Climate. Recording climatic stations were installed in the spring and summer of 1980 at six sites throughout the Upper Susitna Basin. One was located in the midst of the upper glaciers, one somewhat downstream in the Denali Highway area, one in the southeast corner of the basin, one further west in the Kosina Creek drainage, and one near each of the proposed damsites. Data parameters recorded on magnetic tape at 15-minute intervals were air temperature, average wind speed, resultant wind direction, relative humidity, cumulative precipitation, solar radiation intensity, and peak wind gust speed.

Atmospheric Icing. Freezing rain and in-cloud icing data were sought for two locations near the proposed transmission line corridor to estimate the severity of icing conditions to be expected on the proposed line. Heavy-duty transmission cables and horizontal steel plates were installed near the proposed Watana Damsite and near Denali to permit measurement of accumulated ice on them. A recording icing detector was also installed near Watana to measure ice build-up in general.

Snow Depth and Density. Snow surveys were undertaken in the basin cooperatively with the SCS, who has been managing the program statewide for years. Existing aerial markers were observed jointly, new markers and snow courses were established and observed by R&M, and the data for all were assimilated and reported by SCS. The new markers were all primarily on and around the major basin glaciers - West Fork, East Fork, and Susitna Glaciers.

Glacial Characteristics. The contributions of the major glaciers in the basin was sought to be determined to evaluate their effect on the flow regime of the river. Mass balance, glacial velocity and dynamics, and sediment contribution were the chief parameters investigated. As noted previously, climate and snow data were also collected in close proximity to the glaciers.

Snow Creep. The importance of snow creep forces on transmission line towers in the region was investigated by installing two simulated transmission towers on movable plates on steep slopes. The maximum force of the snow on the towers was recorded by a maximum-reading indicator. Generally light snow conditions in the basin and late winter installation in the 1980-81 winter cause doubt as to the representativeness of the data obtained from that period.

River Ice Observations. Experience with hydroelectric projects elsewhere has emphasized the importance of careful study of ice conditions and processes for engineering works in arctic and subarctic climates. Field observations were made during freeze-up in the fall of 1980, during the continuous ice-covered period in the winter, and during break-up in the spring of 1981. Aerial photographs were taken to document ice accumulation locations and dates, progress of ice cover growth was recorded, and water levels and velocities were observed at selected sites at certain times.

Evaporation. An evaporation pan was installed near the proposed Watana Damsite in April of 1981. Observations were made of daily pan evaporation so that an estimate could be made of evaporation to be expected from the two proposed project reservoirs.

All the known existing hydrologic data (collection periods, locations, and specific parameters observed) are documented in the R&M Field Data Index (1982). The index has been updated twice annually - the most recent revision is dated January 1982.

Data collection sites are shown in Attachment A to this report. Locations of both active and historical sites are shown. Station names and other particulars may be found in the Field Data Index, referenced above.

Attachment B describes the specific equipment and measurement techniques used for field observations of each type of parameter. Laboratory methods and office methods for data reduction, where appropriate, are also given.

The record of site visits and periods of record for the continuous recorders are presented in Attachment C, the Field Observation Log.

Correspondence pertaining to instrument selection and data collection site locations, received from the Alaska Power Authority, Acres, other subcontractors, and other government agencies, are reproduced in Attachment D.

Attachment E contains summaries of all the field data collected by the current study effort, itemized by parameter type. Finally, Attachment F is a compilation of hydrologic and climatogic data collected by other agencies through the present date.

3 - STREAMFLOW (CONTINUOUS)

The U.S. Geological Survey has established three stream gaging stations on the Upper Susitna River (i.e. above Talkeetna). These are at Denali, Vee Canyon ("Susitna River near Cantwell") and Gold Creek. The latter two sites are separated by approximately 80 river miles, and it is between these two sites that the Devil Canyon and Watana projects are proposed. A new continuous streamgage was set up just downstream of the proposed Watana damsite. This site was chosen to provide a more precise estimate of discharge at the actual damsite. The station is also well-located to continue gaging of streamflow if the project is built (i.e. record discharge from the Watana Reservoir). The gaging methods used are described in Attachment B.1, and the streamflow data are contained in Attachment E.1.

4 - STREAMFLOW (PARTIAL)

Partial streamflow records consist of infrequent water surface elevation observations made at various locations. In the current program, data were obtained at two types of installation: crest-stage recorder (also called crest gage) sites and staff gages. The crest gages were devices designed to record the highest water level at a site since the gage was last reset. Staff gages consisted of calibrated marks where the water level at the time of reading could be observed. The crest gage installations and specific staff gages are described in Attachment B.2, and data are summarized in Attachment E.2.

Crest-stage recorder sites were selected primarily to provide water surface elevation data through two river reaches for use in calibration of the HEC-2 Water Surface Profiles computer program. One reach was from Devil Canyon to the Susitna-Chulitna confluence, and the other was from Devil Creek to Deadman Creek (around the Watana Damsite). The recorder called Devil Canyon Upper, located about two miles upstream of the proposed Devil Canyon Damsite and between these two reaches, was installed to provide site-specific information near the damsite for construction and cofferdam planning.

Staff gages were installed at three locations to provide information on stage-discharge relationships in the tailrace areas of the two proposed dams and to provide estimates of streamflow near the upstream end of the basin during the summer.

5 - WATER QUALITY

A water quality program was initiated by R&M Consultants in 1980 to define baseline parameters on the Susitna River. This basic information was to aid the reservoir, fisheries, and instream-flow studies for Phase I of the Susitna Hydroelectric Project.

The data collection program was established in conjunction with an environmental consultant, L.A. Peterson and Associates. The program consisted of a continuous water quality recorder situated about one mile below the proposed Watana Damsite and a sampling schedule at Gold Creek and Vee Canyon, designed to supplement the U.S. Geological Survey data acquisition program. This sampling schedule is based on specific streamflow events in order to determine the range of variations in water quality parameters.

The sampling sites were selected to represent water quality conditions flowing into (Vee Canyon) and out of (Gold Creek) the proposed reservoir system. The baseline data would be extended at each site since the U.S.G.S. had sampled historically.

Those parameters requiring instantaneous measurement were determined on site in the field. At the same time, samples were collected, preserved and shipped on ice to Anchorage for laboratory analysis.

A complete description of specific sampling events and procedures is included in Attachment B.3. Summarized data tables are presented in Attachment E.3.

6 - SEDIMENT DISCHARGE

A study was implemented to gain information on the sediment regime of the Susitna River in order to assess the impact of flow regulation and sediment trapping by the Susitna Hydroelectric Project. The sites sampled were near inflow and outflow points of the proposed project.

Suspended sediment samples were collected during each water quality sampling event. The sampling schedule was designed to include a wide range of discharges so that a discharge/sediment transport relationship could be established.

Depth-integrated samples were collected at Vee Canyon and Gold Creek. Suspended sediment analyses were conducted by a certified laboratory in Anchorage. For each sample the laboratory reported suspended sediment concentration in mg/l, and for three preselected samples, a particle distribution was analyzed and reported as a percentage by size.

Bedload samples were collected in 1981 to further define the coarse sediment transport. In cooperation with the U.S. Geological Survey, samples were obtained at the gaging stations at Sunshine and Gold Creek on the Susitna River. Additional samples were collected in the Talkeetna River and the Chulitna River. The U.S.G.S. was responsible for all sample analysis and reporting of data.

Detailed data collection procedures are outlined in Attachment B.4. Attachment E.4 contains data tables for suspended sediment and bedload discharges.

7 - CLIMATE

The Upper Susitna River basin contains over 6000 square miles of diverse climatic regions: high glaciated mountains; the flat-lying, poorly-drained terrain characteristic of the Tyone River Valley; and the high plateau area that makes up much of the basin. In this entire upper basin there existed no operating climatic stations. Outside of the upper basin a few climate stations exist from which a general climatic history of the basin can be approximated but none are truly representative of the basin.

In order to provide accurate meteorological data for hydrologic work, wildlife studies, and engineering design, six weather stations were installed in the Upper Susitna Basin during the spring and summer of 1980. Their locations, descriptions, and histories are given in Attachment B.5, and the recorded data from the stations are summarized in Attachment E.5.

8 - FREEZING RAIN AND ICING

Instrumentation for measuring freezing rain and in-cloud icing conditions was installed at two sites, Watana Camp and Denali. A set of cables was used to model icing on transmission lines, and horizontal steel plates were used to simulate conditions that could be expected for freezing rain accumulation on transmission line towers. An electronic ice detector was later added at Watana Camp to give a more accurate and continuous reading of icing condition occurrence.

The Watana Camp and Denali locations were chosen due to their proximity to proposed power transmission routes and also due to the convenient setting near climate stations. It was also intended that placing the instrumentation close to Watana Camp would permit more frequent observation by camp personnel.

The installations used for the measurements are described in Attachment B.6, and the observations are summarized in Attachment E.6.

9 - SNOW SURVEYS

Much of the water in the Susitna basin originates as snowfall. This snowfall is especially concentrated in the high mountains at the headwaters of the basin. Since the runoff from precipitation as snow does not normally occur until spring melt, knowledge of snow pack allows estimates of spring floods in advance of their occurrence.

The Soil Conservation Service administers the snow courses and snow surveys that are in the Susitna River Basin. Prior to the present study, there was a scarcity of data on many parts of the basin, including especially the high mountain areas, where large amounts of snowfall were expected. R&M Consultants, cooperating with the S.C.S., established 21 sites at various locations (described in Attachment E.7) and surveyed these each month between January and May to determine snow depth and water content. The sites were selected with field input from the S.C.S. Snow Survey Supervisor who offered advice on locations that would best fill gaps in the basin data, as well as site-specific suggestions to try to avoid installations in unrepresentative locations.

The field data collection techniques are described in Attachment B.7, and the data are summarized in Attachment E.7.

10 - GLACIAL OBSERVATIONS

The purpose of this study was to conduct a reconnaissance level investigation of the primary glaciers in the Upper Susitna Basin. Assessments were made to determine whether significant changes in water and sediment yield could occur, to determine if potential floods from glacier-dammed lakes were possible and to develop a long-term glacial observation and study program oriented toward hydropower development.

The Geophysical Institute of the University of Alaska provided consulting services for this study. The Geophysical Institute was responsible for all data reduction, analyses and reporting with respect to velocity surveys, sediment contribution analysis, mass balance studies, volume analysis and glacier temperature determinations. R&M Consultants provided logistic support, field support, suspended sediment data, and low-altitude snow survey data and conducted all velocity surveys and gradient determinations.

Procedures involved in these studies are described in Attachment B.8.

11 - SNOW CREEP

Instrumentation for measuring the effect of snow creep pressure on transmission line towers was installed by R&M Consultants during the winter of 1980-81. Two locations were chosen along the proposed transmission line route, a south-facing slope near Tsusena Butte above Watana Camp and a north-facing slope near Devil Canyon. The two sites were selected based on proximity to the proposed route, accessibility from the damsite areas for ease of measurement, location in expected heavy-snow areas, and location on creep-prone slopes.

The field installations are described in Attachment B.9, and the observations are summarized in Attachment E.9.

12 - RIVER ICE OBSERVATIONS

Observations were made at different times and locations of the various ice processes acting in the Susitna River. Freeze-up, the winter ice cover, and break-up were all documented in detail. Areas of primary interest were the vicinity of the two proposed damsites and the reach between Devil Canyon and Talkeetna, with less concern below the Talkeetna confluence and in the extreme upper basin.

The importance of ice observations (and analysis under subtask 3.06) was to assist with an assessment of post-project and during-construction effects on the ice regime and also effects of the ice on the project construction and operation. Thus, the damsite areas were studied carefully, as were developed areas downstream (i.e. Talkeetna, the Alaska Railroad, other small communities).

Attachments B.10 and E.10 give descriptions of the observation program itself and the general results of the observations, respectively.

13 - EVAPORATION

The evaporative losses from the proposed Watana and Devil Canyon reservoirs are influenced by several factors, primarily solar radiation, air temperature, relative humidity and wind. These same factors determine rate of evapotranspiration from land and evaporation from a pan. Thus, measurement of pan evaporation provides an index of the total effect of meteorological conditions on lake evaporation.

There are few evaporation pans in Alaska. The two closest to the Susitna watershed are at McKinley Park, with 14 years of data, and at Matanuska Agricultural Experiment Station, with 30 years of data. McKinley has an interior climate greatly influenced by the Alaska Range. The climate at the Matanuska station, located 40 miles northeast of Anchorage in Palmer, is influenced by the proximity of the Cook Inlet.

In order to obtain an estimate of actual evaporation in the Susitna watershed, an evaporation pan was installed near the proposed Watana damsite in May 1981. The data collection techniques are described in Attachment B.11, and the data are summarized in Attachment E.11.

14 - REFERENCES

Harrison, William D. and R&M Consultants, Inc. Susitna Basin Glacier Studies - 1981. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Fairbanks, Alaska, and Anchorage, Alaska. December.

Meyer, Robert. (1978). Snow creep investigations in Southeast Alaska. In Applied Techniques for Cold Environments, Cold for Regions Speciality Conference, Anchorage, Alaska, May 1978. Published by American Society of Civil Engineers, New York, New York.

R&M Consultants, Inc. (1981a). "Evaporation in the Susitna Hydroelectric Project. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. December.

_____. (1981b). Hydrographic surveys. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. October.

_____. (1981c). Ice observations. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. August.

_____. (1981d). Preliminary channel geometry, velocity and water level data for the Susitna River at Devil Canyon. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska, April 22, 1981.

_____. (1981e). Summaries of published USGS and NWS data from Susitna Basin stations through 1981. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. December.

_____. (1981f). Water quality annual report. Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. December.

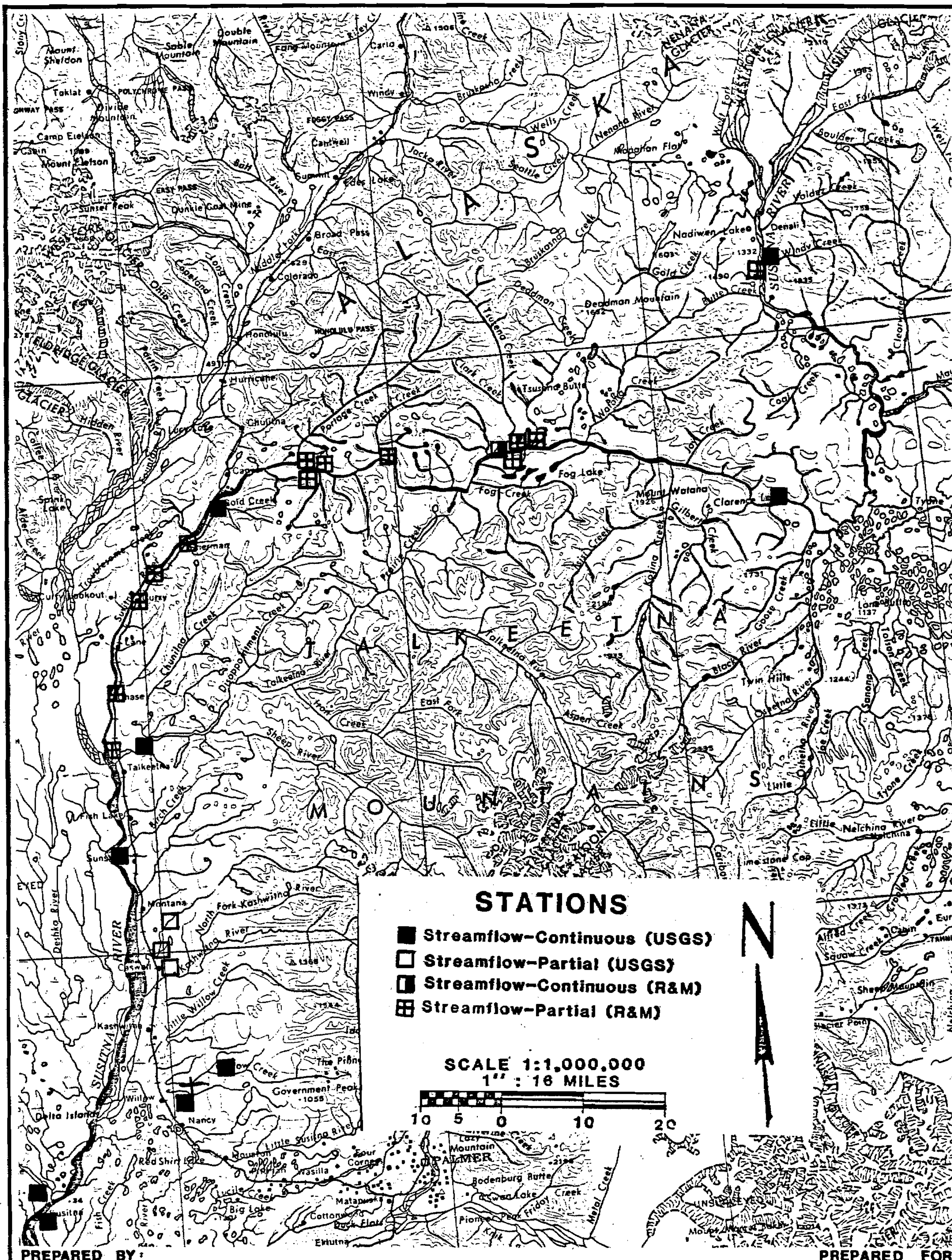
_____. (1981g). Water quality procedures manual (revised) Part of Susitna Hydroelectric Feasibility Report. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. December.

_____. (1982). Hydrology field data index. Prepared for Acres American, Inc., Buffalo, New York. Anchorage, Alaska. February.

United States Department of Agriculture, Soil Conservation Service (1981). Water Supply Outlook. February - June and also same period in 1980. Anchorage, Alaska.

ATTACHMENT A

LOCATIONS OF DATA COLLECTION SITES



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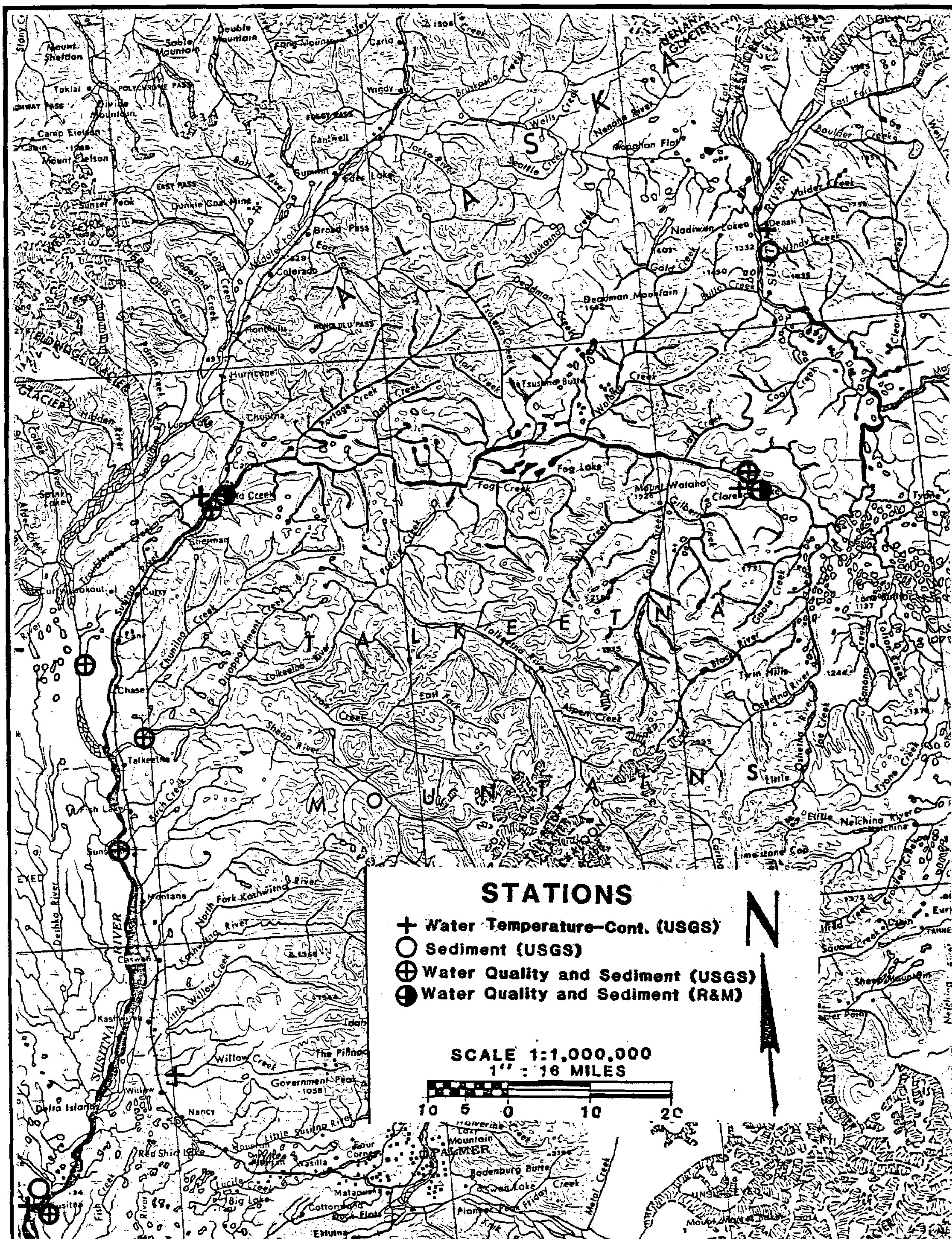
CURRENT DATA COLLECTION
STATION SITES

FIGURE A.1

ACRES



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PREPARED FOR:

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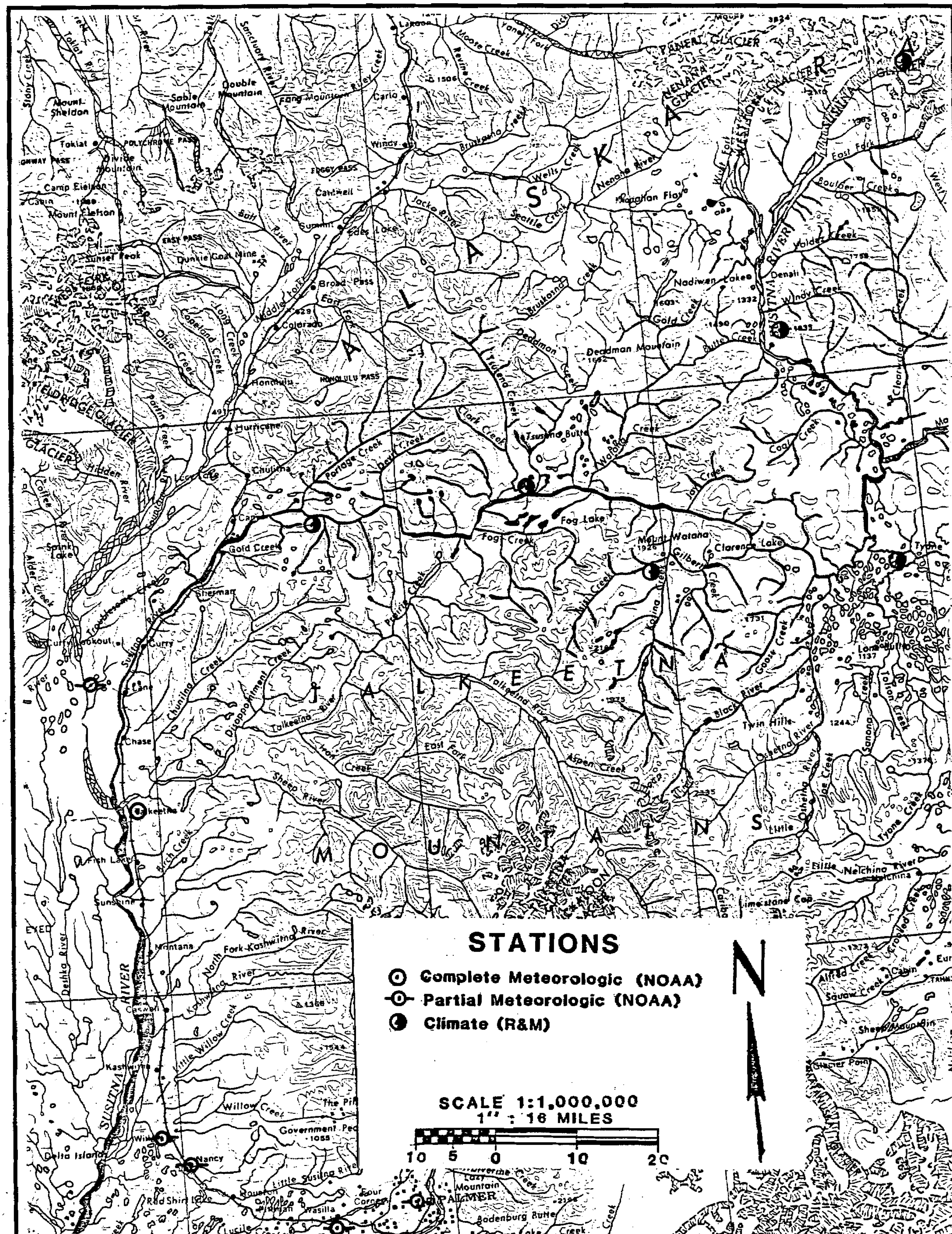
CURRENT DATA COLLECTION STATION SITES

FIGURE A.2



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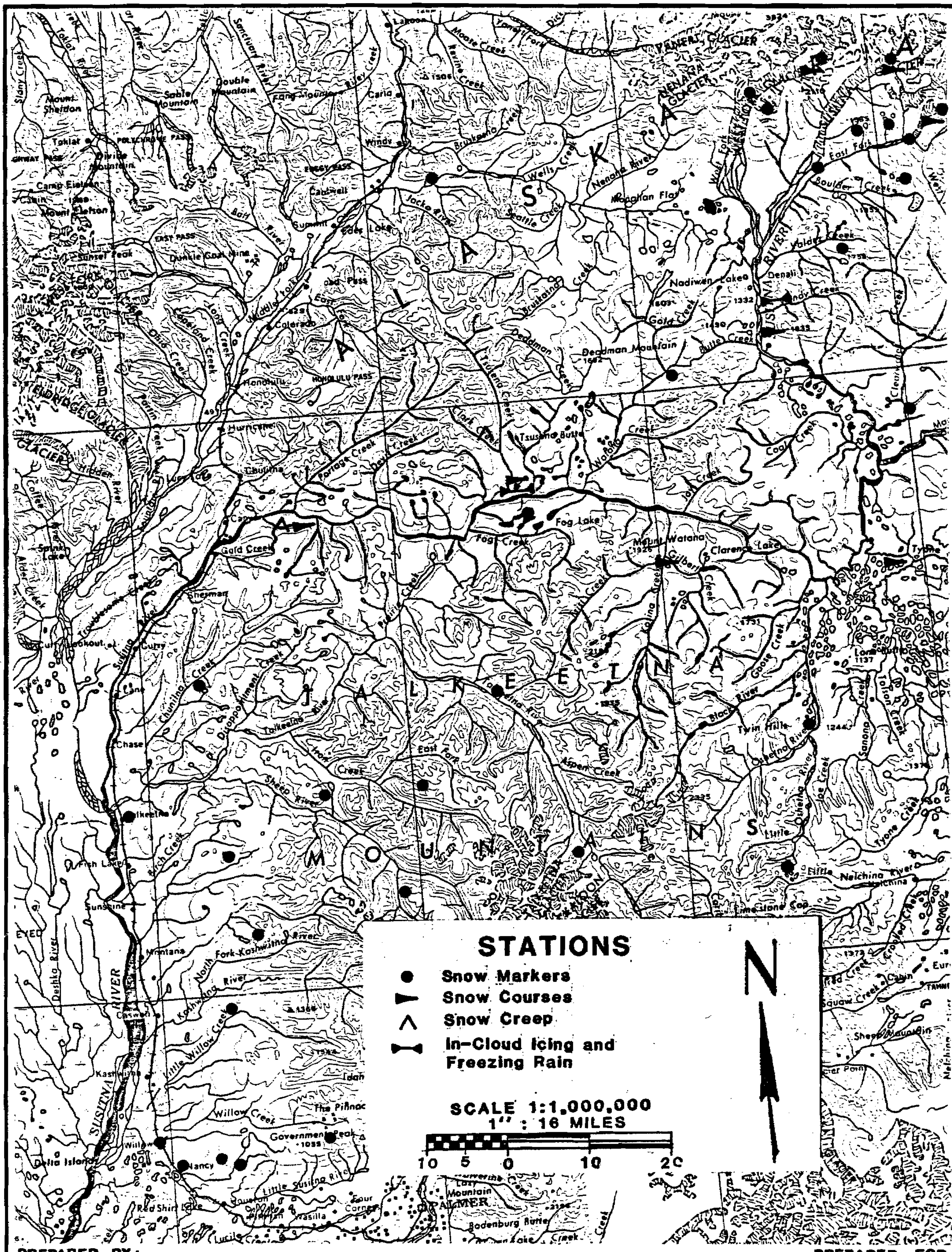
CURRENT DATA COLLECTION
STATION SITES

ACRES

FIGURE A.3



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CURRENT DATA COLLECTION
STATION SITES

FIGURE A.4

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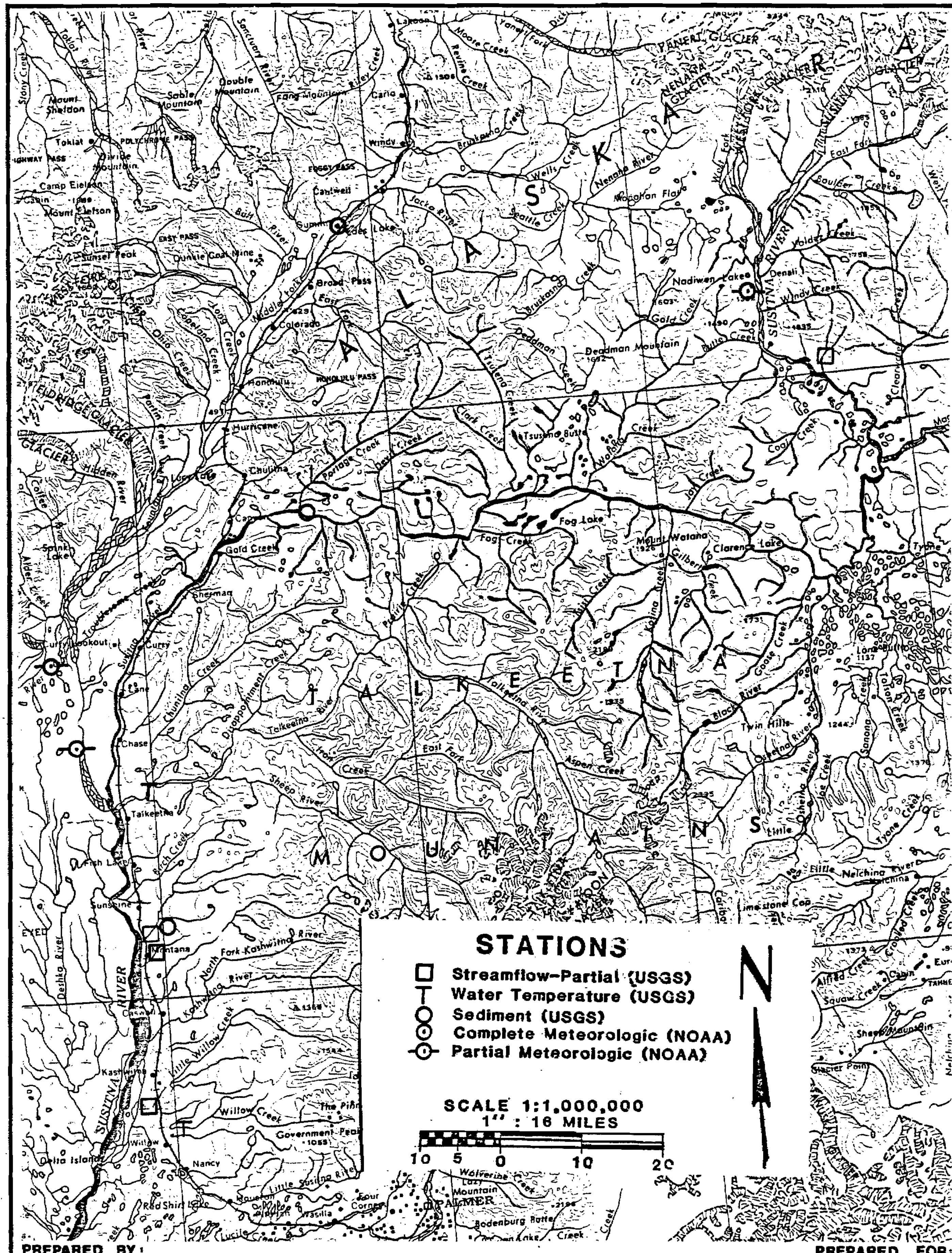

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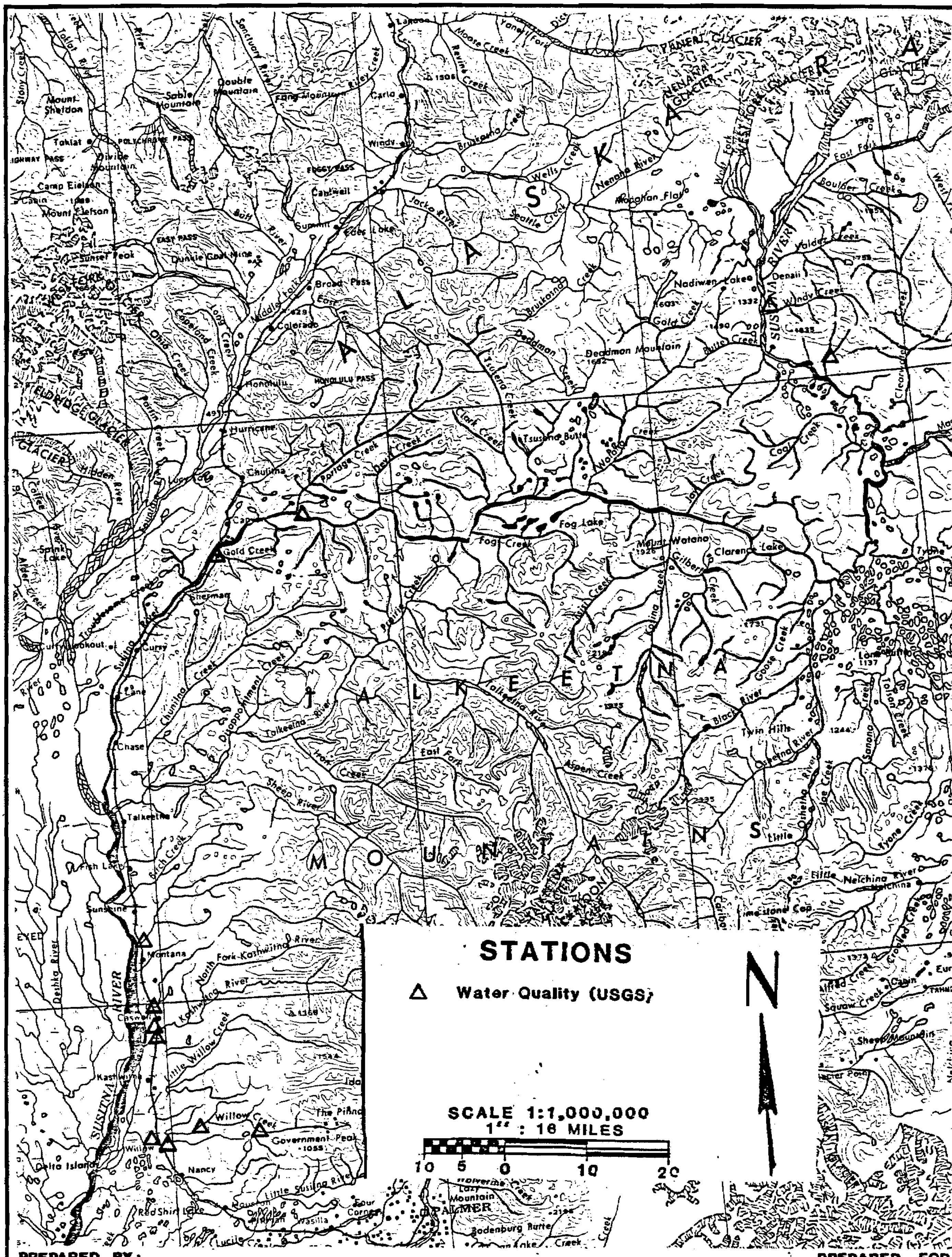
HISTORICAL DATA COLLECTION STATION SITES

(NO LONGER CURRENT)

FIGURE A.5



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HISTORICAL DATA COLLECTION STATION SITES

(NO LONGER CURRENT)

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FIGURE A.6

ATTACHMENT B

DATA COLLECTION EQUIPMENT
AND TECHNIQUES

B.1 - Streamflow (Continous)

Susitna River near Watana Damsite.

Location - On right bank 0.3 miles upstream from Tsusena Creek, 4.3 miles downstream from Deadman Creek, and 2.0 miles downstream of the proposed Watana Dam centerline. Talkeetna Mountains (D-4) quad. map. Gage house is in trees just above vegetation line of bank.

Established - June 1980 by R&M Consultants.

Drainage Area - 5,180 square miles, from topographic map.

Gage - Leupold & Stevens A-71 Water Stage Recorder coupled to manometer gage. Housed in white 4 x 4 x 8-foot wooden shelter. Bubble tube is housed in 2-inch galvanized pipe.

Reference Marks - TBM-1 is paint mark at downstream corner of large rock at right bank of river 30 feet upstream from gagehouse. Elevation 1444.72 feet M.S.L.

TBM "LOST" is spike in upstream side of 14-inch spruce tree 50 feet upstream of gage house. Elevation 1445.41 feet M.S.L.

Channel - Channel is straight above and below gage site. Banks are gradually sloping on both sides of river. Bed material is gravel and cobbles.

Discharge Measurements - All open-water measurements are made at the gage site using a boat. A 1/4" cable tag line is strung across the river at this point. It is painted yellow at 10-foot intervals with white paint at the 100-foot points. River is 428 feet wide at high water.

Winter Flow - Flow drops off quickly in October or November. There is usually complete ice cover at the site during winter. Winter measurements are made at this site.

Accuracy of Records - Believed good, based on uniformity of cross-section and fairly consistent stage-discharge rating curve.

The Watana streamgage consists of a servo manometer assembly and a strip-chart recorder. In this system nitrogen gas is bubbled through a small tube and discharged through an orifice at a fixed elevation in the river. The pressure in the tube is equal to the head of the water above the orifice. This pressure is converted to a stage of the water which is recorded on the water stage recorder. The major advantage of this setup is that it allows the instrumentation to be safely located away from the river. The river stage was recorded in 1980 from July 11 to December 2, when the orifice was removed from the ice. An attempt was made to record 1981 breakup flows, but this resulted in the orifice being carried away by ice. No data were obtained until after breakup when a new orifice was replaced on May 21, 1981.

To convert stage data to discharge a rating curve was developed using eight measurements made during 1980 and 1981. These measurements ranged from 5820 to 39,725 c.f.s., producing a well-defined rating curve between these limits.

Open-water discharge measurements were made using a standard Price Type A current meter suspended from a boom fixed to the boat and operated by a B-56 reel. For winter stream gaging, a Marsh-McBirney current meter was used. The conventional current meter tend to ice up but the Marsh-McBirney meter has no moving parts, and thus eliminates this problem. Measurements were made through the ice at the same location as open-water measurements.

B.2 - Streamflow (Partial)

B.2.1 - Crest-Stage Recorders

Crest-stage recorders were established at ten sites on the Susitna River, six on the lower river below Devil Canyon, one in the reach between Devil Creek and Devil Canyon, and the remaining three on the upper river above Devil Creek. A crest stage recorder is normally used to determine the highest stage of the year but in our case was serviced periodically to determine maximum stages for separate storms. In addition, the sites were visited frequently at various flows and the water level surveyed to define a rating curve for each site as an aid in the calibration of the HEC-2 Water Surface Profiles Computer program.

The Crest Stage Recorders consisted of a pipe set vertically along the riverbank with an opening at the bottom to allow the inflow of water. The pipe contains a marked wooden staff and a quantity of powdered cork. When the water rises during a flood the pipe fills to the level of the flood crest, the cork is floated to the top, and is left clinging to the wooden staff at the high-water mark. This mark can later be surveyed to determine the flood crest. Each installation consisted of a series of 7-foot pipes staggered up the bank to cover the full extent of expected flood crests. A sketch of a typical crest gage is detailed in Figure B.2.1.

The stage-discharge rating curves, contained in Attachment E.2, were constructed using stage data determined from surveys along with discharge data from the closest recording station (i.e. Gold Creek or Watana). These discharge data were multiplied by a factor for each station based on a drainage area comparison between the crest-stage recorder site and the recording station site (see Table B.2.1).

B.2.2 - <u>Staff Gages</u>

Staff gages were established for specific reasons at three sites.

(1) Denali - A gage was installed at the Denali Highway bridge over the Susitna River and its datum related to the existing U.S.G.S. recording stream gage. An observer from a local mining operation visited the station each day at 0800 during the months of July and August 1981. This information was used to anticipate timing of a flood peak for the water quality hydrograph sampling program. No data from this staff gage are included in this report as they were used solely for estimation purposes and are redundant with the data from the U.S.G.S. gage at the site.

(2) Watana Damsite - A staff gage was painted on a rock wall at the location of the continuous water quality monitor. This location was selected to provide stage information for the proposed Watana Dam tailrace.

(3) Devil Canyon - A staff gage was located at the downstream end of the canyon, about 1 mile upstream from Portage Creek. It consisted of a weighted rope marked at one-foot intervals and hung over a short cliff. Its purpose was to provide stage information on the tailwater from the proposed Devil Canyon Dam.

B.3 - Water Quality

Table B.3.1 lists the dates and hydrologic events of each of the water quality sampling times.

A complete discussion of equipment, calibration, sampling techniques and laboratory analysis methods is included in the R&M Consultants 1981 Water Quality Annual Report (R&M, 1981f).

B.4 - Sediment Discharge

A complete description of techniques and equipment has been presented in the R&M Consultants 1981 Water Quality Annual Report (R&M, 1981f).

B.5 - Climate

Six Meteorological Research, Inc. (MRI), Series 5100 "Weather Wizard" units were installed in the Upper Susitna basin. These instruments are continuous-recording and are located at the following sites:

> Site 1 - Susitna Glacier: This site is located near the confluence of four major glaciers feeding the mainstem of the Susitna River . It is a fairly high-elevation station, located at the 4700-foot elevation.
>
> Site 2 - Denali: This site is considered to represent the high plateau at the base of the Alaska Range. Data from this site will extend an existing partial climate record.
>
> Site 3 - Tyone River: The Tyone drainage area is relatively large and is characterized by gently rolling or flat terrain with numerous lakes and poor drainage. Climatic data within this basin are important for runoff studies.
>
> Site 4 - Kosina Creek: This station was selected to assist Alaska Department of Fish and Game caribou studies and satisfy hydrology data requirements for the area south of the Susitna River in the Talkeetna Mountain drainages.
>
> Site 5 - Watana Camp: Represents conditions at the proposed Watana Damsite and impoundment, as well as being at a convenient location for servicing.
>
> Site 6 - Devil Canyon: This site offers a good location for satisfying transmission line, environmental and hydrology requirements for this region. Data have also been obtained for use in access road and dam construction.

The instrument used for data collection was the MRI Model 5100, a continuous-recording, digital weather station that monitors temperature, windspeed and direction, wind gusts, precipitation, relative humidity and solar radiation. A description of the parameters recorded is located on Page B-7. This system was purchased because it was felt to offer cost-effective data collection and reduction. A number of problems were encountered which resulted in the loss of some data. A summary of the first year's experience is presented in Tables B.5.2 and B.5.3, describing each site's problems and precentage of data recorvery. Problems of these sorts are fairly common at remote locations and with new equipment. The actual data are summarized in Attachment E.5.

Climatic stations are located at the following sites. One station (Watana Camp) has been recording data since April 8, 1980. The other five stations were installed during July and August 1980. Descriptions of the sites and their map locations are given below.

Site 1 - Susitna Glacier: Station is located in the headwaters of the Susitna River, adjacent to Susitna Glacier. The site is on a hillside to the north of the main glacier, at about the 4,700-foot elevation.
It is located on map Mt. Hayes (C-16).
Map location: NE¼ Sec. 14, R4E, T16S, Fairbanks Meridian.

Site 2 - Denali: Station is located about a mile east of the Susitna River on the left bank, near Susitna Lodge. The site is on a bluff west of the air strip next to the lodge.
It is located on map Healy (A-1).
Map location: SW¼ Sec. 13, R1E, T21S, Fairbanks Meridian.

Site 3 - Tyone River: Station is located about five miles east-southeast of the Susitna River on the left bank in the Tyone River drainage. The site is on a terrace between the Tyone River and a bluff above it, about 1.5 miles (straight line) downstream from the confluence of Tyone Creek and Tyone River.
It is located on map Talkeetna Mountains (C-1).
Map location: SE¼ Sec. 3, R10W, T10N, Copper River Meridian.

Site 4 - Kosina Creek: Station is located about six miles south of the Susitna River in the Kosina Creek drainage. The site is on a bluff about ½-mile upstream from the confluence of Tsisi and Gilbert Creeks and between the two creeks.
It is located on map Talkeetna Mountains (C-2).
Map location: NW¼ Sec. 16, R8E, T30N, Seward Meridian.

Site 5 - Watana Camp: Station is located about 100 yards NE of the base camp in a fairly open, gradually sloping area. No large trees are in the immediate vicinity. The site is about a mile north of the Susitna River on the right bank, about midway between Tsusena and Deadman Creeks.
It is located on map Talkeetna Mountains (D-4).
Map location: NW¼ Sec. 27, R5E, T32N, Seward Meridian.

Site 6 - Devils Canyon: Station is ½-mile downstream of the Devil Canyon damsite on a ridge on the south bank. It is located on map Talkeetna Mountains (D-5). Map location: SE¼ Sec. 32, R1E, T32N, Seward Meridian.

Seven climate parameters are measured at each station. These parameters are presently recorded at 15-minute intervals at all stations, although the Susitna Glacier station initially was setup to record at 30 minute intervals and was changed in June 1981.

The parameters measured are explained below:

Time	Data are recorded at 15 or 30 minute intervals, with time of day noted for each record.
Temperature	Air temperature at time of recording, in °C.
Windspeed	Average windspeed during preceding interval, in meters per second.
Wind direction	Average wind direction during preceding interval, in degrees true, with 000° being true north and 90° being east.
Relative humidity	Percentage of vapor saturation, in percent.
Precipitation	Cumulative precitation, in millimeters. Restarted at zero when total reaches 100 mm or when instrument is turned off.
Solar Radiation	Incident intensity at time of recording, in milliwatts per square centimeter.
Peak wind gust	Highest 15-second wind speed, in meters/second, during preceding interval.
Battery voltage	Power supply voltage.

B.6 - Freezing Rain and Icing

To determine the amount of icing that might affect transmission facilities in the Susitna Basin, three systems were used. The first two systems were both used at the Denali and Watana climate station sites, and the third was used at Watana only, where AC power was available. The first method was to install a sample section of transmission line between two upright posts. The cables were 12-foot lengths of one-inch diameter aluminum (steel core) transmission line suspended 8 to 10 feet above the ground. As in-cloud icing caused rime build-up on the cables, its thickness was to be measured by vernier caliper during visits to the site.

The second method used a horizontal, eight-inch square steel plate mounted six feet above the ground on a vertical steel pipe. It was designed to permit measurement of ice that accumulated during freezing-rain events. The thickness of ice buildup on the plate would again be measured by vernier caliper during site visits.

The third method to measure amount of atmospheric icing was an attempt to continuously record the occurrence of icings. The Rosemount ice detector is a device which senses the presence of ice (sensitivity = 0.025") and produces an output signal suitable for automatic control of de-icing equipment. The unit contains a built-in heater which automatically de-ices the detector each time an ice warning signal is produced, thus preparing the detector for another ice-sensing cycle. This device is designed for use as an automatic control mechanism to de-ice fixed antenna installations. For our purposes, the unit was connected to a counter which totaled the number of times that the detector indicated an occurrence of icing. The counter was then to be read during site visits.

Each of the three systems had problems associated with data collection. The first two both require fairly prompt site visits following the icing events. Since this is not always possible, some icings may have occurred and gone unrecorded. Ice was never observed on either the cables or the plates.

It had been planned that the electronic ice detector system would be able to automatically and accurately record occurrence of icing. However, the detector counts the number of times icings occur but also records power outages the same as icings*. The unit is located near Watana Camp and uses AC power from the camp's generators to operate. These outages occur frequently when the camp generators are switched off for daily servicing or changeover. Thus, a number of the recorded counts are due merely to power interruptions.

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* This is a safety feature designed into the device to permit the de-icing signal to be generated when the power supply is interrupted.

As a solution to this problem, an attempt was made to keep a count of the number of power interruptions at the camp. The intent was that these would then be subtracted from the counts recorded by the detector, with the balance of the counts being the number of icings occurring. The generator operator was enlisted to record the timing of each power outage.

Keeping accurate track of the number of power interruptions was a more difficult task than originally envisioned. Sometimes a shut-off might not be recorded, or during a shut-off the generator might kick on and off a few times, thus causing multiple icing counts to be recorded but not necessarily logged by the operator.

For this reason, the detector results are suspect. However, the winter of 1980-81 was a dry one, and judging by observation of the icing cable and plate, we suspect that little if any icing actually did occur during the winter at the observation sites. This suspicion is supported by discussion with long-term residents of Watana Camp. When the camp maintenance men and/or cooks were asked at frequent intervals during visits to the camp, none ever reported any freezing rain or icing conditions.

Attachment E.6 is a comparison of ice detector counts and recorded camp power outages for the period December 5, 1980 to April 17, 1981.

B.7 - Snow Surveys

The snow course is a permanently marked area where snow surveys are taken each year. The snow course measurement is obtained by sampling snow depth and water equivalent at these locations. Five to ten samples are taken at each location and the average of these are reported as snow depth and water equivalent for the area.

In the Susitna Basin 20 snow survey sites were established in 1980. Five of these sites were at the existing climate stations (all stations except Susitna Glacier). Of the other 15, 12 were located in the glaciated mountains at the headwaters of the basin, and 3 along the drainage of Butte Creek. See Map A.2 in Attachment A for exact locations.

The criteria used for selection of snow course sites were:

(a) The site should represent the snow conditions for the general area.

(b) The site should be open and large enough so it is not affected by interception, yet should be protected from high winds.

(c) Finally, the site should be accessible throughout the season (January 1 - May 1).

Due to the large size and the diversity of topographic conditions within the Susitna Basin, many snow courses were needed to accurately represent snowfall in the basin. Also, because of the relative inaccessibility of many of the sites, snow depth was found by aerial survey and snow density and water content were estimated from other measured sites.

Snow surveys were made monthly utilizing a helicopter and coordinating the snow survey with servicing of climate stations in the basin. Depth and water content were measured using an aluminum snow tube. This tube is cored into the snow. Depth of snow is read from the graduations on the tube and the tube full of snow is weighed to determine water content of the snow. Depth can also be estimated from the aerial markers. These markers are described Figure B.7.1. Data for all stations are listed in Attachment E.7.

During the first season of measurements five of the sites were found to be poorly located. The problem in each case was wind carrying away the snow. These markers were removed during the summer of 1981. Four new sites were also established in locations where it was felt additional data were needed. Two sites were added at higher elevations along East Fork Glacier so that an attempt could be made at correlating elevation to snowpack. Two sites were also added in the Clearwater Mountains slightly downstream of the glaciers. This left a total of 19 snow survey sites for the 1981-82 season.

B.8 - Glacial Observations

In May of 1981, R&M Consultants assisted personnel from the Geophysical Institute of the University of Alaska with the installation of snow markers, ablation stakes and with the digging of snow pits. Data were gathered on all major glaciers of the Upper Susitna Basin with the exception of the Eureka and Oshetna Glaciers. Study of the Eureka Glacier was limited to visual observations and aerial photography. The Oshetna Glacier was not considered a major contributor to the flow or sediment regime of the Susitna River and therefore was omitted from this study.

R&M conducted the control and velocity surveys on the West Fork Glacier, West Tributary of Susitna Glacier, Turkey Glacier and East Tributary of Susitna Glacier. The velocity surveys were repeated monthly through September to determine ice movement as an aid in mass balance and glacier dynamics analyses.

A thermocouple string was installed to a depth of 66 feet at an elevation of 7700 feet on the West Tributary of Susitna Glacier to determine the thermal regime of the ice.

The snow markers and ablation stake sites on all the glaciers were visited again in July 1981. The lower-altitude ablation stakes were found to have fallen over, signifying a total ablation at these points of more than 3 meters in 3 months. In August the holes for the velocity stakes had to be drilled deeper; otherwise, they also would have been lost. The locations of the stakes are shown in Figure B.8.1.

The results of this data gathering effort as well as a thorough description of field procedures and analytical methods are presented in a report by William Harrison of the Geophysical Institute (Harrison, 1981).

B.9 - Snow Creep

Snow Creep is the slow movement of a snowpack downhill. It is most prevalent on slopes of 25-35°. Above this angle the movement of snow will more likely occur as an avalanche.

In 1973 in Southeast Alaska several transmission line towers servicing the Snettisham Hydroelectric Project failed for a reason unknown but theorized to be caused by high winds or snow creep pushing the base of the tower off its base. In 1974 and 1975 the Corps of Engineers installed a system to evaluate the amount of force that snow creep could exert on a transmission line tower (Meyer, 1978). These tests measured a maximum pressure of 460 lbs/ft^2 with a 71-inch depth of 37%-density snow, but concluded that snow creep forces did not contribute to the failure of the tower.

Even though not judged to be a factor in the Snettisham failures, snow creep was considered to be a potentially large force in Alaska. To try to determine the magnitude for the transmission line servicing the Susitna Project, two installations were set up to measure snow creep forces. To simulate conditions at the actual transmission line towers as closely as possible, 24-inch diameter, 3/8" thick tubular steel sections were placed on the chosen slopes. These sections were allowed to slide over the ground and were held from sliding downhill by a cable attached to a dynamometer. The dynamometer measured the force in the cable which was needed to support the pipe section. If creep of the snowpack did occur, the force would have been transmitted to the pipe section, cable and dynamometer where its maximum would have been recorded by a maximum-recording gauge. (See sketch, Figure B.9.1).

The two setups were installed in January of 1981. During setup, the snowpack was unavoidably disturbed. Partly because of this and also due to the lack of abundant snow during the winter, no usable snow creep data were collected. Some readings were taken, however, which indicate the type of base readings that may occur on the instrument with no snow (due to thermal, wind, or other stresses).

The 1981 observations are summarized in Attachment E.9.

B.10 - River Ice Observations

Frazil ice first appeared in 1980 on October 11 and in 1981 on September 28 in the Susitna River. The ice cover was nearly complete over the whole river by mid-December though open water leads did persist in several turbulent reaches throughout the winter. The presence of a hydrographic survey crew in the Devil Canyon-Talkeetna reach during the fall of 1980 permitted extensive observation and photography of the freeze-up processes. Also, measurements were made at several ice accumulation sites to record the increase in water level at the upstream ends and to record the advance of the cover upstream with time.

Mid-winter observations consisted of taking photographs at areas of interest to record locations of open leads as well as ice cover characteristics. In addition, ice thicknesses and top-of-ice elevations were measured at several locations in February 1981, notably the crest gage sites.

Break-up on the Susitna was relatively mild in 1981, compared to a number of the historical records. Abundant spring sunshine and warm temperatures early on reduced the low-elevation snowpack, and a lack of significant precipitation kept the river level fairly low. Observations again consisted of aerial reconnaissance of the primary areas of interest and a few on-site measurements of water stage and velocity.

Freeze-up in 1981 was begun with an early appearance of frazil ice (September 28 at Gold Creek). Warmer temperatures in October, however, dissipated the frazil and delayed further freeze-up activity for several weeks. Observations were made periodically during the fall and early winter, primarily by means of aerial fixed-wing flights.

The full extent of the ice observation program through spring 1981 breakup is described in a separate R&M report, Ice Observations (R&M, 1981c). The report details descriptive observations made in the field and presents climatological, hydrologic, and ice-related data collected during the period. The dates of field observations are summarized in the Hydrology Field Observation Log, included as Appendix C to this report.

B.11 - Evaporation

A National Weather Service Type A evaporation pan was installed at the Watana Site on May 7, 1981. The location chosen was an open area 200 feet northeast of the camp buildings and near the Watana Climate Station. Observations of the change in water level and the minimum-maximum water temperatures during the preceeding 24 hours were made each morning at 0700.

One problem with this arrangement was the lack of responsible camp personnel to make the daily observations. Thus, there were frequent periods when readings were not taken for several days. This caused a loss of some daily data, but it does not affect the monthly evaporation totals which are cumulative.

To compute evaporation, precipitation amounts at the site during the same time period are needed. These were obtained from the precipitation gage at the weather station nearby.

TABLE B.2.1

Factors for Relating Recorded Streamflows to Other Sites, Based on Drainage Area

Station	Cross-Section Number	Discharge Factor
Deadman Creek	URX-101	$0.969 \times Q_{Watana}$
Watana Dam	URX-106.3	$1.000 \times Q_{Watana}$
Devil Creek	URX-121	$1.079 \times Q_{Watana}$
Devil Canyon Upper	-	$0.933 \times Q_{G.C.}$
Portage Creek	LRX-62	$0.943 \times Q_{G.C.}$
Sherman	LRX-35	$1.000 \times Q_{G.C.}$
Section 25	LRX-28	$1.000 \times Q_{G.C.}$
Curry	LRX-24	$1.000 \times Q_{G.C.}$
Chase	LRX-9	$1.029 \times Q_{G.C.}$
Susitna-Chulitna Confl.	LRX-4	$1.029 \times Q_{G.C.}$

Note:

1. Discharges at crest stage recorder sites were estimated using flows from nearby continuous recorders (Gold Creek for LRX's , Watana for URX's) multiplied by a factor based on comparative drainage areas.

2. ($Q_{G.C.}$ = flow observed at Gold Creek).

TABLE B.3.1

WATER QUALITY SAMPLING SUMMARY

1980 WATER QUALITY SAMPLING
DATES AND EVENTS

Vee Canyon	Gold Creek	Event
6/19/80	-	Glacier runoff and snowmelt.
8/8/80	8/8/80	After heavy summer rain.
9/5/80	-	Low summer discharge.
9/17/80	-	After heavy rains.
10/17/80	10/14/80	Pre-freezeup.

1981 WATER QUALITY SAMPLING
DATES AND EVENTS

Vee Canyon	Gold Creek	Event
1/13/81	1/14/81	Winter, under ice cover.
5/20/81	5/27/81	Breakup.
6/18/81	6/17/81	Glacier runoff and snowmelt.
-	6/30/81	Heavy rains, hydrograph peak.
6/30/81	7/1/81	Descending limb of hydrograph.
8/2/81	-	Heavy rain, rising limb of hydrograph.
8/3/81	8/2/81	Heavy rain, hydrograph peak.
8/3/81	8/3/81	Descending limb of hydrograph.
9/15/81	9/14/81	Late summer, low discharge.
10/7/81	10/8/81	Pre-freezeup.

TABLE B.5.1
OPERATING HISTORY
SUSITNA GLACIER CLIMATE STATION
Prepared May 1981

7/20/80	Installed.
7/20/80 to 8/12/80	Good record RH very erratic suspect no-good.
8/12/80 to 8/28/80	Garbled data.
8/28/80 to 10/26/80	Good record RH very low suspect no good.
10/26/80 to 12/4/80	Garbage on tape due to high voltages approximately 1% loss.
12/4/80	Voltage limiter added. RH sensor replaced.
12/4/80 to 2/3/81	Good record.
2/3/81 to 4/2/81	Loss of some midday data due to high voltages approximately 2%.
4/2/81 to 4/22/81	Missing 20 days of data.
4/22/81 to 4/30/81	Still erratic garbage on tape, approximately 3% loss.

TABLE B.5.1 (Continued)
OPERATING HISTORY
DENALI CLIMATE STATION
Prepared May 1981

7/18/80	Installed.
8/29/80	Unit not working.
9/11/80	Unit started working. RH much too low.
9/18/80	Unit stopped again.
10/17/80	Unit started again.
10/17/80 to 10/30/80	Wind speed and gust no good. Garbage and spacing causing loss of approximately 5% of data.
10/30/80 to 12/4/80	No wind speed and wind gusts. Approximately 2% loss of data to garbage and spacing.
12/4/80 to 2/2/81	No wind speed and gusts. RH still too low.
2/2/81	Wind speed, gust, and RH fixed.
2/2/81 to 3/19/81	Losing some of mid-day readings due to high battery voltage, approximately 1%.
3/19/81	Solar collector hooked up correctly.
3/19/81 to 4/30/81	Good data.

TABLE B.5.1 (continued)
OPERATING HISTORY
TYONE CLIMATE STATION
Prepared May 1981

8/27/80	Installed.
8/30/80	Instrument stopped working. Faulty electronic chips
10/17/80	Monitor replaced - data erratic.
12/5/80	New monitor installed but did not operate till 1/9.
1/9/81	Monitor warmed up and started working. Slightly erratic.
2/11/81	Monitor stopped working.
3/4/81	Monitor replaced. Solar very high.
4/1/81	Solar connection repaired. Data looks good.

TABLE B.5.1 (continued)
OPERATING HISTORY
KOSINA CREEK CLIMATE STATION
Prepared May 1981

8/25/80	Installed.
10/17/80	Worked good until this date. Monitor replaced and then lots of garbage and spacing errors introduced. Useless without cleanup program but with cleanup program most of it becomes useful and losses occur mostly in temperature and wind speed, about 35%, and about 5% of the rest of the parameters. Data would not file 10/17 - 10/29.
1/8/81 to 1/15/81	No data. W.W. removed 1/8.
1/15/81	New W.W. installed. Recorded well for 2 days.
1/16/81	W.W. stopped working due either to recorder releasing tape or loose screws on display module.
2/3/81 to 3/6/81	Record good.
3/6/81 to 3/25/81	Garbage loss of about 5%. Reason unknown.
3/25/81 to 4/1/81	Good data.
4/1/81 to 4/5/81	5% loss of data.
4/5/81 to 4/30/81	Total loss of data.

TABLE B.5.1 (continued)
OPERATING HISTORY
WATANA CLIMATE STATION
Prepared May 1981

3/13/80	Installed.
4/8/80	First tape retrieved no data because head bar not depressed.
4/28/80	Second data tape retrieved, processed by MRI, record good.
5/8/80	Lighting strikes - time lag of 9 hours introduced.
5/28/80	New unit installed in place of Demo unit.
6/13/80	Tape removed - unit left off until 6/19/80 because of blown fuse.
6/19/80	New fuse. New tape.
6/21/80	Time messed up between 6/21 and 6/25.
6/21/80 to 7/30/80	Good Record.
7/30/80 to 8/14/80	No record. Faulty solar panel drained battery.
8/14/80 to 8/28/80	All garbage. Improper type cassette installed.
8/28/80 to 10/2/80	Some garbage causing loss after cleanup of approximately 2% of temperature and wind speed data.
10/2/80 to 10/17/80	No record. Electrical malfunction in W.W.
10/17/80 to 10/30/80	Good record.
10/30/80	Solar radiation became very high today - N.G.
10/30/80 to 12/5/80	Record okay except for solar. New power supply installed.
12/5/80 to 2/2/81	Good record. Solar still bad.

TABLE B.5.1 (continued)
OPERATING HISTORY
WATANA CLIMATE STATION
Prepared May 1981
(CONTINUED)

2/2/81	New solar sensor.
2/2/81 to 2/13/81	Good record.
2/13/81	High voltages causing loss of some data.
2/13/81 to 2/26/81	Loss of about 50% of data.
2/26/81	Power at station found turned off.
2/26/81 to 3/6/81	Data looks good.
3/6/81 to 3/16/81	Slight losses of data.
3/16/81 to 4/29/81	Good data.

TABLE B.5.1 (continued)
OPERATING HISTORY
DEVIL CANYON CLIMATE STATION
Prepared May 1981

7/17/80	Installed.
7/17/80 to 7/23/80	Some errors mostly in spacing.
7/23/80 to 8/13/80	Data good.
8/13/80 to 10/1/80	No data. Recorder did not advance. New unit installed 10/1.
10/1/80 to 10/4/80	Good data.
10/4/80	Some garbled data.
10/4/80 to 10/12/80	Good data.
10/12/80	Some spacing problems.
10/13/80	Solar suddenly gets very high.
10/12/80 to 10/16/80	Good data, except for solar.
10/16/80 to 10/30/80	Possible 2% loss due to spacing when voltage got too high. Solar very high.
10/30/80 to 12/3/80	Solar too high throughout. RH looks bad throughout. 50% okay the rest too high.
12/3/80 to 1/12/80	Voltage regulator battery installed.
1/12/80 to 2/25/81	Looks good. Solar all bad. RH seems high.
3/16/81	Changed solar panel connection.
3/16/81 to 4/30/81	Data good. Unlikely RH readings occur periodically throughout the record.

Table: B.5.2 R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 610 NAME : GLACIER

MONTH	TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
JULY ,1980	91.5	91.5	91.5	0.0	91.5	91.5	91.5	91.5	0.0
AUGUST ,1980	49.6	49.7	49.7	0.0	49.7	49.7	49.7	49.7	0.0
SEPTEMBER ,1980	99.9	99.9	99.9	0.0	99.9	99.9	100.0	99.9	0.0
OCTOBER ,1980	93.0	94.2	98.9	0.0	.1	98.8	99.7	98.3	0.0
NOVEMBER ,1980	94.0	94.9	98.3	0.0	0.0	99.7	100.0	97.8	0.0
DECEMBER ,1981	99.9	99.9	99.9	79.0	0.0	99.9	100.0	99.9	79.0
JANUARY ,1981	99.9	99.9	96.0	90.9	0.0	100.0	100.0	100.0	90.7
FEBRUARY ,1981	96.4	96.6	52.4	63.2	0.0	98.5	99.9	98.2	61.0
MARCH ,1981	89.9	87.0	91.7	79.0	0.0	93.8	98.3	92.3	73.1
APRIL ,1981	28.3	27.4	29.4	17.5	31.0	30.0	31.7	30.1	15.1
MAY ,1981	99.6	99.6	99.5	88.8	99.5	99.6	99.7	99.6	88.8
JUNE ,1981	100.0	100.0	100.0	84.9	100.0	100.0	100.0	100.0	84.9
JULY ,1981	100.0	100.0	100.0	96.6	100.0	100.0	100.0	100.0	96.6
TOTAL	86.7	86.5	83.9	44.6	37.0	88.3	89.1	88.0	43.7

Table: B.5.2 (continued)

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 620 NAME : DENALI

MONTH	TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
JULY ,1980	100.0	100.0	100.0	92.9	100.0	100.0	100.0	100.0	92.9
AUGUST ,1980	92.7	92.7	92.7	83.2	92.7	92.7	92.7	92.7	83.2
SEPTEMBER ,1980	22.5	0.0	22.5	0.0	22.5	22.5	0.0	22.5	0.0
OCTOBER ,1980	46.9	0.0	46.9	0.0	0.0	46.8	0.0	46.6	0.0
NOVEMBER ,1980	99.9	0.0	100.0	0.0	0.0	99.7	0.0	99.6	0.0
DECEMBER ,1981	100.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0
JANUARY ,1981	100.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0
FEBRUARY ,1981	99.9	94.2	99.9	77.7	0.0	99.6	94.3	99.6	77.7
MARCH ,1981	99.2	99.1	99.2	89.2	0.0	99.2	99.2	99.2	89.2
APRIL ,1981	99.4	99.4	99.4	87.2	0.0	99.4	99.7	99.4	87.2
MAY ,1981	100.0	100.0	100.0	94.5	100.0	100.0	100.0	100.0	94.5
JUNE ,1981	100.0	100.0	100.0	96.7	100.0	100.0	100.0	100.0	96.7
JULY ,1981	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL	87.9	55.0	87.9	49.9	32.1	87.8	55.1	87.8	49.9

Table: B.5.2
Continued

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 630 NAME : TYONE

MONTH	TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
AUGUST ,1980	69.5	69.5	69.5	34.3	69.5	69.5	69.5	69.5	34.3
SEPTEMBER ,1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCTOBER ,1980	25.3	25.0	24.3	7.3	0.0	25.3	26.2	25.4	6.7
NOVEMBER ,1980	95.0	95.7	95.3	24.0	0.0	96.8	97.6	96.0	22.5
DECEMBER ,1981	14.2	14.2	14.2	0.0	0.0	14.2	14.2	14.2	0.0
JANUARY ,1981	57.1	56.9	56.6	10.8	0.0	56.2	57.9	56.6	10.8
FEBRUARY ,1981	37.9	37.9	37.9	9.8	0.0	37.6	38.2	37.6	9.8
MARCH ,1981	59.4	59.4	59.4	26.5	0.0	0.0	59.7	59.4	26.5
APRIL ,1981	100.0	100.0	100.0	52.6	0.0	98.3	100.0	100.0	52.6
MAY ,1981	100.0	100.0	100.0	68.7	100.0	100.0	100.0	100.0	68.7
JUNE ,1981	100.0	100.0	100.0	73.1	100.0	100.0	100.0	100.0	73.1
JULY ,1981	98.4	98.4	98.4	62.3	98.4	98.4	100.0	98.4	62.3
TOTAL	59.4	59.4	59.3	27.7	21.5	53.3	59.9	59.4	27.5

Table: B.5.2 (continued)

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 640 NAME : KOSINA STATION

MONTH	TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
AUGUST ,1980	100.0	100.0	100.0	90.2	100.0	100.0	100.0	100.0	90.2
SEPTEMBER ,1980	100.0	100.0	100.0	80.1	100.0	100.0	100.0	100.0	80.1
OCTOBER ,1980	86.8	88.8	92.5	87.5	0.0	92.3	92.7	92.3	81.9
NOVEMBER ,1980	95.6	95.4	100.0	98.2	0.0	100.0	100.0	100.0	93.8
DECEMBER ,1981	97.0	97.6	100.0	99.1	0.0	100.0	100.0	100.0	96.1
JANUARY ,1981	28.9	28.5	29.0	28.8	0.0	29.0	29.2	29.0	28.6
FEBRUARY ,1981	91.2	91.2	91.2	87.1	0.0	91.2	91.4	91.2	87.1
MARCH ,1981	53.9	54.6	54.3	53.1	0.0	54.4	55.6	53.8	51.6
APRIL ,1981	16.0	16.0	15.7	14.7	0.0	14.2	16.1	16.0	14.7
MAY ,1981	45.0	45.0	45.0	44.0	45.0	39.0	45.3	45.0	44.0
JUNE ,1981	64.6	64.6	64.6	60.8	64.6	62.2	64.9	64.6	60.8
JULY ,1981	100.0	100.0	100.0	95.1	100.0	100.0	100.0	100.0	95.1
TOTAL	68.6	68.8	69.9	65.9	23.2	68.9	70.2	69.9	64.5

Table: B.5.2 (continued)

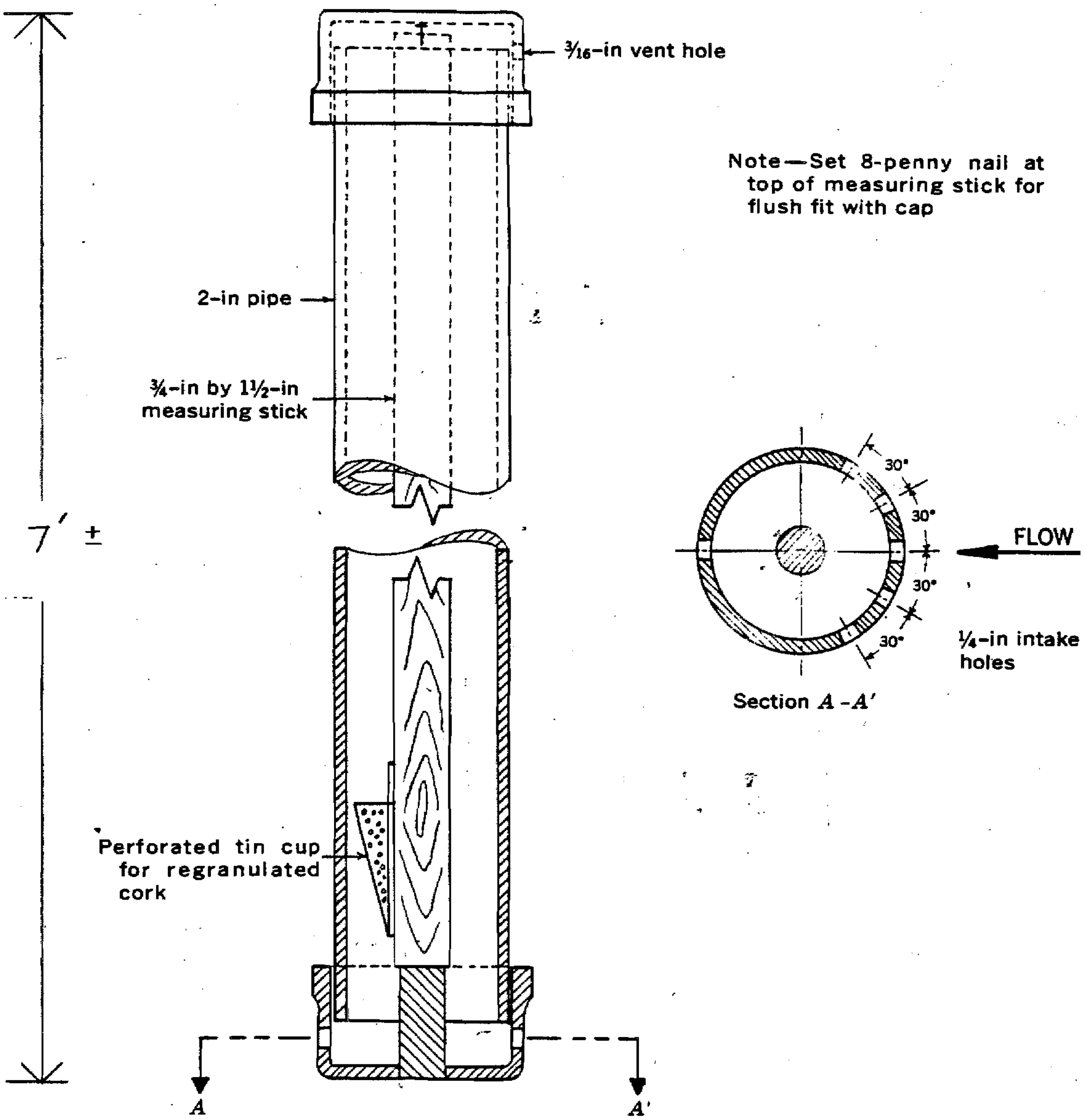
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 650 NAME : WATANA STATION

MONTH		TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
APRIL	,1980	99.8	99.8	99.8	93.3	99.8	99.8	100.0	99.8	93.3
MAY	,1980	98.7	98.7	98.7	90.1	98.7	98.7	98.7	98.7	90.1
JUNE	,1980	69.7	69.6	69.7	61.5	54.2	69.9	69.9	69.9	61.4
JULY	,1980	96.1	96.1	96.1	91.0	96.1	96.1	96.1	96.1	91.0
AUGUST	,1980	2.2	2.3	2.3	2.2	2.3	2.3	2.4	2.3	2.0
SEPTEMBER	,1980	58.2	58.2	58.3	55.4	58.3	58.3	58.6	58.3	55.3
OCTOBER	,1980	46.4	46.4	46.4	44.1	46.4	2.0	46.4	46.4	44.1
NOVEMBER	,1980	100.0	100.0	100.0	94.9	100.0	0.0	100.0	100.0	94.9
DECEMBER	,1981	100.0	100.0	100.0	99.5	100.0	0.0	100.0	100.0	99.5
JANUARY	,1981	100.0	100.0	100.0	98.0	100.0	0.0	100.0	100.0	98.0
FEBRUARY	,1981	52.7	52.7	52.7	41.1	52.7	46.6	53.0	52.7	41.1
MARCH	,1981	96.6	96.8	96.8	94.2	96.6	96.4	97.0	96.0	94.1
APRIL	,1981	100.0	100.0	100.0	95.3	100.0	100.0	100.0	100.0	95.3
MAY	,1981	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	94.8
JUNE	,1981	100.0	100.0	100.0	95.6	100.0	100.0	100.0	100.0	95.6
JULY	,1981	100.0	100.0	100.0	90.9	100.0	100.0	100.0	100.0	90.9
TOTAL		81.2	81.3	81.3	76.7	80.2	57.4	81.4	81.2	76.6

Table: B.5.2 (continued)

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT
PERCENTAGE OF USABLE (HOURLY DATA) FOR WEATHER WIZARD STATION ID: 660 NAME : DEVIL CANYON

MONTH	TEMP	WS	WD	RH	PRECIP.	SOLAR	PK-GUST	BATTERY	DEW POINT
JULY ,1980	100.0	100.0	100.0	72.0	100.0	100.0	100.0	100.0	72.0
AUGUST ,1980	41.7	41.7	41.7	28.8	41.7	41.7	41.7	41.7	28.8
SEPTEMBER ,1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCTOBER ,1980	98.8	98.8	98.8	74.9	0.0	39.7	98.9	98.8	74.9
NOVEMBER ,1980	100.0	82.6	82.6	90.3	0.0	0.0	100.0	100.0	90.3
DECEMBER ,1981	100.0	100.0	100.0	89.2	0.0	0.0	100.0	100.0	89.2
JANUARY ,1981	100.0	100.0	100.0	86.7	0.0	0.0	100.0	100.0	86.7
FEBRUARY ,1981	100.0	27.8	24.3	93.3	0.0	12.6	100.0	100.0	93.3
MARCH ,1981	99.6	99.6	100.0	89.4	0.0	99.9	100.0	99.7	89.0
APRIL ,1981	100.0	100.0	100.0	90.1	100.0	100.0	100.0	100.0	90.1
MAY ,1981	100.0	100.0	100.0	75.3	100.0	100.0	100.0	100.0	75.3
JUNE ,1981	100.0	100.0	100.0	77.6	100.0	100.0	100.0	100.0	77.6
JULY ,1981	98.4	98.4	98.4	92.1	98.4	98.4	100.0	98.4	92.1
TOTAL	86.1	78.9	78.7	72.4	34.4	47.8	86.2	86.2	72.3



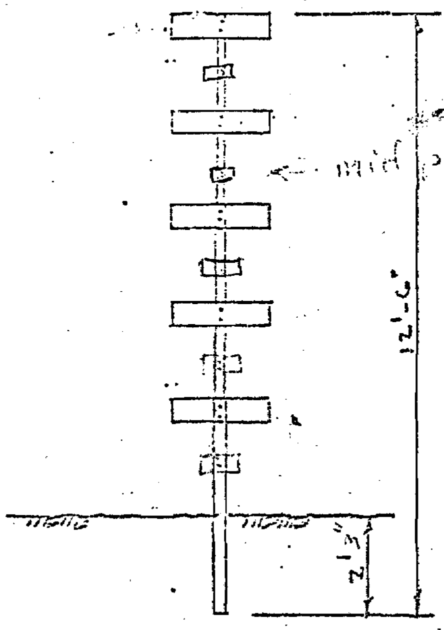
Crest Stage Recorder (typical)

Source: Discharge measurements at gaging stations, Techniques of Water - Resources Investigations. USGS, 1968, p. 28.

Figure B.2.1

SNOW SURVEY MARKER DETAIL

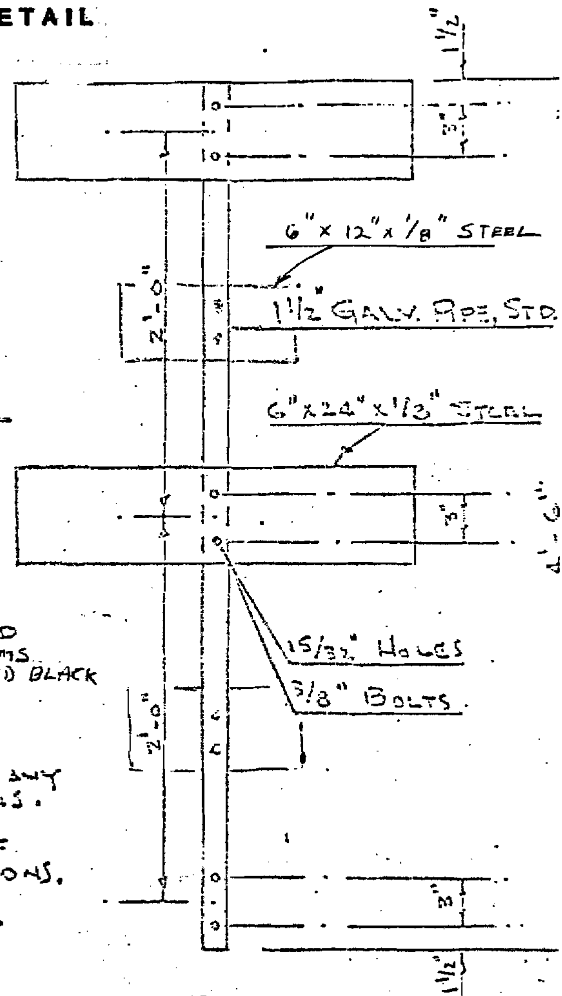
Figure B.7.1



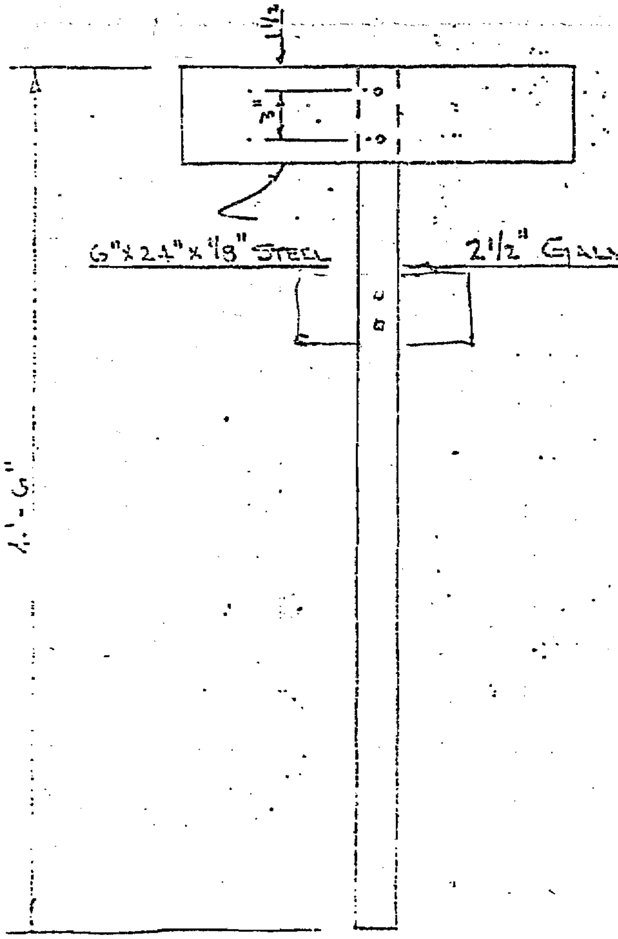
AERIAL SNOW MARKER

NOTES:

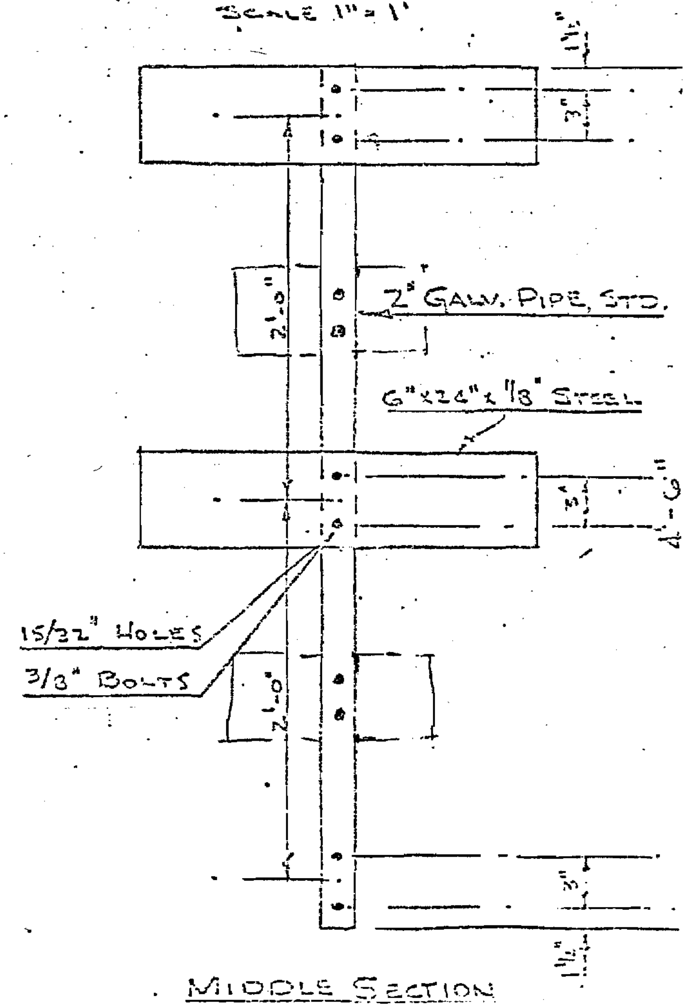
1. ~~ALL~~ 5 CROSS ARMS SHALL BE 6"x24"x1/8" STEEL. & 5 each 6"x12"x1/8" STEEL
2. ALL HOLES ARE 15/32".
3. ALL BOLTS ARE HEX. HEAD, 4"x3/8".
4. 24" CROSS ARMS SHALL BE PRIMED & PAINTED ORANGE; 12" CROSS ARMS SHALL BE PRIMED & PAINTED BLACK
5. ALL HOLES SHALL BE IN ALIGNMENT.
6. REMOVE ALL BURRS & ANY OTHER DEFORMATIONS.
7. REAM TOP ENDS OF MIDDLE & BASE SECTIONS.
8. SHOP TEST FOR FIT.



TOP SECTION
SCALE 1"=1'



BASE SECTION



MIDDLE SECTION

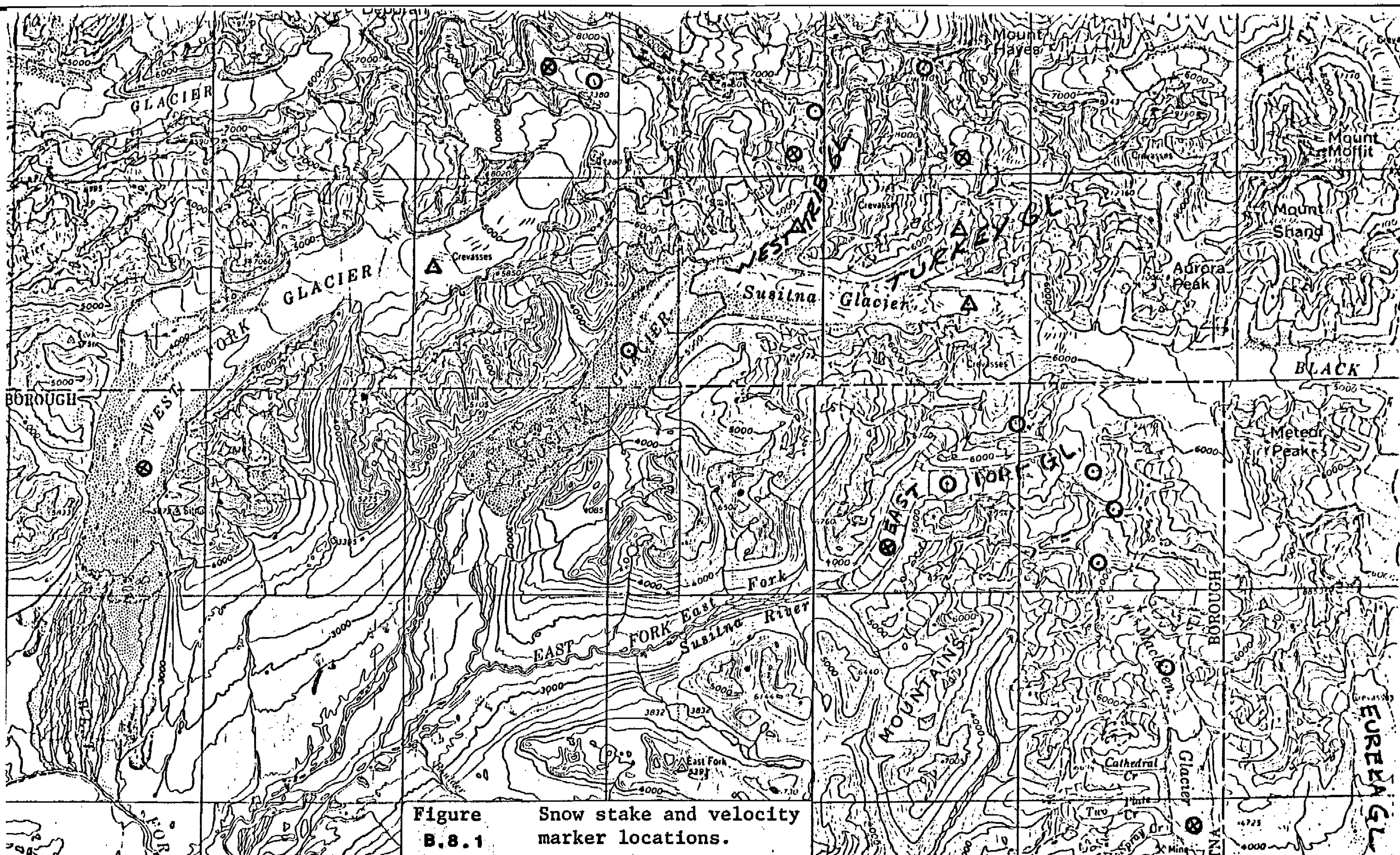


Figure B.8.1 Snow stake and velocity marker locations.

Prepared by:

R&M CONSULTANTS, INC.

Prepared for:

ACRES

○ snow stake

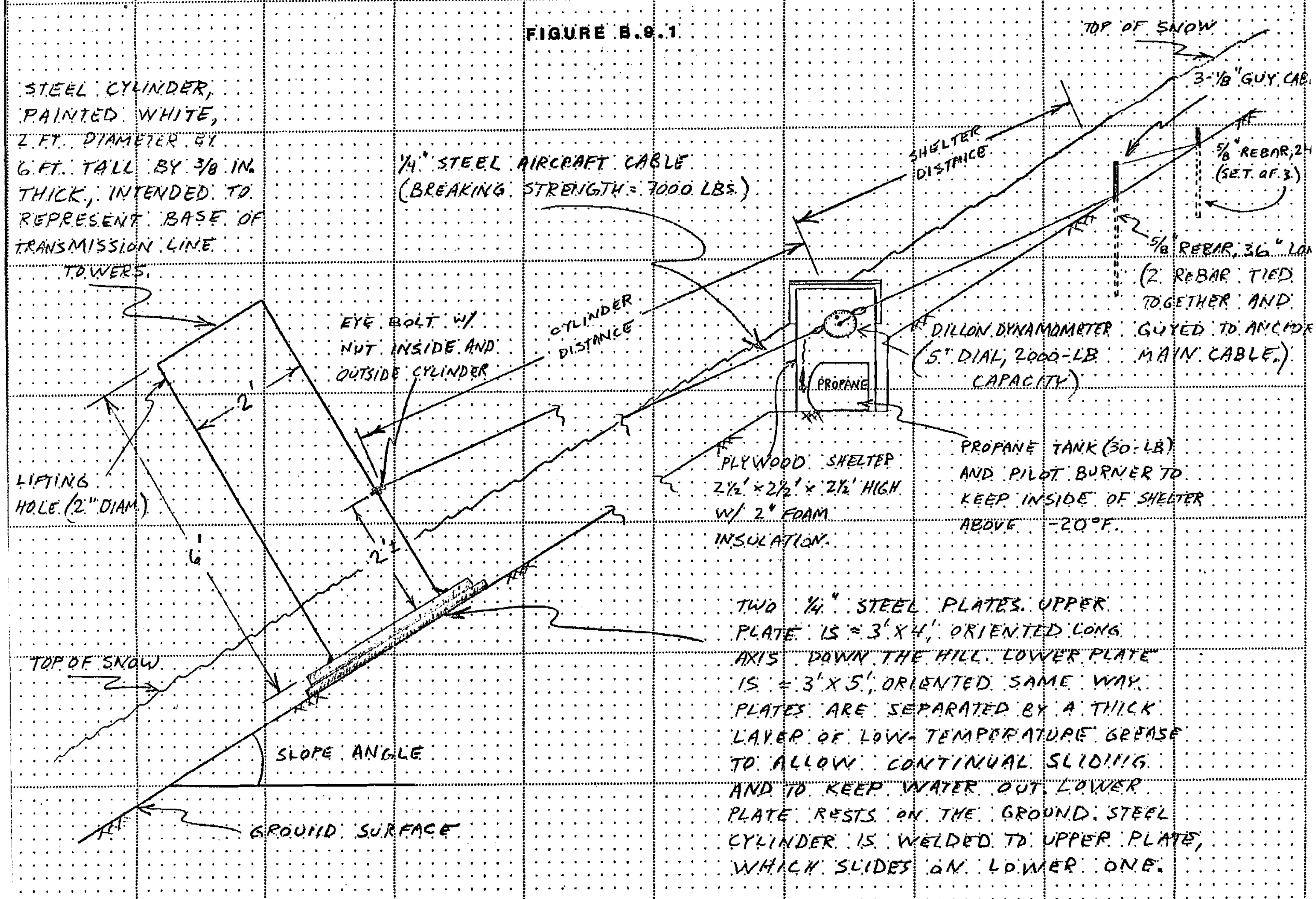
△ velocity marker

⊗ lost stake

SUSITNA HYDRO. PROJECT

SNOW CREEP STATION (TYPICAL)

FIGURE B.9.1



SUSITNA HYDROELECTRIC PROJECT

TABLE B.9.1

Description of Snow Creep Station Installations

Site Name: Devils Canyon

Site Number: 0940

Date of Installation: February 25, 1981

Installation Crew: J. Coffin, C. Schoch, R. Butera

Site-Specific Information

1. Location: SW ¼, Sec. 32, T33N, R1E, Seward Meridian
2. U.S.G.S. Map: Talkeetna Mountains (D-5)
3. Elevation of Site: 1,500 ft. (from map)
4. Slope Aspect: Northeast
5. Slope Angle: 29°
6. Snow Depth @ Time of Installation: 20+ inches
7. Air Temperature @ Time of Installation: 32°F
8. Soil Material: Thick tundra, frozen
9. Shelter Distance (see sketch): 15 ft. (approx.)
10. Cylinder Distance (see sketch): 65 ft. (approx.)
11. Maximum Pretensioning Force Used: 1000 lbs.
12. Final Dynamometer Reading @ Time of Installation: 470 lbs.
13. Dynamometer Installed: W.C. Dillon Co., 2000-lb. (pound) Capacity, 5"dial S/N 10576
14. Notes: Pilot burner did not funtion properly at time of installation. Thus, it was not connected until the next visit to the station, March 15, 1981.

susit4/g2

SUSITNA HYDROELECTRIC PROJECT

TABLE B.9.2

Description of Snow Creep Station Installations

Site Name: Watana

Site Number: 0920

Date of Installation: February 26, 1981

Installation Crew: J. Coffin, C. Schoch, R. Butera

Site-Specific Information

1. Location: NW ¼, Sec. 30, T33N, R5E, Seward Meridian
2. U.S.G.S. Map: Talkeetna Mountains (D-4)
3. Elevation of Site: 3,200 ft. (from map)
4. Slope Aspect: Southwest
5. Slope Angle: 35°
6. Snow Depth @ Time of Installation: 24-30 inches
7. Air Temperature @ Time of Installation: 30°F
8. Soil Material: Broken rock and tundra, all frozen
9. Shelter Distance (see sketch): 20 ft. (approx.)
10. Cylinder Distance (see sketch) : 90 ft. (approx.)
11. Maximum Pretensioning Force Used: 900 lbs.
12. Final Dynamometer Reading @ Time of Installation: 440 lbs.
13. Dynamometer Installed: W.C. Dillon Co., 2000-lb. (pound) Capacity, 5"dial, S/N 10575
14. Notes: Pilot burner did not funtion properly at time of installation. Thus, it was not connected until the next visit to the station, March 16, 1981.

susit4/g1

ATTACHMENT C

FIELD OBSERVATION LOG

R&M FIELD DATA COLLECTION LOG AS OF DECEMBER 15, 1981

susi6/g Page 1

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(1) River Stage*	Susitna River near Watana Damsite	Scientific Instr. Co. Manometer Stevens Water Level Recorder	6/20/80	Continuous	7/10-12/1/80 4/15/81-12/2/81	Scheduled	Instrument functioning normally.
(2) River Discharge	Susitna River near Watana Damsite	Teledyne-Gurley Price Current Meter Marsh-McBirney Flow Meter	N/A	Unscheduled	8/20/80 8/21/80 9/3/80 9/18/80 10/20/80 4/01/81 5/24/81 6/2/81 7/3/81	Event Event Event Event Event Event Event Event Event	Stage-discharge rating curve and table have been prepared from field measure-ments.
(3) River Crest Stage* (Susitna River)	(a) Susitna-Chulitna Confluence (LRX-4)	Crest-stage recorder	6/26/80	Unscheduled	7/31/80 7/27/81 8/31/81 11/2/81	Event	Observations are made at recorder following flood events. Water surface elevations are recorded periodically at most of the crest gage sites.
	(b) Chase (LRX-9)	Crest-stage recorder	7/31/80	Unscheduled	12/2/80 7/27/81 11/2/81	Event	
	(c) Curry (LRX-24)	Crest-stage recorder	6/26/80	Unscheduled	7/31/80 7/27/81 8/31/81 11/2/81	Event	
	(d) Section 25 (LRX-28)	Crest-stage recorder	6/26/80	Unscheduled	7/31/80 7/27/81 8/31/81 11/2/81	Event	
	(e) Sherman (LRX-35)	Crest-stage recorder	6/26/80	Unscheduled	7/31/80 7/27/81 8/31/81 11/2/81	Event	
	(f) Portage Creek (LRX-62)	Crest-stage recorder	6/25/80	Unscheduled	9/6/80 11/11/80 7/27/81 11/2/81	Event	

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(3) River Crest Stage* (Susitna River) (Continued)	(g) Devil Canyon Upper	Crest-stage recorder	6/25/80	Unscheduled	7/31/80 5/24/81 5/31/81 7/31/81 9/3/81 9/17/81	Event	
	(h) Devil Creek (URX-121)	Crest-stage recorder	5/24/80	Unscheduled	7/81/81 9/3/81 11/2/81	Event	
	(i) Watana Dam (URX-106.3)	Crest-stage recorder	7/30/80 10/01/80	Unscheduled	7/28/81 9/3/81 11/2/81	Event	
	(j) Deadman Creek (URX-101)	Crest-stage recorder	7/30/80	Unscheduled	7/28/81 9/3/81 11/2/81	Event	
(4) River Stage (Susitna River)	(a) Devil Canyon	Staff Gauge	3/25/81	Unscheduled	3/30/81 4/14/81 5/1/81 5/8/81 5/14/81 5/24/81 5/31/81 6/2/81 6/6/81 7/27/81 7/31/81 8/5/81 8/6/81 8/10/81 8/12/81 9/3/81 9/4/81 9/17/81	Event	Observations are made periodically by field personnel.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(4) River Stage (Susitna River) (Continued)	(b) Watana Damsite	Staff Gauge	4/16/81	Unscheduled	5/7/81 5/21/81 6/1/81 6/3/81 6/9/81 6/10/81 7/28/81 8/5/81 8/12/81	Event	
	(c) Denali Bridge	Staff Gauge	5/31/81	Daily	-	Scheduled	Daily observations by personnel of the Denali Mining Company.
(5) Water Quality (1,2)*	(a) Susitna River near Watana Damsite	Martek Water Quality Data Logger	10/23/80	Continuous	10/23/80-4/16/81, 5/21/81-7/2/81, 8/5/81-Present	Scheduled	Damage to cable caused loss of all but temperature data for period to 7/2/81. Instrument repaired and factory - calibrated in 7/81. Appears to be functioning normally at present. D.O. sensor not working properly from 10/?/81 to 11/3/81.
	(b) Susitna River near Cantwell (Vee Canyon Site)	VWR pH Meter YSI DO Meter YSI S-C-T Meter Van Dorn Sampler Imhoff Cones	N/A	Summer: monthly Winter: 2-3 months	6/19/80	Scheduled	Spring break-up.
					8/8/80	Scheduled	Summer high-flow period (sampled by helicopter).
					9/5/80	Scheduled	Summer low-flow period.
					9/17/80	Sched/Event	Right after heavy rainstorm (post-peak).
					10/17/80	Scheduled	During river freeze-up.
					1/13/81	Scheduled	Winter through-ice sampling.
					5/20/81	Scheduled	After ice breakup, spring.
					6/30/81	Sched/Event	Summer hydrograph - falling limb.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(5) Water Quality (1,2)* (Continued)	(b) Susitna River near Cantwell (Vee Canyon Site)				8/2/81	Event	Summer hydrograph - - rising limb.
					8/3/81	Event	Summer hydrograph - peak.
					8/3/81	Event	Summer hydrograph - falling limb.
					9/15/81	Scheduled	Summer low-flow period.
					10/7/81	Scheduled	During river freeze-up.
	(c) Susitna River at Gold Creek	Same as at Vee Canyon	N/A	Summer: monthly Winter: 2-3 months	8/8/80	Scheduled	Summer high-flow period (sampled by helicopter).
					10/14/80	Scheduled	During river freeze-up.
					1/14/81	Scheduled	Winter through-ice sampling.
					5/27/81	Scheduled	After ice break-up, spring. (Sampled same day by USGS).
					6/30/81	Sched/Event	Summer hydrograph - peak.
					7/1/81	Sched/Event	Summer hydrograph - falling limb.
					8/2/81	Event	Summer hydrograph - peak.
					8/3/81	Event	Summer hydrograph - falling limb.
					9/14/81	Scheduled	Summer low-flow period.
					9/17/81	Scheduled	Samples taken for quality - control check of laboratory.
					10/8/81	Scheduled	During river freeze-up.
(6) Suspended Sediment Discharge	(a) Susitna River near Cantwell (Vee Canyon Site)	Point-integrating Suspended Sediment Sampler	N/A	Summer: monthly Winter: 2-3 months	9/5/80	Scheduled	Summer low-flow period.
					9/17/80	Sched/Event	Right after heavy rainstorm (post-peak).
					10/18/80	Scheduled	During river freeze-up.
					1/13/80	Scheduled	Winter through-ice sampling.
					5/20/81	Scheduled	After ice break-up, spring.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(6) Suspended Sediment Discharge	(a) Susitna River near Cantwell (Vee Canyon Site)				6/30/81	Sched/Event	Summer hydrograph - falling limb.
					8/2/81	Event	Summer hydrograph - rising limb.
					8/3/81	Event	Summer hydrograph - peak.
					8/3/81	Event	Summer hydrograph - falling limb.
					9/15/81	Scheduled	Summer low-flow period.
	(b) Susitna River at Gold Creek	Same as at Vee Canyon	N/A	Summer: monthly Winter: 2-3 months	10/16/80	Scheduled	During river freeze-up.
					1/14/81	Scheduled	Winter through-ice sampling.
					5/27/81	Scheduled	After ice break-up, spring.
					6/30/81	Sched/Event	Summer hydrograph - peak.
					7/1/81	Sched/Event	Summer hydrograph - falling limb.
					8/2/81	Event	Summer hydrograph - peak.
					8/3/81	Event	Summer hydrograph - falling limb.
					9/14/81	Scheduled	Summer low-flow period.
(7) Climate (3)*	(a) Watana Camp	MRI Weather Wizard (WW)	3/13/80	Continuous (15-min.)	4/8/80-Present	Scheduled	**
	(b) Devil Canyon	MRI Weather Wizard	7/17/80	Continuous (15-min.)	7/17/80-Present	Scheduled	**
	(c) Kosina Creek	MRI Weather Wizard	8/25/80	Continuous (15-min.)	8/25/80-Present	Scheduled	**
	(d) Tyone River	MRI Weather Wizard	8/27/80	Continuous (15-min.)	8/27/80-Present	Scheduled	**
	(e) Denali (Susitna Lodge)	MRI Weather Wizard	7/18/80	Continuous(15-min.)	7/18/80-Present	Scheduled	**
	(f) Susitna Glacier	MRI Weather Wizard	7/20/80	Continuous (15-min. or 30-min.)	7/20/80-Present	Scheduled	**

** Occasional gaps in data records due to mechanical or electronic malfunctions or other field problems. Data summaries prepared by MRI for period to 7/1/81. Summaries for more recent data are being prepared by R&M.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(8) Snow Density and Depth (4)*	(a) West Fork Glacier Snow Course	Carpenter Machine Works Snow Sampling Kit Aerial Snow Markers	8/26/80, 8/81	Winter: monthly	01/07/81 2/2-2/3/81 3/6/81 4/2/81 4/30/81	Scheduled	Three aerial markers on and around the glacier.
	(b) Susitna Glacier Snow Course	Same as at West Fork	8/28/80, 9/4/80, 8/81	Winter: monthly	1/7/81 2/2-2/3/81 3/6/81 4/2/81 4/30/81	Scheduled	Three aerial markers on and around the glacier (three of original six markers mov to better locations in 8/81).
	(c) East Fork Glacier Snow Course	Same as West Fork	9/4/80, 8/81	Winter: monthly	1/7/81 2/2-2/3/81 3/6/81 4/2/81 4/30/81	Scheduled	Five aerial markers on and around the glacier (including two additional markers placed on the ice in 8/81).
	(d) Butte Creek Pass	Aerial Snow Markers	9/11/80	Winter: monthly	2/2/81 3/6/81 4/1/81 4/30/81	Scheduled	One aerial marker in vicinity of Butte Creek Pass (two of original three markers removed and used elsewhere).
(9) Ice Buildup during Precipitation*	(a) Watana Camp	Steel Plate	11/80	Unscheduled	Same dates as any winter trip to Watana Camp	Event	Measurements to be made during or immediately af freezing rain. No observed freezing rain to date.
	(b) Denali (Susitna Lodge)	Steel Plate	11/80	Unscheduled	Same dates as Denali climate station runs	Event	Same as at Watana Camp.
(10) In-Cloud Icing (Ice Buildup on Transmission Line)*	(a) Watana Camp	Short Section of Transmission Line	9/10/80, 10/16/80	Unscheduled	Same dates as any winter trip to Watana Camp	Event	Measurements to be made during or immediately after icing conditions. No in-cloud icing has been observed to date.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(10) In-Cloud Icing (Ice Buildup on Transmission Line)*	(b) Denali (Susitna Lodge)	Short Section of Transmission Line	9/11/80, 10/20/80	Unscheduled	Same dates as Denali climate station runs	Event	Same as at Watana Camp.
(11) Snow Creep*	(a) Watana Camp	Dillon Dynamometer Section of Transmission Line Tower	2/26/81	Winter: monthly	3/6/81 3/16/81 4/1/81 10/2/81 11/3/81 12/2/81	Scheduled	Installed on a north-facing slope about 2 miles west of Tsusena Butte.
	(b) Devil Canyon	Dillon Dynamometer Section of Transmission Line Tower	2/25/81	Winter: monthly	3/5/81 3/16/81 3/31/81 10/2/81 11/3/81 12/3/81	Scheduled	Installed on a north-facing slope near the Devil Canyon climate station.
(12) Ice Thickness and Competence*	Susitna River and Tributaries (5)	Ice Auger Measuring Tape	N/A	Winter	2/27/81	Scheduled	Ice thickness surveys were conducted at all CSR locations, except at Section 25 and the Susitna-Chulitna confluence. See parameter (3).
					4/1/81	Scheduled	Adjacent to Watana Strea... gauge and in conjunction with through-ice discharge measurements.
(13) Extent of Ice Cover, Locations of Ice Jams*	Susitna River	SLR Camera	N/A	Daily or weekly during Freeze-up and Break-up	10/80 11/80, 12/80 1/81, 2/81 3/81, 4/81 5/81 10/2/81, 10/6/81, 10/29/81, 11/6/81, 11/18/81, 12/14/81	Event	Black & white aerial photos taken 11/14/80, 12/5/80, 4/27/81, 5/6/81.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(14) Glacial Composition and Movement (6)	Susitna Glacier, West Fork Glacier, Turkey Glacier, West Fork Susitna Glacier	Survey Equipment SLR Camera Aerial Photography	5/17- 5/18/81 5/30/81	Monthly through July, August, September	5/81 7/30/81 8/11/81 9/2/81	Scheduled	Velocity points, camera mounts and thermocouple were installed. Horizontal control net establish and initial survey conducted. Extensive snow depth and density studies throughout glacier network were conducted.
(15) Evaporation	Watana Camp	Monel, Class A Standard Weather Bureau Evaporation Pan	5/7/81	Daily, May-Sept.	-	Scheduled	Daily observations recorded by camp personnel.
(16) Icing Detector*	Watana Camp	Rosemount Ice Detector with electronic counter	12/5/80	Continuous	1/7/81 2/3/81 3/6/81 3/31/81 4/30/81 6/1/81	Scheduled	Any interruption of AC power is recorded as one count. Counter observed during site visits. No significant amount of icing has been recorded to date.
(17) Bedload Transport*	(a) Susitna River @ Gold Creek	Helley-Smith Sampler	-	Unscheduled	7/22/81 8/26/81 9/28/81	Event	***
	(b) Talkeetna River near Talkeetna	Helley-Smith Sampler	-	Unscheduled	7/21/81 8/25/81 9/29/81	Event	***
	(c) Chulitna River near Talkeetna	Helley-Smith Sampler	-	Unscheduled	7/22/81 8/25/81 9/29/81	Event	***
	(d) Susitna River near Sunshine	Helley-Smith Sampler	-	Unscheduled	7/22/81 8/26/81 9/30/81	Event	***

*** Bedload sampling done jointly and in cooperation with the USGS. The July trip was done at a relatively high flow level, the August one at an intermediate of Susitna River flow level, and the September trip at a relatively low flow.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

Status As of: December 15, 1981

Parameter Measured	Station Location	Type of Instrument Used	Date of Installation	Observation Frequency	Dates of Observation	Type of Observation	Comments
(18) Sequential Aerial Photography of Susitna River*	N/A	Olympus OM-2 Camera (35-mm film)	-	Unscheduled	11/14/80	Event	Freeze-up, Delta Island to Watana Creek.
					12/5/80	Event	Freeze-up, Cook Inlet to Watana Creek.
					4/27/81	Event	Break-up, Bell Island to Watana Creek.
					5/6/81	Event	Break-up, Bell Island to Curry.
					8/24/81	Event	Medium flow. Cook Inlet to Devil Canyon, for Vegetation Studies.
					10/19/81	Event	Low flow, Cook Inlet to Talkeetna Confluences, for Morphology Studies.

SUSITNA HYDROELECTRIC PROJECT
Subtask 3.03 - Hydrology Field Observation Log

NOTES:

* An asterisk after a parameter in column one (1) indicates that the entry for that parameter has been altered from the last log's entry.

(1) WQ parameters measured by the continuous water quality monitor: water temperature, dissolved oxygen, conductivity, pH, and oxidation - reduction potential.

(2) WQ parameters measured in the field: dissolved oxygen, water temperature, conductivity, pH, alkalinity, settleable solids, and free carbon dioxide.

(3) Climate parameters measured at each station: air temperature, average wind speed, wind direction, peak wind gust, relative humidity, precipitation, and solar radiation. Snowfall amounts will be measured in heated precipitation bucket at Watana only. Prior to 4/30/81, data were recorded at thirty (30) minute intervals at the Susitna Glacier station and at fifteen (15) minute intervals at all the other stations. Since that date, a 15-minute interval has been used at all stations.

(4) Dates of installation refer to aerial snow survey markers. The actual snow courses are located at one of the markers at each of the three glaciers. There is no snow course at Butte Creek Pass, only an aerial marker. Snow surveys are conducted concurrently at all the climate monitor locations, with the exception of the Susitna Glacier Station, where the snow course is at a more suitable location nearby.

(5) Several sites along the main stem of the Susitna and a few sites on the larger tributaries are to be observed.

(6) Dates of installation refer to snow survey markers.

(7) Last log prepared was as of 10/2/81.

212

SUSITNA HYDROELECTRIC PROJECT

FIELD DATA COLLECTION AND PROCESSING VOLUME 2

FEBRUARY 1982

Prepared by:

R&M CONSULTANTS, INC.

Prepared for:

ACRES

ALASKA POWER AUTHORITY

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING
VOLUME 2

FEBRUARY 1982

Prepared for:

ACRES AMERICAN INCORPORATED
1000 Liberty Bank Building
Main at Court
Buffalo, New York 14202
Telephone: (716) 853-7525

Prepared by:

R&M CONSULTANTS, INC.
5024 Cordova
Anchorage, Alaska 99502
Telephone: (907) 279-0483

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING

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ATTACHMENT D

PERTINENT CORRESPONDENCE

March 17, 1980
P5700.01

052303

R&M Consultants
PO Box 6087
5024 Cordova Street
Anchorage, Alaska 99503

Attn: Mr. Brent Drage, P.E.

Dear Bent,

Susitna Hydroelectric Project
Snow Courses Survey

Enclosed is a copy of a letter from TES commenting on ADF&G's request for snow courses and climatic stations, for your information.

We believe that in your discussions with John Hayden in Anchorage, it was decided that you will finalise an agreed program and cost estimates with ADF&G and send it for our review.

We await your early response to this matter.

Yours truly,

G. Krishnan

GK:adh
Enclosure

ACRES AMERICAN INCORPORATED

Terrestrial Environmental Specialists, inc.
R.D. 1 BOX 388 PHOENIX, N.Y. 13135

RECEIVED MAR 0 4 1980

February 28, 1980
218.082

Dr. John Hayden
Acres American, Inc.
Liberty Bank Building
Main at Court
Buffalo, New York 14202

Dear John:

As suggested at my meeting with Ian Hutchison and John Lawrence on February 20, we have reviewed ADF&G's request for snow courses and climatic stations (January 31 letter and map from Karl Schneider). A summary of our recommendations follows.

It appears that Karl prepared his request without the benefit of a copy of the February POS. Our comparison of his request with the program as described in the POS indicates that some of ADF&G's needs would be met by existing or proposed stations.

Specifically, we feel that none of the climatic stations proposed by ADF&G are needed, due to the proximity of stations proposed by R&M. However, minor modifications in R&M's program might be appropriate to better suit ADF&G's needs for climatic data.

However, we feel that some of the snow courses recommended by ADF&G should be added to the program, whereas others may not be necessary. Specifically, the seven snow courses circled on the attached map should be added. Those not circled are felt to be unnecessary due to the proximity of existing or proposed stations (as described in the POS), or due to a low likelihood that the data would be of value to the program. If any existing stations are scheduled for discontinuation, a re-evaluation of our recommendations will be required.

Please keep us informed of further developments in the program.

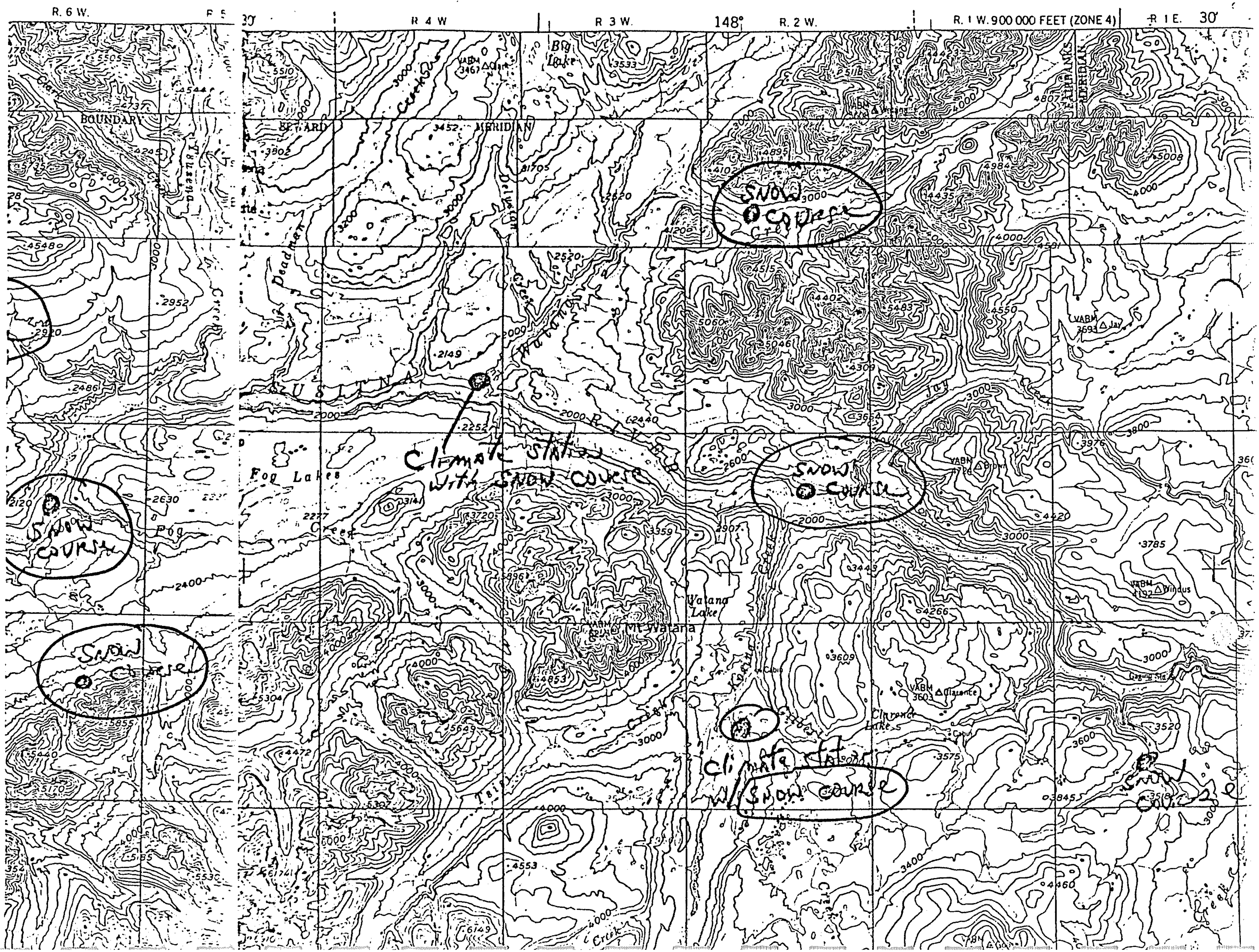
Sincerely,

Vince

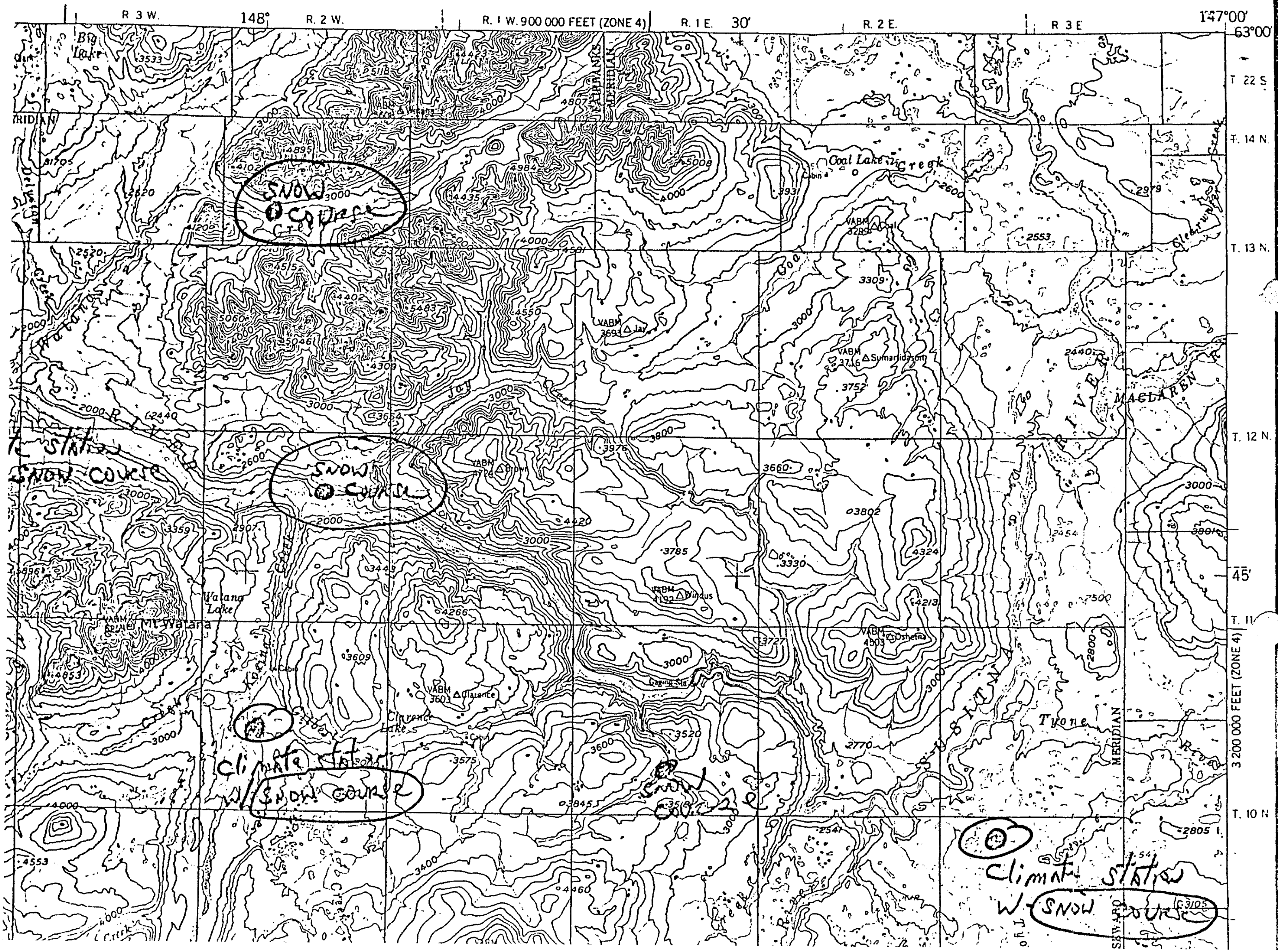
Vincent J. Lucid, Ph.D.
Director of Environmental Studies

VJL/vl
Enc.


000 FEET (ZONE 3)
45'
WILLOW 83 MI.
6980000m. N.
150°00'
350000m. E.
R. 12 W.
R. 11 W.
SUMMIT 30 MI.
30' R. 10 W.
R. 9 W.
R. 8 W.
0 FEET (ZONE 3)
149°
R 7 W
FOUNTAIN R.
Eldridge Gl
ANCHORAGE
FAIRBANKS
RAILROAD
Coal Creek
Granite Cr
Hurricane
Chulitna Butte
Chulitna Pass
Gold Creek
Sherman
Canyon
Devils
High Lake
Thoroughfare
Prairie
Daneka Lake
Stephan Lake
NORTH
Cabin
Climate Station
Snow Course



R. 6 W.
R. 4 W
R. 3 W.
148°
R. 2 W.
R. 1 W. 900 000 FEET (ZONE 4)
R. 1 E.
30'
BOUNDARY
MERIDIAN
FAIRBANKS MERIDIAN
Big Lake
Deadman
Fog Lakes
SUSITNA RIVER
Watana Lake
Mt Watana
Clarence Lake
Tsusena
Jay
Windus
Clarence
SNOW COURSE
Climate station with snow course
Climate station w/ snow course



R 3 W.
148°
R. 2 W.
R. 1 W. 900 000 FEET (ZONE 4)
R. 1 E.
30'
R. 2 E.
R. 3 E
147°00'
63°00'
T. 22 S.
T. 14 N.
T. 13 N.
T. 12 N.
45'
T. 11
T. 10 N
3 200 000 FEET (ZONE 4)
FAIRBANKS MERIDIAN
SEWARD MERIDIAN
Big Lake
Coal Lake
Creek
Watana Lake
Mt Watana
Clarence Lake
Jay Creek
Tyone River
SUSITNA RIVER
MACLAREN R.
Clearwater Creek
VABM 3693 △ Jay
VABM 3716 △ Sumarlidason
VABM 4503 △ Oshetna
VABM 4192 △ Windus
VABM 3603 △ Clarence
VABM 3289 △ Coal
Gaging Sta
Cabin
SNOW COURSE
SNOW COURSE
station SNOW COURSE
climate station w/ SNOW COURSE
Snow Course
climate station W-SNOW COURSE

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

March 21, 1980

R&M No. 052303

Dr. I.P.G. Hutchison
Acres American
Main @ Court
Liberty Bank Building
Buffalo, New York

Re: Cooperative Agreement with S.C.S. on the Snow Survey Program

Dear Ian,

On March 19, 1980, I met with George Claggett (S.C.S.) on developing a cooperative program for continuation of snow course work for the Susitna Project. This discussion related to two time frames; (1) continuing snow surveys for 1980 and (2) snow surveys for 1981 and 1982.

Continuing the 1980 snow survey program was outlined in the February 12, 1980 letter from S.C.S. to A.P.A. and concurrence was expressed in a memo dated February 19, 1980 from Robert Mohn to John Lawrence. This program will be carried out as outlined except that for the May 1, 1980 snow course run, a helicopter will be required to conduct on-site inspections of our high elevation snow courses which will be installed this summer.

R&M participation in the 1980 program is going to require four man days in addition to our Plan of Study budget which amounts to about $1,280.00.

For 1981 and 1982 snow course work, we have tentatively agreed on the following cooperative program.

a) The Susitna basin will be divided into the Lower Basin and the Upper Basin.
b) S.C.S. will furnish one man and R&M Consultants will furnish one man.
c) The Lower Basin will require one days operation out of a fixed wing aircraft. S.C.S. will provide the fixed wing.
d) The Upper Basin will require one days operation out of a helicopter in order to service the high elevation snow courses. Acres will provide the helicopter.
e) S.C.S. will process data and include it in their monthly bulletins.
f) Snow pillows will not be installed during 1980 because of the potential bridging problem at high elevations. If determined feasible after one years operation, they will then selectively be installed.

The 1981 and 1982 program as outlined above can be conducted within the existing R&M Snow Course Budget and it is believed that the extra effort required during 1980 can be absorbed within this budget. The aircraft requirements as specified above are similar to those as were determined for the program outlined in the Plan of Study.

If you are in concurrence with this program please outline it for A.P.A. so that a cooperative agreement can be firmed up.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/dj/SUS12-B

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

March 21, 1980 R&M No. 052303

Dr. I.P.G. Hutchison
Acres American
Main @ Court
Liberty Bank Building
Buffalo, New York

Re: Budget and Scope Review to Accommodate Cooperative Agreement with the U.S.G.S. Water Resource Division

Dear Ian,

I have reviewed Subtask 3.03 and 3.10 budgets in conjunction with the budget submitted by U.S.G.S. to A.P.A. for cooperative participation in the Susitna hydrologic data collection program. Attached are summaries and cost breakdowns for accomplishing the work outlined by U.S.G.S. and included in the February Plan of Study. The scope has been expanded to include efforts which were discussed during our meeting with U.S.G.S., A.P.A., S.C.S. & D.N.R. on February 7, 1980. In addition, budgets presented on the attachments account for continuing stream gaging at those stations which the Corps of Engineers is going to discontinue funding as of October, 1980.

A cooperative program for hydrologic data collection should enhance the Susitna Project. Generally, the U.S.G.S. will develop a good data base for engineering and environmental studies and R&M Consultants will expand the data for required site specific analyses. Working in a cooperative manner will develop a stronger base for forthcoming decisions.

The program outlined in the letter from U.S.G.S. to A.P.A., dated February 27, 1980 is included in its entirety with the exception of Tyone River and the Yentna River. I do not feel that establishment of a stream gage on the Tyone River is warranted at this time, however it should be considered at a later time when we can better define its influence on the Susitna system. The U.G.S.S. did not include costs for establishing a stream gage on the Yentna River. Estimated costs for this station are included and were developed based on information related to me during a phone conversation with Larry Levine. John Hayden has recommended a full station be established on the Yentna River rather than a staff gage.

A cost breakdown for Subtask 3.10 is attached. When this subtask was outlined, we included only the installation of a staff gage on the Yentna River with field visits to be coordinated with environmental activities. This station is upgraded to a full station which includes discharge, sediment, water quality, and temperature. For the Chulitna River gage, we scoped in efforts for obtaining sediment and discharge, however, it appears that we estimated lower costs than the U.S.G.S. proposes. The stream gage on the Susitna River near the Parks Highway Bridge included only discharge measurements whereas the U.S.G.S. proposes additional measurements of water quality and sediment. This additional effort, which is justifiable for environmental studies, constitutes part of the cost overrun.

Consider this submittal a "draft" for negotiating a cooperative agreement between the U.S.G.S. and the A.P.A. Following finalization, budget adjustments will probably be required. Please give a call after you have had an opportunity to review.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T Drage

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/dj/SUS12-A

Summary

Budget Breakdown for U.S.G.S.
Cooperative Agreement

		Labor	Equipment	Lab.	Total
1.	Available budget as per page 6 Subtotal	$170,000	$71,300	$125,000	$366,300
2.	U.S.G.S. Costs thru June 1981 Based on Feb. 27, 1980 letter from U.S.G.S. to A.P.A.	*117,980	67,520		185,500
3.	U.S.G.S. Costs July 81 thru June 1982 - Projected from data on above letter	*104,150			104,150
4.	R&M Budget for 2 Stations Plus event oriented work and coordination with U.S.G.S.	105,333	24,656	83,330	213,319
	Subtotal	327,463	92,176	83,330	502,969
	Summary	(157,463)	(20,876)	41,670	(136,669)
	Overrun =				$136,669

*Lab Analyses included in Labor

Summary of
Areas Constituting Overrun

1.	Continuing operation of Stream Gages that were previously funded by Corps of Engineers	
	As per U.S.G.S. letter to A.P.A. Jan. 17, 1980	$ 43,800.00
	Continued operation from Oct. 1981 to June 1982 (9/12 x $43,800)	32,850.00
	Subtotal	$ 76,650.00
2.	Upgrading Yentna River gage from a staff gage to Full Stream gage.	
	. Costs through June 1981	$ 30,000.00
	. Costs from July 1981 to June 1982	15,000.00
		$ 45,000.00
	Minus budget allocated in Subtask 3.10	
	Construction	5,000.00
	Operation	10,000.00
		- 15,000.00
	Subtotal	$ 30,000.00
3.	Additional Costs for operating Chulitna and Susitna @ Sunshine Stream gages than budgeted for in Subtask 3.10	$ 35,000.00
		$141,650.00

Subtask 3.10
Lower Susitna Studies
Budget Breakdown

1.	Field Equipment	
	. Staff gage near Yentna River Mouth	$ 5,000.00
	. Establish Gages @	
	. Susitna near Parks Bridge	15,000.00
	. Chulitna River near Talkeetna	15,000.00
		$ 35,000.00
2.	Gage Operation Labor	
	3 Stations @ 5,000 per year x 2 years	$ 30,000.00
	. Discharge & Sediment at Chulitna	
	. Discharge only on Susitna & Yentna	
3.	Field Observations and documentation for Lower Susitna morphology studies	
	. 8 trips per year x 2 years x $1,600.00/trip	$ 25,600.00
	. Miscellaneous Expenses	1,400.00
4.	Office Report	
	. Reduction of Data	
	. Analyses of Data	
	. Regime Analyses	
	. Report Preparation	$ 14,000.00
		$106,000.00

Note: Aircraft Charter under Direct Cost
Orthophoto Mosaic under Task 2.08.

Budget Breakdown for U.S.G.S.
Cooperative Agreement

1. Total Budget

From Ian Hutchison (Acres) breakdown

a. Discharge		
	Labor	$ 43,800.00
	Equipment	36,300.00
b. Sediment		
	Labor	77,400.00
	Lab Analyses	50,000.00
c. Water Quality		
	Labor	18,800.00
	Lab Analyses	75,000.00
d. Task 3.10		
	Field Equipment - 3 gages	35,000.00
	Labor	30,000.00
	Total	$366,300.00

2. U.S.G.S. Cost Summary
Based on February 27th letter from U.S.G.S. to A.P.A. & phone conversation with L. Levine.

Costs through June, 1981

. Susitna R. near Denali	$ 14,130.00
. Maclaren R. near Paxón	10,140.00
. Susitna R. near Cantwell	50,000.00
. Susitna R. @ Gold Creek	15,430.00
. Chulitna R. near Talkeetna	25,700.00
. Susitna R. @ Sunshine	32,300.00
. Yentna R. near mouth (est. per phone conversation with L. Levine)	30,000.00
. Susitna R. @ Susitna Station	7,800.00
Total	$185,500.00

3. U.S.G.S. Costs, July 1981 to June 1982
Projected from data on February 27, 1980 letter from U.S.G.S. to A.P.A.

. Susitna R. near Denali	$ 12,140.00
. Maclaren R. near Paxon	9,870.00
. Susitna R. near Cantwell	18,900.00
. Susitna R @ Gold Creek	13,440.00
. Chulitna R. near Talkeetna	11,200.00
. Susitna R. @ Sunshine	15,800.00
. Yentna R. near Mouth (est.)	15,000.00
. Susitna R. @ Susitna Station	7,800.00
Total	$104,150.00

4. U.S.G.S. Costs for continuation of Stations that funding will be discontinued by Corps of Engineers as of October 1980.

As per U.S.G.S. letter to A.P.A., January 17, 1980	$ 43,800.00
Extended from October 1981 to June 1982 (9/12 x 43,800)	32,850.00
Total	$ 76,650.00

5. R&M Consultants Budget required for maintaining 2 complete stations plus event oriented work and coordination with U.S.G.S.

[From Ian Hutchison (Acres) breakdown]

. Discharge	
Equipment 2/3 x $36,300	$ 24,656.00
Labor 2/3 x $43,800	29,200.00
. Sediment	
Labor 2/3 x $77,400	51,600.00
Lab 2/3 x $50,000	33,330.00
. Water Quality	
Labor 2/3 x $18,800	12,533.00
Lab 2/3 x $75,000	50,000.00
Total	$201,319.00

Coordination of U.S.G.S. Field Activities	
10 hours per month x 24 months x $50.00/hour	$ 12,000.00
Total	$213,319.00

R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

April 2, 1980

R&M No. 052303

Acres American, Inc.
The Liberty Bank Building
Main @ Court
Buffalo, N.Y. 14202

Attention: G. Krishnan

Re: Water Quality Program - Meeting with Alaska Department of Conservation

Dear Mr. Krishnan:

On March 28, 1980, a meeting was held with Dave Sturdevant (ADEC) concerning the Susitna Project water quality program. Present were Jim Landman, Larry Pederson and Brent Drage. The meeting addressed the present status of the Susitna Project water quality program and a request by ADEC, that they be kept informed on the Susitna project progress.

Attached is an informal response by ADEC to the Water Quality Program as outlined in the P.O.S. We explained that the Water Quality Program is currently under revision and once it is finalized we would send ADEC a copy. After describing our program and quality control procedures, he appeared to be satisfied. We are entering him on our Data Index Distribution mailing list so that ADEC will be kept abreast of our progress.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/dj/L3-N

STATE of ALASKA

MEMORANDUM

TO: Dave Sturdevant
Management & Technical Assistance

DATE: March 14, 1980

FILE NO:

TELEPHONE NO:

FROM: Jeff Hock
EQM&LO

SUBJECT: Comments - Acres POS
Susitna Hydro Development

The following comprise a summation of comments regarding the water quality section of Acres American plan of study (POS) for Phase I Feasibility Studies of the Susitna Hydroelectric Project.

1. The POS recognizes the inter-relationship between water quantity and water quality.

2. Definitions of summer and winter should be more clearly defined, utilizing break-up and freeze-up as transition boundaries.

3. USGS will monitor temperature on a continuous basis. This will be essential for permit and certification purposes. An understanding of natural temperature variation will be valuable.

4. Due to the glacial origin of the Susitna River, turbidity should be monitored on more frequent intervals through the summer months, including data at peak flow periods.

5. Field instrumentation should be clearly established, including models and degree of precision expected for each parameter. Methodology for each parameter should be established and clearly referenced. It should be EPA approved or meet specification guidelines.

6. In order to assure accurate and reliable data, Acres should include an outline of their quality control program for each parameter to be monitored. How often will the instrument be calibrated? What approach will be taken with regard to standard and reference materials? Each parameter should institute some plan for quality control over the results.

7. Methodology utilized in the collection and transport of samples from the sampling point to the location for analysis should be clearly defined, including sample container preparation.

8. It is unclear as to what is meant by total nitrogen on pg. 5-56. Nitrate (NO3) and nitrite (NO2) nitrogen would be more valuable for monitoring productivity. It is the soluble, inorganic nitrate (NO3) nitrogen that is utilized by the aquatic primary producers. Total kjeldahl nitrogen will monitor the degree of organic decomposition present.

9. It would be valuable to acquire background data regarding nitrogen gas. Nitrogen supersaturation is a problem associated with large scale dams. The potential has been addressed in the POS through engineering design considerations.

10. Methodology for total dissolved and suspended solids should be defined, referred to in Standard Methods (14th ed.) as total filterable and non-filterable residues. Exceedingly high residue levels can produce interference in filtration, and drying.

11. The type of trace metals to be analyzed should be specified, including methodology, equipment and degree of precision.

12. A biological inventory should be established through coordination with respective resource agencies, so ADEC can determine what species and life stages are most biologically important and sensitive.

Registered
Professional
Engineer

MILO C. BELL
Consulting Engineer
BOX 23
MUKILTEO, WASHINGTON 98275

RWW
RECEIVED
14 Apr '80
R218.178

April 9, 1980 RTD

File 052303
052307
cc Brent

Mr. Robert Williams
Terrestrial Environmental Specialists, Inc.
R. D. 1, Box 388
Phoenix, New York 13135

Dear Bob:

This letter indicates that the Alaska Department of Fish and Game intend to use river events in their work when obtaining water quality samples in the field by taking grab samples. Our suggestions, therefore, for using changing flows from different sources is compatible with their program.

A single set of grab samples taken may be useful but not necessarily indicative, as bed load transfer is a function of water flow and a sample taken at the lower part of the river may be representative of something that has happened upriver days or weeks before. I should think that they would want to take samples widely spaced in the watershed in a relatively short time space, say 48 hours, to see if new material being introduced have long or short time value.

Have they indicated any method that they would accept for the measurement of bed load and its movement? There should be some meeting of the minds on this subject, as well as a decision as to who will be responsible for operating an agreed-to system.

I have discussed this with Clint Atkinson, and this letter may be considered as a joint letter as he is in general agreement.

Sincerely yours,

Milo

R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH: 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

May 9, 1980 R&M No. 052303

Dr. I.P.G. Hutchison
Acres American
The Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Re: Susitna Water Quality Data Collection; List of Parameters to be Collected and Sampling Procedures

Dear Ian,

Attached is the list of water quality parameters that we propose to collect at the Watana and Gold Creek Stations. Please note that our list is compared to the list included in the POS and input from TES. Our list includes all suggested parameters plus some additional parameters. It is our intent to measure this comprehensive list during 1980 and then review the results this winter and revise the 1981 program as required to meet project objectives.

Also attached is a copy of our sampling procedures and required water quality sampling equipment. This list is considered to be minimum for this seasons activity and a request for purchase of this equipment has been submitted to Jim Gill.

If you have any questions or comments please call.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/dj/L4-DD

WATER QUALITY PROGRAM FOR THE SUSITNA HYDROELECTRIC PROJECT

Original Parameters in Acres Proposal	Parameters to be measured by U.S.G.S (1)	Parameters suggested by L.A. Peterson & Assoc.	Parameters suggested by TES	Parameters R & M proposes to collect at Susitna River at Gold Creek & Watana
FIELD:				X
Dissolved Oxygen	X	X	X	X
pH	X	X	X	X
Conductivity	X	X	X	X
Temperature	X	X	X	X
Carbon Dioxide	X	X	X	X
Alkalinity	X	X	X	X
		Settleable Solids	X	X
LABORATORY:				
Turbidity		X	X	X
Total Dissolved Solids	X	X	X	X
Total Suspended Solids		X	X	X
Total Phosphate	X	X	X	X
Ortho Phosphate	X	X	X	X
Keldal Nitrogen		X	X	X
Total Nitrogen		X	X	X
Trace Metals	X(5)			
		Nitrate Nitrogen	X	X
		Ammonia Nitrogen	X	X
		Chemical Oxygen Demand	X	X
		Hardness	X	X
		Chloride	X	X
		Color	X	X
		Sulfate		X
		ICAP-Scan (1)		X
		Uranium (2)		X
		Radioactivity, gross alpha (2)		X
		Organic chemical (pesticides) (2)		X
			Calcium (3)	
			Copper (3)	
			Iron (3)	
			Sodium (3)	
			Nickel (3)	
			Lead (3)	
			Silicon (3)	
			Zinc (3)	
			Total Organic Carbon	
			Total Inorganic Carbon	

Footnotes:

(1) A summary of individual materials tested is listed below.

(2) To be done three times (at a location downstream of Devils Canyon) during the first year. The three periods would be: breakup, summer baseflow and low winter flow.

(3) Included in the ICAP-Scan

(4) The USGS will be sampling at the following sites:
- Susitna River near Denali
- Chulitna @ mouth
- Susitna River at Cold Creek
- Talkeetna River near mouth
- Susitna River at Susitna Station

(5) Should try to see if U.S.G.S. could use ICAP scan instead of Trace Metals if it is more comprehensive and of no additional cost.

ICAP-Scan includes the following:

Silver	Magnesium
Aluminum	Molybdenum
Arsenic	Sodium
Gold	Nickel
Boron	Manganese
Barium	Phosporous
Bismuth	Lead
Calcium	Platinum
Cadmium	Anamony
Cobalt	Selenium
Chromium	Tin
Copper	Strontium
Iron	Titanium
Mercury	Vanadium
Potassium	Tungsten
	Zinc
	Zirconium

Summary: the fine points

① R&M would collect all the data at two locations along the Susitna River at least 5 times during the first year. The five times would include: 1) Spring breakup, 2) Summer baseflow (maximum effect of glaciers), 3) Immediately after a heavy rainstorm (as close to hydrograph peak as possible) 4) just prior to freeze-up, and at 5) Winter low flow (under ice cover)

② Both R&M and the USGS will be collecting data on the Susitna River at Cold Creek so we will get a very good record at this site. This will allow more knowledgeable extrapolation of the data collected at other sites. R&M will conduct event oriented sampling at Cold Creek. The site will be occupied during flood events and water quality sampled 3 to 5 times through the hydrograph.

③ R&M will install Continuous Recorder for key water quality parameters at the Watana site:
- Dissolved Oxygen
- pH
- Temperature
- Conductivity
- Turbidity

MEMO TO: Brent Drage

FROM: Jim Aldrich JWA

RE: Water Quality Sampling Procedures and Equipment Required for the Susitna Project
R & M Project No. 052303

DATE: April 14, 1980

As per your instructions, I have prepared a list of the procedures and equipment required to perform the water quality sampling to be done by R & M Consultants in the Susitna River Basin this summer. The parameters we will be measuring in the field include: dissolved oxygen, pH, specific conductivity, temperature, carbon dioxide, alkalinity, and suspended solids. In addition, we will also be collecting water samples for analysis by a commercial laboratory.

In order to analyse the above parameters in the field, it is suggested that the following procedures be used. The equipment needed to perform the analyses is also discussed.

Dissolved oxygen will be measured using a YSI Model 51B Dissolved Oxygen Meter. The procedures will be as described in "Standard Methods" (14th Edition) section 422F and as outlined in the instructions for the instrument. Other associated equipment that will be required include: a standard membrane kit for the probe, an "O" ring kit for the probe, a barometer, and a thermometer.

The pH will be measured with a Digital Mini pH meter, and the procedure will be as outlined in the instructions for the meter. A 1-quart bottle of buffer with a pH of 4 and another with a pH of 7 will also be required.

Specific conductance will be measured with a YSI Model 33 S-C-T meter. The procedures will be as outlined in the instructions for the instrument, however the specific conductance should be converted to an equivalent value at the standard 25° C temperature.

Temperature will be meausred with a standard laboratory thermometer. The thermometer should be calibrated in increments of 0.1° C.

Carbon dioxide will be measured according to the procedures outlined in "Standard Methods" section 407B. A Van Dorn or Kemmerer water sampler should be used to collect the sample, to insure that air cannot mix with the water sample.

Alkalinity will be measured according to the procedures outlined in "Standard Methods" section 403, the potentiometric method. Field personnel should be alerted to the special procedrues required if the pH is above 8.3.

Suspended solids will be measured with a Imhoff Cone according to the procedures outlined in "Standard Methods" section 208F. The results will be reported as ml/liter of suspended solids.

Equipment that will be required for a number of the above analyses, but which was not mentioned above, include: a 10 ml buret, a 25 ml buret, a buret stand and holder, 30 ml drop dispenser bottles, 250 ml wide mouth wash bottles, 250 ml beakers, 600 ml beakers, 10 ml pipets, and a variety of tubing.

Since VWR Scientific has an office in Anchorage and can supply most of what we need, they probably offer the most expeditous place from which to purchase the equipment. Attached is a list of the required equipment that VWR could supply, along with catalog numbers, quantities needed, and prices.

A Van Dorn type water sampler can be pruchased from WILCO Instruments. Since we will be collecting samples for trace metal analyses, as well as for standard water analyses, it would probably be best to purchase the Beta Plus horizontal sampler with a 2.2 liter acrylic bottle. A picture of the sampler is on page 69 of the attached "out of date" catalog. The acrylic bottle, although not mentioned in the attached catalog, is now available. The cost of the sampler and carrying case is about $290.00 plus shipping. WILCO Instruments may take as long as 5 days to process the order. Since they apparently make the equipment once the order has been placed, I suggest calling them (to get them started) at the same time a purchase request is being sent. A horizontal rather than a vertical sampler is suggested as it generally performs better in a river.

To collect water samples for analysis by a commercial laboratory we will need various sample bottles, preservatives, and Coleman coolers. Since it appears that Chemical and Geological Laboratories of Alaska, Inc. will probably be performing the laboratory analyses, I suggest that we make arrangements for them to supply the sample bottles with preservative in them and marked as to parameter and site. We would buy the Coleman coolers (after finding out from the lab how many bottoles will be required), and the lab would fill them with sample bottles ready to go at the time of each sampling trip.

I also suggest that we have Chemical and Geological Laboratories of Alaska prepare the standard solutions that we will need for the field analyses, and that they have the standards ready with the sampling bottles. The standard solutions required include: phenolphthalein indicator solution prepared with carbon dioxide-free distilled water, 0.0454N Na_2CO_3, 0.01 $NaHCO_3$, either 0.1N H_2SO_4 or 0.1 N HCl, and either 0.02 N H_2SO_4 or 0.02 HCl (these could probably be made in the field from the 0.1N solutions but making them might not be much fun in the winter). A gallon of distilled water should also be supplied for field use on each trip.

The use of Chemical and Geological Laboratories of Alaska for preparing the standard solutions and sampling bottles will save us washing all the bottles after each trip, adding various preservatives, making the standard solutions, and purchasing a drying oven, Metler balance and chemicals in order to make the standards.

Since we will require a relatively small amount of tubing and only about 25 - 10 ml disposable pipets, I recommend buying these items from one of the local labs rather than ordering them. The quantities normally offered from places such as VWR Scientific are much larger than we would require.

In terms of back-up equipment, should something go wrong with ours, a discussion with Larry Peterson and Steve Ede of Chemical and Geological Laboratories of Alaska has suggested that we could borrow equipment from either of them in an emergency. A more formal arrangement might be in order.

To protect the equipment that will be going to the field regularly and to provide a working surface, I suggest we build one or more carrying cases for the equipment. The cases would include styrofoam insulation cut out to hold each piece of equipment in a particular place, legs to make a table on which analyses could be done, a white surface to do the titrations on, and a stand for the Imhoff Cone (note that a stand was not suggested for purchase with the cone). A rough sketch of such a case, with some ideas, is attached.

The water quality sampling kits (once made) should also include a water proof note pad, standard data sheets (which we will have to prepare), and instructions for each of the tests on water proof paper. It should be insisted that the field personnel take plenty of notes (on the water proof pad) during each sampling trip, as they can be very useful in analysing funny looking results at a later date.

Also attached is a copy of the relevant pages in the new VWR Scientific catalog, and copies of the "Standard Method" prcedures referenced above.

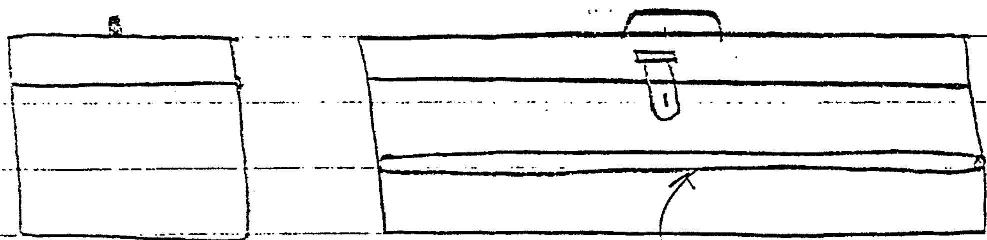
Here endeth the epistle. As always, if I can be of any further assistance to you, please don't hesitate to call.

EQUIPMENT TO BE ORDERED FROM VWR SCIENTIFIC

DESCRIPTION	CATALOG NUMBER	PAGE NO. IN CATALOG 80	PRICE	QUANTITY	COST
Oxygen Meter (Yellow Springs 51B)	52455-003	903	$ 415.00	1	$415.00
Oxygen, Temperature Probe	52457-010		$ 128.00	1	$128.00
Membranes, Standard (Yellow Springs 5775)	52457-552	906	$ 7.10	1	$ 7.10
Cable Assembly, 10-Foot (Yellow Springs 5740-10)	52457-155	906	$ 57.00	1	$ 57.[illegible]
"O" Ring Kit (Yellow Springs 5945)	52457-610	906	$ 2.25	1	$ 2.25
Barometer, Aneroid, Hanging Type, Marine Compensated	13117-000	70	$ 47.99	1	$ 47.99
Salinity Meter, S-C-T, Battery Operated (Yellow Springs Instr. 33)	66121-254	1265	$ 378.00	1	$378.00
Digital Mini pH Meter - Model 55	34100-630	651	$ 198.00	1	$198.00
Buffer Solution, Red Label, pH = 4	34180-253	698	$ 4.30/pt.	2 pts.	$ 8.60
Buffer Solution, Green Label, pH = 7	34180-286	698	$ 4.30/pt.	2 pts.	$ 8.60
Thermometers, Fractional Division, White Back, (460mm length, 0.1 Div./°c, -1°c to +51°c)	61027-204	1195	$ 27.15/ea.	2	$ 54.3[illegible]
Burets, Accu-Red, PRYEX Brand (Corning 2122A, 10 ml cap.)	17452-109	243	$ 27.55	1	$ 27.55
Burets, Accu-Red, PRYEX Brand (Corning 2122A, 25 ml cap.)	17452-120	243	$ 27.55	1	$ 27.55
Buret Support Stand Only	17683-054	258	$ 25.00	1	$ 25.00
Double Buret Holder Only	17683-101	258	$ 13.00	1	$ 13.00

DESCRIPTION	CATALOG NUMBER	PAGE NO. IN CATALOG 80	PRICE	QUANTITY	COST
Cone, Imhoff, Styrene (Nalge 1000-0010)	66186-001	1276	$ 8.00/ea.	1	$ 8.00
Bottles, Drop-Dispenser Conventional Polyethylene, Nalge (30 ml cap., Nalge #16354-421)	16354-421	230	$ 8.28/doz.	1 doz.	$ 8.28
Wide-Mouth Wash Bottles-250 ml cap., Nagle #2402-0250	16651-573	235	$ 5.40/pk. of 4	1 pk.	$ 5.40
Polypropylene Griffin Beakers 250 ml. cap.	13890-080	104	$ 6.55/pk of 6	1 pk.	$ 6.55
Polypropylene Griffin Beakers - 600 ml. cap.	13890-126	104	$ 9.52/pk. of 4	1 pk.	$ 9.[illegible]
				TOTAL	$1435.66

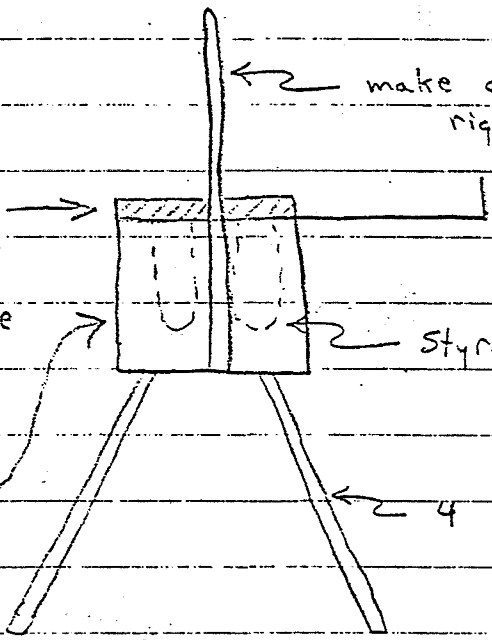
Water Quality Sampling Kit



end view

front view

legs fasten to outside



make case such that buret stand screws right into bottom of case

Carry a piece of white Masonite in lid that becomes surface of table once case is set-up.

Styrafoam with hole cut for instruments

4 detachable legs

make a bracket that attaches to the outside of the case and will hold the Imhoff Cone.

052303

May 21, 1980
P5700.11.10
T.160

Mr. Brent T. Drage
R & M Consultants
5024 Cordova
Box 6087
Anchorage, Alaska 99502

Dear Brent:

Susitna Hydroelectric Project
Water Quality Sampling Procedures
and Equipment

We have reviewed the Water Quality Sampling Procedures and Equipment List submitted by you and offer the following comments:

1. The equipment list has been approved and arrangements are being made for their purchase.

2. We strongly recommend that a field manual for collection, preservation and analysis of each sample be prepared and rehearsed. A checklist for collection and field testing for all parameters at each station should be made prior to every site visit and documented for future reference and catalogue.

3. Since a pH meter will be available in the field, we suggest that potentiometric method for measuring carbon dioxide be used with phenolphthalein indicator as a backup.

4. Preservatives should not be added ahead of time for all samples. The local laboratory should be able to advise in this regard. Please let us know if you need any information.

5. We assume that you are in touch with Mr. Bob Williams to identify and select a continuous water quality recording instrument to be set up at Watana Camp. Please inform us as soon as you finalize the details.

Should you have any queries, please call me.

Sincerely,

G. Krishnan

GK:pg

ACRES AMERICAN INCORPORATED
Consulting Engineers
The Liberty Bank Building, Main at Court
Buffalo, New York 14202

Telephone 716-853-7525 Telex 91-6423 ACRES BUF

Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

June 12, 1980 R&M No. 052303

George Clagett
Snow Survey Supervisor
Soil Conservation Service
2221 East Northern Lights Blvd.
Room 129
Anchorage, Alaska 99504

Re: Susitna Hydroelectric Project, Snow Survey Program.

Dear George:

This letter confirms our agreement for conducting snow surveys in the Susitna River basin for the Susitna Hydroelectric Project. As per our previous discussions, the program will be carried out jointly between SCS, R&M Consultants and Acres American Inc. This agreement covers snow surveys for the winters of 1980, 1981 and 1982.

This cooperative agreement basically consists of:

a) R&M Consultants will furnish one person per snow survey and summer maintenance trips.
b) Acres American Inc., will pay 50% of cost for air transportation
c) Helicopter useage for high elevation snow courses will be provided by Acres.
d) SCS will process data and include in the monthly bulletins.

It is anticipated that the following trips will be required:

ITEM	NO. OF TRIPS
1980 Snow Survey Trips	
March 1, April 1, May 1	3
Summer Maintenance & Installation	2
1981 and 1982 Snow Surveys	
2 x Feb. 1, March 1, April 1, May 1	8
Summer Maintenance Trips	2
Total No. Trips	15

Reimbursement for 50% of air transportation costs should be referenced as follows:

Susitna Hydroelectric Project
Subtask 3.03
Snow Surveys

and billed to the following address with copies of receipts:

Acres American Inc.
C/O Jim Gill
2207 Spenard Road
Anchorage, Alaska 99503

As per your letter dated February 19, 1980, to the Alaska Power Authority, the estimated costs for air transportation is $2,700.00 per year and per our subsequent conversations there should be a 20 per cent contingency for of bad weather allowance.

If you have any questions or comments, please give me a call.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drege, P.E.
Senior Engineer

BTD/jh/L-3-Q

CC: G. Krishnan,

Terrestrial
Environmental
Specialists, inc.
R.D. 1 BOX 388 PHOENIX, N.Y. 13135

Copy Leslie Scuttle
Jim Aldrich - FBK
L.A. Peterson
118 Skyline Dr.
FBKS, AK
99701

June 16, 1980
218.198

Mr. Kevin Young
Acres American, Inc.
Liberty Bank Building
Main at Court
Buffalo, New York 14202

Dear Kevin:

As we discussed on the phone, it is important to the Susitna environmental program that the water quality data collected at the various sampling locations yield comparable results. TES has agreed that an event-oriented approach to sampling is a valid and useful approach. In doing so, we have assumed that the same hydrologic events would be sampled at all of the sampling stations, and that the key parameters that we have previously identified would be measured at each of the stations. Of course, we also assumed that the field and laboratory methods would be selected so as to yield comparable results for each station.

TES has not yet received details of the USGS portion of the program, or of the finalized Acres/R&M portion. If documentation of the combined programs is now available, we wish to review it and to be assured that the total program will meet the needs of the Task 7 environmental analysis.

Sincerely,

Vince

Vincent J. Lucid, Ph.D.
Environmental Study Director

VJL/vl
cc: B. Drage, R&M
B. Williams
C. Atkinson
M. Bell

R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
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July 8, 1980 R&M No. 052303

G. Krishnan
Acres American, Inc.
Liberty Bank Building
Main at Court
Buffalo, New York 14202

Re: Documentation of Selected Climatic Station Sites and Associated Criteria

Dear Mr. Krishnan:

During the week of June 30, 1980, Mr. Paul Denison of Acres met with R&M Consultants for the purpose of establishing location criteria for climatic stations and field selection of specific sites. Mr. Denison provided climatological expertise for siting, whereas R&M Consultants provided input with regards to the feasibility of installation, local knowledge, operations and maintenance of each station.

A description of each site is attached with locations marked on copies of 1 to 63,360 maps. Some of these locations deviate from the locations specified in the Plan of Study. However, it must be remembered that the Plan of Study's locations were considered only to be representative, and an exercise as was conducted last week was required before each site could be finalized. The following sites have been selected:

Site 1 - Watana Camp

Site unchanged from Plan of Study.

Site 2 - Devil Canyon

A weather station was designated for Gold Creek, Devil Canyon or perhaps a location in between. The Devil Canyon site offers a better location for satisfying transmission line, environmental and hydrology data requirements.

Site 3 - Kosina Creek

This station was added to accommodate Alaska Department of Fish and Game caribou studies and satisfy hydrology data requirements for the area south of the Susitna River in the Talkeetna Mountain drainages.

Site 4 - Tyone River

Establishment of the Kosina Creek site caused the proposed Oshetna River site to become redundant. This station was moved to the Tyone River basin which has unique characteristics with respect to hydrology studies. The Tyone drainage area is relatively large and is characterized with gently rolling or flat terrain with numerous lakes, and the subbasin is poorly drained. Climatic data within this basin will be important for subsequent runoff studies.

Site 5 - Denali

This site is unchanged and considered appropriate to represent the high plateau at the base of the Alaska Range. Data from this site will extend an existing partial climate record.

Site 6 - Susitna Glacier

A high elevation site was specified in the Plan of Study and the field-selected site satisfies data requirements very well. The site is located at the confluence of four major glaciers feeding the main stem of the Susitna River.

A meeting with Sterling Miller and Warren Bollard of Alaska Department of Fish and Game was held on June 30, 1980, to discuss wildlife climatic data requirements as specified in their letter dated March 17, 1980, to Jim Gill. It was concluded that a climate station located in the Kosina Creek drainage would satisfy hydrology data requirements as well as data for caribou calving grounds. However, Alaska Department of Fish and Game data requirements in the Watana Creek drainage would not add to hydrology studies significantly enough to warrant transferring one of the proposed sites or provide justification for additional funding. However, it was recognized that climatic data would significantly aid Alaska Department of Fish and Game wildlife studies, therefore, it was agreed that R&M and Acres would procure, install, operate and maintain the Watana Creek stations if Alaska Department of Fish and Game acquires additional funding. Acres/R&M will provide updated capital and operating costs to Alaska Department of Fish and Game for the additional stations.

The Susitna Glacier Station could experience extreme winds which will dictate special attention. Paul Denison, along with my support, recommended installing the MRI 200 mph anemometer. We hereby request authorization to upgrade this instrument. In addition, R&M will be obligated to install special anchoring systems on the unit to secure it during strong winds.

Recognition that it will not be possible to retrieve 100 percent data from multiple remote climate stations was revealed. In order to minimize lost data, it became apparent that a spare unit should be purchased and stored at the Watana Camp. This unit would consist of a Weather Wizard component, anemometer and associated cabling and structural members. It is hereby requested that a standby unit be authorized for purchase.

It was discussed with Paul Denison and agreed upon that Acres - Buffalo would provide R&M with formats for climatic data processing. Mr. Denison was provided with R&M's data processing procedures which were submitted to G. Krishnan. Mr. Denison will review and modify accordingly to insure that the data will be processed adequately for hydrological, environmental, transmission line and other subsequent analyses.

In summary, the meetings and field trip were very productive and informative. R&M is prepared to install the weather stations beginning July 14, 1980. Please respond by telephone if you have concerns or comments.

Very truly yours,

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/kad/L2-D

Attachment

SUSITNA HYDROELECTRIC PROJECT - TASK 3.03

Climatic Station Locations

The following sites have been field located for six climate stations to be installed this year. One station (Watana Camp) has been recording data since April 8, 1980. The other five stations are anticipated to be installed during July 1980. Descriptions of the sites and their map locations are given below.

Site No. 1 - Watana Camp

Station is located about 100 yards NE of the base camp in fairly open, gradually sloping area. No large trees are in the immediate vicinity. The site is about a mile north of the Susitna River on the right bank, about midway between Tsusena and Deadman Creeks.
It is located on map Talkeetna Mountains (D-4).
Map location: NW¼ Sec. 27, R5E, T32N, Seward Meridian.

Site No. 2 - Devils Canyon

Station will be about 1/8 mile south of the Susitna River, adjacent to the Devil Canyon damsite on the south bank. The site is in a small clearing near a cabin and a small lake.
It is located on map Talkeetna Mountains (D-5).
Map location: SE¼ Sec. 32, R1E, T32N, Seward Meridian.

Site No. 3 - Kosina Creek

Station will be about 6 miles south of the Susitna River in the Kosina Creek drainage. The site is on a bluff about 1/2 mile upstream from the confluence of Tsisi and Gilbert Creeks and between the two creeks.
It is located on map Talkeetna Mountains (C-2).
Map location: NW¼ Sec. 16, R8E, T30N, Seward Meridian.

Site No. 4 - Tyone River

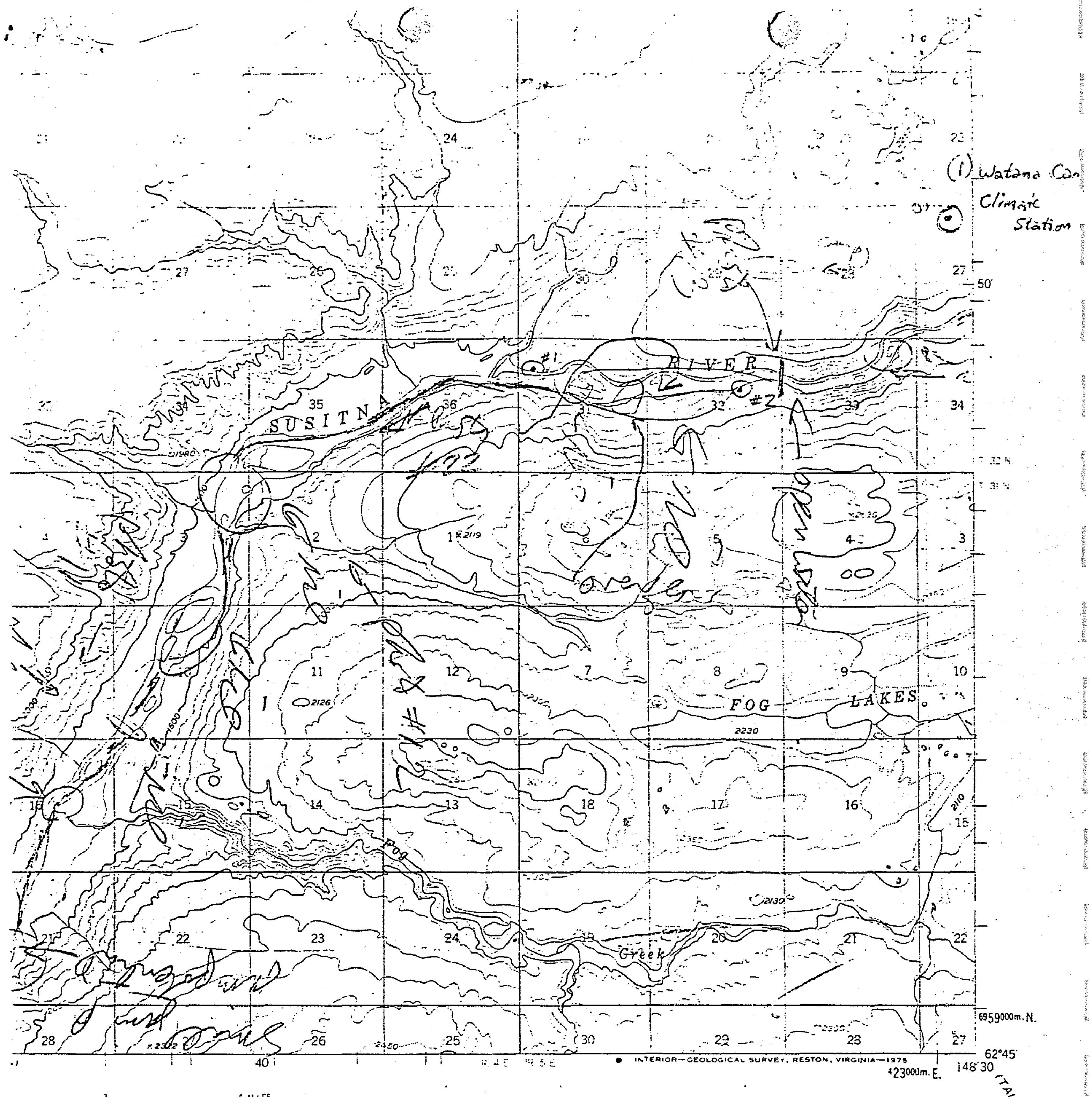
Station will be about 5 miles east-southeast of the Susitna River on the left bank, in the Tyone River drainage. The site is on a terrace between the Tyone River and a bluff above it, about 1.5 miles (straight line) downstream from the confluence of Tyone Creek and Tyone River.
It is located on map Talkeetna Mountains (C-1).
Map location: SE¼ Sec. 3, R10W, T10N, Copper River Meridian.

Site No. 5 - Denali

Station will be about a mile east of the Susitna River on the left bank, near Susitna Lodge. The site is on a bluff west of the air strip next to the lodge.
It is located on map Healy (A-1).
Map location: SW¼ Sec. 13, R1E, T21S, Fairbanks Meridian.

Site No. 6 - Susitna Glacier

Station will be in the headwaters of the Susitna River, adjacent to Susitna Glacier. The site is on a hillside to the right of the glacier, at about the 4500-foot elevation.
It is located on map Mt. Hayes (C-16).
Map location: NE¼ Sec. 14, R4E, T16S, Fairbanks Meridian.



ROAD CLASSIFICATION

No roads or trails in this area

929

TALKEETNA MOUNTAINS (D-4), ALASKA

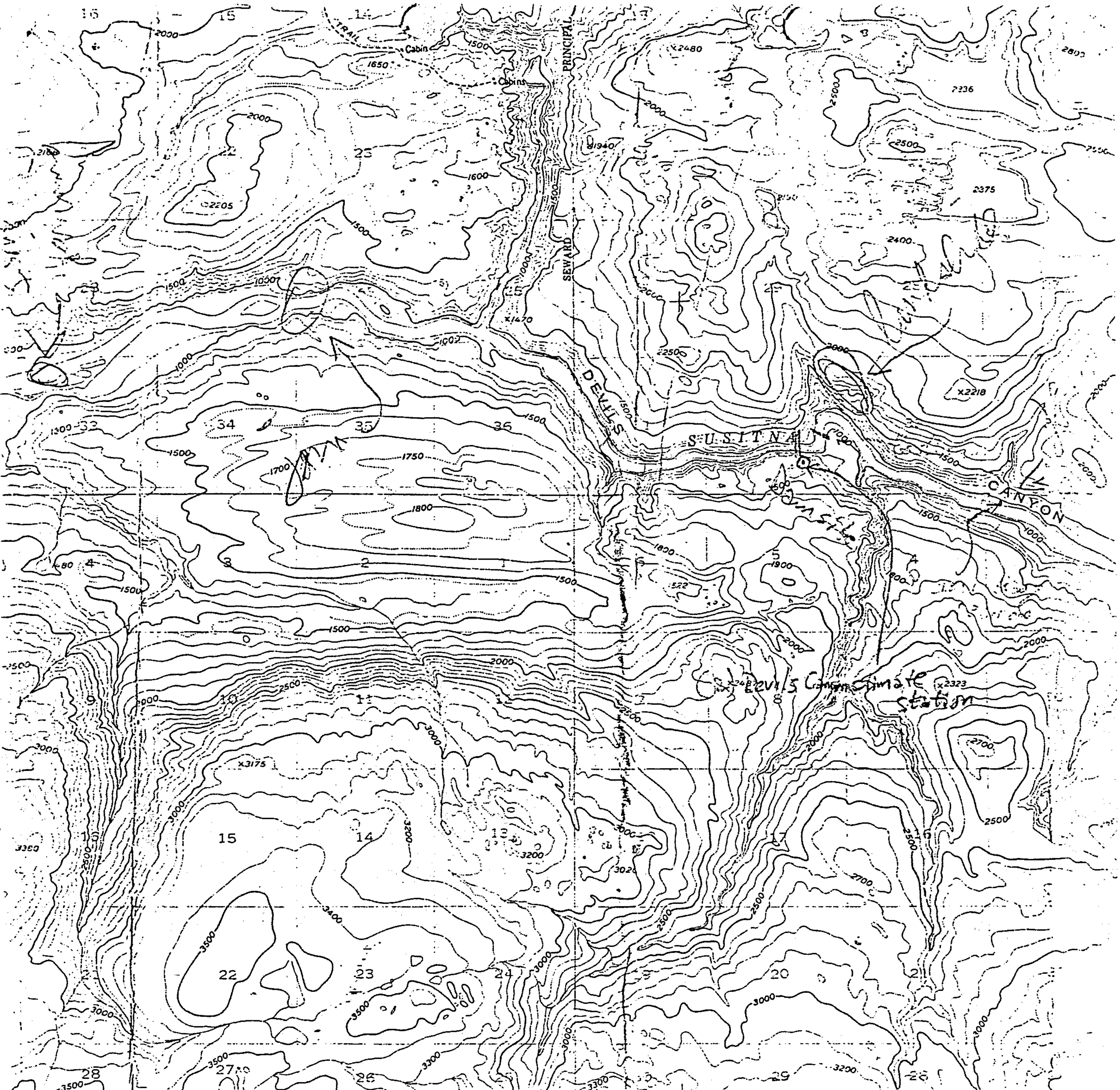
N6245—W14830/15X30

1951

MINOR REVISIONS 1965

STON, VIRGINIA 22092

·ABLE ON REQUEST

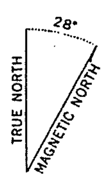


edited, and published by the Geological Survey
USGS and USC&GS

by photogrammetric methods from aerial photographs
, field annotated 1950. Map not field checked

Transverse Mercator projection, 1927 North American datum
grid based on Alaska coordinate system, zone 4
Universal Transverse Mercator grid ticks,
own in blue

represent unsurveyed and unmarked locations
ned by the Bureau of Land Management
, Fairbanks Meridian and S 1 S-2, Seward Meridian



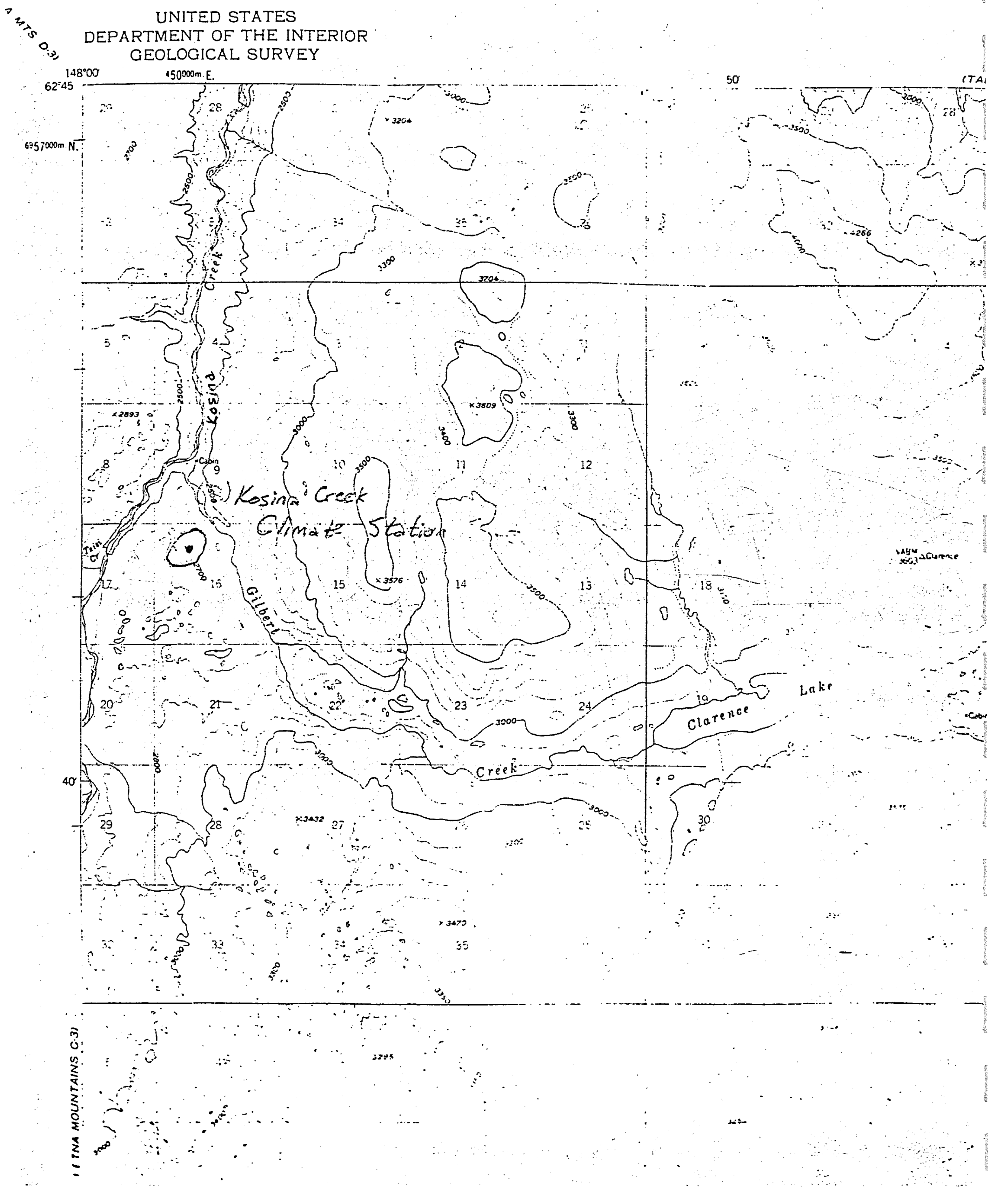
APPROXIMATE MEAN DECLINATION, 1950

SCALE 1:

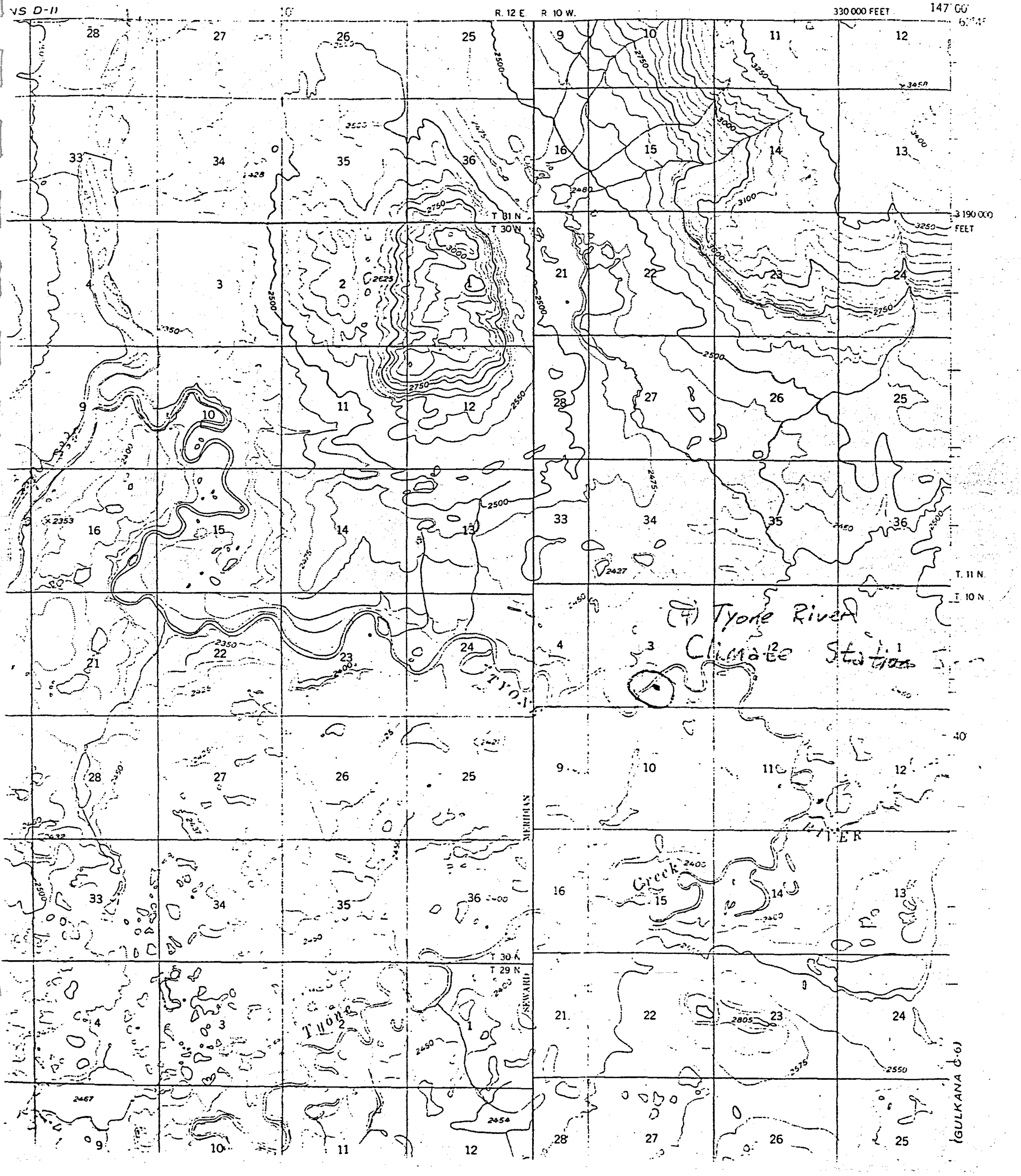
CONTOUR INTERVAL
DOTTED LINES REPRESENT
DATUM IS MEAN SEA LEVEL

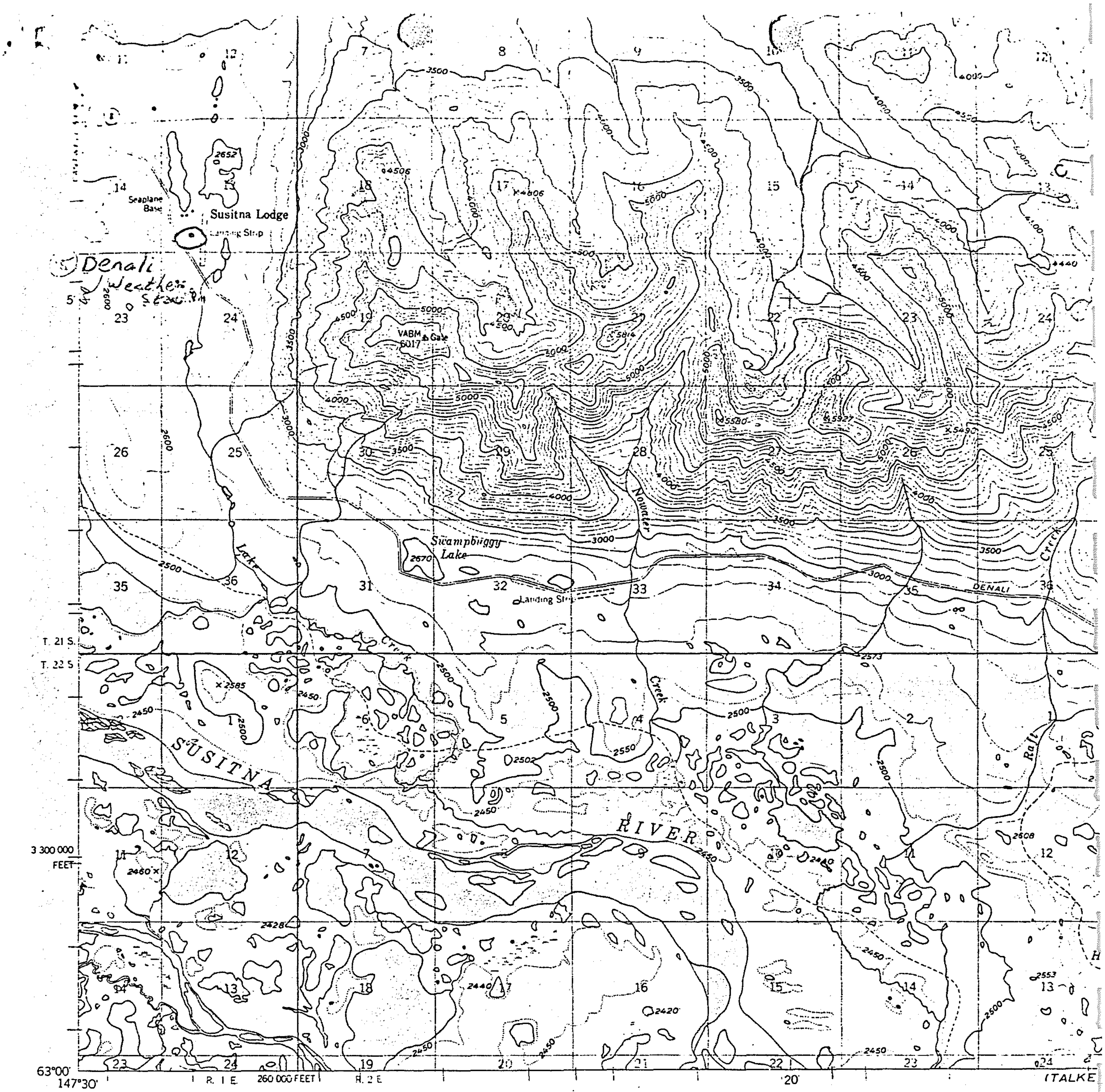
FOR SALE BY U. S. GEOLOGICAL
FAIRBANKS, ALASKA 99701, DENVER, COLORADO 802
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMB

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



TALKEETNA MOUNTAINS (C-1) QUADRANGLE
MATANUSKA—SUSITNA BOROUGH—ALASKA
1:63 360 SERIES (TOPOGRAPHIC)





Mapped, edited, and published by the Geological Survey

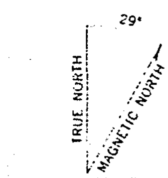
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1949. Map not field checked

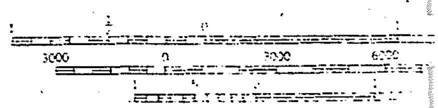
Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 3
1000 meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management Folio F 9, Fairbanks Meridian

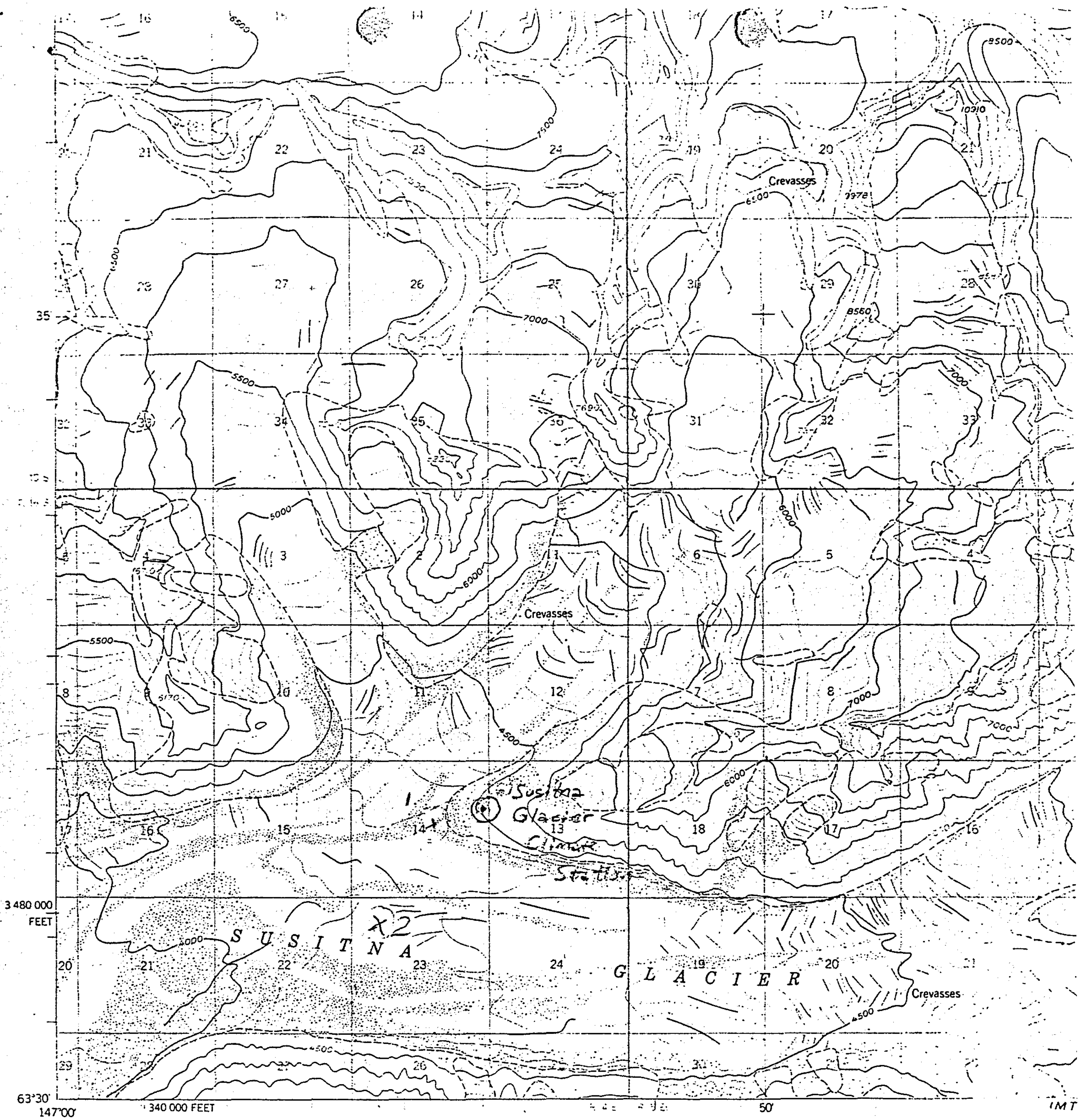
Swamps as portrayed, indicate only the wetter areas, usually of low relief, as interpreted from aerial photographs



APPROXIMATE MEAN DECLINATION



FOR SALE BY
FAIRBANKS, ALASKA 99701, DENVER,
A FOLDER DESCRIBING TOPOGRAF



(HEALY B-1)

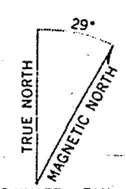
Mapped, edited, and published by the Geological Survey

Control by USGS

Topography by photogrammetric methods from aerial photographs taken 1950 and 1956, field annotated 1951. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 3
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folio F-9, Fairbanks Meridian



APPROXIMATE MEAN DECLINATION, 1951

FOR SALE BY
FAIRBANKS, ALASKA 99701, DENVER,
A FOLDER DESCRIBING TOPOGRAPHIC

ACRES

OFFICE MEMORANDUM

TO:	B. Drage, R&M Consultants	*Date:*	July 22, 1980
FROM:	I. Hutchison	*File:*	P5700.11.10
SUBJECT:	Susitna Hydroelectric Project Subtask 3.03 - Quality Control Checks on Meteorological Data		

As promised during the recent trip, Paul Denison has drawn up the attached list of quality control checks and notes on meteorological data. These conform to standard North American practice.

I. Hutchison

GK:ccv
Attachment

QUALITY CONTROL CHECKS ON METEOROLOGICAL DATA

1 - Precipitation

(a) solar radiation should decrease as precipitation intensity increases

(b) any six hourly amount should be less than 125 mm in absolute change from preceding six hourly amount

2 - Temperature

(a) change from previous hour should be less than 16°C

(b) temperature should be greater than or equal to dew point

3 - Dew Point

(a) change from previous hour should be less than 11°C

(b) dew point should be less than or equal to temperature

(c) value should be less than 27°C and greater than -47°C

4 - Wind Direction

(a) if 00 then wind speed should be 00

(b) must be less than or equal to 36

5 - Wind Speed

(a) if 00 then wind direction should be 00

(b) value should be less than double the previous hour if greater than 50 knots

(c) if current hour value is less than previous hour value the difference should be less than 40 knots

NOTES

1 - If values required for the checks are missing for either the current or previous hour, bypass the checks.

2 - If any data fail the checks enter a flag on the quality control listing.

3 - If the same values (other than missing) occur on six consecutive hours, list the values on the previous seven hours and the current hour.

4 - If one value is missing calculate and enter the average of the preceding and following values and enter with flag E on the quality control listing.

ACRES

OFFICE MEMORANDUM

TO: Brent Drage *Date:* July 22, 1980

FROM: G. Krishnan *File:* P5700.11.10

SUBJECT: Susitna Hydroelectric Project
Subtasks 3.03/3.04 - Glacial Studies
and Outstanding Items

---

1. Attached is a suggested distribution of work and budget for the glacial studies, among Professor Harrison of the University of Alaska, R&M and Acres for your review. This should be finalized with Ian Hutchison during his visit in August to Anchorage. Desk studies and field work may be started soon thereafter.

2. We are awaiting details of your program of field installation and procedures for measuring freezing rain, snow creep and in-cloud icing. The Rosemount ice detector we propose to install at Watana Camp will be delivered to us in late October. We would expect the installation and commissioning only in November. At the same time, we hope to have the ice-load measuring equipment ready for installation at Devil's Canyon weather station.

3. A detailed log of all field observations should be made available to us with monthly updates (clause (e) Subtask 3.03 of our agreement). The following is a list of items we would suggest for inclusion in the log:

    1. Parameter to be measured.
    2. Station location.
    3. Type of instrument used.
    4. Installation date, actual or proposed (including 1981).
    5. Observation frequency and dates of observations.
    6. Observation event (regular or specific hydrologic).
    7. Data collected so far.
    8. Problems encountered - instrumental and other.
    9. Comments/suggestions/remarks from field crew.
    10. Corrective actions planned or undertaken where necessary.
    11. Any other relevant information.

G. Krishnan

GK:ccv
Attachment

June 10, 1980

SUSITNA HYDROELECTRIC PROJECT

Glacial Studies

Suggested Distribution of Work and Budget

ITEM	Performed By	Estimated Manhour	Estimated Cost $
1. Review Black River Glacier Study of USGS; abstract information for evaluation of Susitna, West Fork and Maclaren Glaciers	WH	20	1000
2. Acquisition of vertical photography Susitna Glacier only	R&M + WH	-	1800
3. Aerial inspection (fixed wing)	R&M	(air transport)	600
	WH	(manhours)	1500
4. Stereo models & topographic interpretation + Data Reduction	Univ. AK		
	WH		5700
5. Organization, interpretation, discussion of hydrology, sediment & flow yield changes	WH		5000
6. Field Measurement Program.			
Design & execution	R&M	300	15000
Design & interpretation of data	WH	80	4000
Materials	R&M		550
Air Transport	AAI		15000
R&M Coordination	R&M		1500
7. Correlation of Susitna behaviour to West Fork & Maclaren glaciers + discussion	WH	40	2000
	AAI	20	500
8. Summary of surge history of glaciers & future behaviour	WH	10	500
	AAI	20	500
9. Misc. provisions - final report & recommendation for longterm monitoring of glacier movements, etc.	AAI		2000
		TOTAL	~~$57150*~~

*Figure includes provision for scope of work under 3.03

Registered
Professional
Engineer

MILO C. BELL
Consulting Engineer
BOX 23
MUKILTEO, WASHINGTON 98275

File 052303
cc Leslie
C. A. Atkinson
Brent

July 31, 1980

R & M Consultants, Inc.
5024 Cordova
Box 6067
Anchorage, Alaska 99502

Attention: Brent T. Drage, P. E.
Susitna Project Coordinator

Gentlemen: Re: R & M No. 052303

Messrs. Atkinson and Bell have looked over your submission, Procedures Manual for the Water Quality Data Collection, Susitna River.

It is in order and meets our approval.

Sincerely yours,

Milo Bell

c.c. R. W. Williams
C. E. Atkinson

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH 907·279·0483 • TLX 090·25280
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

August 4, 1980

R&M No. 052303

Mr. G. Krishnan
Acres American, Inc.
Liberty Bank Building
Main at Court
Buffalo, New York 14202

Re: Crest - Stage Recorder Locations

Dear Krishnan:

Attached are updated descriptions of crest-stage recorders that have been installed along the Susitna River. Please note that, for completeness, descriptions of all the recorders have been included, even though six of them were described in a previous letter (dated July 9, 1980). Also note that the numbering system has been revised to allow sequential numbering of the sites from the Susitna - Chulitna confluence up to the recorder above the Watana damsite.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage
Project Coordinator, Susitna

Enclosure

JC:BTD/jh/L1/S

August 4, 1980 R&M No. 052303

Susitna Hydroelectric Project - Task 3.03

Locations of Crest-Stage Recorders

As of the present time, nine crest-stage recorders have been installed along the Susitna River between Talkeetna and Deadman Creek. At each of the nine sites, there are two calibrated pipes partially sunk in the ground at different elevations, in the hope of recording the peak elevations of flood events at those river cross-sections. Brief descriptions of the sites and their map locations (USGS 1:63, 360 maps) are given below, and the locations are pinpointed on the attached maps.

Site No.1 - Susitna - Chulitna Confluence

Recorder is on the left bank of the Susitna about 200 yards downstream of the downstream end of a small slough. The immediate area appears to be a slow-water section of bank, so scour of the recorders should not be an imminent problem. Recorder was installed June 26, 1980.
It is located on map Talkeetna (B-1).
Map location: SE¼ Sec. 11, R5W, T26N, Seward Meridian.

Site No. 2 - Chase

Recorder is on the left bank of the Susitna near the downstream end of a long gravel bar. The location is about 5 miles below the community of Chase and near a gravel pit that is adjacent to the railroad tracks. Recorder was installed July 31, 1980.
It is located on map Talkeetna (B-1).
Map location SE¼ Sec. 26 (almost on line between Sec. 26 and Sec. 25), R5W, T27N, Seward Meridian.

Site No. 3 - Curry

Recorder is on the left bank of the Susitna about half a mile downstream of Deadhorse Creek and just upstream of the Alaska RR depot. The site is in a little nook that is on the downstream end of a gravel bar (at the existing flow). Recorder was installed June 26, 1980.
It is located on map Talkeetna (C-1).
Map location: SE¼ Sec. 9, R4W, T29N, Seward Meridian.

Site No. 4 - Section 25

Recorder is on the left bank of the Susitna at the upstream end of a small slough. The installation is on the downstream edge of the river bank adjacent to the slough. Recorder was installed June 26, 1980.
It is located on map Talkeetna Mountains (C-6).
Map location: SW¼ Sec. 25, R4W, T30N, Seward Meridian.

Site No. 5 - Sherman

Recorder is on the left bank of the Susitna about 100 yards upstream of the mouth of a small creek and near a large cottonwood tree. Recorder was installed June 26, 1980.
It is located on map Talkeetna Mountains (C-6).
Map location: SE¼ Sec. 3, R3W, T30N, Seward Meridian.

Site No. 6 - Portage Creek

Recorder is on the right bank of the Susitna and the left bank of Portage Creek at the confluence of the two. A survey photo panel is immediately adjacent to the site. Recorder was installed June 25, 1980.
It is located on map Talkeetna Mountains (D-5).
Map location: SW¼ Sec. 25, R1W, T32N, Seward Meridian.

Site No. 7 - Devils Canyon Upper

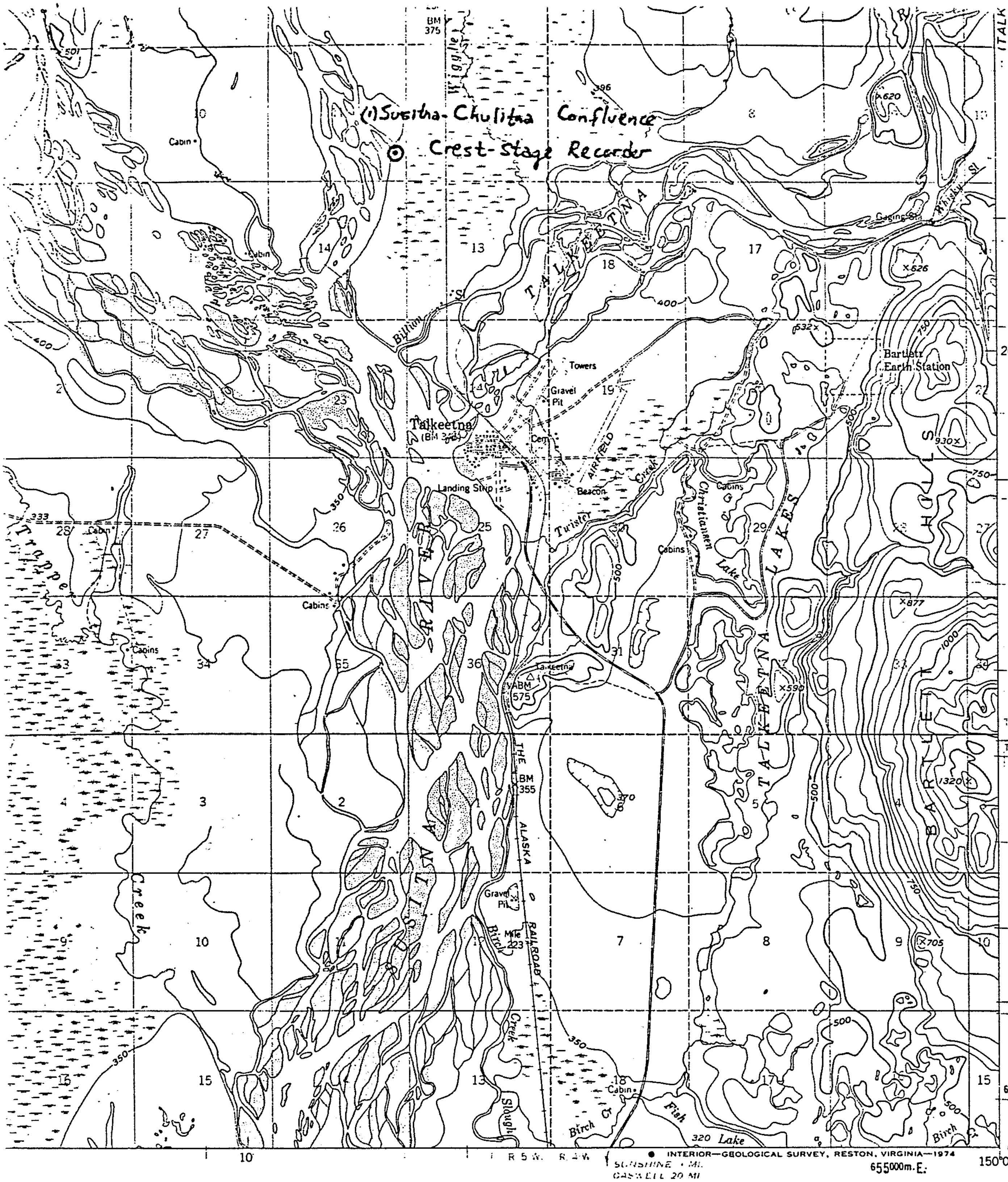
Recorder is on the right bank of the Susitna about 50 yards upstream of a small creek. There appears to be an eddy area at the site, which should be beneficial to the recorder. Recorder was installed June 25, 1980.
It is located on map Talkeetna Mountains (D-5).
Map location: NW¼ Sec. 3, R1E, T31N, Seward Meridian.

Site No. 8 - Watana Dam

Recorder is on the right bank of the Susitna about 200 yards upstream from the axis of the proposed Watana Dam. There is a sandy beach at the site, and the recorder is at the upstream end of the beach. Recorder was installed July 30, 1980.
It is located on map Talkeetna Mountains (D-4).
Map location: NW¼ Sec. 33, R5E, T32N, Seward Meridian.

Site No. 9 - Deadman Creek

Recorder is on the right side of a large island in the center of the Susitna about 200 yards upstream from the mouth of Deadman Creek. The site is at the downstream edge of a fairly heavy growth of trees. At the downstream end of the island is an aerial photo panel. Recorder was installed July 30, 1980.
It is located on map Talkeetna Mountains (D-3).
Map location: SE¼ Sec. 26, R5E, T32N, Seward Meridian.



(TALKEETNA MTS. A-6)

3 4 MILES

15000 18000 21000 FEET

4 5 KILOMETERS

ROAD CLASSIFICATION

Medium-duty ———— Light-duty ————

Unimproved dirt - - - - - - - -

◯ State Route

ALASKA

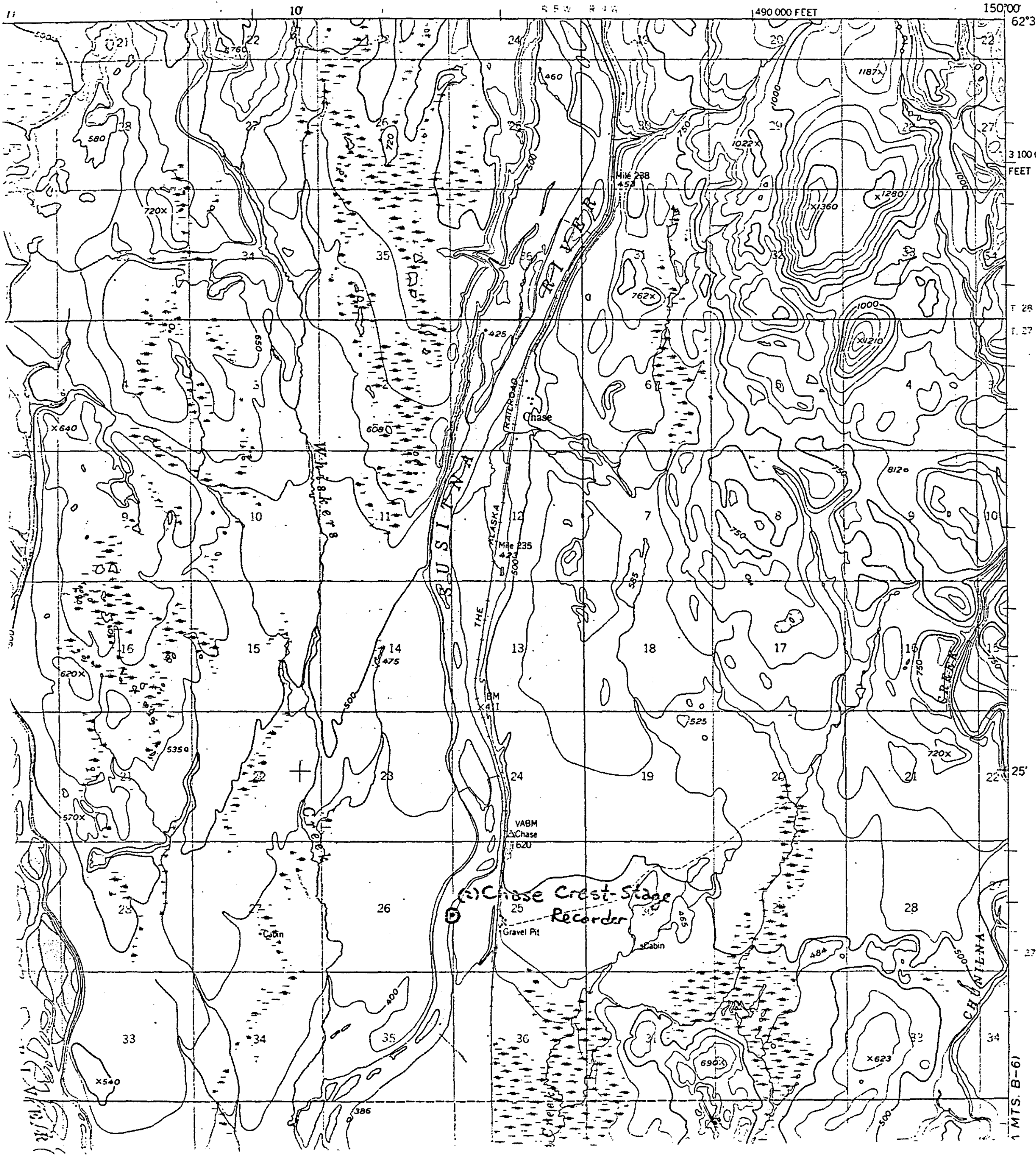
QUADRANGLE LOCATION

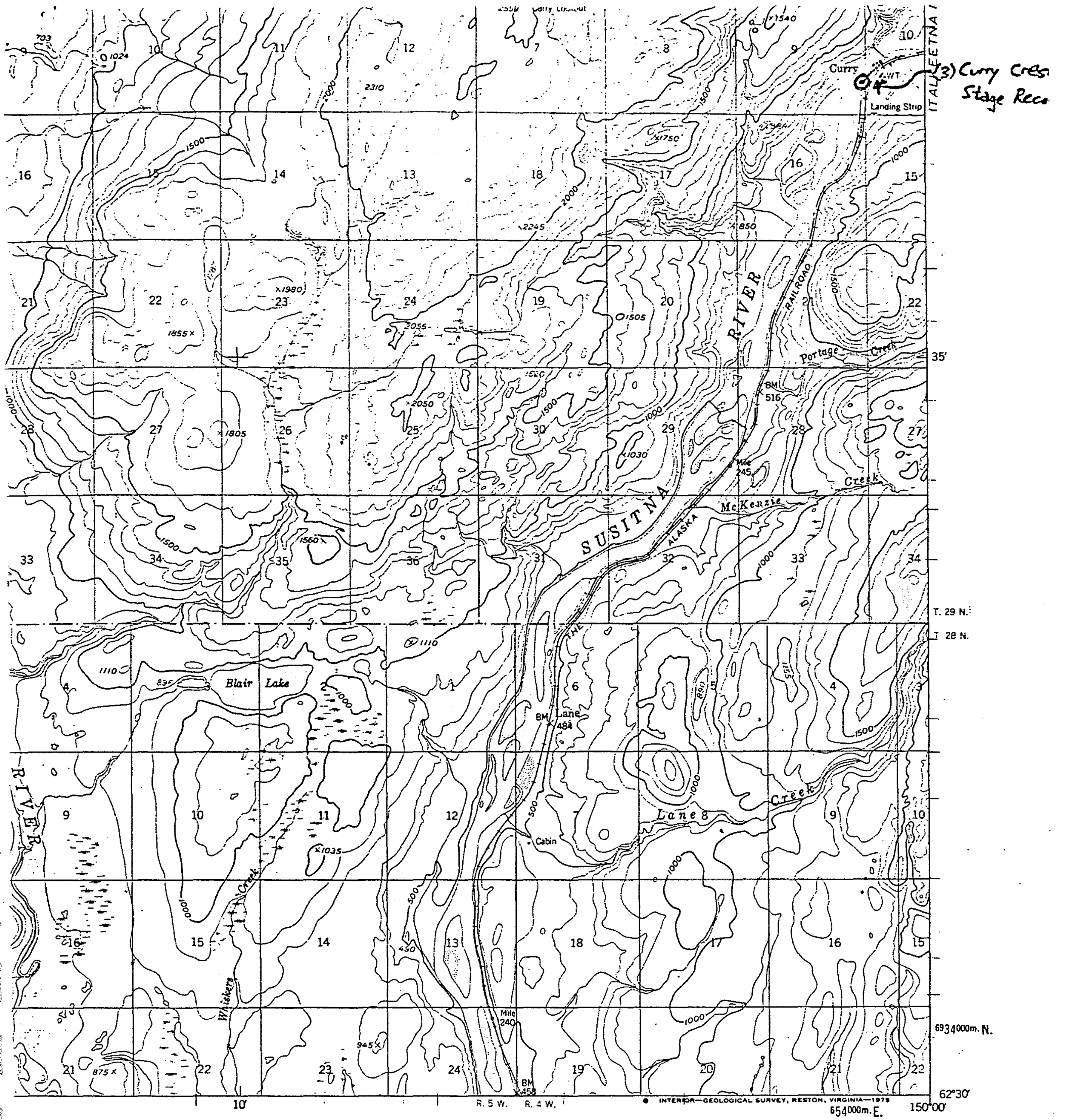
EY
ASHINGTON, D. C. 20242
VAILABLE ON REQUEST

TALKEETNA (B-1), ALASKA
N6215—W15000/15X30

1958
MINOR REVISIONS 1973

TALKEETNA (B-1) QUADRANGLE
ALASKA-MATANUSKA-SUSITNA BOROUGH
1:63 360 SERIES (TOPOGRAPHIC)





3 4 MILES

15000 18000 21000 FEET

4 5 KILOMETRES

ROAD CLASSIFICATION

Medium-duty ....

State Route

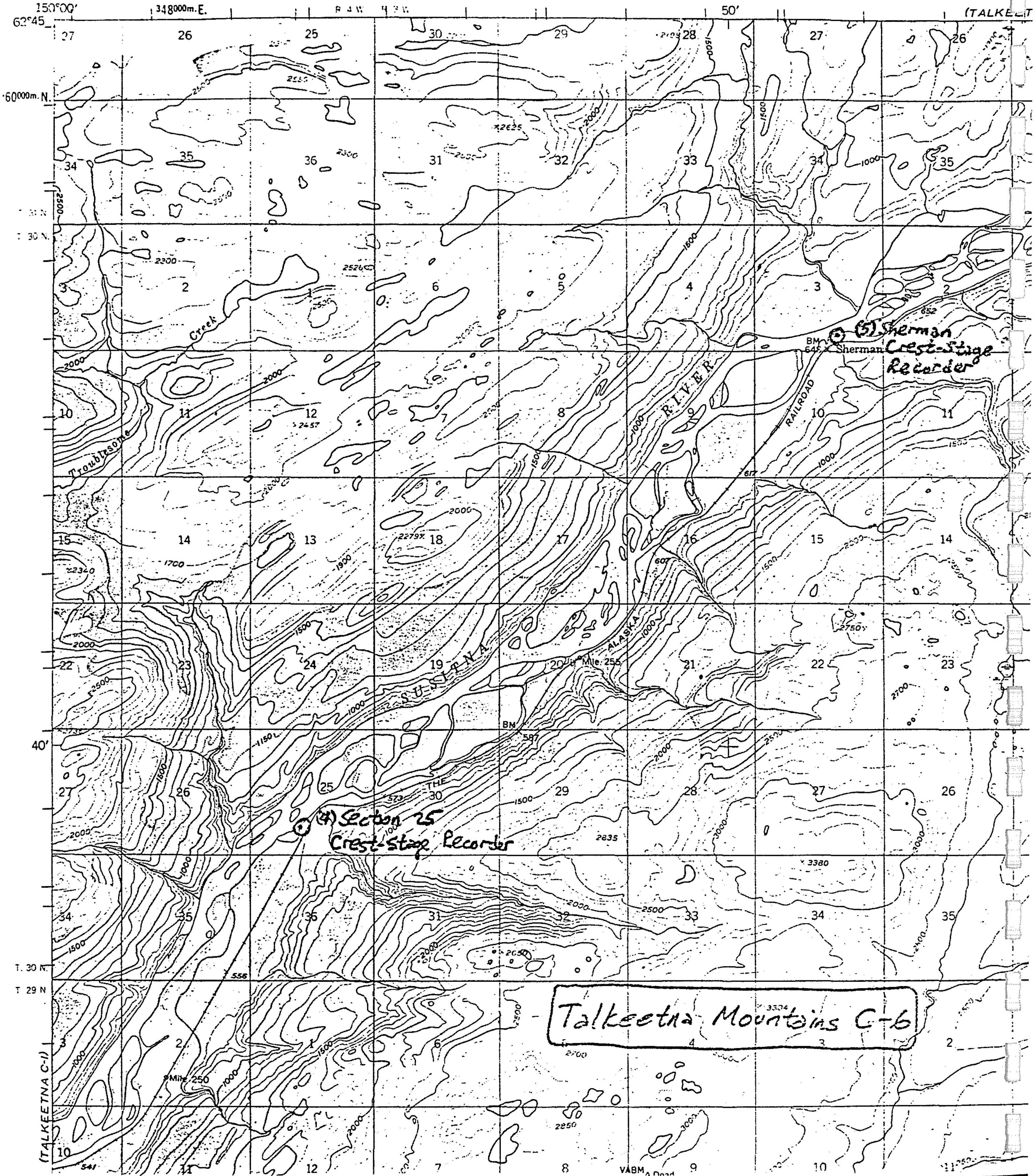
QUADRANGLE LOCATION

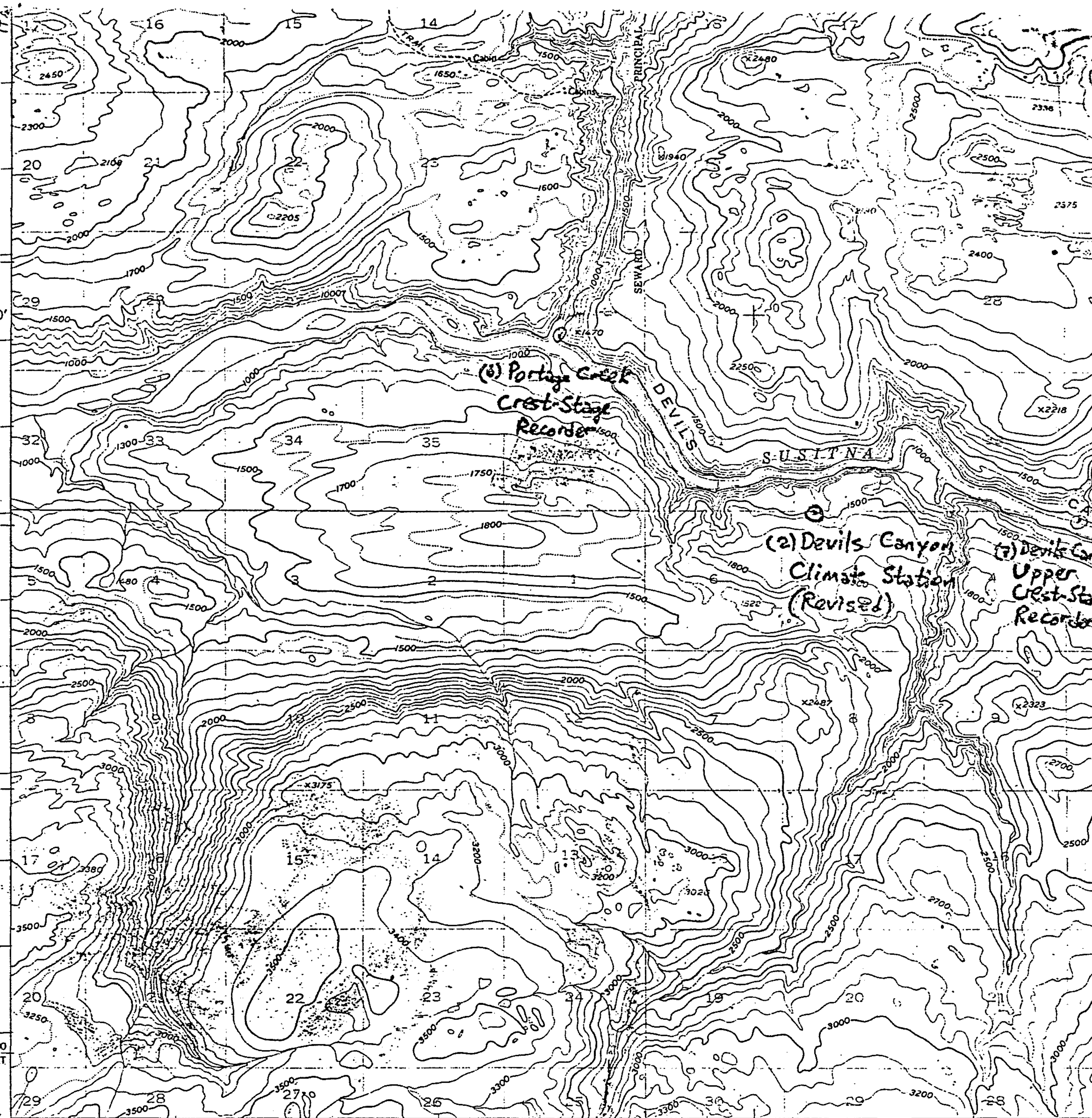
Y
ESTON. VIRGINIA 22092
AILABLE ON REQUEST

TALKEETNA (C-1), ALASKA
N6230—W15000/15X30

1958
MINOR REVISIONS 1974

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY





Talkeetna Mtns. (D-5)

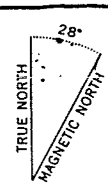
Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1949, field annotated 1950. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 4
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folios F-10, Fairbanks Meridian and S-1, S-2, Seward Meridian



APPROXIMATE MEAN DECLINATION, 1950

SC

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3000 0 3000 6000

1 .5 0 1

CONTOUR

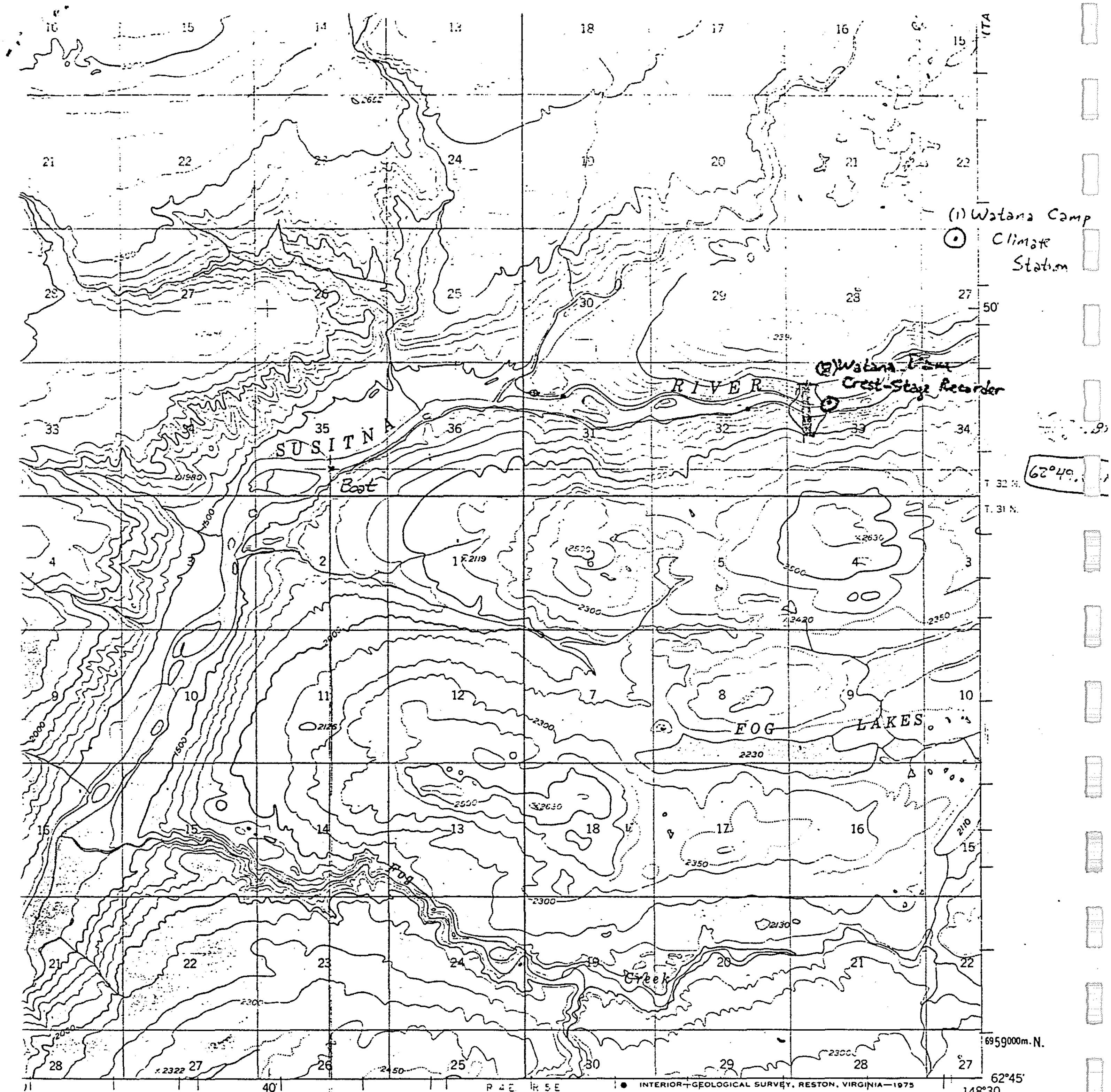
DOTTED LINES RE

DATUM

FOR SALE BY U.

FAIRBANKS, ALASKA 99701, DENVER, C

A FOLDER DESCRIBING TOPOGRAPHIC

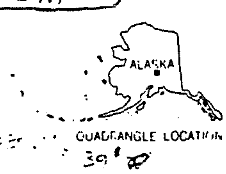


3 4 MILES
15000 18000 21000 FEET
4 5 KILOMETRES

148°39.1'W

ROAD CLASSIFICATION

No roads or trails in this area

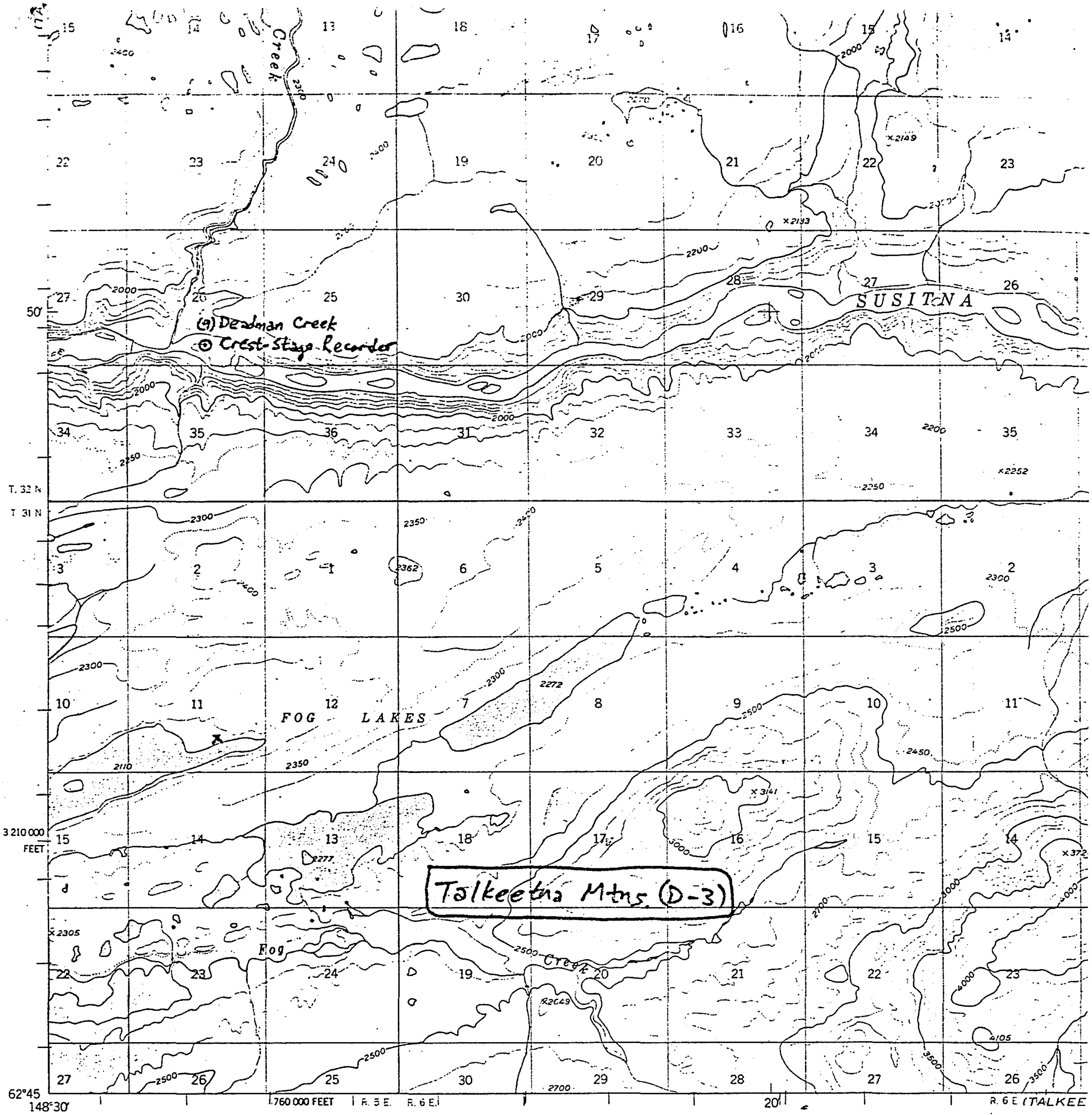


929

STON, VIRGINIA 22092
ILABLE ON REQUEST

TALKEETNA MOUNTAINS (D-4), ALASKA
N6245—W14830/15X30

1951
MINOR REVISIONS 1965



TNA C-4)

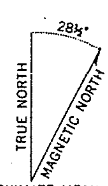
Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1949, field annotated 1951. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 4
1000-metre Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folios S-1, Seward Meridian and F-10, Fairbanks Meridian



APPROXIMATE MEAN DECLINATION, 1951

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NATIONAL GEOD

FOR SALE B
FAIRBANKS, ALASKA 99701, DENV
A FOLDER DESCRIBING TOPOGRAP

August 7, 1980
P5700.11.10
T.338

R&M Consultants, Inc.
5024 Cordova Street
Box 6087
Anchorage, Alaska 99502

Attention: Mr. Brent T. Drage

Dear Brent:

Susitna Hydroelectric Project
Subtask 3.03 Data Collection
and Processing Procedures

A. Water Quality Data Collection Procedures

We have reviewed the procedures for Water Quality Data Collection sent with your letter of July 22, 1980 and have the following comments to offer.

(i) It is not clear if the field analyses will be carried out at site, Watana Camp or at Talkeetna. We feel that analyses for ph, alkalinity and settleable solids will be difficult to carry out on site in winter and recommend that these be done at base camp or Talkeetna.

(ii) Procedures for temperature and dissolved oxygen measurements appear complicated. Perhaps it will be simpler to insert the probes about one foot below water surface at each location for a reading.

(iii) Better results for ph measurements may be obtained if the probe is kept in Susitna water in between sampling and calibrated 2-3 times per day.

(iv) We feel that filtering samples on site will be difficult especially in winter. Samples should be obtained in collector bottles and then transferred to sample bottles after filtration at Watana Camp or Talkeetna. For metals we would recommend adding preservatives in the field rather than in the laboratory (Anchorage). We have also sent copies of Water Quality Data Collection Procedures to TES and ADF&G for review. Should they have any comments, we will let you know.

B. Hydrometeorological Data Processing

Our comments on the data processing procedures were sent to you in our letter of May 16, 1980. Subsequent discussions with Meteorology Research, Inc. have confirmed that it will not be possible to record the maximum 5-second gust by the proposed weather wizard stations without expensive modifications. We should therefore continue to monitor only the maximum 15-second gust. Further, item 9 of our above letter should read "Bed-material sampling stations...." instead of "Bed-load sampling stations ....".

C. Formats for Data Presentation, and Storage

The proposed NOAA/USGS formats for climatological and hydrological data respectively and the proposed one-page data sheet for water quality measurements are adequate.

D. General

We recommend that you incorporate all our comments and produce a consolidated procedures manual for data collection and processing as soon as possible for distribution to team members.

Sincerely yours,

Ian P. G. Hutchison

GK:jmh:cmt

R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH. 907-279-0483 • TLX. 090-25280

ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

August 25, 1980

R&M No. 052304

Dr. Ian Hutchison
Acres American Incorporated
Liberty Bank Building
Main at Court
Buffalo, New York 14202

Re: Glacial Studies; Subtasks 3.04 and 3.03.

Dear Ian:

On August 22, 1980, I met with Dr. Will Harrison to develop a detailed scope of work for glacial studies. Attached are brief descriptions of subtasks that were defined for Phase I of the Susitna project. Would you please review and provide comments.

I spent a considerable amount of time briefing Dr. Harrison on the Phase I objectives and other related activities that will produce data for glacial studies. In turn, Dr. Harrison related basic activities required to establish a creditable glacial study. The attached subtasks should produce reconnaissance level information for determining water and sediment yield, lake dump potential and glacial behavior.

Dr. Harrison considers the Norweigans to be most advanced in developing glacial basins for hydropower development. It would be advantageous to conduct a thorough review of their work to not only extract knowledge but also to develop a Phase II program.

Volume change studies require field controlled aerial photography. We are going to scope out this effort to determine if it can fit in the Phase I budget. Although it does not appear likely, Dr. Harrison emphasized that this is a basic exercise required for determining long term water yield.

Field monitoring will primarily be conduted with the R&M hydrology field crew. These activities will be coordinated with snow course and climate station visits to minimize helicopter time and field labor.

A detailed budget has not been generated yet. Please review scope and available funds. Will Harrison and R&M are going to detail the budget in the coming week.

Very truly yours,

R&M CONSULTANTS, INC.

Brent Drage, P.E.
Susitna Project Coordinator

Enclosure

BD/jcp

1) Review experience and literature from the United States and Europe. Extract information and data applicable to Susitna Basin.

Will Harrison
Acres American

2) Long term and short term volume changes will be investigated to determine effects on hydrological regime. Harrison to design program appropriate for feasibility stage of Susitna Project. If photogrametric prodedures are found to be necessary, R&M will install field control. Present budget does not include photogrammetry.

Will Harrsion
R&M Consultants

3) Long term and short term sediment yield. R&M will provide Will Harrison with basic sediment data collected by USGS and preliminary analyses. Objective is to develop mean annual and seasonal sediment production rates from glacial basins. Continuous turbidity meter will be investigated for installtion at Denali stream gage. Turbidity data will augment suspended sediment data.

Will Harrison
R&M Consultants

4) Mass balance studies are required to provide breadth of study needed for creditibility. Four markers with reference points will be installed on the Susitna Glacier and positions determined a minimum of three times per year. This will be reported in context with Black Rapids experience. Report will be prepared addressing implications that significant mass balance changes will have on water yield.

Will Harrison
R&M Consultants

jcp

5) General field reconnaissance of study area and review of existing USGS data wil be made. Relevent glacier features will be documented with photgraphs and descriptions.

Will Harrison
R&M Consultants

6) Glacial dynamics including surging and lake dumps will be investigated. Field observations will be supported with existing historical knowledge for definition of glacial behavior. One bore hole will be steam drilled fifteen meters deep and a thermister string installed. Readings obtained three times per year. The use of an on-site time-lapse camera will be investigated.

Will Harrison
R&M Consultants

7) Will harrison in conjuction with R&M will develop draft report. R&M will provide Harrison with basic data and field observations. Acres American will provide final review and report preperation.

Will Harrison
R&M Consultants
Acres American

Copy 052303
052306
052307
Brent ☐
Leslie ☐
Jeff ☐

ACRES

OFFICE MEMORANDUM

TO: Brent Drage
R&M Consultants

Date: August 25, 1980

FROM: I.P.G. Hutchison

File: P5700.11.10

SUBJECT: Susitna Hydroelectric Project
Subtask 3.03 Crest-Stage Recorders

We have received your letter of August 6, 1980, describing locations of crest-stage recorders installed along the Susitna River. We concur with the selection of these locations.

It appears that you propose to record only the peak elevations of flood events at each location. The data obtained from these gages are to be used, as you know, to calibrate the HEC-2 model to estimate pre- and post-project water profiles downstream of the dam sites. To enable accomplishment of this calibration, we should have facility to pick up water levels for a range of discharges at different times during the year including the peaks recorded. We, therefore, recommend that the time and the river stage be recorded at every site visit in addition to peak level. A rough estimate of average channel flow velocity should also be made to facilitate some estimate of lag time between recording stations. (This can be done by timing a log or other floating object located as far from the bank as possible.)

IPG/jh

I.P.G. Hutchison

052303
cc Jeff

ACRES

OFFICE MEMORANDUM

TO:	B. Drage, R&M Consultants	*Date:*	September 12, 1980
FROM:	I.P.G. Hutchison	*File:*	P5700.11.10
SUBJECT:	Susitna Hydroelectric Project Task 3 Hydrology - Miscellaneous Items		

1. This is to confirm the telecon between Krishnan and yourself regarding in-cloud icing measurements. Two 25' sections of conductor will be installed at each Watana Camp and Denali near the weather wizard stations. Ice accretion on these sections will be measured by calipers during every site visit to the weather station. Whenever possible, such visits will be scheduled to coincide with periods of ice formation. Measurements will be made over the length of each cable to give a reasonable average thickness of ice formed. The design suggested in the sketch handed to you by me during my recent visit should be used for the set up. Ed Shadeed will be advising you on the availability of the smaller 795 MCM conductors which can be used in place of the larger 956 MCM originally proposed. The station at Healy will be established in the Fall of 1981 after the weather wizard station is located there.

2. We propose to install a Rosemount ice detector and a totalizer package at Watana Camp. The installation will need 115 V power supply for operation and there will be no interface between this package and the MRI weather wizard. This will require manual readings to be taken of the totalizer count every week or so. We expect the package to be ready for installation by mid-October. Installation details will be sent to you as soon as they are ready.

3. We have decided to withhold installation of an ice accretion monitor proposed for installation at Devils Canyon until Spring 1981 after analyzing data accumulated at Watana.

4. Your input to the closeout report (draft) on Subtask 3.01 is urgently required so that we can finalize the report.

5. A detailed log of all field observations should be made available by the end of September with subsequent regular monthly updates. In addition to our recent conversations, you should incorporate the suggestions listed in Krishnan's memo to you dated July 16, 1980.

Please call if you have any queries.

I.P.G. Hutchison

GK:ccv

cc: E. Shadeed

September 15, 1980
P5700.11.10
T438

R&M Consultants, Inc.
5024 Cordova St.
Box 6087
Anchorage, AK 99502

052303
052309

Attention: Brent T. Drage

Dear Brent:

Susitna Hydroelectric Project
Subtasks 3.03, 3.04 - Glacial Studies

We have reviewed the scope of glacial studies developed by you and Will Harrison and have the following comments:

(i) While lending the study a credible basis, the scope should conform to the objectives of the POS and adhere to the budget provisions. Acres' manhour budget (50 hours) provides only for our involvement in preparation of broad outlines of the study, review of results and final reporting. Budget for air transportation cannot be converted to manhours or other costs. Therefore, provision for Harrison's involvement should come from R&M budget (of some $35,000) under Subtasks 3.03 and 3.04 for these studies.

(ii) If the scope of work as detailed cannot be carried out within this budget, then we would strongly recommend that a revised study and budget be prepared and agreed to between Will Harrison and yourself and sent to us for review as soon as possible.

Comments on the Scope of Work as presented in your letter of August 25, 1980 are as follows:

(i) A certain amount of data is assumed to have been (or will be) collected and reviewed as part of Subtask 3.01 by R&M. We also feel it may not be necessary for extensive literature review on European or U.S. experience except for direct Alaskan and perhaps northern U.S. and Canada experience.

(ii) Photogrammetric procedures, installation of turbidity meter, time-laps camera, etc. may be recommended for Phase II studies if found necessary. We would appreciate an early resolution of the work plan to enable completion of the subtask within available budget provisions and time constraints.

ACRES AMERICAN INCORPORATED
Consulting Engineers
The Liberty Bank Building, Main at Court
Buffalo, New York 14202

Telephone 716-853-7525

Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC

Telex 91-6423 ACRES BUF

If you have any queries, please contact Ian Hutchison or myself.

Yours truly,

J.W. Hayden
Technical Study Director

GK:ccv

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

465-2636

JAY S. HAMMOND, GOVERNOR

POUCH O — JUNEAU 99811

September 15, 1980

Copy 052303

Brent Drage
R&M Consultants, Inc.
P.O. Box 6087
Anchorage, Alaska 99503

Dear Brent:

I am enclosing comments which have been prepared by our laboratory section regarding the Susitna water quality procedures manual. Our approach in the matter is to use "standard methods" insofar as possible. I would like to request that you send me an informal response with your position concerning these points. Thank you for forwarding the procedures manual; I will appreciate being notified of any major changes, findings, or developments in the program.

Sincerely,

D. Sturdevant

David C. Sturdevant
Management and Technical
Assistance Section

STATE
of ALASKA

MEMORANDUM

TO: Dave Sturdevant
EQM/M&TA
Juneau

DATE: August 29, 1980

FILE NO:

TELEPHONE NO: 364-2165

FROM: Jeff Hock
EQO/EQMLO
Douglas

SUBJECT: Susitna Hydro W.Q. Procedures

R&M Consultants, Inc. have drawn up their data collection procedures for water quality for the "Susitna Hydroelectric Project - Procedures Manual Water Quality Data Collection "July 1, 1980.

I would like to raise the following points regarding those procedures.

(1) Standard Methods (14th ed.) and EPA recommend measuring dissolved oxygen, conductivity, temperature and pH, "in situ." This means that the determinations should be made in the water column itself. Measuring these parameters on a composite sample after its removal from the water column is an unacceptable practice.

(2) Carbonate alkalinity measurements should be conducted according to Standard Methods (14th ed.). The proposed method is only applicable to alkalinities in the range of 0-20mg/l as $CaCO_3$.

(3) Organic chemical samples will be collected in glass with a previous rinse in organic solvent. Blanks should be run on a "clean" sample bottle to demonstrate no residue remains. This should be done regularly. It has also been suggested that the filtrate on said samples be analysed. Up to 90% of the organics can be found in the particulate matter. Finally, the filtration unit should be washed between field filtration procedures. This will reduce chances of cross-contamintaion.

(4) Under laboratory procedures, I recommend that the most recent edition of EPA - Methods for Chemical Analysis of Water and Wastes, 1979, be used (March, 1979 edition EPA 600/4-79-020).

ACRES

OFFICE MEMORANDUM

TO: B. Drage

Date: September 24, 1980

FROM: I. Hutchison

File: P5700.11.10
052303

SUBJECT: Susitna Hydroelectric Project
Subtask 3.03 - Water Quality Data Collection

We have reviewed the results of water quality analyses of samples taken at Vee and Gold Creek on August 8th and 9th and have the following comments:

Concentration of settleable solids of 0.1 mg/l seems very low when compared to the suspended load concentration. This is probably due to the use of a relatively short retention period. We recommend longer retention times such as 1 week or more be considered before measuring settleable soild concentration. This will allow us to obtain more useful data.

You should bear in mind that we require particle size distributions for the suspended material from samples taken at different times during the year. This information will be required both for the reservoir sedimentation as well as river morphology studies.

Please keep us informed of developments.

I. Hutchison

GK:ccv

R&M
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ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

October 1, 1980

R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Dr. I.P.G. Hutchison

Re: 1980 Freeze-Up Ice Program

Dear Ian:

I have prepared our ice observation program and it is schematically shown on the attachment. We have coordinated this program with other on-going field activities to develop a comprehensive program that will be cost effective. We will be conducting ice surveys from the glaciers to the mouth and only a couple of special trips will be required.

The schedule I have prepared is considered tentative and will be adjusted depending on how freeze-up progresses. It should provide a good basis for Tom Lavender to schedule his trip, particularly if he wants to participate in our other data collection programs. The freeze-up dates were provided by the U.S.G.S. and they reflect the occurrence of ice at the gaging stations and may not represent the ice regime within a river reach.

If you have queries, please call.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/kah

Enclosures

cc: T. Lavender - Acres - Niagara Falls
T. Osterkamp - U of A - Geophysical Institute
L. Griffiths
J. Coffin
H. Tomingus

BTD 10/1/80

1980 Freeze-up Program

River Reaches

ACTIVITY	Denali	Vee	Watana	Gold Creek	Talkeetna	Parks Hwy Bridge	Yentna Confluence
Freeze-up dates (1)	Oct 1-27	Oct 22-31	?	Oct 15-28	Oct 7-23	?	≈ Oct 20

Concurrent Activities by R&M

- Maintain Weather Stations → (Denali to Gold Creek)
- Water Q Sediment Sampling (Vee)
- Q measurements (Watana)
- Water Q Sediment (Gold Creek)
- River Crossections → (Gold Creek to Parks Hwy Bridge)
- Crest Stage measurements → (Watana to Parks Hwy Bridge)
- Task 3.10 Lower Susitna → (Gold Creek to Yentna Confluence)

R&M Personnel Responsible

Drage, Coffin → Drage, Griffiths, Tominyus → Drage →

Additional Measurements to be made

(2) Observations documented with 35mm photos →
- Water Temperature
- Stage Measurements

Scheduled Field Visits

- Oct 15 & Nov 1, Maintain Weather Sta's →
- Cross Sections, continuous until Freeze-up →
- Oct 20 to 23, Water Quality, Q, Sediment →
- Oct 20, Lower River Reconnaisance →
- After Ice Cover has formed, ≈ Nov 20 ice thickness, water Qual, Sediment, stage, Q →

Additional Aerial and Ground Observations Required. Dates to be adjusted depending on Sequence of significant events.

- Nov 1 →
- Nov 15 →

Notes: (1) Dates as reported by USGS. Occurrence of ice reflected on recording chart. Float gage freezes in stilling well, or reflection on chart from manometer.

(2) Observations to document key locations and type of ice formation. Classification scheme will be that developed by Michel, B. "Winter Regime of Rivers and Lakes"

052303

Terrestrial Environmental Specialists, inc.
R.D. 1 BOX 388 PHOENIX, N.Y. 13135

OCT 28 1980
R & M
ANCH.

October 17, 1980
218.324

R&M Consultants, Inc.
5024 Cordova, Box 6087
Anchorage, Alaska 99502

Attention: Brent Drage

Re: Procedures for Water Quality Data Collection, Susitna Hydroelectric Project.

Dear Brent:

I apologize for the long delay in this formal response to your letter of July 22, 1980. As you know, we did review the R&M Procedures Manual for Water Quality Data Collection when it was received. On behalf of himself and Clint Atkinson, Milo Bell expressed approval of the manual to you in a letter of July 31.

Bob Williams has informed me that the Procedures Manual covers the aspects of the program as they were discussed in the April 23, 1980 meeting held at the Acres' office in Buffalo, New York. His one reservation, which I share, concerns the collection, analysis and reporting to be done by USGS, in that every attempt should be made to coordinate with R&M. We would also like to see a plan developed to insure the incorporation of the USGS data into the R&M reports. We feel confident that R&M will handle these areas of question without there being any unnecessary problems.

As ADF&G staffs up for their Susitna fisheries effort, TES will be adding an aquatic ecologist to our Anchorage office staff. We expect that this person will work closely with R&M water quality personnel and ADF&G fishery personnel to the overall benefit of the project effort.

Sincerely,

Vince

Vincent J. Lucid, Ph.D.
Environmental Study Director

VJL/vl
cc. K. Young
R. Williams

052303

L.A. PETERSON
& ASSOCIATES
Environmental Consulting

November 3, 1980

NOV 5 1980
R & M
ANCH.

Mr. Brent Drage
R & M Consultants, Inc.
5024 Cordova
Anchorage, Alaska 99503

Dear Brent:

This letter is written in response to your request for my comments regarding the letter written to you by Mr. Dave Sturdevant on September 15, 1980. Dave's letter includes a copy of a memo written by Mr. Jeff Hock on August 29, 1980, which contains four points regarding the procedures followed by R & M on the Susitna Project. My comments pertaining to these points appear below in the order presented in the memo.

Point 1: I whole heartedly agree with the basic reasoning of this point; DO, pH, conductivity, and temperature should be measured in the water column whenever practical. Also, I would agree or disagree with the statement that measuring DO and temperature after removal from the water column is an unacceptable procedure depending on how the sample was handled. The procedures followed by R & M are acceptable for the following reasons.

Three separate water samples are collected one foot below the surface at each site using a Van Dorn sampler. This sampler, open at both ends allowing water to pass through until the trigger is activated to release the end-seals, collects an undisturbed water sample. Water is transferred from the Van Dorn bottle to a beaker by attaching Tygon tubing to the oulet on the bottle and filling the beaker from the bottom. At least three times the volume of the beaker is added so that the aerated portion of sample is eliminated. Standard Methods, 14th edition, page 443 describes the above procedure. The Van Dorn bottle is a Kemmerer-type sampler. The use of a BOD bottle in the procedure on page 443 is required because the procedure being described is for a wet chemistry method of determining DO. It should be noted that Standard Methods states, "Record the temperature of the sample to the nearest degree Celsius or more precisely." Recall that this is a 300-ml sample. The R & M procedure calls for measuring temperature on the 1.2 to 1.3 liter portion of sample not used for the DO determination. Temperature in this volume should change at a slower rate than in a 300-ml volume since it is four times larger. DO and temperature are determined on each of three separate samples, not on a composite as stated in Hock's memo.

Conductivity and pH values are determined within an hour of collection. The 1974 edition of the EPA methods manual states the holding time is 6 hours for pH and 24 hours for conductivity, which means sample for these parameters can be removed from the water column. Regarding conductivity, Standard Methods, 14th edition, page 71 states that, "The sensor (or cell) may be...placed directly in the flowing stream, depending on conditions at the monitoring site."

118 Slater Drive, Fairbanks, Alaska 99701/(907) 456-6392

The added emphasis is mine because I feel it is significant that Standard Methods does not use a stronger word such as "should" or recommend," which they would if it were warrented. Also, Standard Methods, 14th edition, pages 460 - 465, does not say anything about having to measure pH in the water column.

The R & M procedures being followed are mainly the result of the working conditions. The Susitna River is turbulent, which makes it difficult to work from a boat. Since the field crew consists of two people, only one is available for sampling because the second has to operate the boat to keep it on station during sampling.

Point 2: The R & M procedure for alkalinity does follow Standard Methods. Although the EPA 1974 methods manual is cited, the two methods are the same. Also, R & M is determining total alkalinity, not carbonate alkalinity as stated in Hock's memo. Hock's statement that the R & M procedure is only applicable to alkalinities in the range of 0 - 20 mg/l is incorrect. That range is attained by following the procedure on page 280 of Standard Methods, 14th edition, which states that one should titrate to the end point pH without recording intermediate pH values. The R & M procedure records the intermediate pH value. Also, the R & M procedures manual presents the pH end points (both intermediate and final) that are used for alkalinities from 30 to 500 mg/l.

Point 3: A copy of this comment should be forwarded to Chemical & Geological Laboratories to insure they are running blanks on a regular basis. I suspect they are, since they are certified by the Douglas lab of DEC to determine these chemicals. The suggestion to determine organics on the particulate matter is really up to you, Brent, since you have to make the $$$ decisions. I recommend against it, however, for two reasons: A) the next sample period will be in December and there will be little if any suspended solids, and B) USGS has some historical data that we can review before we decide to spend another $150.00 per sample. Since the project schedule calls for a review of the water quality program in January, 1981, it seems appropriate to wait and consider the above suggestion during the upcoming review.

Point 4: I wrote EPA and requested copies of the 1979 edition of EPA's methods manual be sent to you and me.

Please contact me at your convenience if you have questions or comments regarding the above information.

Very truly yours,
L. A. PETERSON & ASSOCIATES

Larry

Laurence A. Peterson

Brent

R&M

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ENGINEERS
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November 7, 1980

R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Dr. Ian Hutchison

Re: 1980 Freeze-up Ice Program

Dear Ian:

In response to your letter Number P5700.11.10, please find enclosed our field book which will be utilized for making freeze-up observations during 1980. A separate log will be made for each observation trip, which will document observations made at critical locations. The ice observation log was created during Tom Lavenders trip to Alaska.

Basically, field observations and measurements will consist of the following:

- Documentation by description, the time and location of significant freeze-up processes.
- Field interpretation of freeze-up processes.
- Measurement of significant hydraulic parameters at critical sections. Description of parameters and methods of measurement are contained in the field book.

All observations and measurements will be filed chronologically until after freeze-up. Following the establishment of an ice cover, the data will be retrieved, screened and summerized.

As of November 7, 1980, frazil ice is still flowing in the river and an ice cover has not formed. Ice bridges have been observed at the following locations:

- Devil Canyon Damsite
- Downstream of Devil Creek
- Downstream of Tsusena Creek

- Deadman Creek Confluence
- Near Kosina Creek Confluence
- Vee Canyon

Due to the uncertainty of the exact time that an ice cover will form, we are coordinating our activities so that personnel will be in the field most of the time. In addition, we have established good communication with the helicopter pilots whom will notify us of significant changes in the ice regime.

Hope this meets with your satisfaction. I am still waiting for a copy of Tom Lavenders report on his trip to Alaska.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/jdb

Enclosure

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH. 907-279-0483 • TLX. 090-25280
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PLANNERS
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November 26, 1980 R&M No. 052303

Dr. W.D. Harrison
Associate Professor of Physics
Geophysical Institute
C.T. Elvey Building
Univeristy of Alaska
Fairbanks, Alaska 99701

Re: Glacial Studies, Sustina Hydroelectric Project

Dear Will:

Attached please find for your review, a draft scope and budget that we finally resolved during our phone conversation on November 23, 1980. This budget and scope has evolved from your recommendations on technical requirements for reconnaissance glacial studies, coordination with R&M hydrology field activities in the Sustina Basin and budget constraints imposed by Acres.

The objective of this study is to conduct a reconnaissance level investigation into the primary glaciers feeding the upper Susitna basin. Assess whether significant changes in water and sediment yield could occur, if potential lake dumps exist and develop a long-term glacial observation and study program oriented towards hydropower development if it is warrented.

Would you please review the attachment and offer any comments. With your concurrence, the study plan will be forwarded to Acres with a recommendation for inclusion in the 1981 program.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage P.E.
Susitna Project Coordinator

BTD/jsusi4/m

Attachment

GLACIER STUDIES

TASK		Will Harrison	R&M	Acres
1	Literature Review and Program Development ° Integrate USGS and R&M Data into Glacial Studies. ° Review Literature	$2,800	$1,500	
			Subtotal	$4,300.00
2	Aerial Photography			
	° Obtain Air Photos - Aug. 1980 Uncontrolled, flown by NPAS		$3,000	
	° Coordination and Expenses	$ 400	$ 400	
	° Air Photo Interpretation of 1950 and 1981 Photo's; Volume Analysis Feasibility Report	$3,300		
			Subtotal	$7,100.00
3	Sediment Analysis ° Review USGS data at Denali & Maclaren for applicability to Glacial Sediment Yield. Base Information from Sediment Studies, Subtask 3.07.	$1,200	$1,200	
			Subtotal	$2,400.00
4	Temperature			
	° Thermistor String		N/C	
	° Manual Readings Monthly		N/C	
	° Reader Box		N/C	
	° Installation	$ 800	$ 600	
	° Data Reduction	$1,200		
			Subtotal	$2,600.00

Glacier Studies (Continued)

TASK		Will Harrison	R&M	Acres
5	Velocity Survey DD 12/12/80			
	° Establish ~~3~~ 2 Markers on Susitna Glacier and Referance with Ground Points		$1,700	
	° Survey 3 Times During 1981		$2,100	
	° Data Reduction and Interpretation	$1,200		
			Subtotal	$5,000.00
6	Field Reconnaissance			
	° Harrison and R&M	$1,700	$ 900	
	° One Week Office	$2,500		
	° Disbursements	$ 500		
			Subtotal	$5,600.00
7	Report			
	° Draft Preparation	$4,000	$1,300	
	° Final Review			$3,000
			Subtotal	$8,300.00
8	Transporation			
	° Helicopter			$18,200
	TOTALS	$19,600	$12,700	$21,200.00
	COMBINED TOTALS		$53,500.00	

December 2, 1980

Brent Drage
Susitna Project Coordinator
R & M Consultants, Inc.
5024 Cordova
Box 6087
Anchorage, AK 99502

Dear Brent:

Thanks for your letter, R & M No. 052303. We seem to be in good agreement now on the glacier studies, although I will try to clarify a few points, and make one request.

Task 3, Sediment Analysis. R & M is to supply me with all the sediment data in tabular form (except for what I may get myself from obscure sources). Can you also please supply the discharge data at the time the samples were taken, when there is any?

Task 2, Aerial Photography. It should be understood by Acres that what we are proposing for the volume analysis is only a pilot program to see if glacier volume changes can be estimated by comparison of old and new photography. The new photography will also be used to identify morphological changes. Part of my $3700 in that category will be used by NPAS.

Task 4, Temperature. Although it is not quite clear in your letter, it is my understanding that I am responsible for supplying an existing thermocouple string and a potentiometer for reading it.

There is no task on our list covering glacier mass balance, but I assume that you are including it as part of your snow course studies. Since this will at least have to be referred to in the glacier studies report, I need access to the data. I may also have something to say about its interpretation.

I propose to do the work through the university. In your letter you should specify how you want us to be reimbursed (will you issue us a purchase order or letter of agreement to the Institute?), when we should start spending the money, and when the draft report needs to be completed. Since we will be working so closely together, we will have to maintain good communications to meet our deadlines.

Geophysical Institute, C.T. Elvey Building, University of Alaska, Fairbanks, Alaska 99701
PHONE: 907-479-7282 TELEX: 35414 GEOPH INST SBK

I would like to put into writing some philosophical comments about our program. It is the best that we could plan within the budget limitations, but given the realities of salary costs, it will be more superficial that I would like to see even for a feasibility study. It may also be somewhat vulnerable to bad weather or bad luck, given the realities of field work in the mountains. It should also be realized that glaciers, their behavior, and mass balances are highly variable things, and it is simply not possible to answer all of the important questions in a one-year program.

I look forward to the program. It is challenging, and our interests seem quite complimentary.

Sincerely,

Will

Will Harrison
Associate Professor of Physics

WH:plm

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH 907-279-0483 • TLX 090-25280
ENGINEERS
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December 23, 1980 R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Mr. G. Krishnan

Re: Transmittal of Snow Survey Marker Locations, Subtask 3.03

Dear Mr. Krishnan:

Enclosed for your information is a September 29 letter to the Alaska Snow Survey Supervisor of the U.S. Soil Conservation Service detailing the locations of the snow survey markers installed by R&M Consultants this year. Should you desire additional information, please contact me.

Very truly yours,

R&M CONSULTANTS, INC.

Jeffrey H. Coffin

Jeffrey H. Coffin
Staff Engineer

JHC/kxz

Enclosures

copies: [illegible]
[illegible]
Files
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ADF&G (Cornelius
Reading?

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA ■ BOX 6087 ■ ANCHORAGE, ALASKA 99502 ■ PH. 907-279-0483 ■ TLX. 090-25360
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

September 29, 1980

R&M No. 052303

Mr. George P. Clagett
Snow Survey Supervisor
2221 E. Northern Lights Blvd., Room 129
Anchorage, Alaska 99504

Dear George:

Enclosed for your use is a copy of our Snow Course Marker Data. Attached are copies of the map locations as we can best identify them. If you need any additional information, please contact me.

Very truly yours,

R&M CONSULTANTS, INC.

Jeffrey R. Coffin

Jeff Coffin
Staff Engineer

JC/kxe

Enclosures

9/22/80

SNOW COURSE MARKERS

Map	R&M MAP #		COURSE NAME	ELEV.*	LAT.	LONG	Meas. Dates	Meas. [illegible]
Healy (A-2)	B-3	Butte Creek Pass	BUTTE CREEK	2900'	63°01'N	147°54'W	2,3,4,5	a, j **
Healy (A-2)	B-2	Butte Creek Pass	MOOSE	2750'	63°04'N	147°41'W	"	"
Healy (A-2)	B-1	Butte Creek Pass	RED FOX	2750'	63°04'N	147°40W	"	"
Healy (B-1)	W-1	West Fork Glacier	CIRQUE	4700'	63°28'N	147°27'W	"	"
Healy (C-1)	W-2	West Fork Glacier	ICE CAVE	4000'	63°30'N	147°25'W	"	"
Healy (C-1)	W-3	West Fork Glacier	WEST FORK GLACIER	5050'	63°33'N	147°10'W	"	"
Mt. Hayes (C-6)	S-1	Susitna Glacier	CREVASSE	4150'	63°32'N	146°55'W	"	"
Mt. Hayes (C-6)	S-2	Susitna Glacier	MT. HAYES	4200'	63°31N	146°54'W	"	"
Healy (B-1)	S-3	Susitna Glacier	CARIBOU	4100'	63°25'N	147°05'W	"	"
Healy (B-1)	S-4	Susitna Glacier	MALAMUTE	2600'	63°23'N	147°11'W	"	"
Healy (B-1)	S-5	Susitna Glacier	MT. DEBORAH	3800'	63°25'N	147°19'W	"	"
Mt. Hayes (C-6)	S-6	Susitna Glacier	AURORA PEAK	4300	63°31'N	146°50'W	"	"
Mt. Hayes (B-6)	E-2	East Fork Glacier	EAST FORK	2900'	63°24'N	146°51'W	"	"
Mt. Hayes (B-6)	E-1	East Fork Glacier	PYRAMID	4250'	63°25'N	146°53'W	"	"
Mt. Hayes (B-6)	E-3	East Fork Glacier	JATU PASS	4500'	63°27'N	146°44'W	"	"

* Elevations estimated to nearest 50 feet from USGS topographic maps.

** j = ALASKA POWER AUTHORITY
a = U.S. Soil Conservation Service

:63360

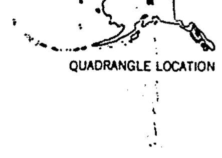
2 3 4 MILES

12000 15000 18000 21000 FEET

3 4 5 KILOMETRES

RVAL 100 FEET
NT 50-FOOT CONTOURS
RTICAL DATUM OF 1929

EOLOGICAL SURVEY
RADO 80225, OR RESTON, VIRGINIA 22092
AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION

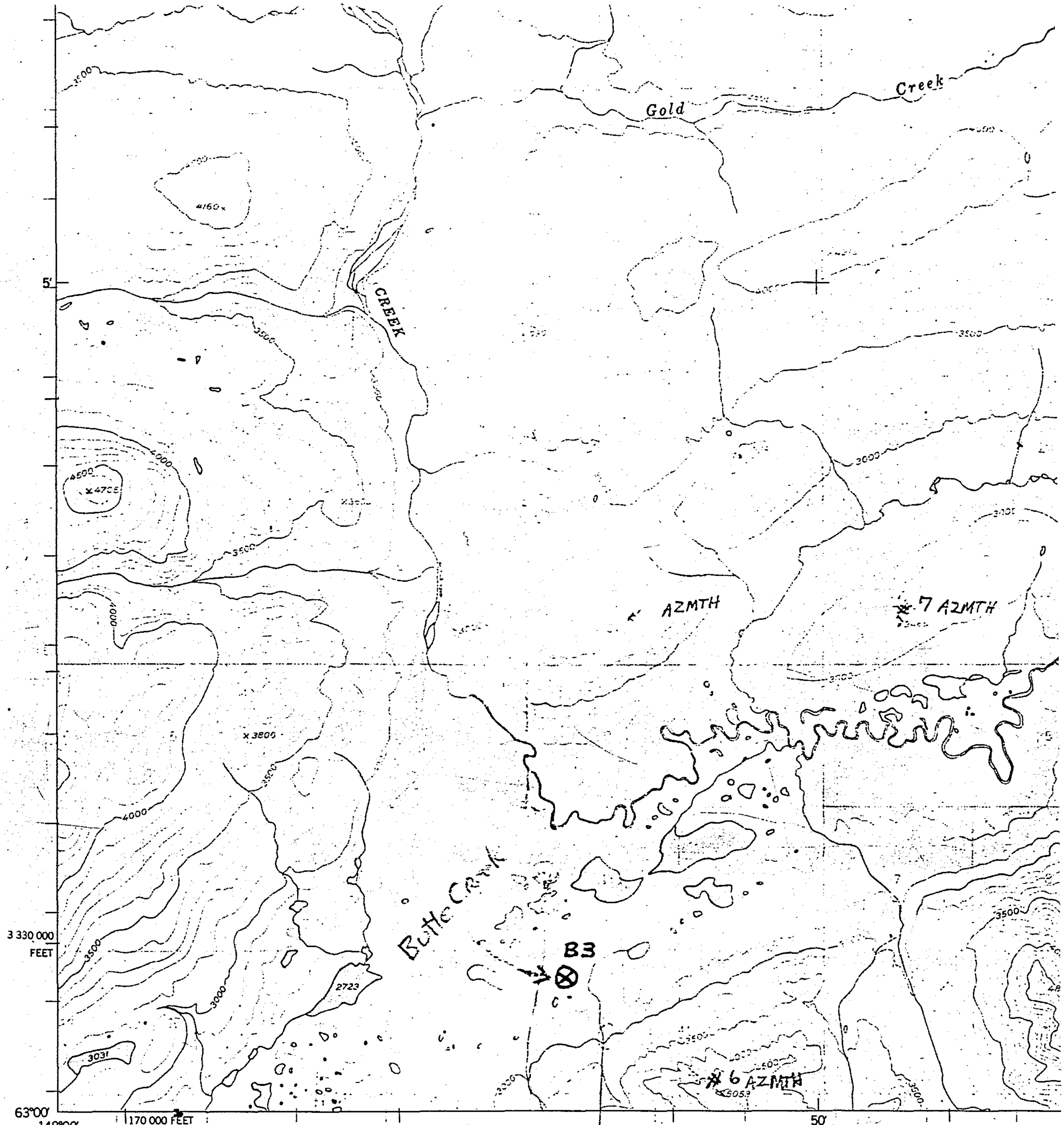
ROAD CLASSIFICATION

Light-duty Unimproved dirt

State Route

HEALY (A–2), ALASKA
N6300—W14730/15X30

1951
MINOR REVISIONS 1975



(TALKEETNA MTS. D-3)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

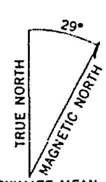
Topography by photogrammetric methods from aerial photographs taken 1949, field annotated 1951. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 3
1000-metre Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management Folios F-9 and F-10, Fairbanks Meridian

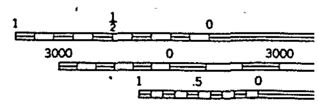
Swamps, as portrayed, indicate only the wetter areas, usually of low relief, as interpreted from aerial photographs

Healy (A-2)



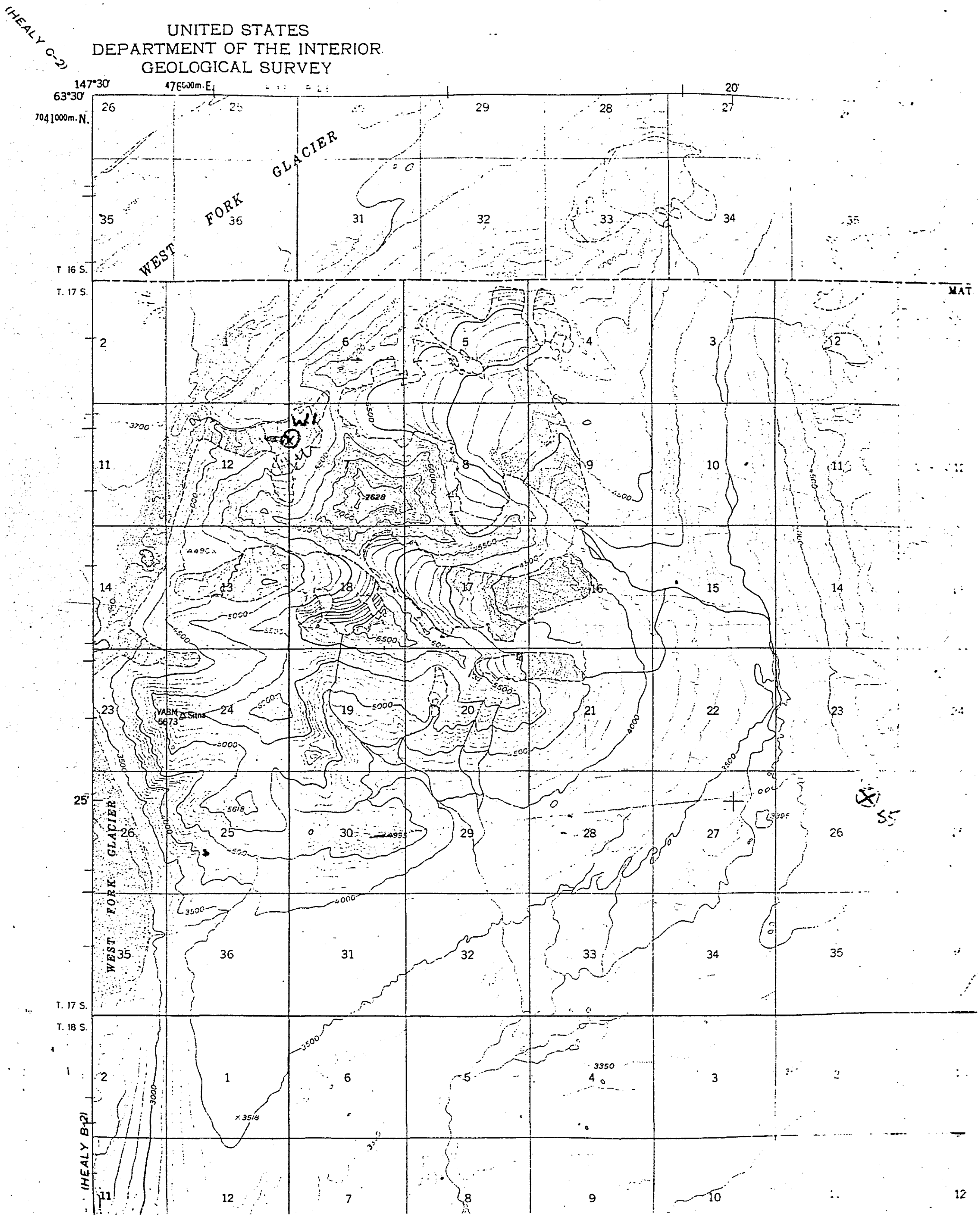
APPROXIMATE MEAN DECLINATION, 1951

1980
27° 15'



FAIRBANKS, ALASKA 9
A FOLDER DESCRIBIN

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



(HEALY B-2)

Mapped, edited, and published by the Geological Survey

Control by USGS

Topography by photogrammetric methods from aerial photographs taken 1952 and 1956, field annotated 1951. Map not field checked

Universal Transverse Mercator projection. 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 3
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

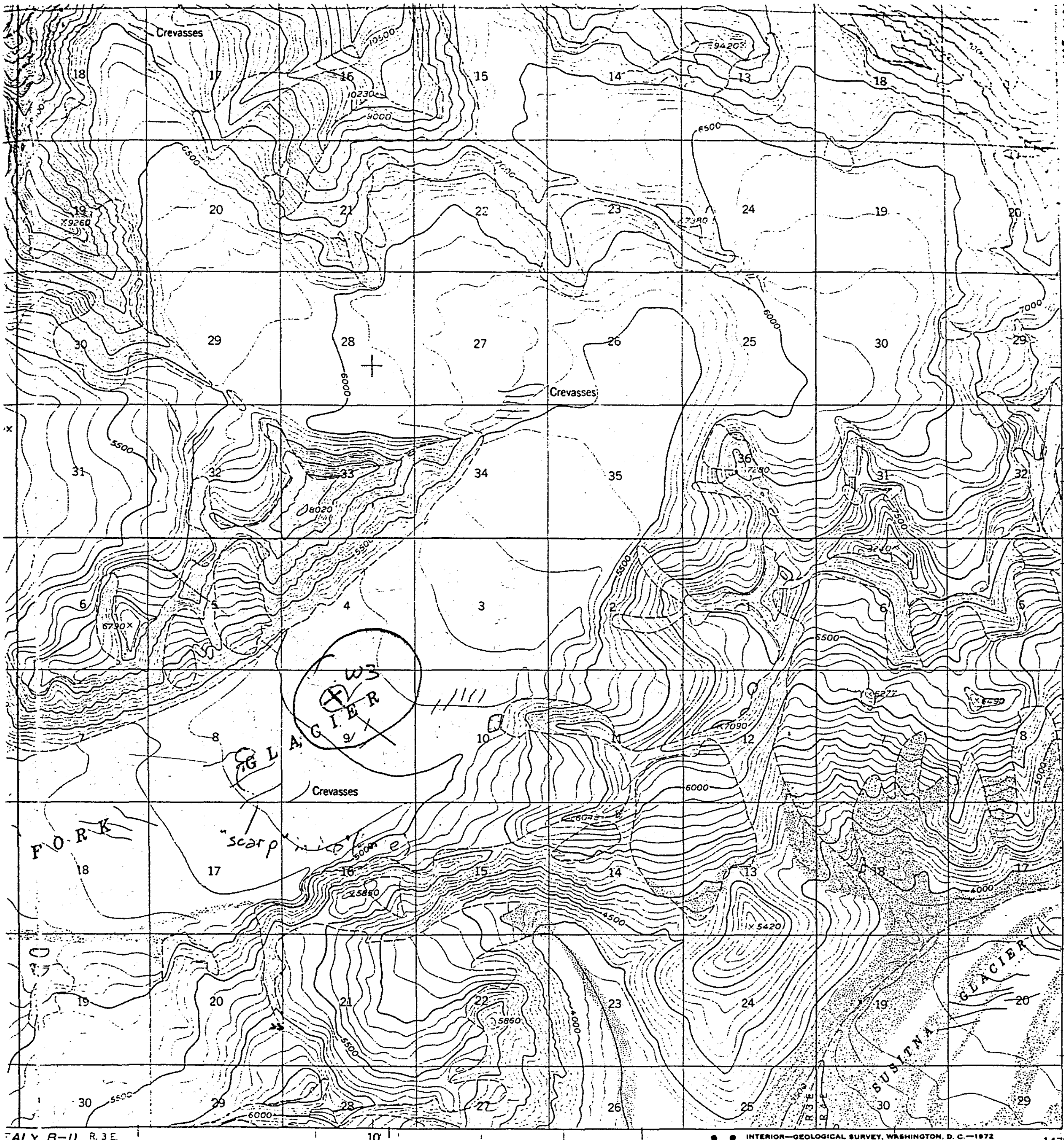
Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folio F-9, Fairbanks Meridian

Healy (C-1)

28½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1951

CONT
DA

FOR SALE BY
FAIRBANKS, ALASKA 99701, DENVER
A FOLDER DESCRIBING TOPOGRAPH



ALY B-1) R. 3 E. 10' INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972 499000m.E. 147°00' 63°30'

ALE 1:63360

2 3 4 MILES

9000 12000 15000 18000 21000 FEET

2 3 4 5 KILOMETERS

INTERVAL 100 FEET

S MEAN SEA LEVEL

ROAD CLASSIFICATION

No roads or trails in this area

QUADRANGLE LOCATION

. S. GEOLOGICAL SURVEY

OLORADO 80225, OR WASHINGTON, D. C. 20242

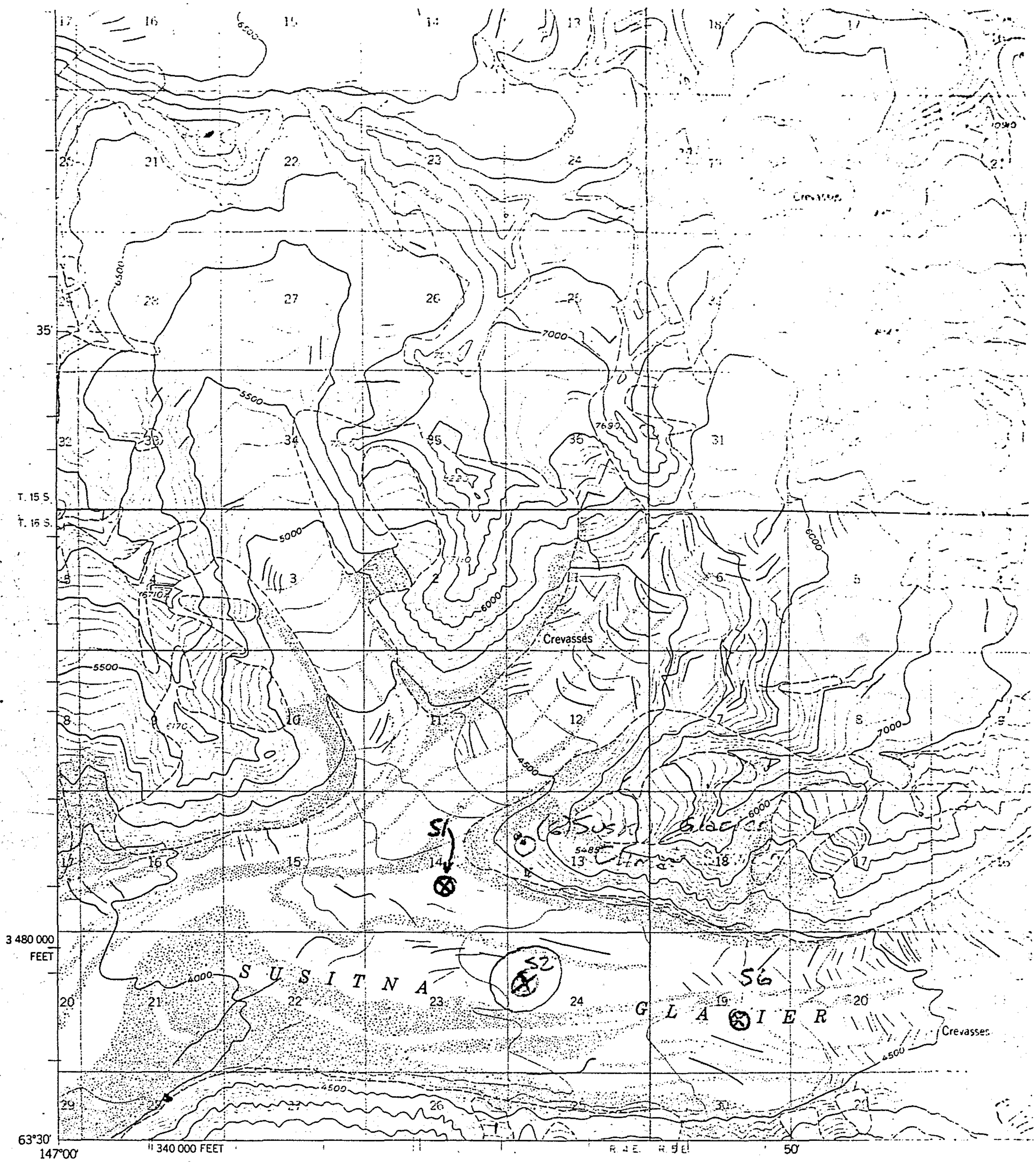
MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

HEALY (C-1), ALASKA

N6330—W14700/15X30

1951

MINOR REVISIONS 1972



(HEALY B-1)

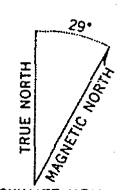
Mapped, edited, and published by the Geological Survey

Control by USGS

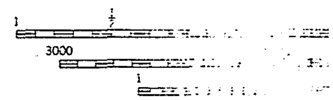
Topography by photogrammetric methods from aerial photographs taken 1950 and 1956, field annotated 1951. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 3
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folio F-9, Fairbanks Meridian



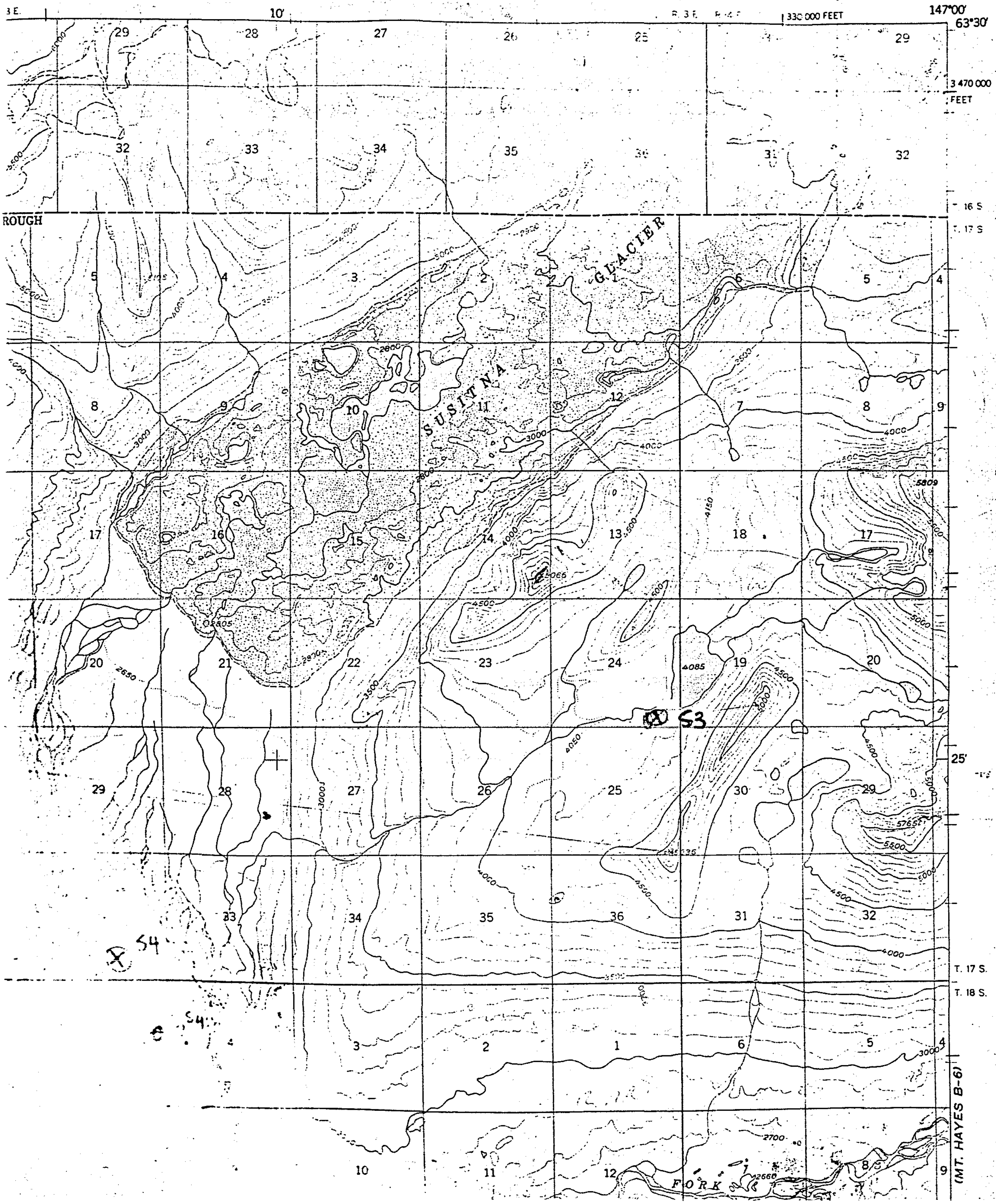
APPROXIMATE MEAN DECLINATION, 1951



Mt. Hayes C-6

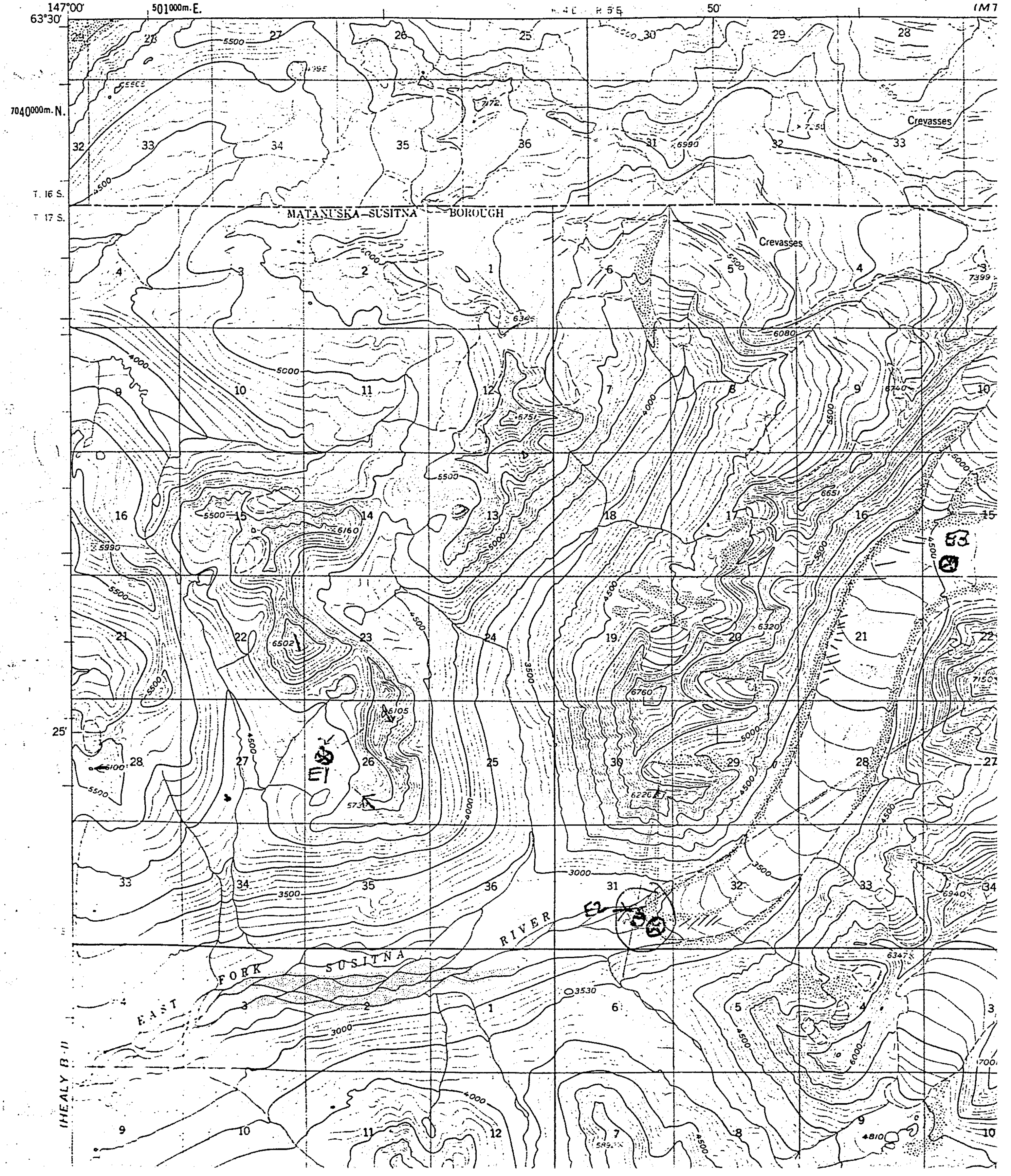
FOR
FAIRBANKS, ALASKA 9970
A FOLDER DESCRIBING T

HEALY (B-1) QUADRANGLE
ALASKA
1:63 360 SERIES (TOPOGRAPHIC)



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Mt. Hayes (B-6)



052303

January 6, 1981
P5700.11.10
T637

R&M Consultants, Inc.
5024 Cordova
Box 6087
Anchorage, AK 99502

Attention: Brent T. Drage

Dear Brent:

Susitna Hydroelectric Project
Subtask 3.03 - Snow Creep
Measurement System

This is to confirm the telephone conversation Jeff Coffin and Krishnan had on the snow creep measurement system and the changes to be made in the setup of the equipment.

(i) To simulate as closely as possible, conditions at the actual transmission towers snow creep forces should be measured on a 24" diameter 3/8" thick tubular section instead of the 4" X 4" X 3/8" angle iron as proposed in your original design.

(ii) The connections and sliding plates should be redesigned to accommodate the tubular section.

(iii) The steel cable size should be increased to 3/8" diameter from the proposed 1/4" to allow for a wider range of forces to be recorded by the dynamometer.

(iv) The two systems should be located at Watana and Devil Canyon respectively. One system should be located on a north facing slope and the other on a south facing slope. The systems should be located on relatively steepslopes where a good buildup of snow is anticipated.

It should be borne in mind that as the installation will be done in January, some snow creep may have already taken place. The first year measurements should, therefore, be considered as preliminary and modifications to the systems and changes in location may be necessary before the winter of 1981.

Funds for the work should come from R&M provisions under Snow Course Surveys. Please let us know the exact location of the measurement stations once these are known.

ACRES AMERICAN INCORPORATED
Consulting Engineers
The Liberty Bank Building, Main at Court
Buffalo, New York 14202
Telephone 716-853-7525
Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC
Telex 91-6423 ACRES BUF

Should you have any queries, please call Krishnan or myself.

Yours sincerely,

I.P.G. Hutchison

GK:ccv

cc: J. Gill

R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH. 907-279-0483 • TLX. 090-25280
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

March 17, 1981

R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Mr. G. Krishnan

Re: Location of Snow Creep Measurement Sites, Subtask 3.03

Dear Mr. Krishnan:

Attached are site locations and descriptions for the two snow creep measurement set-ups installed last month on the Susitna Project. Because the manufacturer had had a problem obtaining shackles for their assembly, we did not receive the dynamometers until February 20. Per our earlier discussions and your letter of January 6, 1981, one site is near each of the two damsites, Watana and Devils Canyon. Also, one slope is essentially north-facing and one is essentially south-facing. Ample snow accumulation is expected at each site. However, as we discussed, modifications may be necessary to the systems or their locations after our experience this winter. We plan to visit the stations to take dynamometer readings at least once per month, probably coincident with our climate station/snow survey trips.

Should you have any questions or comments on the installations, please contact Brent Drage or myself.

Very truly yours,

R&M CONSULTANTS, INC.

Jeffrey H. Coffin

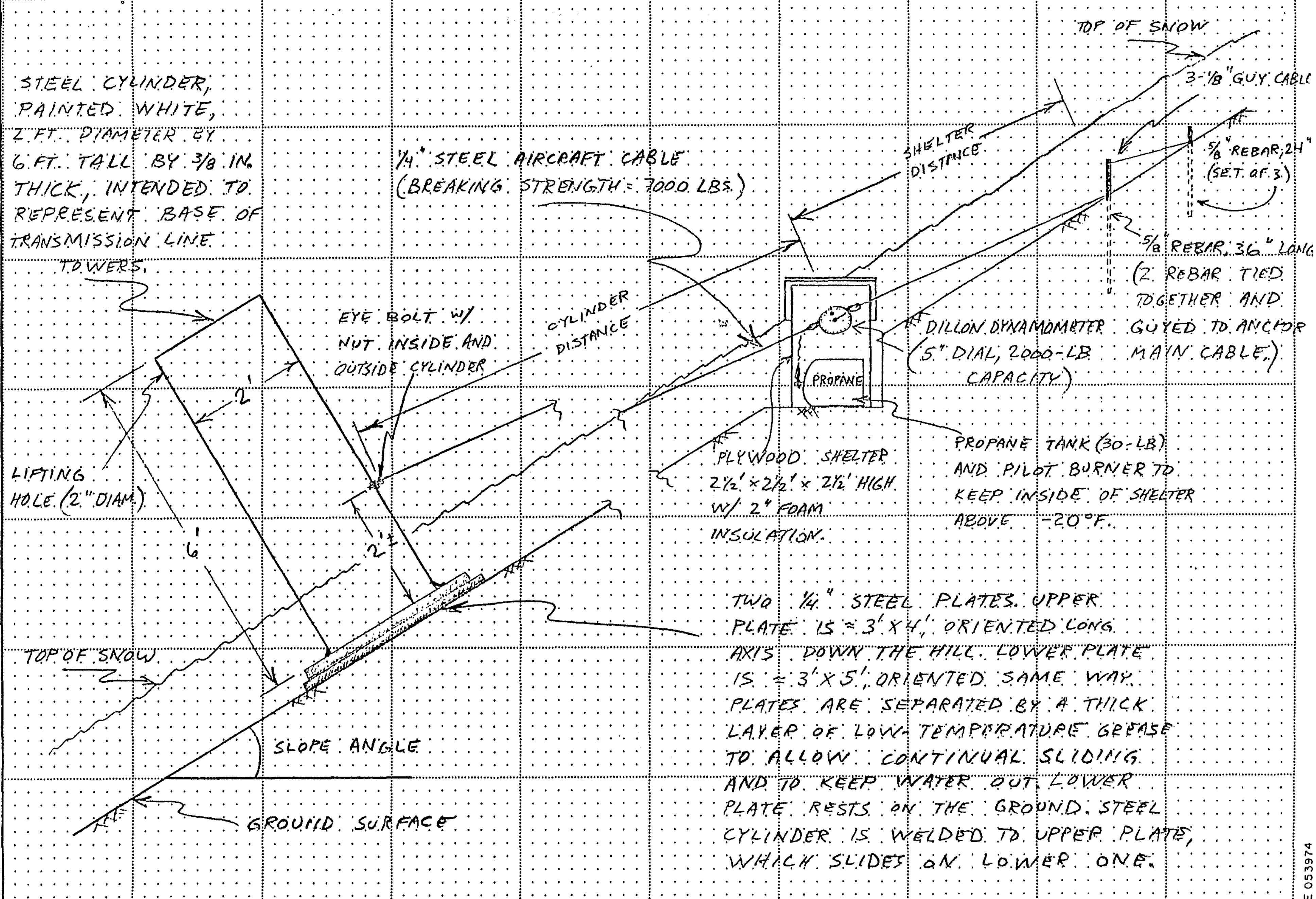
Jeffrey H. Coffin
Staff Engineer

JHC/jcf

Attachment

SUSITNA HYDRO. PROJECT

SNOW CREEP STATION (TYPICAL)



SHEET NO. 1 OF 5
JOB NO. 052303

R&M CONSULTANTS, INC.

SUBJECT Susitna Hydro Project
CALC BY JHZ DATE 3/3/81
CHKD BY ____ DATE ____

E 053974

SUSITNA HYDROELECTRIC PROJECT

Description of Snow Creep Station Installations

Site Name: Watana

Site Number: 0920

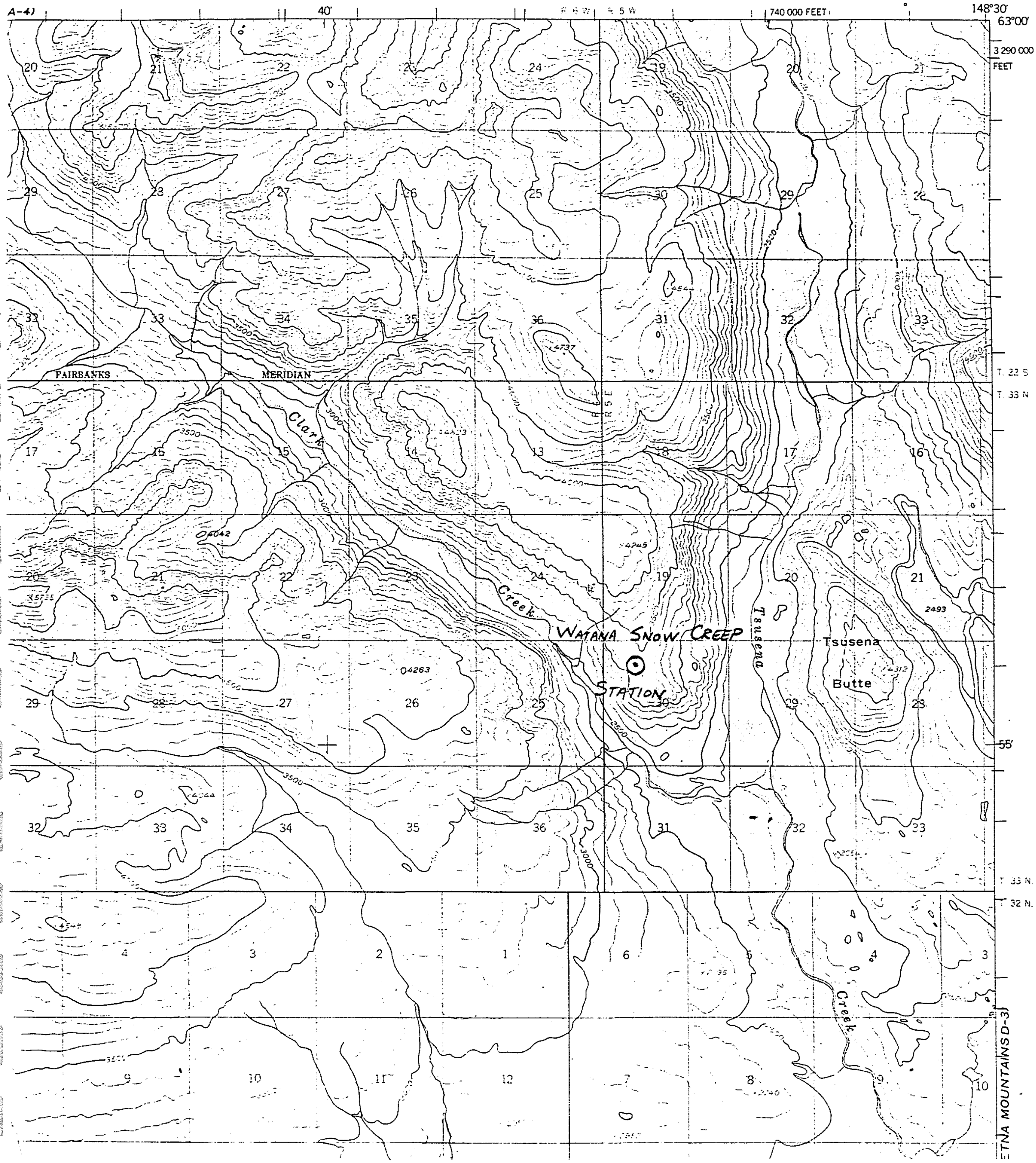
Date of Installation: February 26, 1981

Installation Crew: J. Coffin, C. Schoch, R. Butera

Site-Specific Information

1. Location: NW ¼, Sec. 30, T33N, R5E, Seward Meridian
2. U.S.G.S. Map: Talkeetna Mountains (D-4)
3. Elevation of Site: 3,200 ft. (from map)
4. Slope Aspect: Southwest
5. Slope Angle: 35°
6. Snow Depth @ Time of Installation: 24-30 inches
7. Air Temperature @ Time of Installation: 30°F
8. Soil Material: Broken rock and tundra, all frozen
9. Shelter Distance (see sketch): 20 ft. (approx.)
10. Cylinder Distance (see sketch) : 90 ft. (approx.)
11. Maximum Pretensioning Force Used: 900 lbs.
12. Final Dynamometer Reading @ Time of Installation: 440 lbs.
13. Dynamometer Installed: W.C. Dillon Co., 2000-lb. (pound) Capacity, 5"dial, S/N 10575
14. Notes: Pilot burner did not funtion properly at time of installation. Thus, it was not connected until the next visit to the station, March 16, 1981.

TALKEETNA MOUNTAINS (D-4) QUADRANGLE
ALASKA–MATANUSKA–SUSITNA BOROUGH
1:63 360 SERIES (TOPOGRAPHIC)



SUSITNA HYDROELECTRIC PROJECT

Description of Snow Creep Station Installations

Site Name: Devils Canyon

Site Number: 0940

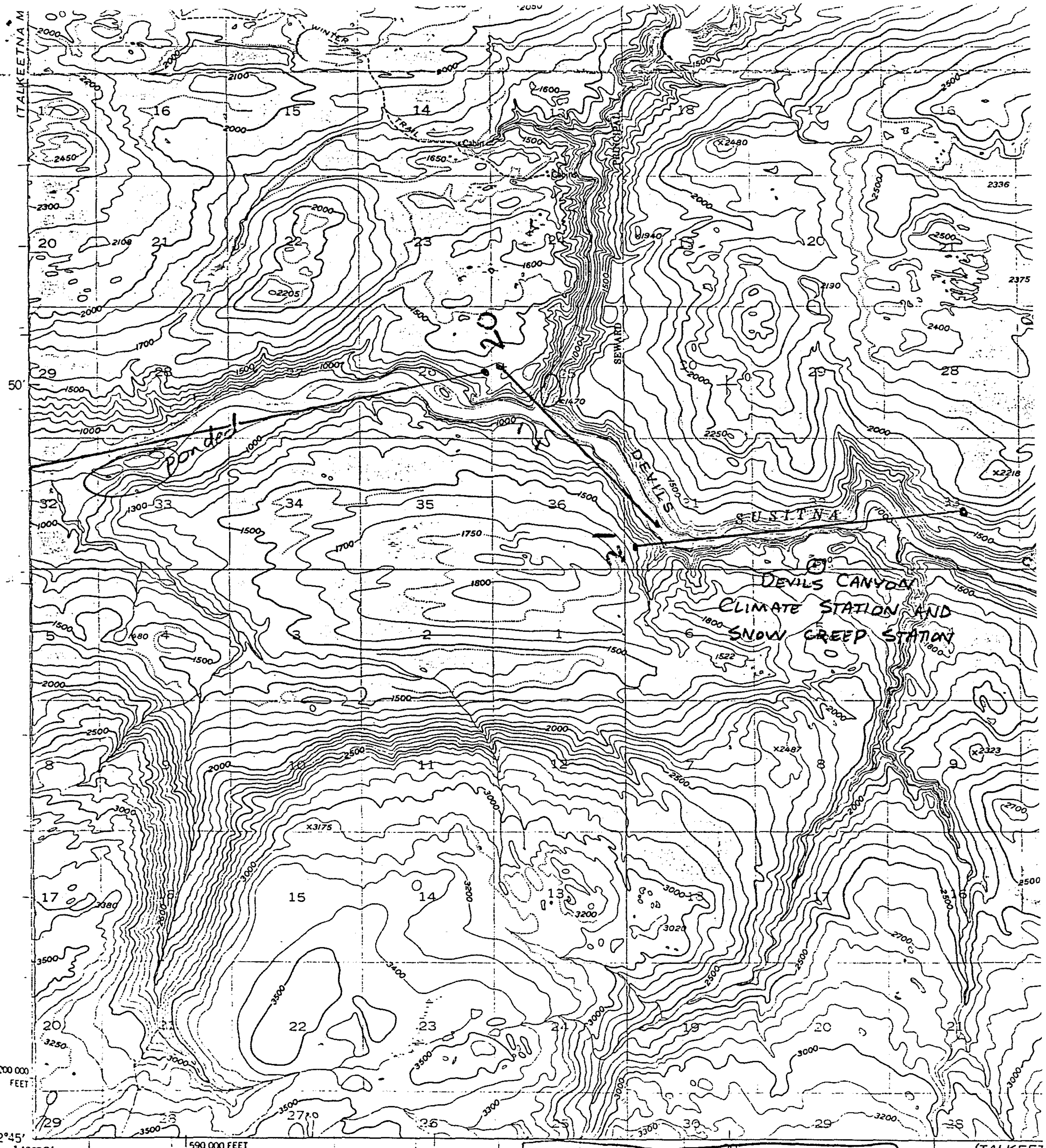
Date of Installation: February 25, 1981

Installation Crew: J. Coffin, C. Schoch, R. Butera

Site-Specific Information

1. Location: SW ¼, Sec. 32, T33N, R1E, Seward Meridian
2. U.S.G.S. Map: Talkeetna Mountains (D-5)
3. Elevation of Site: 1,500 ft. (from map)
4. Slope Aspect: Northeast
5. Slope Angle: 29°
6. Snow Depth @ Time of Installation: 20+ inches
7. Air Temperature @ Time of Installation: 32°F
8. Soil Material: Thick tundra, frozen
9. Shelter Distance (see sketch): 15 ft. (approx.)
10. Cylinder Distance (see sketch): 65 ft. (approx.)
11. Maximum Pretensioning Force Used: 1000 lbs.
12. Final Dynamometer Reading @ Time of Installation: 470 lbs.
13. Dynamometer Installed: W.C. Dillon Co., 2000-lb. (pound) Capacity, 5"dial S/N 10576
14. Notes: Pilot burner did not funtion properly at time of installation. Thus, it was not connected until the next visit to the station, March 15, 1981.

susit4/g2



TALKEETNA . MOUNTAINS (D-5)

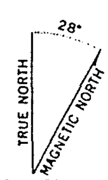
Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1949, field annotated 1950. Map not field checked

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 4
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folios F-10, Fairbanks Meridian and S-1, S-2, Seward Meridian



APPROXIMATE MEAN DECLINATION, 1950

CONTOUR
DOTTED LINES
DATU

FOR SALE BY U
FAIRBANKS, ALASKA 99701, DENVER,
A FOLDER DESCRIBING TOPOGRAPHIC

MEMORANDUM

State of Alaska

TO: Dave Wozniak
Su Hydro Project Manager
Alaska Power Authority
333 W. 4th Avenue, Suite 31
Anchorage, Alaska 99501

DATE: April 15, 1981

FILE NO: 052303
052000

TELEPHONE NO:

FROM: Thomas W. Trent
Aquatic Studies Coordinator
Su Hydro Aquatic Studies
Anchorage

SUBJECT: USGS Water Quality Measurements

The present USGS and R&M Su Hydro Water Quality sampling programs for sites on the Susitna River downstream from Devil Canyon (figure 1) have been reviewed by my staff. Inconsistencies with the types and level of analysis will prevent comparison of these sites for hydrologic appraisal of the overall lower Susitna Basin. Following is a summary of the existing USGS and R&M water quality program and our recommendations for improvement.

According to the present USGS work plan, sediment samples are analyzed by particle analysis (Attachment 1) and suspended sediment at the Gold Creek Site; whereas the samples at the Sunshine site are analyzed to the sand break (Attachment 2). In addition, the water quality analysis at the Sunshine site is more comprehensive than the Gold Creek site (Attachments 3 and 4).

R&M is collecting water quality data above the proposed dam site and at Gold Creek (Attachment 4).

There are three basic differences between the R&M and USGS sampling and analysis schemes: 1) parameters; 2) methods of collection and preservation; and, 3) methods of analysis.

Parameters

The differences in parameters being analyzed are: USGS measures suspended sediment and R&M measures settleable solids and total suspended solids. These are not comparable (Madison 1981). The specific nutrients which USGS and R&M measures are different. The USGS will measure a broader range of inorganic cations and anions than R&M.

Collection and Preservation

The differences between the methods of collection and preparation are significant and make comparison of samples questionable if at all possible at 3 stations. R&M composites 3 grab samples which are collected 1 foot under the surface across the river (right and left bank and center channel) (R&M 1980), whereas USGS takes a depth integrated composite sample at several points along a transect across the river. The USGS depth integrated method accounts for differences in concentration which will otherwise result if a sample is collected in too shallow of water or the water is stratified and not homogeneous, thus give a better representation of the river water quality. The 3 R&M surface grab samples may not be sufficient to represent overall water quality of the river. The preservation techniques for nutrients are not the same; thus, data comparison is questionable.

Analysis

The methods and level of analysis used for trace metals by R&M are different; thus data comparison is questionable.

With this wide variety of differences in sample collection and analysis, comparison of the USGS data which are collected on the Chulitna and Sunshine Stations to R&M data at their Gold Creek stations would be inadvisable. USGS concurred with us concerning the advantages of modifying their program (attachment 1) to permit comparative analysis. It was also their opinion that a coordinated uniform hydrologic appraisal of the lower Susitna Basin would be beneficial to the overall Su Hydro Feasibility Study Program. In addition, the USGS suggested that the Chulitna River station be included in this proposed revised sampling and analysis scheme because of its proportionally high contribution to the Susitna River and potentially significant influence on water quality and channel geometry (Attachment 5).

A summary of the suggested revisions to the USGS program currently funded by the APA and R&M program follow:

USGS Modifications

	WATER QUALITY*		SEDIMENT*	
	present:	change to:	present:	change to:
Gold Creek	USGS minimal and R&M data	USGS comprehensive	particle size	-
Sunshine	USGS comrehensive	-	sand break	particle size
Chulitna	none	USGS comprehensive	particle size	--

*examples of minimal and comprehensive water quality and particle size and sand break analysis are attached.

Estimated additional costs to the existing APA/USGS cooperative sampling program to implement these changes would be:

	4/1-6/30 1981	7/1-9/30 1981	10/1-6/30 1982
Chulitna River	$4,120	$4,120	$9,100
Susitna River at Gold Cr. Susitna R. at Sunshine	$2,340	$2,340	$7,720
TOTAL	$6,460	$6,460	$16,820

R&M Modifications

To enable the use of R&M data for comparison purposes with existing and historical USGS data, uniform data collection and analysis procedures which are approved by USGS should be adopted by R&M.

R&M and USGS Evaluation

The Steering Committee should review the overall USGS and R&M water quality and hydraulic sampling and analysis procedures to evaluate the validity of the existing programs and determine whether they are integrated. It is our understanding that the only Su Hydro study participants which are presently required to author procedure manuals are TES subcontractors and the ADF&G.

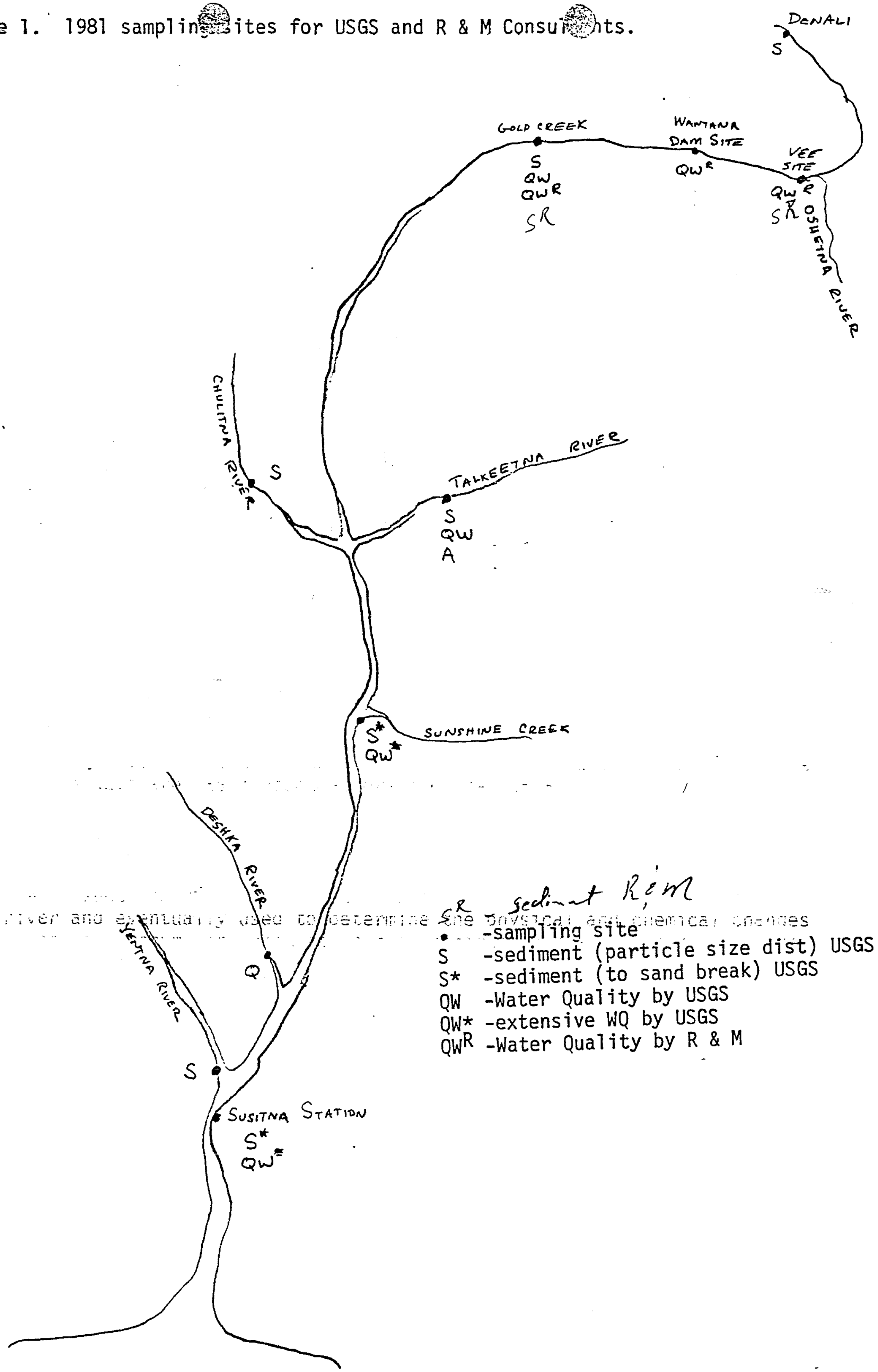
We strongly support the changes to the USGS program and believe they will benefit all study participants. With respect to the Department of Fish and Game's use of this information, it will be evaluated to assess the present relationship between discharge and water quality on the river and eventually used to determine the physical and chemical changes which will occur with changes in flow regimes if the proposed dams were constructed. Therefore we suggest and request that these minor changes to the existing USGS APA program be adopted and funded by the APA.

Madison, B. 1981. Personal communication pertaining to evaluation of R&M water quality procedure manual. April 15, 1981. USGS.

R&M. 1980 Susitna Hydroelectric Project. Procedures for water quality data collection. R&M Consultants. Anchorage. 11pp.

cc: R. George - USGS
B. Drage - R&M

Figure 1. 1981 sampling sites for USGS and R & M Consultants.



Attachment 1. Example of USGS particle site distribution analysis.

15292000 SUSITNA RIVER AT GOLD CREEK--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1949-58, 1962, 1967-68, 1974 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June to September 1957, July 1974 to September 1978 (seasonal and fragmentary), October 1978 to September 1979.
SUSPENDED-SEDIMENT DISCHARGE: May to September 1952, June to September 1957.

INSTRUMENTATION.--Temperature recorder since July 30, 1974.

REMARKS.--No record Dec. 16 to May 21 and July 10-31, sensor frozen in ice and clock stopped; respectively.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum, 15.0°C July 3, 4 (may have been greater during period of no record July 10-31); minimum, 0.0°C on most days during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SAMP-LING DEPTH (FT)	DEPTH AT SAMPLE LOC-ATION, TOTAL (FEET)	TEMPER-ATURE (DEG C)
JUL					
10...	1431	60	1.6	8.00	12.3
10...	1432	60	6.4	8.00	12.3
10...	1433	130	2.2	10.8	12.3
10...	1434	130	8.6	10.8	12.3
10...	1435	185	2.5	12.5	12.1
10...	1436	185	10	12.5	12.2
10...	1437	230	2.5	12.5	12.1
10...	1438	230	10	12.5	12.1
10...	1439	290	2.3	11.3	12.0
10...	1440	290	9.0	11.3	12.0
10...	1441	345	1.5	7.60	12.0
10...	1442	345	6.1	7.60	12.0
10...	1443	400	3.5	5.80	12.0

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM
MAY								
21...	1450	17400	168	7890	--	--	--	--
JUL								
10...	1430	25700	627	43500	16	21	27	34
SEP								
05...	1430	8820	67	1600	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAY							
21...	--	--	--	--	--	--	--
JUL							
10...	40	47	56	72	91	98	98
SEP							
05...	--	--	--	--	--	--	--

Attachment 2. Example of USGS sediment analysis to the [illegible]d break. See outlined column.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	COBALT, SUS-PENDED RECOV-ERABLE (UG/L AS CO)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, SUS-PENDED RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, SUS-PENDED RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, SUS-PENDED RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	0	<3	3	1	2	490	400	90	11	7	4	40
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	6	0	25	21	4	14000	14000	170	60	60	0	10
JUN 19...	0	7	29	28	1	12000	12000	0	12	10	2	250
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	5	<3	37	36	1	26000	--	40	16	14	2	580

DATE	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	MERCURY SUS-PENDED RECOV-ERABLE (UG/L AS HG)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, TOTAL (UG/L AS SE)	SELE-NIUM, SUS-PENDED TOTAL (UG/L AS SE)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	SILVER, SUS-PENDED RECOV-ERABLE (UG/L AS AG)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	30	10	.1	.1	.0	1	0	1	1	1	0	10
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	0	10	.2	.2	.0	1	1	0	0	0	0	50
JUN 19...	240	10	.1	.1	.0	1	0	1	0	0	0	60
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	580	4	.1	.1	.0	1	1	0	0	0	0	80

DATE	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C)	LENGTH OF EXPO-SURE (DAYS)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	CHLOR-A PERI-PHYTON CHROMO-GRAPHIC FLUOROM (MG/M2)	CHLOR-B PERI-PHYTON CHROMO-GRAPHIC FLUOROM (MG/M2)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 02...	--	--	--	--	--	--	--	--	--	--	[illegible]	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	[illegible]	--
JAN 15...	7	3	9.3	.2	--	--	--	--	--	3	[illegible]	--
APR 05...	--	--	--	--	80	.000	.000	.000	.000	4	[illegible]	--
MAY 14...	40	10	6.8	1.8	--	--	--	--	--	E683	[illegible]	E36
JUN 19...	50	10	.9	2.6	36	.000	.000	.000	.000	416	[illegible]	54
JUL 26...	--	--	--	--	--	--	--	--	--	2370	1[illegible]	74
AUG 29...	--	--	--	--	--	--	--	--	--	742	[illegible]	72
SEP 17...	80	<3	.6	1.1	--	--	--	--	--	901	2[illegible]	55

E ESTIMATED

Attachment 3. Example of comprehensive water quality analysis that will be taken at Sunshine.

Page 1 of 7.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1955, 1970, 1975 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: May 1975 to current year (seasonal).

INSTRUMENTATION.--Temperature recorder since May 23, 1975.

REMARKS.--No record Oct. 1 to May 14, when gage was shut down for the winter. Records represent water temperature at sensor within 0.5°C. Temperature at the sensor was compared with the average for the river by temperature cross-sections Oct. 2, Jan. 15, Apr. 5, May 14, June 19, July 26, Aug. 29, and Sept. 17. A maximum variation of 2.5°C was found within the cross-sections.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: Maximum, 16.5°C July 9, 1976 and July 3 and 4, 1979; minimum, 0.0°C on most days during winter periods.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum, 16.5°C July 3 and 4; minimum, 0.0°C on most days during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)
OCT							
02...	1401	1.0	155	7.6	4.0	12.8	98
02...	1402	180	155	7.6	3.9	12.8	98
02...	1403	380	158	7.8	3.8	12.8	98
02...	1404	580	160	7.6	3.8	12.8	98
02...	1405	830	167	7.6	3.7	12.8	98
02...	1406	1030	168	7.4	3.6	12.8	98
02...	1407	1248	160	--	3.8	12.8	98

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)
JAN							
15...	1231	150	196	6.7	.0	11.4	80
15...	1232	480	196	6.8	.0	11.5	81
15...	1233	942	201	7.0	.0	10.0	70

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SPECIFIC CONDUCTANCE (MICROMHOS)	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)
APR					
05...	1331	250	199	.2	11.0
05...	1332	900	212	.2	11.4
05...	1333	1000	218	.2	10.3

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SAMPLING DEPTH (FT)	PERCENT OF TOTAL DEPTH	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)
MAY									
14...	1530	150	19	80	95	7.6	5.5	12.7	100
14...	1531	150	4.9	20	--	--	5.5	--	--
14...	1532	250	14	80	95	7.6	5.5	12.7	100
14...	1533	250	3.5	20	--	--	5.5	--	--
14...	1534	450	10	80	90	7.6	6.0	12.5	99
14...	1535	450	2.5	20	--	--	6.0	--	--
14...	1536	700	9.4	80	90	7.6	6.5	12.2	98
14...	1537	700	2.4	20	--	--	6.5	--	--
14...	1538	950	7.0	80	95	7.7	6.6	12.0	97
14...	1539	950	1.8	20	--	--	6.6	--	--
14...	1540	.0	--	--	95	--	5.6	12.4	98

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SAMPLING DEPTH (FT)	DEPTH AT SAMPLE LOCATION, TOTAL (FEET)	STREAM VELOCITY, POINT (FPS)	PERCENT OF TOTAL DEPTH (FEET)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	[illegible]	[illegible]
JUN										
19...	1331	50	--	15.0	5.30	--	112	--		
19...	1332	50	3.0	15.0	5.40	20	--	--		
19...	1333	50	9.1	15.0	--	60	--	--		
19...	1334	50	12	15.0	5.20	80	--	--		
19...	1335	50	.5	15.0	--	--	110	7.9		
19...	1336	150	--	30.0	5.40	--	112	--		
19...	1337	150	5.9	30.0	6.00	20	112	--		
19...	1338	150	18	30.0	--	60	112	--		
19...	1339	150	24	30.0	4.80	80	112	--		
19...	1340	150	.5	30.0	--	--	110	8.0		
19...	1341	200	--	27.0	5.60	--	112	--		
19...	1342	200	5.5	27.0	6.70	20	--	--		
19...	1343	200	16	27.0	--	60	--	--		
19...	1344	200	22	27.0	4.60	80	--	--		
19...	1345	200	.5	27.0	--	--	110	7.9	110	7.9
19...	1346	250	--	23.0	5.40	--	112	--	112	--
19...	1347	250	4.6	23.0	6.30	20	--	--		
19...	1348	250	14	23.0	--	60	--	--	--	--
19...	1349	250	19	23.0	4.60	80	--	--	--	--
19...	1350	250	.5	23.0	--	--	110	7.8	110	7.8
19...	1351	350	--	17.0	5.70	--	115	--	[illegible]	--
19...	1352	350	3.4	17.0	7.00	20	115	--		
19...	1353	350	10	17.0	--	60	113	--		
19...	1354	350	14	17.0	4.60	80	--	--	--	--
19...	1355	350	.5	17.0	--	--	110	7.8	110	7.8
19...	1356	450	--	15.0	5.70	--	115	--	115	[illegible]
19...	1357	450	3.0	15.0	6.30	20	--	--		
19...	1358	450	8.9	15.0	--	60	--	--		
19...	1359	450	12	15.0	5.20	80	--	--		
19...	1400	450	.5	15.0	--	--	115	7.7		
19...	1401	600	--	15.0	5.00	--	120	--		
19...	1402	600	3.0	15.0	6.50	20	--	--		
19...	1403	600	8.9	15.0	--	60	--	--		
19...	1404	600	12	15.0	3.80	80	--	--		
19...	1405	600	.5	15.0	--	--	115	7.7		
19...	1406	700	--	14.0	5.90	--	122	--		
19...	1407	700	2.7	14.0	6.60	20	--	--		
19...	1408	700	8.2	14.0	--	60	--	--		
19...	1409	700	11	14.0	5.40	80	--	--		
19...	1410	700	.5	14.0	--	--	115	--		
19...	1411	850	--	15.0	4.70	--	124	--		
19...	1412	850	3.1	15.0	5.90	20	126	--		
19...	1413	850	9.2	15.0	--	60	126	--		
19...	1414	850	12	15.0	3.80	80	--	--		
19...	1415	850	.5	15.0	--	--	120	--		
19...	1416	1000	--	14.0	3.90	--	127	--		
19...	1417	1000	2.9	14.0	4.90	20	--	--		
19...	1418	1000	8.6	14.0	--	60	--	--		
19...	1419	1000	11	14.0	3.10	80	--	--		
19...	1420	1000	.5	14.0	--	--	120	--		

SOUTH-CENTRAL ALASKA

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	BICARBONATE (MG/L AS HCO3)	SULFATE DISSOLVED (MG/L AS SO4)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	SEDIMENT, SUSPENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
JUN								
19...	--	--	--	46	10	11000	327	70
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	45	11	11000	365	58
19...	10.9	--	--	46	10	12000	362	68
19...	10.9	--	--	--	--	--	398	60
19...	10.9	--	--	45	10	11000	469	53
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	45	10	11000	602	39
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	46	10	--	486	48
19...	11.0	--	--	--	--	--	--	--
19...	11.0	--	--	--	--	--	--	--
19...	11.0	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	47	11	13000	413	39
19...	10.9	--	--	46	11	11000	343	70
19...	10.9	--	--	46	11	12000	444	55
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	47	12	11000	428	56
19...	10.8	--	--	--	--	--	--	--
19...	10.8	--	--	--	--	--	--	--
19...	10.8	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	49	14	9000	350	64
19...	10.3	--	--	--	--	--	--	--
19...	10.3	--	--	--	--	--	--	--
19...	10.3	--	--	--	--	--	--	--
19...	--	11.1	99	--	--	--	--	--
19...	--	--	--	49	15	8880	376	56
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--
19...	--	--	--	50	15	8700	614	34
19...	9.9	--	--	51	15	8100	314	65
19...	10.0	--	--	--	--	--	411	50
19...	10.0	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--
19...	--	--	--	51	15	8600	451	45
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	SEDIMENT, SUSPENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
JUL									
26...	1605	147	112	7.5	11.2	11.1	100	2030	59
26...	1610	247	115	7.6	11.2	11.1	100	1880	76
26...	1615	447	112	7.7	9.0	11.5	99	2150	81
26...	1620	697	115	7.8	8.4	11.7	99	2790	75
26...	1625	1097	120	7.6	8.5	11.7	99	2980	78

Attachment 3. Page 4 of 7.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOC- ATION, CROSS SECTION (FT FM L BANK)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	TEMPER- ATURE (DEG C)	OXYGEN, DIS- SOLVED (MG/L)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION)	SEDI- MENT, SUS- PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
AUG										
29...	1401	110	24.0	122	7.0	10.1	11.0	99	608	84
29...	1402	210	29.0	123	7.0	10.0	11.0	99	654	79
29...	1403	360	17.0	126	7.2	9.6	11.0	99	711	75
29...	1404	660	15.0	130	7.3	8.0	11.3	97	810	66
29...	1405	910	13.0	132	7.4	8.0	11.2	97	927	56

DATE	TIME	SAMPLE LOC- ATION, CROSS SECTION (FT FM L BANK)	SAMP- LING DEPTH (FT)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET)	STREAM VELOC- ITY, POINT (FPS)	PER- CENT OF TOTAL DEPTH	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	TEMPER- ATURE (DEG C)
SEP									
17...	1601	50	--	16.0	3.20	--	133	--	--
17...	1602	50	.3	16.0	--	--	135	7.2	8.2
17...	1606	150	--	30.0	5.00	--	132	--	--
17...	1607	150	.3	30.0	--	--	135	7.2	8.3
17...	1608	150	6.0	30.0	5.40	20	133	--	--
17...	1609	150	18	30.0	--	60	133	--	--
17...	1610	150	24	30.0	4.70	80	133	--	--
17...	1611	200	--	27.0	4.60	--	132	--	--
17...	1612	200	.3	27.0	--	--	135	7.3	8.2
17...	1616	250	--	26.0	5.20	--	132	--	--
17...	1617	250	.3	26.0	--	--	131	7.4	8.1
17...	1621	350	--	17.0	5.80	--	131	--	--
17...	1622	350	.3	17.0	--	--	131	7.4	8.1
17...	1623	350	3.4	17.0	6.50	20	131	--	--
17...	1624	350	10	17.0	--	60	131	--	--
17...	1625	350	13	17.0	5.10	80	131	--	--
17...	1626	450	--	14.0	5.90	--	124	--	--
17...	1627	450	.3	14.0	--	--	124	7.6	7.0
17...	1631	550	--	14.0	6.80	--	125	--	--
17...	1632	550	.3	14.0	--	--	124	7.7	7.0
17...	1636	650	--	14.0	4.90	--	124	--	--
17...	1637	650	.3	14.0	--	--	124	7.7	7.0
17...	1641	800	--	14.0	5.10	--	127	--	--
17...	1642	800	.3	14.0	--	--	127	7.6	7.1
17...	1643	800	2.8	14.0	6.20	20	128	--	--
17...	1644	800	8.4	14.0	--	60	128	--	--
17...	1645	800	11	14.0	4.00	80	127	--	--
17...	1646	950	--	12.0	2.90	--	129	--	--
17...	1647	950	.3	12.0	--	--	129	7.6	7.2

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	SEDI-MENT, SUS-PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
SEP								
17...	--	--	54	0	21	18000	543	75
17...	11.2	98	--	--	--	--	--	--
17...	--	--	53	0	21	15000	645	64
17...	11.2	99	--	--	--	--	--	--
17...	--	--	54	0	21	17000	594	68
17...	--	--	54	0	21	17000	616	66
17...	--	--	54	0	21	17000	675	61
17...	--	--	54	0	22	19000	768	55
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	21	18000	780	57
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	21	19000	737	61
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	20	17000	628	71
17...	--	--	55	0	20	19000	749	60
17...	--	--	55	0	21	16000	948	49
17...	--	--	56	0	21	20000	1380	42
17...	11.3	97	--	--	--	--	--	--
17...	--	--	57	0	20	21000	1030	55
17...	11.4	97	--	--	--	--	--	--
17...	--	--	56	0	20	19000	1120	53
17...	11.4	97	--	--	--	--	--	--
17...	--	--	57	0	22	19000	1190	48
17...	11.4	97	--	--	--	--	--	--
17...	--	--	58	0	21	18000	767	73
17...	--	--	57	0	21	19000	1040	52
17...	--	--	57	0	21	19000	1400	40
17...	--	--	58	0	21	18000	1030	60
17...	11.5	98	--	--	--	--	--	--

DATE	TIME	STREAM WIDTH (FT)	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE, AIR (DEG C)	TUR-BID-ITY (NTU)	BARO-METRIC PRES-SURE (MM OF HG)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
OCT												
02...	1400	1250	28200	--	--	--	--	755	--	--	--	--
DEC												
20...	1545	1195	8410	183	--	-32.0	--	--	--	<1	--	--
JAN												
15...	1230	960	9890	--	--	E-1.0	2.2	740	K3	<1	79	13
APR												
05...	1330	1100	6700	--	--	--	1.5	--	K11	K1	84	13
MAY												
14...	1630	1350	86800	92	7.6	E11.0	160	765	K15	<1	37	3
JUN												
19...	1330	1300	95200	119	--	--	170	760	K7	K1	49	10
JUL												
26...	1600	1897	186400	115	7.7	--	790	760	K91	K65	60	6
AUG												
29...	1400	1210	90700	--	--	--	260	--	K9	K14	53	9
SEP												
17...	1600	1170	87700	130	--	11.5	100	731	K28	K8	59	13

E ESTIMATED
K NON-IDEAL COLONY COUNT

Attachment 3. Page 6 of 7.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	73	0	--	--	--	--	--	--
JAN 15...	25	3.9	7.0	1.5	80	0	18	11	.2	9.8	130	116
APR 05...	27	4.0	7.6	1.6	86	0	15	14	.1	11	113	123
MAY 14...	12	1.7	3.0	1.0	41	0	3.7	3.4	.1	6.3	64	52
JUN 19...	16	2.3	2.6	1.4	48	--	17	2.9	.1	5.0	68	71
JUL 26...	20	2.4	3.0	1.7	66	0	9.2	1.5	.3	4.3	70	75
AUG 29...	17	2.5	2.5	1.5	53	0	16	2.3	.1	4.2	66	72
SEP 17...	19	2.7	2.6	1.5	56	0	17	2.3	.1	4.9	79	78

DATE	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, NH4 + ORG. SUSP. TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N)	NITRO-GEN, TOTAL (MG/L AS N)	NITRO-GEN, DIS-SOLVED (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P)	ARSENIC TOTAL (UG/L AS AS)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	.21	--	.06	.16	.22	.12	.10	.43	--	.02	.05	2
APR 05...	.21	--	.04	.03	.07	.00	.11	.28	--	.01	.02	--
MAY 14...	.50	--	.01	.16	.17	.00	.21	.67	--	.01	.01	8
JUN 19...	.13	--	.04	1.2	1.2	.88	.32	1.3	--	.25	.00	10
JUL 26...	.09	--	.02	.45	.47	.46	.01	.56	--	.77	.01	--
AUG 29...	.07	--	.03	.40	.43	.31	.12	.50	--	.46	.00	--
SEP 17...	.08	.09	.01	.41	.42	.00	.42	.50	.51	.36	.01	11

DATE	ARSENIC SUS-PENDED TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)	BARIUM, SUS-PENDED RECOV-ERABLE (UG/L AS BA)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM SUS-PENDED RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, SUS-PENDED RECOV. (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	--	1	0	0	40	0	0	1	0	0	10	1
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	--	1	200	200	0	1	1	0	20	10	10	6
JUN 19...	--	2	200	200	0	1	0	1	30	20	10	7
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	9	2	100	70	30	0	0	<1	40	30	10	8

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	COBALT, SUS-PENDED RECOV-ERABLE (UG/L AS CO)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, SUS-PENDED RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, SUS-PENDED RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, SUS-PENDED RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	0	<3	3	1	2	490	400	90	11	7	4	40
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	6	0	25	21	4	14000	14000	170	60	60	0	10
JUN 19...	0	7	29	28	1	12000	12000	0	12	10	2	250
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	5	<3	37	36	1	26000	--	40	16	14	2	580

DATE	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	MERCURY SUS-PENDED RECOV-ERABLE (UG/L AS HG)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, TOTAL (UG/L AS SE)	SELE-NIUM, SUS-PENDED TOTAL (UG/L AS SE)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	SILVER, SUS-PENDED RECOV-ERABLE (UG/L AS AG)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	30	10	.1	.1	.0	1	0	1	1	1	0	10
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	0	10	.2	.2	.0	1	1	0	0	0	0	50
JUN 19...	240	10	.1	.1	.0	1	0	1	0	0	0	60
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	580	4	.1	.1	.0	1	1	0	0	0	0	80

DATE	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)
OCT 02...	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--
JAN 15...	7	3	9.3	.2	3	80
APR 05...	--	--	--	--	4	72
MAY 14...	40	10	6.8	1.8	E683	--
JUN 19...	50	10	.9	2.6	416	107000
JUL 26...	--	--	--	--	2370	1190000
AUG 29...	--	--	--	--	742	182000
SEP 17...	80	<3	.6	1.1	901	213000

E ESTIMATED

Attachment 4. List of parameters measured by R & M and USGS at Gold Creek. This is also an example of minimal USGS Water Quality analysis.

WATER QUALITY PARAMETERS TO BE MEASURED

PARAMETER	R&M	USGS
FIELD:		
Dissolved Oxygen	X	X
pH	X	X
Specific Conductance	X	X
Temperature	X	X
Carbon Dioxide	X	X
Alkalinity	X	X
Settleable Solids	X	
LABORATORY:		
Turbidity	X	
Total Dissolved Solids	X	X
Total Suspended Solids	X	
Total Phosphorous	X	X
Ortho-Phosphate	X	X
Kjeldahl Nitrogen	X	
Total Nitrogen	X	
Nitrate Nitrogen	X	
Ammonia Nitrogen	X	
Chemical Oxygen Demand	X	
Hardness	X	
Chloride	X	
Color	X	
Sulfate	X	
ICAP Scan	X	
Uranium	X	
Radioactivity, Gross Alpha	X	
Organic Chemicals	X	
Total Organic Carbon	X	
Total Inorganic Carbon	X	
Trace Metals	X	X

UNITED STATES
DEPARTMENT OF THE INTERIOR

Attachment 5.

GEOLOGICAL SURVEY
Water Resources Division
733 W. Fourth Ave., Suite 400
Anchorage, Alaska 99501

March 31, 1981

Mr. Tom Trent
Susitna River Study
Department of Fish and Game
State of Alaska
2207 Spenard Road
Anchorage, Alaska 99503

Dear Mr. Trent:

This letter is in response to your recent request for cost estimates for the collection of additional water quality parameters at the two Susitna River stations downstream from Devils Canyon presently operated under the cooperative program with Alaska Power Authority. In order to provide the kinds of information needed for a hydrologic appraisal of the Susitna basin we feel strongly that the same types of data should also be collected at the Chulitna River site. The costs for the increased data collection are shown below and are broken down into periods to reflect our different Fiscal Years.

	April 1- June 30, 1981	July 1- September 30, 1981	October 1- June 30, 1982
Chulitna R	2,340	2,340	7,720
Susitna R at Gold Creek / Susitna R at Sunshine	4,120	4,120	9,100
Total	$6,460	$6,460	$16,820

These costs would be in addition to the present operating cost for these stations.

Listed below is a breakdown of the specific parameters that would be collected at each of the stations and the frequency of collection:

1. Nutrients + Organics. 8/year

   $NO_2 + NO_3$ dissolved, NH_4 dissolved, NH_4 + Organic N dissolved, $NO_2 + NO_3$ total, NH_4 total, NH_4 + Organic N total, Phosphorus dissolved total, Phosphorus total, dissolved organic Carbon, and suspended organic Carbon.

2. Inorganic Constituents. 8/year

Silica, Calcium, Magnesium, Sodium, Potassium, Sulphate, Chloride, Flouride, Turbidity, and dissolved solids (residue at 180°C).

3. Minor Elements (dissolved and total). 4/year

Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selemium, and Zinc.

4. Field Parameters. 8/year

Specific conductance, alkalinity, pH, temperature, dissolved oxygen, and bacteria.

5. Suspended Sediment and complete particle size analysis. 8/year

Robert J. Madison
Acting District Chief

April 28, 1981
P5700.11.10
T853

052304

R&M Consultants, Inc.
5024 Cordova
Box 6087
Anchorage, AK 99502

Attention: Brent T. Drage

Dear Brent:

Susitna Hydroelectric Project
Subtask 3.04 - Evaporation Studies

We have reviewed your proposal for determination of reservoir evaporation as per your letter of April 9, 1981 and hereby instruct you to proceed as below. This confirms the telecon Krishnan had with you on April 21 on the subject.

1. Provide adequate information on the evaporation pan and ancilliary equipment to Jim Gill so a purchase order can be issued immediately. You should plan to have the pan installed and commissioned by early May near the Watana camp.

2. Arrange through Jim Gill/Bo Brownfield for a permanent Watana camp staff member to operate the instrument and collect data during the period May to October.

3. Commence the collection and processing of available evaporation records in the basin. Based on the available data, preliminary estimates of evaporation from the project reservoirs should be made using correlation techniques. The results should be available for Acres' review by mid-July. The calculated estimates of evaporation should be compared to the field data obtained this summar and modified if necessary. The final estimates should be available by early November 1981.

Acres has an in-house "FILLIN" computer program which was used to extend monthly streamflow data at the Susitna gaging stations. It will be possible to use this program for extension of any presently available evaporation data. Jeff Coffin may be in a position to do this work under Acres' guidance when he will be in Buffalo in June. You should, therefore, plan on collecting all existing data in May.

ACRES AMERICAN INCORPORATED
Consulting Engineers
The Liberty Bank Building, Main at Court
Buffalo, New York 14202
Telephone 716-853 7525
Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC
Telex 91-6423 ACRES BUF

In a subsequent conversation with Jim Gill, your request for the purchase of the required equipment was approved.

We await your finalizing the plans for the field work and analytical study. If you have any queries, please call G. Krishnan or myself.

Yours truly,

John W Hayden

J.W. Hayden
Technical Study Director

GK:ccv

cc: J. Gill

R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH 907-279-0483 • TLX 090-25280

ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

June 4, 1981 R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Mr. G. Krishnan

Re: Subtask 3.03, Review of Climate Data Retrieval

Dear Mr. Krishnan:

We have reviewed the success of data retrieval from the six MRI "Weather Wizard" weather stations. The review period extends from time of installation until April 30, 1981.

This summary should provide a good overview for project personnel to peruse for determination of the quantity and quality of data available for each weather station and each climatic parameter. In addition, it provides an assessment of the performance for the first year's experience with this type of instrumentation and operation. Since the instrument warranties are scheduled to run out soon, determination of whether we should continue using the MRI "Weather Wizards" needs to be made. The following summary provides the basic background for this decision.

Attached are abstract operating histories for each station, briefly describing performance and causes of data gaps. Also attached are monthly summaries of the percentage of usable data retrieved for each station. Usable data is defined as that data which passes the "Clean Up" Weather Data Computer Program and is determined acceptable for inclusion in the Weather Data Summaries. In some situations, short-term data gaps (one interval to perhaps several hours) are either bridged across manually or by the computer and determined as usable. Therefore, percentage of usable data does not reflect intermittent data gaps and may be biased towards a higher degree of success than would be determined if each data point were utilized.

A summary of the percentage of usable data is as follows:

Susitna Glacier (#0610)	80%
Denali (#0620)	71%
Tyone River (#0630)	41%
Kosina Creek (#0640)	68%
Watana (#0650)	74%
Devil Canyon (#0660)	73%
Overall Average	68%

Major data losses were accountable to three categories:

1. Deterioration of the PROM (Programmable Read Only Memory) chip, resulted in several of the instruments to be inoperative during September and October of 1980. MRI has redesigned and manufactured the chip and assured R&M that the problem would not reoccur.

2. Voltage regulator between the solar panel and Weather Wizard caused high voltages which scrambled the data. This problem has been resolved.

3. Operational problems and human error associated with new instrumentation, remote sites and extreme weather conditions. Experience will decrease this cause of data loss.

It is our opinion that even though we did not achieve our target goal of 70% data retrieval, the overall program was successful for the first year's operation. Most stations did exceed 70% and it was primarily the Tyone River site that brought the overall average down. It is our recommendation to continue with the program for the next year with a target data retrieval of 80%.

Since a major portion of data gaps resulted from instrumentation problems, it is also recommended that MRI be requested to extend the period of warranty 6 months. MRI has provided good warranty service; however, an extension is justifiable until we feel confident that serious bugs are resolved in a relatively new technically complex product utilized in extreme environments.

If you have questions or require further clarification, please give us a call.

Very truly yours,

R&M CONSULTANTS, INC.

Brent T. Drage

Brent T. Drage, P.E.
Susitna Project Coordinator

BTD/kah

Enclosures

ACRES

June 9, 1981
P5700.11
T917
052000
052303

Alaska Power Authority
333 West 4th Avenue
Suite 31
Anchorage, AK 99501

Attention: Mr. David D. Wozniak

Dear Dave:

Susitna Hydroelectric Project
Subtask 3.03 - Water Quality
Sampling Program

This has reference to your letter of May 1, 1981, dealing with Tom Trent's critique on the water quality sampling program being carried out by R&M. As per your request, the details of Tom Trent's memo of April 15, 1981, to you were discussed in the meeting held on May 7, 1981, in Anchorage and in subsequent discussions among R&M, ADF&G, and USGS on May 14, 1981. Relevant extracts of the minutes of these meetings are attached for ready reference.

As you may recall, the current R&M program on water quality sampling was designed after extensive discussions last year among all agencies including APA, ADF&G, DNR, TES, R&M, and Acres and was considered adequate for the Phase I studies and for planning of Phase II work. The primary question raised in Tom Trent's memo is the comparability of R&M data with the USGS data so that one will supplement the other in analyses and interpretation.

The following summarizes our response to the specific questions raised by Tom Trent:

a) R&M report settleable solids and total suspended solids from grab samples under their water quality program but also collect depth-integrated samples for separate sediment analysis and reporting. To avoid confusion in interpreting the two data sets, it has been agreed to delete reporting suspended sediment data under R&M water quality and report settleable solids measurements and suspended sediment analyses of depth-integrated samples only. These data would be comparable with the USGS records.

b) USGS takes a depth integrated sample at several points along a transect across the river and form a composite to analyze water quality parameters. R&M composites three grab samples collected

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at one foot below the river surface for their analyses. While there are significant differences in the collection procedure, the participants at the May 7 meeting were of the opinion that it would be difficult to say how the sampling procedures affected the analytical results. To resolve this question, the subsequent meeting on May 14 was held and a joint USGS, R&M field sampling at Gold Creek was conducted on May 26 and 27. Results of R&M analyses should be available by June 15 whereas USGS analyses may take somewhat longer. The two results will be compared and actions, where necessary, will be undertaken to ensure comparability of the two data sets.

c) The differences in the actual parameters measured by USGS and R&M were discussed in the May 7 meeting, and it was concluded that there is no need for additional parameters to be measured during Phase I work, and that, the ICAP scan would provide adequate base line data.

d) Methods of collection, preservation, and analyses of water quality samples carried out by R&M conform to EPA standards which differ somewhat from USGS practice. This was discussed at some length in the meetings, and it was concluded that the results would be adequate for use in the environmental analyses.

e) As regards the suggested revisions to the USGS program, we recommend on the basis of the above discussions that the USGS water quality program at Gold Creek be extended to a USGS comprehensive analysis. Sediment analyses at Sunshine stations should be extended to particle size analyses.

We trust that the increased budget requirement can be supported partly by the current USGS budget from the savings made from the non-installation of a cableway at Chulitna station and by additional funding from APA. The cost of the two program modifications should be $12,400 through June 1982 (per Tom Trent's April 15 letter).

f) Water quality sampling at Chulitna station was dropped from the USGS program as being of lower priority than other data collection programs. We agree that it would be useful, though not necessary, to have this data. Thus, we do not recommend adding USGS comprehensive water quality sampling at Chulitna station at this time.

We trust the above adequately addresses all the questions raised in Tom Trent's April 15 memo. If you have any queries, please call me.

Yours sincerely,

John Haydu

For John D. Lawrence
Project Manager

GK:db
Attachment

cc: R&M - B. Drage
ADF&G - T. Trent
USGS - B. Madison
W. Trihey
TES
J. Gill

EXTRACT FROM MINUTES OF MEETING HELD ON MAY 7, 1981

ACTION BY

The meeting proceeded to discuss the Acres/R&M water quality program as being conducted in the light of observations made by Tom Trent in a memo to APA (Attachment C).

Krishnan briefly traced the development of the water quality program as currently being carried out by R&M citing the meetings last year with representatives of USGS, ADF&G, APA, DNR, TES, R&M and Acres.

Bob Madison of USGS stressed the point that the methods of USGS and R&M for water quality sampling were not comparable. It was difficult, however, to say how the sampling procedure affected the analytical results. Christopher Estes emphasized the need for the compatability of results of the R&M and USGS observations so that R&M could compliment and extend the USGS historical records. He also stated that it would be logical to insure that the same parameters be evaluated at each sampling site as discussed in the memo from Tom Trent to Dave Wozniak (April 15, 1981).

Dana Schmidt indicated that the WQ parameters presently measured by R&M are adequate for purposes of preparing the initial license application and Phase II study plan; hence expansion of the present WZ data collection program is not necessary at this stage. — Acres/TES/ADF&G

After some discussion it was agreed that:

(a) R&M will collect depth integrated WQ samples and three surface samples during their next field observations at Gold Creek and analyze the two samples. The results would be evaluated jointly with USGS to determine the comparability of the two sampling procedures.

(b) Brent will set up a meeting with USGS personnel to determine the sampling schedule and analysis techniques which will be followed to resolve the present question concerning incompatability of WQ data. — R&M/USGS

Christopher requested that the APA consider funding the Chulitna water quality program, with the understanding that R&M and USGS would resolve the comparability issue, adding that the Chulitna data would be of value to all study participants. Jim Gill said APA would have to make the final decision on the Chulitna water quality monitoring. — Acres/APA

MINUTES OF MEETING

Held at the Office of

Acres American, Incorporated, Anchorage

May 14, 1981

WATER QUALITY SAMPLING COORDINATION MEETING

Susitna Hydroelectric Project, Subtask 3.03

The meeting was attended by:

Andy Hoffman	ADF&G
Bob Lamke	USGS
Bob Madison	USGS
Derrill Cowing	USGS
Brent Drage	R&M
Leslie Griffiths	R&M

Basically, it was decided that total phosphorous and total nitrogen should be reported as total dissolved phosphorous and nitrogen since in our analyses we only analyze the dissolved fraction in the water and not the totals available in the water-sediment mixture. The terminology conforms to those terms as defined in the 1979 "Water Resources Data for Alaska" (USGS).

There was also some question as to what exactly was defined by the total suspended solids analysis reported in our water quality reports. Brent explained how this related to the suspended sediment analysis and settleable solids field tests. Generally, it was agreed we'd be saved a lot of confusion if this parameter was deleted from our water quality program, leaving the settleable solids measurements and actual suspended sediment analysis taken from the depth - integrated samples.

There was some discussion on the value of ICAP scan versus wet chemistry techniques for water quality analyses. It was agreed that for this phase, the ICAP scan would provide baseline data that was adequate to describe the system. As specific parameters were identified as being of greater importance, different, perhaps more accurate or refined analysis techniques could be implemented.

To resolve the immediate problem we agreed to coordinate a sampling trip with this USGS where they would do sampling following their normal procedures and we would collect both grab samples and depth integreated samples for analysis and comparison. As it stands, that trip is scheduled for the 26th and 27th of May.

R&M will meet again with the USGS to compare results for the analyses and determine what, if anything needs to be done to improve or change our program to optimize the usefulness of water quality data collected.

R&M
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ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

July 24, 1981 R&M No. 052303

Susitna Hydroelectric Project
Acres American, Incorporated
2207 Spenard Road
Anchorage, Alaska 99503

Attention: Mr. Jim Gill

Re: Initial Bedload Sampling Trip

Dear Jim:

The initial bedload sampling trip for the Susitna Hydroelectric Project was conducted during July 21-23, 1981. The sampling team consisted of Steve Bredthauer (R&M), Larry Laveen (USGS-Anchorage), Bob Burrows (USGS-Fairbanks), together with a boat operator from Mahay's Riverboat Service, Talkeetna.

There was a delay on the first day. Don Elbert (R&M) had all parts for the sampling boom cut to specifications in Anchorage, assuming a 24-foot jetboat would be used. However, the 24-foot boat was sent to Prudhoe Bay on a long-term lease the week before the bedload trip. Mahay substituted his 27-foot jetboat. This required Don to acquire new materials, cut them to size, and fabricate a new boom. The second boom was not completed until the evening of July 20.

The boom was designed to swing inboard after collecting the bedload sample. However, the force of the current on the 3" sampler bent a 1/8" thick flange, making it necessary to leave the boom suspended over the side of the boat. Fortunately, this did not create a stability problem, as the 27-foot jetboat had a 10-foot beam, and proved to be quite stable, even when working in standing waves. The power winch arrangement did not work, and will have to be modified to use two belts before the next trip.

A 130-pound sampler with a 3-inch nozzle was used to collect samples at all 4 sites. Some large cobbles were collected which were barely able to enter the sampler. It is possible that some larger cobbles were moving which were not collected. The bedload moving at high flows will require a 6-inch nozzle on the Helley-Smith sampler. It was also attempted to collect bedload using a sampler with a 6-inch nozzle. However, the 6-inch sampler used weighed approximately 165 pounds, and had a very large tailfin assembly. At high flows, the force of the current makes this assembly too light.

Bob Burrows recommended a heavier sampler with a smaller tailfin assembly. The USGS will try to get another sampler before the next trip, but it will not be the heavy one required for high flows.

Velocities were too high for effective sampling at the USGS cableways at Chulitna River and Susitna River at Gold Creek. Cross-sections were selected nearby which had lower velocities. However, since no cableway was available for positioning, an electronic distance measuring (EDM) device was used for positioning. The EDM was placed on shore with an operator, and a reflecting prism placed on the boat. Distance and alignment information were relayed to the boat operator via walkie-talkies. This set-up required 4 people in the crew.

The next sampling trip is tentatively scheduled for the week of August 24. This trip is dependent on the river stage being at an intermediate level.

Also enclosed is the bill for boat fuel used by Mahay.

Very truly yours,

R&M CONSULTANTS, INC.

Stephen Bredthauer

Stephen Bredthauer, P.E.
Susitna Hydrology Coordinator

SB/kxz

cc: B. Drage
G. Krishnan
J. Hayden
W. Trihey
L. Leveen (USGS)

R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH. 907-279-0483 • TLX. 090-25280
ENGINEERS
GEOLOGISTS
PLANNERS
SURVEYORS

August 11, 1981

R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Mr. G. Krishnan

Re: Relocation of Aerial Snow Markers, Subtask 3.03

Dear Mr. Krishnan:

Attached is a memo detailing the changes made to some of the snow marker locations in the Upper Susitna Basin. Please reference my letter of December 23, 1980 for the original marker sites. As noted in Carl Schoch's letter of July 14, ~~1980~~ 1981 to you regarding the proposed relocations, these changes were recommended by George Clagett of SCS, the Alaska Snow Survey Supervisor. We agreed on additional or modified sites to give more representative snow accumulation data for the coming winter.

Should you have any questions, please contact Carl Schoch or myself.

Very truly yours,

R&M CONSULTANTS, INC.

Jeffrey H. Coffin

Jeffrey H. Coffin
Staff Engineer

JHC/jia

MEMORANDUM

R&M

TO	SUBJECT	
Steve Bredthauer	Relocation of Aerial Snow Markers	
FROM	**DATE**	**PROJECT NO.**
Carl Schoch	8-10-81	052303

1. Aerial snow marker "Red Fox" was relocated to the headwaters of Valdez Creek at an elevation of 4360 feet. The marker is located on Grogg Point in a shallow bowl. The panels are facing west and the bottom edge of the lowest panel is 1.2' feet above ground level. A small cairn was built around the base to provide addition support.

   The marker is in the SW ¼ of the NW ¼ of Section 2, T20S, R3E.

2. An aerial marker was donated to R&M by SCS and placed in the Boulder Creek drainage at an elevation of 4000 feet and on the east shore of a one mile long lake in Boulder Creek. The panels face west and the bottom edge of lowest panel (orange) is 24 inches above ground level.

   The marker is in Section 13, T17S, R5E.

3. The original marker ice caves was not found and was replaced by former marker "Mt. Deborah". The new marker was installed at approximately the same location but in a slightly more sheltered area. Panels are facing south (down glacier) and the bottom edge of the lowest panel is .7 feet above the ice. Should be checked in September for stability.

4. Aerial marker "West Fork" was not found and was replaced by former marker "Moose", at elevation 5000 feet and due east of a large hole in the ice field. This is at approximately that same location as the missing marker. The panels face down glacier and the bottom edge of the lowest panel is .4 feet above ice.

   The marker should be checked in September for stability.

5. The marker "Mt. Hayes" had fallen over and was reinstalled at same location. Panels are facing down glacier and the bottom edge of the lowest panel is flush with the ice to account for ablation.

   Marker should be remeasured and checked for stability in September.

6. A new aerial marker was placed at 5200 Feet on the East Fork Glacier. The panels face downglacier and the bottom edge of the lowest panel is .6 feet above the ice. The marker is located on the south edge of the northern 1/3 of the ice field.

7. Aerial marker "Jatu Pass" had fallen over and was reinstalled at the same location. Panels are facing downglacier and the bottom edge of the lowest panel is .6 feet above the ice.

8. A new marker was installed on the East Fork Glacier at 3500 feet. The panels face downglacier and the bottom edge of the lowest panel is flush with the ice to account for ablation.

   The marker is located in Section 32, T17S, R5E. This marker should also be checked in Septmeber for stability.

R&M
R&M CONSULTANTS, INC. 5024 CORDOVA • BOX 6087 • ANCHORAGE, ALASKA 99502 • PH. 907-279-0483 • TLX. 090-25280
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PLANNERS
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September 25, 1981 R&M No. 052303

Project Manager
Susitna Hydroelectric Project
Acres American Incorporated
Liberty Bank Building
Main @ Court
Buffalo, New York 14202

Attention: Mr. G. Krishnan

Re: Susitna Hydroelectric Project; Subtask 3.03

Dear Krishnan:

Enclosed are the results of the water quality sampling trip which compared R&M's grab samples and depth-integrated samples, and the U.S.G.S. depth-integrated samples. Also enclosed is Larry Peterson's interpretation of the results with the following conclusions:

1. Generally, there were no major differences in the water quality characteristics. The magnitude of variation for those parameters that displayed a difference was much less than an order-of-magnitude.

2. The following parameters displayed values that exceeded the expected differences associated with analyzing the same water sample.

   Iron
   Phosphorus
   Chloride
   Total Suspended Solids (TSS)
   Turbidity
   Color
   Total Organic Carbon (TOC)

   It is likely that TSS and turbidity varied as the result of the two sampling techniques. The values of 10 and 15 color units for color are reported in increments of 5 color units and are thus not considered to be significantly different.

3. The different values for the other parameters may be caused by either the different sampling techniques, by different sampling times (with an actual change in water quality), or by laboratory error.

Larry Peterson could not conclusively designate the cause of the variation. However, a quality control check on the laboratory techniques has been conducted, using identical water samples collected in September. The results of the analyses will be available soon. We will call you to let you know how it turned out.

It appears that the results from the two sampling techniques are comparable with the above exceptions, and some of them may yet be explained.

Very truly yours,

R&M CONSULTANTS, INC.

Stephen Bredthauer

Stephen Bredthauer, P.E.
Susitna Hydrology Coordinator

SB/rdg

Enclosures

#052303
#052080

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

JAY S. HAMMOND, GOVERNOR

Su Hydro Aquatic Studies
2207 Spenard Road
Anchorage, Alaska 99503

JAN 18 1982
R & M

January 7, 1982

Stephen Bredthauer
Senior Staff Hydraulogist
R&M Consultants
P.O. Box 6087/5024 Cordova Street
Anchorage, Alaska 99502

Dear Mr. Bredthauer:

Please reference my letter to Dave Wozniak of December 21, and his response of December 30 (attached) concerning the comparability of USGS and R&M data. I would appreciate it if you would please apprise me of any conclusions reached resulting from actions taken as proposed in the spring of 1981 agreements between R&M and USGS (refer to Acres June 3, 1981 publication: "Summary Information Package on On-going Hydraulic and Hydrology Studies").

We would also appreciate securing four copies of all reports pertaining to the Su Hydro Study as you distribute them.

Thank you.

Sincerely,

Tom Trent
Su Hydro Aquatic Studies
Coordinator

cc: D. Wozniak
D. Schmidt
W. Trihee
Acres: John Lawrence

11-K7LH

ALASKA POWER AUTHORITY

334 WEST 5th AVENUE - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-0001

December 30, 1981

Mr. Tom Trent
Alaska Department of Fish & Game
Su Hydro Studies
2207 Spenard Road
Anchorage, Alaska 99503

Dear Tom:

With reference to your December 21, 1981 letter concerning comparability of R&M and USGS data, accommodation was reached between those two organizations. To help cut down the confusion factor, you are authorized direct contact with both R&M or USGS for information on results obtained.

Sincerely,

FOR THE EXECUTIVE DIRECTOR

David D. Wozniak
Project Engineer

DDW/es

cc: Acres, John Lawrence
Steve Bredthauer, R&M
Bob Lemke, USGS (w/Trent Letter)

RECEIVED

DEC 31 1981

Alaska Dept. of Fish & Game
Sport Fish/Susitna Hydro

December 21, 1981

Dave Wozniak
Su Hydro Project Manager
Alaska Power Authority
333 W. 4th Avenue, Suite 31
Anchorage, Alaska 99501

Dear Mr. Wozniak:

Please reference the May 7th and May 14th, 1981 meetings with respect to the comparability of R&M and USGS data. The minutes of these meetings were published in Acres June 3rd 1981 publication "Summary Information Package on On-going Hydraulic and Hydrology Studies".

As you will note, R&M and USGS agreed to exchange appropriate data and also arranged to accompany each other into the field in order to compare techniques. The objective of these agreements was to determine if the two sources of data would permit comparability of results.

We have not been informed of the conclusions or changes implemented, if suggested, resulting from these activities. I would appreciate it if you would please advise me of the present status of the above subject matter.

Sincerely,

Thomas W. Trent

Thomas W. Trent
Aquatic Studies Coordinator
Su Hydro Aquatic Studies
Department of Fish and Game
Telephone: 274-7583

cc: R&M Consultants
D. Schmidt
W. Trihey

214

SUSITNA HYDROELECTRIC PROJECT

FIELD DATA
COLLECTION AND PROCESSING
VOLUME 3

3

FEBRUARY 1982

Prepared by:
R&M
R&M CONSULTANTS, INC.

Prepared for:
ACRES

ALASKA POWER AUTHORITY

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING
VOLUME 3

FEBRUARY 1982

Prepared for:

ACRES AMERICAN INCORPORATED
1000 Liberty Bank Building
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Buffalo, New York 14202
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Anchorage, Alaska 99502
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ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

TASK 3 - HYDROLOGY

FIELD DATA COLLECTION AND PROCESSING

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VOLUME ONE

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s14/g1

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ATTACHMENT E

FIELD DATA SUMMARIES

ATTACHMENT E.1

STREAMFLOW (CONTINUOUS)

TABLE E.1.1

Daily Gage Height, in feet, and discharge, in cubic feet per second
Susitna River at Watana for the year ending September 30, 1980

Day	April		May		June		July		August		September	
	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge
1									39.25	24,900	36.66	11,700
2									38.76	22,200	36.56	11,300
3									38.41	20,300	36.25	10,000
4									38.16	19,000	36.07	9,200
5									38.14	18,900	35.94	8,600
6									37.96	18,000	35.83	8,100
7									37.96	18,000	35.76	7,900
8									38.46	20,600	35.70	7,700
9									39.10	24,000	35.65	7,500
10									38.68	21,700	35.74	7,800
11							39.22	24,700	38.39	20,200	35.74	7,800
12							39.56	26,800	38.46	20,600	-	-
13							39.96	29,400	38.50	20,800	35.70	7,700
14							39.84	28,600	38.80	22,400	36.12	9,400
15							39.64	27,200	38.46	20,600	37.94	17,900
16							39.64	27,200	38.17	19,000	39.23	24,800
17							40.16	30,700	38.00	18,200	38.56	21,100
18							40.52	33,100	37.74	17,000	37.66	16,600
19							40.13	30,500	38.00	18,200	37.16	14,100
20							40.08	30,200	38.01	18,200	36.83	12,600
21							39.26	25,000	38.14	18,900	36.68	11,800
22							39.12	24,100	38.14	18,900	36.70	11,900
23							38.91	23,000	37.92	17,800	36.74	12,100
24							38.80	22,400	37.66	16,600	36.78	12,300
25							38.91	23,000	37.43	15,300	36.76	12,200
26							39.21	24,700	37.27	14,600	36.58	11,400
27							39.31	25,300	37.17	14,100	36.59	11,500
28							40.75	35,000	37.16	14,100	36.44	10,900
29				Peak of 42.15/47,500			41.58	42,000	37.17	14,100	36.39	10,700
30							40.16	30,700	37.04	13,500	36.33	10,300
31							39.64	27,200	36.89	12,900	36.21	9,800
Mean							-		18,490		11,551	
Maximum							42,000		24,900		24,800	
Minimum							-		12,900		7,500	

Table: E.1.1 (continued)

Daily Gage Height, in feet, and discharge, in cubic feet, per second
Susitna River at Watana for the year ending September 30, 1981.

Day	October Gage height	October Discharge	November Gage height	November Discharge	December Gage height	December Discharge	January Gage height	January Discharge	February Gage height	February Discharge	March Gage height	March Discharge
1	36.23	9,900	34.31	3,100	34.58	3,800						
2	36.19	9,800	34.24	3,000	34.65	4,100						
3	36.23	9,900	34.17	2,800								
4	36.09	9,300	34.10	2,600								
5	36.01	8,900	34.17	2,800								
6	35.95	8,600	34.26	3,000								
7	35.94	8,600	34.39	3,400								
8	36.07	9,200	34.22	2,900								
9	36.18	9,700	34.05	2,500								
10	36.01	8,900	33.64	1,700								1,450
11	35.75	7,800	33.69	1,800								
12	35.52	6,900	34.16	2,800								
13	35.34	6,200	34.40	3,400								
14	35.23	5,800	34.07	2,500				1,100				
15	35.28	5,900	34.05	2,500								
16	35.35	6,200	34.40	3,400								
17	35.22	5,800	34.84	4,600								
18	35.23	5,800	34.86	4,700								
19	35.12	5,500	34.60	3,900								
20	35.07	5,300	34.67	4,100								
21	34.93	4,900		4,000								
22	34.86	4,700		4,000								
23	34.86	4,700		4,000								
24	34.91	4,800		4,000								
25	34.89	4,800		4,000								
26	34.68	4,100		3,500								
27	34.60	3,900		3,500								
28	34.52	3,700		3,500								
29	34.51	3,600		3,500								
30	34.46	3,500	34.47	3,500								
31	34.42	3,400										

Year		October	November	December	January	February	March
	Total						
	Mean	6,458	3,297				
	Maximum	9,900	8,700				
	Minimum	3,400	1,700				
	Cfsm						
	Runoff in inches						
	Acre-feet						

Table: E.1.1 (continued)

Daily Gage Height, in feet, and discharge, in cubic feet, per second
Susitna River at Watana for the year ending September 30, 1981.

Day	April		May		June		July		August		September	
	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge
1		1020			39.55	26,700	37.99	18,200	39.18	24,500	38.60	21,300
2					38.65	21,600	37.50	15,700	40.86	35,800	38.30	19,700
3					37.82	17,300	37.19	14,300	41.60	42,200	37.89	17,700
4					37.42	15,300	36.87	12,700	40.53	33,200	37.57	16,000
5					37.47	15,600	36.77	12,200	39.63	27,200	37.48	15,600
6					37.91	17,700	36.99	13,300	39.20	24,600	37.40	15,200
7					37.48	15,600	37.57	16,000	38.96	23,300	37.41	15,200
8					37.20	14,300	38.30	19,700	39.68	27,500	37.43	15,300
9					37.55	15,900	38.50	20,800	41.21	38,800	-	-
10					37.77	17,100	39.46	26,200	41.42	40,600	-	-
11					37.30	14,800	41.33	39,800	41.32	39,800	-	-
12					37.08	13,700	42.04	46,400	40.98	36,900	-	-
13					36.95	13,100	41.29	39,600	41.48	41.100	-	-
14					37.05	13,500	40.07	30,100	41.61	42,300	-	-
15					37.34	15,000	39.45	26,100	41.70	43,000	-	-
16					37.92	17,800	39.88	28,900	41.51	41,400	36.50	11,100
17					37.90	17,700	40.83	35,600	40.55	33,400	36.49	11,100
18					37.78	17,100	41.43	40,700	39.54	26,700	36.34	10,400
19					37.74	17,000	41.31	39,700	39.24	24,900	36.27	10,100
20					37.62	16,300	41.22	38,900	39.88	28,800	36.46	10,900
21			36.93	13,000	37.56	16,000	40.88	36,000	41.18	38,500	36.65	11,700
22			36.56	11,300	37.62	16,300	40.41	32,500	40.92	36,400	36.45	10,900
23			36.23	9,900	37.58	16,100	40.03	29,900	40.53	33,200	36.20	9,800
24			36.17	9,600	37.62	16,300	40.15	30,700	39.92	29,100	36.11	9,300
25			36.42	10,800	37.71	16,800	40.30	31,700	39.29	25,200	36.05	9,100
26			36.81	12,400	37.73	16,900	40.63	34,000	38.88	22,800	35.88	8,300
27			37.05	13,600	37.81	17,300	40.56	33,400	38.80	22,400	35.65	7,500
28			37.44	15,400	38.35	19,900	39.80	28,300	38.91	23,000	35.58	7,200
29			38.21	19,200	38.64	21,500	39.35	25,500	38.91	23,000	35.47	6,700
30			38.21	19,200	38.19	19,200	39.18	24,500	38.91	23,000	35.42	6,500
31			38.85	22,700			39.00	23,500	38.72	21,900		
				---		17,017		27,890		31,435		12,026
				22,700		26,700		46,400		42,200		21,300
				---		13,100		12,200		21,900		6,500

Table: E.1.1 (continued)

Daily Gage Height, in feet, and discharge, in cubic feet per second Susitna River at Watana for the year ending September 30, 1982.

Day	October Gage height	October Discharge	November Gage height	November Discharge	December Gage height	December Discharge	January Gage height	January Discharge	February Gage height	February Discharge	March Gage height	March Discharge
1	35.35	6,200	34.10	2,600								
2	35.21	5,700	34.09	2,600								
3	35.12	5,500	34.02	2,400								
4	35.20	5,700	34.10	2,600								
5	35.20	5,700	34.17	2,800								
6	35.14	5,500	34.12	2,600								
7	35.10	5,400	34.11	2,600								
8	35.10	5,400	34.07	2,550								
9	35.07	5,300	34.09	2,600								
10	35.05	5,200	34.20	2,900								
11	35.01	5,100	34.34	3,250								
12	35.02	5,100	34.35	3,250								
13	35.13	5,500	34.10	2,600								
14	35.37	6,300	34.00	2,400								
15	35.53	7,000	33.95	2,300								
16	35.41	6,400	33.90	2,200								
17	35.28	5,900	33.95	2,300								
18	35.17	5,600	34.12	2,650								
19	34.84	4,650	34.25	3,000								
20	34.74	4,350	34.37	3,300								
21	34.93	4,900	*									
22	35.12	5,450										
23	35.43	6,500										
24	35.64	7,450										
25	35.51	6,800										
26	35.32	6,050										
27	35.10	5,400										
28	34.80	4,500										
29	34.43	3,500										
30	34.22	2,950										
31	34.10	2,600										

Year		October	November	December	January	February	March
	Total	167,600					
	Mean	5,407					
	Maximum	7,450					
	Minimum	2,600					
	Cfsm	3.24					
	Runoff in inches						
	Acre-feet						

* Freeze-up

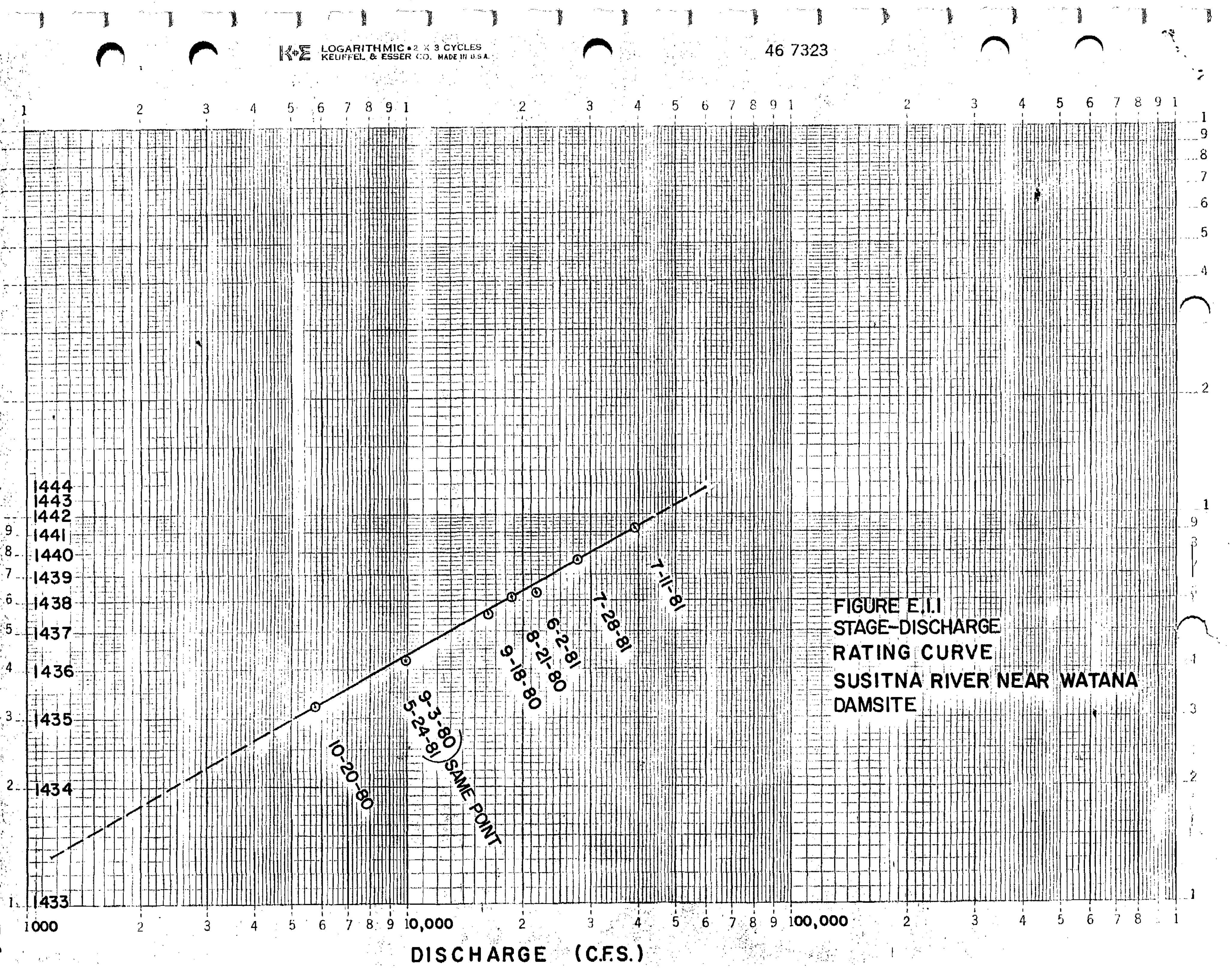
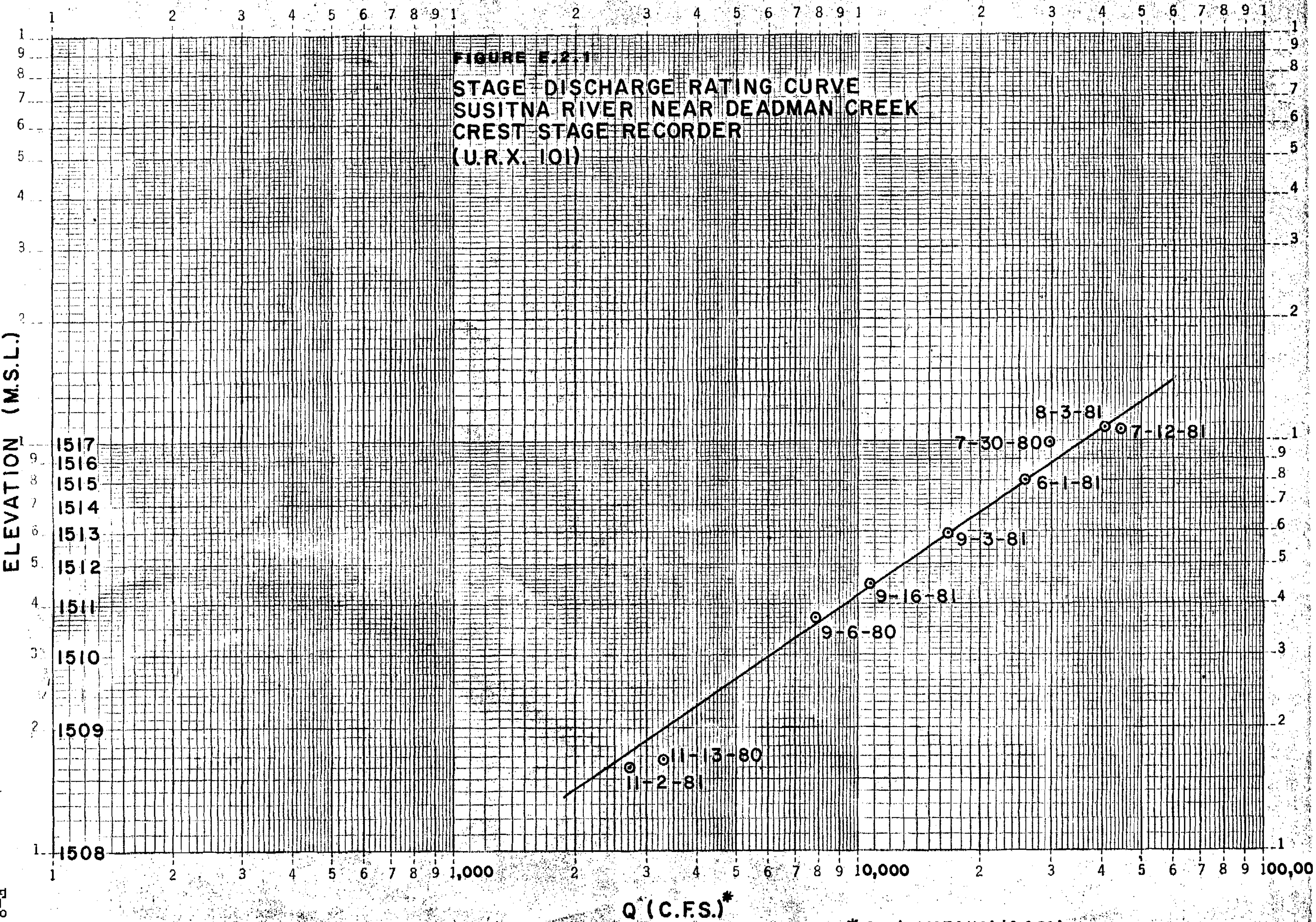


FIGURE E.1.1
STAGE-DISCHARGE
RATING CURVE
SUSITNA RIVER NEAR WATANA
DAMSITE

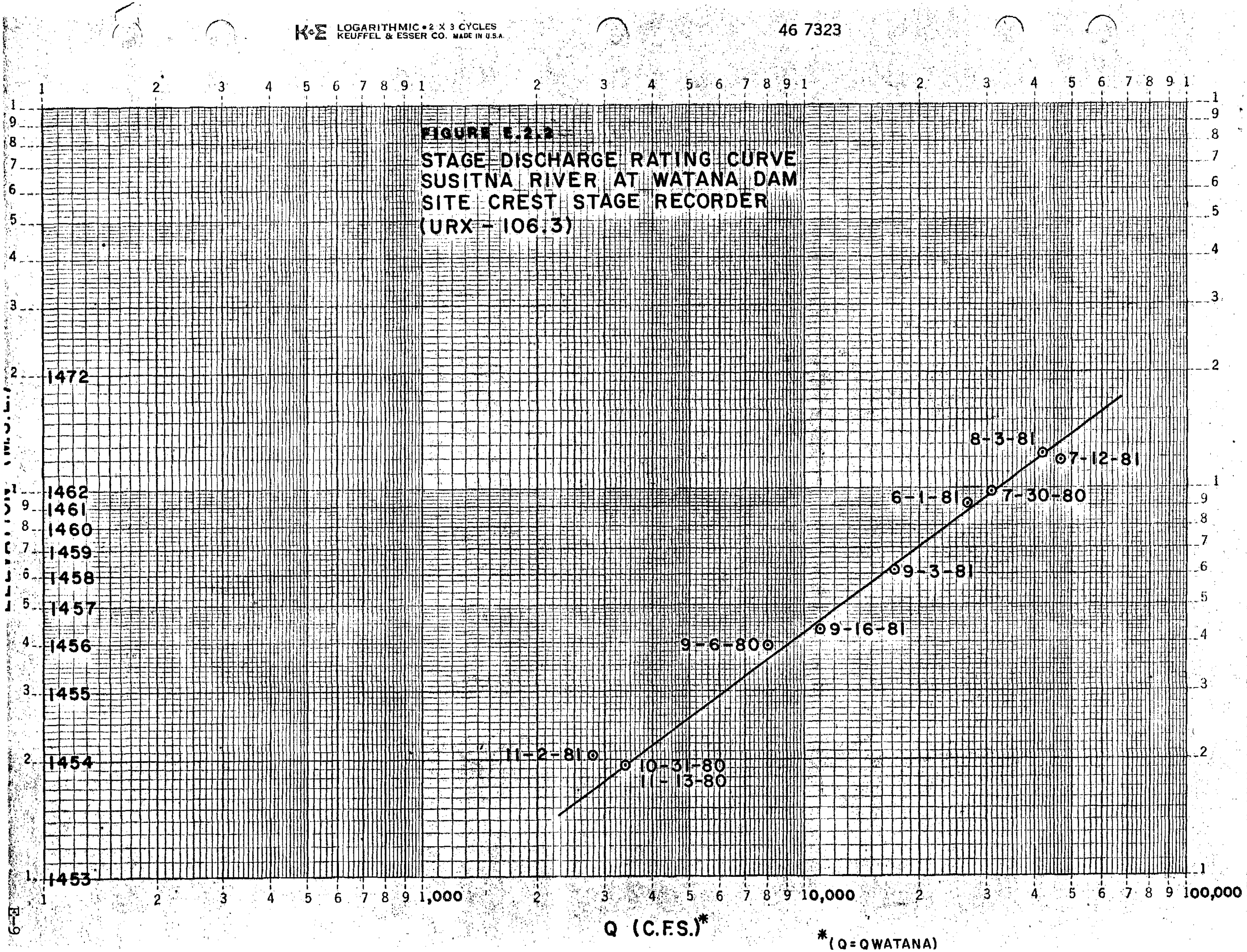
ATTACHMENT E.2

STREAMFLOW (PARTIAL)

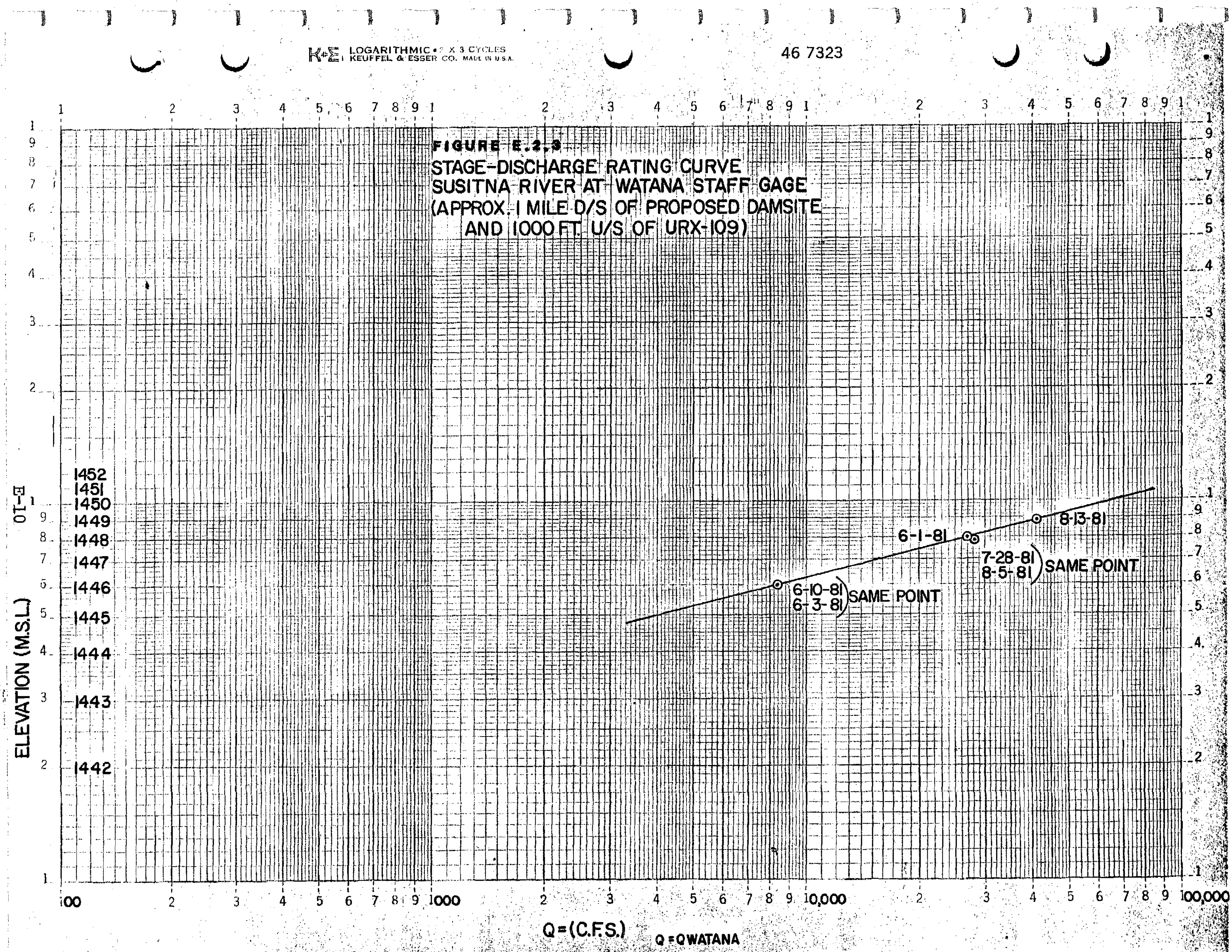
K+E LOGARITHMIC 2 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7323



* Q = (QWATANA) (0.969)

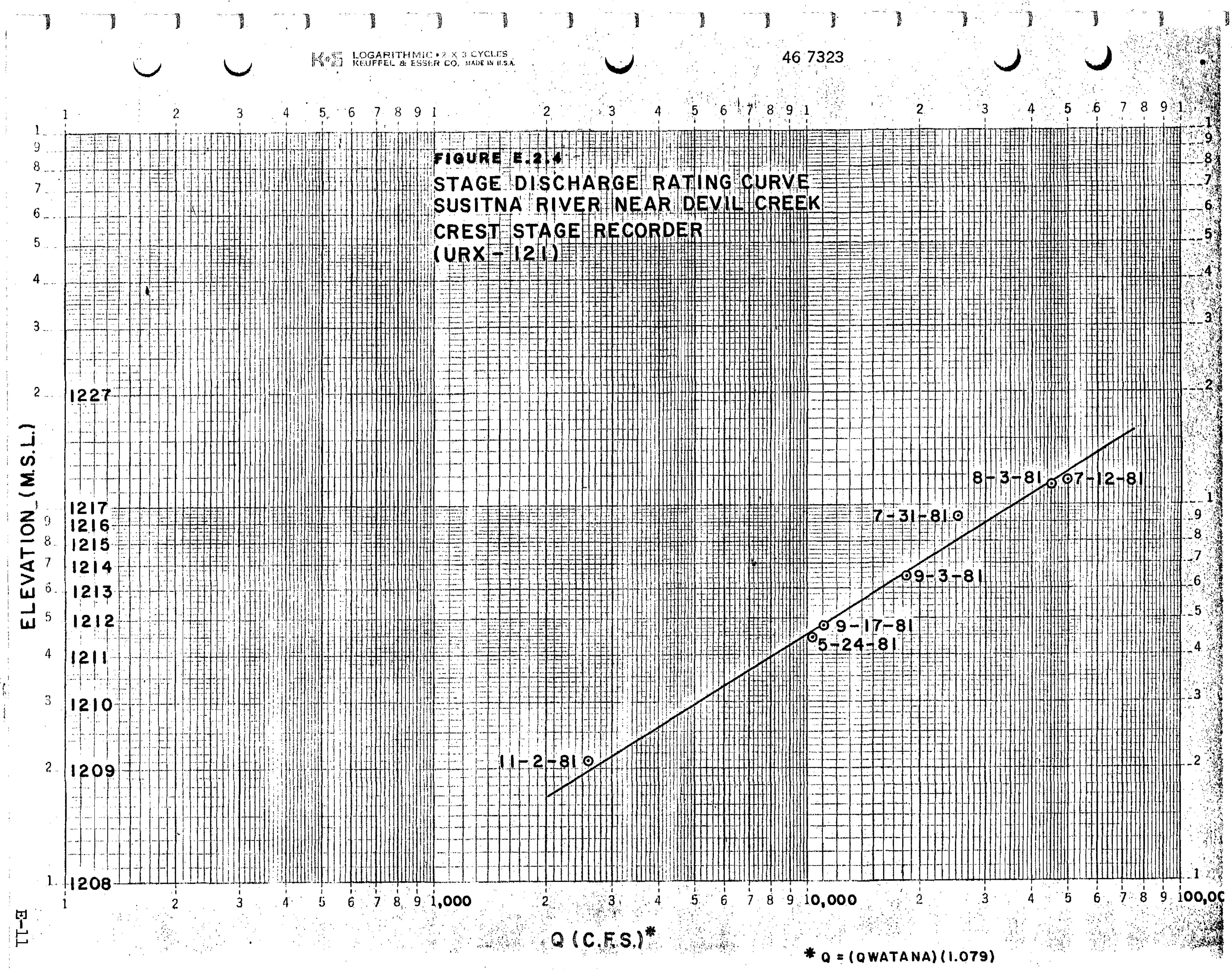


K+E LOGARITHMIC • 2 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323
FIGURE E.2.2
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT WATANA DAM
SITE CREST STAGE RECORDER
(URX - 106.3)
1472
1462
1461
1460
1459
1458
1457
1456
1455
1454
1453
8-3-81
7-12-81
6-1-81
7-30-80
9-3-81
9-16-81
9-6-80
11-2-81
10-31-80
11-13-80
1,000
10,000
100,000
Q (C.F.S.)*
*(Q = Q WATANA)



K+E LOGARITHMIC 3 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323
FIGURE E.2.3
STAGE-DISCHARGE RATING CURVE
SUSITNA RIVER AT WATANA STAFF GAGE
(APPROX. 1 MILE D/S OF PROPOSED DAMSITE
AND 1000 FT. U/S OF URX-109)
6-1-81
8-13-81
7-28-81
8-5-81
SAME POINT
6-10-81
6-3-81
SAME POINT
ELEVATION (M.S.L.)
1452
1451
1450
1449
1448
1447
1446
1445
1444
1443
1442
100
1000
10,000
100,000
Q=(C.F.S.)
Q = QWATANA

E-10



K&E LOGARITHMIC • 2 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323
FIGURE E.2.4
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER NEAR DEVIL CREEK
CREST STAGE RECORDER
(URX - 121)
ELEVATION (M.S.L.)
1227
1217
1216
1215
1214
1213
1212
1211
1210
1209
1208
8-3-81
7-12-81
7-31-81
9-3-81
9-17-81
5-24-81
11-2-81
1,000
10,000
100,00
Q (C.F.S.)*
* Q = (QWATANA)(1.079)

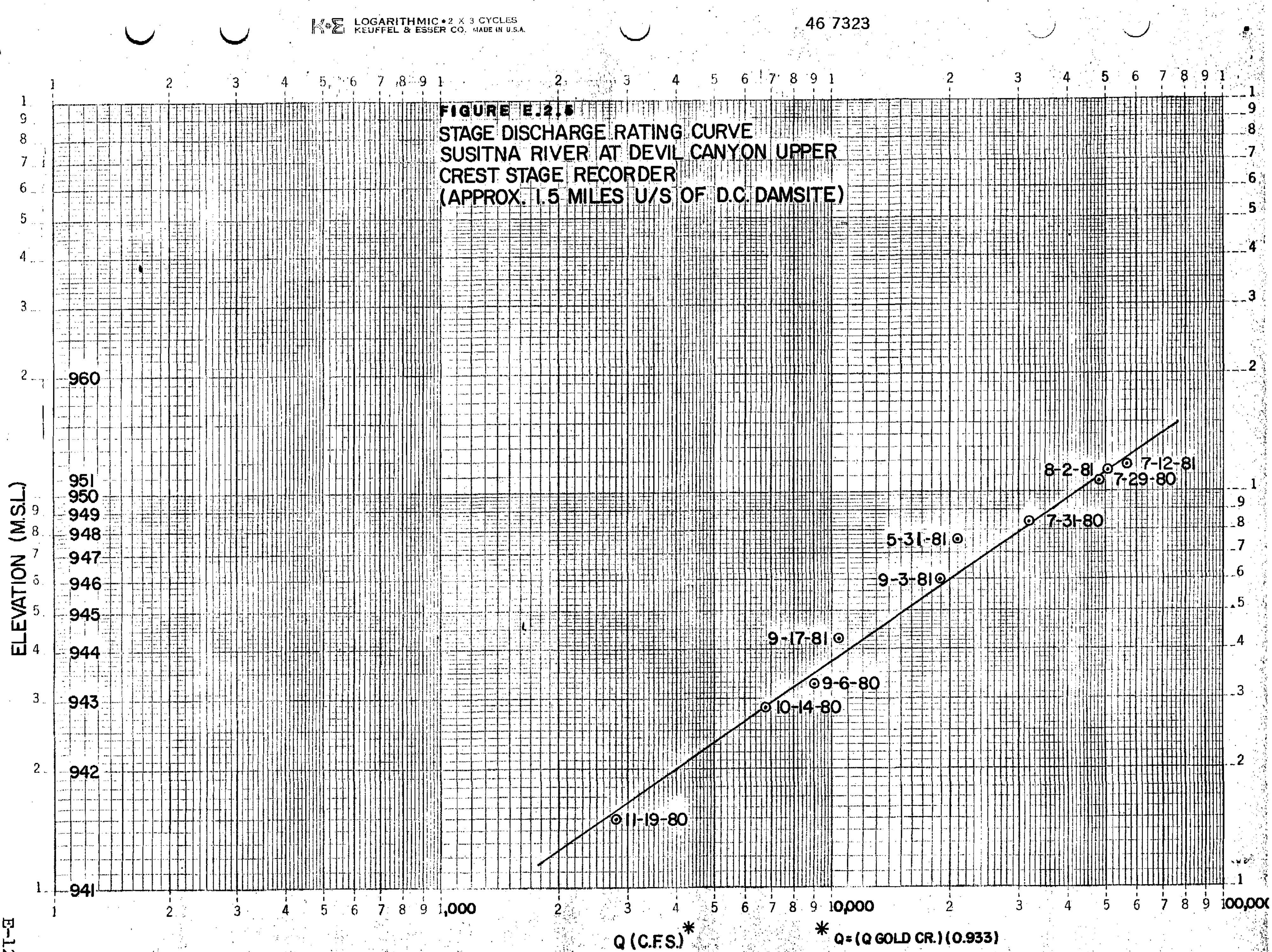


FIGURE E.2.5
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT DEVIL CANYON UPPER
CREST STAGE RECORDER
(APPROX. 1.5 MILES U/S OF D.C. DAMSITE)

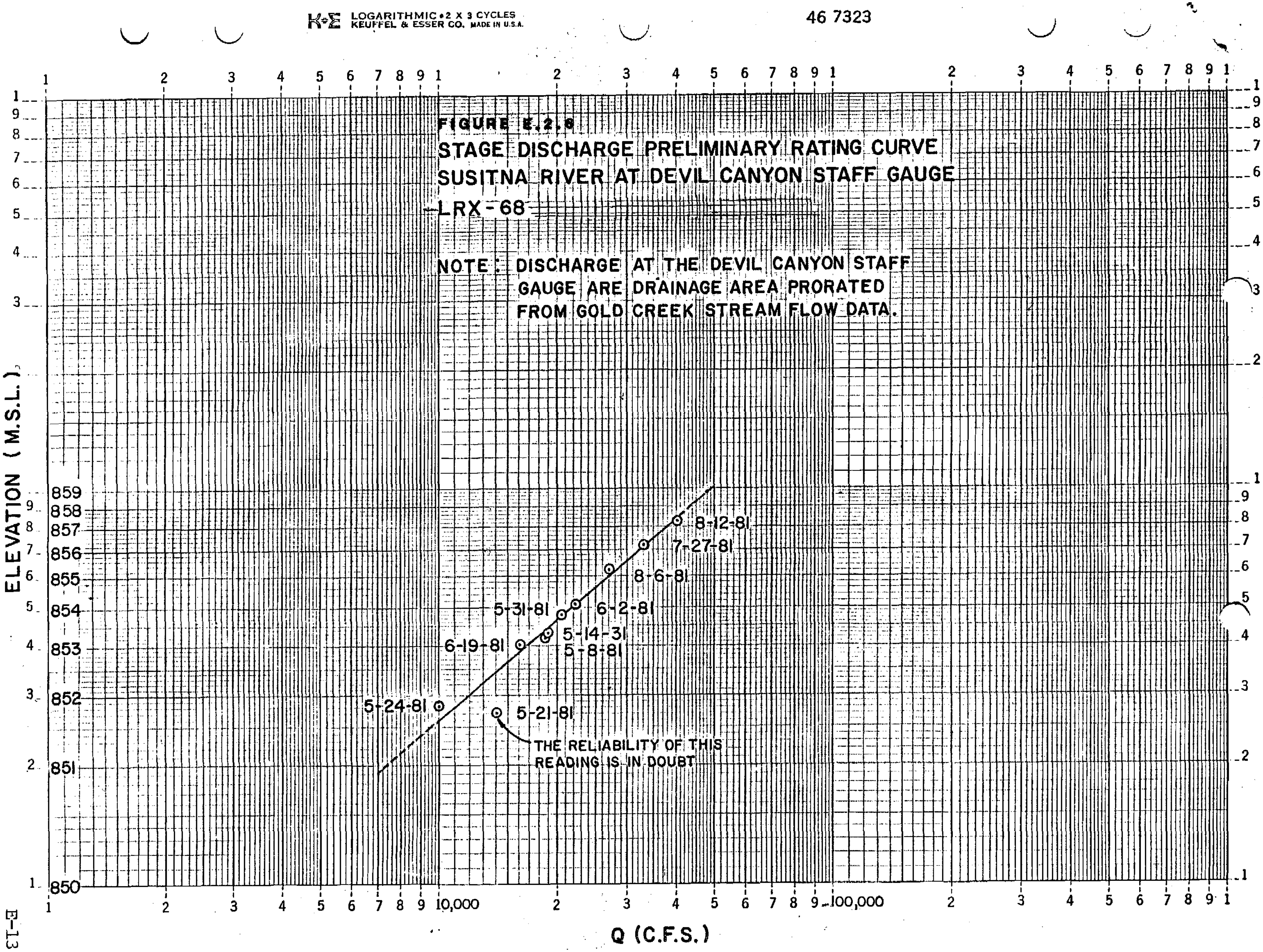
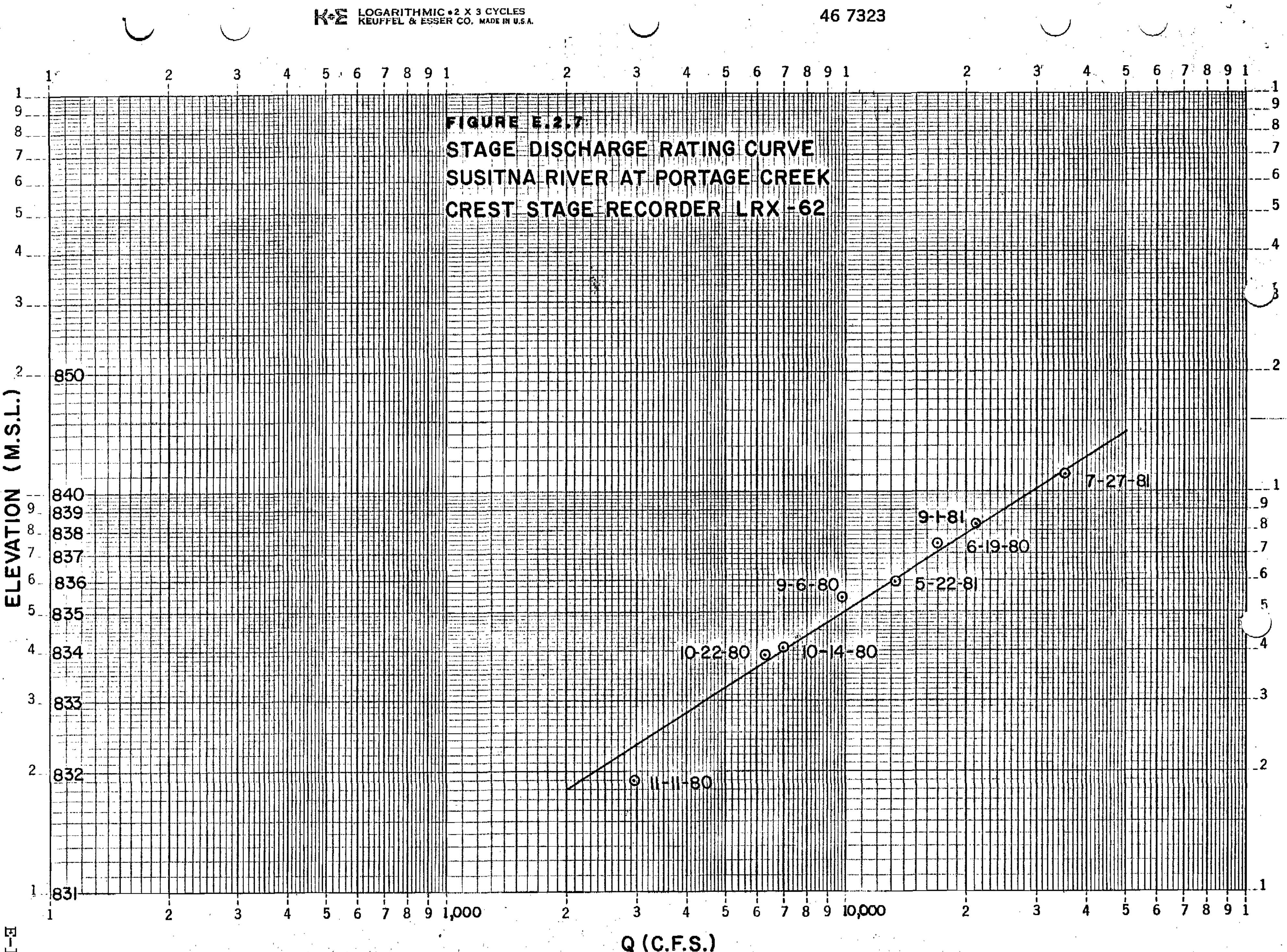


FIGURE E.2.6
STAGE DISCHARGE PRELIMINARY RATING CURVE
SUSITNA RIVER AT DEVIL CANYON STAFF GAUGE
LRX-68


K+E LOGARITHMIC 2 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323
FIGURE E.2.7
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT PORTAGE CREEK
CREST STAGE RECORDER LRX-62
ELEVATION (M.S.L.)
850
840
839
838
837
836
835
834
833
832
831
1,000
10,000
Q (C.F.S.)
7-27-81
9-1-81
6-19-80
5-22-81
9-6-80
10-22-80
10-14-80
11-11-80

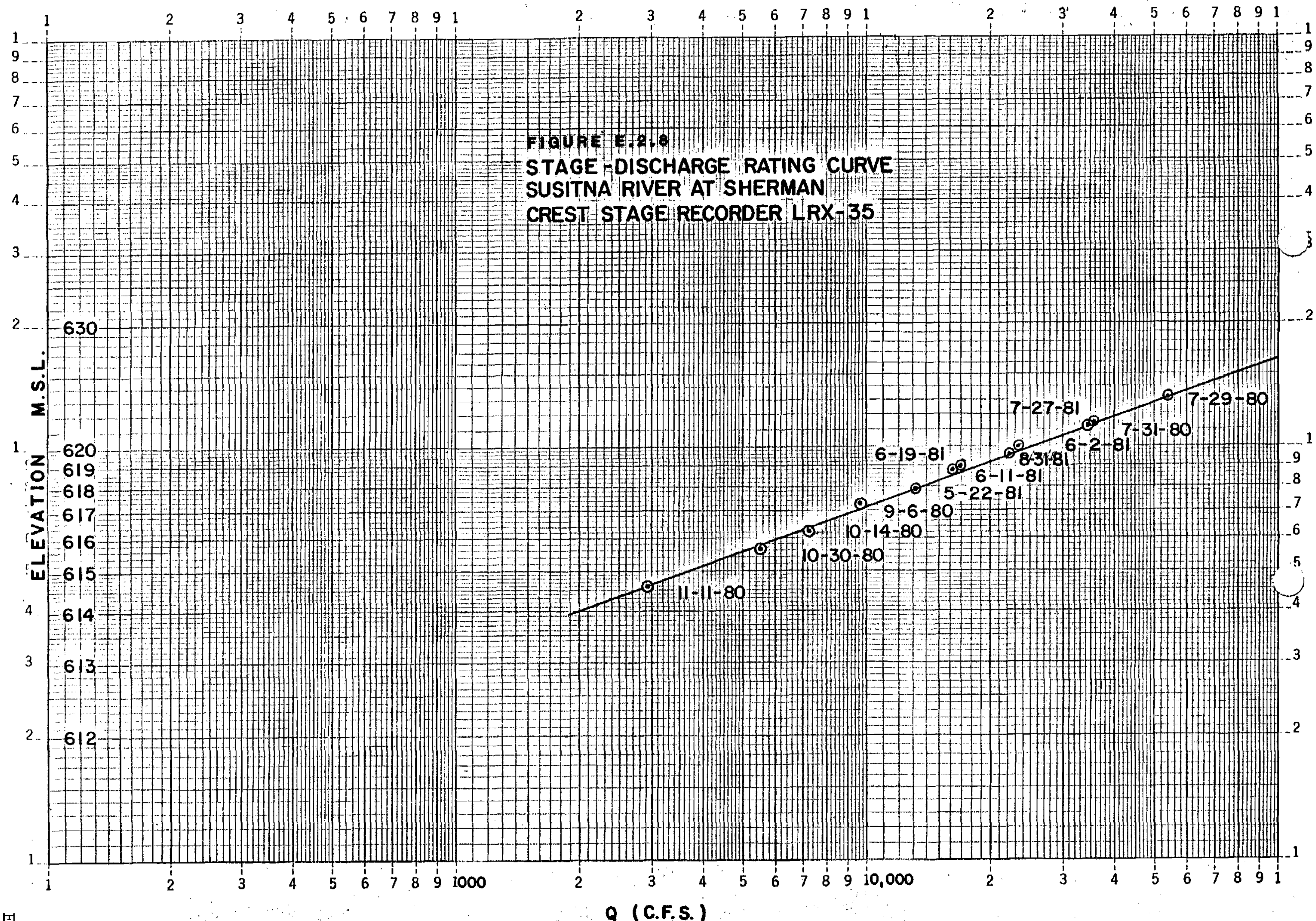


FIGURE E.2.8
STAGE-DISCHARGE RATING CURVE
SUSITNA RIVER AT SHERMAN
CREST STAGE RECORDER LRX-35
ELEVATION M.S.L.
630
620
619
618
617
616
615
614
613
612
7-29-80
7-27-81
7-31-80
6-2-81
8-31-81
6-19-81
6-11-81
5-22-81
9-6-80
10-14-80
10-30-80
11-11-80
1000
10,000
Q (C.F.S.)

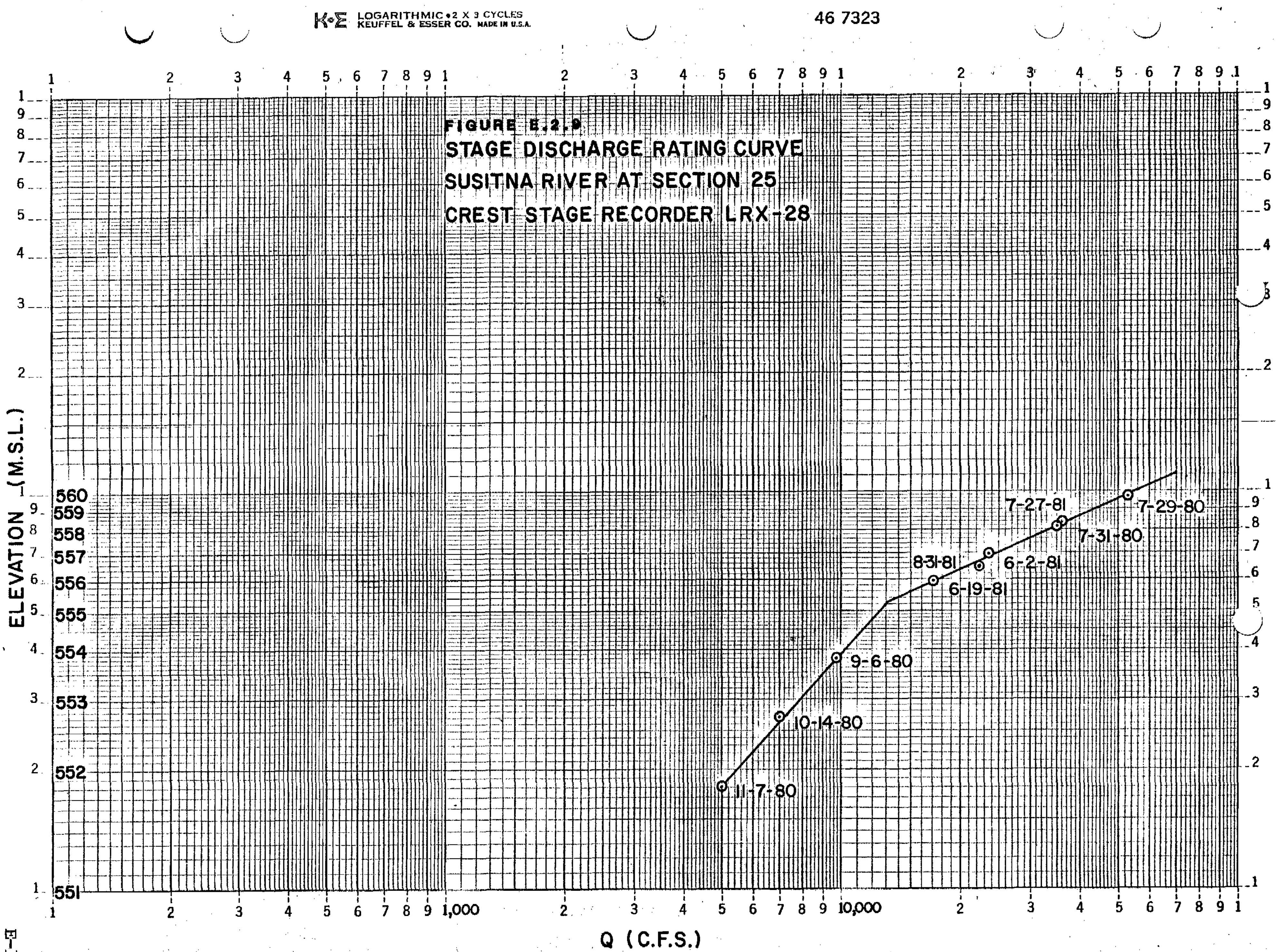


FIGURE E.2.9
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT SECTION 25
CREST STAGE RECORDER LRX-28

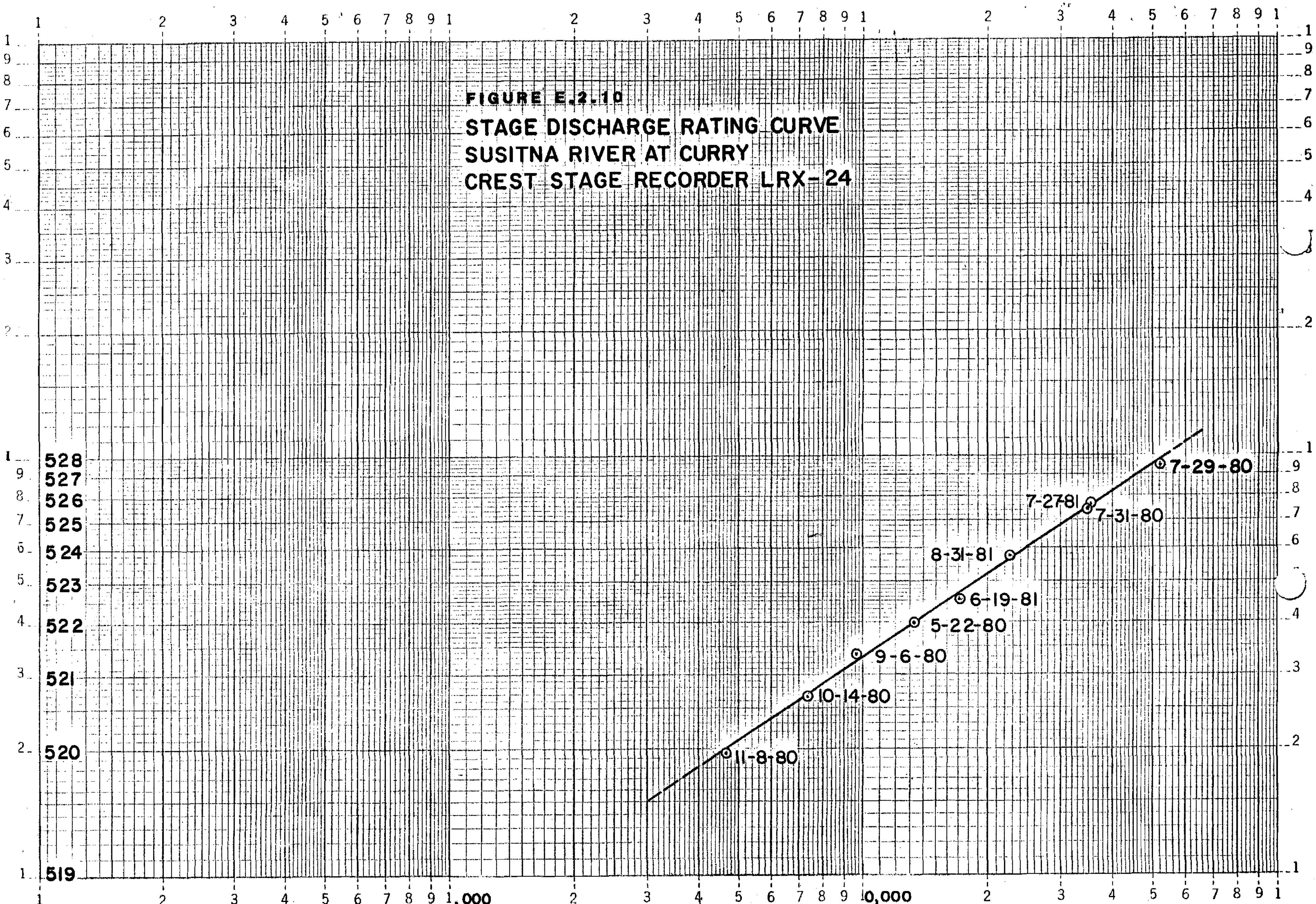


FIGURE E.2.10
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT CURRY
CREST STAGE RECORDER LRX-24
528
527
526
525
524
523
522
521
520
519
7-29-80
7-27-81
7-31-80
8-31-81
6-19-81
5-22-80
9-6-80
10-14-80
11-8-80
1,000
10,000
Q (C.F.S.)

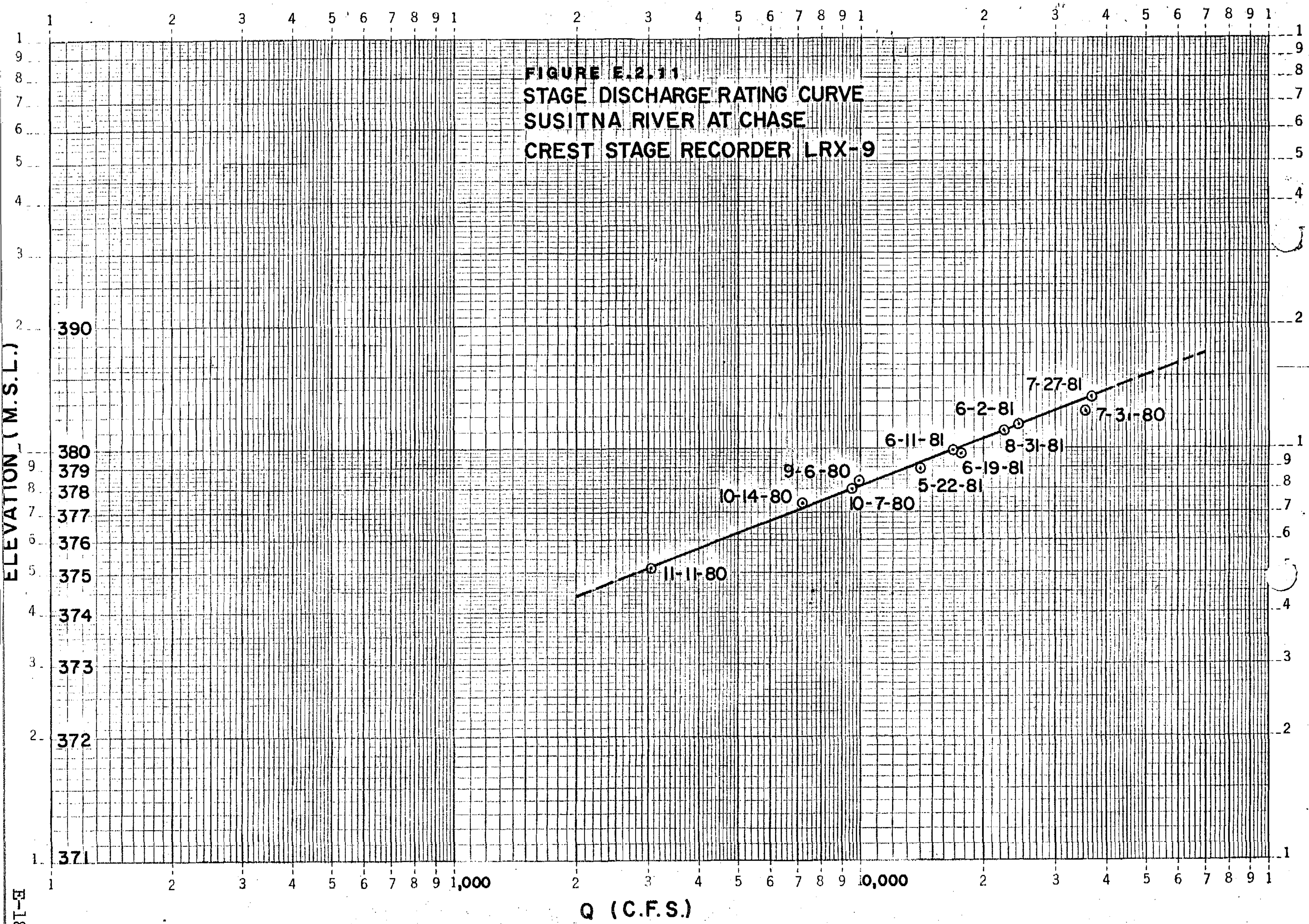


FIGURE E.2.11
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT CHASE
CREST STAGE RECORDER LRX-9
ELEVATION (M.S.L.)
390
380
379
378
377
376
375
374
373
372
371
1,000
10,000
Q (C.F.S.)
7-27-81
6-2-81
7-31-80
6-11-81
8-31-81
6-19-81
9-6-80
5-22-81
10-14-80
10-7-80
11-11-80

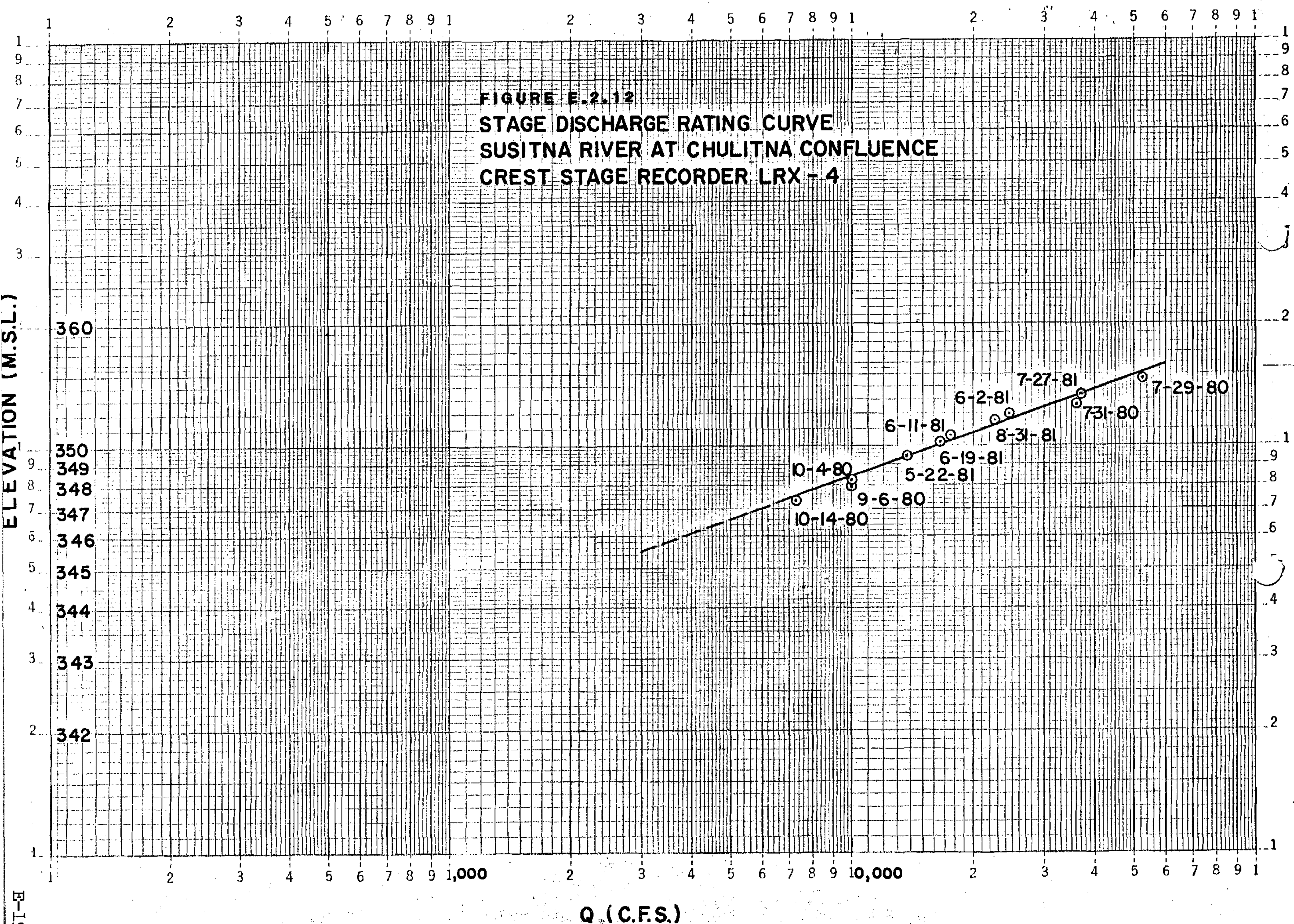


FIGURE E.2.12
STAGE DISCHARGE RATING CURVE
SUSITNA RIVER AT CHULITNA CONFLUENCE
CREST STAGE RECORDER LRX - 4
ELEVATION (M.S.L.)
360
350
349
348
347
346
345
344
343
342
7-27-81
7-29-80
6-2-81
7-31-80
6-11-81
8-31-81
6-19-81
10-4-80
5-22-81
9-6-80
10-14-80
1,000
10,000
Q (C.F.S.)

ATTACHMENT E.3, PART 1

WATER QUALITY DATA SUMMARIES

TABLE E.3.1

WATER QUALITY DATA SUMMARY
SUSITNA RIVER

Agency: R&M CONSULTANTS, INC.
Station: VEE CANYON 1980 - 1981
Elevation: 1900 FT.

NOTE: Not Detectable is abbreviated ND

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Obser-vations
Field Parameters (1)				
Dissolved Oxygen	12.6/13.8/10.4	8.7/10.7/10.4	11.5/12.6/10.4	8/3/1
Percent Saturation	110/104/83	82/84/83	99/97/83	8/3/1
pH, pH Units	7.9/7.6/6.6	7.0/7.2/6.6	7.6/7.4/6.6	10/3/1
Conductivity, umhos/cm @ 25°C	171/242/100	103/130/100	129/171/100	9/3/1
Temperature, °C	11.9/0.1/6.5	5.3/-0.1/6.5	7.7/0.0/6.5	10/3/1
Free Carbon Dioxide (2)	4.5/20.0/-	1.7/5.5/-	3.0/10.3/-	7/3/0
Alkalinity, as $CaCO_3$	81/187/-	41/57/-	61/111/-	7/3/0
Settleable Solids, ml/l	1.0/ND/ND	ND/ND/ND	0.27/ND/ND	10/3/1
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	0.27/0.26/0.13	ND/ND/0.13	0.11/0.12/0.13	9/3/1
Organic Nitrogen	0.63/0.85/0.34	ND/0.08/0.34	0.44/0.40/0.34	9/3/1
Kjeldahl Nitrogen	0.79/0.85/0.47	0.26/0.17/0.47	0.60/0.52/0.47	9/3/1
Nitrate Nitrogen	0.19/ND/ND	ND/ND/ND	0.07/ND/ND	10/3/1
Nitrite Nitrogen	ND	ND	ND	9/3/1
Total Nitrogen	0.92/0.85/0.47	0.39/0.17/0.47	0.61/0.52/0.47	9/3/1
Ortho-Phosphate	0.49/0.02/ND	ND/ND/ND	0.06/0.01/ND	10/3/1
Total Phosphorus	0.49/0.07/ND	ND/ND/ND	0.08/0.02/ND	10/3/1
Alkalinity, as $CaCO_3$	60/66/-	40/66/-	48/66/-	4/1/0
Chemical Oxygen Demand	39/12/8	8/6/8	20/9/8	8/3/1
Chloride	11/18/4.5	ND/16/4.5	4.7/17/4.5	10/3/1

TABLE E.3.1CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Obser-vations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	175/30/15	5/10/15	72/70/15	9/3/1
Hardness, as $CaCO_3$ (4)	76/121/37	51/78/37	58/96/37	10/3/1
Sulfate	9/16/4	2/11/4	6/13/4	10/3/1
Total Dissolved Solids	170/149/100	38/115/100	98/136/100	10/3/1
Total Suspended Solids	1150/14/93	25/0.6/93	398/7.6/93	10/3/1
Turbidity, NTU	120/2.5/25	8.7/0.35/25	68/1.6/25	10/3/1
Uranium	ND	ND	ND	5/2/0
Radioactivity, Gross Alpha, pCi/l	-	-	11.6±0.6/10.3±0.6	1/1/0
Total Organic Carbon	23/23/40	11/23/40	16/23/40	5/1/1
Total Inorganic Carbon	60/106/46	46/21/46	54/64/46	6/2/1
Organic Chemicals				
Endrin	ND	ND	ND	3/1/0
Lindane	ND	ND	ND	3/1/0
Methoxychlor	ND	ND	ND	3/1/0
Toxaphene	ND	ND	ND	3/1/0
2, 4-D	ND	ND	ND	3/1/0
2, 4, 5-TP Silvex	ND	ND	ND	3/1/0
ICAP Scan				
Ag, Silver	ND	ND	ND	10/3/1
Al, Aluminum	2.2/0.18/ND	ND/ND/ND	0.41/0.06/ND	10/3/1
As, Arsenic	ND	ND	ND	10/3/1
Au, Gold	ND	ND	ND	10/3/1
B, Boron	ND	ND	ND	10/3/1
Ba, Barium	0.12/ND/ND	ND/ND/ND	0.07/ND/ND	10/3/1
Bi, Bismuth	0.19/ND/ND	ND/ND/ND	0.02/ND/ND	10/3/1
Ca, Calcium	23/36/13	13/25/13	18/30/13	10/3/1
Cd, Cadmium	ND	ND	ND	10/3/1
Co, Cobalt	ND	ND	ND	10/3/1
Cr, Chromium	ND	ND	ND	10/3/1
Cu, Copper	ND	ND	ND	10/3/1

TABLE E.3.1 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	4.0/0.37/0.08	ND/ND/0.08	0.97/0.12/.08	10/3/1
Hg, Mercury	ND	ND	ND	10/3/1
K, Potassium	5.0/9.0/1.6	ND/ND/1.6	2.1/3.7/1.6	10/3/1
Mg, Magnesium	3.4/7.6/1.7	ND/ND/1.7	1.5/3.8/1.7	10/3/1
Mn, Manganese	ND	ND	ND	10/3/1
Mo, Molybdenum	ND	ND	ND	10/3/1
Na, Sodium	5.1/7.2/2.0	2.4/6.3/2.0	3.4/6.7/2.0	10/3/1
Ni, Nickel	ND	ND	ND	10/3/1
Pb, Lead	ND	ND	ND	10/3/1
Pt, Platinum	ND	ND	ND	10/3/1
Sb, Antimony	ND	ND	ND	10/3/1
Se, Selenium	ND	ND	ND	10/3/1
Si, Silicon	6.9/5.0/1.7	2.0/3.7/1.7	3.5/4.3/1.7	10/3/1
Sn, Tin	ND	ND	ND	10/3/1
Sr, Strontium	0.08/0.13/ND	ND/0.06/ND	0.05/0.10/ND	10/3/1
Ti, Titanium	0.24/ND/ND	ND/ND/ND	0.05/ND/ND	10/3/1
W, Tungsten	ND/0.4/ND	ND/ND/ND	ND/0.13/ND	9/3/1
V, Vanadium	ND	ND	ND	10/3/1
Zn, Zinc	0.07/ND/ND	ND/ND/ND	0.01/ND/ND	10/3/1
Zr, Zirconium	ND	ND	ND	10/3/1

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

susi6/t1

TABLE E.3.2

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: R&M CONSULTANTS, INC.

Station: GOLD CREEK 1980 - 1981

Elevation: 676.5 FT.

NOTE: Not Detectable is abbreviated ND

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	13.4/14.1/11.5	8.6/13.3/11.2	12.3/13.8/11.4	6/3/2
Percent Saturation	116/101/102	81/100/101	108/101/102	6/3/2
pH, pH Units	7.8/7.8/6.7	7.0/7.1/6.4	7.4/7.4/6.5	7/3/2
Conductivity, umhos/cm @ 25°C	169/249/106	75/162/105	116/193/106	7/3/2
Temperature, °C	12.8/0.8/10.5	6.8/0.0/10.3	9.4/0.4/10.4	7/3/2
Free Carbon Dioxide (2)	36/23/-	2.1/3.2/0	17/13/-	5/3/-
Alkalinity, as $CaCO_3$	64/144/-	25/46/-	44/88/-	5/3/-
Settleable Solids, ml/l	0.6/ND/ND	ND/ND/ND	0.1/ND/ND	7/3/2
Laboratory Parameters (1)(3)				
Ammonia Nitrogen	0.09/0.52/0.08	ND/ND/ND	.04/0.28/.04	6/3/2
Organic Nitrogen	0.74/0.81/0.34	0.39/0.34/0.27	0.55/0.54/0.31	6/3/2
Kjeldahl Nitrogen	0.74/0.99/ND	0.47/0.66/ND	0.59/0.82/0.34	6/3/2
Nitrate Nitrogen	0.32/0.18/ND	ND/ND/ND	0.15/.06/ND	7/3/2
Nitrite Nitrogen	ND/ND/ND	ND/ND/ND	ND/ND/ND	6/3/2
Total Nitrogen	0.95/0.99/0.35	0.48/0.66/0.34	0.74/0.88/0.35	6/3/2
Ortho-Phosphate	0.10/0.02/ND	ND/ND/ND	0.01/0.01/ND	7/3/2
Total Phosphorus	0.34/ND/0.08	ND/ND/ND	0.08/ND/0.04	7/3/2
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	24/16/11.9	12/2/7.9	18/9/10	7/3/2
Chloride	14/29/10	ND/14/6	5/20/8	7/3/2

TABLE E.3.2 CONTINUED

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Obser-vations
Laboratory Parameters (1)(3) (continued)				
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	110/40/15	5/10/10	50/20/13	7/3/2
Hardness, as $CaCO_3$ (4)	62/121/43	31/68/43	48/88/43	7/3/2
Sulfate	12/16/6	1.5/9.5/5	5.4/11.8/6	7/3/2
Total Dissolved Solids	99/188/90	63/100/87	82/135/89	7/3/2
Total Suspended Solids	1255/7.7/56	57/ND/49	329/5/53	7/3/2
Turbidity, NTU	86/1.2/19	14/0.3/15	43/0.8/17	7/3/2
Uranium	ND	ND	ND	4/2/0
Radioactivity, Gross Alpha, pCi/l	-/2.6/-	-/2.0/-	-/2.3/-	0/2/0
Total Organic Carbon	41/39/25	10/27/15	20/33/20	5/2/2
Total Inorganic Carbon	61/90/44	34/90/41	45/90/43	6/1/2
Organic Chemicals				
Endrin	ND	ND	ND	3/1/0
Lindane	ND	ND	ND	3/1/0
Methoxychlor	ND	ND	ND	3/1/0
Toxaphene	ND	ND	ND	3/1/0
2, 4-D	ND	ND	ND	3/1/0
2, 4, 5-TP Silvex	ND	ND	ND	3/1/0
ICAP Scan				
Ag, Silver	ND	ND	ND	7/3/2
Al, Aluminum	0.70/0.18/ND	ND/ND/ND	0.13/0.06/ND	6/3/2
As, Arsenic	ND	ND	ND	7/3/2
Au, Gold	ND	ND	ND	7/3/2
B, Boron	ND	ND	ND	7/3/2
Ba, Barium	0.11/0.05/0.07	0.06/ND/0.05	0.09/0.02/0.06	7/3/2
Bi, Bismuth	0.19/0.07/ND	ND/ND/ND	0.03/0.02/ND	7/3/2
Ca, Calcium	20/32/14	10/22/14	14/26/14	7/3/2
Cd, Cadmium	ND	ND	ND	7/3/2
Co, Cobalt	ND	ND	ND	7/3/2
Cr, Chromium	ND	ND	ND	7/3/2
Cu, Copper	ND	ND	ND	7/3/2

TABLE E.3.2 CONTINUED

Laboratory Parameters (1)(3) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	2.3/0.35/0.07	ND/ND/0.05	0.67/0.12/.06	7/3/2
Hg, Mercury	ND	ND	ND	7/3/2
K, Potassium	2.0/2.4/1.9	1.3/2.0/1.8	1.7/2.2/1.9	7/2/2
Mg, Magnesium	2.9/10.0/2.0	1.4/3.2/2.0	2.3/5.6/2.0	7/3/2
Mn, Manganese	ND	ND	ND	7/3/2
Mo, Molybdenum	ND	ND	ND	7/3/2
Na, Sodium	6.2/13.0/4.1	2.8/7.4/3.9	3.9/9.6/4.00	7/3/2
Ni, Nickel	ND	ND	ND	7/3/2
Pb, Lead	ND	ND	ND	7/3/2
Pt, Platinum	ND	ND	ND	7/3/2
Sb, Antimony	ND	ND	ND	7/3/2
Se, Selenium	ND	ND	ND	7/3/2
Si, Silicon	5.9/5.0/2.5	2.6/3.9/2.4	3.5/4.4/2.5	7/3/2
Sn, Tin	ND	ND	ND	7/3/2
Sr, Strontium	0.09/0.19/0.07	ND/0.10/.06	0.05/0.13/0.07	7/3/2
Ti, Titanium	0.14/ND/ND	ND/ND/ND	0.04/ND/ND	7/3/2
W, Tungsten	ND	ND	ND	7/3/2
V, Vanadium	ND	ND	ND	7/3/2
Zn, Zinc	ND	ND	ND	7/3/2
Zr, Zirconium	ND	ND	ND	7/3/2

(1) Table values are mg/l unless noted otherwise.

(2) All values for free CO_2 determined from nomograph on p. 297 of Standard Method, 14th edition.

(3) Samples for all parameters except chemical oxygen demand, dissolved and suspended solids, and turbidity were filtered.

(4) Hardness calculated by R&M personnel.

ATTACHMENT E.3, PART 2

WATER QUALITY MONITOR DATA SUMMARIES

susi11/k18

TABLE E.3.3

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

OCTOBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
23	-00.21	-00.04	-00.16	08.09	0332	12.07	2329	12.38	1529	12.15	0125	0237	0144
24	-00.22	00.05	-00.10	08.15	0338	12.03	0729	12.38	2329	12.16	0130	0247	0149
25	00.06	00.18	00.13	08.49	0369	12.39	0129	12.69	2329	12.57	0165	0313	0184
26	00.16	00.26	00.20	08.58	0376	12.66	1829	12.80	1029	12.72	0177	0336	0196
27	00.19	00.27	00.22	08.60	0378	12.60	2129	12.80	1229	12.68	0179	0340	0198
28	00.18	00.24	00.20	08.57	0375	12.47	1829	12.61	1229	12.54	0179	0340	0199
29	00.18	00.21	00.19	08.56	0373	12.53	0029	12.82	1129	12.66	0180	0342	0200
31	00.06	00.16	00.10	08.29	0357	12.90	2329	13.39	1429	13.20	0100	0190	0030
31	-00.22	00.27	00.09	08.41	0362	12.03	0729	13.39	1429	12.58	0154	0292	0162

TABLE E.3.3 (continued)

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

NOVEMMBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN PH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	00.05	00.20	00.15	08.30	0356	12.47	0729	12.88	0329	12.69	0106	0201	0030
2	00.05	00.23	00.12	08.19	0343	11.74	1629	12.57	0029	12.17	0105	0199	0019
3	-00.02	00.15	00.08	08.18	0341	11.64	1629	12.32	2029	12.06	0110	0209	0018
4	-00.13	-00.04	-00.08	08.13	0334	11.99	0429	12.98	1629	12.45	0103	0195	0012
5	-00.15	-00.10	-00.12	08.08	0328	12.14	1929	12.52	1429	12.30	0096	0182	0008
6	-00.11	-00.02	-00.07	08.13	0334	12.18	2329	12.65	1429	12.35	0090	0171	0012
7	-00.10	-00.05	-00.07	08.14	0334	12.09	0729	12.58	1429	12.30	0088	0167	0013
8	-00.04	00.06	00.01	08.28	0348	12.42	0129	13.17	1429	12.84	0104	0197	0028
9	00.04	00.14	00.08	08.37	0354	13.00	0429	13.47	1529	13.17	0112	0212	0036
10	00.04	00.17	00.10	08.30	0346	10.52	2329	13.14	0029	12.14	0115	0218	0030
11	00.08	00.17	00.12	08.24	0340	09.56	0629	11.97	2329	10.32	0135	0256	0024
12	-00.06	00.14	00.03	08.28	0342	11.83	0329	13.15	1629	12.54	0130	0247	0028
13	-00.12	-00.05	-00.08	08.17	0329	12.97	0929	13.11	2329	13.04	0103	0195	0017
14	-00.05	00.03	-00.01	08.27	0338	13.16	0029	13.41	1429	13.27	0109	0207	0026
15	-00.07	00.00	-00.02	08.25	0338	12.95	2329	13.30	1229	13.19	0106	0201	0023
16	-00.12	-00.06	-00.09	08.17	0329	12.76	0929	12.94	0029	12.81	0097	0184	0016
17	-00.10	-00.05	-00.07	08.18	0330	12.75	0929	12.84	2029	12.79	0099	0188	0018
18	-00.09	-00.03	-00.06	08.21	0331	07.24	1629	12.92	1329	10.70	0101	0191	0020
19	-00.12	-00.06	-00.08	08.17	0328	07.43	0029	08.45	2129	08.10	0097	0184	0017
20	-00.11	-00.06	-00.09	08.17	0327	07.56	2219	08.35	0029	07.97	0096	0182	0017
21	-00.08	-00.04	-00.05	08.21	0330	07.30	1719	07.77	1419	07.55	0099	0188	0021
22	-00.14	-00.05	-00.09	08.17	0325	07.04	0419	08.14	2019	07.63	0096	0182	0016
23	-00.11	-00.07	-00.08	08.18	0325	07.31	1219	07.83	1919	07.53	0096	0182	0017
24	-00.15	-00.08	-00.11	08.13	0321	07.01	2219	07.59	1319	07.35	0091	0172	0012
25	-00.15	-00.11	-00.12	08.12	0319	06.88	1019	07.23	1619	07.06	0090	0171	0011
26	-00.14	-00.10	-00.11	08.13	0320	06.82	1919	07.08	0219	06.93	0090	0171	0012
27	-00.15	-00.10	-00.12	08.12	0319	06.77	2119	06.97	1819	06.88	0088	0167	0012
28	-00.12	-00.06	-00.09	08.17	0322	06.73	1419	07.41	0819	06.91	0091	0172	0016
29	-00.07	00.13	00.04	08.35	0340	07.05	0019	07.39	1819	07.23	0110	0209	0034
30	00.05	00.16	00.11	08.44	0349	07.10	2319	07.32	0119	07.20	0123	0233	0043
30	-00.15	00.23	-00.02	08.20	0334	06.73	1419	13.47	1529	10.38	0102	0193	0020

TABLE E.3.3 (continued)
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

DECEMBER, 1980

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	00.02	00.10	00.05	08.35	0340	06.88	1419	07.09	0419	06.97	0116	0220	0035
2	00.08	00.14	00.10	08.42	0346	06.74	0819	07.10	1319	06.92	0124	0235	0041
3	00.09	00.13	00.10	08.42	0345	06.84	0519	07.15	2319	06.97	0126	0239	0042
4	00.08	00.11	00.09	08.42	0345	07.08	0219	10.77	1719	09.61	0125	0237	0041
5	00.08	00.16	00.11	08.44	0347	09.30	1319	10.69	0219	10.17	0125	0237	0043
6	00.06	00.15	00.11	08.44	0347	10.27	1219	11.14	0019	10.65	0125	0237	0043
7	00.14	00.23	00.16	08.52	0353	09.63	1619	10.28	2219	09.98	0132	0250	0050
8	00.16	00.24	00.21	08.57	0359	09.53	0319	10.38	1419	09.96	0138	0262	0055
9	00.18	00.29	00.23	08.61	0362	10.09	0119	10.96	2319	10.46	0142	0269	0058
10	00.19	00.40	00.28	08.68	0369	09.50	1819	10.83	0019	10.02	0149	0283	0066
11	00.29	00.43	00.36	08.78	0378	08.66	2119	09.51	0019	09.14	0160	0304	0075
12	00.24	00.33	00.28	08.68	0367	08.63	0619	09.05	0219	08.85	0150	0285	0065
13	00.04	00.28	00.14	08.50	0348	08.27	1519	08.87	0419	08.57	0133	0252	0046
14	00.02	00.12	00.06	08.40	0338	08.09	0419	08.37	1019	08.24	0123	0233	0036
15	00.13	00.23	00.17	08.55	0353	08.13	0319	08.50	1219	08.28	0139	0264	0052
16	00.23	00.28	00.25	08.65	0362	08.19	0319	08.54	1319	08.39	0148	0281	0061
17	00.13	00.86	00.38	08.80	0378	08.27	1219	09.06	2319	08.58	0165	0313	0077
18	00.90	01.07	01.00	09.55	0454	08.95	0019	09.39	2319	09.22	0243	0461	0154
19	00.98	01.05	01.01	09.56	0454	08.99	2019	09.43	0819	09.23	0244	0463	0155
20	00.98	01.09	01.01	09.56	0455	09.12	1219	09.53	2219	09.25	0244	0463	0154
21	01.04	01.14	01.10	09.66	0465	09.11	2319	09.58	0019	09.39	0254	0482	0165
22	00.90	01.00	00.93	09.46	0445	08.79	2019	09.32	0119	09.00	0233	0442	0146
23	01.01	01.09	01.05	09.59	0458	08.79	2319	09.16	1519	08.96	0247	0469	0159
24	00.85	00.99	00.93	09.46	0444	08.56	2319	08.94	0619	08.79	0234	0444	0145
25	00.85	01.04	00.93	09.46	0444	08.59	2119	08.87	0419	08.68	0234	0444	0145
26	01.06	01.17	01.11	09.66	0465	08.63	2019	08.89	1219	08.78	0255	0484	0166
27	00.94	01.07	00.99	09.52	0451	08.34	2319	08.69	0019	08.51	0242	0459	0152
28	00.95	01.10	01.04	09.58	0456	08.35	0519	08.63	1819	08.50	0248	0471	0158
29	00.72	01.09	00.93	09.44	0443	07.92	2219	08.49	0019	08.29	0235	0446	0145
30	00.52	00.68	00.60	09.05	0403	07.72	1919	07.97	0019	07.84	0194	0368	0104
31	00.12	00.49	00.23	08.62	0360	07.17	1719	07.73	0019	07.35	0152	0288	0061
31	00.02	01.17	00.51	08.94	0394	06.74	0819	11.14	0019	08.82	0179	0340	0093

TABLE E.3.3 (continued)
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

JANUARY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.23	00.20	-00.01	08.38	0338	06.86	2319	07.38	0019	07.08	0132	0250	0040
2	-00.29	00.18	-00.13	08.30	0332	06.76	0519	07.25	2319	06.94	0127	0241	0034
3	00.21	00.44	00.34	08.80	0379	07.17	2119	07.61	1219	07.38	0173	0328	0082
4	-00.03	00.19	00.04	08.51	0353	06.92	1819	07.30	0019	07.07	0146	0277	0055
5	00.10	00.38	00.26	08.72	0372	07.07	0019	07.42	1219	07.25	0170	0323	0075
6	-00.29	00.27	-00.03	08.43	0346	06.52	2319	07.18	0319	06.83	0140	0266	0049
7	-00.70	-00.28	-00.50	08.00	0310	06.07	1619	06.65	0119	06.30	0104	0197	0012
8	-00.51	-00.16	-00.33	08.15	0323	06.10	0019	06.58	2219	06.34	0115	0218	0025
9	-02.81	-00.12	-01.23	07.41	0261	03.91	1238	06.62	0519	05.44	0058	0110	-0034
10	-01.47	-00.26	-00.73	07.67	0276	05.13	0038	06.33	2138	05.84	0066	0125	-0022
11	-00.27	-00.15	-00.19	08.07	0308	06.24	1138	06.40	1738	06.31	0094	0178	0008
12	-00.16	-00.04	-00.11	08.13	0313	06.23	0338	06.58	1518	06.42	0098	0186	0013
13	-00.12	-00.04	-00.08	08.17	0316	06.37	1218	06.57	0918	06.46	0101	0191	0017
14	-00.16	-00.10	-00.12	08.11	0310	06.31	2318	06.55	0418	06.44	0095	0180	0011
15	-00.19	-00.15	-00.16	08.04	0305	06.26	1518	06.48	0218	06.32	0089	0169	0005
16	-00.16	-00.10	-00.12	08.50	0310	06.23	0318	06.56	2318	06.36	0092	0174	0010
17	-00.14	-00.11	-00.12	08.09	0310	06.38	2318	06.60	1118	06.48	0092	0174	0011
18	-00.14	-00.10	-00.12	08.08	0310	06.29	1518	06.54	1118	06.41	0092	0174	0010
19	-00.13	-00.10	-00.12	08.08	0310	06.27	2018	06.49	0018	06.38	0092	0174	0011
20	-00.08	00.02	-00.04	08.17	0320	06.30	0018	06.76	2118	06.52	0101	0191	0020
21	-00.07	00.04	-00.01	08.20	0324	06.63	1718	06.89	0518	06.75	0105	0199	0025
22	-00.09	-00.03	-00.06	08.13	0316	06.45	1318	06.87	0018	06.72	0098	0186	0018
23	-00.10	-00.05	-00.07	08.10	0314	06.47	2018	06.73	0618	06.60	0096	0182	0015
24	-00.09	-00.03	-00.06	08.12	0316	06.27	1618	06.70	0418	06.49	0099	0188	0017
25	-00.12	-00.07	-00.09	08.07	0312	06.23	0418	06.44	1418	06.33	0096	0182	0014
26	-00.10	-00.06	-00.07	08.11	0316	06.24	0618	06.46	1218	06.34	0101	0191	0018
27	-00.08	00.00	-00.05	08.13	0318	06.26	0118	06.46	1547	06.36	0103	0195	0020
28	00.00	00.12	00.07	08.29	0335	06.43	0047	06.71	1547	06.58	0120	0228	0038
29	-00.07	00.07	00.00	08.18	0325	06.31	2047	06.66	1047	06.54	0110	0209	0028
30	-00.13	-00.05	-00.09	08.05	0312	06.21	1647	06.49	0047	06.36	0098	0186	0015
31	-00.13	-00.09	-00.10	08.04	0311	06.28	0847	06.50	2047	06.40	0096	0182	0014
31	-02.81	00.44	-00.12	08.16	0319	03.91	1238	07.61	1219	06.51	0106	0201	0021

TABLE E.3.3 (continued)
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

FEBRUARY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.13	-00.07	-00.10	08.03	0311	06.34	1447	06.53	0347	06.42	0097	0184	0014
2	-00.15	-00.05	-00.11	08.03	0310	06.28	1247	06.58	0447	06.38	0096	0182	0013
3	-00.13	-00.10	-00.11	08.02	0310	06.30	0747	06.45	2347	06.38	0096	0182	0013
4	-00.14	-00.10	-00.12	08.00	0308	06.32	1147	06.45	1447	06.38	0094	0178	0011
5	-00.13	-00.10	-00.11	08.00	0309	06.26	2147	06.51	1247	06.43	0094	0178	0012
6	-00.15	-00.12	-00.13	07.97	0306	06.33	1847	06.46	0947	06.39	0091	0172	0010
7	-00.14	-00.04	-00.07	08.03	0312	06.36	0247	06.54	1647	06.46	0096	0182	0016
8	-00.12	-00.07	-00.09	08.02	0311	06.40	1847	06.56	1047	06.49	0096	0182	0015
9	-00.12	-00.07	-00.09	08.01	0311	06.38	1947	06.56	0447	06.47	0096	0182	0016
10	-00.12	-00.09	-00.10	08.00	0310	06.03	0347	06.51	0447	06.39	0094	0178	0013
11	-00.08	00.00	-00.04	08.07	0316	06.31	1047	06.53	1847	06.44	0102	0193	0021
12	00.00	00.07	00.05	08.18	0329	06.40	0947	06.61	1747	06.52	0114	0216	0034
24	-00.02	00.01	00.00	08.05	0318	10.33	2313	10.37	1813	10.35	0108	0205	0025
25	-00.08	00.00	-00.03	07.99	0312	10.26	1613	10.34	0113	10.29	0103	0195	0019
26	-00.08	00.06	00.00	08.04	0318	10.33	2313	10.47	0713	10.38	0108	0205	0025
27	-00.10	-00.02	-00.05	07.97	0311	10.26	1913	10.38	0613	10.32	0102	0193	0018
28	-00.09	-00.01	-00.05	07.98	0312	10.30	2313	10.39	0813	10.33	0102	0193	0020
28	-00.15	00.07	-00.07	08.02	0312	06.03	0347	10.47	0713	07.57	0099	0188	0017

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TABLE E.3.3 (continued)

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

MARCH, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.13	-00.05	-00.09	07.93	0307	10.25	1713	10.36	0313	10.29	0097	0184	0014
2	-00.13	-00.07	-00.11	07.90	0305	10.24	1813	10.29	2313	10.26	0094	0178	0012
3	-00.05	00.02	-00.01	08.02	0317	10.30	0013	10.41	2313	10.35	0107	0203	0025
4	-00.01	00.13	00.04	08.09	0324	10.37	2013	10.53	0813	10.44	0114	0216	0033
5	-00.08	00.00	-00.03	07.97	0313	10.36	2313	10.43	1313	10.39	0103	0195	0022
6	-00.08	00.02	-00.03	07.98	0314	10.33	1613	10.42	2313	10.37	0104	0197	0022
7	-00.05	00.11	00.01	08.04	0321	10.34	1913	10.54	0513	10.43	0111	0210	0029
8	-00.06	00.06	-00.00	08.00	0316	10.35	2213	10.49	0213	10.40	0107	0203	0025
9	-00.10	-00.04	-00.06	07.93	0309	10.28	1813	10.37	0513	10.33	0099	0188	0018
10	-00.08	-00.02	-00.05	07.93	0310	10.35	0013	10.47	1213	10.42	0102	0193	0019
11	-00.14	-00.04	-00.09	07.89	0306	10.29	1813	10.45	0113	10.35	0098	0186	0015
12	-00.12	-00.08	-00.10	07.86	0304	10.26	1913	10.36	0313	10.30	0096	0182	0013
13	-00.08	-00.01	-00.05	07.92	0309	10.35	0413	10.39	2013	10.37	0102	0193	0019
14	-00.12	-00.06	-00.08	07.88	0305	10.31	2213	10.40	0713	10.35	0098	0186	0015
15	-00.09	00.03	-00.03	07.94	0311	10.34	0013	10.48	0713	10.40	0104	0197	0021
16	-00.08	00.07	-00.00	07.97	0315	10.35	1713	10.50	0913	10.42	0108	0205	0025
17	-00.14	-00.07	-00.10	07.84	0302	10.35	0913	10.42	2113	10.38	0095	0180	0012
18	-00.16	-00.11	-00.13	07.80	0298	10.40	0813	10.49	1913	10.44	0091	0172	0008
19	-00.15	-00.08	-00.11	07.82	0301	10.46	1713	10.52	0713	10.49	0094	0178	0011
20	-00.12	-00.02	-00.07	07.87	0306	10.51	0013	10.63	0813	10.58	0099	0188	0016
21	-00.09	00.06	-00.03	07.92	0311	10.60	2013	10.74	0713	10.64	0105	0199	0022
22	-00.07	00.05	-00.02	07.93	0312	10.61	2213	10.74	0813	10.66	0106	0201	0023
23	-00.10	00.00	-00.04	07.90	0309	10.57	2213	10.69	0213	10.62	0102	0193	0020
24	-00.12	-00.07	-00.09	07.83	0303	10.55	1313	10.64	2313	10.57	0097	0184	0014
25	-00.09	00.01	-00.04	07.89	0309	10.59	1413	10.72	0613	10.66	0103	0195	0020
26	-00.14	-00.05	-00.08	07.83	0303	10.59	2011	10.68	0311	10.62	0096	0182	0014
27	-00.14	-00.08	-00.11	07.80	0299	10.55	1111	10.62	2311	10.58	0094	0178	0011
28	-00.12	-00.03	-00.08	07.84	0304	10.57	1911	10.66	0911	10.62	0099	0188	0016
29	-00.09	00.02	-00.05	07.87	0307	10.63	0011	10.77	0811	10.69	0102	0193	0019
30	-00.11	00.05	-00.04	07.88	0309	10.72	2311	10.83	0811	10.76	0103	0195	0020
31	-00.10	-00.03	-00.06	07.84	0305	10.68	1011	10.78	2311	10.72	0100	0190	0017
31	-00.16	00.13	-00.05	07.90	0308	10.24	1813	10.83	0811	10.48	0100	0190	0018

TABLE E.3.3 (continued)

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

APRIL, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	-00.10	-00.02	-00.05	07.86	0307	10.67	2211	10.81	0111	10.72	0102	0193	0019
2	-00.09	-00.04	-00.07	07.83	0304	10.69	0011	10.79	2311	10.73	0099	0188	0016
3	-00.07	00.06	-00.01	07.90	0311	10.79	1411	10.89	0711	10.84	0107	0203	0023
4	-00.06	00.12	00.00	07.94	0316	10.86	1511	11.04	0811	10.93	0110	0209	0027
5	-00.08	00.12	00.00	07.94	0316	10.92	2211	11.11	0711	10.99	0111	0210	0027
6	-00.07	00.06	-00.00	07.91	0312	10.92	0011	11.04	2311	10.97	0108	0205	0025
7	00.11	00.36	00.24	08.24	0346	11.11	0011	11.38	0811	11.28	0142	0269	0059
8	00.22	00.48	00.33	08.31	0356	11.32	2211	11.56	0711	11.42	0153	0290	0069
9	00.22	00.35	00.28	08.25	0350	11.33	0011	11.54	2311	11.44	0147	0279	0063
10	00.28	00.54	00.38	08.37	0362	11.55	1511	11.75	0611	11.63	0160	0304	0076
11	00.21	00.51	00.34	08.31	0356	11.53	1711	11.77	0511	11.62	0154	0292	0070
12	00.21	00.45	00.31	08.28	0353	11.54	1511	11.71	0711	11.61	0151	0286	0066
13	00.25	00.49	00.33	08.30	0355	11.59	1311	11.75	0711	11.64	0154	0292	0069
14	00.28	00.51	00.36	08.34	0359	11.63	1411	11.78	0711	11.69	0159	0302	0074
15	00.25	00.51	00.36	08.33	0358	11.62	1611	11.81	0511	11.70	0158	0300	0073
16	00.26	00.53	00.42	08.41	0366	11.48	1326	11.81	0511	11.70	0166	0315	0081
16	-00.10	00.54	00.19	08.15	0339	10.67	2211	11.81	0511	11.30	0136	0258	0052

TABLE E.3.3 (continued)

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

MAY, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
21	07.13	08.03	07.49	08.29	0198	11.42	1458	11.76	2358	11.52	0090	0140	0107
22	05.84	08.02	06.99	08.25	0187	11.46	1058	12.41	0458	11.87	0091	0146	0108
23	06.44	09.15	07.76	08.20	0189	11.40	1858	11.97	0558	11.64	0092	0143	0110
24	07.07	09.71	08.52	08.26	0199	11.02	2358	11.74	0558	11.35	0100	0151	0117
25	08.61	11.70	10.02	08.19	0202	10.47	1858	11.23	0658	10.84	0096	0137	0110
26	08.36	10.73	09.79	08.22	0212	02.36	2358	11.21	0658	06.12	0092	0135	0106
27	08.91	10.08	09.41	08.05	0205	01.87	1658	02.34	0258	02.05	0077	0113	0089
28	07.61	08.84	08.02	07.69	0180	00.96	1958	02.02	0358	01.47	0047	0071	0056
29	~~04.57~~ 5.61	09.73	~~07.84~~ 8.26	07.77	0194	00.37	0858	02.64	1358	02.00	0057	0089	0070
30	08.70	11.90	10.37	08.16	0231	02.41	0958	02.89	0558	02.59	0102	0145	0116
31	08.57	11.29	09.99	08.10	0228	01.81	1458	05.28	2058	02.98	0108	0158	0125
31	~~04.57~~ 5.61	11.90	08.74	08.10	0202	00.37	0858	12.41	0458	06.76	0086	0130	0101

TABLE E.3.3 (continued)
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

JUNE, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	08.14	09.79	09.01	08.17	0219	02.76	1958	05.35	0558	03.74	0113	0166	0133
2	08.43	10.62	09.41	08.29	0229	02.13	1758	03.20	0058	02.55	0134	0197	0157
3	08.86	10.70	09.70	08.29	0227	02.12	0958	02.43	0458	02.27	0144	0211	0169
4	08.47	09.99	09.19	08.18	0218	01.73	1124	02.48	0324	02.09	0145	0213	0172
5	07.94	09.13	08.33	07.98	0209	01.41	1724	02.03	0724	01.74	0142	0215	0171
6	06.67	09.22	08.02	07.77	0199	00.11	1024	01.67	2324	01.08	0136	0206	0167
7	07.26	11.16	08.93	07.95	0221	01.04	1024	01.82	2324	01.54	0164	0248	0196
8	08.74	10.27	09.44	08.23	0252	01.02	2224	02.00	0624	01.48	0199	0292	0235
9	06.53	10.72	08.61	07.57	0235	-00.03	1224	01.08	2353	00.83	0138	0209	0167
10	09.05	11.25	10.15	07.17	0255	01.02	0953	01.49	1353	01.18	0093	0132	0105
11	09.36	11.90	10.62	07.13	0260	00.77	1853	01.10	0453	00.92	0092	0131	0104
12	10.12	13.57	11.85	07.10	0266	00.62	1853	00.91	0553	00.74	0093	0129	0103
13	11.64	13.37	12.45	07.11	0274	00.63	1553	00.81	0553	00.70	0098	0132	0107
14	11.26	12.36	11.85	07.10	0277	00.72	0053	00.99	2353	00.81	0098	0136	0108
15	10.97	12.89	11.83	07.06	0276	00.87	2053	01.17	0753	01.00	0095	0131	0105
16	11.02	13.91	12.56	07.07	0277	00.72	2153	00.99	0553	00.83	0097	0131	0106
17	12.12	13.61	12.86	07.08	0279	00.67	1853	00.87	0553	00.75	0102	0137	0111
18	11.68	18.67	12.66	07.10	0289	00.66	1053	01.27	1250	00.99	0106	0143	0115
19	11.73	13.16	12.40	07.15	0303	01.12	1950	01.38	0650	01.23	0111	0150	0121
20	11.50	12.24	11.88	07.18	0305	01.18	0150	01.29	0950	01.23	0114	0158	0125
21	10.99	12.30	11.66	07.14	0300	01.25	1850	01.40	0750	01.31	0110	0152	0123
22	10.43	12.83	11.81	07.13	0305	01.16	1950	01.48	0550	01.29	0113	0156	0125
23	11.26	13.14	12.19	07.07	0303	01.22	1650	01.37	0650	01.29	0111	0150	0123
24	11.36	12.76	12.03	07.02	0304	01.36	0250	01.60	1050	01.51	0083	0112	0091
25	09.40	11.97	10.68	07.07	0316	01.47	2150	01.60	1150	01.53	0058	0082	0064
26	07.22	09.29	08.34	07.07	0315	01.40	1750	01.60	0850	01.50	0066	0100	0077
27	06.39	07.28	06.78	06.96	0307	01.38	1550	01.97	2350	01.59	0079	0127	0096
28	06.15	07.27	06.72	06.78	0285	01.39	2150	02.14	0450	01.80	0069	0111	0085
29	06.64	07.99	07.19	06.69	0283	00.56	1350	01.45	0050	00.95	0068	0106	0084
30	06.74	09.13	07.82	06.54	0273	-00.07	1050	00.83	0050	00.38	0054	0084	0067
30	06.15	13.91	010.23	07.34	0269	-00.07	1050	05.35	0558	01.36	0107	0155	0124

TABLE E.3.3 (continued)

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

AUGUST, 1981

J.D.	DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN pH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
217	5	10.64	11.20	10.94	07.13	0098	10.73	2129	12.43	1429	11.26	0096	0137	0133
	6	10.03	10.84	10.42	07.17	0089	09.88	2129	11.95	1629	10.91	0103	0147	0142
	7	09.46	10.24	09.70	07.19	0092	09.52	1529	11.87	0129	10.72	0105	0154	0146
	8	08.66	09.36	08.97	07.17	0090	10.84	0829	13.08	2029	11.88	0099	0150	0141
	9	08.34	09.16	08.73	07.29	0091	12.07	2229	12.89	1129	12.46	0096	0145	0136
222	10	08.26	08.98	08.65	07.29	0094	11.77	0629	12.96	2129	12.48	0095	0143	0136
	11	07.86	09.07	08.41	07.24	0098	12.18	1829	13.61	1029	12.69	0097	0146	0138
	12	~~02.72~~ 08.24	08.87✓	~~05.23~~ 8.52	~~08.26~~ 7.24	~~0095~~ 104	~~11.36~~ 12.15	~~1848~~ 0029	12.97✓	0929✓	~~12.24~~ 12.60	~~0123~~ 101	~~0205~~ 144	~~0154~~ 144
	13	~~02.75~~ 07.49	07.80✓	~~05.54~~ 7.70	~~08.30~~ 7.74	~~0120~~ 144	~~10.68~~ 10.88	~~1449~~ 1449	~~12.49~~ 11.50	~~0848~~ 2049	~~11.64~~ 11.29	~~0127~~ 110	~~0211~~ 161	~~0171~~ 167
	14	06.95	07.51	07.22	07.72	0157	11.32	2349	12.08	0449	11.63	0110	0171	0168
227	15	06.17	07.14	06.53	07.68	0164	11.07	0049	12.41	0549	11.67	0110	0177	0168
	16	05.45	06.14	05.77	07.64	0167	11.52	0149	12.27	0949	11.78	0110	0183	0170
	17	04.76	06.40	05.52	07.61	0165	10.40	2249	12.64	0249	11.59	0111	0185	0175
	18	05.90	07.43	06.60	07.51	0158	09.48	2249	11.07	0449	10.33	0110	0177	0174
	19	07.03	07.81	07.35	07.43	0155	08.39	1849	10.08	0549	09.22	0110	0171	0173
232	20	06.83	07.36	07.02	07.37	0152	09.20	0349	10.83	2049	10.07	0102	0159	0162
	21	06.26	07.58	06.94	07.29	0149	09.95	1449	11.64	0949	10.62	0086	0138	0142
	22	07.51	07.60	07.56	07.29	0157	09.74	2249	11.21	0349	10.35	0088	0137	0141
	23	06.94	07.81	07.38	07.21	0154	09.46	1549	10.66	0749	10.12	0085	0132	0140
	24	06.67	08.38	07.48	07.24	0161	09.14	2149	10.92	0749	09.86	0091	0142	0148
237	25	07.75	09.65	08.50	07.17	0168	07.10	1749	09.56	0049	08.52	0094	0142	0150
	26	08.84	10.83	09.68	07.12	0178	07.02	1249	08.98	0349	07.92	0098	0144	0153
	27	09.86	11.61	10.66	07.17	0189	06.25	1449	08.37	0749	07.36	0105	0150	0158
	28	10.46	11.58	11.01	07.20	0200	06.64	1649	08.22	0849	07.33	0106	0147	0157
	29	09.57	10.86	10.04	07.31	0215	06.75	1249	08.06	0649	07.41	0109	0155	0164
	30	09.60	10.24	09.93	07.32	0207	06.23	1349	08.27	2049	07.49	0106	0155	0161
243	31	09.04	10.04	09.47	07.42	0212	06.03	1449	08.21	0349	07.31	0113	0166	0171
	31	~~02.75~~ 04.76	11.61✓	~~08.19~~ 08.40	~~07.39~~ 07.34	~~0147~~ 0148	06.03✓	1449✓	13.61✓	1029✓	10.25✓	~~0103~~ 0102	~~0156~~ 0154	~~0154~~ 0154

TABLE E.3.3 (continued)
R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WATER QUALITY MONITOR

SEPTEMBER, 1981

DAY	MIN. TEMP (C)	MAX. TEMP (C)	MEAN TEMP (C)	MEAN PH	MEAN ORP	MIN. D.O. PPM	TIME	MAX. D.O. PPM	TIME	MEAN D.O PPM	MEAN COND uMHO	MEAN COND ADJ. uMHO	MEAN MEAS ADJ. uMHO
1	07.59	09.16	08.34	07.70	0230	07.11	1949	08.69	0649	07.73	0136	0206	0203
2	07.05	08.05	07.41	07.71	0238	07.07	1949	09.39	0049	07.77	0139	0217	0213
3	06.75	07.97	07.29	07.52	0207	06.71	1249	12.55	2038	09.00	0122	0190	0190
4	07.22	08.13	07.60	07.42	0162	09.53	1338	12.29	0238	10.77	0102	0159	0154
5	07.23	08.32	07.70	07.40	0165	09.25	2038	11.77	1038	10.65	0100	0156	0152
6	06.92	07.80	07.39	07.41	0171	09.53	1738	11.38	0038	10.52	0099	0154	0150
7	06.30	07.35	06.69	07.43	0183	09.94	2038	11.82	0838	10.88	0100	0161	0153
8	05.69	06.81	06.28	07.40	0196	09.98	1738	11.82	0738	10.82	0094	0151	0147
9	05.61	06.60	06.10	07.47	0225	10.00	1838	11.68	0438	10.77	0100	0161	0154
10	06.14	07.05	06.57	07.38	0231	09.14	2138	11.69	0738	10.02	0096	0154	0150
11	05.72	06.67	06.14	07.37	0238	09.02	0038	11.68	0738	09.99	0095	0153	0149
12	05.61	06.49	06.08	07.27	0234	08.83	0038	11.79	1138	09.81	0087	0140	0140
13	05.15	06.37	05.72	07.37	0246	08.87	2338	11.07	2038	09.88	0094	0156	0149
14	04.59	06.07	05.21	07.38	0249	08.71	1638	12.06	1238	10.27	0096	0160	0153
15	05.01	06.02	05.48	07.33	0246	08.63	1930	11.69	1338	09.87	0093	0155	0149
16	05.63	07.19	06.36	07.40	0224	09.40	1130	11.54	0830	10.23	0102	0164	0159
17	06.00	07.20	06.67	07.48	0205	09.38	2128	10.54	0328	10.05	0107	0172	0165
18	06.29	06.93	06.60	07.51	0228	09.36	2328	10.13	1228	09.71	0108	0174	0167
19	06.37	06.81	06.51	07.51	0244	09.28	1928	09.95	1128	09.54	0109	0175	0168
20	05.86	06.36	06.14	07.48	0249	08.91	2328	10.01	2128	09.28	0104	0167	0162
21	05.42	06.31	05.77	07.51	0256	08.83	1828	09.93	0628	09.19	0106	0176	0164
22	04.62	05.56	05.06	07.53	0261	08.91	1928	09.65	0828	09.23	0107	0178	0166
23	03.96	04.98	04.30	07.56	0266	09.16	0028	09.57	0828	09.37	0109	0187	0171
24	02.70	04.16	03.26	07.58	0271	09.32	0128	09.72	0828	09.51	0110	0196	0175
25	02.15	03.18	02.72	07.60	0274	09.57	0128	10.08	2328	09.78	0113	0209	0181
26	00.50	01.95	01.02	07.73	0289	10.22	0028	10.92	0928	10.40	0122	0234	0194
27	00.30	00.84	00.46	07.77	0295	10.24	0828	11.07	2028	10.40	0127	0254	0203
28	00.28	00.44	00.36	07.67	0283	09.58	1228	10.80	2328	10.25	0118	0236	0194
29	00.28	00.48	00.37	07.70	0286	09.63	1628	10.84	0128	10.22	0122	0244	0200
30	00.23	00.42	00.32	07.64	0280	09.85	0628	10.70	2228	10.19	0117	0234	0195
30	00.23	09.16	05.19	07.50	0237	06.71	1249	12.55	2038	09.88	0107	0178	0169

NOTE: DISSOLVED OXYGEN DATA SHOULD BE DISMISSED DUE TO SENSOR MALFUNCTION

ATTACHMENT E.4

SEDIMENT DISCHARGE

susi11/k4

TABLE E.4.1

SEDIMENT DISCHARGE, SUSITNA RIVER AT VEE CANYON

Date	Streamflow (c.f.s.)	Water Temperature (°C)	Suspended Sediment Concentration (mg/l)	Suspended Sediment Discharge (tons/day)
9/5/80	5,040	5.3	61	827
9/17/80	14,200	5.9	297	11,345
10/18/80	5,000	0.0	5.7	77
1/13/81	5,000	0.1	0.9	12
5/20/81	9,800	6.5	132	3,483
6/18/81	11,600	11.9	316	9,860
6/30/81	13,700	7.9	172	6,339
8/2/81	26,375	8.1	839	59,526
8/3/81	29,420	8.1	755	59,750
8/3/81	28,000	9.8	616	46,400
9/15/81	7,800	5.9	47	985

susi13/l

TABLE E.4.2

SEDIMENT DISCHARGE, SUSITNA RIVER AT GOLD CREEK

Date	Streamflow (c.f.s.)	Water Temperature (°C)	Suspended Sediment Concentration (mg/l)	Suspended Sediment Discharge (tons/day)
10/16/80	7,000	0.0	7.8	147
1/14/81	NA[1]	0.3	8.4	NA
5/27/81	14,400	10.5	65	2,520
6/3/81	27,900	7.3	180	12,060
6/17/81	17,700	12.8	151	7,190
7/1/81	21,900	8.6	100	5,900
8/1/81	51,000	9.2	420	57,600
8/3/81	46,000	9.2	810	100,000
9/14/81	12,600	6.8	69	2,340

[1] NA' = Not available.

susi13/l

TABLE 4.3
R&M CONSULTANTS, INC.
AND U.S. GEOLOGICAL SURVEY

1981 BEDLOAD TRANSPORT DATA[1]

Sampling Site U.S.G.S. Gauge	Date	Bedload Transport Tons/Day	Discharge c.f.s.
Gold Creek	July 22	2180	37,200
Chulitna[2]	July 22	3450	31,900
Talkeetna	July 21	1940	16,800
Sunshine	July 22	3520	89,000
Gold Creek	August 26	380	25,900
Chulitna	August 25	5000	22,500
Talkeetna	August 25	800	9,900
Sunshine	August 26	4520	61,900
Gold Creek	September 28	1	8,540
Chulitna	September 29	3820	6,000
Talkeetna	September 29	30	2,910
Sunshine	September 30	400	19,100

1. Provisional data only.

2. Bedload sample obtained downstream of gauging station.

susi9/o

ATTACHMENT E.5

CLIMATE DATA SUMMARIES

ATTACHMENT E.5, PART 1

SUSITNA GLACIER CLIMATE DATA

ATTACHMENT E.5, PART 1

SUSITNA GLACIER CLIMATE DATA

susi11/k12

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING JULY , 1980

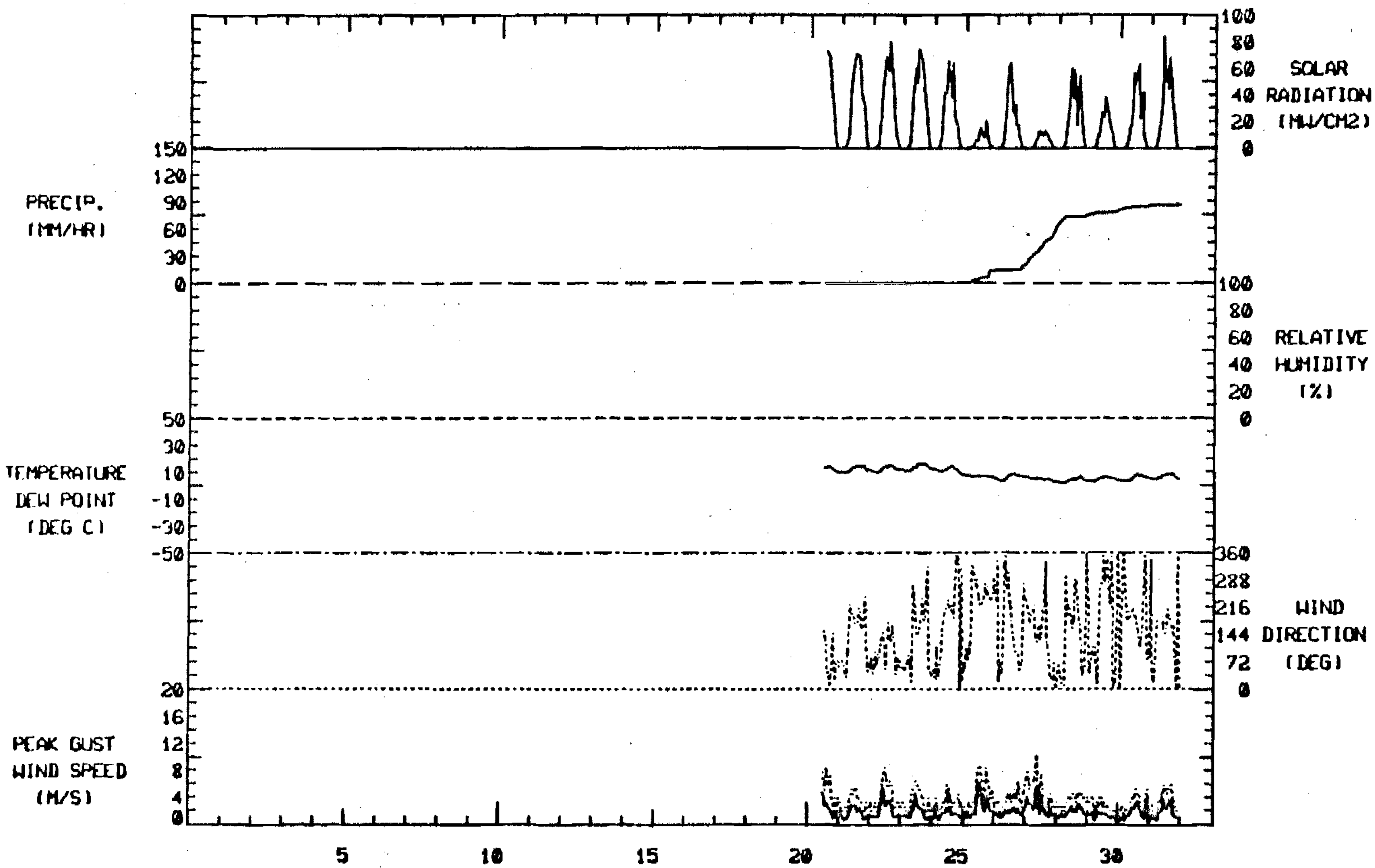
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	177	1.0	1.6	180	5.1	SSW	**	*****	0.0	8002	20
21	15.3	9.3	12.3	***	****	****	***	****	MSG	**	*****	****	***	21
22	15.6	9.4	12.5	115	1.6	2.1	051	8.3	E	**	*****	0.0	6690	22
23	16.6	10.5	13.5	151	.6	1.7	143	6.3	NE	**	*****	0.0	6855	23
24	15.0	7.7	11.4	239	.3	1.4	224	5.7	SSW	**	*****	1.2	5275	24
25	7.8	5.1	6.5	244	1.8	2.5	226	8.9	SW	**	*****	13.4	1335	25
26	8.6	3.0	5.8	085	.2	1.6	044	6.3	E	**	*****	9.0	4295	26
27	5.8	2.2	4.0	167	1.3	2.5	128	10.2	SE	**	*****	40.8	1255	27
28	6.8	1.3	4.1	143	.2	1.8	288	4.4	NNE	**	*****	11.0	5155	28
29	6.6	2.7	4.7	354	.5	1.3	016	3.8	N	**	*****	5.4	2860	29
30	9.0	3.1	6.1	159	.8	1.7	189	5.1	SSW	**	*****	6.0	4865	30
31	8.9	4.3	6.6	160	1.0	1.7	140	5.7	SSE	**	*****	0.0	5990	31
MONTH	16.6	1.3	7.9	168	.5	1.8	128	10.2	SSW	**	*****	86.8	52577	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 20   JULY   ,   1980

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	9.7	3.0	6.4	137	1.6	2.1	146	6.3	ENE	**	*****	0.0	6590	01
02	8.9	3.4	6.1	102	1.0	1.7	137	7.0	ENE	**	*****	3.0	2705	02
03	9.4	2.9	6.1	202	.2	1.3	151	5.1	NE	**	*****	3.2	4090	03
04	10.3	3.6	6.9	325	.5	1.5	224	5.1	N	**	*****	1.4	5395	04
05	12.7	5.7	9.2	179	.5	1.3	176	3.8	SSW	**	*****	0.0	6020	05
06	11.9	6.7	9.3	067	.8	1.4	132	5.7	E	**	*****	3.6	1960	06
07	8.1	4.2	6.2	344	.2	1.1	356	5.1	N	**	*****	12.4	1735	07
08	7.6	3.0	5.3	220	.6	1.2	146	3.2	SSW	**	*****	1.0	3700	08
09	9.2	5.2	7.2	084	2.7	2.9	080	9.5	ENE	**	*****	.8	1865	09
10	15.8	5.9	10.9	106	1.8	2.6	057	10.2	ENE	**	*****	0.0	6000	10
11	17.8	12.7	15.3	107	2.6	3.2	138	7.6	ENE	**	*****	0.0	5845	11
12	*****	*****	*****	138	.9	2.1	059	10.8	ENE	**	*****	0.0	6622	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	5.5	2.2	3.8	***	****	1.4	288	3.8	N	**	*****	.6	5611	28
29	2.8	0.0	1.4	010	1.1	1.6	044	5.1	NNE	**	*****	20.0	1035	29
30	7.3	1.5	4.4	095	1.3	2.1	062	6.3	ENE	**	*****	0.0	3670	30
31	6.4	2.4	4.4	064	.7	1.5	070	7.6	N	**	*****	0.0	2185	31
MONTH	17.8	0.0	6.9	100	.8	1.8	059	10.8	ENE	**	*****	46.0	65028	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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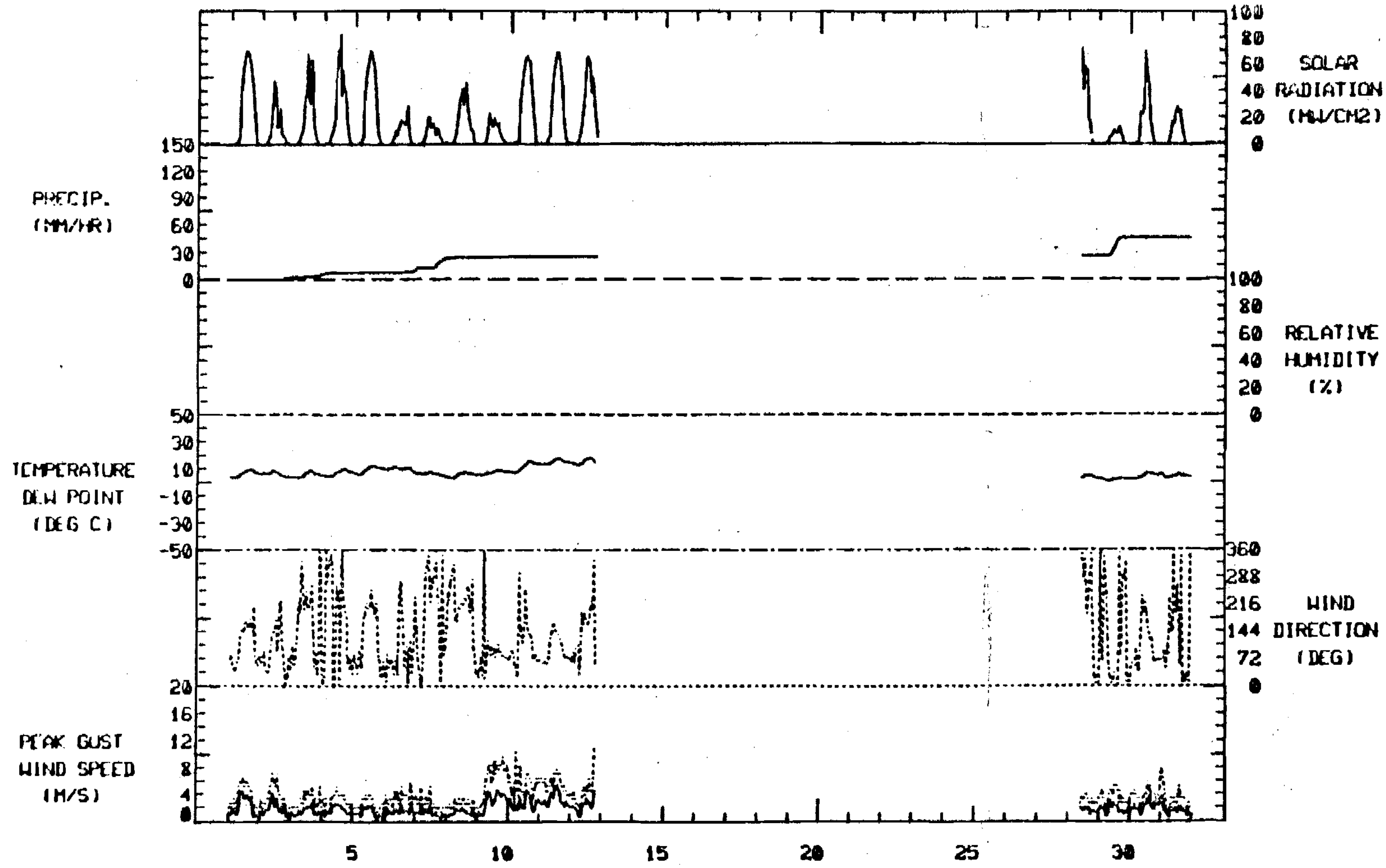
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	3.5	-9.3	-2.9	105	.4	1.8	093	15.2	SW	**	*****	0.0	1320	01
02	.7	-10.5	-4.9	083	1.1	1.6	219	4.4	NE	**	*****	0.0	4515	02
03	-2.1	-9.0	-5.6	095	2.2	2.8	085	8.9	NE	**	*****	0.0	4855	03
04	2.3	-8.4	-3.0	040	.8	1.6	069	7.6	N	**	*****	2.6	4375	04
05	5.2	-2.1	1.5	038	.8	1.6	090	7.6	NE	**	*****	1.8	4360	05
06	2.3	-1.1	.6	092	.6	1.4	164	4.4	ENE	**	*****	0.0	2870	06
07	5.5	.5	3.0	112	1.7	2.4	072	7.6	ENE	**	*****	0.0	3795	07
08	7.0	2.0	4.5	096	.9	1.7	142	7.0	NE	**	*****	0.0	2360	08
09	3.1	-.5	1.3	180	.2	1.0	236	5.1	ENE	**	*****	1.2	1970	09
10	3.1	-1.1	1.0	187	.4	1.2	207	4.4	SSW	**	*****	4.4	3550	10
11	6.2	.7	3.4	130	.6	1.6	143	5.1	ENE	**	*****	0.0	3735	11
12	4.7	-1.1	1.8	120	1.9	2.5	136	7.6	ENE	**	*****	0.0	2300	12
13	4.7	-.8	2.0	050	.7	1.0	028	3.8	NNE	**	*****	10.6	1650	13
14	6.4	3.3	4.9	070	1.1	1.4	043	3.8	ENE	**	*****	24.4	830	14
15	6.2	1.8	4.0	107	.1	1.0	078	4.4	WSW	**	*****	17.8	1095	15
16	5.6	-.4	2.6	153	.7	1.6	163	5.7	ENE	**	*****	0.0	3220	16
17	5.2	-1.2	2.0	154	.6	1.3	169	4.4	NE	**	*****	0.0	3290	17
18	.9	-2.5	-.8	329	2.1	2.7	326	13.3	NNW	**	*****	0.0	2185	18
19	1.7	-3.9	-1.1	279	.5	1.6	294	5.7	NNW	**	*****	0.0	2510	19
20	.3	-4.3	-2.0	058	.8	1.2	055	5.1	ENE	**	*****	.8	2800	20
21	-.2	-2.1	-1.1	196	.3	.8	175	3.2	SW	**	*****	0.0	1645	21
22	4.3	-2.3	1.0	129	.1	.4	021	1.3	ENE	**	*****	5.6	1785	22
23	1.0	-1.6	-.3	028	.6	1.2	043	4.4	NNW	**	*****	4.6	1335	23
24	7.5	-1.2	3.2	065	.7	1.0	052	3.2	ENE	**	*****	5.4	2625	24
25	7.5	-1.1	3.2	063	1.2	1.5	148	4.4	ENE	**	*****	.6	2520	25
26	8.5	0.0	4.3	084	2.0	2.1	095	9.5	E	**	*****	2.8	2020	26
27	5.6	.1	2.9	101	1.7	2.1	104	11.4	ESE	**	*****	0.0	1585	27
28	5.0	-1.2	1.9	048	1.2	1.5	026	5.7	NNE	**	*****	.2	2585	28
29	5.0	.9	2.9	085	1.4	1.9	062	7.0	ENE	**	*****	2.2	2160	29
30	2.3	.6	1.5	095	3.1	3.5	096	14.0	E	**	*****	4.2	1220	30
MONTH	8.5	-10.5	1.1	085	.7	1.6	093	15.2	ENE	**	*****	89.2	77065	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 9.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 6.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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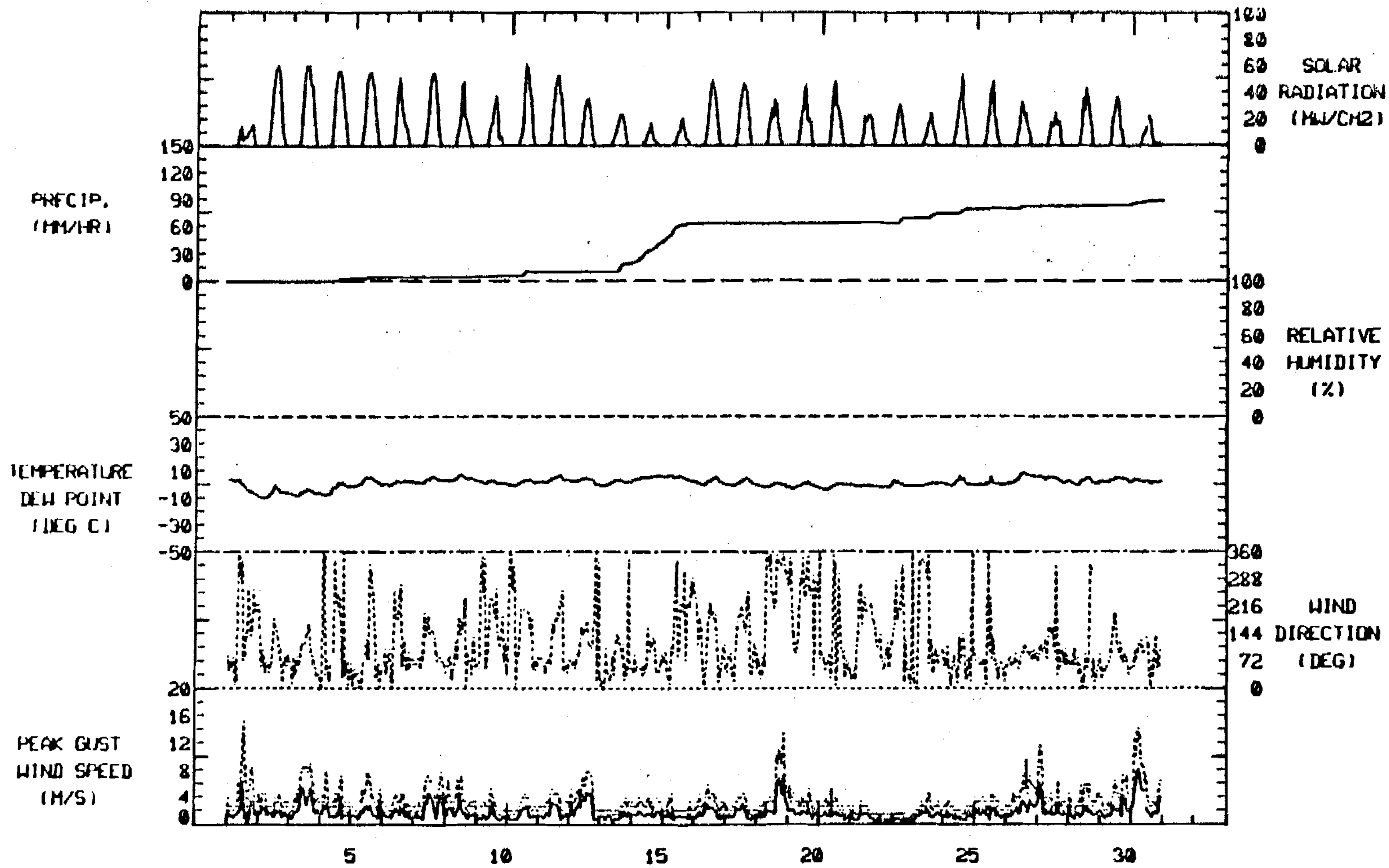
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH GLACIER WEATHER STATION

DATA START: 01 SEPTEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	4.8	.4	2.6	079	1.8	2.1	081	8.3	ENE	**	*****	0.0	2150	01
02	1.2	-2.9	-.9	059	.9	1.6	125	5.7	ENE	**	*****	****	915	02
03	1.1	-4.1	-1.5	062	1.2	1.7	089	7.6	ENE	**	*****	****	1680	03
04	.9	-3.9	-1.5	071	1.1	1.4	085	5.1	E	**	*****	****	2590	04
05	2.2	-2.5	-.2	087	1.4	2.2	135	9.5	ENE	**	*****	****	1365	05
06	3.3	-.6	1.4	062	1.7	2.3	082	9.5	ENE	**	*****	****	1330	06
07	3.6	.7	2.2	062	1.7	2.2	083	8.3	NNE	**	*****	****	1170	07
08	1.1	-7.2	-3.1	103	.7	1.8	104	10.8	N	**	*****	****	1075	08
09	.9	-9.2	-4.2	038	1.1	1.8	085	9.5	ENE	**	*****	****	580	09
10	-1.0	-7.6	-4.3	108	1.4	2.5	122	16.5	E	**	*****	****	2015	10
11	-3.6	-9.3	-6.4	065	.9	1.3	070	3.8	ENE	**	*****	****	2145	11
12	-4.6	-9.1	-6.9	070	.8	1.2	057	3.2	ENE	**	*****	****	1455	12
13	-2.0	-8.1	-5.1	071	1.2	1.3	051	3.8	ENE	**	*****	****	1450	13
14	.3	-7.0	-3.3	077	2.6	3.1	096	11.4	ENE	**	*****	****	960	14
15	1.1	-6.3	-2.6	155	2.9	4.4	146	24.1	SW	**	*****	****	895	15
16	-4.1	-6.0	-5.1	103	1.1	1.9	109	7.0	SW	**	*****	****	1185	16
17	.1	-6.2	-3.0	074	1.9	2.3	138	13.3	ENE	**	*****	****	1265	17
18	.7	-2.5	-.9	093	3.9	4.2	025	15.2	E	**	*****	****	750	18
19	1.3	-3.3	-1.0	082	2.9	3.5	096	10.8	E	**	*****	****	920	19
20	1.8	-4.0	-1.1	078	1.5	2.1	094	7.6	NE	**	*****	****	1155	20
21	1.8	-4.2	-1.2	089	3.1	3.4	077	11.4	E	**	*****	****	1100	21
22	6.8	1.5	4.2	084	4.4	4.5	084	11.4	E	**	*****	****	1175	22
23	6.9	-.7	3.1	060	1.6	1.8	072	6.3	ENE	**	*****	****	899	23
24	6.8	-.3	3.3	089	3.6	4.0	111	12.7	E	**	*****	****	1042	24
25	2.0	-3.3	-.7	083	1.7	1.9	091	7.6	E	**	*****	****	1241	25
26	.3	-4.0	-1.8	067	1.8	1.9	070	5.7	ENE	**	*****	****	1057	26
27	1.2	-4.7	-1.8	068	1.6	1.7	059	5.7	ENE	**	*****	****	904	27
28	-.3	-5.2	-2.8	063	1.2	1.4	056	5.1	ENE	**	*****	****	670	28
29	-5.1	-8.2	-6.7	045	.5	.9	284	3.2	ENE	**	*****	****	275.	29
30	-4.1	-8.0	-6.1	070	1.4	1.5	073	5.7	ENE	**	*****	****	1012	30
31	-5.8	-9.7	-7.8	055	2.4	2.4	043	7.6	NE	**	*****	****	991	31
MONTH	6.9	-9.7	-2.0	080	1.7	2.3	146	24.1	ENE	**	*****	0.0	37415	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 22.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 19.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 19.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 17.8

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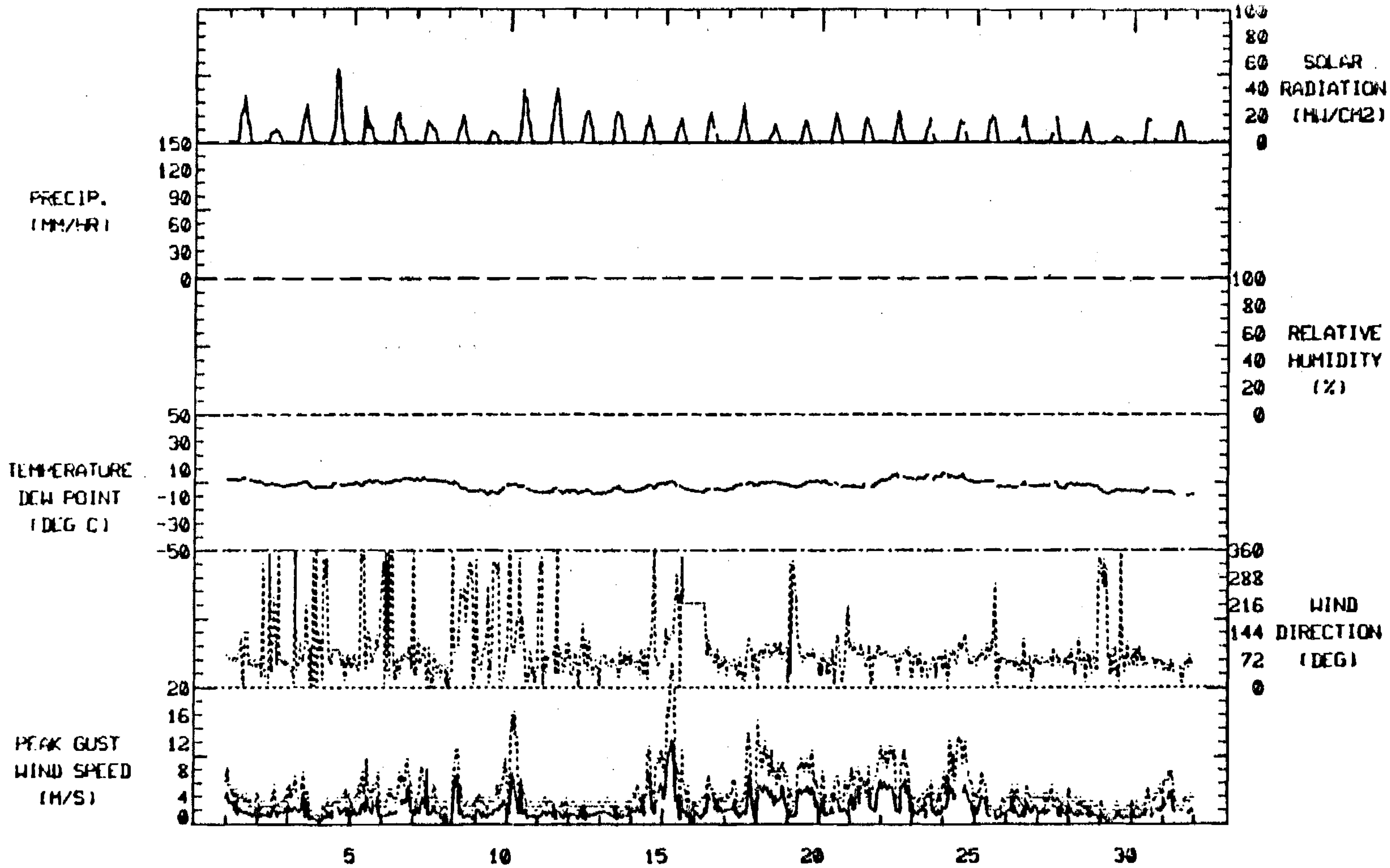
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

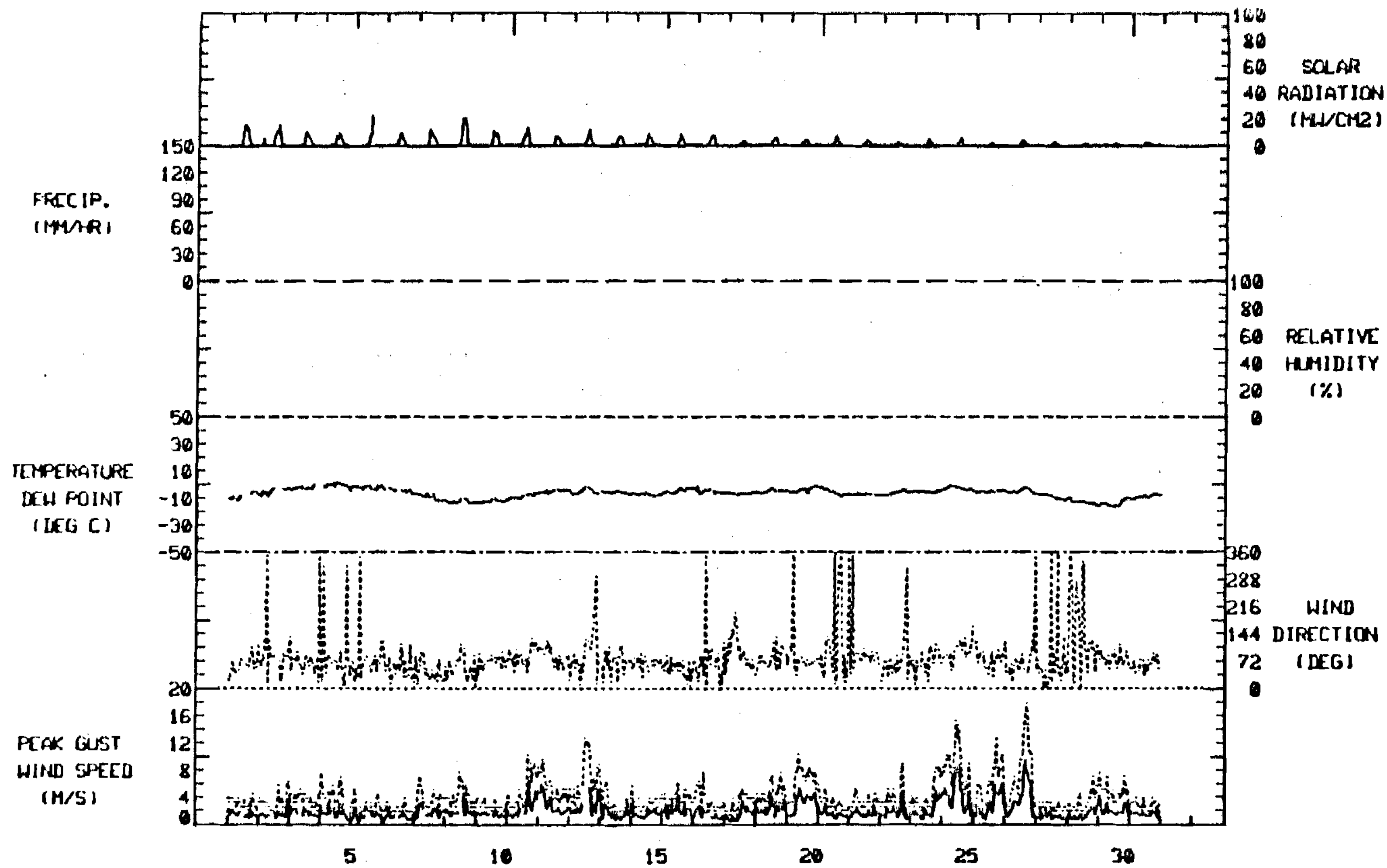
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-4.0	-10.9	-7.4	058	1.3	1.5	033	4.4	ENE	**	*****	****	915	01
02	-2.0	-9.2	-5.6	082	1.2	1.4	093	6.3	E	**	*****	****	850	02
03	.1	-3.8	-1.9	066	1.5	1.7	070	5.1	ENE	**	*****	****	560	03
04	2.2	-2.5	-.2	054	1.3	1.7	061	7.6	ENE	**	*****	****	530	04
05	1.0	-3.2	-1.1	062	1.0	1.2	020	5.1	ENE	**	*****	****	613	05
06	-2.0	-7.6	-4.8	055	.8	1.0	055	3.8	NNE	**	*****	****	460	06
07	-6.7	-12.8	-9.8	049	1.5	1.7	077	7.0	NNE	**	*****	****	605	07
08	-9.9	-14.8	-12.4	057	1.6	1.9	114	7.6	NE	**	*****	****	1045	08
09	-9.9	-13.9	-11.9	070	1.3	1.4	056	3.8	ENE	**	*****	****	625	09
10	-6.0	-10.8	-8.4	096	2.2	2.4	091	10.2	E	**	*****	****	685	10
11	-3.7	-6.5	-5.1	090	2.8	3.0	098	9.5	E	**	*****	****	495	11
12	-1.2	-7.9	-4.6	088	1.9	2.8	126	12.7	ENE	**	*****	****	495	12
13	-4.2	-7.5	-5.9	074	1.4	1.6	070	6.3	E	**	*****	****	430	13
14	-6.1	-8.6	-7.4	066	1.4	1.5	047	5.7	ENE	**	*****	****	485	14
15	-1.9	-6.7	-4.3	053	1.9	2.1	069	6.3	NE	**	*****	****	455	15
16	.3	-9.2	-4.5	060	1.0	1.4	055	7.6	NE	**	*****	****	380	16
17	-5.6	-7.8	-6.7	079	1.1	1.4	093	5.1	NE	**	*****	****	245	17
18	-2.8	-6.6	-4.7	085	2.0	2.2	101	7.6	ENE	**	*****	****	390	18
19	-1.3	-6.2	-3.8	070	3.0	3.1	074	10.2	ENE	**	*****	****	340	19
20	-1.6	-9.2	-5.4	059	.9	1.4	062	5.7	N	**	*****	****	340	20
21	-6.7	-8.4	-7.6	079	1.3	1.5	091	5.1	E	**	*****	****	280	21
22	-3.5	-7.9	-5.7	070	1.3	1.7	106	8.9	ENE	**	*****	****	180	22
23	-3.7	-6.6	-5.2	078	1.8	2.0	094	8.3	ENE	**	*****	****	315	23
24	-.8	-5.4	-3.1	101	4.1	4.3	119	15.2	E	**	*****	****	345	24
25	-4.2	-6.2	-5.2	084	2.7	2.9	101	12.7	E	**	*****	****	225	25
26	-1.7	-7.1	-4.4	062	3.2	3.7	048	17.8	NE	**	*****	****	290	26
27	-7.3	-12.3	-9.8	035	.8	1.0	047	3.2	N	**	*****	****	165	27
28	-8.9	-16.1	-12.5	079	.7	1.4	071	7.0	ESE	**	*****	****	195	28
29	-9.4	-16.4	-12.9	082	2.0	2.1	098	7.6	E	**	*****	****	270	29
30	-6.6	-11.0	-8.8	061	1.3	1.4	053	3.8	ENE	**	*****	****	330	30
MONTH	2.2	-16.4	-6.4	074	1.6	1.9	048	17.8	ENE	**	*****	****	13538	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 16.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 NOVEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-2.4	-8.4	-5.4	058	.9	1.0	046	2.5	NE	35	-20.7	****	290	01
02	-.4	-4.8	-2.6	063	1.1	1.2	065	4.4	NE	30	-17.4	****	360	02
03	-3.5	-8.4	-5.9	059	1.0	1.2	337	4.4	ENE	34	-19.3	****	340	03
04	-8.4	-13.9	-11.1	062	.7	1.0	127	3.8	ENE	41	-20.0	****	332	04
05	-13.0	-15.2	-14.1	050	1.2	1.5	054	7.6	NE	62	-20.0	****	290	05
06	-14.6	-20.7	-17.7	050	2.1	2.3	051	7.0	NE	50	-26.5	****	290	06
07	-12.9	-19.6	-16.3	067	1.8	2.1	073	10.2	ENE	31	-29.8	****	465	07
08	-11.5	-15.8	-13.6	074	1.6	1.7	099	5.1	ENE	25	-29.7	****	515	08
09	-10.8	-15.8	-13.3	063	1.6	1.6	045	4.4	ENE	24	-29.7	****	520	09
10	-15.7	-23.0	-19.4	052	1.3	1.4	050	4.4	ENE	38	-31.1	****	405	10
11	-23.1	-31.5	-27.3	034	1.6	1.8	078	5.7	NNE	47	-35.0	****	325	11
12	-17.6	-33.5	-25.5	051	1.2	1.4	058	5.1	ENE	55	-30.1	****	310	12
13	-10.1	-19.1	-14.6	027	1.1	1.6	007	7.0	NNW	70	-18.2	****	220	13
14	-11.3	-28.3	-19.8	082	1.2	1.4	103	7.0	E	75	-27.8	****	180	14
15	-25.3	-32.2	-28.8	049	.5	.9	082	3.8	N	69	-34.8	****	220	15
16	-26.1	-33.2	-29.6	046	1.3	1.5	023	4.4	NE	61	-35.9	****	235	16
17	-14.8	-26.5	-20.7	068	1.0	1.1	071	3.2	ENE	29	-33.7	****	485	17
18	-13.6	-18.8	-16.2	066	1.2	1.3	046	4.4	ENE	22	-32.3	****	515	18
19	-12.0	-19.1	-15.5	036	1.4	1.6	069	5.1	NNE	26	-30.1	****	500	19
20	-9.2	-13.6	-11.4	069	2.0	2.1	062	7.6	ENE	18	-30.8	****	520	20
21	-2.9	-10.4	-6.6	065	1.7	1.8	060	7.6	ENE	15	-29.1	****	535	21
22	-3.3	-8.4	-5.9	068	1.6	1.7	061	7.0	ENE	15	-28.8	****	530	22
23	-4.1	-9.5	-6.8	072	1.4	1.4	079	5.1	ENE	18	-27.9	****	515	23
24	-3.9	-12.9	-8.4	075	2.3	2.5	100	9.5	ENE	24	-25.9	****	475	24
25	-9.8	-17.5	-13.6	073	2.4	3.6	318	14.6	E	28	-28.8	****	475	25
26	-16.5	-21.7	-19.1	061	2.1	2.3	093	7.0	NE	25	-34.5	****	515	26
27	-18.6	-23.1	-20.8	055	1.0	1.1	074	3.8	ENE	24	-36.2	****	515	27
28	-11.9	-20.0	-16.0	061	1.2	1.4	086	3.8	ENE	19	-33.5	****	520	28
29	-5.6	-15.5	-10.6	069	1.4	1.6	043	8.3	ENE	38	-22.5	****	440	29
30	-4.6	-11.4	-8.0	087	1.3	1.7	090	10.2	E	80	-9.9	****	160	30
31	1.1	-4.3	-1.6	135	6.7	7.9	156	30.5	ESE	70	-5.7	****	420	31
MONTH	1.1	-33.5	-14.4	070	1.4	1.8	156	30.5	ENE	39	-27.0	****	12417	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 16.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 26.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 19.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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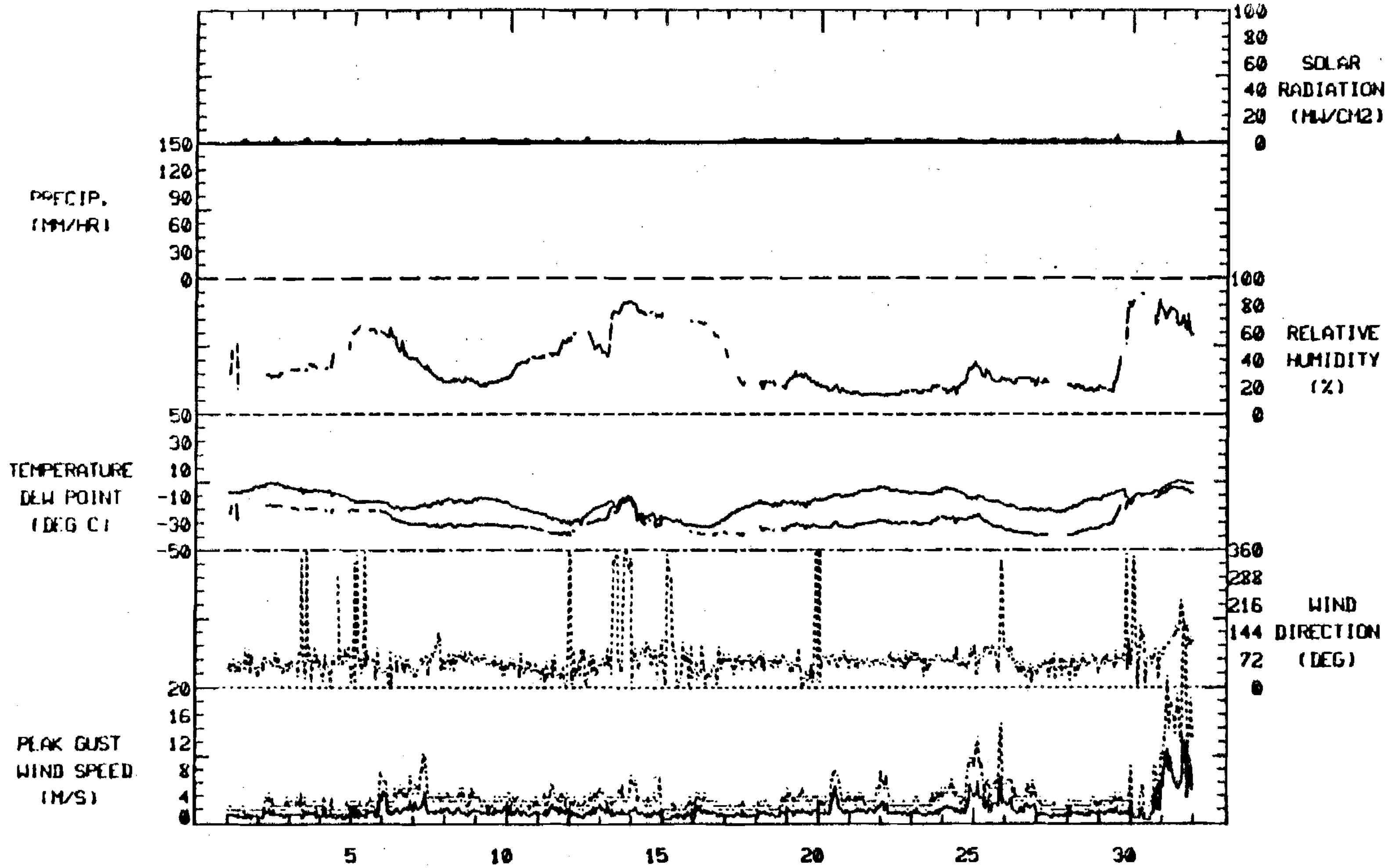
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 DECEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	2.8	-1.8	.5	114	4.9	6.2	151	27.9	E	64	-5.8	****	210	01
02	-1.3	-4.9	-3.1	139	3.8	4.8	154	32.4	ENE	51	-12.7	****	285	02
03	-1.7	-6.1	-3.9	066	1.6	1.7	033	5.1	ENE	21	-20.8	****	175	03
04	-1.7	-7.0	-4.4	075	2.1	1.9	125	7.0	ENE	58	-14.0	****	250	04
05	-2.6	-6.8	-4.7	***	****	1.7	011	8.3	NE	34	-22.8	****	200	05
06	1.1	-6.2	-2.6	092	2.9	3.2	112	12.1	E	48	-11.6	****	345	06
07	2.4	-1.5	.5	085	3.3	3.6	119	12.7	ENE	54	-7.9	****	290	07
08	1.6	-4.9	-1.6	089	1.8	2.4	155	9.5	ENE	46	-16.1	****	225	08
09	3.5	-5.5	-1.0	087	2.4	3.1	124	12.7	E	28	-19.3	****	240	09
10	-2.5	-5.6	-4.1	082	2.8	3.0	123	12.1	ENE	55	-12.0	****	335	10
11	-.3	-4.4	-2.3	073	1.9	2.1	066	7.6	ENE	62	-9.2	****	260	11
12	-2.9	-6.7	-4.8	066	1.0	1.3	057	4.4	NE	63	-10.1	****	210	12
13	3.3	-3.9	-.3	097	4.2	4.5	143	16.5	E	36	-12.6	****	315	13
14	2.6	-1.8	.4	108	5.3	5.8	143	24.8	E	59	-7.8	****	270	14
15	2.1	-3.3	-.6	124	5.1	5.9	113	24.1	ESE	72	-5.1	****	210	15
16	1.9	-3.6	-.8	094	3.3	3.9	133	21.6	E	51	-10.5	****	350	16
17	3.9	-1.6	1.2	094	4.5	4.9	145	19.7	E	45	-10.3	****	380	17
18	4.4	-1.4	1.5	099	4.5	4.9	118	22.2	ESE	42	-10.7	****	340	18
19	2.2	-9.7	-3.8	120	2.8	3.6	089	16.5	SSE	60	-13.4	****	265	19
20	-4.8	-10.1	-7.5	099	2.3	2.9	149	12.1	ENE	52	-19.6	****	335	20
21	1.7	-10.7	-4.5	094	3.0	3.5	110	16.5	E	47	-12.6	****	280	21
22	1.6	-3.1	-.8	093	3.4	3.7	113	10.8	E	65	-8.3	****	355	22
23	-1.5	-3.3	-2.4	117	6.2	6.9	129	23.5	E	69	-7.4	****	295	23
24	1.8	-5.7	-2.0	111	5.7	6.4	146	19.0	E	45	-15.3	****	360	24
25	2.7	-2.8	-.1	131	6.6	6.9	147	22.9	SE	43	-11.7	****	480	25
26	-3.0	-8.4	-5.7	055	.7	1.4	178	7.6	ENE	52	-15.6	****	440	26
27	-8.4	-12.6	-10.5	067	1.0	1.2	020	3.8	ENE	60	-16.7	****	240	27
28	-9.2	-13.7	-11.5	068	1.8	1.9	083	5.7	ENE	39	-26.6	****	535	28
29	-3.9	-10.9	-7.4	096	5.1	5.4	096	14.6	E	54	-14.7	****	495	29
30	.5	-4.1	-1.8	110	7.9	8.0	110	21.6	ESE	48	-11.3	****	590	30
31	-1.3	-3.9	-2.6	082	2.1	2.4	108	8.3	E	58	-11.7	****	500	31
MONTH	4.4	-13.7	-2.9	102	3.3	3.8	154	32.4	E	51	-13.0	****	10060	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 27.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 27.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 27.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 19.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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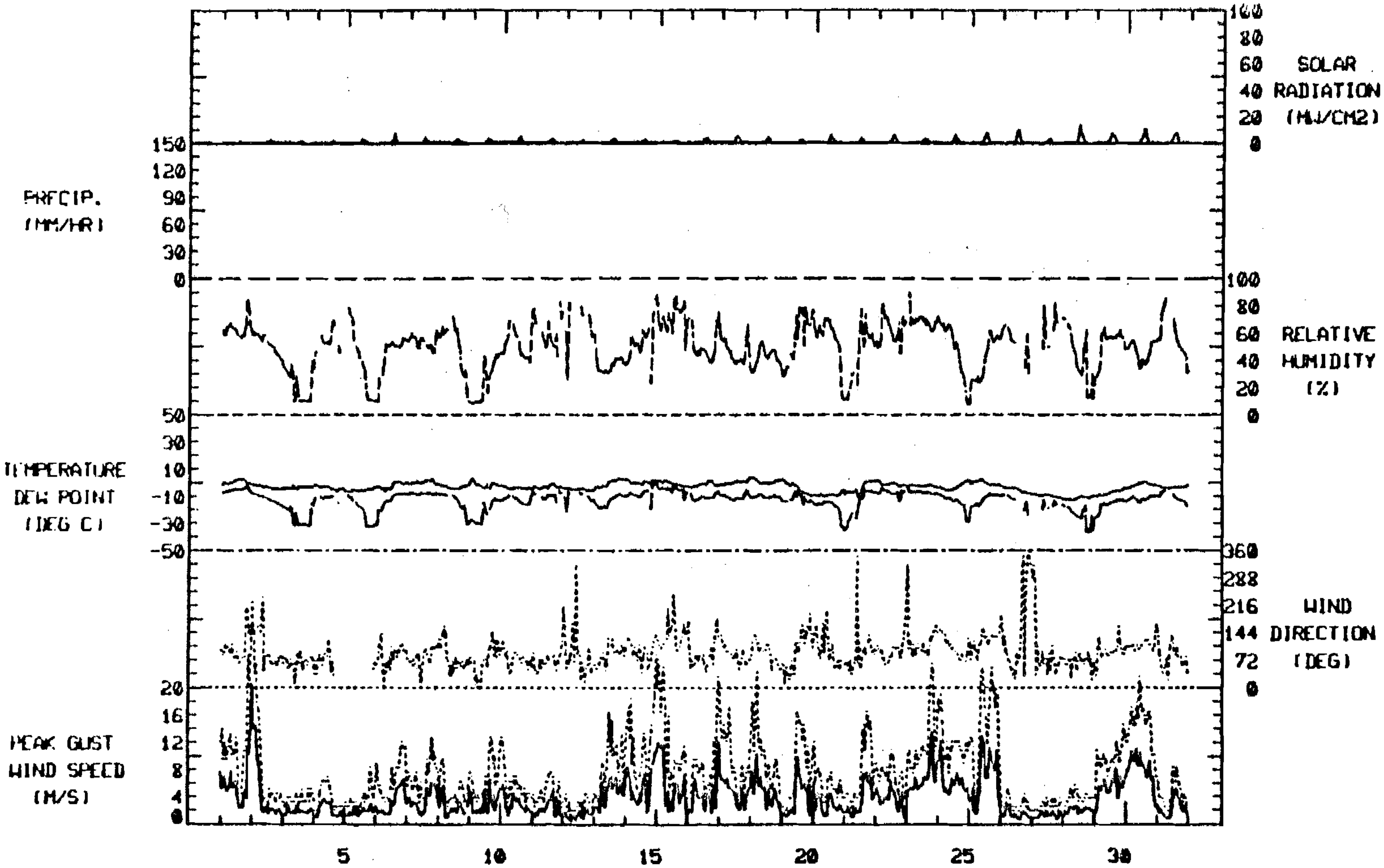
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	.4	-2.5	-1.0	130	3.4	4.4	151	21.6	ESE	62	-7.2	****	550	01
02	-.4	-6.2	-3.3	142	8.1	8.6	145	25.4	SSE	60	-10.8	****	610	02
03	-5.0	-7.4	-6.2	073	.7	1.7	124	7.6	NE	58	-14.2	****	350	03
04	-5.0	-6.3	-5.7	051	1.2	1.5	071	7.0	ENE	66	-18.8	****	400	04
05	-3.9	-5.8	-4.9	093	.9	1.2	098	4.4	ESE	70	-12.6	****	285	05
06	-2.6	-5.7	-4.1	089	.5	1.8	099	7.0	E	72	-9.2	****	350	06
07	-3.1	-7.6	-5.4	056	1.2	1.4	001	4.4	ENE	57	-12.6	****	615	07
08	-2.5	-5.2	-3.8	***	****	1.2	***	4.4	ENE	61	-10.6	****	770	08
09	-1.6	-8.3	-4.9	319	.3	1.2	018	4.4	N	62	-12.0	****	665	09
10	-7.0	-12.9	-10.0	293	.9	1.2	236	5.7	N	53	-16.7	****	365	10
11	-12.0	-15.3	-13.6	***	****	1.7	***	7.0	MSG	76	-18.6	****	420	11
12	-9.7	-19.2	-14.5	***	****	1.3	***	5.7	MSG	48	-23.4	****	1310	12
13	-12.3	-19.6	-15.9	***	****	1.5	***	4.4	MSG	55	-25.4	****	1575	13
14	-19.1	-25.7	-22.4	***	****	2.6	***	8.9	MSG	45	-30.8	****	1634	14
15	-14.3	-25.3	-19.8	***	****	1.3	***	5.1	MSG	44	-31.2	****	1605	15
16	-16.9	-21.8	-19.4	***	****	1.0	***	3.8	MSG	54	-26.1	****	1120	16
17	-9.4	-18.3	-13.9	***	****	1.6	***	4.4	MSG	34	-27.0	****	1476	17
18	-8.4	-18.1	-13.3	***	****	1.9	***	5.7	MSG	34	-25.9	****	1028	18
19	-6.5	-11.8	-9.1	***	****	1.7	080	6.3	E	61	-14.6	****	1010	19
20	-4.2	-8.9	-6.6	079	3.4	3.5	112	10.2	ENE	49	-15.3	****	1132	20
21	-3.6	-12.1	-7.9	100	4.1	3.5	125	12.7	ESE	51	-18.1	****	1216	21
22	-10.5	-13.4	-12.0	***	****	1.6	***	5.1	MSG	36	-26.3	****	1210	22
23	-3.9	-11.4	-7.6	***	****	1.1	***	3.8	MSG	58	-20.8	****	800	23
24	-5.2	-10.5	-7.9	***	****	1.3	020	5.1	NNE	50	-17.2	****	760	24
25	-2.6	-7.5	-5.1	057	1.3	1.6	102	8.9	NNE	61	-13.6	****	760	25
26	-2.5	-6.1	-4.3	055	.9	1.0	051	5.1	NE	58	-11.0	****	1130	26
27	-2.7	-8.3	-5.5	073	.6	.9	100	5.1	N	75	-11.5	****	786	27
28	-4.2	-7.1	-5.7	092	4.4	4.5	093	10.8	E	47	-14.9	****	1765	28
MONTH	.4	-25.7	-9.1	102	1.7	2.1	145	25.4	E	56	-17.7	****	25698	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 15.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 21.6
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 18.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 18.4

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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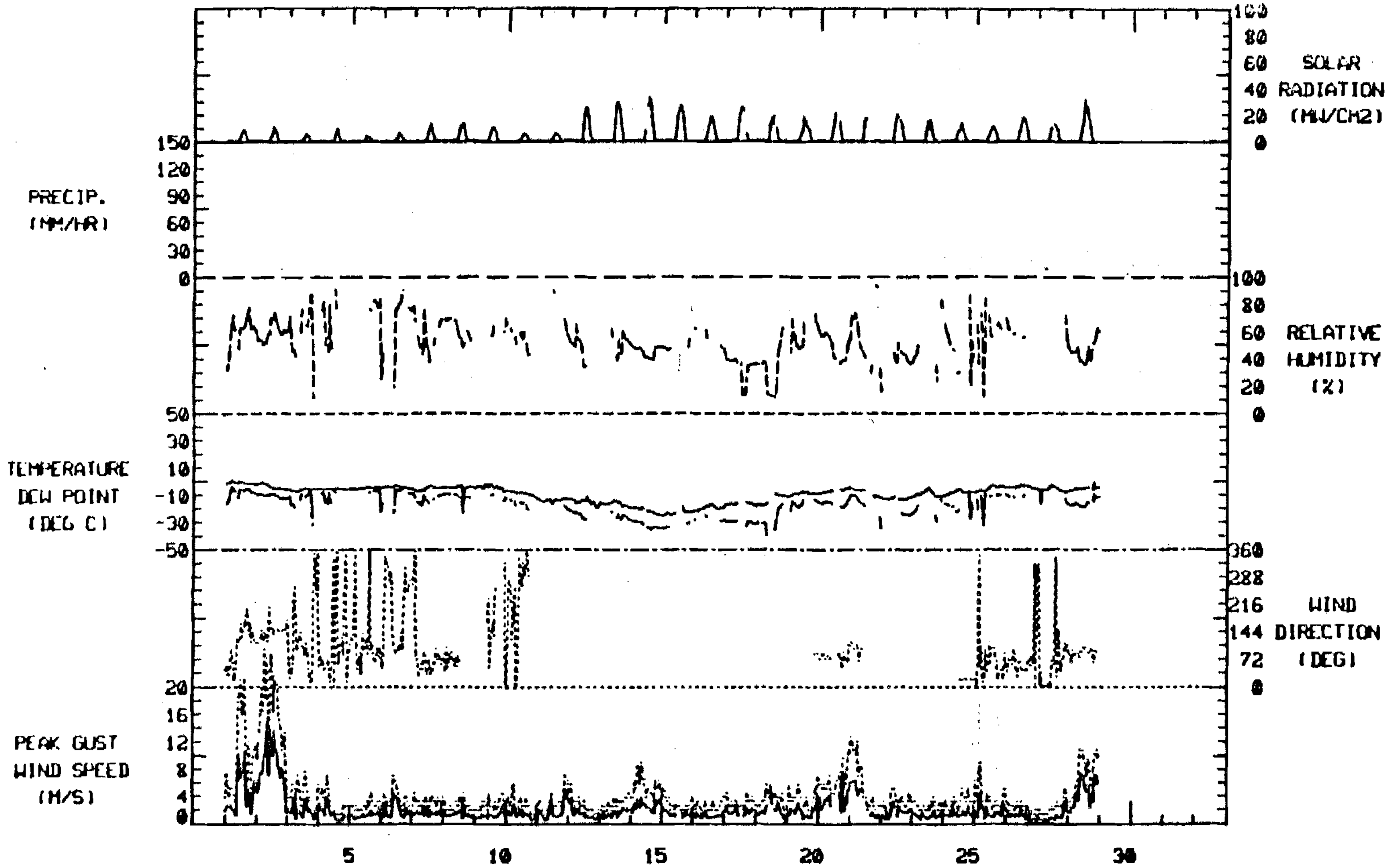
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 FEBRUARY, 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING MARCH , 1981

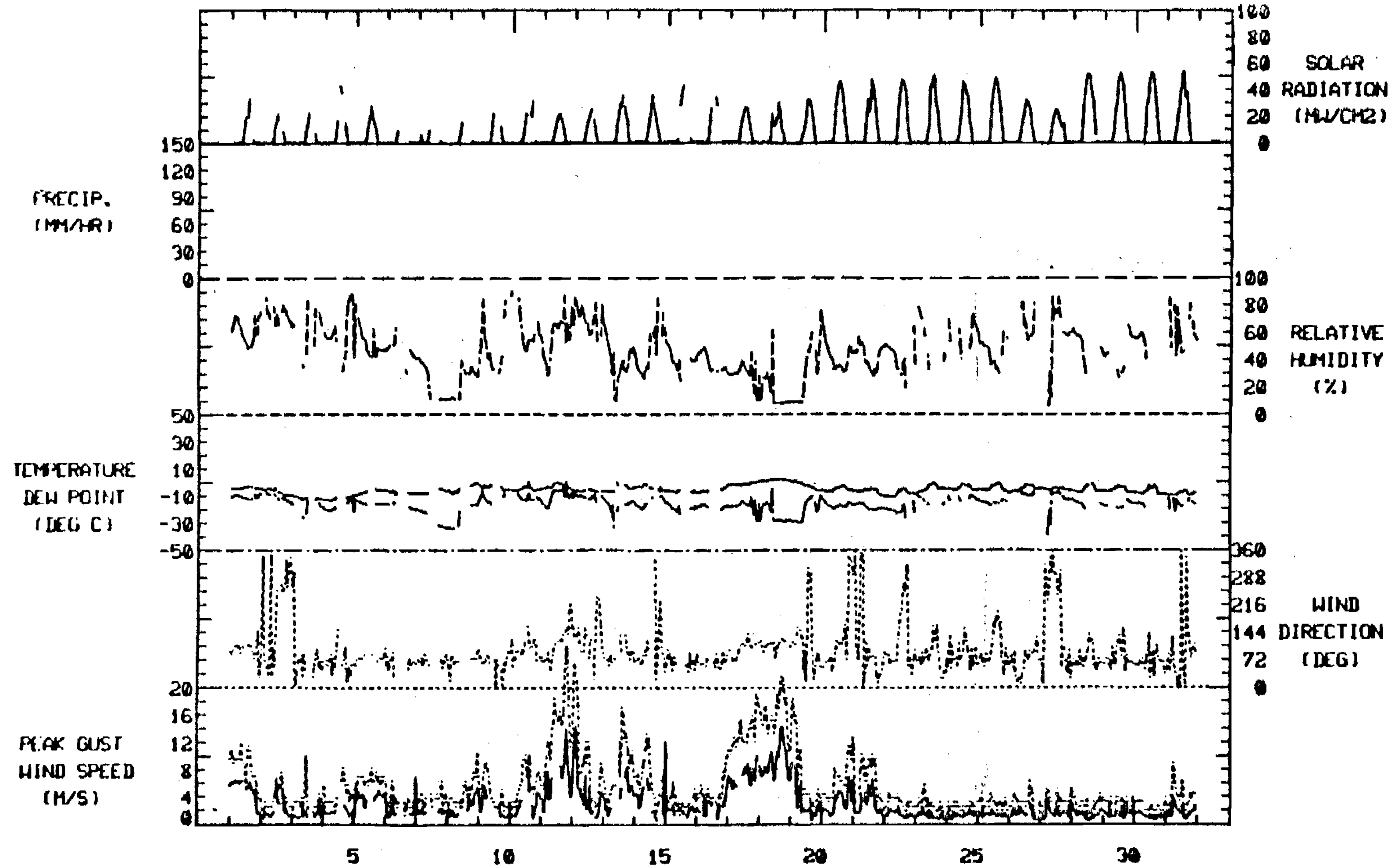
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-2.5	-5.0	-3.8	098	4.8	5.0	095	12.1	ESE	63	-10.1	****	1419	01
02	-2.4	-10.1	-6.3	286	.9	2.1	254	7.6	WSW	72	-11.9	****	1310	02
03	-6.1	-13.1	-9.6	052	1.1	1.4	020	9.9	NE	59	-18.2	****	1353	03
04	-7.4	-13.5	-10.5	066	1.7	1.9	085	8.3	ENE	60	-16.2	****	1942	04
05	-4.9	-9.5	-7.2	079	3.9	3.9	095	8.3	ENE	52	-15.2	****	1565	05
06	-4.0	-10.0	-7.0	066	1.7	1.8	114	7.0	ENE	46	-17.4	****	1372	06
07	-1.1	-8.6	-4.9	071	2.1	2.1	056	6.3	ENE	22	-27.1	****	1737	07
08	.4	-8.4	-4.0	077	2.4	2.5	106	10.8	ENE	26	-20.9	****	1248	08
09	0.0	-6.8	-3.4	071	2.4	2.6	074	8.9	ENE	55	-12.6	****	1658	09
10	-2.5	-6.7	-4.6	098	2.7	3.1	186	10.2	ESE	61	-11.9	****	1800	10
11	-.3	-6.0	-3.2	125	5.4	7.1	159	26.0	ESE	60	-10.0	****	1505	11
12	-4.9	-7.2	-6.1	124	4.1	4.7	129	23.5	SE	70	-10.6	****	1598	12
13	-.7	-7.0	-3.8	093	4.1	4.4	116	17.1	ENE	38	-19.2	****	2354	13
14	-.8	-6.7	-3.8	079	3.5	3.9	120	13.3	ENE	48	-14.0	****	2075	14
15	-1.9	-8.1	-5.0	070	1.8	1.9	079	6.3	ENE	36	-20.2	****	2297	15
16	-1.1	-7.7	-4.4	075	2.0	2.2	096	8.9	ENE	37	-17.7	****	2373	16
17	.8	-2.7	-.9	105	6.9	7.3	120	19.0	ESE	30	-17.5	****	1870	17
18	3.0	.1	1.5	113	9.2	9.4	130	22.2	ESE	16	-22.3	****	1830	18
19	1.2	-6.6	-2.7	112	2.6	3.5	123	18.4	ESE	33	-20.7	****	2130	19
20	-2.5	-7.5	-5.0	069	1.5	3.3	332	12.7	ESE	42	-17.1	****	3310	20
21	-4.1	-11.1	-7.6	057	2.2	3.1	328	10.8	NE	43	-18.0	****	2985	21
22	-3.7	-11.2	-7.5	082	.8	1.4	051	4.4	ENE	44	-19.9	****	3335	22
23	.7	-7.9	-3.6	078	.9	1.2	084	5.7	ENE	54	-13.3	****	3140	23
24	0.0	-6.8	-3.4	082	1.1	1.3	052	3.8	NE	56	-31.8	****	3100	24
25	1.0	-8.1	-3.6	096	.9	1.3	059	4.4	ENE	46	-14.6	****	3555	25
26	-1.1	-8.0	-4.6	064	1.1	1.5	106	6.3	E	62	-12.8	****	2430	26
27	-3.3	-6.4	-4.9	337	.4	1.6	234	5.1	WNW	56	-11.1	****	2075	27
28	4.7	-8.0	-1.7	072	1.3	1.4	069	4.4	ENE	48	-16.9	****	4045	28
29	-.7	-8.4	-4.6	082	1.3	1.5	059	3.8	ENE	45	-16.5	****	3875	29
30	.1	-9.4	-4.6	067	1.0	1.1	057	3.8	ENE	55	-15.0	****	3990	30
31	-5.5	-10.5	-8.0	065	1.4	1.8	062	8.9	NNE	63	-20.1	****	3765	31
MONTH	4.7	-13.5	-4.8	091	2.2	2.9	159	26.0	ENE	48	-16.8	****	73041	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 23.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 24.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 22.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 17.1

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01 MARCH , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING APRIL , 1981

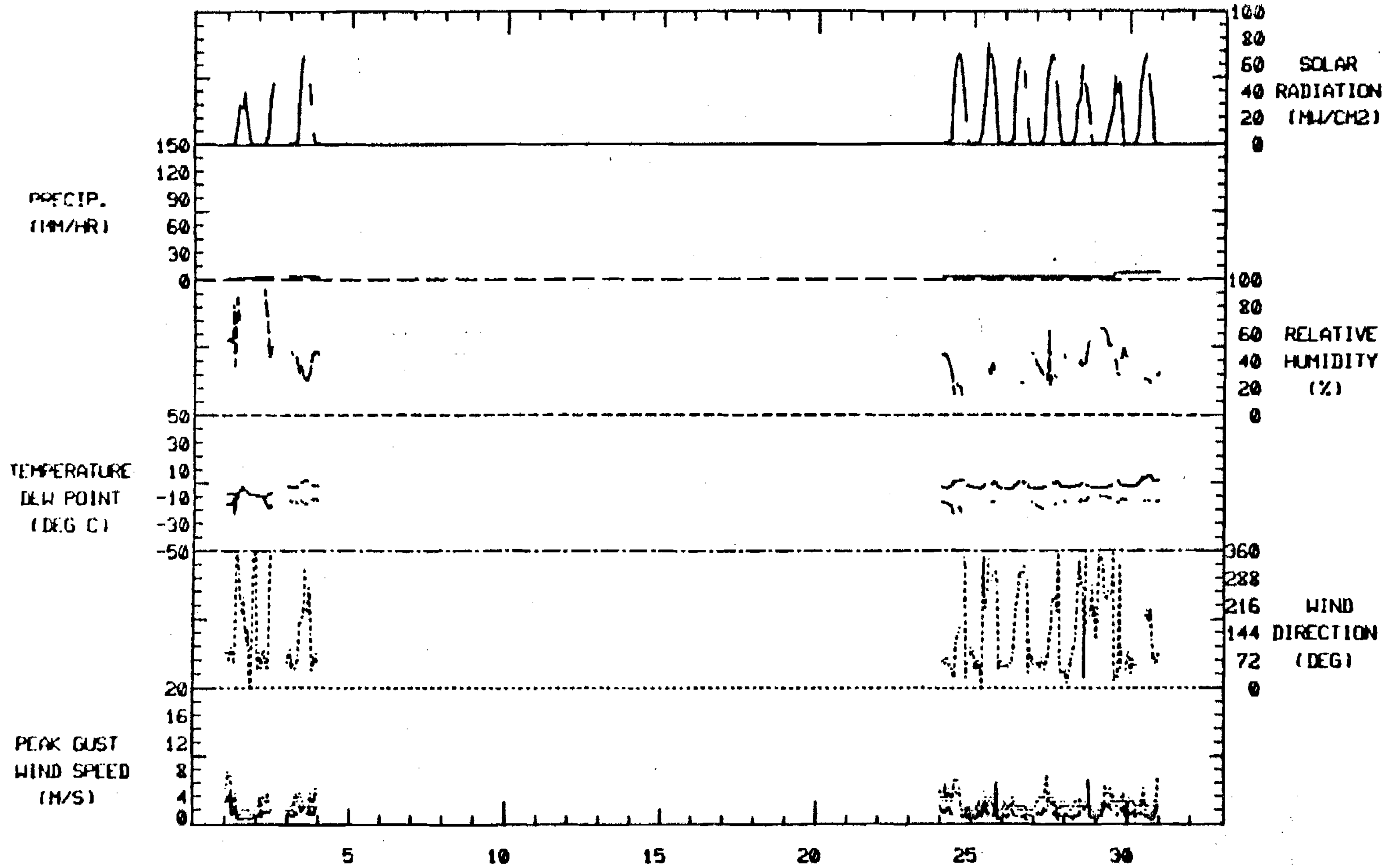
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-.1	-9.7	-4.9	078	.8	1.4	087	7.6	E	63	-24.0	2.4	2755	01
02	-7.2	-10.8	-9.0	***	****	1.3	065	4.4	ENE	57	-15.9	.2	3780	02
03	*****	*****	*****	***	****	.9	058	1.9	ENE	**	*****	.8	240	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	4.0	-3.0	.5	***	****	****	***	****	MSG	**	*****	****	***	22
23	2.6	-3.9	-.7	101	.7	1.5	090	5.1	NE	38	-14.0	0.0	5471	23
24	2.6	-4.2	-.8	085	1.3	1.8	126	6.3	ENE	32	-16.9	0.0	6015	24
25	1.8	-4.3	-1.3	298	.4	1.4	234	3.8	ENE	38	-13.7	0.0	5750	25
26	1.3	-4.8	-1.8	052	.4	1.1	162	3.8	ENE	37	-15.5	0.0	5355	26
27	1.6	-4.5	-1.5	073	.8	1.5	078	7.0	NE	34	-17.2	0.0	5821	27
28	.1	-3.8	-1.9	201	.1	1.4	326	3.8	SSE	46	-13.5	0.0	4195	28
29	2.0	-3.8	-.9	325	.5	1.8	237	5.7	WSW	49	-12.1	4.6	3950	29
30	7.1	-3.2	2.0	097	.8	1.3	101	7.0	E	31	-13.8	.6	4911	30
MONTH	7.1	-10.8	-1.8	076	.5	1.4	087	7.6	ENE	42	-15.7	8.6	48243	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   GLACIER WEATHER STATION

DATA START: 01   APRIL   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING MAY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	5.1	-2.2	1.5	076	1.0	2.0	065	8.3	NNE	32	-13.9	0.0	6395	01
02	5.1	-5.3	-.1	007	.2	1.3	226	4.4	NNE	41	-13.0	0.0	6258	02
03	2.8	-2.6	.1	124	1.4	2.5	179	7.6	ESE	42	-11.1	0.0	5045	03
04	4.3	-1.5	1.4	107	1.9	3.2	081	12.7	E	38	-12.0	0.0	5410	04
05	6.4	-1.1	2.7	063	.6	1.2	053	3.8	NE	37	-12.5	0.0	5863	05
06	9.0	.5	4.8	125	.4	1.2	172	3.8	ENE	28	-12.0	0.0	6423	06
07	11.9	5.9	8.9	083	1.5	2.1	141	7.6	ENE	18	-21.3	0.0	5656	07
08	12.1	4.7	8.4	105	.9	1.7	144	6.3	NE	18	-20.8	0.0	6403	08
09	8.6	3.1	5.9	030	.4	1.5	013	5.7	N	29	-12.8	0.0	4598	09
10	4.9	.3	2.6	267	.1	1.3	192	4.4	NNE	51	-6.7	0.0	4843	10
11	5.4	-.4	2.5	012	.2	1.4	237	5.1	NNE	44	-9.2	0.0	4957	11
12	8.4	.9	4.6	109	2.4	2.8	137	7.6	SE	29	-11.3	0.0	6924	12
13	9.1	3.1	6.1	087	.7	2.0	051	7.6	ENE	35	-8.8	0.0	6202	13
14	9.1	2.6	5.9	123	1.8	2.6	142	7.6	SE	40	-7.5	0.0	5933	14
15	10.0	2.9	6.4	134	.9	1.8	151	7.0	SSE	34	-8.3	0.0	6934	15
16	8.9	2.6	5.8	130	.5	1.9	214	6.3	NE	41	-7.8	0.0	6295	16
17	7.7	1.4	4.6	222	.5	1.3	180	5.1	SSW	45	-6.9	0.0	5468	17
18	6.4	.1	3.3	208	.2	1.6	246	11.4	N	51	-7.0	6.4	4475	18
19	5.0	1.3	3.2	113	3.7	4.0	132	13.3	ESE	46	-7.6	2.6	4115	19
20	6.1	-.2	3.0	140	2.7	3.6	151	14.0	SE	40	-11.1	1.0	4565	20
21	5.1	-2.5	1.3	219	.1	1.6	329	5.1	SSW	30	-15.4	0.0	6510	21
22	6.5	.4	3.4	250	.6	2.0	218	7.6	W	30	-13.8	0.0	6520	22
23	7.7	-.3	3.7	159	1.2	2.3	152	7.0	SSE	37	-10.4	0.0	7368	23
24	10.3	2.7	6.5	124	1.1	2.0	155	5.7	ENE	20	-20.0	0.0	6510	24
25	9.1	2.1	5.6	035	.4	1.5	070	7.0	NW	43	-5.9	3.8	4988	25
26	10.1	4.8	7.5	083	1.3	2.0	106	8.9	ESE	36	-6.7	.2	5813	26
27	11.1	5.9	8.5	179	.4	1.3	177	4.4	SSW	40	-3.5	0.0	4635	27
28	6.5	2.4	4.4	259	.4	1.4	240	5.7	S	58	-4.1	4.6	2463	28
29	15.4	2.3	8.9	135	.6	1.7	219	5.7	ENE	16	-18.7	0.0	7330	29
30	14.9	6.4	10.6	125	.7	2.1	066	10.2	ENE	21	-15.5	1.0	6707	30
31	7.7	1.1	4.4	183	.2	1.8	261	6.3	SSE	48	-7.1	14.4	2683	31
MONTH	15.4	-5.3	4.7	116	.7	2.0	151	14.0	ENE	36	-11.1	34.0	174283	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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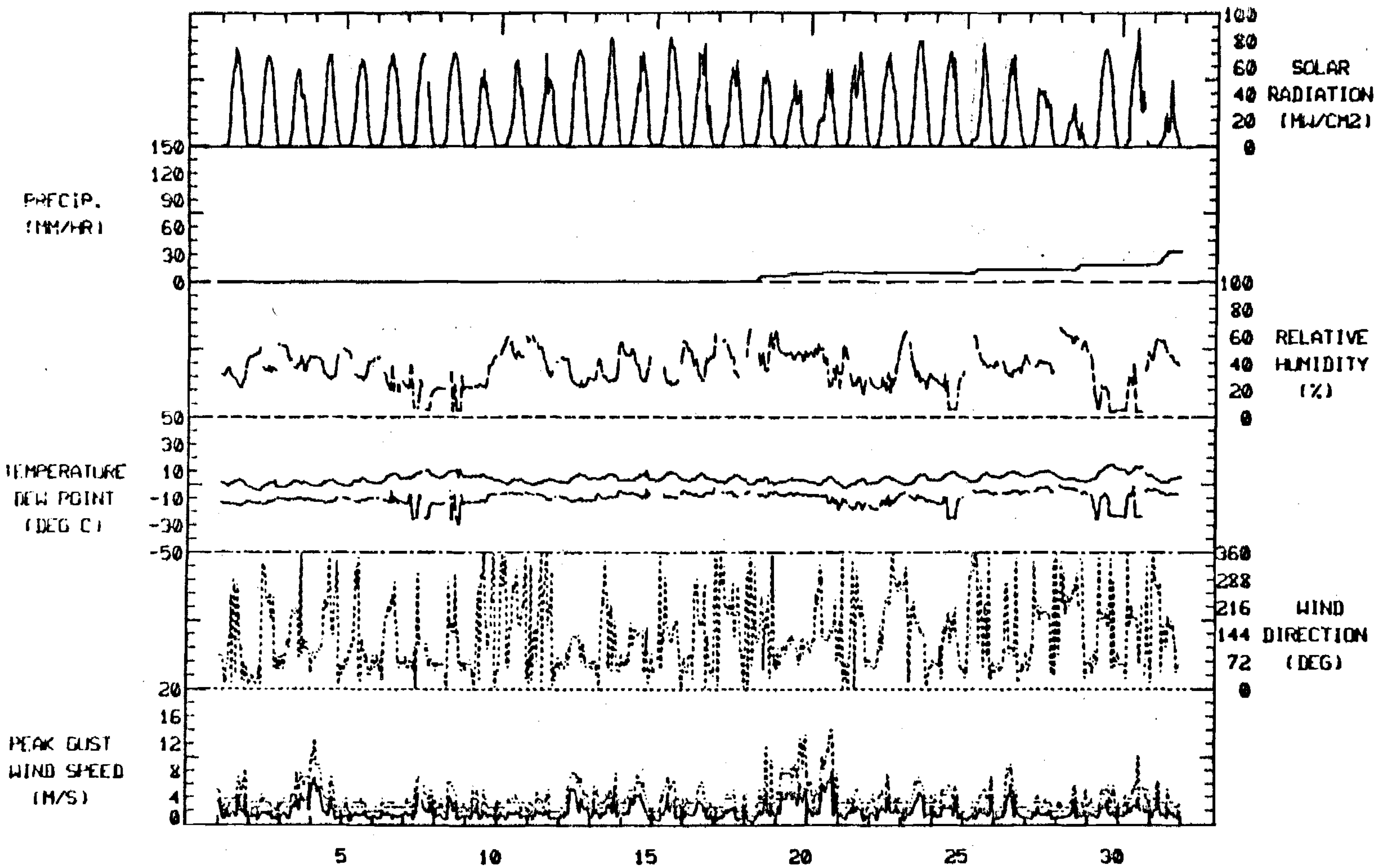
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH GLACIER WEATHER STATION

DATA START: 01 MAY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING JUNE , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	9.0	.9	4.9	143	.7	1.8	261	5.7	SE	32	-10.8	1.4	6448	01
02	8.3	.6	4.4	107	.0	1.6	229	6.3	NE	36	-10.0	5.2	5960	02
03	6.9	.1	3.5	129	.2	1.8	133	7.0	E	42	-8.7	4.2	4888	03
04	8.7	.3	4.5	277	.6	2.1	263	10.2	WSW	40	-8.9	.6	7070	04
05	11.9	-.8	5.6	032	.3	.7	334	2.5	NNW	43	-11.1	18.2	3840	05
06	9.7	-.9	4.4	059	.7	1.7	221	5.1	N	31	-17.2	7.2	7675	06
07	10.2	.1	5.2	133	.6	1.8	330	9.5	S	23	-20.4	2.8	7695	07
08	6.6	-.9	2.9	016	1.7	3.6	028	13.3	NNE	29	-14.8	0.0	3820	08
09	6.0	-1.1	2.5	228	.9	1.4	250	5.7	SW	31	-17.0	3.2	5405	09
10	9.0	-.1	4.4	150	.8	1.6	167	5.1	NNE	09	-27.2	0.0	7847	10
11	10.6	2.8	6.7	111	.9	2.2	224	8.9	ENE	12	-27.5	0.0	6203	11
12	12.1	3.4	7.8	174	.7	1.6	160	5.7	SSW	16	-24.7	0.0	7625	12
13	14.3	7.5	10.9	101	1.8	2.6	114	8.9	ENE	05	-27.2	0.0	7083	13
14	13.4	5.1	9.3	165	.7	1.9	278	10.2	ESE	16	-20.6	0.0	6925	14
15	13.6	6.6	10.1	102	.9	2.1	098	10.8	NNE	15	-20.5	0.0	7148	15
16	14.0	5.9	10.0	126	1.2	2.0	145	7.0	E	11	-25.2	0.0	7575	16
17	15.2	8.7	12.0	100	.8	2.0	016	7.6	ENE	05	-27.0	0.0	7850	17
18	12.7	7.0	9.9	072	.8	2.4	333	9.5	N	10	-22.1	.4	4483	18
19	12.1	6.0	9.1	029	2.9	3.3	018	10.8	NNE	11	-24.2	0.0	7918	19
20	12.8	6.6	9.7	150	1.0	1.8	241	5.7	SSE	09	-23.7	0.0	6625	20
21	9.4	4.2	6.8	248	1.2	1.7	256	6.3	WSW	37	-7.3	1.0	5548	21
22	11.3	3.8	7.6	209	.5	2.0	331	8.3	S	27	-11.6	.2	6510	22
23	11.9	5.8	8.9	116	1.4	2.7	013	7.6	SSE	16	-17.4	0.0	7928	23
24	12.7	4.7	8.7	241	.2	1.7	019	7.0	SSW	22	-13.1	2.8	6908	24
25	11.0	3.7	7.4	208	.4	1.5	140	6.3	NW	35	-8.6	.4	5205	25
26	5.6	1.1	3.4	229	1.6	2.9	214	10.8	SW	52	-6.2	17.4	820	26
27	7.4	-.4	3.5	020	.9	1.3	102	5.1	N	38	-12.1	30.2	3388	27
28	14.2	-.4	6.9	041	.7	1.1	353	3.8	N	27	-16.7	24.2	5600	28
29	7.8	-.9	3.5	049	.8	1.4	127	4.4	ENE	32	-13.9	5.8	4793	29
30	12.3	-2.5	4.9	076	.3	1.4	205	9.5	NE	27	-16.4	16.2	5408	30
MONTH	15.2	-2.5	6.6	102	.3	1.9	028	13.3	NNE	25	-17.1	141.4	182185	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 11.4
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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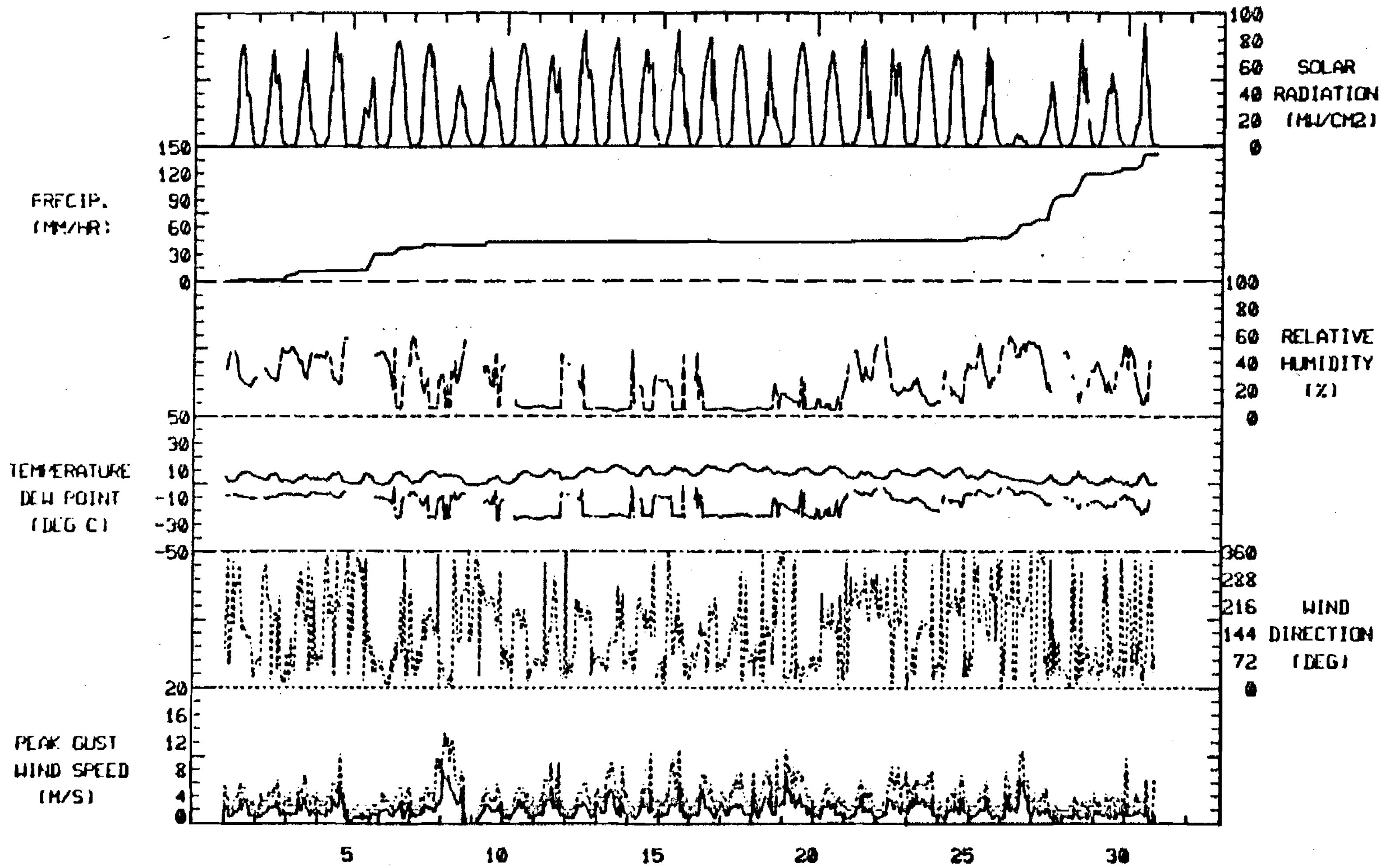
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH GLACIER WEATHER STATION

DATA START: 01 JUNE , 1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	7.2	.2	3.7	086	1.9	2.2	128	6.3	E	16	-21.6	2.0	7753	1
2	5.3	1.6	3.5	117	2.1	2.5	084	7.6	ESE	18	-19.7	0.0	5790	2
3	6.7	1.5	4.1	147	2.5	3.2	223	10.2	SE	16	-20.3	0.0	7943	3
4	8.5	1.8	5.2	078	.2	1.5	188	4.4	NE	14	-21.5	1.8	6805	4
5	2.9	.2	1.6	302	.8	1.7	251	6.3	W	43	-9.8	29.0	2778	5
6	8.2	.7	4.5	351	.6	1.4	320	7.6	NNE	28	-14.1	4.8	6445	6
7	4.8	.3	2.6	190	2.8	3.8	188	17.8	SSW	42	-9.3	7.8	1723	7
8	5.1	-.3	2.4	121	.5	1.2	173	5.7	SSE	41	-8.9	23.6	1343	8
9	5.4	3.5	4.5	218	.9	1.5	200	7.0	WSW	45	-6.5	27.6	1260	9
10	6.6	2.6	4.6	036	1.0	1.5	119	5.7	N	35	-10.1	45.2	1798	10
11	4.9	2.6	3.8	041	1.2	1.8	010	5.7	NNE	34	-10.8	35.4	2155	11
12	7.1	2.4	4.8	083	.1	1.5	099	3.8	SSW	29	-11.9	4.2	3395	12
13	7.2	4.8	6.0	063	.3	1.5	296	4.4	SSE	29	-11.4	1.6	2873	13
14	6.9	4.6	5.8	087	.6	1.5	122	5.1	ESE	30	-10.7	10.6	2140	14
15	8.8	4.7	6.8	029	.4	1.1	127	3.8	N	32	-9.4	15.8	2888	15
16	9.5	6.7	8.1	053	.5	1.3	184	3.8	NNE	31	-7.9	12.6	2790	16
17	10.9	6.6	8.8	108	.5	1.3	135	5.1	E	28	-10.1	13.0	3550	17
18	9.5	4.9	7.2	082	.2	1.4	198	7.6	ESE	29	-10.3	4.8	2933	18
19	7.5	4.7	6.1	117	.3	1.4	073	3.2	SSE	32	-10.1	11.8	2973	19
20	7.3	5.1	6.2	079	.2	1.2	036	4.4	NNE	34	-9.0	8.0	2645	20
21	11.0	4.8	7.9	195	.7	1.2	169	4.4	SSW	29	-10.2	1.4	4455	21
22	9.5	5.5	7.5	164	.4	1.2	028	4.4	S	28	-10.5	2.4	3515	22
23	10.4	5.3	7.9	140	.5	1.3	061	4.4	SE	27	-11.0	11.8	3700	23
24	10.3	6.0	8.2	064	.5	1.3	111	5.7	NNE	26	-11.2	2.6	2555	24
25	8.5	3.9	6.2	016	.4	1.2	012	5.1	NNE	31	-9.9	15.0	2603	25
26	7.6	3.6	5.6	182	.4	1.1	038	4.4	S	32	-10.3	4.4	3088	26
27	10.3	5.5	7.9	054	.1	1.2	347	4.4	N	21	-13.7	0.0	3813	27
28	10.3	4.6	7.5	083	.2	1.4	138	5.1	ESE	28	-11.2	1.4	2710	28
29	8.1	4.0	6.1	161	.6	1.3	157	3.8	SSE	31	-10.8	4.0	3770	29
30	9.0	4.3	6.7	202	.4	1.2	162	3.8	SSW	27	-12.2	.2	4043	30
31	6.9	4.3	5.6	085	.6	1.5	036	7.6	NE	32	-10.0	21.4	1820	31
MONTH	11.0	-.3	5.7	119	.4	1.6	188	17.8	NNE	30	-11.8	324.2	108046	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 16.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 17.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 16.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 15.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

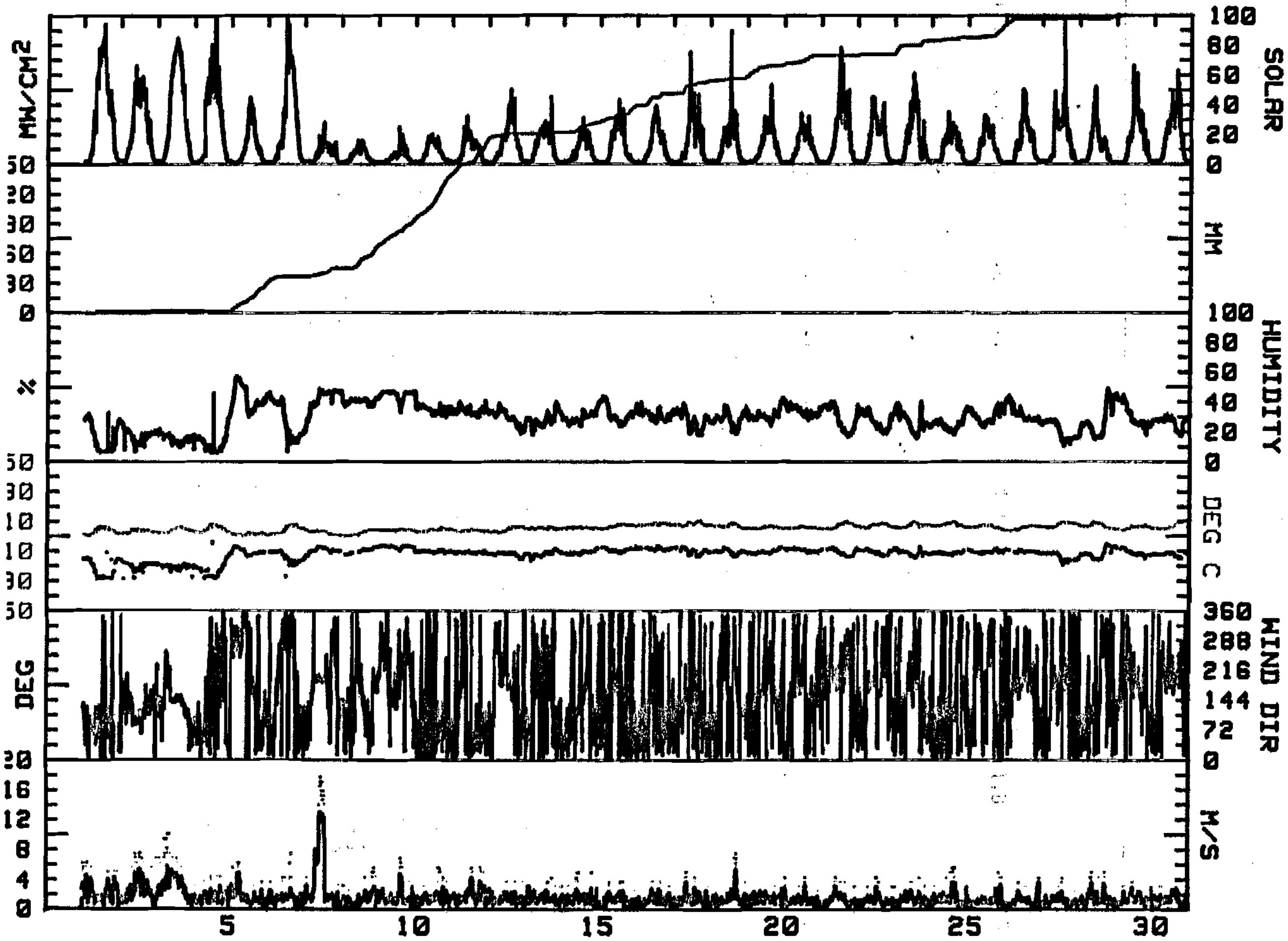
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

GLACIER WEATHER STATION

July, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	7.7	4.5	6.1	059	.9	1.5	126	5.7	NNE	32	-10.1	31.8	1388	1
2	8.4	4.3	6.4	179	.4	1.3	115	5.7	SSE	28	-12.1	2.4	3580	2
3	10.3	4.5	7.4	085	.9	2.3	084	8.9	NNE	16	-19.5	0.0	5690	3
4	12.8	5.2	9.0	069	1.7	2.9	055	10.8	NE	9	-25.1	0.0	6308	4
5	10.4	6.9	8.7	108	2.1	2.8	119	13.3	E	11	-20.1	0.0	3100	5
6	8.8	4.6	6.7	101	2.1	2.8	130	14.0	E	20	-14.8	9.4	1530	6
7	7.2	4.3	5.8	050	1.4	1.8	077	6.3	NNE	29	-11.1	39.2	960	7
8	9.2	2.0	5.6	112	1.7	2.8	115	11.4	ESE	29	-10.9	11.4	2425	8
9	7.7	2.0	4.9	066	.8	1.7	149	8.9	NNE	33	-11.2	25.2	1943	9
10	9.5	1.8	5.7	110	1.0	2.3	128	12.1	SSE	30	-11.9	11.6	3075	10
11	7.3	1.5	4.4	078	.5	1.7	133	10.2	NNE	34	-11.4	14.8	2625	11
12	4.5	.6	2.6	007	1.5	1.7	015	3.8	N	34	-12.0	28.0	1870	12
13	6.0	-.2	2.9	343	.3	1.5	248	10.2	N	38	-11.6	12.2	2470	13
14	3.2	-.7	1.3	088	1.0	1.6	131	10.2	ESE	33	-14.6	19.2	2258	14
15	4.8	-2.5	1.2	078	.3	1.0	070	8.3	ESE	35	-15.6	19.0	1745	15
16	4.0	-4.7	-.4	187	.4	2.0	197	13.3	ENE	23	-22.7	1.8	4075	16
17	14.3	-4.2	5.1	071	1.6	1.8	052	5.7	ENE	15	-25.5	5.0	5303	17
18	8.9	.5	4.7	058	.8	1.0	061	3.2	NE	18	-17.9	18.2	4548	18
19	6.3	1.7	4.0	053	1.4	1.7	076	8.3	NNE	23	-15.8	16.2	3150	19
20	8.5	2.6	5.6	072	3.0	3.3	085	11.4	E	17	-18.8	5.6	3240	20
21	8.6	.9	4.8	113	2.3	3.5	136	15.2	E	19	-18.7	10.0	2968	21
22	5.2	.5	2.9	000	.8	1.2	020	3.2	N	32	-12.9	14.6	2965	22
23	6.8	1.1	4.0	055	.4	1.3	058	4.4	ENE	21	-17.5	.2	3820	23
24	11.8	5.0	8.4	128	.4	1.4	200	4.4	ENE	11	-20.7	0.0	5050	24
25	14.1	8.1	11.1	109	.5	1.4	118	3.8	NE	12	-17.4	0.0	3478	25
26	17.7	11.1	14.4	112	.2	1.5	047	4.4	ENE	9	-18.1	0.0	4855	26
27	17.4	10.0	13.7	093	.7	1.7	136	6.3	ENE	9	-19.8	0.0	4795	27
28	15.5	9.4	12.5	158	.3	1.6	153	5.7	NE	8	-20.8	0.0	4788	28
29	14.6	6.4	10.5	161	.6	1.5	167	5.1	E	10	-24.0	0.0	4580	29
30	8.8	4.6	6.7	288	.1	1.2	122	5.1	N	29	-11.0	3.6	2578	30
31	8.5	2.5	5.5	182	.5	3.2	315	12.1	SE	19	-21.9	.8	4648	31
MONTH	17.7	-4.7	6.2	084	.8	1.9	136	15.2	ENE	22	-16.6	300.2	105803	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 15.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS TH[AN] ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

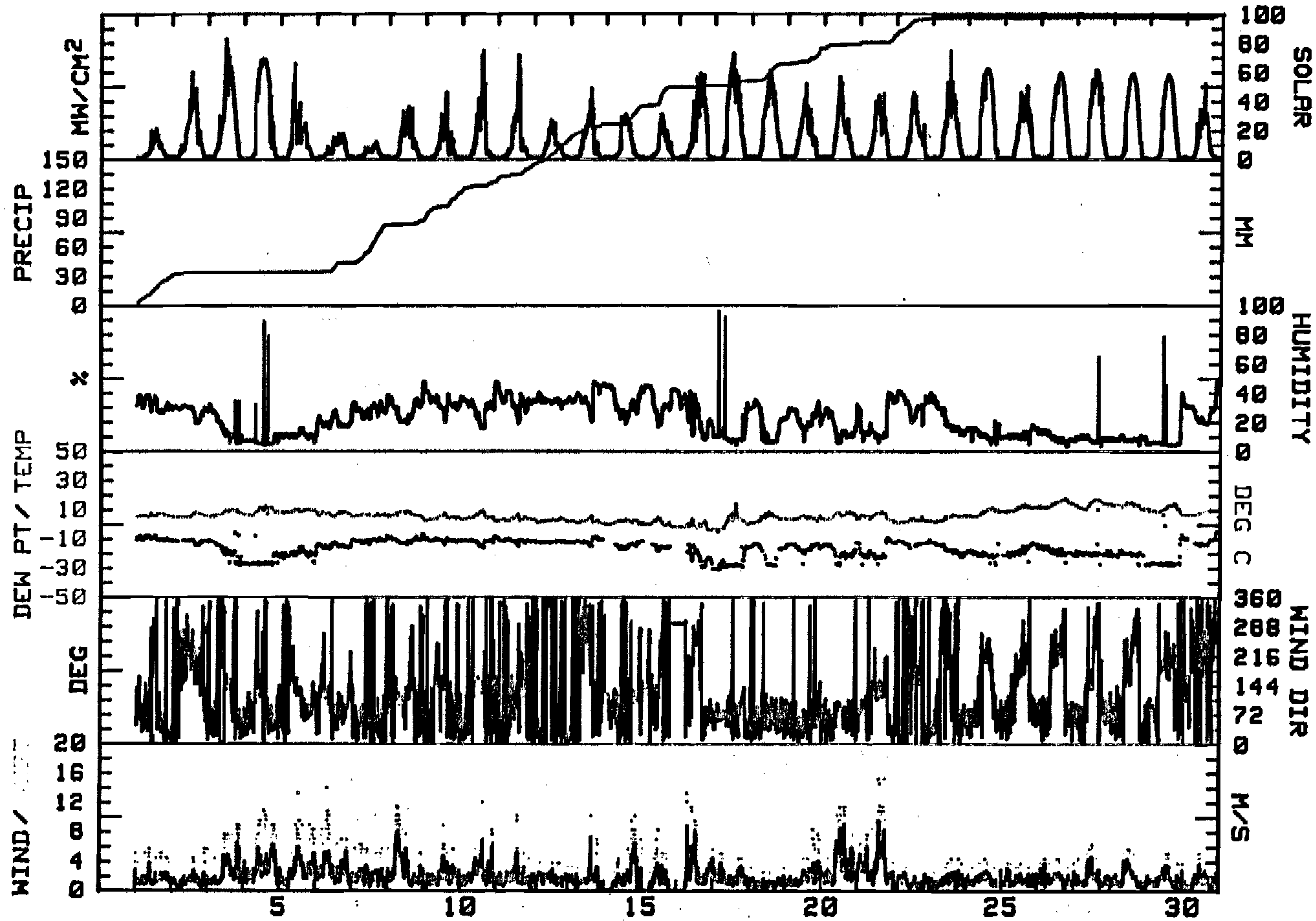
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

GLACIER WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR GLACIER WEATHER STATION
DATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	10.0	2.1	6.1	118	.8	1.7	079	5.7	NE	11	-24.8	0.0	4500	1
2	8.8	3.0	5.9	314	.3	1.3	301	4.4	N	17	-20.5	0.0	3018	2
3	7.2	3.0	5.1	194	.3	1.1	171	3.8	SSW	24	-14.7	0.0	2758	3
4	5.4	3.3	4.4	170	.2	1.2	135	4.4	ESE	21	-16.4	.4	2828	4
5	7.4	3.4	5.4	080	.8	1.5	098	8.3	E	20	-16.1	2.0	2428	5
6	8.5	.1	4.3	111	.7	1.8	215	14.6	ENE	25	-14.8	2.2	2805	6
7	5.6	.5	3.1	056	.7	1.3	059	4.4	ENE	25	-17.1	11.8	2823	7
8	6.8	-.1	3.4	127	.7	1.8	080	6.3	S	23	-17.3	3.0	3915	8
9	6.8	2.0	4.4	075	.8	1.7	273	5.7	NE	20	-17.3	.4	2985	9
10	5.4	1.4	3.4	092	.3	1.7	149	7.6	SW	26	-14.9	.4	2968	10
11	4.0	-.5	1.8	084	.3	1.3	268	5.7	N	29	-14.8	.4	2173	11
12	7.2	-.5	3.4	097	1.8	2.1	106	7.6	ESE	28	-15.5	9.8	2525	12
13	3.2	.2	1.7	092	1.4	2.2	111	7.0	E	27	-15.6	.6	2375	13
14	6.8	.3	3.6	056	1.2	1.9	349	7.0	NE	23	-15.5	0.0	3363	14
15	5.4	-.1	2.7	099	.6	1.5	157	7.6	N	29	-15.2	15.2	1418	15
16	4.1	-.8	1.7	093	2.3	2.6	087	9.5	E	26	-15.9	4.2	1925	16
17	7.0	.7	3.9	082	2.1	2.9	065	11.4	E	22	-16.3	0.0	3610	17
18	7.0	1.4	4.2	067	.9	1.9	072	7.0	NE	25	-15.8	0.0	2740	18
19	5.3	-.4	2.5	049	.9	1.6	088	6.3	NNE	30	-14.0	9.8	1430	19
20	3.7	-1.1	1.3	012	.0	.8	032	3.8	NE	32	-15.7	5.2	1890	20
21	1.3	-2.6	-.7	033	.3	1.2	093	3.8	NNE	24	-18.8	.6	2063	21
22	1.0	-5.0	-2.0	330	.2	1.4	235	4.4	NNW	24	-20.6	0.0	2825	22
23	-.5	-4.7	-2.6	046	.5	1.2	224	4.4	N	29	-18.6	.2	1323	23
24	-2.5	-7.2	-4.9	038	.9	2.4	088	8.9	E	27	-21.3	0.0	1848	24
25	-.9	-7.7	-4.3	113	1.6	2.1	125	7.0	ESE	19	-25.3	0.0	2670	25
26	-1.7	-9.6	-5.7	051	1.5	1.6	066	5.1	NE	18	-27.8	.2	2975	26
27	-3.5	-9.6	-6.6	068	1.0	1.4	046	3.8	NE	17	-28.7	0.0	2883	27
28	-1.3	-9.6	-5.5	044	1.5	1.9	118	7.0	NNE	17	-28.4	0.0	2608	28
29	3.1	-8.9	-2.9	059	1.3	1.9	095	8.3	NE	17	-26.1	0.0	2425	29
30	1.6	-6.7	-2.6	103	1.3	2.3	244	10.8	SSE	19	-23.0	0.0	2768	30
MONTH	10.0	-9.6	1.1	079	.8	1.7	215	14.6	NE	23	-18.9	66.4	78858	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS	3.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL	3.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL	10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS	5.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS TH[AN] ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAIL[Y] OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

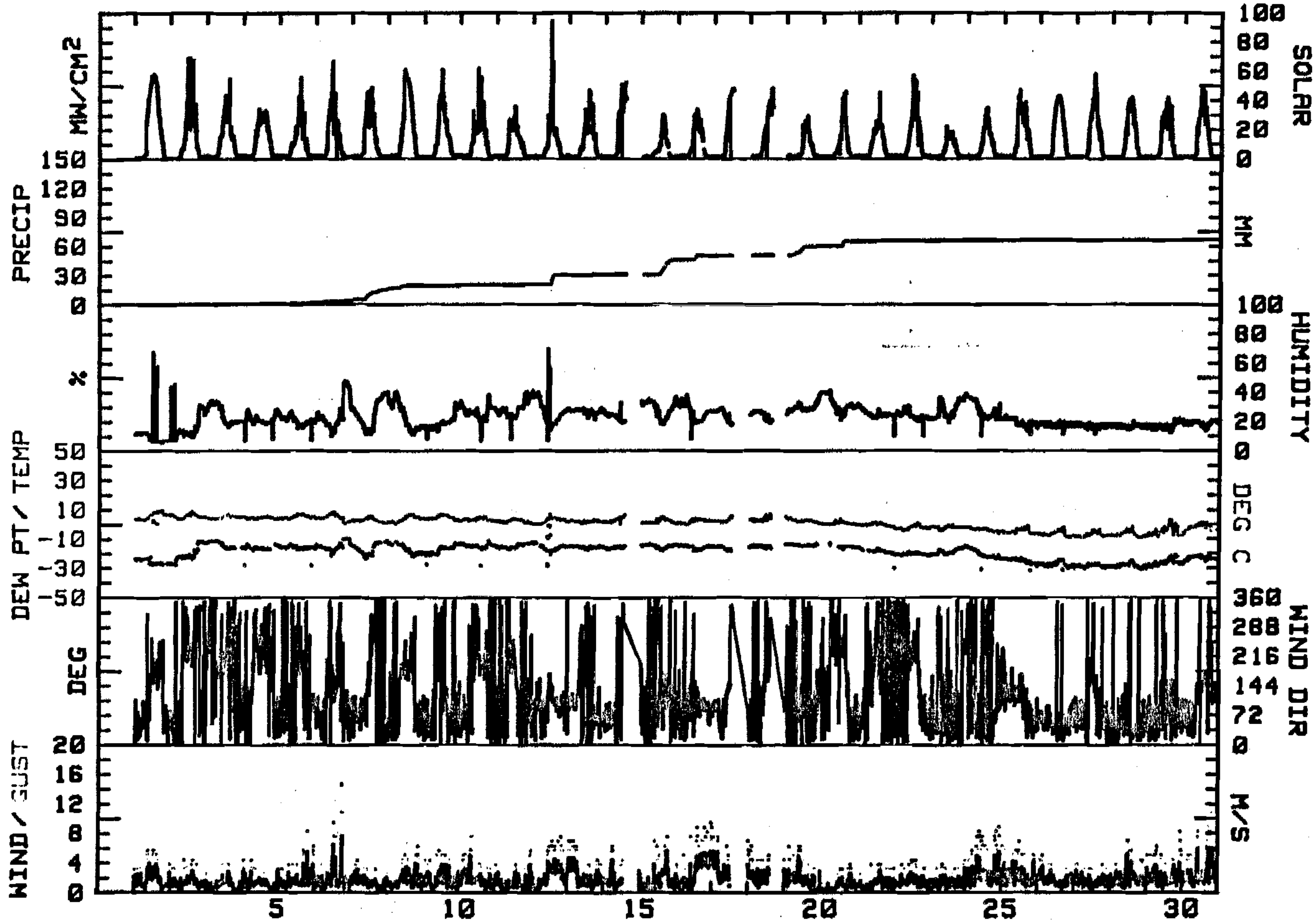
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

GLACIER WEATHER STATION

September, 1981



ATTACHMENT E.5, PART 2

DENALI CLIMATE DATA

susi11/k13

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING JULY , 1980

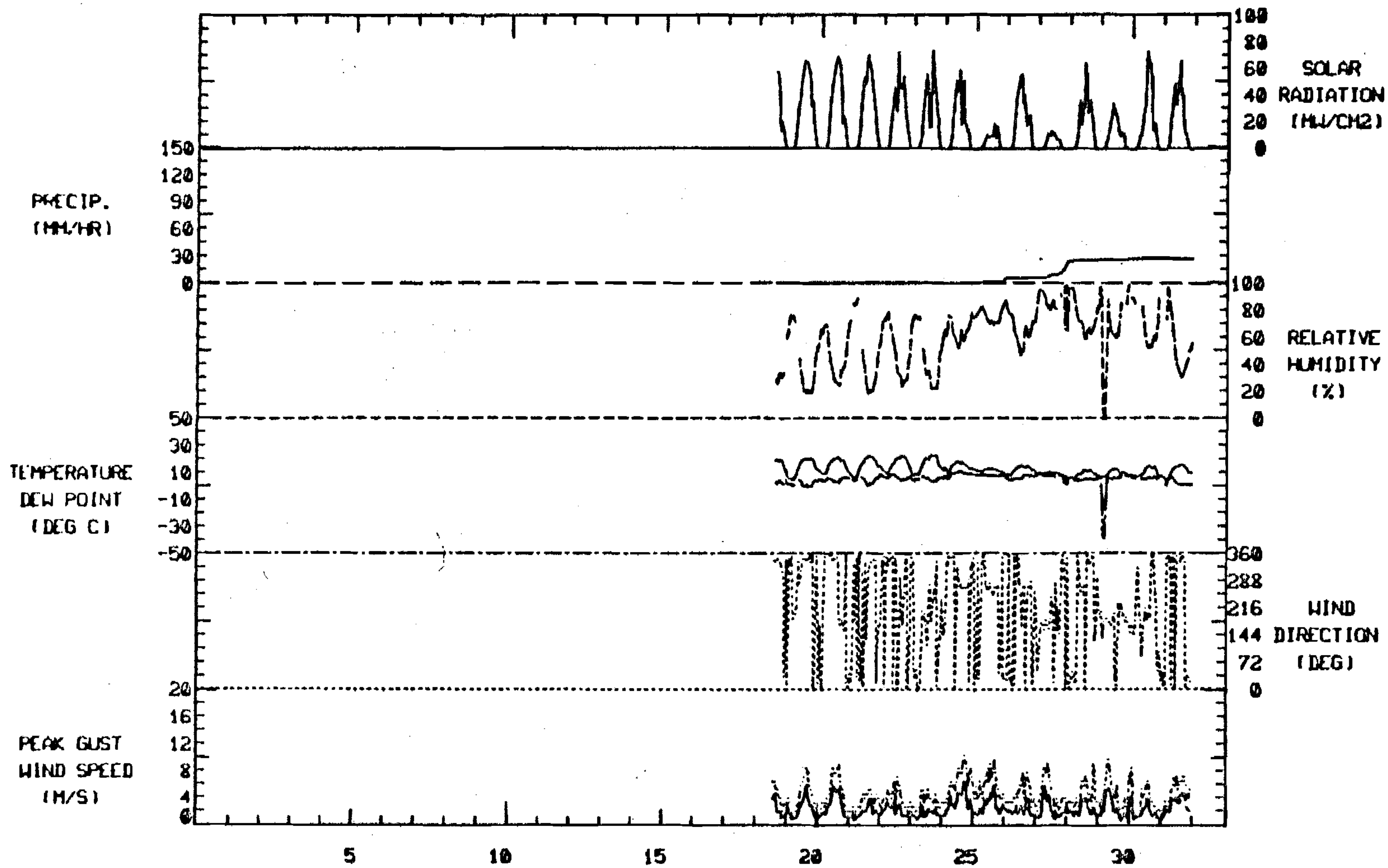
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	19.4	4.8	12.1	***	****	2.4	341	6.3	NNW	37	.4	0.0	4314	18
19	20.6	2.6	11.6	343	1.8	2.3	339	8.3	NNW	42	-1.9	.2	6493	19
20	20.8	7.7	14.3	343	1.0	2.7	168	8.9	NNW	47	2.8	0.0	6320	20
21	22.2	5.5	13.9	345	.9	1.7	332	5.1	NNW	44	1.9	0.0	6350	21
22	22.6	7.7	15.1	341	1.4	2.1	002	7.0	NNW	51	3.8	0.0	5565	22
23	23.7	7.1	15.4	261	.2	1.6	177	5.1	N	45	3.4	0.0	5523	23
24	19.0	8.2	13.6	302	2.4	3.3	271	10.2	W	66	8.0	.6	4518	24
25	13.1	9.1	11.1	293	1.7	2.7	268	9.5	W	77	7.3	4.6	1330	25
26	15.4	7.2	11.3	324	1.1	2.1	277	7.6	NNE	66	5.7	.6	4840	26
27	10.2	6.1	8.2	181	1.1	2.1	165	8.9	S	87	6.9	18.4	1150	27
28	12.7	5.6	9.2	339	1.2	2.1	159	8.9	NNW	76	4.4	1.4	4375	28
29	12.7	6.0	9.4	182	1.8	2.2	172	9.5	S	66	-.6	1.2	2653	29
30	14.5	6.2	10.4	181	1.0	1.8	164	8.3	S	70	5.1	.6	4813	30
31	16.1	3.7	9.9	357	2.5	2.7	355	7.0	NNW	52	-13.2	0.0	5053	31
MONTH	23.7	2.6	11.8	318	.8	2.3	271	10.2	NNW	59	2.4	27.6	63295	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.0
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 18   JULY , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	16.1	4.0	10.0	356	2.7	3.0	312	7.6	NNE	50	.5	0.0	5993	01
02	12.9	2.4	7.6	172	2.1	2.7	158	10.6	S	67	3.8	1.6	2725	02
03	14.6	6.5	10.6	335	.8	2.0	294	6.3	N	68	5.8	1.6	2928	03
04	16.3	7.7	12.0	306	1.6	2.6	268	7.6	W	64	4.8	0.0	3168	04
05	20.1	3.5	11.8	325	.7	1.8	265	6.3	NNW	62	5.1	0.0	5233	05
06	18.3	7.6	13.0	260	1.2	2.5	265	8.3	W	69	8.1	0.0	3690	06
07	11.1	6.8	9.0	267	.4	1.4	068	5.7	W	70	-27.0	10.6	1155	07
08	11.9	6.3	9.1	172	1.4	2.0	171	8.9	SSE	74	5.3	.2	2098	08
09	14.4	8.7	11.6	147	4.8	5.1	142	15.9	SE	55	3.1	0.0	2390	09
10	20.7	7.0	13.9	174	2.6	3.0	179	10.8	S	46	3.2	0.0	5335	10
11	22.6	5.8	14.2	176	1.8	2.3	177	8.9	S	43	4.7	0.0	5265	11
12	23.3	6.6	15.0	205	1.3	2.1	236	12.7	S	31	-19.8	0.0	5060	12
13	8.4	5.2	6.6	269	3.4	3.6	270	10.2	W	31	-13.6	4.0	745	13
14	11.1	5.3	8.2	283	1.5	2.2	275	7.0	W	43	-7.2	1.2	1623	14
15	9.0	5.0	7.0	302	.1	1.3	244	3.8	N	23	-16.5	2.0	1640	15
16	10.4	4.8	7.6	005	1.1	2.2	339	8.9	N	23	-13.6	2.4	2483	16
17	14.4	5.1	9.8	136	2.0	3.9	128	14.6	SSE	41	-7.6	.4	3643	17
18	10.5	4.9	7.7	279	1.0	2.0	235	10.2	W	18	-20.1	5.2	1858	18
19	11.9	5.4	8.6	284	.8	1.6	258	8.3	W	29	-22.8	1.0	2873	19
20	10.1	4.0	7.1	210	.8	1.6	257	7.0	WSW	24	-21.9	.8	2690	20
21	10.4	2.5	6.4	167	1.4	2.3	172	8.9	S	27	-15.4	.8	2435	21
22	13.3	1.0	7.1	345	3.2	3.5	312	9.5	NNW	37	-12.2	0.0	4535	22
23	16.0	-1.2	7.4	345	1.3	1.6	318	5.1	N	35	-6.6	0.0	5110	23
24	16.3	.5	8.4	342	.7	1.2	308	5.1	NNE	36	-1.0	0.0	4130	24
25	12.8	3.1	7.9	359	3.5	3.6	000	10.2	N	44	-2.9	0.0	3838	25
26	14.5	.9	7.7	353	1.2	1.8	060	5.7	NNW	44	-10.2	0.0	3465	26
27	11.9	1.4	6.6	191	.6	1.4	244	7.0	S	57	-8.4	3.6	1922	27
28	11.5	4.0	7.8	323	.7	1.9	264	7.6	NE	49	-3.7	1.4	2183	28
29	*****	*****	*****	238	1.7	2.4	255	7.6	SSW	39	-9.6	0.0	1322	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	23.3	-1.2	9.3	263	.3	2.4	142	15.9	S	45	-6.7	36.8	91529	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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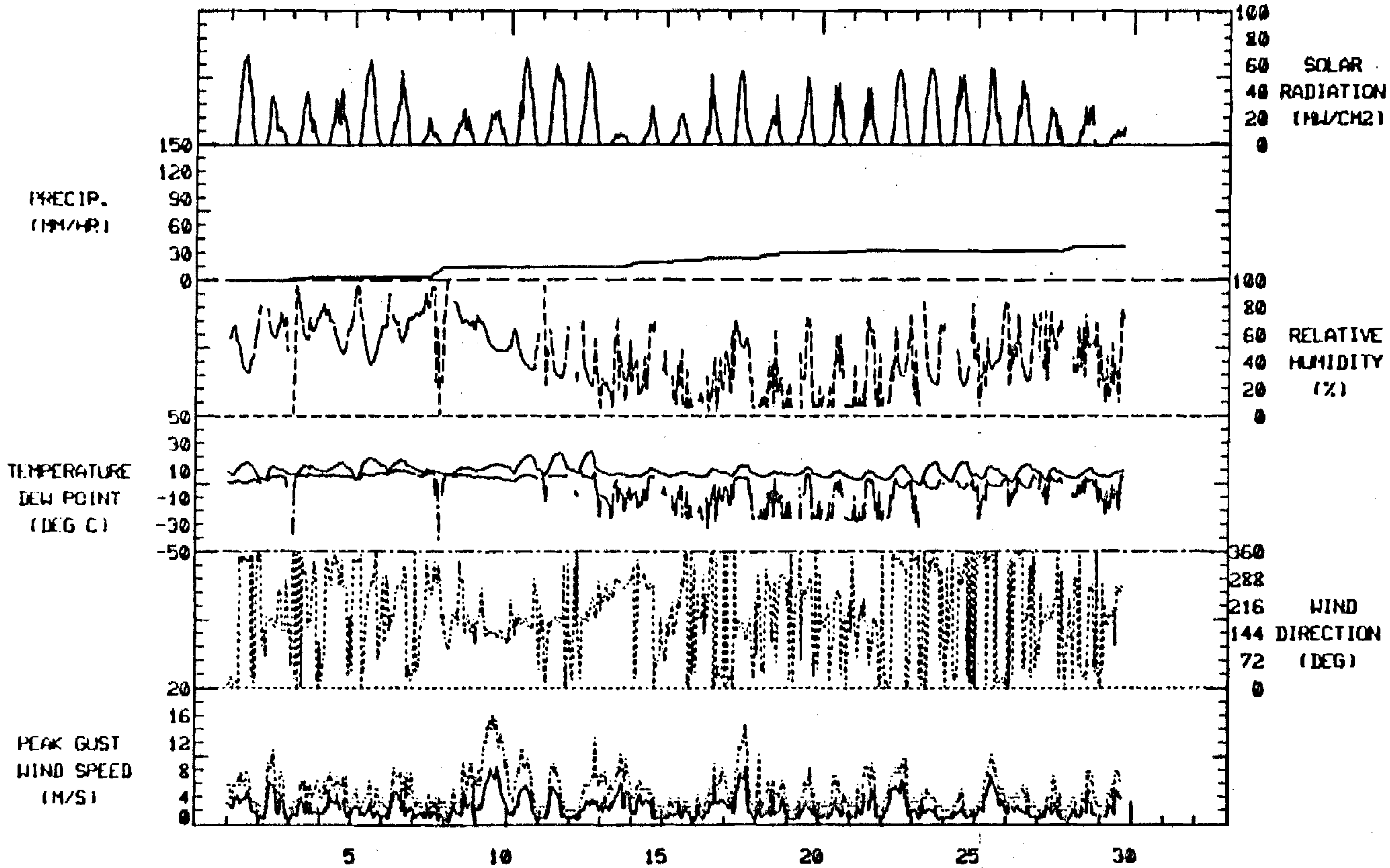
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DENALI WEATHER STATION

DATA START: 01 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	12.6	.5	6.6	***	****	****	***	****	SSW	**	*****	0.0	2937	11
12	8.4	-3.5	2.4	154	****	****	***	****	SSE	**	*****	1.0	1448	12
13	4.5	.6	2.6	187	****	****	***	****	S	**	*****	5.2	855	13
14	8.0	3.8	5.9	175	****	****	***	****	S	**	*****	3.4	578	14
15	9.6	6.5	8.1	353	****	****	***	****	N	**	*****	5.6	918	15
16	9.5	2.9	6.2	003	****	****	***	****	NNE	**	*****	0.0	2983	16
17	9.3	-2.6	3.3	351	****	****	***	****	NNW	**	*****	0.0	2898	17
18	*****	*****	*****	***	****	****	***	****	NNE	**	*****	0.0	196	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
MONTH	12.6	-3.5	5.0	063	****	****	***	****	MSG	**	*****	15.2	12811	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

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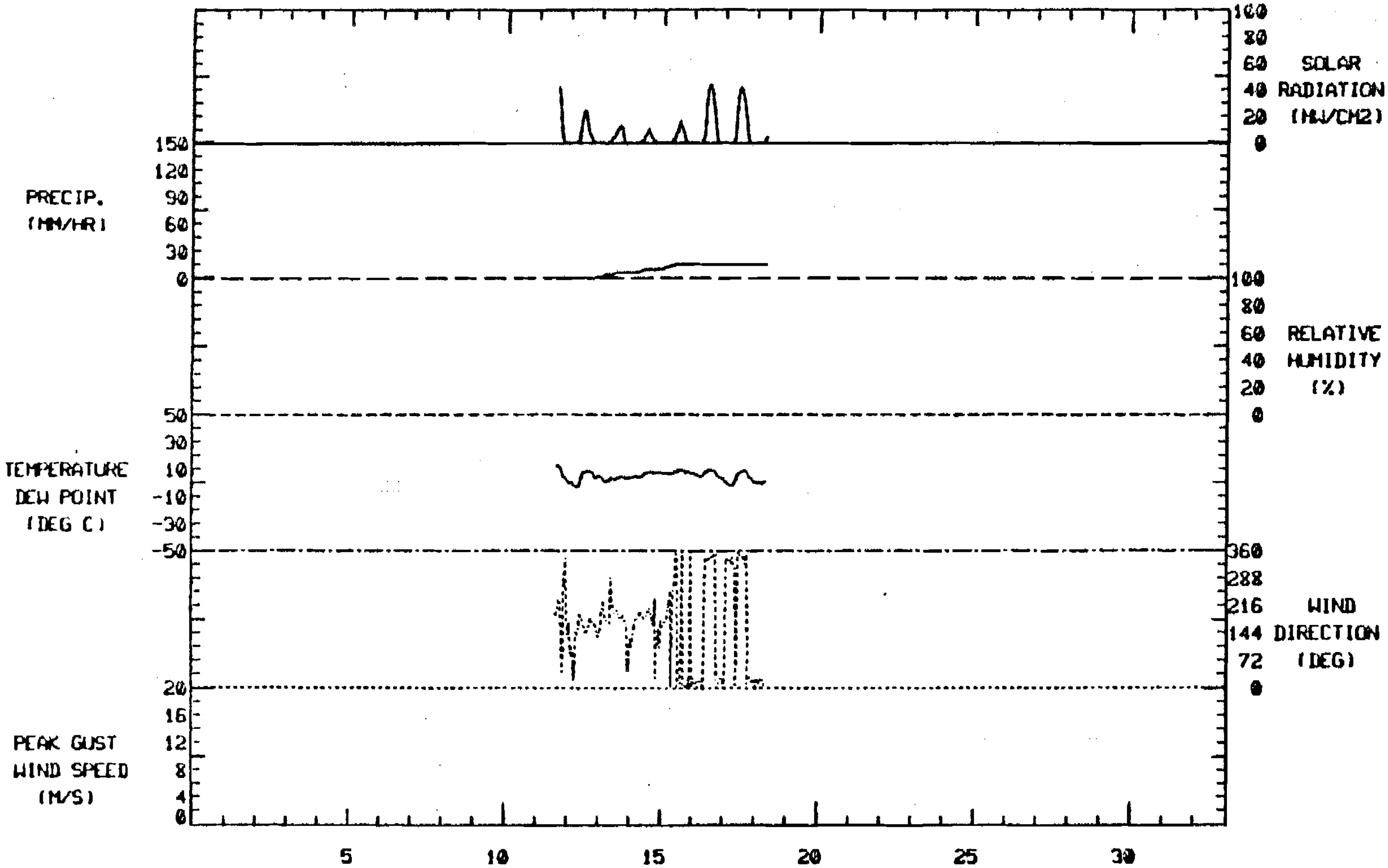
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DENALI WEATHER STATION

DATA START: 01 SEPTEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	-.4	-3.8	-2.1	***	****	****	***	****	SSW	**	*****	****	1282	17
18	3.6	-2.5	.5	178	****	****	***	****	S	**	*****	****	1437	18
19	6.0	-1.0	2.5	141	****	****	***	****	SE	**	*****	****	1040	19
20	3.5	-5.9	-1.2	169	****	****	***	****	S	**	*****	****	1175	20
21	5.1	-6.4	-.6	184	****	****	***	****	S	**	*****	****	1255	21
22	6.2	-1.9	2.2	180	****	****	***	****	SSW	**	*****	****	1251	22
23	3.1	-5.0	-1.0	078	****	****	***	****	N	**	*****	****	1023	23
24	8.9	-5.3	1.8	158	****	****	***	****	S	**	*****	****	1986	24
25	1.8	-7.1	-2.7	151	****	****	***	****	S	**	*****	****	1773	25
26	.1	-8.7	-4.3	039	****	****	***	****	N	**	*****	****	1470	26
27	-4.8	-13.1	-9.0	003	****	****	***	****	N	**	*****	****	1230	27
28	-.7	-10.3	-5.5	165	****	****	***	****	SSE	**	*****	****	998	28
29	-2.2	-5.8	-4.0	015	****	****	***	****	N	**	*****	****	695	29
30	-3.7	-14.4	-9.0	018	****	****	***	****	N	**	*****	****	828	30
31	-7.9	-21.0	-14.5	341	****	****	***	****	NNW	**	*****	****	1352	31
MONTH	8.9	-21.0	-3.1	125	****	****	***	****	MSG	**	*****	****	18795	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

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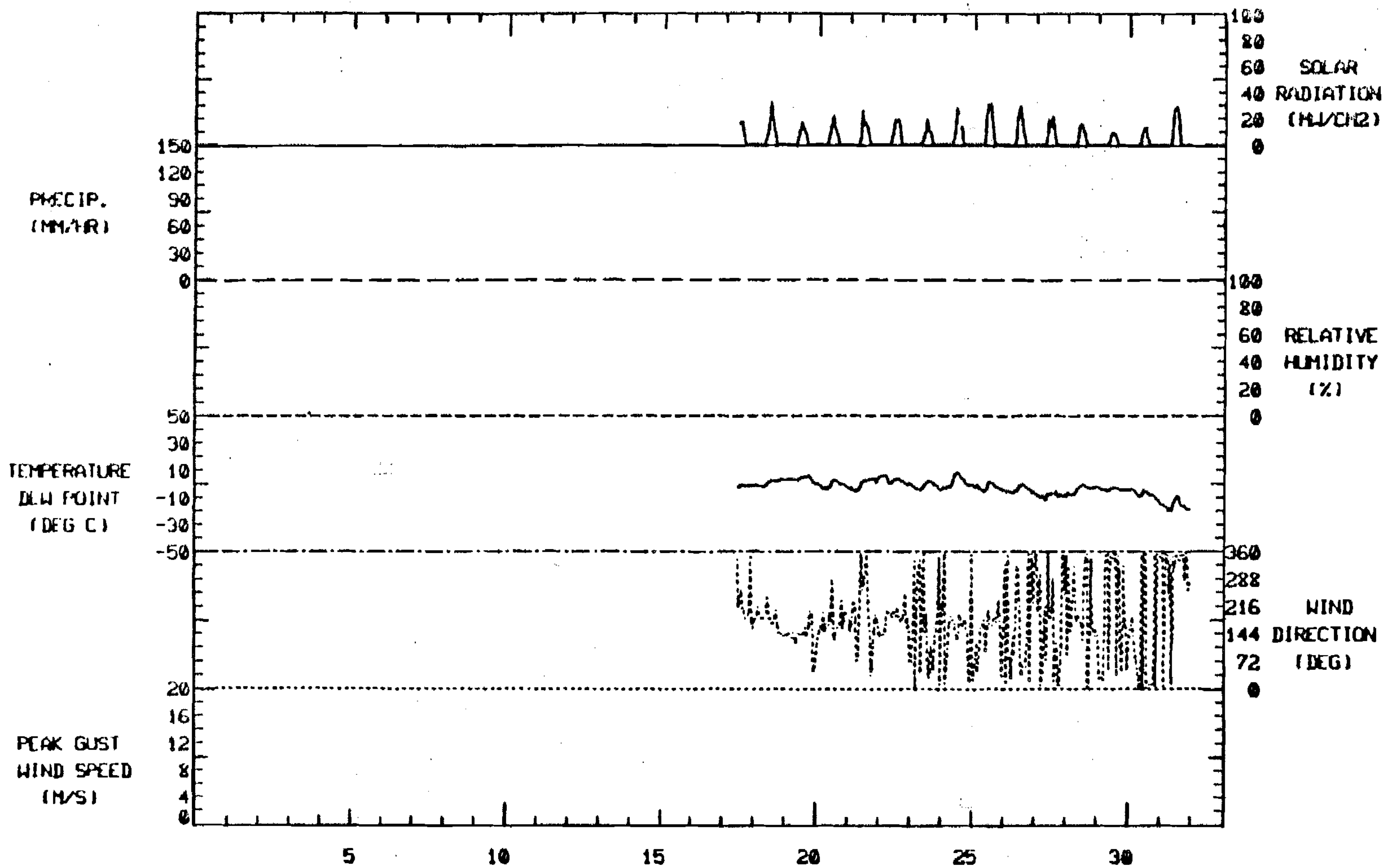

DAY OF THE MONTH DENALI WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-8.4	-23.0	-15.7	021	****	****	***	****	N	**	*****	****	1326	01
02	-6.0	-14.2	-10.1	004	****	****	***	****	N	**	*****	****	763	02
03	-3.2	-11.0	-7.1	352	****	****	***	****	N	**	*****	****	530	03
04	.1	-10.3	-5.1	203	****	****	***	****	SSW	**	*****	****	635	04
05	1.4	-10.1	-4.4	329	****	****	***	****	NNW	**	*****	****	590	05
06	-3.3	-8.8	-6.1	345	****	****	***	****	NNW	**	*****	****	478	06
07	-3.2	-8.6	-5.9	007	****	****	***	****	N	**	*****	****	628	07
08	-8.1	-19.1	-13.6	014	****	****	***	****	NNE	**	*****	****	709	08
09	-13.1	-23.5	-18.3	006	****	****	***	****	N	**	*****	****	1129	09
10	-8.4	-18.3	-13.4	187	****	****	***	****	S	**	*****	****	578	10
11	-4.8	-16.0	-10.4	181	****	****	***	****	SSW	**	*****	****	632	11
12	-3.5	-19.4	-11.5	151	****	****	***	****	S	**	*****	****	630	12
13	-.8	-12.2	-6.5	167	****	****	***	****	S	**	*****	****	671	13
14	-7.1	-15.1	-11.1	043	****	****	***	****	ENE	**	*****	****	488	14
15	-7.5	-13.8	-10.6	020	****	****	***	****	NNW	**	*****	****	475	15
16	-3.3	-10.9	-7.1	146	****	****	***	****	S	**	*****	****	952	16
17	-4.8	-9.5	-7.2	183	****	****	***	****	S	**	*****	****	563	17
18	-5.7	-14.3	-10.0	191	****	****	***	****	S	**	*****	****	458	18
19	1.0	-6.9	-3.9	171	****	****	***	****	S	**	*****	****	518	19
20	-3.8	-12.4	-8.1	176	****	****	***	****	S	**	*****	****	631	20
21	-7.3	-13.8	-10.5	198	****	****	***	****	S	**	*****	****	470	21
22	-1.2	-8.6	-4.9	193	****	****	***	****	S	**	*****	****	395	22
23	1.5	-11.4	-4.9	176	****	****	***	****	S	**	*****	****	475	23
24	3.5	-3.0	.3	162	****	****	***	****	SSE	**	*****	****	380	24
25	.6	-4.7	-2.0	158	****	****	***	****	SE	**	*****	****	385	25
26	-.6	-7.6	-4.1	359	****	****	***	****	N	**	*****	****	390	26
27	-5.0	-8.9	-6.9	000	****	****	***	****	N	**	*****	****	358	27
28	-7.9	-10.5	-9.2	011	****	****	***	****	N	**	*****	****	403	28
29	-10.1	-24.7	-17.4	001	****	****	***	****	NNE	**	*****	****	520	29
30	-19.0	-27.8	-23.4	006	****	****	***	****	N	**	*****	****	663	30
MONTH	3.5	-27.8	-9.0	090	****	****	***	****	MSG	**	*****	****	17818	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
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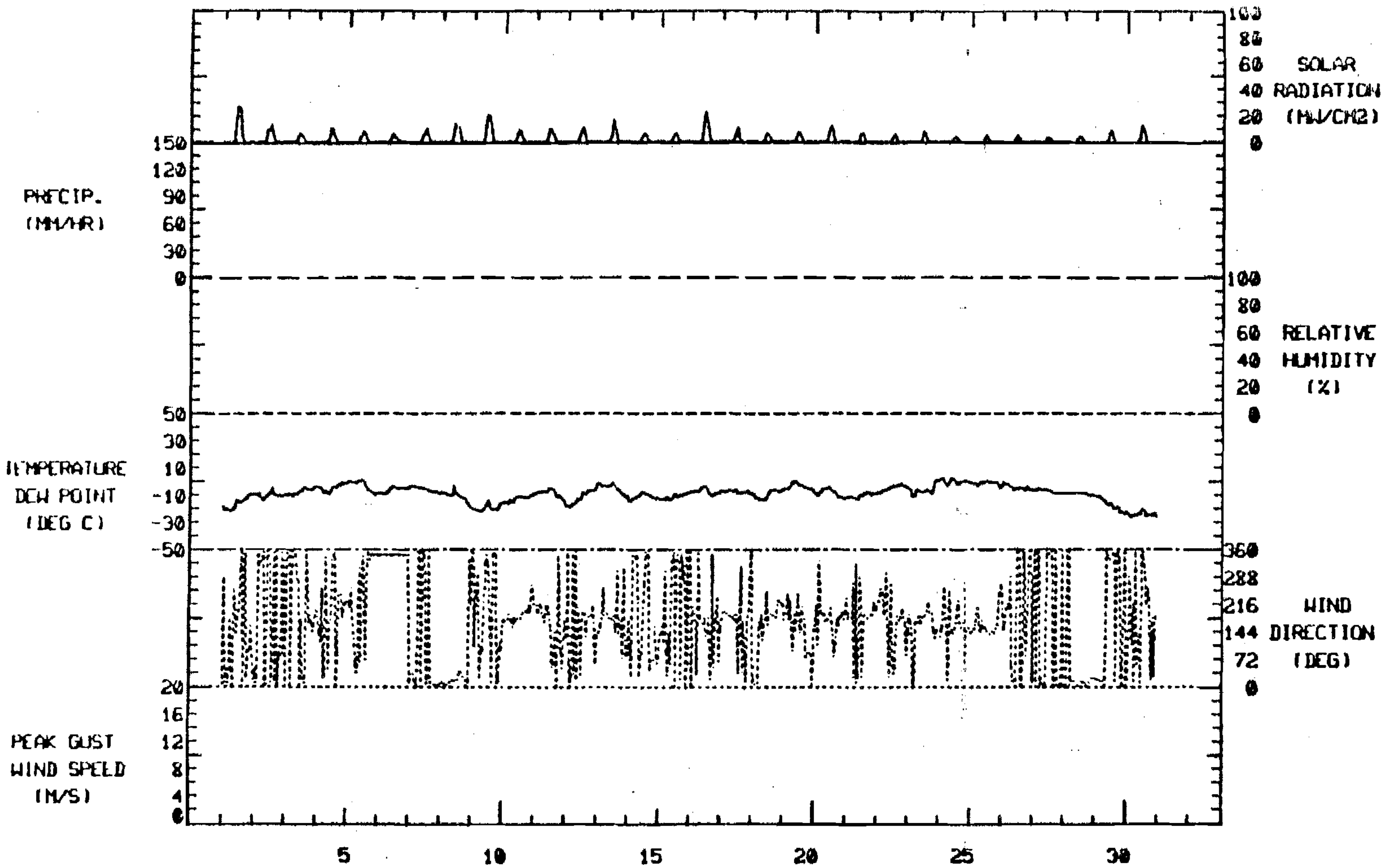

DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01 NOVEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-20.5	-26.5	-23.5	033	****	****	***	****	N	**	*****	****	518	01
02	-19.4	-27.9	-23.7	043	****	****	***	****	N	**	*****	****	575	02
03	-18.6	-26.4	-22.5	217	****	****	***	****	S	**	*****	****	520	03
04	-19.0	-25.5	-22.3	163	****	****	***	****	S	**	*****	****	490	04
05	-17.3	-26.4	-21.9	010	****	****	***	****	S	**	*****	****	488	05
06	-15.3	-30.5	-22.9	001	****	****	***	****	N	**	*****	****	538	06
07	-26.1	-35.1	-30.6	327	****	****	***	****	N	**	*****	****	571	07
08	-24.3	-35.4	-29.9	347	****	****	***	****	N	**	*****	****	605	08
09	-27.0	-36.4	-31.7	191	****	****	***	****	SSW	**	*****	****	593	09
10	-21.2	-37.5	-29.4	347	****	****	***	****	N	**	*****	****	565	10
11	-25.3	-37.4	-31.4	330	****	****	***	****	N	**	*****	****	428	11
12	-33.6	-39.1	-36.3	218	****	****	***	****	S	**	*****	****	530	12
13	-24.3	-36.3	-30.3	350	****	****	***	****	N	**	*****	****	273	13
14	-22.7	-29.8	-26.3	360	****	****	***	****	N	**	*****	****	310	14
15	-26.3	-37.4	-31.9	358	****	****	***	****	N	**	*****	****	403	15
16	-30.6	-43.1	-36.8	348	****	****	***	****	NNW	**	*****	****	380	16
17	-34.4	-43.3	-38.9	132	****	****	***	****	S	**	*****	****	425	17
18	-32.9	-41.9	-37.4	143	****	****	***	****	N	**	*****	****	420	18
19	-31.4	-40.9	-36.2	155	****	****	***	****	SSE	**	*****	****	410	19
20	-30.5	-38.4	-34.5	163	****	****	***	****	S	**	*****	****	410	20
21	-26.1	-38.7	-32.4	166	****	****	***	****	S	**	*****	****	428	21
22	-27.1	-35.7	-31.4	237	****	****	***	****	S	**	*****	****	440	22
23	-26.1	-34.1	-30.1	184	****	****	***	****	S	**	*****	****	450	23
24	-23.6	-34.3	-29.0	359	****	****	***	****	N	**	*****	****	453	24
25	-27.0	-36.2	-31.6	000	****	****	***	****	N	**	*****	****	445	25
26	-29.0	-38.7	-33.8	138	****	****	***	****	S	**	*****	****	458	26
27	-31.3	-39.3	-35.3	014	****	****	***	****	N	**	*****	****	453	27
28	-30.3	-39.0	-34.7	069	****	****	***	****	N	**	*****	****	438	28
29	-18.0	-40.3	-29.2	017	****	****	***	****	N	**	*****	****	310	29
30	-.8	-19.7	-10.3	132	****	****	***	****	SE	**	*****	****	275	30
31	5.7	-.8	2.4	136	****	****	***	****	SE	**	*****	****	333	31
MONTH	5.7	-43.3	-28.8	040	****	****	***	****	MSG	**	*****	****	13929	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
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GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

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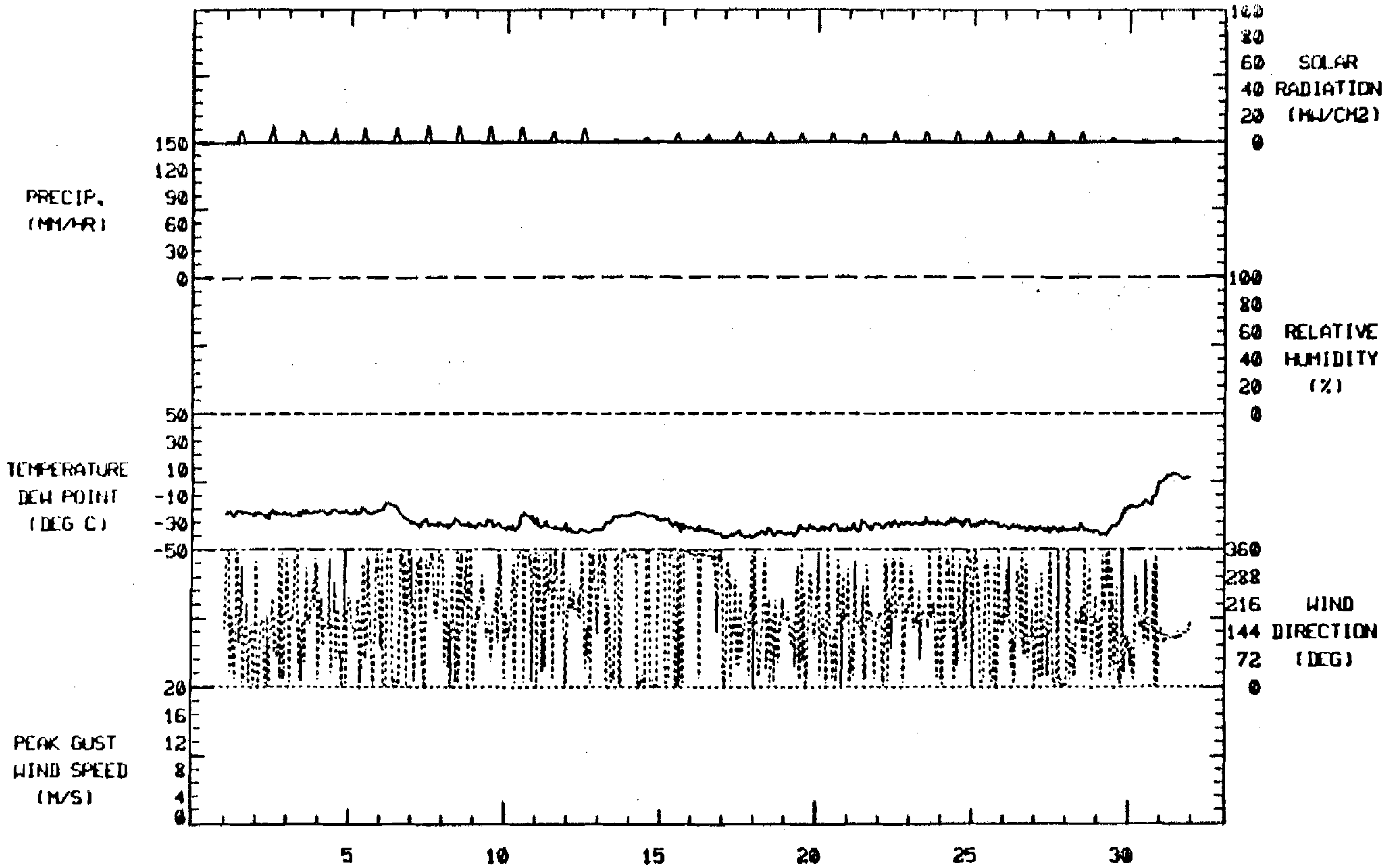
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01 DECEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	6.7	.5	3.6	153	****	****	***	****	SE	**	*****	****	320	01
02	2.8	-14.7	-6.0	153	****	****	***	****	SSE	**	*****	****	482	02
03	-11.7	-19.8	-15.8	238	****	****	***	****	SSW	**	*****	****	468	03
04	-6.2	-12.2	-9.2	145	****	****	***	****	SSE	**	*****	****	318	04
05	-9.3	-19.3	-14.3	345	****	****	***	****	N	**	*****	****	315	05
06	-5.1	-17.3	-11.2	181	****	****	***	****	S	**	*****	****	395	06
07	5.5	-6.2	-.3	188	****	****	***	****	S	**	*****	****	353	07
08	-2.5	-14.6	-8.6	176	****	****	***	****	S	**	*****	****	595	08
09	-3.6	-13.9	-8.8	171	****	****	***	****	S	**	*****	****	438	09
10	-.8	-11.1	-5.9	172	****	****	***	****	S	**	*****	****	528	10
11	-2.5	-9.2	-5.9	176	****	****	***	****	S	**	*****	****	343	11
12	-1.6	-11.2	-6.4	167	****	****	***	****	S	**	*****	****	423	12
13	-1.6	-15.3	-8.4	185	****	****	***	****	S	**	*****	****	358	13
14	6.2	-5.6	.3	174	****	****	***	****	SE	**	*****	****	353	14
15	5.0	-2.2	1.4	146	****	****	***	****	SE	**	*****	****	375	15
16	1.9	-7.8	-3.0	161	****	****	***	****	SSE	**	*****	****	497	16
17	3.0	-4.8	-.9	154	****	****	***	****	S	**	*****	****	433	17
18	5.1	-6.1	-.5	147	****	****	***	****	SE	**	*****	****	380	18
19	-.1	-6.7	-3.4	143	****	****	***	****	SE	**	*****	****	328	19
20	-3.8	-14.8	-9.3	183	****	****	***	****	S	**	*****	****	440	20
21	-9.1	-13.2	-11.2	358	****	****	***	****	N	**	*****	****	408	21
22	-2.3	-12.4	-7.4	203	****	****	***	****	SSW	**	*****	****	438	22
23	3.2	-5.7	-1.3	157	****	****	***	****	SE	**	*****	****	415	23
24	6.5	-2.8	1.8	152	****	****	***	****	SSE	**	*****	****	443	24
25	6.5	-3.4	1.5	167	****	****	***	****	S	**	*****	****	618	25
26	-2.6	-8.1	-5.4	175	****	****	***	****	S	**	*****	****	500	26
27	-6.1	-16.8	-11.5	142	****	****	***	****	S	**	*****	****	630	27
28	-14.3	-20.2	-17.3	180	****	****	***	****	S	**	*****	****	745	28
29	.1	-14.8	-7.3	163	****	****	***	****	SE	**	*****	****	475	29
30	2.9	-3.4	-.3	158	****	****	***	****	SE	**	*****	****	588	30
31	2.6	-4.9	-1.1	150	****	****	***	****	SSE	**	*****	****	865	31
MONTH	6.7	-20.2	-5.5	168	****	****	***	****	MSG	**	*****	****	14260	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
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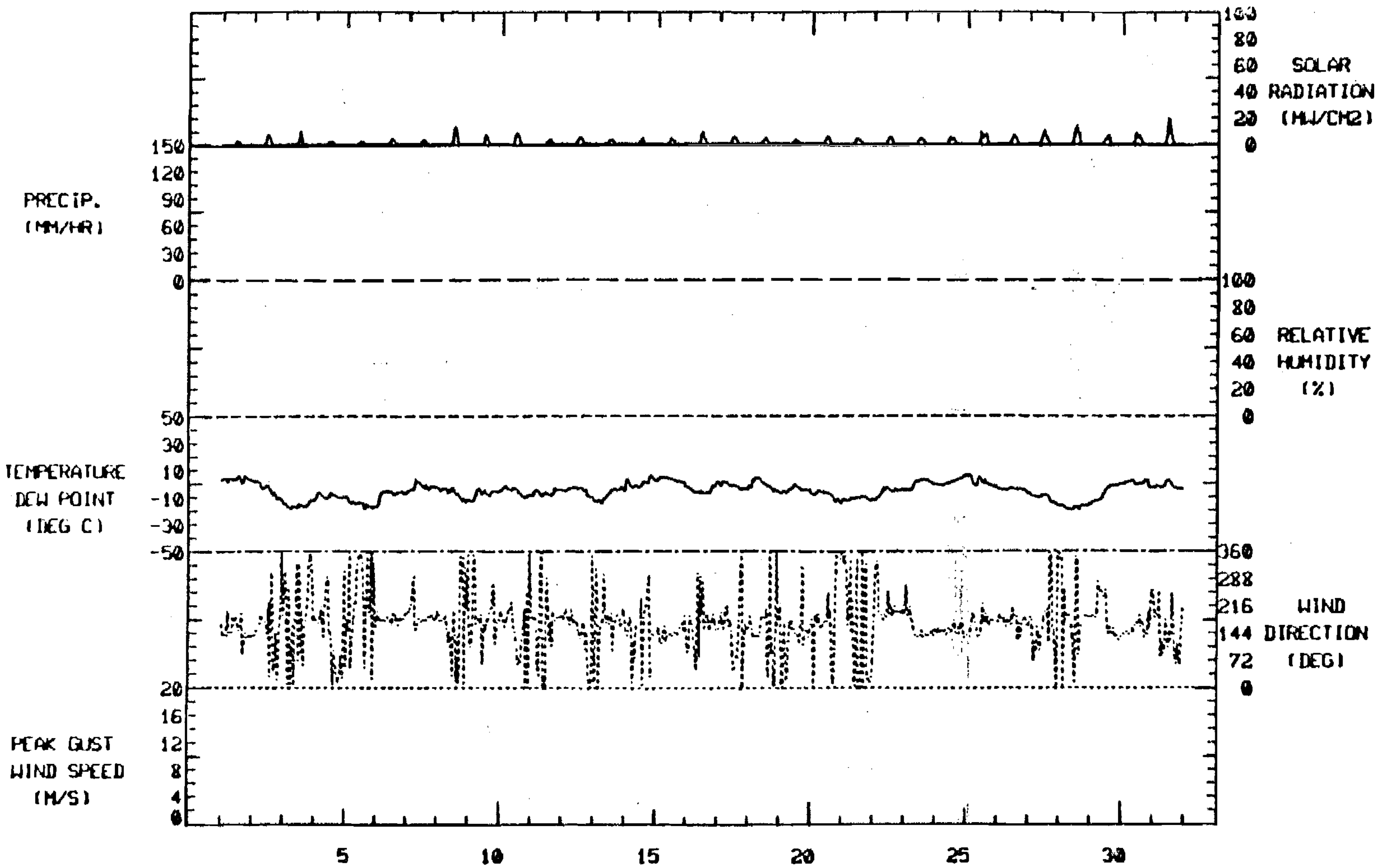
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	3.7	-4.1	-.2	159	****	****	***	****	SE	**	*****	****	520	01
02	4.0	-72.7	-34.3	146	6.4	6.7	136	13.3	SE	57	-9.6	****	865	02
03	.2	-3.6	-1.7	156	4.5	5.1	162	14.6	SE	70	-6.7	****	615	03
04	.1	-6.5	-3.2	182	.7	1.5	181	7.6	SSW	75	-6.4	****	675	04
05	-1.1	-7.0	-4.1	192	1.3	1.7	201	8.9	SSW	82	-5.8	****	433	05
06	.2	-4.0	-1.9	191	1.8	2.4	209	10.8	SSW	80	-4.4	****	533	06
07	-3.8	-11.6	-7.7	331	.3	.8	201	3.8	N	83	-10.8	****	570	07
08	-3.4	-7.6	-5.5	336	.1	.5	133	1.9	SSW	85	*****	****	555	08
09	-3.8	-6.4	-5.1	162	.9	1.7	182	7.0	S	85	-6.9	****	728	09
10	-.8	-9.2	-5.0	012	2.2	2.6	003	9.5	N	75	-9.4	****	1017	10
11	-9.0	-14.6	-11.8	359	2.9	3.6	347	10.2	N	66	-16.9	****	873	11
12	-13.8	-22.2	-16.0	124	.7	2.7	173	9.5	N	70	-21.6	****	993	12
13	-14.5	-26.6	-20.5	004	3.1	3.4	003	8.9	N	64	-25.7	****	1578	13
14	-18.4	-25.1	-21.8	010	4.6	4.6	000	8.3	N	54	-27.7	****	1355	14
15	-22.5	-33.9	-28.2	341	.4	.9	230	3.8	N	61	-34.0	****	1690	15
16	-21.1	-26.1	-23.6	350	1.0	1.2	001	3.8	N	67	-27.7	****	1150	16
17	-21.1	-29.5	-25.3	352	1.2	1.6	346	5.1	N	65	-30.2	****	2173	17
18	-19.9	-29.2	-24.6	359	1.2	1.5	019	5.7	N	67	-27.0	****	1443	18
19	-13.2	-23.4	-18.3	342	.5	1.7	185	8.3	N	72	-22.4	****	943	19
20	-1.8	-22.2	-12.0	015	.2	1.6	137	17.8	N	73	-16.3	****	1579	20
21	-4.3	-8.9	-6.6	182	3.1	3.9	171	14.6	S	70	-11.8	****	1257	21
22	-6.5	-14.2	-10.4	195	.7	1.9	184	8.9	S	65	-16.2	****	1347	22
23	-6.9	-15.1	-11.0	350	.4	1.2	001	3.8	N	74	-15.2	****	1303	23
24	-1.6	-16.2	-8.9	177	3.6	4.0	138	16.5	S	76	-12.3	****	1273	24
25	2.2	-7.4	-2.6	178	2.6	3.2	170	16.5	SSE	67	-8.8	****	1256	25
26	-3.3	-9.2	-6.3	223	.3	2.4	187	8.3	N	80	-8.4	****	1158	26
27	-2.6	-9.4	-6.0	183	3.1	3.6	187	9.5	S	84	-6.4	****	1408	27
28	1.0	-11.8	-5.4	168	2.9	4.3	132	22.2	SE	67	-9.0	****	2173	28
MONTH	4.0	-72.7	-11.8	154	.5	2.6	132	22.2	N	72	-15.3	****	31456	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 15.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 17.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 21.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 17.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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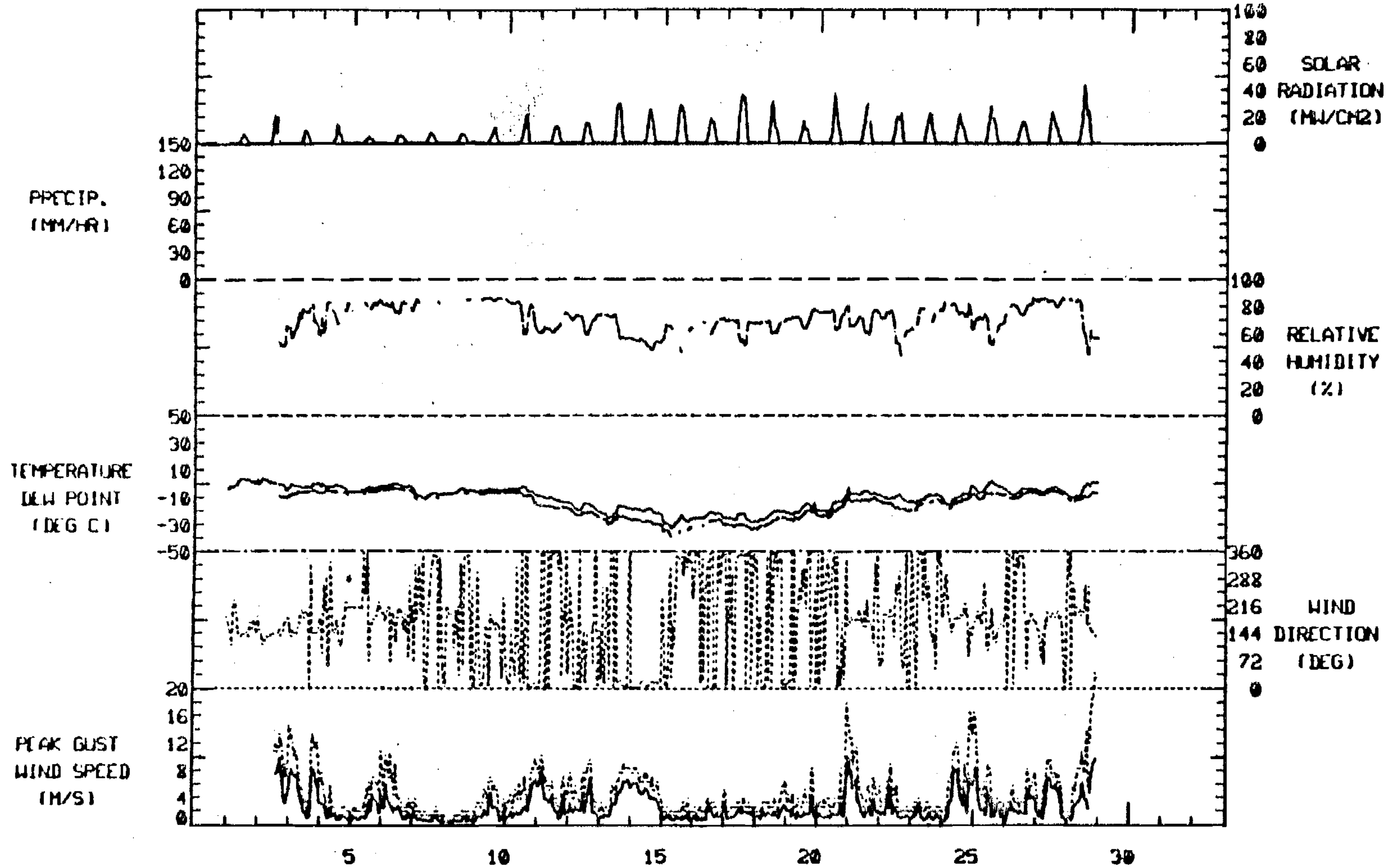
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01 FEBRUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING MARCH , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	1.8	-2.3	-.3	126	6.0	6.6	127	21.0	SE	59	-6.8	****	1515	01
02	-1.9	-6.1	-4.0	263	1.4	2.5	267	9.5	W	77	-8.3	****	1258	02
03	-2.1	-17.5	-9.8	296	.1	1.0	323	3.8	NNW	76	-14.7	****	1566	03
04	-4.0	-17.2	-10.6	153	1.4	2.7	139	16.5	SE	64	-12.8	****	1710	04
05	-.3	-7.5	-3.9	166	2.6	3.6	140	15.9	SE	47	-14.0	****	1915	05
06	-3.3	-14.5	-8.9	207	.5	1.4	179	22.5	S	61	-17.4	****	568	06
07	-7.2	-19.6	-13.4	359	1.1	1.4	354	5.1	N	66	-18.2	****	2795	07
08	-2.9	-20.1	-11.5	186	.2	1.8	168	7.6	N	63	-16.3	****	2370	08
09	-1.2	-10.9	-6.1	187	1.5	2.6	191	9.5	S	69	-11.0	****	1952	09
10	-1.6	-9.4	-5.5	194	2.0	2.6	172	11.4	S	75	-9.3	****	2552	10
11	3.4	-6.0	-1.3	325	5.5	7.2	132	31.1	NW	71	-5.3	****	1548	11
12	.3	-7.0	-3.3	331	8.0	8.1	325	21.0	NNW	59	-8.9	****	1673	12
13	2.0	-9.9	-3.9	337	4.2	4.3	332	22.2	NNW	50	-12.5	****	2313	13
14	2.7	-6.8	-2.1	337	4.1	4.7	337	24.1	NNW	56	-10.3	****	1623	14
15	-1.7	-15.1	-8.4	268	.9	1.7	191	5.7	NNW	58	-15.1	****	3365	15
16	1.5	-16.5	-7.5	348	2.0	2.1	339	16.5	N	54	-12.8	****	2628	16
17	4.5	.3	2.4	012	.6	5.8	316	18.4	NNW	34	-12.7	****	2109	17
18	8.5	-.8	3.8	155	5.7	6.7	155	27.3	SE	20	-16.8	****	2820	18
19	5.3	-7.5	-1.1	202	.9	3.0	141	15.2	N	48	-11.6	****	2895	19
20	-1.5	-12.1	-6.8	358	2.7	2.8	002	6.3	N	64	-13.3	****	3880	20
21	-2.1	-17.1	-9.6	357	1.4	1.7	359	4.4	N	60	-16.8	****	3573	21
22	-3.1	-18.6	-10.9	353	.6	1.5	146	8.9	N	57	-17.2	****	3538	22
23	-1.6	-7.5	-4.6	192	4.3	4.8	170	9.5	SSW	67	-9.2	****	3313	23
24	2.4	-12.6	-5.1	295	.3	1.9	194	7.6	N	68	-10.4	****	3475	24
25	.2	-15.1	-7.4	189	2.3	3.2	184	10.2	S	64	-11.5	****	3863	25
26	2.3	-6.7	-2.2	323	1.1	1.8	187	10.8	N	63	-7.7	****	2295	26
27	2.5	-9.7	-3.6	148	.1	1.2	089	6.3	NNE	70	-7.6	****	2640	27
28	-2.1	-14.0	-8.0	357	2.4	2.5	356	5.7	N	63	-13.5	****	4035	28
29	-.4	-15.8	-8.1	284	.4	1.7	197	5.7	N	66	-12.4	****	4008	29
30	.3	-13.3	-6.5	358	1.5	1.6	357	5.7	N	64	-13.0	****	4313	30
31	-2.9	-10.3	-6.6	004	2.7	2.8	002	9.5	N	59	-13.4	****	3595	31
MONTH	8.5	-20.1	-5.6	322	.4	3.1	132	31.1	N	60	-12.3	****	81698	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 24.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 27.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 28.6
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 29.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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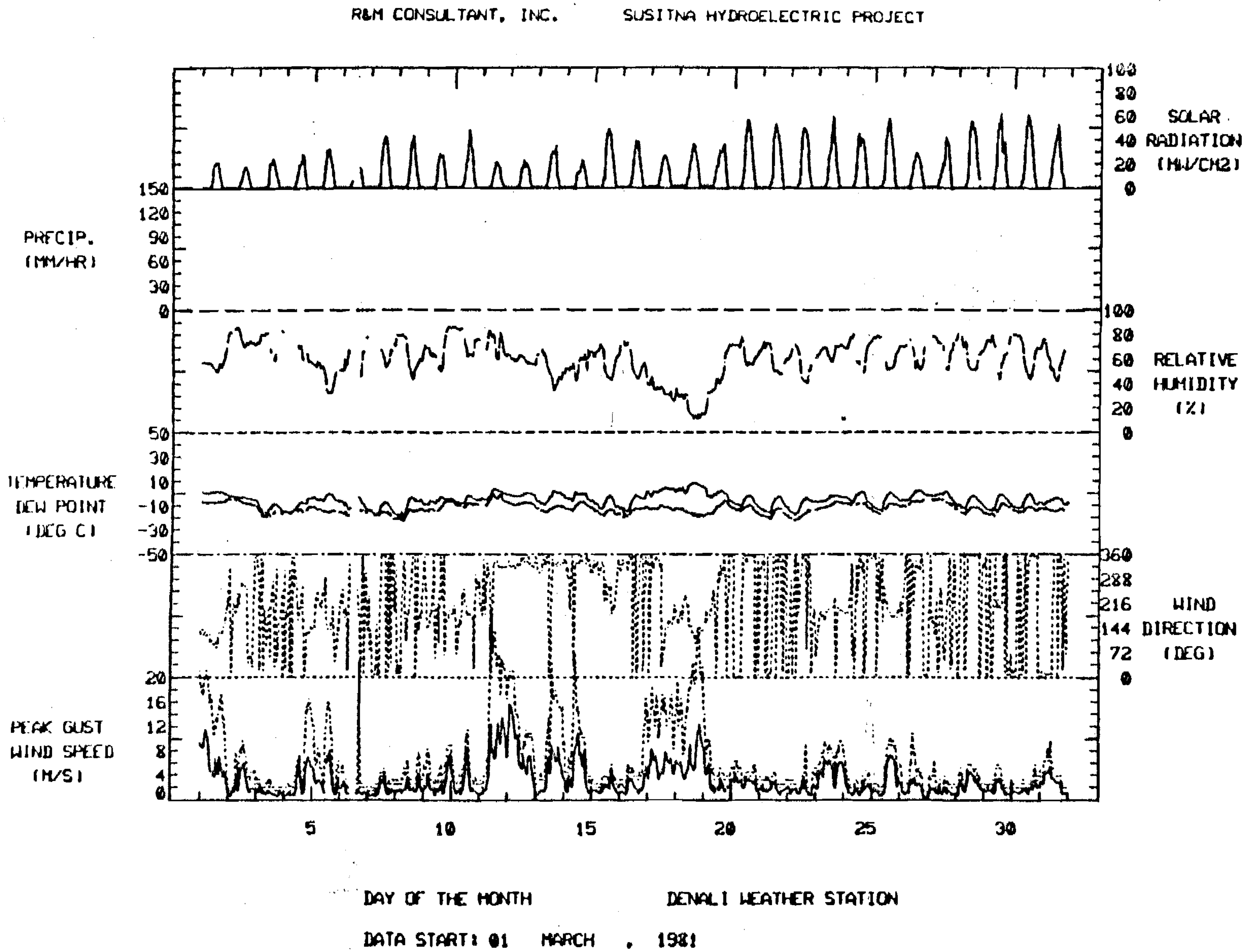
R&M CONSULTANT, INC.
SUSITNA HYDROELECTRIC PROJECT
SOLAR RADIATION (MW/CM2)
100
80
60
40
20
0
PRECIP. (MM/HR)
150
120
90
60
30
0
RELATIVE HUMIDITY (%)
100
80
60
40
20
0
TEMPERATURE DEW POINT (DEG C)
50
30
10
-10
-30
-50
WIND DIRECTION (DEG)
360
288
216
144
72
0
PEAK GUST WIND SPEED (M/S)
20
16
12
8
4
0
5
10
15
20
25
30
DAY OF THE MONTH
DENALI WEATHER STATION
DATA START: 01 MARCH, 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING APRIL , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-1.6	-8.8	-5.2	212	1.1	1.8	194	7.0	SSW	75	-9.0	****	3000	01
02	-1.4	-12.2	-6.6	340	2.0	2.4	293	7.6	N	65	-11.8	****	4683	02
03	-1.8	-15.5	-8.6	352	1.4	1.9	014	5.1	N	65	-16.1	****	4593	03
04	-5.5	-18.4	-12.0	001	3.0	3.0	356	5.7	N	63	-17.8	****	4623	04
05	-2.6	-19.6	-11.1	332	.5	1.1	018	4.4	N	57	-18.5	****	4680	05
06	-3.1	-15.8	-9.4	354	1.1	1.5	356	4.4	N	56	-16.9	****	4778	06
07	-4.0	-15.4	-9.7	006	3.6	3.7	358	9.5	N	61	-14.8	****	4445	07
08	-3.3	-12.9	-8.1	360	3.1	3.3	004	8.9	N	62	-12.6	****	4208	08
09	-4.4	-14.1	-9.3	006	5.5	5.7	013	12.1	N	43	-19.5	****	5115	09
10	-4.2	-18.7	-11.5	358	1.2	1.5	359	4.4	N	45	-21.4	****	5213	10
11	-3.0	-21.4	-12.2	357	1.5	1.9	357	4.4	N	49	-20.0	****	5315	11
12	-2.5	-18.3	-10.4	357	1.2	1.6	355	4.4	N	46	-19.0	****	5333	12
13	-5.3	-19.2	-12.3	357	2.0	2.4	000	7.6	N	47	-20.8	****	5403	13
14	-5.0	-20.7	-12.9	353	2.1	2.4	359	7.6	N	48	-21.2	****	5565	14
15	-6.5	-19.5	-13.0	354	1.6	2.0	353	6.3	N	44	-21.3	****	5630	15
16	-4.5	-19.8	-12.1	357	1.3	1.8	353	6.3	N	42	-22.2	****	5668	16
17	-.7	-18.4	-9.6	203	.9	1.8	199	7.6	SSW	44	-17.2	****	5775	17
18	1.3	-14.2	-6.5	001	.6	1.2	357	3.8	N	45	-14.2	****	5308	18
19	2.8	-6.9	-2.0	197	1.7	2.6	187	7.0	SSW	51	-10.5	****	5818	19
20	5.3	-6.8	-.8	336	.6	2.0	164	8.9	N	60	-8.3	****	5583	20
21	4.4	-6.6	-1.1	001	1.8	2.0	007	5.7	N	59	-7.0	****	6088	21
22	4.7	-7.9	-1.6	360	2.2	2.3	355	5.1	N	58	-8.7	****	6080	22
23	4.6	-6.9	-1.1	358	1.9	2.0	355	5.7	N	59	-6.9	****	5345	23
24	5.4	-6.4	-.5	350	1.4	2.5	036	7.6	N	65	-5.4	****	5903	24
25	5.2	-5.1	.0	056	.7	1.8	078	7.6	NNE	65	-4.6	****	6240	25
26	4.4	-7.2	-1.4	356	2.3	2.3	345	4.4	N	63	-7.5	****	6045	26
27	4.5	-6.8	-1.2	000	3.1	3.1	356	6.3	N	58	-8.2	****	6375	27
28	5.8	-5.0	.4	331	1.3	1.8	300	6.3	N	57	-6.8	****	5365	28
29	6.2	-2.0	2.1	276	1.1	2.2	281	7.6	N	65	-4.2	****	5963	29
30	8.1	-3.8	2.2	194	1.7	2.1	190	7.0	SSW	59	-3.2	0.0	5731	30
MONTH	8.1	-21.4	-6.2	353	1.4	2.3	013	12.1	N	56	-13.2	0.0	159863	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.1

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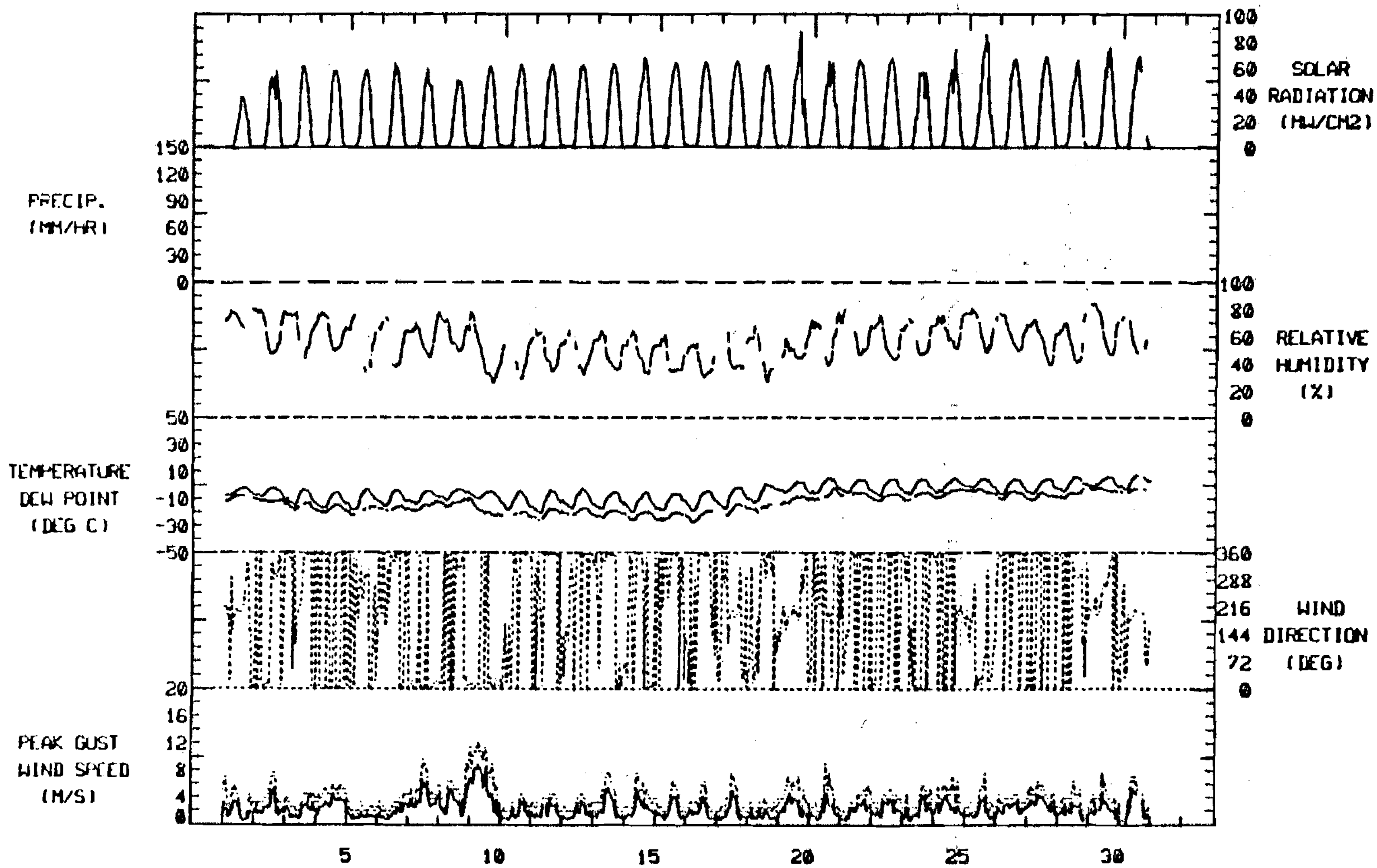
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01   APRIL   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING MAY , 1981

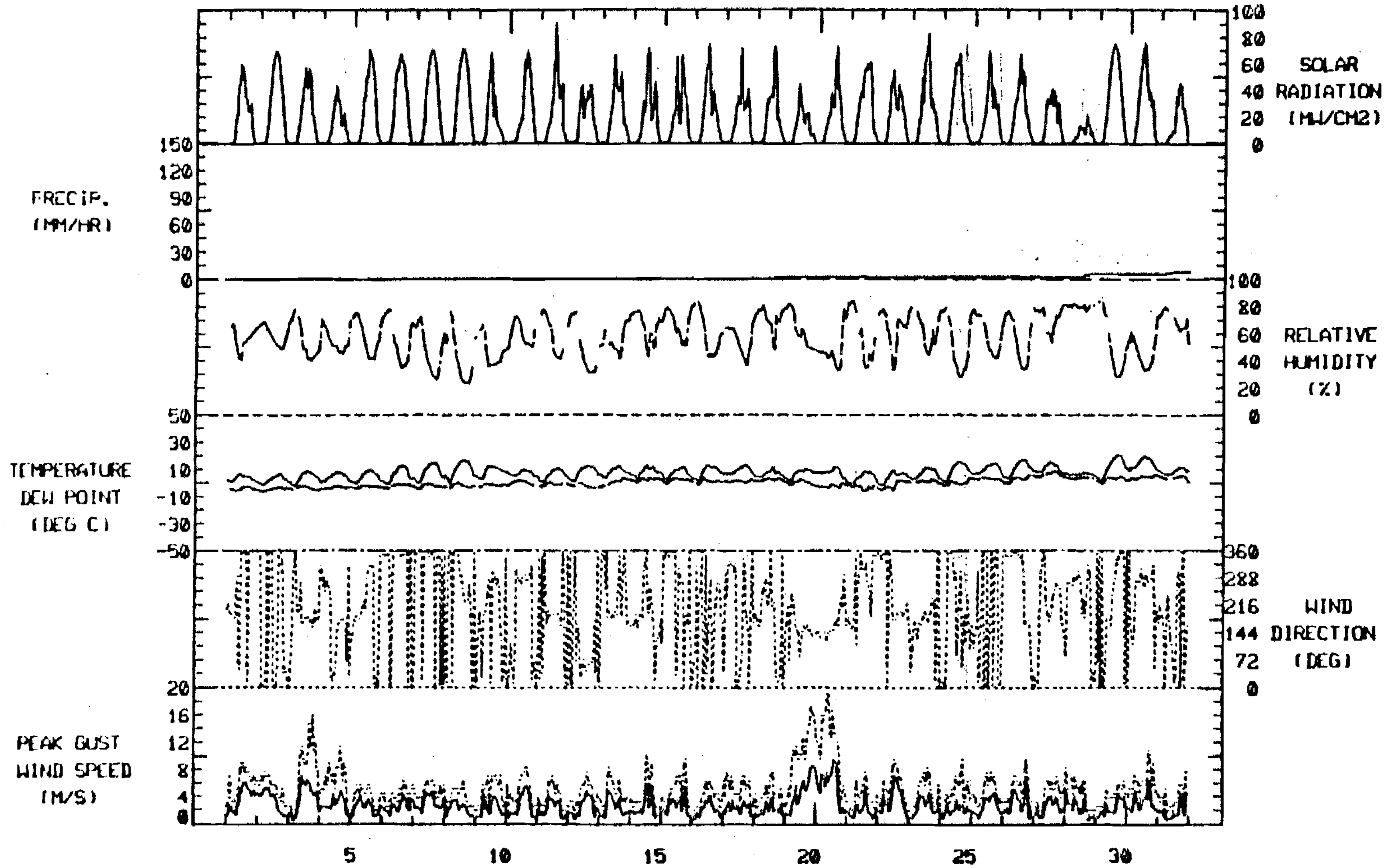
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	6.4	0.0	3.2	357	2.4	3.6	349	8.9	N	57	-4.8	0.0	4993	01
02	6.7	-2.0	2.3	002	3.4	3.4	359	7.6	N	59	-5.0	0.0	6630	02
03	9.0	-2.7	3.2	181	3.1	3.8	160	15.9	S	53	-4.5	0.0	4933	03
04	8.2	-.2	4.0	197	.7	2.8	166	11.4	S	55	-4.0	0.0	3320	04
05	9.4	-1.0	4.2	249	.8	2.3	178	5.7	S	58	-3.3	0.0	5900	05
06	12.7	-1.4	5.7	355	2.4	2.5	348	6.3	N	56	-2.7	0.0	6605	06
07	15.3	-.6	7.3	356	3.0	3.1	357	6.3	N	48	-3.3	0.0	6895	07
08	16.5	-.7	7.9	333	1.3	2.2	190	6.3	N	42	-3.7	0.0	6958	08
09	12.7	1.5	7.1	266	1.1	2.2	286	7.0	WNW	44	-2.6	0.0	4023	09
10	10.3	4.4	7.3	301	1.8	2.5	293	8.3	WNW	60	-.5	0.0	5140	10
11	10.7	-.1	5.3	191	1.0	2.1	180	7.0	SSW	60	-1.9	0.0	5265	11
12	12.9	.2	6.6	050	1.8	2.4	053	7.6	ENE	47	-3.2	0.0	4560	12
13	12.7	3.2	8.0	203	1.3	2.4	181	8.3	S	57	.5	0.0	5040	13
14	13.3	2.7	8.0	189	1.1	2.3	179	10.2	S	65	1.9	.2	5038	14
15	12.1	2.0	7.1	342	1.2	2.6	178	9.5	N	68	1.2	.2	4735	15
16	13.6	1.0	7.3	326	.7	2.0	034	6.3	N	56	.4	0.0	5275	16
17	13.6	5.2	9.4	327	1.0	2.3	307	7.6	NW	56	.7	0.0	4655	17
18	11.9	3.9	7.9	254	.6	2.0	187	7.6	NNE	71	1.8	1.8	4730	18
19	10.4	.9	5.6	150	4.0	4.5	141	17.1	SE	59	-.6	0.0	3238	19
20	13.1	.8	6.9	154	5.3	6.0	150	19.0	SE	50	-3.2	0.0	4658	20
21	9.5	-.8	4.4	292	.9	1.9	286	7.6	N	59	-4.5	0.0	6110	21
22	9.8	-1.9	3.9	206	1.4	3.5	177	9.5	N	64	-1.5	0.0	4975	22
23	12.1	2.4	7.3	183	1.4	2.5	175	8.3	S	62	.4	0.0	6005	23
24	15.8	0.0	7.9	329	.2	2.0	162	9.5	N	52	-.0	0.0	5693	24
25	14.6	6.1	10.4	002	2.1	2.6	006	7.6	N	59	2.1	0.0	5048	25
26	17.4	2.6	10.0	351	1.2	3.0	175	9.5	N	57	2.4	0.0	5135	26
27	16.2	7.3	11.8	236	1.2	2.4	262	7.0	N	72	5.8	0.0	4090	27
28	8.1	4.3	6.2	276	1.6	2.3	275	8.3	W	80	3.3	4.0	1695	28
29	20.6	1.2	10.9	346	1.2	2.2	352	6.3	N	49	1.6	0.0	7898	29
30	19.6	6.6	13.1	283	2.0	3.2	283	10.8	W	48	3.1	0.0	6688	30
31	11.5	6.1	8.8	131	.2	1.9	147	8.3	N	69	3.0	1.8	3528	31
MONTH	20.6	-2.7	7.1	293	.3	2.7	150	19.0	N	58	-.7	8.0	159450	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 15.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 14.6
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 16.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 13.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DENALI WEATHER STATION

DATA START: 01   MAY   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING JUNE , 1981

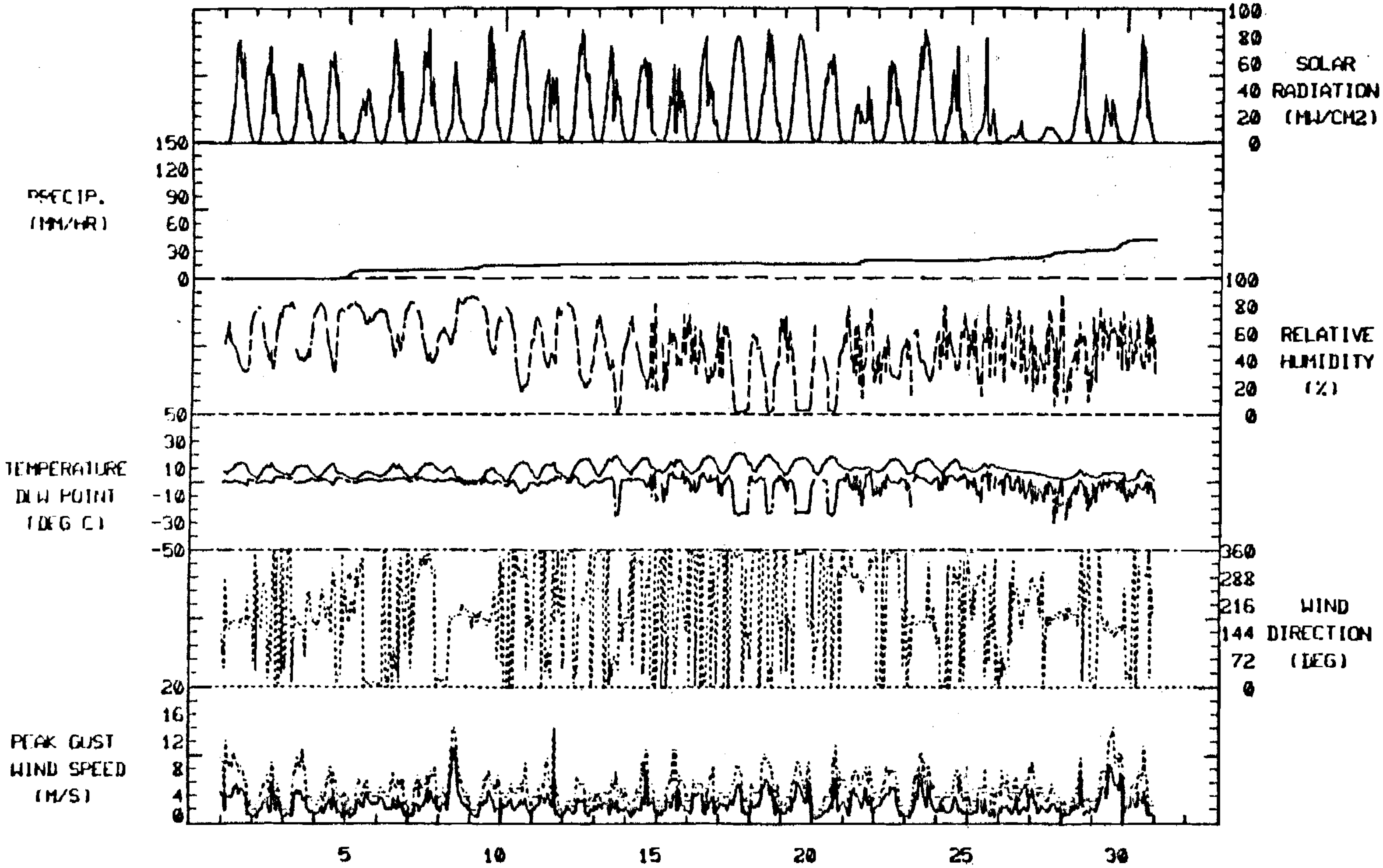
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	14.6	4.1	9.4	163	3.1	3.8	162	12.1	SSE	49	-.9	0.0	6585	01
02	13.5	.9	7.2	350	.9	2.3	358	8.9	N	60	.2	0.0	5658	02
03	12.3	4.3	6.3	167	1.5	2.5	159	10.8	SSE	57	-.1	0.0	5290	03
04	14.5	3.2	8.9	223	.7	2.1	148	8.3	SSE	64	1.0	2.4	5218	04
05	7.4	2.0	4.7	345	1.5	2.4	310	6.3	N	75	.9	6.0	3675	05
06	13.8	3.1	8.4	010	1.6	2.5	104	7.6	N	64	1.3	.4	6125	06
07	13.9	2.3	8.1	329	2.0	2.6	044	8.3	NNW	56	.3	0.0	6415	07
08	10.9	.1	5.5	186	2.8	4.3	182	14.0	S	72	-.4	2.2	3573	08
09	10.6	.4	5.5	164	1.7	2.4	160	7.6	S	67	-.4	3.0	6250	09
10	15.2	-.3	7.5	341	1.6	2.4	040	8.9	N	46	-4.0	0.0	8695	10
11	15.3	.4	7.6	012	1.3	2.6	150	14.0	N	55	.2	.6	5048	11
12	17.1	1.8	9.4	301	.6	2.1	190	7.0	N	48	-1.0	.2	7593	12
13	19.4	3.3	11.4	019	1.3	2.4	050	7.6	N	40	-8.1	.2	5878	13
14	18.2	4.1	11.2	336	1.3	2.6	274	10.8	NNW	43	-1.0	0.0	6543	14
15	17.3	6.4	11.9	353	.7	2.6	056	10.8	N	48	3.4	.6	4593	15
16	19.2	5.5	12.4	348	2.0	2.8	281	8.3	N	41	-7.0	0.0	6390	16
17	21.2	5.0	13.1	354	2.6	3.0	350	8.3	N	25	-19.2	0.0	8565	17
18	20.3	6.1	13.2	003	2.7	3.5	001	10.2	N	36	-8.2	0.0	7515	18
19	17.9	4.6	11.4	358	1.2	3.3	347	8.9	N	25	-16.2	0.0	8680	19
20	19.2	4.8	12.0	324	1.3	2.1	273	11.4	N	29	-9.6	0.0	6453	20
21	12.0	6.1	10.1	296	2.9	3.2	288	8.3	WNW	50	-10.7	4.0	3503	21
22	18.0	6.6	12.3	352	2.7	3.1	330	8.3	N	38	-2.2	0.0	5243	22
23	17.5	4.6	11.1	172	2.7	3.2	172	10.2	S	42	-2.5	0.0	8578	23
24	17.5	5.1	11.3	336	1.1	2.0	279	7.6	NW	52	1.8	.2	4360	24
25	13.8	7.2	10.5	288	.6	1.7	025	8.3	WNW	47	-10.1	2.4	2950	25
26	10.2	6.5	6.4	225	.4	2.0	092	7.6	SW	51	-9.4	0.0	945	26
27	6.8	2.0	4.4	230	1.5	2.5	277	8.9	S	46	-8.2	7.0	1365	27
28	9.8	1.8	5.8	250	.4	2.0	358	9.5	S	39	-12.1	2.0	4823	28
29	7.9	2.6	5.3	149	4.0	5.1	136	14.0	SSE	59	-2.0	8.2	3018	29
30	10.1	.4	5.3	324	1.5	2.7	279	11.4	N	50	-4.5	3.6	5368	30
MONTH	21.2	-.3	9.0	325	.4	2.7	182	14.0	N	49	-4.3	43.0	164888	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DENALI WEATHER STATION

DATA START: 01 JUNE , 1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	11.2	1.3	6.3	172	2.1	3.0	170	9.5	S	51	-4.8	0.0	5123	1
2	10.0	4.6	7.3	014	3.6	3.9	345	8.3	N	49	-2.7	0.0	3795	2
3	12.9	5.7	9.3	356	3.6	3.9	331	8.3	NNW	35	-6.0	0.0	6313	3
4	13.7	2.1	7.9	354	2.2	2.7	359	8.3	N	46	-3.0	.2	5463	4
5	10.0	5.5	7.8	022	1.1	1.7	042	5.1	NNE	55	-3.9	5.6	2163	5
6	11.9	5.1	8.5	330	.9	1.5	314	5.7	N	54	-2.0	2.6	4593	6
7	10.2	2.9	6.6	287	.9	2.4	269	10.2	W	46	-8.1	6.4	1365	7
8	8.7	3.1	5.9	176	1.3	2.2	162	8.9	S	49	-8.8	2.2	1003	8
9	10.7	6.8	8.8	207	.7	1.3	194	5.1	SSW	43	-9.2	7.4	1793	9
10	10.9	6.8	8.9	056	.2	2.0	157	9.5	NNW	44	-5.8	11.2	1788	10
11	11.1	6.8	9.0	262	1.6	2.4	279	8.9	W	57	-1.2	4.6	2610	11
12	13.4	6.7	10.1	329	1.1	1.8	277	6.3	N	57	-1.6	2.2	3450	12
13	12.6	6.3	9.5	294	1.0	1.9	279	7.0	W	56	-.5	0.0	3055	13
14	11.7	7.0	9.4	226	.8	1.8	194	7.0	N	51	-2.2	4.0	2255	14
15	13.9	8.0	11.0	187	1.7	2.6	178	9.5	S	56	.6	2.6	3103	15
16	16.4	9.6	13.0	246	.3	1.5	245	5.7	SSW	49	-.2	3.8	3703	16
17	15.9	9.5	12.7	211	.6	1.4	196	5.7	S	48	-1.4	4.0	3380	17
18	15.2	8.6	11.9	276	1.4	2.5	271	8.3	W	47	-1.0	.6	4813	18
19	12.7	8.3	10.5	296	.3	1.4	265	5.7	NE	58	1.0	.8	2925	19
20	11.9	9.1	10.5	207	.7	2.1	192	7.0	SSW	49	-3.7	2.6	2670	20
21	17.2	8.5	12.9	316	1.3	2.3	332	8.3	N	49	.7	0.0	5785	21
22	15.0	6.4	10.7	300	1.5	2.2	324	7.6	WNW	54	2.1	.4	3828	22
23	15.0	8.7	11.9	195	.7	1.9	176	8.3	S	46	-2.0	4.4	3628	23
24	15.4	9.6	12.5	162	3.2	3.6	146	14.6	SSE	60	3.4	4.2	3028	24
25	13.1	8.3	10.7	163	1.3	2.2	143	7.6	S	57	.1	2.8	2345	25
26	14.2	7.8	11.0	295	1.4	2.1	278	7.0	WNW	56	1.3	0.0	3473	26
27	16.7	3.7	10.2	301	1.1	1.8	280	6.3	NNW	47	-.1	0.0	3758	27
28	15.3	8.3	11.8	324	.6	1.5	290	6.3	WNW	47	-3.7	.4	2628	28
29	14.0	7.7	10.9	000	1.5	1.8	001	7.0	N	52	1.5	1.4	4088	29
30	13.3	7.0	10.2	343	.9	1.6	358	6.3	NNE	60	1.2	1.2	3783	30
31	13.4	8.9	11.2	335	.9	1.7	283	6.3	N	53	.1	.4	2603	31
MONTH	17.2	1.3	9.9	302	.4	2.1	146	14.6	N	51	-1.9	76.0	104301	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

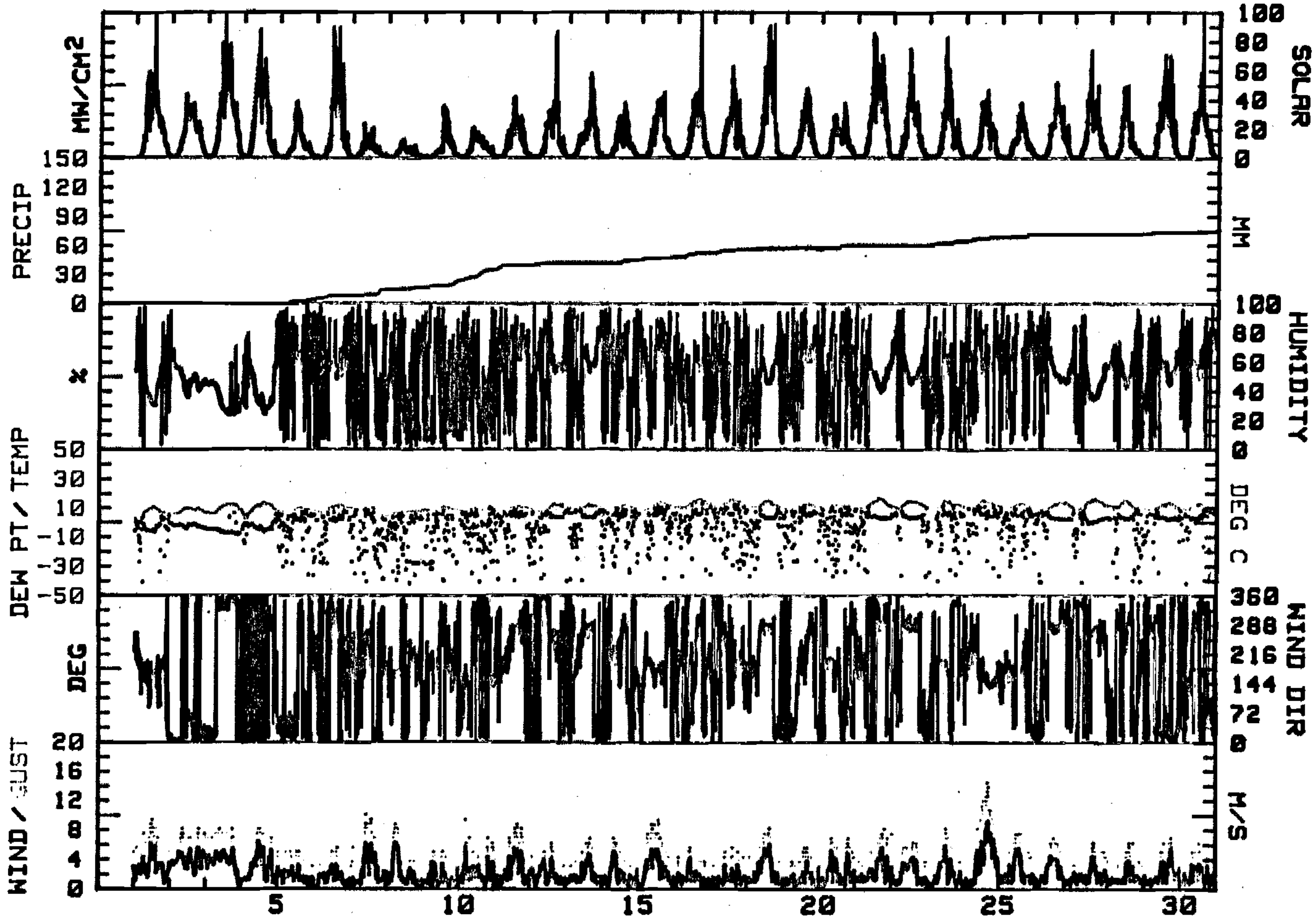
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DENALI WEATHER STATION

July, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	12.6	8.5	10.6	157	5.3	5.6	149	12.1	SSE	61	1.5	2.4	2508	1
2	12.6	7.6	10.1	015	.2	1.5	149	8.9	N	46	-3.9	3.2	3080	2
3	16.8	5.5	11.2	114	.6	3.5	164	9.5	N	44	-1.5	0.0	5943	3
4	18.7	1.8	10.3	043	.5	1.9	075	9.5	N	33	-11.3	0.0	6705	4
5	15.3	7.0	11.2	151	3.9	4.3	143	15.9	SSE	44	-.1	.2	4445	5
6	15.3	8.0	11.7	153	6.8	7.0	143	15.9	SSE	48	.5	.2	4075	6
7	12.3	9.5	10.9	143	10.4	10.4	140	22.2	SE	60	3.7	4.0	1490	7
8	13.3	6.8	10.1	145	4.6	4.9	133	14.6	SE	57	2.5	2.8	2540	8
9	13.0	6.7	9.9	168	1.3	2.6	159	9.5	SSE	54	-2.8	8.8	3478	9
10	13.7	6.5	10.1	177	1.2	2.9	160	11.4	S	49	-3.1	4.0	4128	10
11	11.7	5.8	8.8	158	2.1	2.9	146	13.3	SE	54	-1.8	.6	3260	11
12	9.3	6.1	7.7	156	5.8	6.2	148	12.7	SSE	63	.1	3.6	2215	12
13	10.9	3.6	7.3	149	.0	1.9	165	7.6	NNW	51	-5.5	6.2	3380	13
14	10.2	2.6	6.4	151	5.6	5.9	152	14.0	SSE	48	-3.8	4.4	2415	14
15	7.6	.4	4.0	150	2.9	4.8	146	13.3	SSE	56	-6.1	5.0	1705	15
16	5.1	-2.1	1.5	351	1.0	2.6	211	8.9	N	49	-9.9	1.4	4463	16
17	10.1	-4.5	2.8	174	1.4	2.4	183	7.0	S	43	-9.4	0.0	5625	17
18	8.6	3.2	5.9	191	1.2	1.7	185	7.6	S	46	-7.5	1.6	2228	18
19	9.0	5.2	7.1	352	1.4	2.0	147	10.2	N	39	-8.4	8.0	1625	19
20	11.9	4.3	8.1	003	1.6	2.1	002	8.3	N	48	-7.2	3.0	1775	20
21	14.7	4.7	9.7	165	3.1	4.2	159	12.1	SSE	42	-4.2	2.2	4420	21
22	9.5	5.7	7.6	288	1.2	2.2	276	8.3	W	58	-2.7	.8	2685	22
23	13.7	4.1	8.9	190	.4	1.3	072	4.4	SSW	51	-1.7	0.0	3538	23
24	17.1	1.7	9.4	187	1.7	2.0	176	7.0	S	34	-9.7	0.0	5255	24
25	20.4	6.4	13.4	359	1.3	1.9	356	5.7	N	47	-.8	0.0	3945	25
26	24.5	5.3	14.9	348	1.4	1.8	329	8.3	N	40	.0	0.0	5190	26
27	21.5	8.9	15.2	002	2.7	2.7	002	6.3	N	51	3.7	0.0	4645	27
28	23.3	8.7	16.0	002	2.1	2.2	356	6.3	N	36	-.6	0.0	4628	28
29	16.2	3.4	9.8	288	2.4	3.1	276	8.9	W	50	-1.3	0.0	4353	29
30	16.3	8.0	12.2	343	2.7	3.2	288	9.5	N	47	-2.1	.6	2968	30
31	13.6	3.5	8.6	352	3.9	4.2	051	9.5	N	31	-12.1	.2	4925	31
MONTH	24.5	-4.5	9.4	148	1.2	3.4	140	22.2	N	48	-3.4	63.2	113631	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 15.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 18.4
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 17.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 17.1

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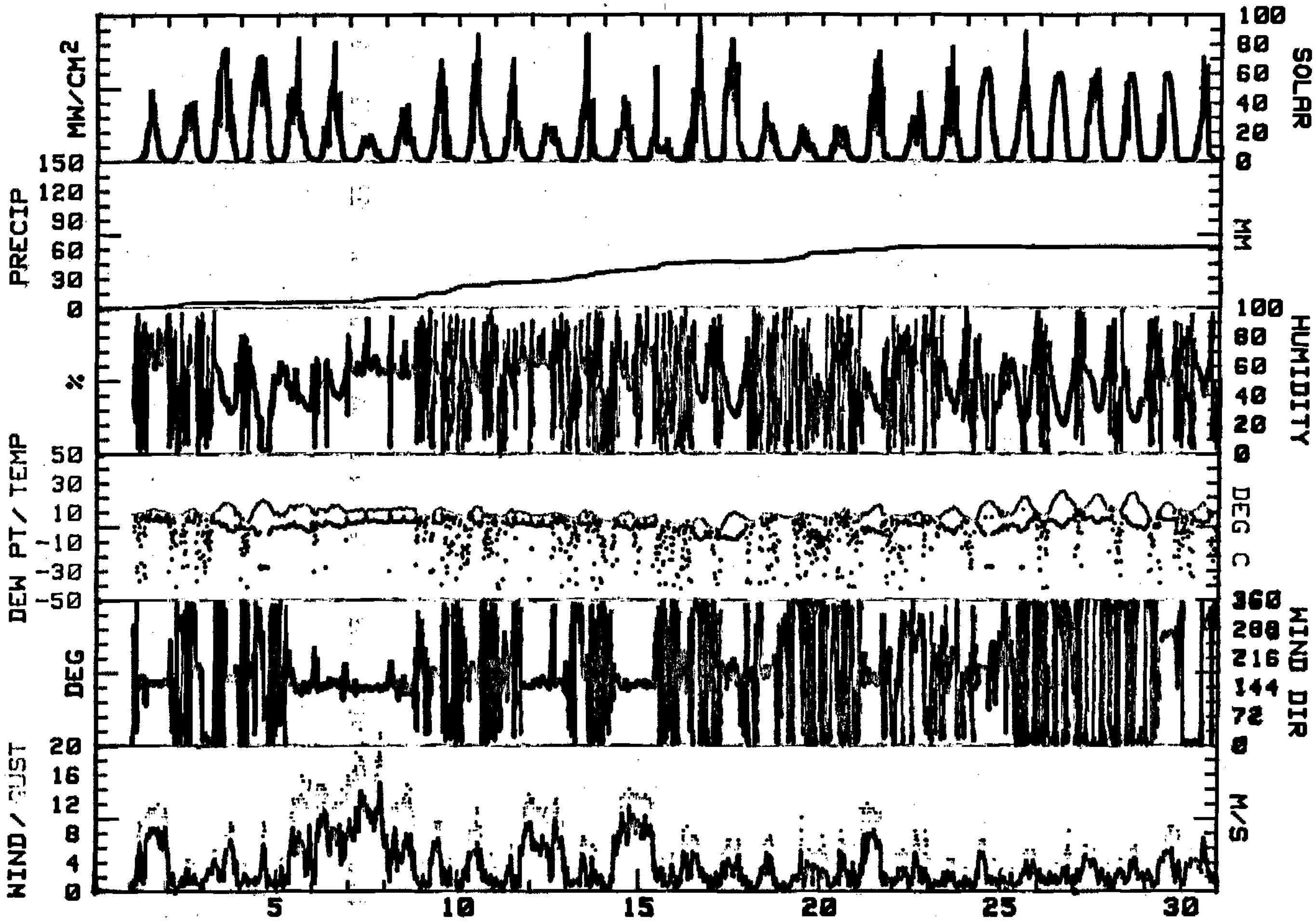
R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DENALI WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DENALI WEATHER STATION
DATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	15.5	-.1	7.7	015	.1	1.6	192	5.7	N	33	-14.7	0.0	4783	1
2	13.6	3.6	8.6	306	.9	2.0	267	7.6	WNW	52	-.6	0.0	3258	2
3	13.8	6.0	9.9	213	.9	1.9	304	6.3	S	50	-2.3	0.0	2933	3
4	9.8	3.7	6.8	184	2.4	2.7	175	9.5	S	57	-3.1	0.0	2413	4
5	12.5	5.7	9.1	183	1.3	2.1	300	9.5	S	50	-.8	.8	2440	5
6	11.9	3.6	7.8	140	1.2	2.4	146	13.3	SSE	52	-3.8	.4	2548	6
7	7.5	1.5	4.5	175	2.0	2.4	174	7.0	S	44	-8.9	.4	1955	7
8	11.7	2.4	7.1	010	1.1	2.0	108	7.6	N	46	-6.0	0.0	3383	8
9	10.0	.2	5.1	355	2.1	2.4	002	6.3	N	54	-4.9	1.6	1895	9
10	9.4	2.6	6.0	000	2.1	2.2	353	7.0	N	51	-4.2	.8	2545	10
11	9.6	1.8	5.7	323	.2	1.7	166	7.6	NNW	57	-5.3	1.2	2198	11
12	10.1	.9	5.5	158	1.9	2.5	158	11.4	SSE	38	-7.0	0.0	2373	12
13	9.2	.3	4.8	175	2.1	2.8	171	10.2	S	54	-4.8	0.0	3153	13
14	11.9	-1.5	5.2	005	1.6	3.3	170	12.1	N	46	-8.2	0.0	2920	14
15	12.2	2.9	7.6	167	3.0	3.8	158	12.7	SSE	47	-4.8	1.0	2120	15
16	10.2	1.5	5.9	147	3.4	3.9	116	15.2	SE	46	-5.7	0.0	2385	16
17	11.9	1.1	6.5	028	.7	3.0	139	11.4	N	35	-9.7	0.0	3570	17
18	9.8	1.8	5.8	357	1.9	2.4	000	10.8	N	52	-4.1	0.0	1790	18
19	9.5	3.6	6.6	135	2.9	4.4	161	19.0	SE	53	-2.5	2.2	983	19
20	7.6	1.1	4.4	199	.9	2.7	173	5.7	S	50	-8.0	0.0	2158	20
21	5.8	.8	3.3	001	3.8	3.8	359	8.3	N	53	-6.5	0.0	2113	21
22	5.4	-2.5	1.5	002	3.1	3.2	356	7.0	N	45	-9.8	0.0	3128	22
23	4.2	-3.3	.5	323	.2	1.3	359	5.1	N	54	-8.0	0.0	1695	23
24	.1	-2.2	-1.1	016	2.7	2.9	013	8.9	NNE	61	-8.6	0.0	750	24
25	-.2	-6.4	-3.3	014	3.9	4.0	350	8.9	NNE	52	-11.2	0.0	1938	25
26	-2.8	-12.4	-7.6	001	3.6	3.6	003	7.6	N	53	-15.4	0.0	2633	26
27	-3.1	-14.2	-8.7	360	1.8	2.0	000	5.7	N	54	-16.7	0.0	2970	27
28	-.8	-11.8	-6.3	005	1.5	1.7	003	7.6	N	51	-16.4	0.0	2740	28
29	-3.2	-14.1	-8.7	000	2.0	2.4	353	6.3	N	55	-15.9	0.0	2315	29
30	1.1	-10.0	-4.5	005	5.0	5.1	358	12.7	N	48	-12.9	0.0	2693	30
MONTH	15.5	-14.2	3.2	023	.6	2.4	161	19.0	N	50	-7.7	8.4	74770	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.0
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 19.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 13.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS TH[illegible] ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAIL[illegible] OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

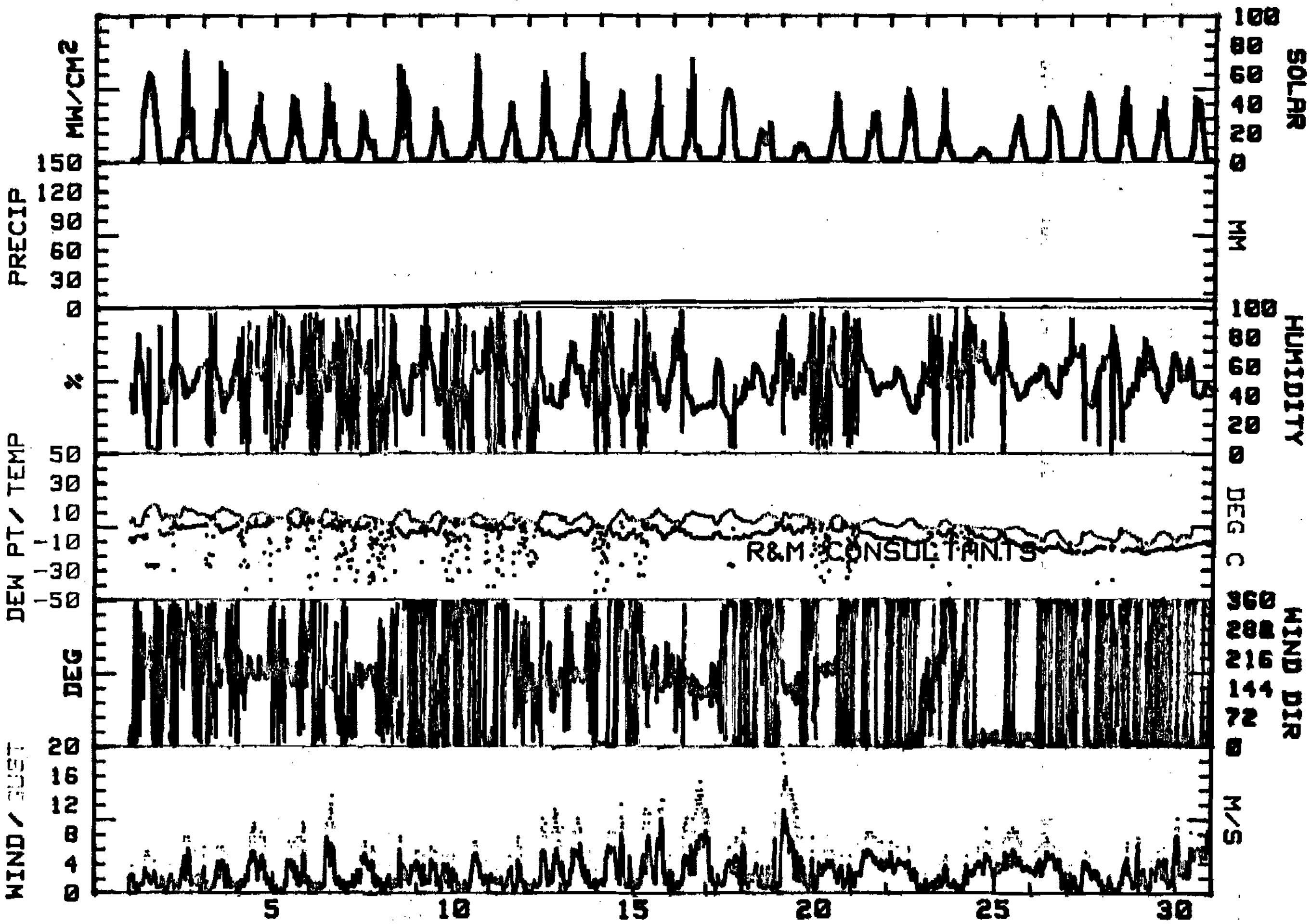
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DENALI WEATHER STATION

September, 1981



ATTACHMENT E.5, PART 3

TYONE RIVER CLIMATE DATA

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

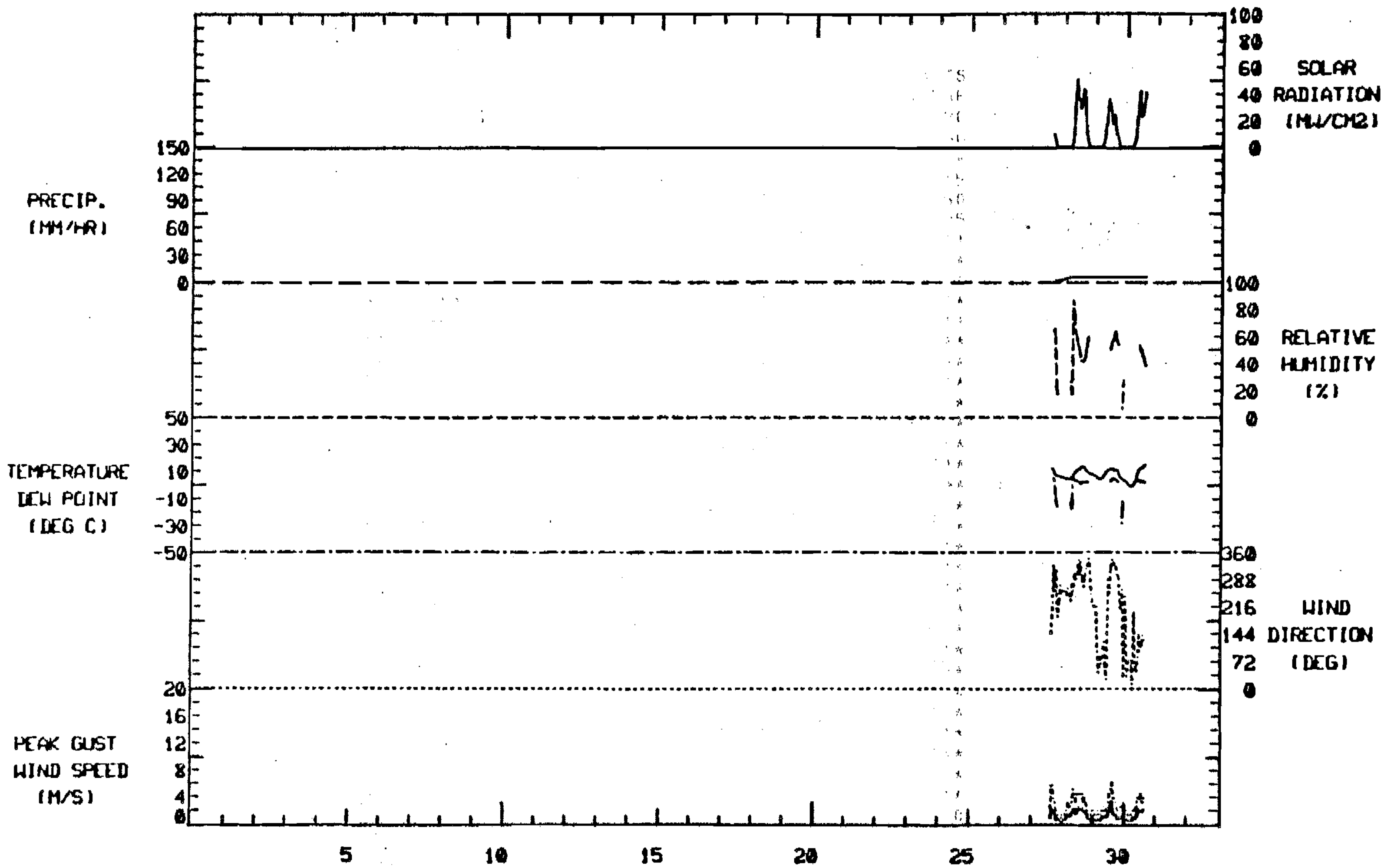
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	11.9	5.2	8.5	***	****	1.1	210	5.7	WSW	42	-12.5	3.6	658	27
28	13.7	4.3	9.0	290	1.1	1.3	347	5.1	WSW	50	-1.3	2.8	3850	28
29	11.9	2.3	7.1	318	.4	1.1	319	6.3	E	51	-6.4	0.0	2588	29
30	*****	*****	*****	109	.7	1.0	138	4.4	SE	46	1.6	0.0	4507	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	13.7	2.3	8.2	306	.3	1.1	319	6.3	WSW	47	-4.7	6.4	11602	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH TYONE WEATHER STATION

DATA START: 27 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
MONTH	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

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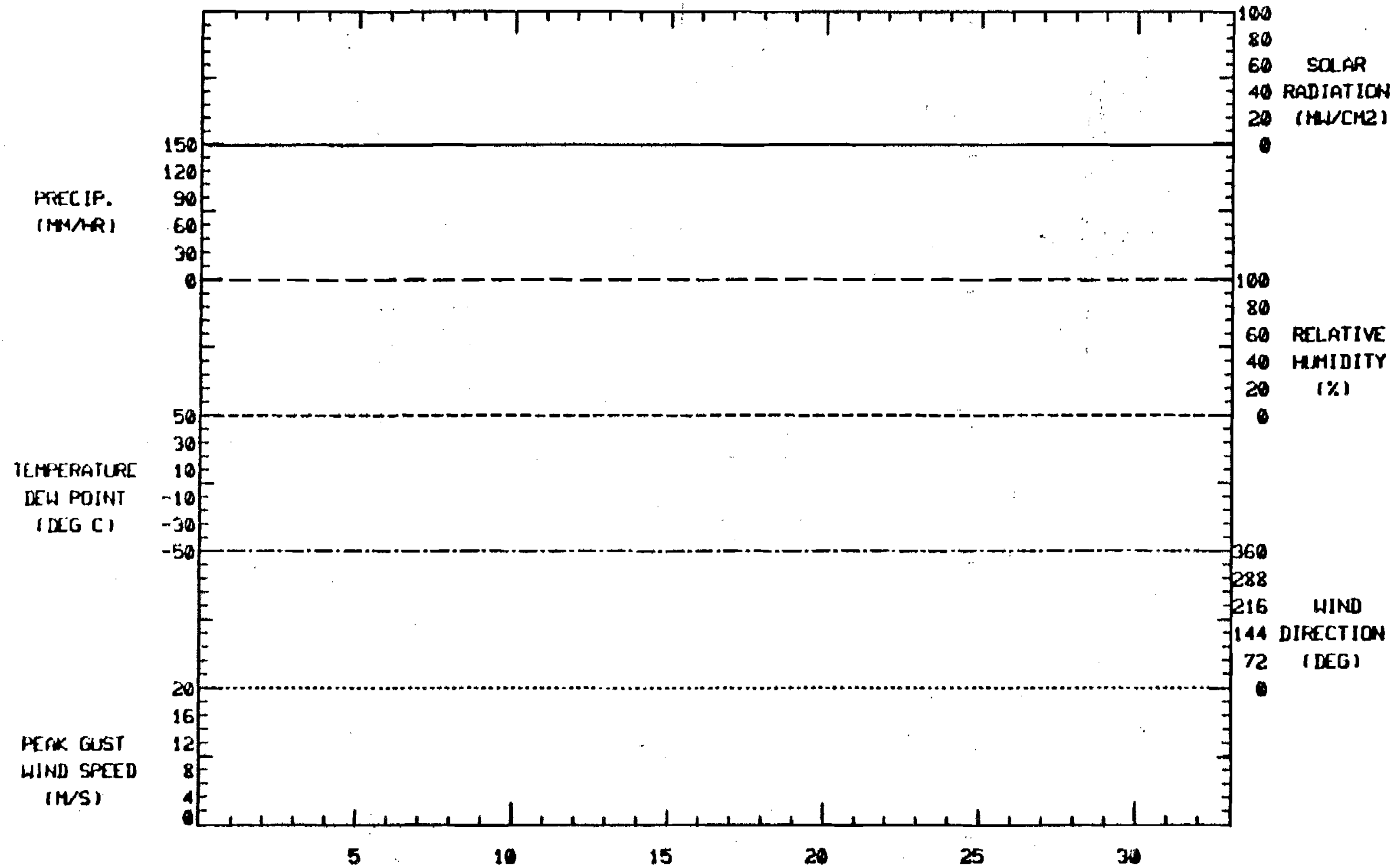
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01 SEPTEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	-.3	-6.4	-3.3	***	****	.4	064	1.9	NE	26	*****	****	2448	17
18	3.2	-4.6	-.7	***	****	1.3	082	5.1	E	58	-5.1	****	345	18
19	*****	*****	*****	***	****	1.5	097	7.0	SW	62	-6.3	****	287	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	.9	-6.2	-2.7	***	****	****	***	****	MSG	**	*****	****	***	21
22	3.8	-6.8	-1.5	132	.7	1.4	101	7.0	SW	57	-7.7	****	1037	22
23	3.0	-8.3	-2.6	157	.1	.6	088	3.2	S	59	-4.1	****	834	23
24	5.8	-11.1	-2.7	158	.4	.8	123	3.8	ESE	56	-20.8	****	274	24
25	2.4	-11.6	-4.6	***	****	.4	247	2.5	NE	60	*****	****	536	25
26	-1.1	-10.8	-5.9	***	****	.6	266	2.5	W	29	*****	****	1096	26
27	-1.0	-8.6	-4.8	***	****	.5	***	2.7	NNE	50	-24.9	****	730	27
28	-2.1	-9.6	-5.9	167	.2	.5	216	2.5	SW	75	*****	****	497	28
29	-.2	-7.0	-3.6	072	.1	.4	021	3.2	ENE	28	*****	****	538	29
30	-3.3	-11.4	-7.4	277	.4	.8	***	4.4	W	46	-23.6	****	889	30
31	-10.9	-11.8	-11.4	***	****	1.8	278	3.2	W	24	*****	****	240	31
MONTH	5.8	-11.8	-4.4	155	.2	.8	097	7.0	E	49	-13.2	****	9746	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 4.4
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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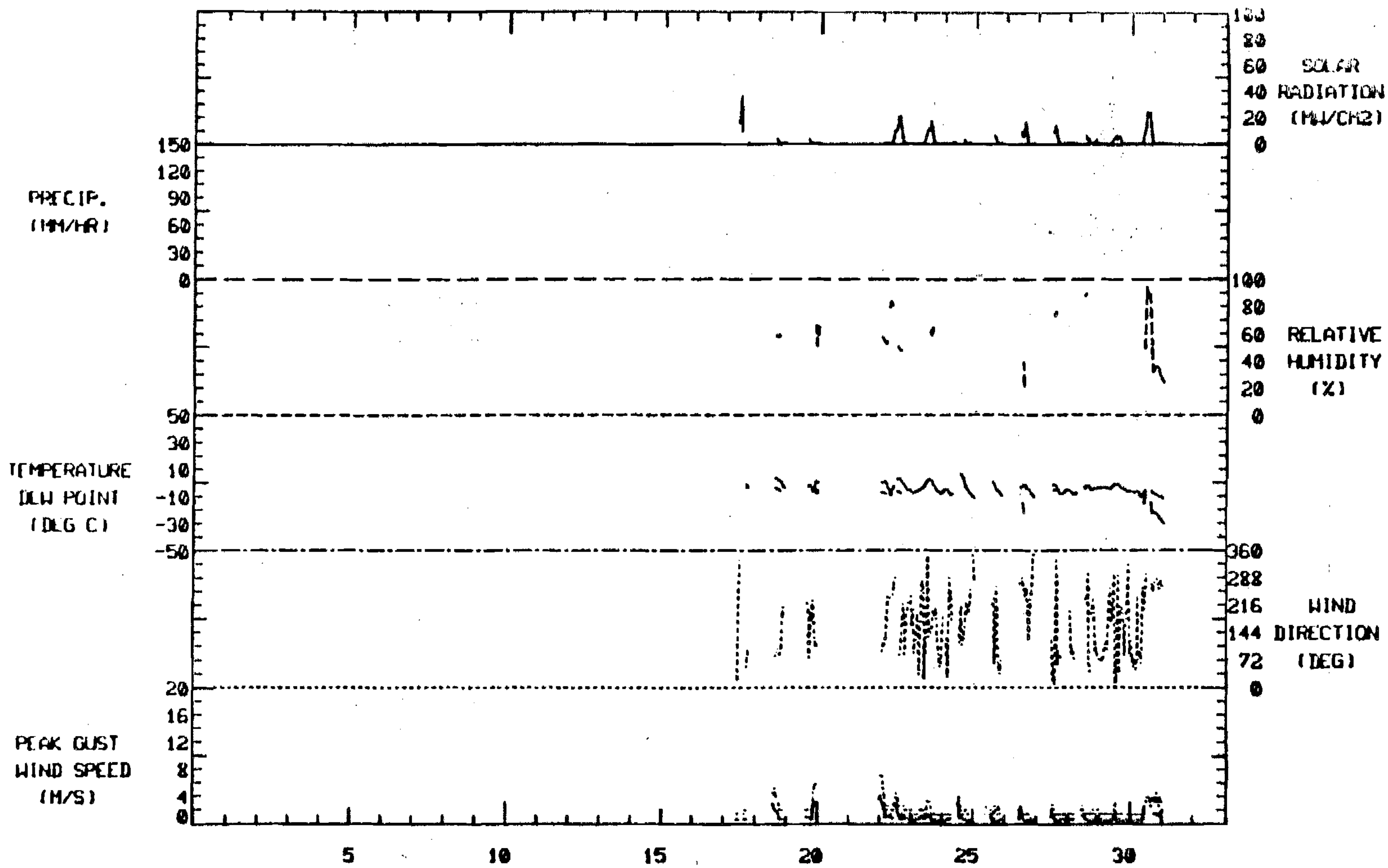
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH TYONE WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	99.0	*****	*****	***	****	.4	167	1.9	SSW	27	-11.8	****	443	01
02	-7.2	-13.8	-10.5	186	.2	.4	215	1.9	SW	46	-20.8	****	621	02
03	-4.9	-10.7	-7.8	249	.3	.7	252	3.2	SW	29	-20.8	****	455	03
04	-2.4	-14.2	-8.3	126	.3	.7	***	3.2	ESE	32	-23.1	****	384	04
05	-.1	-12.7	-6.4	202	.3	.5	219	2.5	SW	33	-1.2	****	612	05
06	-3.8	-11.1	-7.5	214	.3	.3	215	1.9	SW	38	*****	****	376	06
07	-3.3	-7.4	-5.4	324	1.2	1.8	350	8.3	SW	76	-9.1	****	403	07
08	-6.7	-22.5	-14.6	302	1.3	1.7	337	5.7	NW	70	-16.9	****	1011	08
09	-14.4	-28.0	-21.2	082	.2	.4	086	1.9	ENE	72	*****	****	771	09
10	-14.8	-27.7	-21.3	116	.2	.4	072	1.9	ENE	67	*****	****	573	10
11	-10.2	-25.3	-17.8	116	.2	.4	118	1.9	ENE	79	*****	****	749	11
12	-8.0	-25.7	-16.9	158	.2	.5	199	4.3	SSW	54	*****	****	795	12
13	-10.3	-22.6	-16.5	058	.2	.4	050	1.9	ENE	08	*****	****	488	13
14	-7.6	-22.8	-15.2	275	.0	.4	230	1.9	ENE	43	-23.4	****	414	14
15	-5.4	-20.7	-13.1	238	.5	.7	248	3.2	WSW	30	-24.2	****	519	15
16	-4.6	-13.5	-9.1	172	.2	.6	091	4.3	WSW	43	-25.1	****	441	16
17	-6.8	-20.2	-13.5	228	.3	.5	227	2.5	SW	31	-23.1	****	365	17
18	-11.9	-22.1	-17.0	063	.1	.4	***	1.9	NE	21	*****	****	423	18
19	-10.1	-16.1	-13.1	193	.1	.4	217	3.2	SW	29	*****	****	364	19
20	-6.1	-22.7	-14.4	107	.2	.5	057	2.5	NE	52	*****	****	557	20
21	-15.0	-25.3	-20.2	088	.2	.4	124	1.9	NE	**	*****	****	520	21
22	-8.6	-19.0	-13.8	074	.2	.4	092	2.5	NE	22	*****	****	385	22
23	-8.7	-20.2	-14.5	248	.1	.5	223	2.5	NE	34	-24.5	****	384	23
24	-.3	-12.6	-6.4	188	.3	.7	103	4.4	SW	48	-18.5	****	334	24
25	-1.5	-10.5	-6.0	128	.7	1.0	122	5.7	E	32	-20.3	****	403	25
26	.4	-11.2	-5.4	003	.6	1.4	348	7.0	NE	64	-7.0	****	318	26
27	-2.8	-7.5	-5.2	357	1.3	1.5	001	6.3	N	27	-23.4	****	320	27
28	-6.6	-11.0	-8.8	330	2.2	2.5	002	7.0	NW	56	-16.8	****	373	28
29	-9.6	-32.2	-20.9	248	.7	.9	258	3.8	WSW	86	-20.2	****	538	29
30	-19.2	-32.3	-25.6	069	.1	.4	220	1.9	NE	79	-25.0	****	593	30
MONTH	99.0	-32.3	-13.0	317	.1	.7	350	8.3	SW	46	-18.7	****	14928	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS	5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL	5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL	6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS	6.3

NOTE; RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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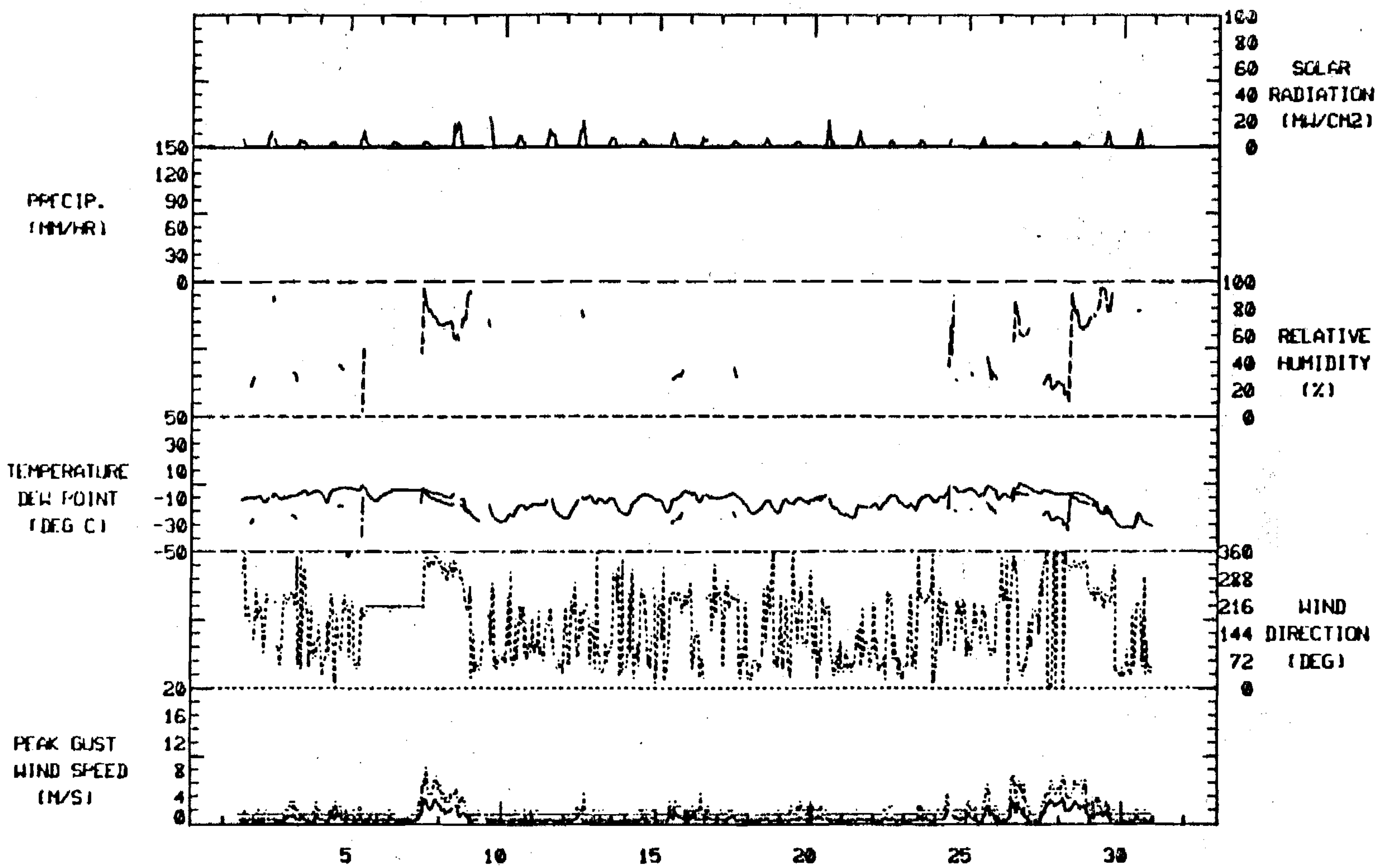
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01 NOVEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

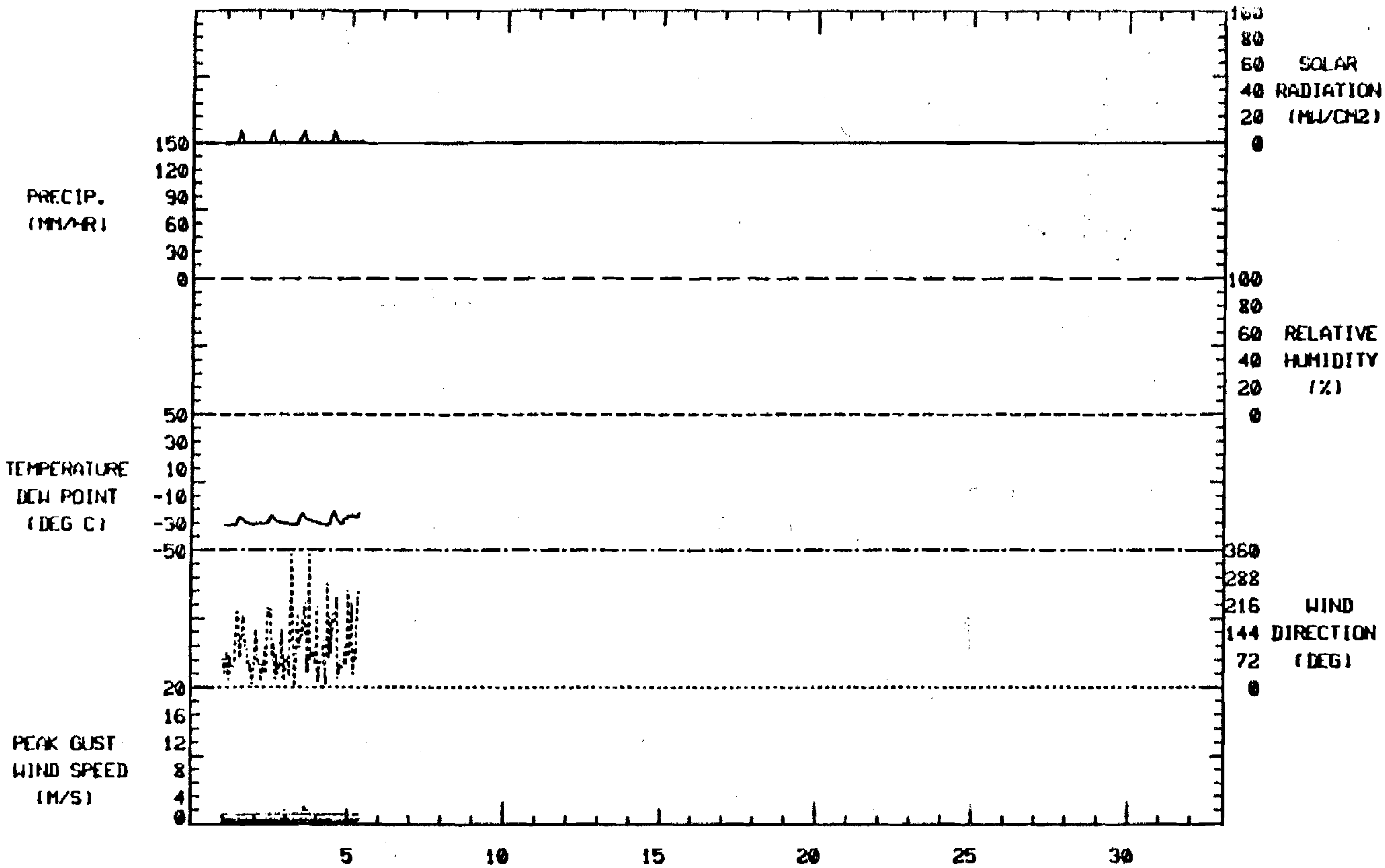
DAY	MAX.. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY$S SOLAR ENERGY WH/SQM	DAY
01	-24.4	-31.5	-26.0	084	.1	.2	126	1.3	NE	**	*****	****	460	01
02	-24.9	-30.9	-27.9	090	.1	.3	202	1.3	NE	74	-29.0	****	475	02
03	-22.6	-31.4	-27.0	093	.1	.3	244	2.5	ENE	73	-27.6	****	493	03
04	-19.4	-31.4	-25.4	077	.1	.3	090	1.9	NE	**	*****	****	480	04
05	*****	*****	*****	***	****	.3	227	1.3	SW	**	*****	****	253	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	-19.4	-31.5	-27.1	086	.1	.3	244	2.5	NE	73	-28.3	****	2160	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 1.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 1.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 1.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS .6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH TYONE WEATHER STATION

DATA START: 01 DECEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	-11.6	-20.6	-16.1	***	****	.3	248	1.9	NNE	**	*****	****	282	09
10	-8.3	-16.5	-13.4	359	.1	.2	036	1.9	NNE	**	*****	****	248	10
11	-5.9	-12.4	-9.1	298	.0	.2	176	1.9	WNW	38	*****	****	203	11
12	-7.7	-13.8	-10.8	328	.1	.1	244	1.3	NNE	**	*****	****	283	12
13	-9.8	-18.2	-14.6	350	.1	.2	321	1.9	N	**	*****	****	253	13
14	2.7	-19.8	-8.5	***	****	2.1	125	10.8	ESE	41	-11.6	****	182	14
15	3.8	-9.9	-3.0	114	3.1	3.2	120	11.4	ESE	27	-19.5	****	630	15
16	-6.0	-18.7	-12.4	***	****	.6	201	2.5	SW	34	*****	****	142	16
17	-6.8	-16.9	-11.9	***	****	.4	246	1.9	NNE	39	*****	****	197	17
18	-1.2	-12.6	-6.9	237	.3	.7	104	3.2	SW	37	-18.8	****	264	18
19	-.4	-10.2	-5.3	137	1.4	1.8	164	10.2	E	56	-14.3	****	237	19
20	-9.8	-18.2	-14.0	***	****	.8	085	3.2	E	30	*****	****	160	20
21	-8.2	-17.3	-12.8	255	.1	.4	212	2.5	NNE	17	*****	****	243	21
22	-11.8	-20.5	-16.2	059	.2	.4	242	1.9	ENE	**	*****	****	240	22
23	-6.3	-23.0	-14.6	***	****	.6	261	1.9	SW	28	*****	****	480	23
24	.2	-13.1	-6.4	118	.7	1.1	091	7.0	E	54	-15.3	****	280	24
25	-.7	-17.8	-9.3	163	.6	1.0	083	5.7	SW	65	-10.6	****	531	25
26	-6.6	-21.4	-14.0	061	.3	.4	058	1.9	NE	07	*****	****	462	26
27	-7.3	-24.6	-15.9	230	.4	.5	230	2.5	SW	35	-23.0	****	355	27
28	-16.1	-25.3	-20.7	***	****	.3	030	.6	NNE	**	*****	****	187	28
29	-4.5	-16.2	-10.4	233	.3	.5	251	2.5	SW	33	-17.2	****	408	29
30	-4.6	-14.7	-9.7	216	.6	.7	248	2.5	SW	27	-26.0	****	419	30
31	-6.7	-20.2	-13.5	169	.1	.4	226	1.9	SW	23	*****	****	600	31
MONTH	3.8	-25.3	-11.7	137	.3	.7	120	11.4	SW	35	-17.4	****	7284	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 9.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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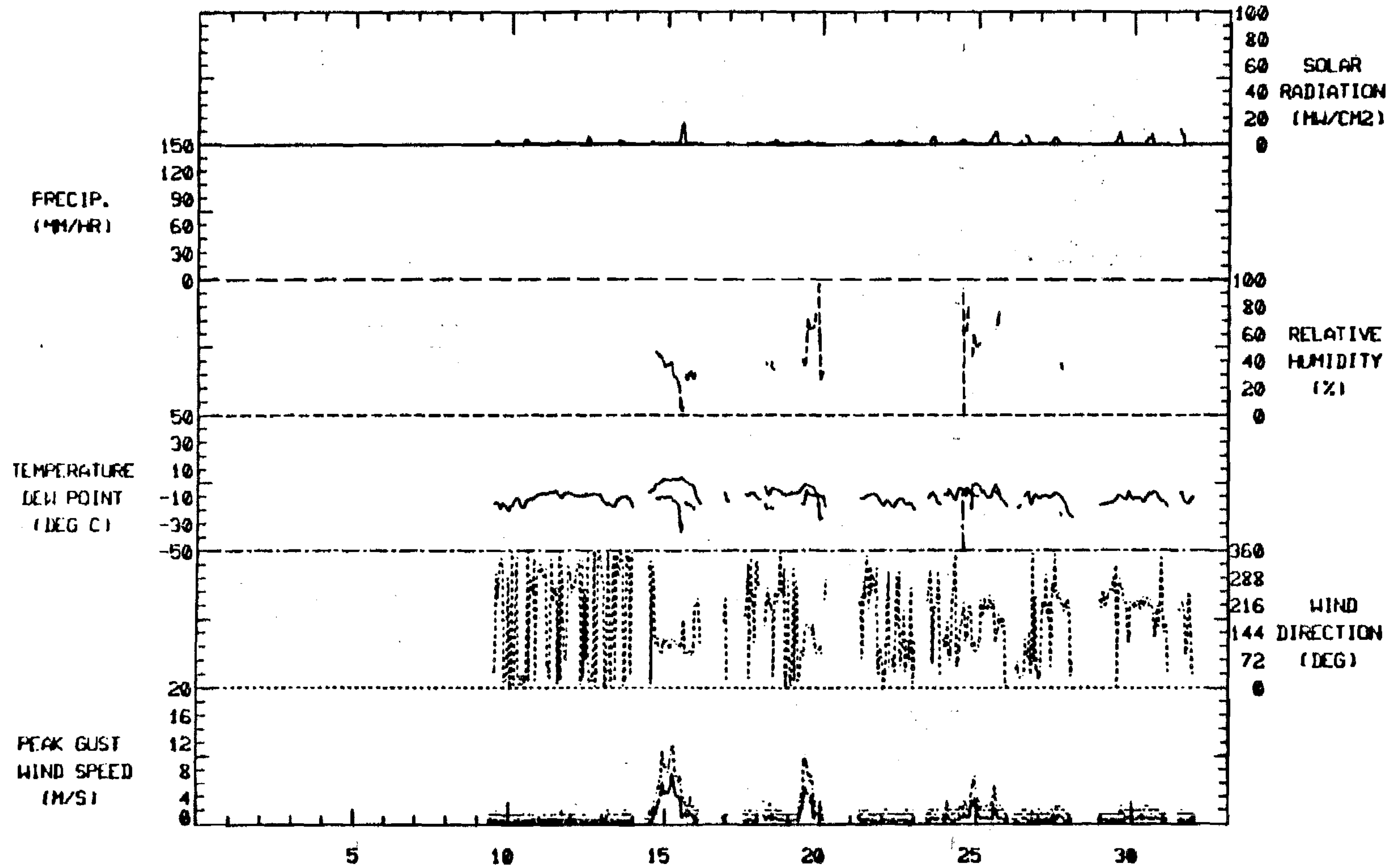
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

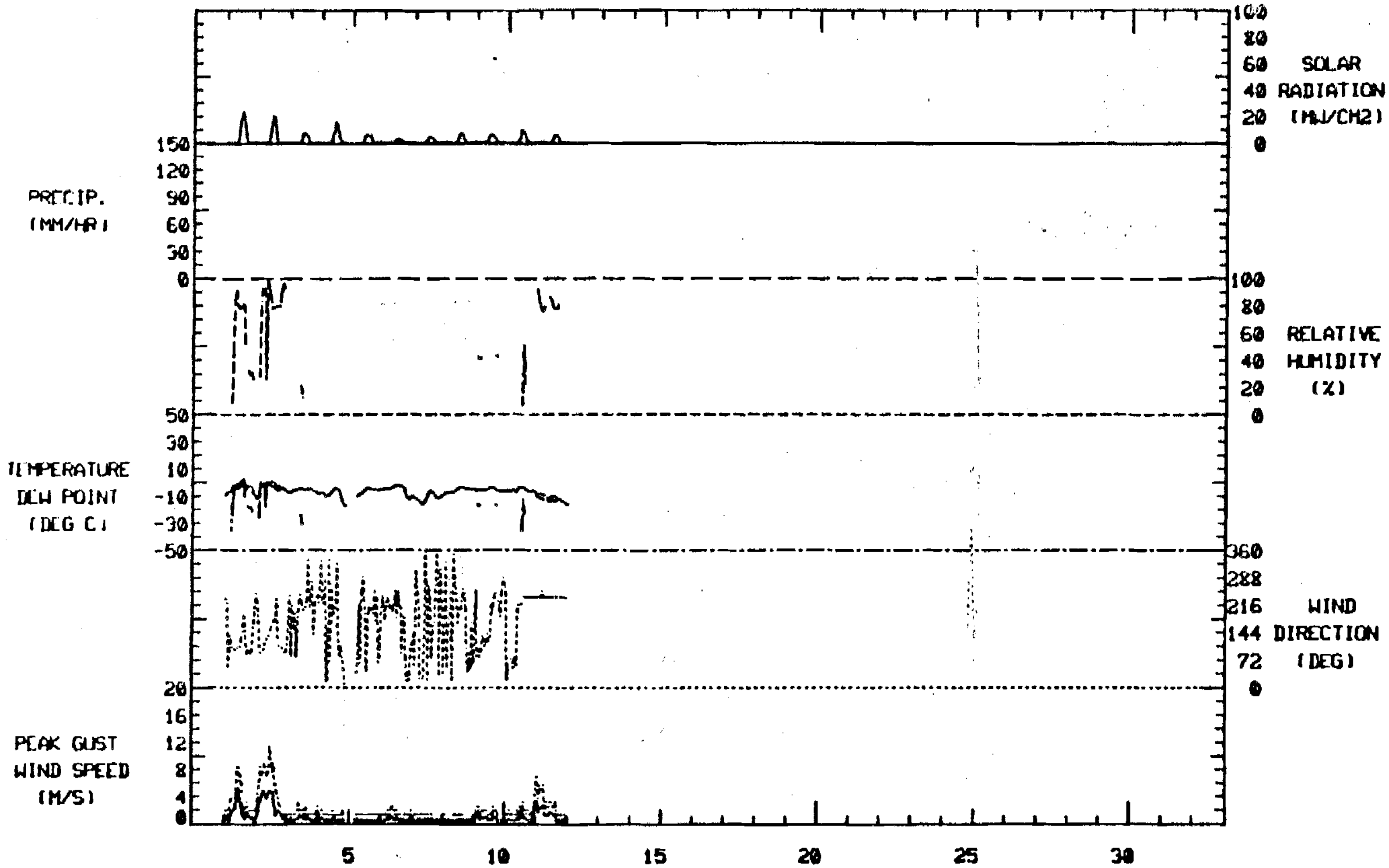
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	2.9	-11.5	-4.3	114	1.3	1.6	093	8.3	ESE	60	-26.4	****	1115	01
02	.9	-12.7	-5.9	131	2.3	2.8	164	11.4	E	79	-3.2	****	908	02
03	-4.3	-6.6	-6.5	217	.4	.6	233	3.2	SW	16	-32.0	****	505	03
04	-4.0	-17.3	-10.6	223	.1	.5	224	2.5	SW	60	*****	****	846	04
05	-3.3	-13.1	-8.2	207	.1	.3	067	1.3	ENE	**	*****	****	548	05
06	-1.8	-12.6	-7.2	212	.3	.5	206	2.5	SW	38	*****	****	293	06
07	-6.3	-16.0	-11.1	006	.0	.3	107	1.9	NNE	**	*****	****	353	07
08	-3.3	-9.2	-6.3	221	.1	.2	113	1.3	SSW	**	*****	****	460	08
09	-3.0	-6.5	-4.8	148	.3	.6	102	2.5	ESE	41	-16.4	****	453	09
10	-1.7	-8.0	-4.9	228	.4	.6	236	5.1	SW	43	-18.6	****	545	10
11	*****	*****	*****	237	1.3	1.3	236	7.0	SW	80	-13.2	****	460	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
MONTH	2.9	-17.3	-7.0	164	.4	.8	164	11.4	SW	52	-18.3	****	6483	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH TYONE WEATHER STATION

DATA START: 01 FEBRUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING MARCH , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	-9.3	-22.2	-15.8	***	****	.5	252	2.5	WSW	79	*****	****	***	04
05	-2.7	-20.7	-11.7	205	.1	.5	200	2.5	SSW	55	-14.7	****	***	05
06	-1.1	-27.0	-14.0	194	.2	.5	005	1.9	SSW	40	-16.5	****	***	06
07	-2.5	-29.8	-16.2	244	.3	.8	259	3.2	NE	51	-14.2	****	***	07
08	*****	*****	*****	***	****	.6	239	2.5	SW	55	-17.0	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	3.4	-6.1	-1.4	***	****	1.0	168	7.0	SW	51	-8.4	****	***	17
18	8.5	-8.4	.1	112	2.2	2.4	112	8.9	ESE	31	-13.6	****	***	18
19	5.6	-13.7	-4.1	229	.3	1.4	326	5.1	SSW	41	-11.9	****	***	19
20	2.9	-18.8	-7.9	320	.6	1.3	338	6.3	NNW	46	-14.7	****	***	20
21	.9	-23.1	-11.1	069	.3	1.2	061	5.1	ENE	44	-12.7	****	***	21
22	-.7	-23.6	-12.1	220	.6	1.0	101	4.4	SW	46	-16.1	****	***	22
23	1.3	-9.5	-4.1	191	.4	.5	144	3.2	SSW	63	-8.3	****	***	23
24	.4	-14.9	-7.3	236	.8	.9	227	3.8	WSW	74	-4.6	****	***	24
25	.7	-19.8	-9.5	135	.6	.8	157	3.8	SE	57	-8.7	****	***	25
26	1.6	-9.9	-4.1	215	.5	.7	224	2.5	SSW	62	-6.7	****	***	26
27	5.4	-14.1	-4.4	156	.3	.8	153	2.5	SW	45	-4.0	****	***	27
28	2.4	-20.0	-8.6	307	.9	1.2	338	5.1	NNE	59	-9.6	****	***	28
29	2.8	-14.0	-5.6	231	.7	.9	207	3.8	SW	41	-11.3	****	***	29
30	1.8	-21.5	-9.9	229	.7	.9	225	3.2	SW	50	-9.7	****	***	30
31	.3	-16.4	-8.1	330	1.4	1.8	352	8.3	SW	55	-12.7	****	***	31
MONTH	8.5	-29.8	-8.2	217	.2	1.0	112	8.9	SW	52	-11.3	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.6

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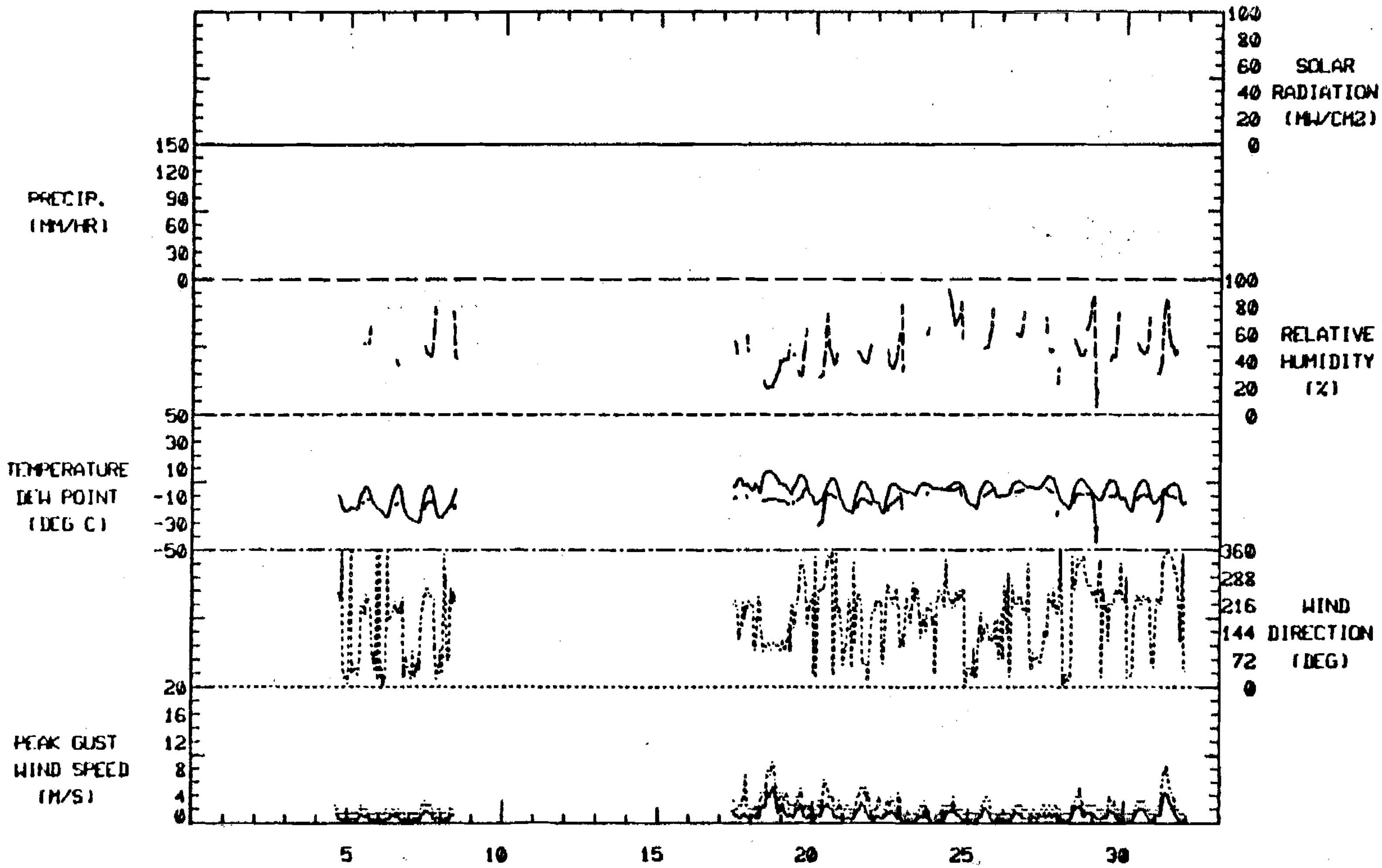
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01 MARCH , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING APRIL , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-1.6	-14.1	-7.9	232	.6	.8	250	3.2	SW	49	-6.5	****	1984	01
02	.6	-19.5	-9.5	291	1.0	1.4	300	5.7	NW	47	-14.1	****	4173	02
03	-.8	-25.0	-12.9	239	.8	1.0	263	3.2	WSW	50	-14.0	****	4918	03
04	-1.0	-22.0	-11.5	275	1.0	1.4	317	4.4	WSW	47	-15.6	****	5085	04
05	-.4	-24.1	-12.3	223	.7	1.0	254	3.2	SSW	36	-18.1	****	5245	05
06	-.2	-26.6	-13.4	228	.5	.8	204	3.2	SW	35	-17.9	****	4905	06
07	-1.5	-23.8	-12.6	324	1.3	1.8	332	7.6	NNW	44	-14.9	****	5125	07
08	-.8	-23.4	-12.1	279	1.1	1.4	322	7.0	W	42	-15.0	****	4425	08
09	-2.7	-21.2	-12.0	331	2.9	3.2	333	10.2	NNW	36	-19.5	****	5463	09
10	-2.4	-27.6	-15.0	223	.6	.9	224	3.8	SW	28	-23.2	****	5670	10
11	.8	-27.5	-13.4	264	.6	1.0	336	3.8	WSW	22	-21.7	****	5743	11
12	.6	-27.3	-13.4	201	.3	1.1	073	5.1	NE	25	-21.2	****	5560	12
13	-2.0	-25.1	-13.5	063	1.2	1.7	071	7.0	ENE	28	-20.3	****	5805	13
14	-4.9	-28.0	-16.5	059	1.1	1.7	064	7.6	NE	37	-20.0	****	5118	14
15	-2.5	-24.0	-13.3	046	1.0	1.7	036	7.0	NE	30	-22.7	****	5985	15
16	-2.5	-23.6	-13.0	226	.9	1.1	223	3.8	SW	35	-22.5	****	5970	16
17	1.0	-27.0	-13.0	227	.6	.8	233	3.2	WSW	27	-20.2	****	6153	17
18	1.8	-24.4	-11.3	233	.5	.9	209	4.4	SW	32	-16.3	****	5175	18
19	5.0	-15.0	-5.0	234	.7	.9	229	3.8	SW	40	-11.6	****	5965	19
20	6.7	-10.0	-1.7	187	.7	1.1	136	5.7	SSW	40	-8.3	****	5368	20
21	7.5	-14.9	-3.7	237	.8	1.0	223	3.2	SW	40	-9.0	****	6338	21
22	8.5	-11.9	-1.7	243	1.0	1.2	243	3.8	WSW	41	-8.5	****	6738	22
23	7.1	-11.6	-2.3	224	.6	1.0	086	3.8	SW	43	-14.9	****	5228	23
24	8.6	-7.1	.8	225	.3	1.2	320	3.8	SW	47	-7.8	****	6203	24
25	8.0	-8.9	-.4	243	.4	.9	318	5.1	SW	45	-5.3	****	7205	25
26	7.4	-11.0	-1.8	246	.9	1.1	236	4.4	WSW	43	-11.7	****	6815	26
27	7.8	-7.8	0.0	300	1.1	1.7	333	5.1	SW	41	-9.1	****	6490	27
28	8.4	-8.7	-.2	273	.8	1.5	353	6.3	SW	39	-10.0	****	5538	28
29	8.2	-5.2	1.5	222	.8	1.0	226	5.7	SW	49	-3.8	****	5768	29
30	10.5	-8.4	1.1	238	.6	.9	264	3.8	SW	42	-4.7	0.0	6585	30
MONTH	10.5	-28.0	-8.0	265	.5	1.2	333	10.2	SW	39	-14.3	0.0	166736	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

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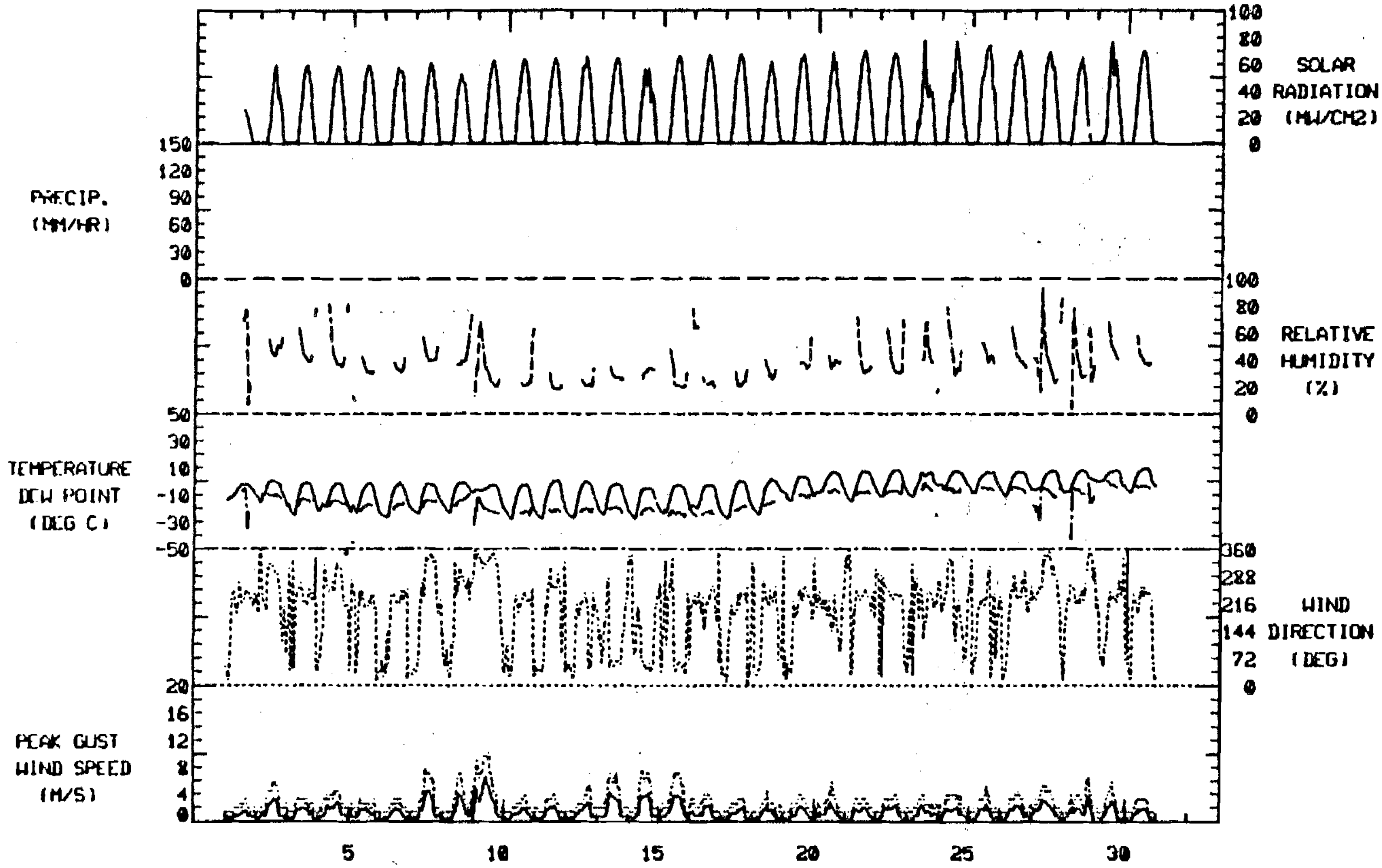
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH TYONE WEATHER STATION

DATA START: 01 APRIL , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING MAY , 1981

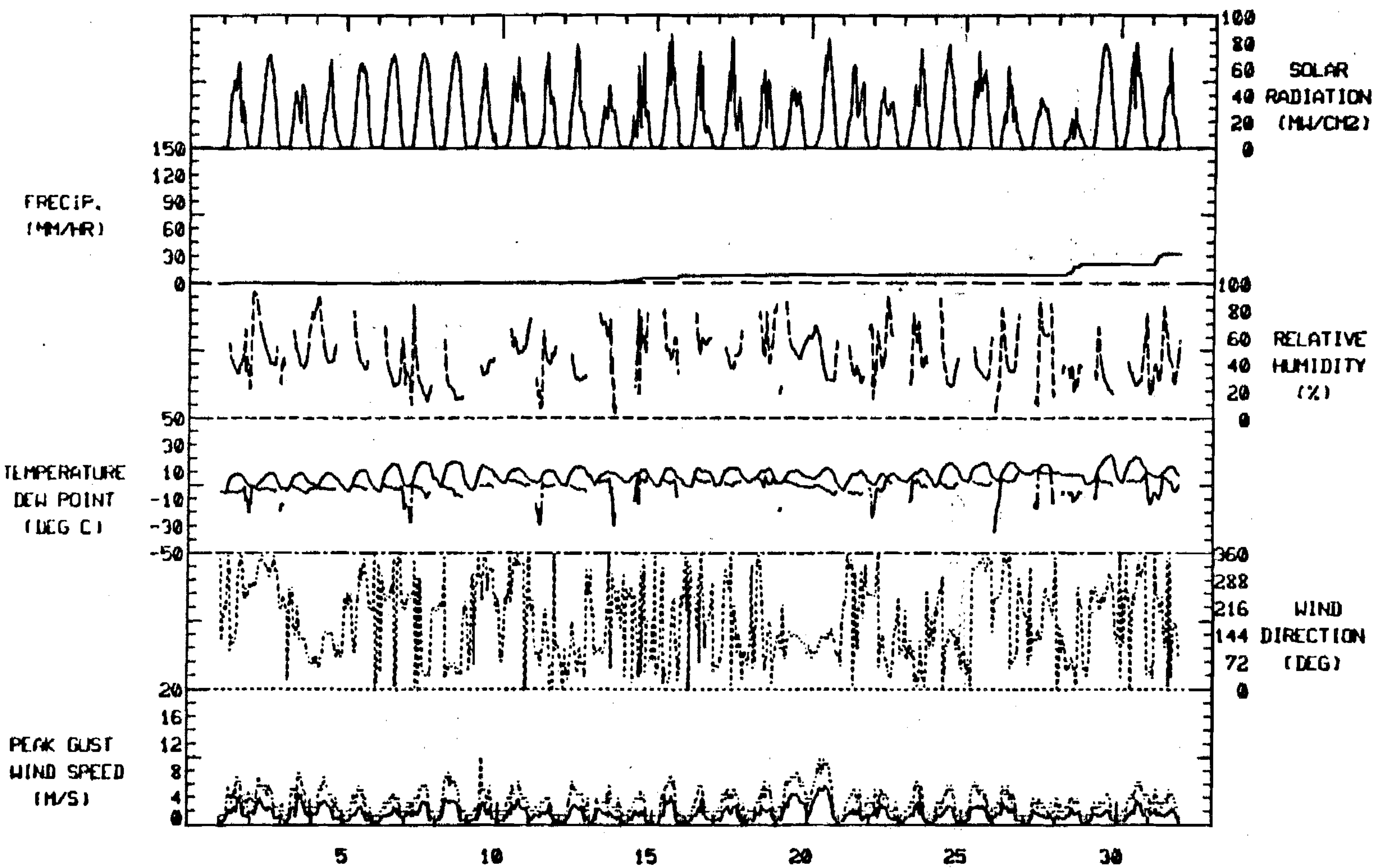
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	9.3	-6.5	1.4	301	.3	1.6	335	7.0	WSW	42	-6.5	0.0	5475	01
02	9.4	-2.3	3.5	318	1.8	2.1	334	7.0	NNW	58	-4.6	0.0	6648	02
03	9.4	-4.5	2.4	137	1.3	1.9	142	7.6	SE	51	-3.6	0.0	4520	03
04	9.3	-.6	4.3	115	1.6	1.9	145	7.0	E	57	-3.1	0.0	4213	04
05	11.3	-4.7	3.3	273	.5	1.2	293	5.7	SW	45	-2.4	0.0	6110	05
06	16.2	-4.6	5.7	304	.6	1.2	333	4.4	N	37	-5.1	0.0	6868	06
07	17.1	-1.0	8.0	351	.4	1.8	055	5.7	WSW	31	-7.2	0.0	7143	07
08	17.7	-2.0	7.9	057	1.3	2.0	093	7.6	NE	27	-6.9	0.0	7243	08
09	15.5	-3.8	5.9	311	.8	1.3	269	10.2	W	41	-.6	0.0	4253	09
10	12.7	.9	6.6	334	1.3	1.8	337	6.3	N	57	1.4	0.0	5153	10
11	12.0	2.0	7.0	104	.4	1.2	201	3.8	E	40	-5.1	0.0	4463	11
12	14.3	-.8	6.8	082	.8	1.4	141	6.3	NE	33	-3.8	0.0	5425	12
13	10.8	.5	5.6	124	.4	1.3	033	5.7	E	52	-3.3	2.0	3748	13
14	12.8	1.9	7.3	329	.1	1.0	056	5.1	ENE	52	-6.3	3.2	4165	14
15	13.2	-.8	6.2	018	.3	1.6	228	7.0	NNE	51	-1.4	2.6	5883	15
16	13.5	-.8	6.4	229	.3	1.1	277	6.3	SW	57	3.1	.2	4448	16
17	13.7	.1	6.9	164	.0	1.4	262	5.1	NE	47	.2	0.0	5383	17
18	13.3	2.2	7.8	065	.4	1.3	067	6.3	ENE	61	2.8	.8	4278	18
19	11.5	.7	6.1	129	2.7	2.9	130	7.6	SE	53	-2.4	0.0	4548	19
20	13.4	-.6	6.4	126	3.2	3.4	133	9.5	SE	46	-3.8	0.0	6503	20
21	11.1	-3.7	3.7	297	.5	1.2	309	5.1	WSW	42	-5.4	0.0	5655	21
22	8.6	0.0	4.3	092	.4	1.5	348	5.1	WSW	58	-4.3	0.0	4470	22
23	13.0	2.6	7.8	057	.8	1.2	018	6.3	NNE	50	-1.4	.4	5590	23
24	16.9	-.9	8.0	147	.7	1.4	134	5.7	SSE	39	-3.3	0.0	6590	24
25	16.9	3.2	10.1	333	1.3	1.6	294	6.3	NNW	37	-5.2	0.0	6498	25
26	17.5	3.4	10.5	339	.6	1.6	358	5.7	WSW	43	.7	0.0	4208	26
27	15.9	8.2	12.1	173	.7	1.1	134	3.8	SE	50	-3.4	0.0	3750	27
28	9.7	1.7	5.7	068	.5	1.2	046	3.8	NE	31	-6.9	12.2	2035	28
29	22.7	.6	11.6	257	.9	1.1	295	4.4	W	34	-1.8	0.0	8203	29
30	21.4	2.0	11.7	314	.8	1.6	342	6.3	W	36	-1.8	0.0	7165	30
31	15.3	6.5	10.9	129	.2	1.7	255	5.1	NE	42	-3.8	11.2	4560	31
MONTH	22.7	-6.5	6.8	081	.2	1.6	269	10.2	SE	45	-3.1	32.6	165185	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 3.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 4.4

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01   MAY   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING JUNE , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	15.6	1.1	8.4	124	1.8	2.1	138	7.0	SE	43	-2.4	0.0	7188	01
02	15.2	-.5	7.4	329	.6	1.4	009	6.3	NW	41	-1.5	0.0	6568	02
03	14.3	.6	7.4	128	1.5	1.7	134	6.3	SE	38	-4.5	0.0	5523	03
04	13.3	-.4	6.4	218	.7	1.6	229	7.6	SW	48	-.6	4.2	5628	04
05	11.3	.4	5.8	304	1.4	1.6	311	6.3	NW	53	.7	8.6	5168	05
06	13.6	0.0	6.8	033	.7	1.4	061	5.7	N	57	-1.8	0.0	6225	06
07	15.3	-1.1	7.1	286	1.4	1.8	245	6.3	WNW	42	-.6	0.0	7283	07
08	8.5	1.5	5.0	074	1.1	1.8	086	6.3	E	33	-11.7	11.6	2233	08
09	12.1	1.6	6.9	208	.7	1.3	173	7.6	SW	50	-1.1	1.0	6618	09
10	16.6	.3	8.4	264	.6	1.3	356	4.4	WSW	36	-8.6	0.0	8110	10
11	14.9	1.1	8.0	333	1.3	2.2	054	7.6	NNW	50	-2.5	0.0	5510	11
12	19.2	-.8	9.2	289	.1	1.1	052	5.1	ENE	34	-4.8	0.0	7530	12
13	22.6	2.6	12.6	115	.7	1.9	096	7.6	E	28	-5.9	0.0	8225	13
14	19.5	3.3	11.4	265	1.1	1.8	343	7.0	W	45	-.7	.4	6500	14
15	19.4	6.7	13.1	312	.3	1.6	044	7.0	WSW	45	4.2	3.6	5965	15
16	21.1	5.5	13.3	300	.9	1.5	142	5.7	W	42	1.8	3.0	6535	16
17	22.4	3.2	12.8	025	.3	1.6	112	5.7	ENE	22	-13.6	0.0	8355	17
18	21.3	1.4	11.4	329	.3	1.5	066	7.6	WSW	33	-3.3	0.0	5663	18
19	18.6	2.6	10.6	106	.9	1.3	044	10.2	ESE	34	.1	.2	7913	19
20	20.3	-.1	10.1	251	.7	1.4	319	5.7	W	26	-4.1	0.0	6938	20
21	14.9	7.1	11.0	273	2.3	2.7	241	7.0	WSW	51	2.7	1.6	6158	21
22	18.7	5.2	12.0	291	.5	1.6	326	5.7	WNW	53	4.2	3.2	5110	22
23	17.1	3.7	10.4	118	.6	1.2	058	7.0	E	47	2.4	4.4	6825	23
24	16.6	6.8	11.7	216	.3	1.6	137	5.7	SSE	45	-1.0	7.4	5043	24
25	16.6	6.8	12.7	298	.6	1.3	349	6.3	S	49	3.5	.6	5280	25
26	11.7	6.8	9.3	302	.9	1.3	327	4.4	NW	69	-.3	.4	1937	26
27	7.3	3.1	5.2	351	1.3	1.5	002	5.1	N	27	-14.7	10.4	1813	27
28	10.6	1.9	6.3	004	.2	1.1	196	3.8	NNW	52	-24.3	5.8	3738	28
29	9.9	1.0	5.4	119	1.3	1.7	190	7.0	ESE	68	-4.0	.2	3573	29
30	11.9	-.5	5.7	315	.7	1.5	264	5.7	E	51	-8.0	.4	4968	30
MONTH	22.6	-1.1	9.1	299	.2	1.6	044	10.2	WSW	44	-3.3	67.0	174115	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.8

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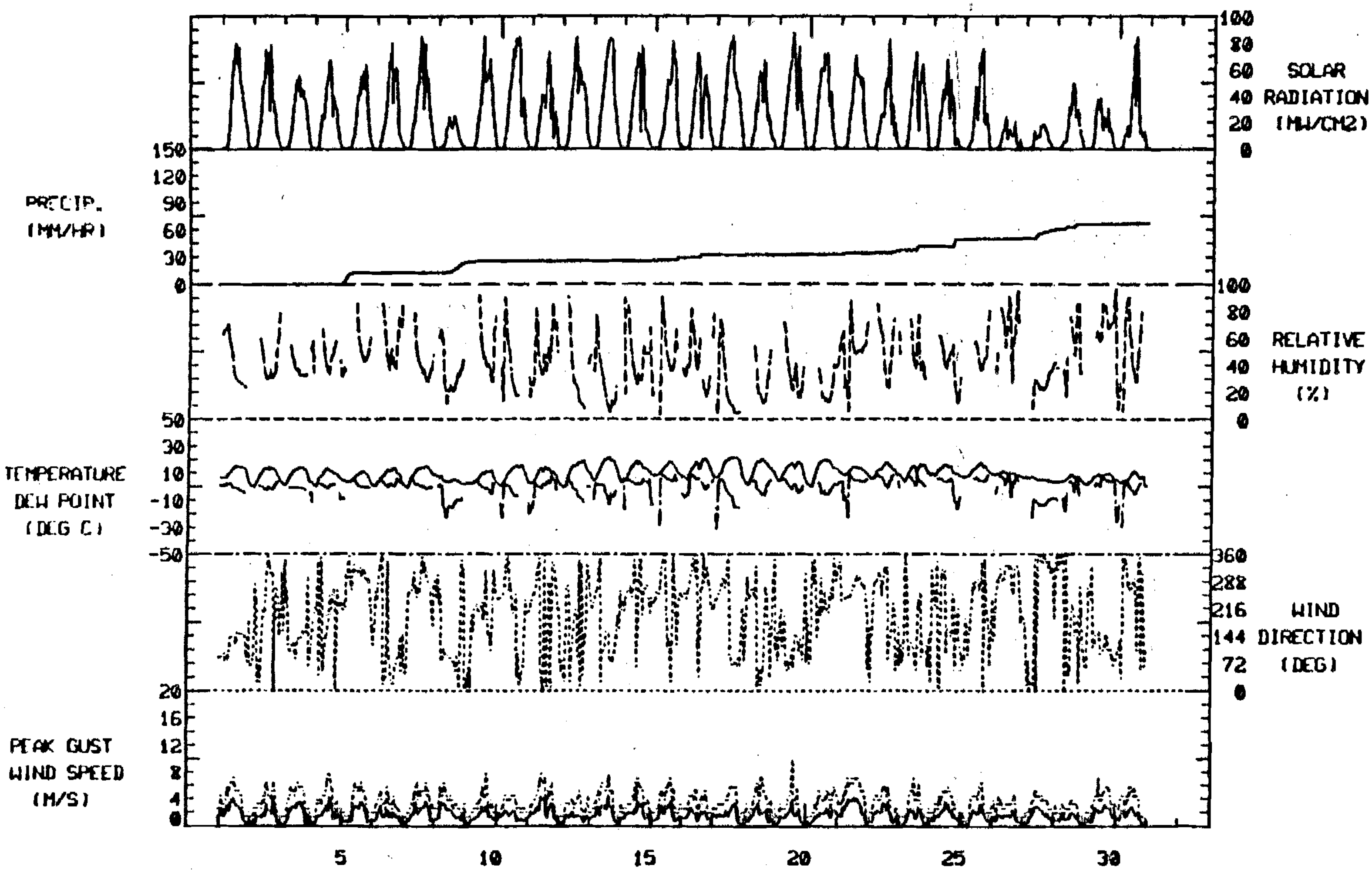
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   TYONE WEATHER STATION

DATA START: 01 JUNE , 1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	10.4	-1.2	4.6	100	.8	1.4	112	5.7	ESE	49	-1.9	.6	5115	1
2	8.9	4.4	6.7	348	1.4	1.8	000	6.3	N	72	2.2	2.2	3058	2
3	13.5	2.7	8.1	003	.4	1.2	345	5.7	N	48	-4.7	0.0	4860	3
4	15.5	1.6	8.6	303	.8	1.5	335	6.3	W	42	-3.7	0.0	5855	4
5	12.1	6.3	9.2	181	.5	1.0	211	3.8	E	44	-4.1	3.0	2950	5
6	14.1	6.6	10.4	039	.2	1.0	010	4.4	E	45	.7	7.4	3483	6
7	13.7	4.4	9.1	027	.5	1.6	010	7.6	N	41	-7.4	5.4	3305	7
8	12.5	4.0	8.3	026	1.0	1.7	343	7.6	E	44	-5.4	.4	3878	8
9	15.3	6.1	10.7	082	.7	1.2	008	5.1	E	55	4.4	.4	4005	9
10	12.1	7.1	9.6	051	1.1	1.5	000	4.4	ENE	19	-16.3	7.4	2198	10
11	15.3	7.3	11.3	343	.6	1.0	336	5.7	NNW	51	3.9	1.2	4453	11
12	14.5	5.8	10.2	345	1.5	1.8	351	5.7	NNW	54	4.6	0.0	4773	12
13	14.3	6.0	10.2	298	.8	1.1	347	3.8	WSW	56	4.5	0.0	3035	13
14	14.0	5.9	10.0	100	.3	1.1	137	3.8	SE	36	-5.2	1.8	2765	14
15	14.7	8.2	11.5	080	1.5	1.5	088	4.4	ENE	29	-10.2	6.6	3150	15
16	18.1	10.2	14.2	073	.1	1.1	089	3.2	ENE	45	1.9	5.0	4210	16
17	17.3	10.7	14.0	260	.2	.9	022	4.4	W	41	-.9	10.4	3640	17
18	16.9	9.8	13.4	289	1.1	1.4	269	5.1	W	43	5.6	4.6	4873	18
19	13.9	9.0	11.5	216	.1	.7	165	3.2	NE	33	-3.4	10.0	3238	19
20	12.7	8.7	10.7	098	.6	1.0	116	3.8	E	48	-1.2	5.6	2998	20
21	18.8	7.7	13.3	251	1.1	1.4	245	5.1	WSW	45	2.3	0.0	5533	21
22	16.9	7.9	12.4	259	1.0	1.2	258	5.1	WSW	50	2.0	1.4	4430	22
23	15.4	9.4	12.4	127	.6	1.0	161	3.8	ENE	47	5.8	7.8	3458	23
24	15.3	9.6	12.5	108	1.7	1.9	138	6.3	E	53	1.9	.4	3645	24
25	14.4	8.5	11.5	117	1.0	1.3	143	4.4	E	36	-4.7	15.0	2875	25
26	15.8	7.9	11.9	310	1.2	1.6	336	6.3	NNW	46	.8	.2	5643	26
27	19.1	8.0	13.6	309	.8	1.3	356	4.4	N	50	2.9	0.0	5740	27
28	17.0	7.0	12.0	301	.4	1.2	277	5.1	NNW	42	-6.2	2.0	3615	28
29	16.6	4.9	10.8	276	1.2	1.4	303	5.1	WNW	40	1.6	.4	4270	29
30	16.2	4.3	10.3	311	.6	1.1	015	5.1	W	50	4.4	.4	3923	30
31	16.3	7.2	11.8	050	.3	1.0	001	5.7	N	46	6.1	.6	3228	31
MONTH	19.1	-1.2	10.8	359	.2	1.3	010	7.6	E	45	-.6	100.2	122189	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.0
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 6.3

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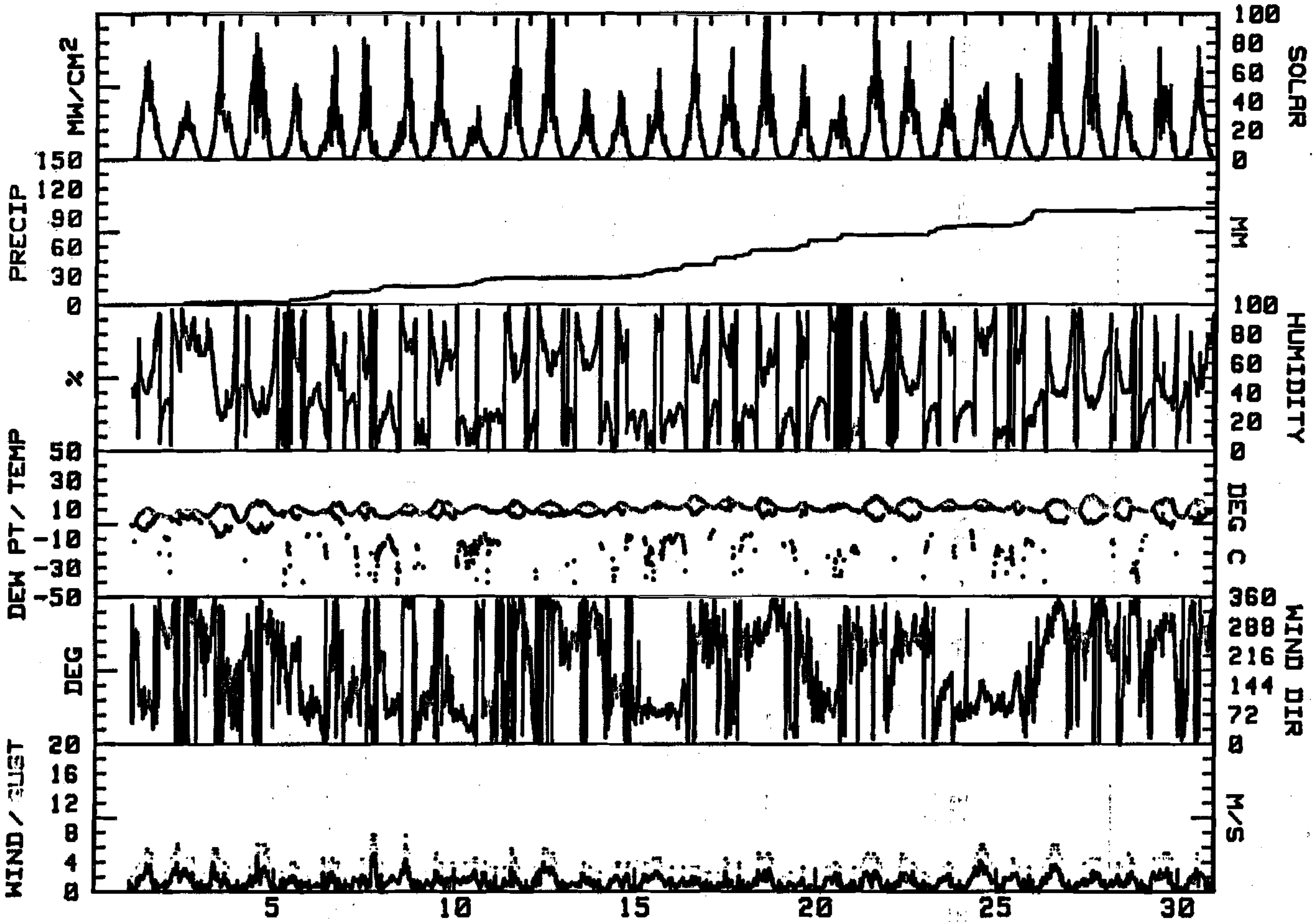
R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

TYONE WEATHER STATION

July, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	12.4	8.0	10.2	082	2.0	2.1	127	5.7	E	51	-4.3	7.4	1683	1
2	12.4	7.7	10.1	087	1.1	1.5	122	4.4	ENE	44	-3.5	11.8	3458	2
3	16.9	1.9	9.4	140	.4	1.2	154	4.4	SE	46	1.8	.4	4688	3
4	18.4	-.8	8.8	055	1.1	1.6	051	7.6	NE	36	-3.7	0.0	5878	4
5	16.6	0.0	8.3	116	1.6	1.8	128	7.0	ESE	44	1.9	.8	3845	5
6	17.4	6.5	12.0	124	2.0	2.2	144	7.0	SE	44	-1.3	2.8	3595	6
7	12.9	7.1	10.0	112	2.2	2.3	107	7.0	E	52	-2.6	1.0	1538	7
8	15.4	6.6	11.0	110	2.2	2.3	132	7.6	E	65	5.4	.4	3398	8
9	16.1	6.6	11.4	125	1.3	1.8	154	6.3	E	47	-.1	2.0	4163	9
10	15.5	5.9	10.7	140	.5	1.2	154	5.1	E	48	1.8	0.0	3603	10
11	14.0	5.1	9.6	129	.7	1.3	186	7.0	SE	50	.8	.8	4215	11
12	12.3	6.3	9.3	122	1.2	1.6	174	6.3	E	64	2.8	.4	2248	12
13	12.6	5.4	9.0	059	1.1	1.8	099	5.7	E	56	.9	3.2	3933	13
14	12.1	4.5	8.3	143	1.3	2.2	173	7.6	ESE	42	-6.9	1.2	2673	14
15	10.2	-.7	4.8	132	.9	1.7	132	6.3	SE	55	-4.3	8.8	2183	15
16	7.9	-3.5	2.2	309	.9	1.6	281	7.0	WNW	47	-5.4	.6	4530	16
17	11.7	-4.7	3.5	122	.5	1.1	150	5.1	NE	36	-8.4	1.0	5170	17
18	9.5	4.9	7.2	085	1.5	1.6	089	4.4	E	29	-13.5	4.2	2138	18
19	11.7	4.7	8.2	083	.7	1.0	101	3.2	E	33	-12.9	7.4	1748	19
20	11.3	3.6	7.5	083	.4	.9	050	4.4	SSW	44	-.4	5.6	1370	20
21	15.9	4.0	10.0	144	1.5	2.0	171	8.3	SE	42	-1.7	0.0	5110	21
22	11.1	5.1	8.1	060	.2	.7	000	2.5	ENE	43	-1.7	3.6	2390	22
23	15.3	.9	8.1	121	.3	.8	100	5.7	ESE	42	-2.8	.4	4080	23
24	18.8	-2.2	8.3	145	.5	.8	130	4.4	SE	32	-6.5	0.0	5485	24
25	24.2	1.3	12.8	080	.1	.8	152	3.2	NE	36	-4.2	0.0	5318	25
26	25.8	4.4	15.1	210	.4	1.1	178	3.8	WSW	34	-3.3	0.0	5325	26
27	24.8	6.3	15.6	340	.8	1.2	292	5.7	N	34	1.5	0.0	5065	27
28	25.4	6.7	16.1	280	.7	1.2	331	5.1	WSW	44	.9	0.0	4510	28
29	19.8	2.2	11.0	246	1.0	1.4	250	7.0	WSW	48	3.7	0.0	5085	29
30	17.8	6.8	12.3	253	1.3	1.7	246	5.7	WSW	50	2.4	1.4	4283	30
31	15.8	-.3	7.8	311	1.8	2.5	004	7.6	N	43	-6.1	.8	5233	31
MONTH	25.8	-4.7	9.6	111	.6	1.5	171	8.3	E	45	-2.2	65.2	117774	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

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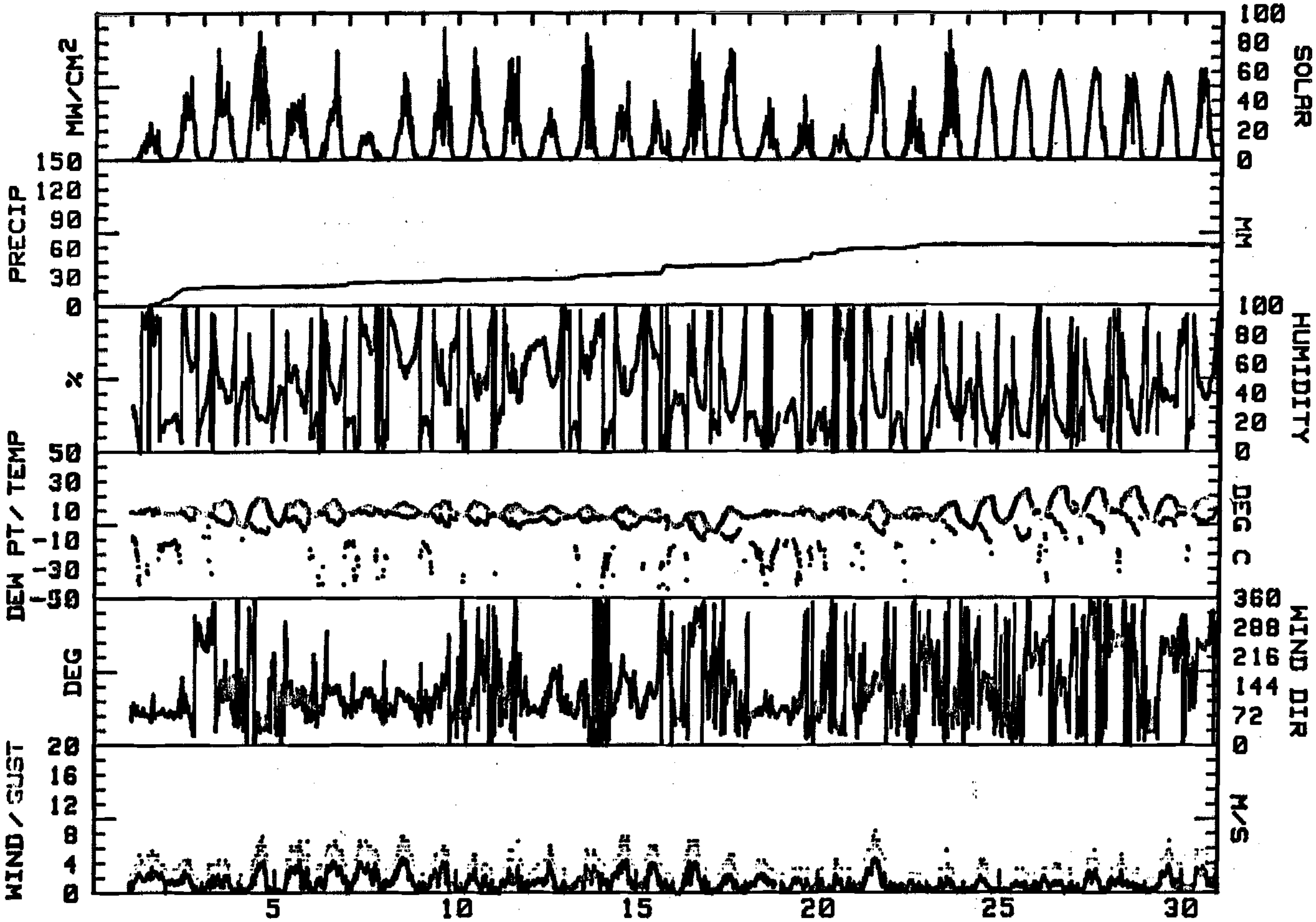
R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

TYONE WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR TYONE WEATHER STATION
DATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	17.9	-4.3	6.8	067	.4	.7	075	4.4	ENE	24	-15.0	0.0	5228	1
2	14.2	-3.0	5.6	340	.6	1.1	333	5.1	NW	43	-.6	0.0	3150	2
3	13.6	2.7	8.2	186	.1	.9	173	4.4	ESE	67	-.1	0.0	2845	3
4	9.8	.1	5.0	092	1.0	1.2	083	5.1	E	52	1.7	.8	1898	4
5	14.2	4.3	9.3	124	.8	1.1	132	4.4	E	50	-.3	0.0	2120	5
6	11.0	-.1	5.5	137	1.0	1.5	151	6.3	ESE	57	1.1	.2	2415	6
7	6.5	-3.1	1.7	280	.1	.5	201	2.5	W	58	.7	3.4	1383	7
8	13.3	1.5	7.4	254	.4	1.0	001	3.8	WSW	51	-3.1	0.0	3918	8
9	10.9	1.3	6.1	326	1.2	1.9	001	5.7	WSW	63	.4	3.0	1793	9
10	12.7	.8	6.8	281	.5	.9	339	4.4	WSW	42	-3.2	3.2	2935	10
11	10.4	-.1	5.2	181	.4	1.1	192	3.8	WSW	53	-5.5	0.0	2130	11
12	11.6	-2.3	4.7	113	.9	1.2	143	5.7	E	43	-3.9	.2	3233	12
13	10.7	-1.9	4.4	105	.8	1.1	078	5.7	E	44	-3.0	0.0	2658	13
14	12.4	-3.4	4.5	069	.1	1.1	358	5.7	ENE	38	-7.6	0.0	2810	14
15	14.3	3.4	8.9	111	1.4	1.8	159	7.0	E	55	-3.9	.2	3078	15
16	12.5	1.5	7.0	118	1.9	2.1	151	6.3	E	45	-6.1	0.0	3163	16
17	13.1	2.5	7.8	062	1.0	1.6	047	7.6	ENE	33	-9.6	0.0	3740	17
18	10.2	2.7	6.5	003	.4	1.1	058	6.3	ENE	51	-4.5	.2	1958	18
19	11.0	3.1	7.1	148	1.2	1.7	134	7.0	SE	51	-3.6	.8	1318	19
20	8.9	.9	4.9	265	.6	.9	319	4.4	WSW	47	-5.3	.8	2573	20
21	7.9	.8	4.4	338	1.8	2.2	359	6.3	N	38	-12.7	0.0	2238	21
22	8.9	-5.5	1.7	321	1.0	1.3	353	5.7	NNW	43	-8.6	0.0	2930	22
23	7.0	-5.8	.6	141	.3	.7	189	3.8	E	50	-7.5	0.0	2593	23
24	2.8	-3.0	-.1	340	1.1	1.4	356	7.0	N	59	-3.3	0.0	1098	24
25	.9	-7.7	-3.4	331	1.6	1.9	344	6.3	N	69	-7.2	1.2	1455	25
26	1.3	-11.3	-5.0	318	1.1	1.7	332	5.7	N	62	-12.5	0.0	3613	26
27	1.1	-14.5	-6.7	336	.3	.9	003	3.8	NNW	58	-13.8	.4	3358	27
28	1.2	-11.5	-5.2	052	.5	1.0	133	5.1	NNE	57	-13.9	0.0	2705	28
29	.4	-12.3	-6.0	259	.3	.9	004	3.8	WSW	67	-11.6	0.0	1895	29
30	3.4	-5.0	-.8	341	2.2	2.4	352	7.0	NNW	49	-10.8	.2	1553	30
MONTH	17.9	-14.5	3.4	025	.2	1.3	047	7.6	E	50	-5.8	14.6	77775	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

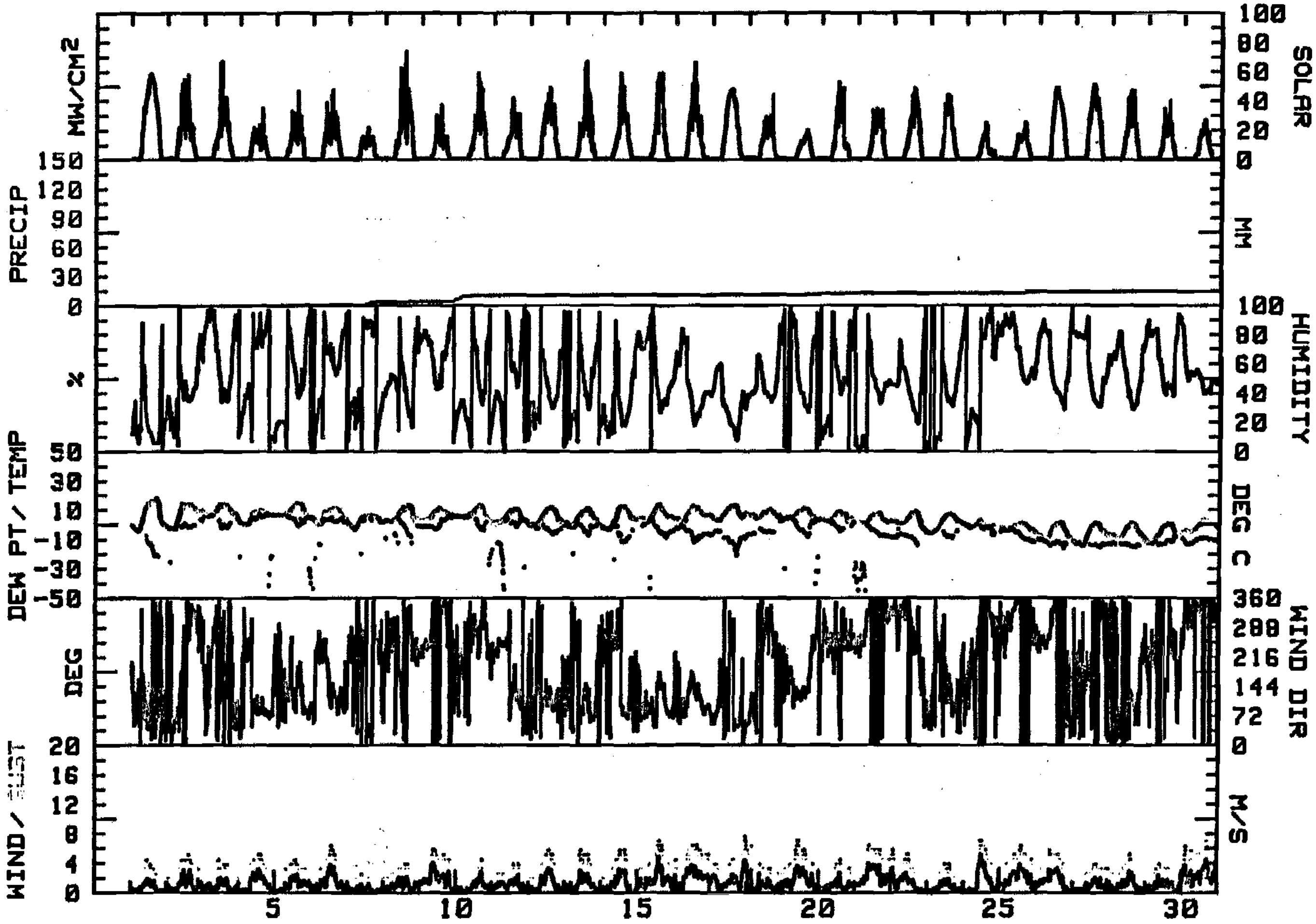
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

TYONE WEATHER STATION

September, 1981



ATTACHMENT E.5, PART 4

KOSINA CREEK CLIMATE DATA

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

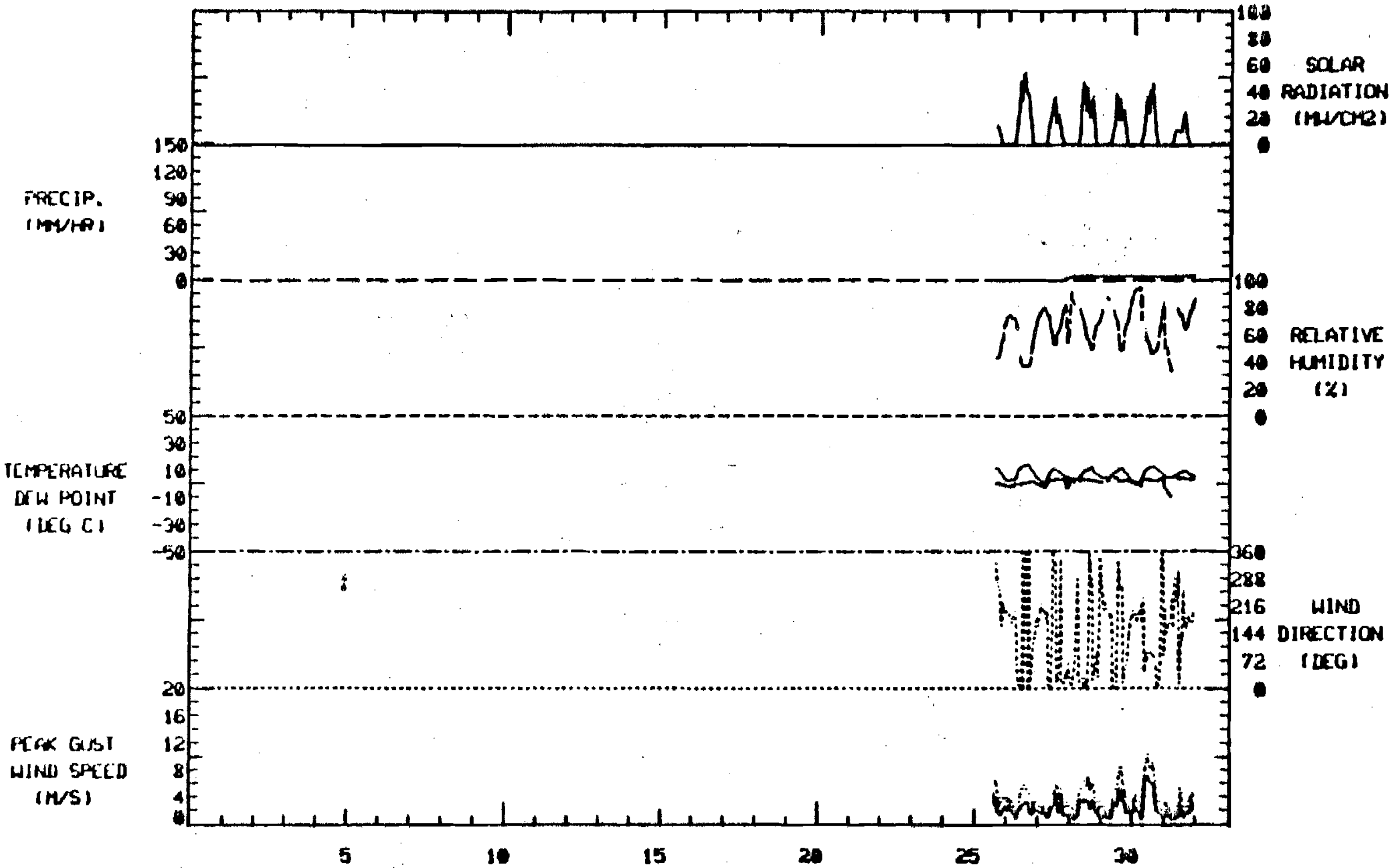
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	11.3	1.4	6.3	***	****	2.4	336	6.3	SSW	55	-1.7	0.0	1383	25
26	14.4	1.2	7.8	031	.2	2.2	005	5.7	N	56	-.7	0.0	4378	26
27	11.4	.4	5.9	010	.8	2.0	029	5.7	NNE	69	1.4	3.4	2520	27
28	12.7	2.9	7.8	013	1.7	2.2	018	7.0	NNE	68	1.5	1.0	3845	28
29	11.6	1.2	6.4	314	.6	2.2	279	8.3	SSW	70	1.6	0.0	2783	29
30	13.1	-.5	6.3	092	2.1	3.3	095	10.2	E	69	2.2	0.0	3150	30
31	9.4	4.0	6.7	177	.9	1.3	113	5.1	SSE	67	.8	.6	1688	31
MONTH	14.4	-.5	6.8	050	.5	2.2	095	10.2	N	65	.7	5.0	19746	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 25 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

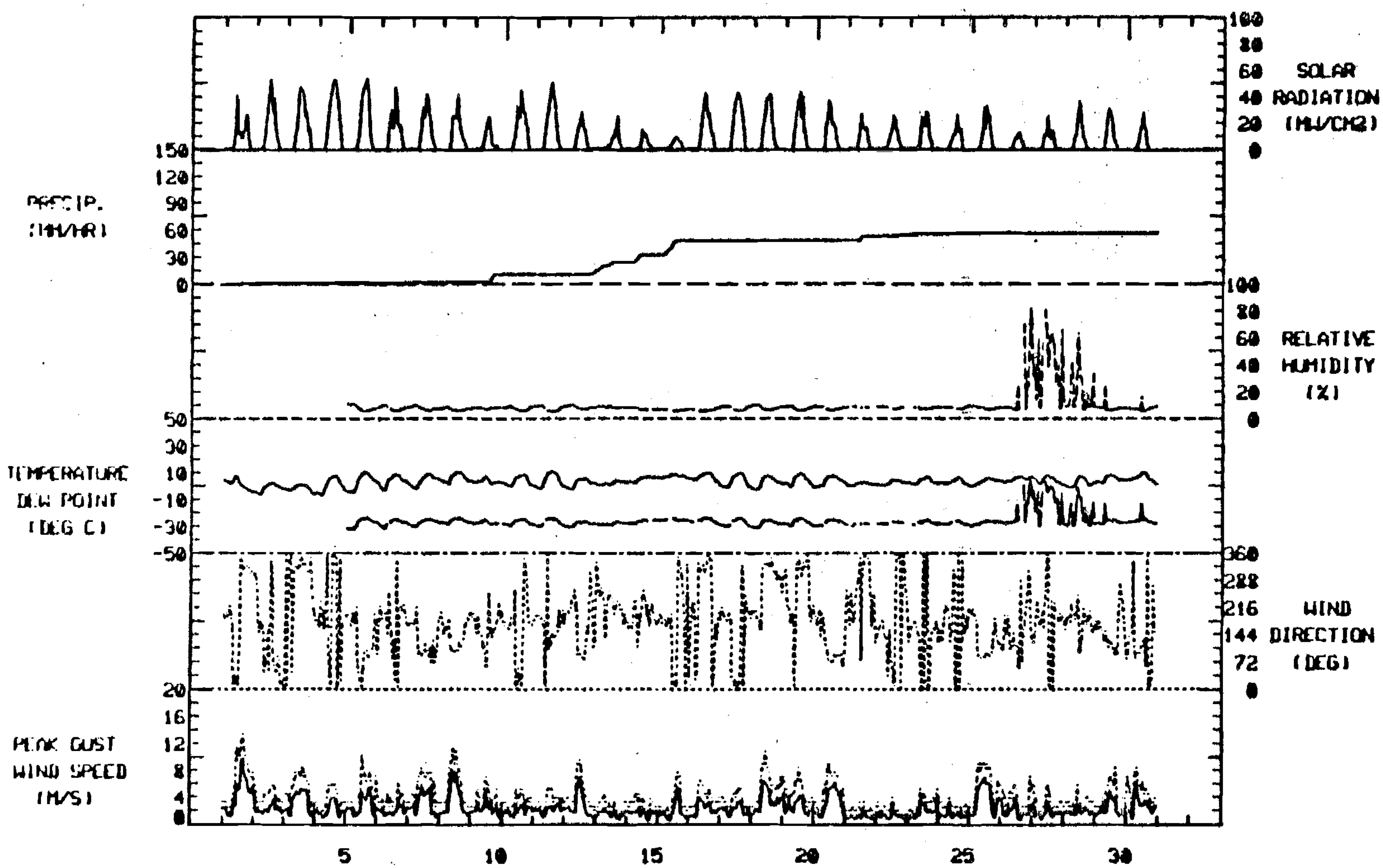
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	8.4	-4.4	2.0	326	3.1	4.4	317	13.3	NW	**	*****	1.2	2280	01
02	2.8	-7.1	-2.2	050	.8	2.4	317	7.6	NNE	**	*****	0.0	3333	02
03	1.1	-7.2	-3.1	328	2.9	3.3	322	8.3	NW	**	*****	0.0	3620	03
04	7.5	-8.7	-.6	351	.3	2.1	350	6.3	N	11	-30.7	0.0	4308	04
05	10.6	-6.7	2.0	108	1.6	2.6	052	10.2	E	08	-28.5	0.0	3748	05
06	9.3	1.4	5.3	192	1.1	2.0	083	7.0	SW	08	-28.3	.6	2566	06
07	8.7	-2.8	3.0	114	2.4	3.1	082	8.3	E	08	-27.7	0.0	2820	07
08	10.2	.6	5.4	122	2.8	3.5	104	11.4	ESE	07	-27.7	0.0	2345	08
09	7.0	1.8	4.4	158	1.5	2.3	090	7.0	SSE	08	-28.2	8.6	1355	09
10	9.0	-1.0	4.0	162	.4	1.9	008	5.1	S	08	-28.3	0.0	2938	10
11	11.1	-3.3	3.9	166	1.6	2.1	100	5.7	SSE	07	-28.6	0.0	3425	11
12	5.4	-3.2	1.1	130	1.1	2.6	096	9.5	E	08	-28.4	5.0	1628	12
13	4.3	.2	2.3	226	1.1	1.4	128	4.4	SW	08	-28.3	8.8	1213	13
14	6.9	2.2	4.6	197	1.2	1.6	195	5.1	S	07	-27.4	8.2	918	14
15	8.9	5.3	7.1	322	.5	1.7	336	7.6	S	07	-27.2	15.8	758	15
16	10.2	.6	5.4	324	1.1	2.1	312	6.3	NW	07	-27.6	0.0	2783	16
17	9.5	-1.6	4.0	278	.3	2.0	008	5.1	S	08	-28.1	0.0	3240	17
18	7.7	-3.4	2.2	309	2.2	3.3	333	10.8	NNW	08	-28.5	0.0	2855	18
19	9.6	-2.5	3.6	296	1.4	2.6	300	8.3	NW	08	-28.2	0.0	2703	19
20	8.0	-1.4	3.3	094	2.6	3.3	074	8.9	E	08	-27.9	0.0	2133	20
21	2.8	-.4	1.2	280	.3	.9	053	3.2	WSW	08	-28.6	5.0	1505	21
22	5.2	.5	2.8	063	.3	1.1	017	3.8	N	08	-28.4	1.6	1540	22
23	6.9	1.2	4.1	096	.4	1.7	010	5.1	N	08	-28.2	.6	1893	23
24	6.3	0.0	3.2	143	.4	1.4	107	5.1	N	08	-28.5	.6	1330	24
25	6.5	-1.2	2.7	100	3.2	3.8	081	8.9	E	08	-28.1	.2	1843	25
26	7.2	2.1	4.6	128	1.3	2.0	118	7.0	ESE	23	-22.4	0.0	790	26
27	8.1	.1	4.1	186	.5	1.7	122	5.7	S	38	-28.2	0.0	1250	27
28	7.1	-2.9	2.1	179	1.4	1.8	260	5.7	SSW	19	-25.1	0.0	1768	28
29	8.4	1.5	4.9	133	1.7	2.3	100	8.3	ESE	08	-27.8	.2	1713	29
30	10.3	.2	5.3	097	1.7	2.7	088	8.3	E	07	-27.5	0.0	1248	30
MONTH	11.1	-8.7	3.1	120	.4	2.3	317	13.3	S	10	-27.9	56.4	65841	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 13.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH KOSINA CREEK WEATHER STATION

DATA START: 01 SEPTEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	8.7	-1.6	3.6	193	2.3	2.4	195	5.7	SSW	09	-28.5	****	1710	01
02	3.8	-4.3	-.3	357	.7	1.9	020	7.0	SW	17	-27.7	****	1297	02
03	1.5	-4.8	-1.7	193	.7	1.0	187	3.2	SSW	26	-28.5	****	708	03
04	2.8	-2.7	.1	147	1.3	1.9	112	5.1	SE	11	-26.7	****	1725	04
05	1.8	-1.1	.4	113	1.7	3.0	086	10.2	E	29	-25.0	****	1038	05
06	4.5	-1.5	1.5	161	1.0	1.8	087	5.7	SSW	32	-19.3	****	588	06
07	6.5	1.8	4.1	104	1.8	2.6	074	8.3	E	08	-28.0	****	920	07
08	1.6	-3.7	-1.0	012	3.0	3.2	009	8.3	NNE	22	-25.9	****	1045	08
09	-3.3	-7.0	-5.2	010	.6	1.3	025	3.8	NNE	13	-29.1	****	818	09
10	-.4	-10.1	-5.3	054	.5	2.1	104	9.5	NNE	11	-31.2	****	690	10
11	-2.3	-15.4	-8.9	181	1.6	2.1	159	5.1	S	13	-33.7	****	1378	11
12	-1.2	-15.9	-8.5	191	1.3	1.8	168	3.8	S	13	-34.3	****	1433	12
13	-5.8	-15.3	-10.5	151	1.4	2.9	078	7.6	SSW	12	-33.1	****	788	13
14	-.1	-7.5	-3.8	132	2.3	3.3	084	9.5	ESE	11	-30.5	****	738	14
15	1.5	-9.3	-3.9	008	.2	2.5	272	6.3	NNE	13	-30.0	****	1028	15
16	-1.1	-12.6	-6.9	183	2.1	2.3	154	5.1	S	15	-32.0	****	1568	16
17	1.5	-6.1	-2.3	191	1.9	2.3	092	8.3	S	11	-30.9	****	522	17
18	-.1	-10.1	-5.1	164	2.1	2.7	106	8.3	SSE	11	-31.7	****	1049	18
19	-.9	-10.9	-5.9	154	2.0	2.9	098	12.1	S	11	-30.8	****	1333	19
20	1.9	-8.4	-3.3	156	.8	2.4	077	7.0	SSW	10	-30.0	****	1158	20
21	2.8	-6.2	-1.7	155	1.6	2.5	092	9.5	SSE	10	-42.5	****	858	21
22	4.8	-8.5	-1.8	136	1.1	2.9	080	10.8	SSW	10	-30.5	****	1213	22
23	1.0	-8.4	-3.7	191	1.9	2.2	198	5.1	S	14	-26.5	****	1198	23
24	-.5	-9.3	-4.9	193	1.7	2.1	190	5.1	SSW	11	-31.9	****	935	24
25	-.7	-8.9	-4.8	161	1.5	1.9	113	4.4	SE	11	-30.5	****	1220	25
26	-2.5	-4.9	-3.7	176	1.4	2.2	161	5.1	SSW	11	-28.6	****	848	26
27	*****	******	*****	***	****	.9	029	2.5	N	11	*****	****	771	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	-1.6	-4.6	-3.1	***	****	2.4	197	5.1	SSW	20	-30.7	****	354	29
30	-4.0	-12.7	-8.4	161	2.1	2.3	192	5.1	SSE	55	-16.2	****	995	30
31	-4.5	-16.8	-10.6	191	1.9	2.1	145	5.1	SSW	76	-15.0	****	860	31
MONTH	8.7	-16.8	-3.6	161	1.1	2.3	098	12.1	SSW	17	-28.9	****	30777	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.9

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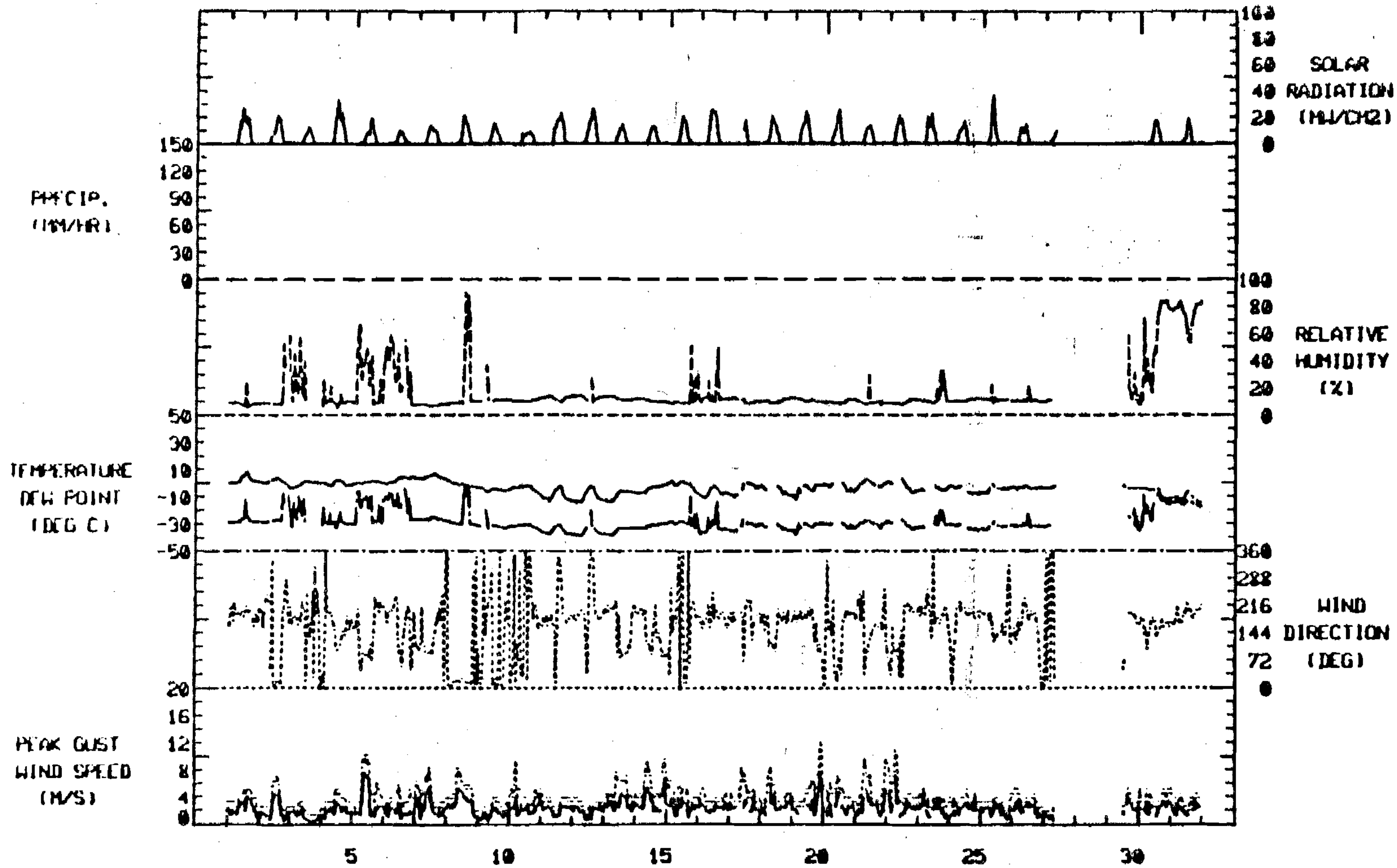
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH KOSINA CREEK WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

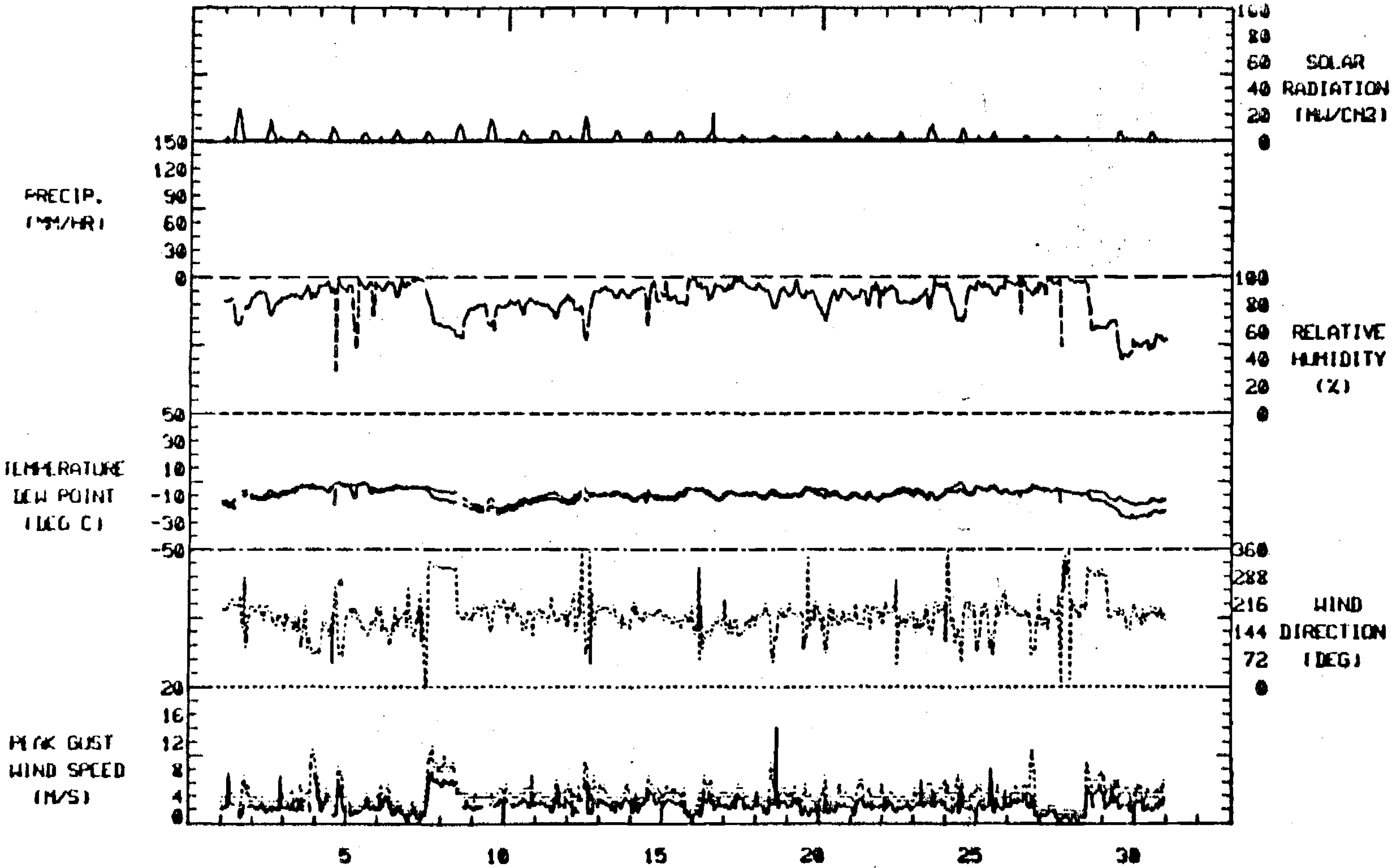
DAY	MAX.. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-6.3	-18.1	-12.2	208	2.3	2.6	094	7.0	SSW	78	-13.9	****	1340	01
02	-6.7	-12.8	-9.8	189	2.2	2.3	193	3.8	SSW	83	-11.4	****	788	02
03	-2.1	-7.9	-5.0	141	2.0	2.6	088	10.8	SSE	87	-6.6	****	523	03
04	-.5	-8.0	-4.3	118	2.5	3.2	091	10.2	E	91	-4.5	****	628	04
05	-.5	-7.6	-4.1	171	1.8	2.0	135	4.4	SSE	88	-22.3	****	513	05
06	-2.6	-6.7	-4.6	162	1.9	2.1	145	5.7	SSE	93	-5.6	****	520	06
07	-3.5	-7.5	-5.5	314	2.5	3.5	313	11.4	NW	82	-8.2	****	495	07
08	-6.1	-17.7	-11.9	291	2.9	4.6	310	10.2	NW	66	-16.8	****	785	08
09	-12.0	-22.4	-17.2	204	2.4	2.6	217	5.1	SSW	75	-21.6	****	933	09
10	-11.4	-18.7	-15.1	186	2.7	3.0	124	7.0	SSW	81	-17.6	****	508	10
11	-7.5	-15.0	-11.3	186	2.7	2.8	178	6.3	S	79	-13.9	****	575	11
12	-4.0	-15.3	-9.6	169	1.5	2.6	089	8.9	SSW	78	-12.7	****	788	12
13	-6.2	-11.1	-8.6	183	2.6	2.8	199	5.7	SSW	89	-10.7	****	495	13
14	-8.1	-14.7	-11.4	191	3.0	3.1	190	7.0	S	88	-12.0	****	453	14
15	-5.0	-13.2	-9.1	177	2.4	2.5	180	5.7	S	87	-10.9	****	480	15
16	-4.9	-15.4	-10.1	152	2.0	2.4	129	7.0	SE	91	-9.9	****	610	16
17	-6.9	-10.2	-8.6	157	2.5	2.7	136	5.7	SE	94	-9.5	****	340	17
18	-5.1	-12.4	-8.8	168	2.6	3.3	083	8.9	S	87	-10.9	****	338	18
19	-3.9	-10.9	-7.4	189	1.8	2.2	185	5.7	SSW	87	-9.3	****	350	19
20	-4.9	-12.6	-8.8	168	1.9	2.3	092	7.0	SSE	84	-10.6	****	395	20
21	-7.5	-13.7	-10.6	183	2.3	2.5	159	6.3	SSW	88	-12.1	****	410	21
22	-4.7	-10.6	-7.7	185	2.0	2.3	135	5.7	S	86	-9.4	****	398	22
23	-5.5	-13.1	-9.3	181	2.6	3.0	161	6.3	SSW	89	-10.4	****	690	23
24	-.8	-11.0	-5.9	169	1.3	2.3	101	7.0	SSW	83	-7.5	****	540	24
25	-2.9	-8.9	-5.9	178	1.8	2.8	202	5.7	SSW	93	-7.0	****	405	25
26	-2.3	-10.1	-6.2	182	2.2	3.0	074	10.8	SSW	92	-6.9	****	333	26
27	-5.4	-8.6	-7.0	193	.6	1.1	161	2.5	S	95	-7.3	****	313	27
28	-6.8	-10.3	-8.5	289	2.3	2.8	311	8.9	WNW	76	-12.4	****	288	28
29	-8.6	-17.7	-13.2	199	2.3	2.9	288	7.0	S	54	-22.4	****	505	29
30	-11.6	-19.4	-15.5	167	2.6	2.8	173	6.3	S	52	-23.1	****	478	30
MONTH	-.5	-22.4	-9.1	185	1.7	2.7	313	11.4	S	83	-11.9	****	16210	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.9

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH KOSINA CREEK WEATHER STATION

DATA START: 01 NOVEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-13.5	-18.8	-16.2	158	4.0	4.1	157	7.6	SSE	61	-22.2	****	353	01
02	-13.9	-18.6	-16.3	148	4.4	4.6	137	8.9	SE	65	-22.0	****	408	02
03	-13.2	-18.5	-15.9	157	4.1	4.2	156	8.3	SSE	66	-21.3	****	425	03
04	-14.8	-19.9	-17.4	170	2.8	3.0	146	7.6	SSE	74	-21.1	****	413	04
05	-13.5	-18.9	-16.2	155	2.6	2.9	144	6.3	SSE	77	-19.8	****	345	05
06	-15.9	-25.0	-20.5	181	1.6	1.9	123	5.1	SSW	75	-23.8	****	387	06
07	-19.1	-27.3	-23.2	185	2.5	2.7	161	6.3	SSW	63	-27.2	****	405	07
08	-18.3	-24.7	-21.5	186	2.7	2.9	160	7.0	S	46	-29.7	****	495	08
09	-20.2	-26.3	-23.3	153	4.4	4.7	145	9.5	SE	51	-30.5	****	403	09
10	-22.2	-29.3	-25.8	169	2.6	3.0	130	8.3	SSW	59	-30.5	****	375	10
11	-26.2	-34.9	-30.6	195	2.3	2.7	128	7.0	SSW	64	-34.8	****	443	11
12	-27.2	-35.7	-31.5	183	3.2	3.4	152	5.7	SSW	61	-37.1	****	855	12
13	-21.1	-27.7	-24.4	135	4.1	4.2	142	8.3	SE	73	-26.8	****	345	13
14	-21.9	-29.5	-25.7	345	.6	1.7	015	4.4	N	79	-27.9	****	470	14
15	-27.6	-33.5	-30.5	200	1.5	1.7	191	3.8	S	70	-34.9	****	787	15
16	-30.0	-34.6	-32.3	181	2.0	2.3	138	5.1	SSE	62	-37.5	****	825	16
17	-27.3	-34.8	-31.1	161	3.8	4.1	139	10.2	SSE	55	-36.7	****	1163	17
18	-24.6	-31.0	-27.8	163	4.5	4.6	149	9.5	SSE	53	-34.0	****	665	18
19	-22.1	-28.7	-25.4	165	3.7	4.0	152	9.5	SSE	55	-32.2	****	563	19
20	-17.7	-28.0	-22.9	171	3.3	3.5	154	6.3	SSE	49	-30.8	****	638	20
21	-14.9	-21.2	-18.0	164	3.8	4.0	143	8.3	SSE	37	-29.3	****	763	21
22	-16.0	-22.7	-19.4	159	4.5	4.7	140	10.2	SSE	41	-30.7	****	720	22
23	-16.1	-22.7	-19.4	165	4.2	4.4	152	8.3	SSE	44	-29.2	****	690	23
24	-14.2	-22.7	-18.5	152	4.7	4.9	143	9.5	SSE	47	-27.0	****	615	24
25	-18.6	-24.6	-21.6	172	2.7	2.9	140	6.3	SSE	53	-29.4	****	568	25
26	-22.6	-27.9	-25.3	199	2.4	2.5	171	5.1	SSW	53	-31.8	****	580	26
27	-23.9	-31.9	-27.9	188	2.4	2.8	145	7.0	SSE	53	-33.1	****	585	27
28	-23.9	-33.3	-28.6	170	4.4	4.7	146	9.5	SSE	54	-34.5	****	573	28
29	-17.7	-29.8	-23.8	141	6.8	6.9	133	11.4	SE	64	-29.6	****	428	29
30	-6.6	-20.2	-13.4	160	2.3	2.5	160	7.0	SSE	85	-14.4	****	403	30
31	2.9	-6.9	-2.0	108	6.0	6.8	102	15.9	E	90	-2.2	****	493	31
MONTH	2.9	-35.7	-22.4	161	3.1	3.7	102	15.9	SSE	61	-28.1	****	17173	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 15.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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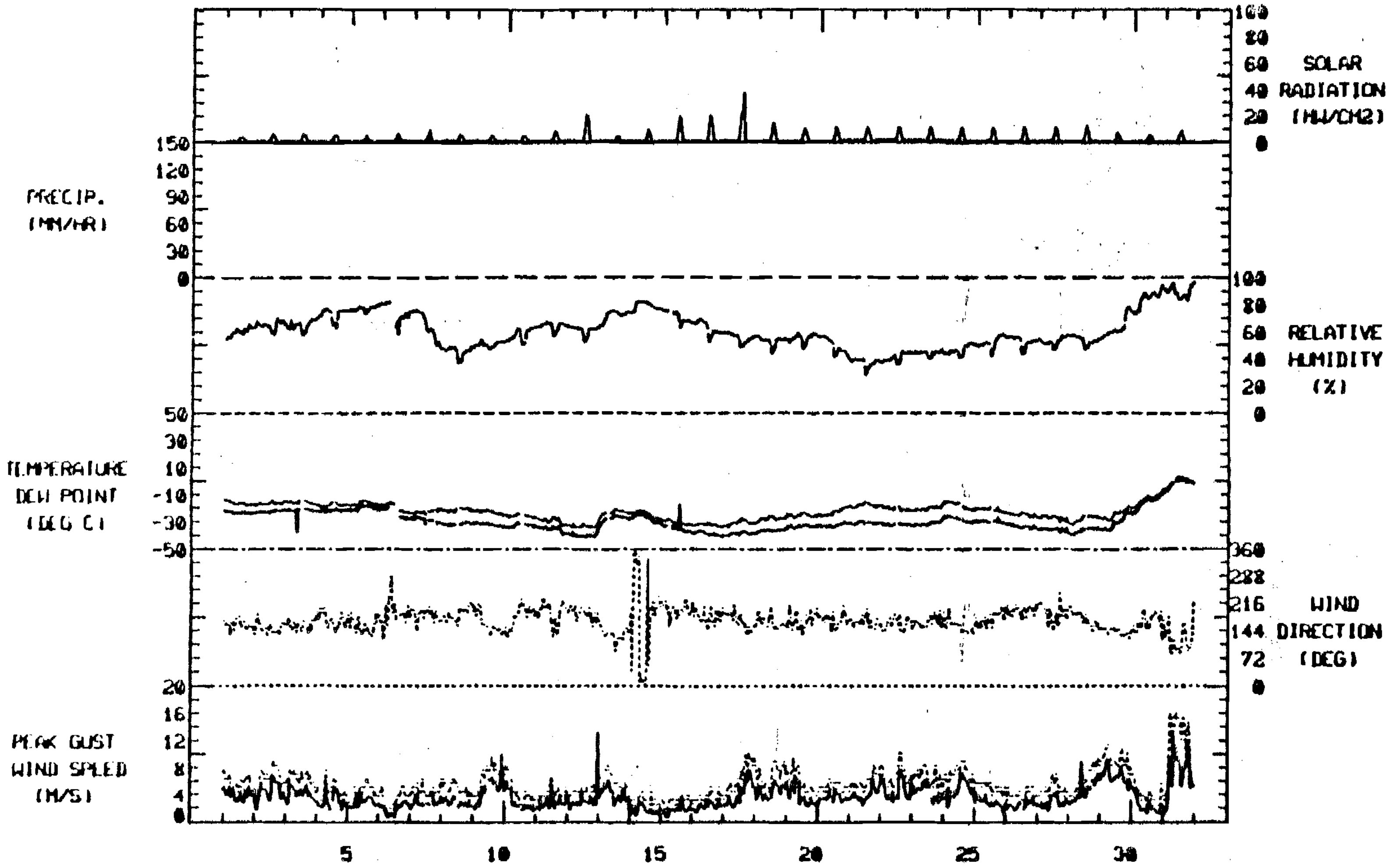
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01 DECEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	2.0	-6.2	-2.1	128	3.3	4.8	098	19.7	E	85	-3.0	****	450	01
02	.1	-12.6	-6.3	181	2.3	2.7	125	11.4	S	75	-11.2	****	770	02
03	-6.5	-13.2	-9.9	200	2.6	2.8	218	5.1	SSW	82	-12.4	****	808	03
04	-5.9	-13.7	-9.8	175	2.2	2.4	160	5.1	SSE	91	-9.3	****	443	04
05	-8.0	-12.1	-10.1	170	2.5	2.6	141	5.7	SSE	86	-11.9	****	468	05
06	-6.1	-9.5	-7.8	112	3.0	4.0	082	10.8	ESE	82	-9.6	****	550	06
07	-1.9	-8.9	-5.4	133	1.7	2.9	073	9.5	SE	79	-7.3	****	488	07
08	*****	*****	*****	172	2.6	2.8	162	5.7	SSE	90	-9.0	****	754	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	2.6	-4.9	-1.1	***	****	2.4	011	7.0	SE	85	-4.5	****	322	15
16	*****	*****	*****	166	1.5	2.5	072	8.9	S	83	-7.4	****	927	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	2.6	-13.7	-6.6	158	2.1	3.0	098	19.7	SSE	84	-8.6	****	5978	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 15.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 19.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 17.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.0

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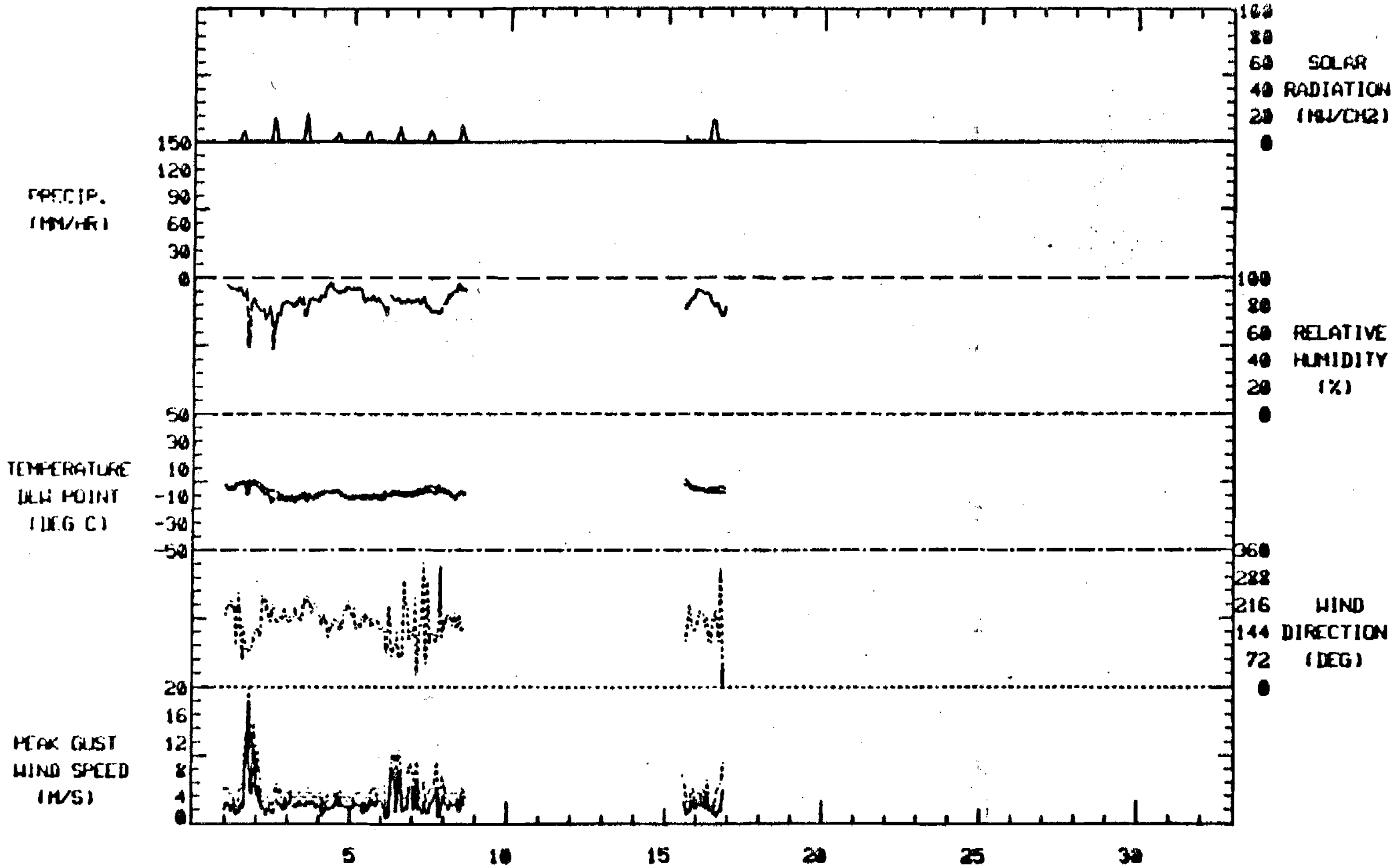
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	-5.0	-7.5	-6.3	***	****	2.0	***	5.1	S	79	-9.1	****	1396	03
04	-2.9	-7.4	-5.1	172	2.0	2.2	189	4.4	SSE	77	-9.0	****	1743	04
05	-2.7	-5.8	-4.3	153	2.0	2.5	073	8.9	SE	80	-6.8	****	1410	05
06	-2.6	-4.7	-3.7	149	1.2	1.9	096	8.3	S	82	-6.5	****	1093	06
07	-3.5	-9.6	-6.6	169	1.8	2.0	136	3.8	SSE	82	-8.6	****	1230	07
08	-2.4	-5.0	-3.7	137	2.2	2.4	140	5.1	SE	84	-6.2	****	1445	08
09	-4.5	-7.2	-5.9	167	2.2	2.6	139	7.0	SE	84	-8.6	****	1940	09
10	-3.7	-7.5	-5.6	047	.2	1.1	019	5.1	NNE	83	-8.4	****	1100	10
11	-7.6	-13.6	-10.6	094	1.3	2.3	089	8.9	SE	67	-15.3	****	1563	11
12	-12.7	-24.5	-18.6	146	1.9	2.8	113	7.0	ESE	60	-23.4	****	2135	12
13	-17.3	-20.6	-19.0	176	1.9	2.1	148	5.1	SSE	67	-23.5	****	2983	13
14	-17.6	-27.9	-22.8	188	1.4	1.6	167	4.4	S	64	-28.6	****	3233	14
15	-22.7	-29.9	-26.3	195	2.3	2.4	190	5.1	SSW	58	-32.8	****	4353	15
16	-20.6	-28.6	-24.6	166	2.5	2.6	148	6.3	SSE	61	-30.0	****	4113	16
17	-18.2	-27.3	-22.8	170	3.1	3.3	155	7.0	SSE	65	-28.6	****	4558	17
18	-17.8	-26.6	-22.2	154	4.2	4.5	134	8.3	SE	66	-26.7	****	3733	18
19	-9.9	-22.7	-16.3	168	3.3	3.6	136	7.0	SSE	68	-21.6	****	4118	19
20	-7.6	-19.4	-13.5	172	2.6	2.9	116	8.3	S	71	-17.1	****	3780	20
21	-7.5	-13.6	-10.6	129	1.8	2.8	086	9.5	SE	74	-13.6	****	3215	21
22	-9.3	-15.0	-12.1	151	1.8	2.5	093	10.2	S	73	-17.1	****	4058	22
23	-7.5	-14.8	-11.1	186	2.6	2.8	197	6.3	S	69	-15.5	****	3755	23
24	-9.2	-13.4	-11.3	178	2.5	3.2	105	8.3	S	75	-14.4	****	3013	24
25	-5.5	-13.3	-9.4	174	2.8	2.9	166	5.1	S	68	-14.0	****	4150	25
26	-2.5	-10.4	-6.4	168	2.0	2.2	152	5.1	SSE	73	-9.7	****	3125	26
27	-4.8	-10.9	-7.9	188	2.5	2.6	187	5.7	S	79	-10.6	****	3808	27
28	-4.2	-11.9	-8.0	181	2.3	2.9	114	8.3	SSW	72	-12.6	****	4643	28
MONTH	-2.4	-29.9	-12.1	166	2.0	2.6	093	10.2	S	72	-16.1	****	75686	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 5.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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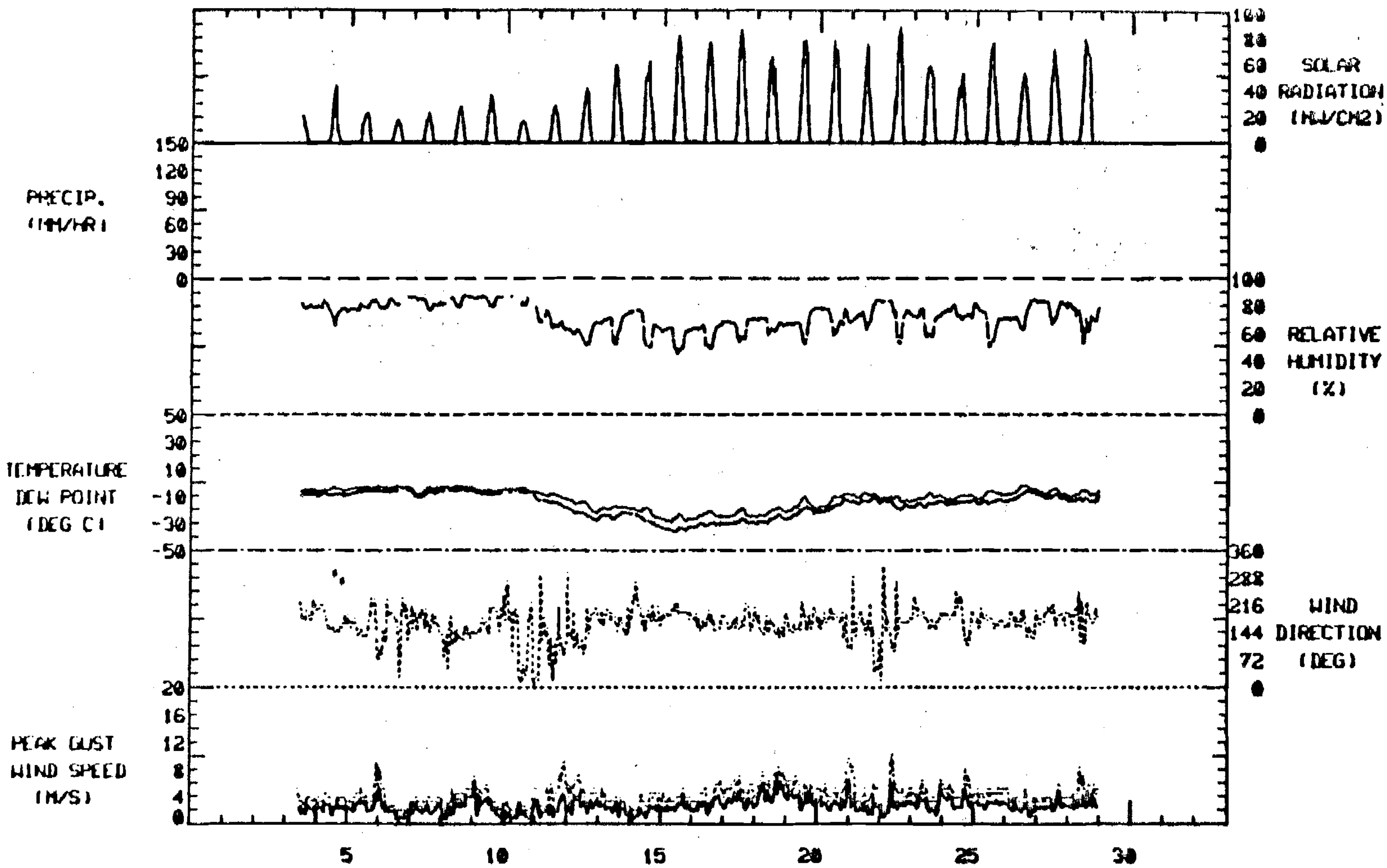


DAY OF THE MONTH KOSINA CREEK WEATHER STATION

DATA START: 01 FEBRUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING MARCH , 1981

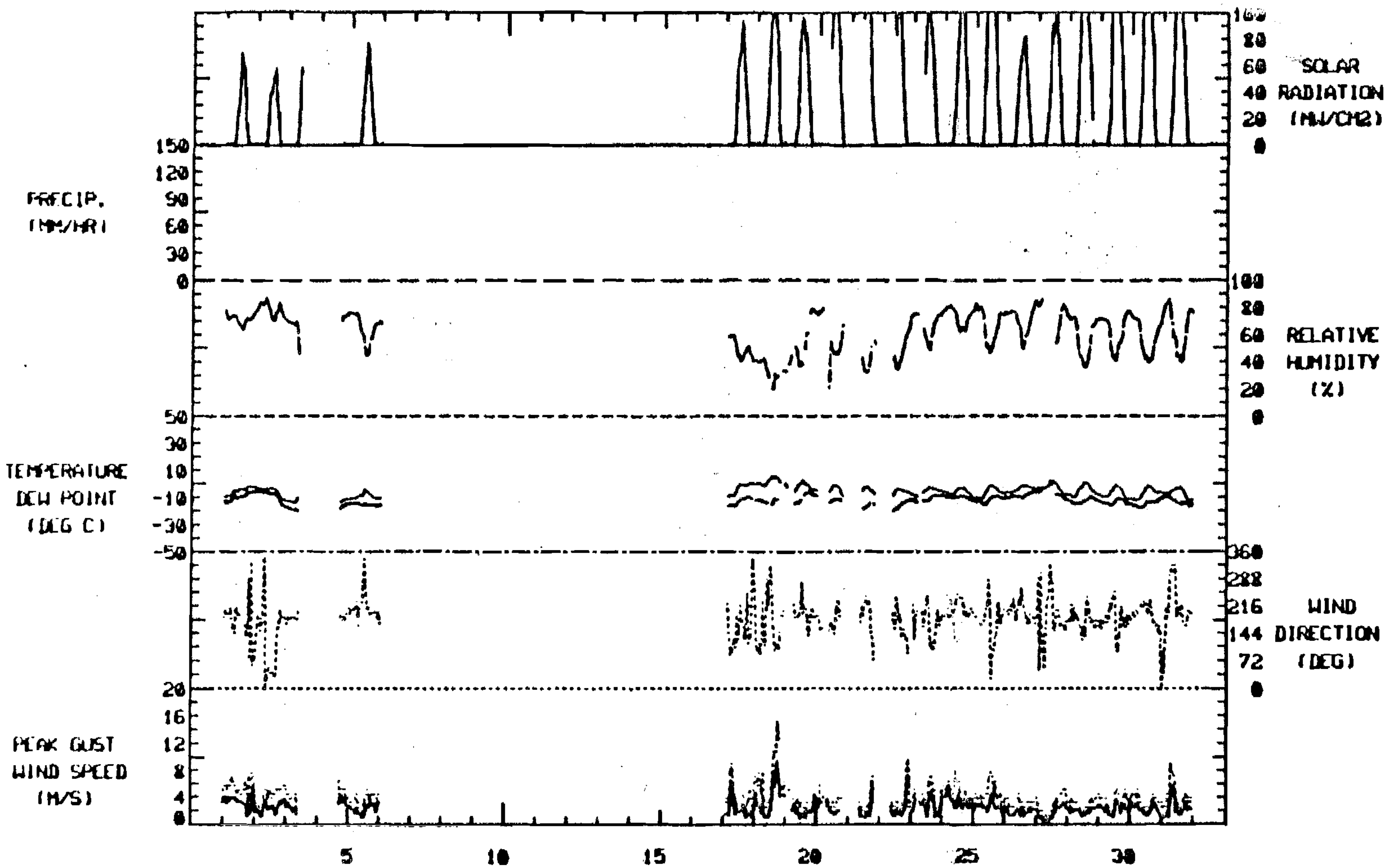
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-1.4	-11.9	-6.6	176	2.3	3.5	098	7.6	SSW	72	-9.4	****	3730	01
02	-2.5	-12.9	-7.7	112	.7	2.6	081	7.0	S	78	-9.4	****	3658	02
03	*****	-15.4	*****	***	****	2.5	174	5.7	S	65	-19.1	****	2571	03
04	-11.3	-13.4	-12.4	***	****	3.3	348	6.3	S	74	-15.9	****	249	04
05	-3.7	-13.2	-8.5	207	2.0	2.2	214	5.1	SSW	65	-15.0	****	4398	05
06	*****	*****	*****	***	****	3.2	179	4.4	SE	68	*****	****	240	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	1.2	-2.5	-.6	134	1.4	2.2	121	8.9	ESE	49	-13.1	****	6353	17
18	6.8	-2.5	2.2	120	2.5	3.8	094	15.2	E	34	-14.0	****	9468	18
19	3.2	-7.8	-2.3	191	1.7	2.0	133	5.7	SSW	59	-11.6	****	8214	19
20	-.2	-10.0	-5.1	180	1.8	2.2	157	5.7	SSE	57	-11.8	****	13525	20
21	-.4	-9.6	-5.0	***	****	1.6	067	7.0	SW	43	-15.7	****	15758	21
22	-3.3	-9.0	-6.2	***	****	2.1	095	9.5	SE	51	-15.2	****	11931	22
23	-1.7	-10.2	-6.0	167	1.8	2.5	109	7.0	SSW	68	-10.7	****	7978	23
24	-2.7	-11.2	-7.0	206	3.0	3.2	***	6.3	SSW	73	-9.9	****	8855	24
25	-.4	-12.5	-6.4	173	1.6	2.6	022	7.6	SSW	66	-11.1	****	12223	25
26	-.8	-7.1	-4.0	199	1.7	1.8	198	4.4	SSW	71	-8.5	****	6085	26
27	2.7	-9.5	-3.4	177	1.1	1.6	147	5.1	S	73	-8.9	****	7123	27
28	3.1	-11.8	-4.3	179	1.7	1.9	152	3.8	SSE	59	-12.8	****	10151	28
29	1.1	-13.6	-6.3	172	1.8	2.3	105	5.1	S	63	-13.6	****	9286	29
30	-1.2	-13.1	-7.2	191	1.9	2.2	198	5.1	SSW	58	-13.9	****	10367	30
31	-1.1	-14.0	-7.6	235	.9	2.3	288	8.9	S	65	-14.1	****	8444	31
MONTH	6.8	-15.4	-5.5	178	1.5	2.5	094	15.2	SSW	62	-12.7	****	160606	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01 MARCH , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING APRIL , 1981

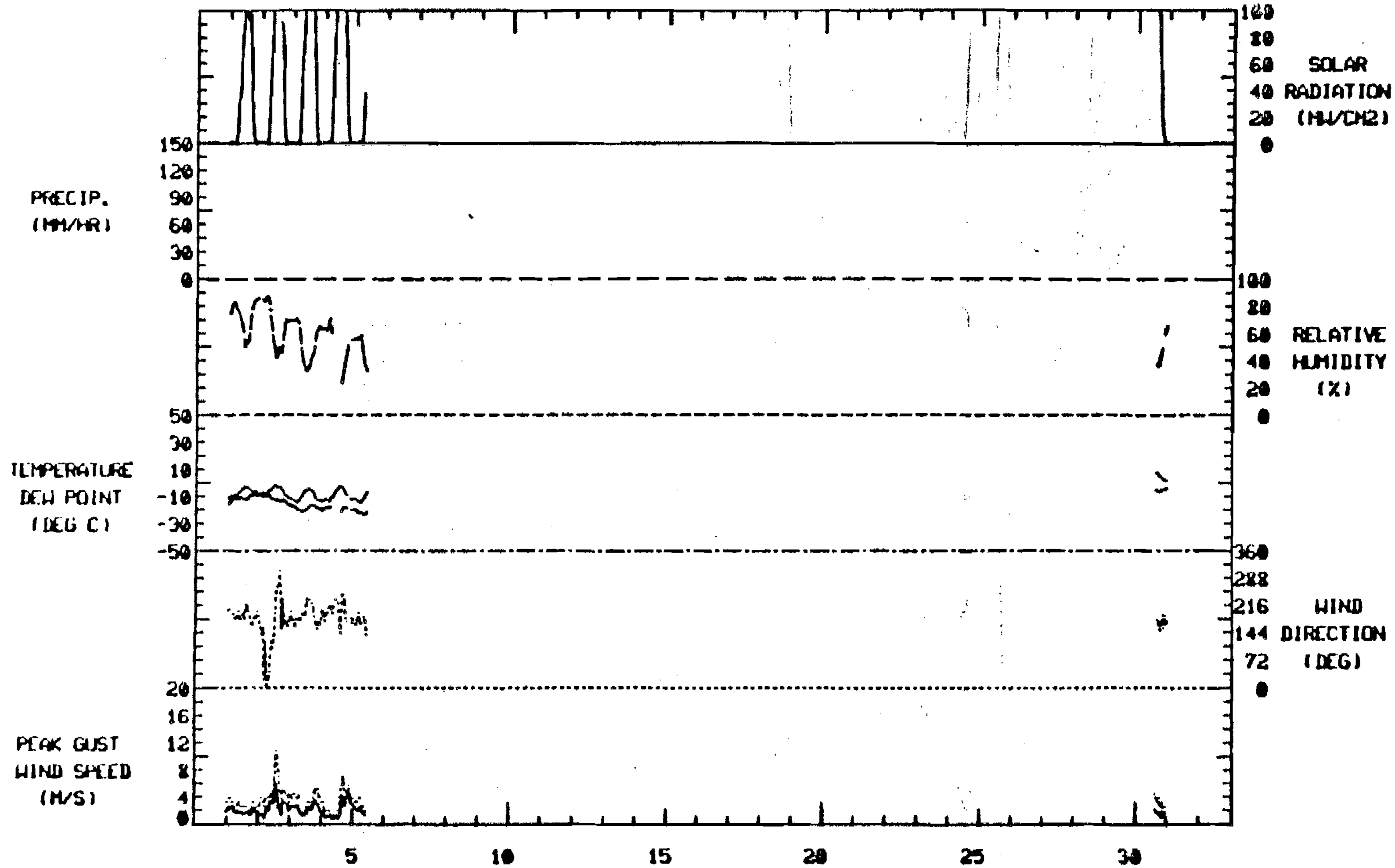
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-2.3	-12.2	-7.3	191	1.7	1.8	204	3.8	SSW	74	-10.9	****	8230	01
02	-1.5	-12.5	-7.0	181	.9	2.6	252	10.8	SSE	65	-12.2	****	6321	02
03	-4.2	-15.8	-10.0	188	2.0	2.2	146	5.7	SSE	53	-18.4	****	9565	03
04	-1.6	-15.0	-8.3	199	1.5	1.8	232	7.0	S	49	-18.8	****	9578	04
05	*****	*****	*****	***	****	2.0	180	3.8	SSE	49	-20.3	****	7028	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	7.7	-4.1	1.8	***	****	1.6	183	4.4	SSE	51	-5.6	0.0	6357	30
MONTH	7.7	-15.8	-6.2	191	1.5	2.0	252	10.8	S	57	-14.4	0.0	47078	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 6.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01 APRIL , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING MAY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	5.2	-1.2	2.0	344	2.4	2.9	334	7.6	NNW	65	-3.2	0.0	11185	01
02	7.5	-4.0	1.8	309	.3	2.2	003	6.3	SE	55	-6.2	0.0	8589	02
03	6.8	-3.1	1.9	109	2.2	3.3	086	9.5	ESE	60	-5.4	0.0	11125	03
04	7.1	-1.2	3.0	121	2.6	3.3	096	10.2	E	55	-5.3	0.0	10737	04
05	9.3	-2.8	3.2	215	.4	2.0	234	5.1	SSE	57	-4.5	0.0	10962	05
06	15.2	-.8	7.2	205	.6	2.1	040	5.1	S	46	-4.6	0.0	9453	06
07	*****	*****	*****	123	1.3	2.7	054	7.6	NE	36	-6.8	0.0	12880	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	15.6	-.3	7.7	***	****	****	***	****	MSG	**	*****	****	***	10
11	9.2	4.9	7.1	***	****	1.4	358	3.8	N	53	-2.3	0.0	2926	11
12	13.3	1.8	7.5	102	2.0	2.8	051	8.9	E	42	-4.4	0.0	9339	12
13	11.6	2.6	7.1	157	.6	2.6	014	9.5	SSW	59	-.9	4.0	10362	13
14	12.7	1.8	7.3	211	1.0	2.5	153	11.4	SSW	70	1.1	3.0	10995	14
15	12.3	2.1	7.2	184	.9	2.7	073	9.5	SSW	68	.7	2.2	8931	15
16	14.8	.9	7.8	176	1.6	2.9	163	8.3	SSE	57	-1.1	.2	9508	16
17	13.8	1.8	7.8	236	.7	2.8	249	7.6	WSW	53	-1.6	0.0	7579	17
18	*****	*****	*****	***	****	1.5	025	4.4	N	81	1.0	1.8	4360	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	11.7	6.5	9.1	***	****	2.7	356	6.3	N	57	-.1	.4	11087	31
MONTH	15.6	-4.0	5.8	137	.6	2.5	153	11.4	SSW	57	-2.7	11.6	150019	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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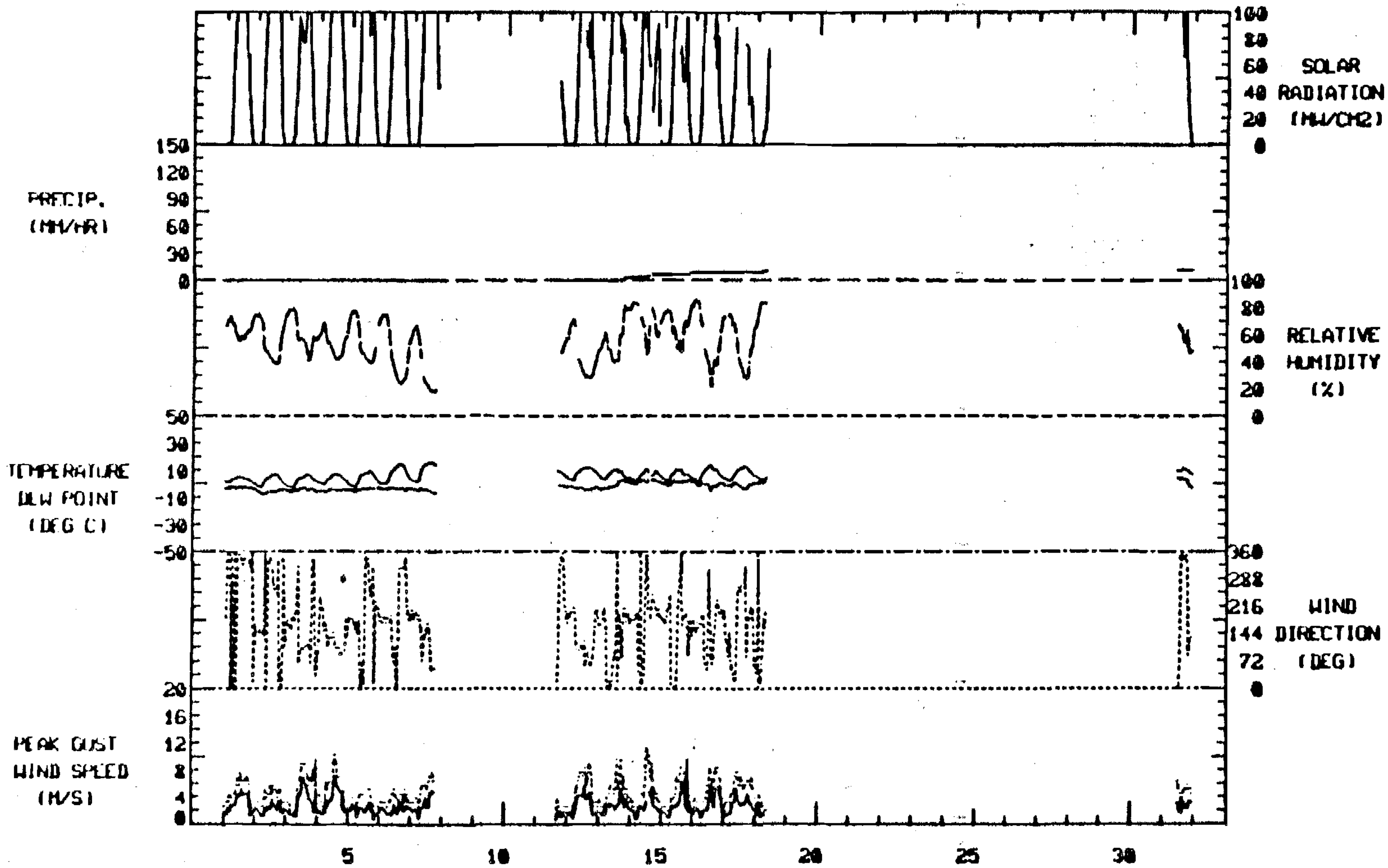
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01   MAY   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA CREEK WEATHER STATION
DATA TAKEN DURING JUNE , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	15.1	1.9	8.5	096	3.7	4.4	123	10.8	E	43	-4.4	0.0	10570	01
02	13.6	-.6	6.5	260	.9	3.0	137	10.8	SSW	60	-1.2	5.4	9778	02
03	12.3	2.1	7.2	081	1.5	2.7	104	9.5	ESE	53	-2.2	.2	9818	03
04	*****	*****	*****	***	****	1.9	208	9.5	N	68	-.1	.2	12254	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	14.5	2.9	8.7	059	.3	2.2	206	5.7	NW	22	-10.7	0.0	8856	10
11	13.9	.7	7.3	060	.5	2.3	195	12.1	NNE	53	-2.2	2.4	4263	11
12	16.6	.9	8.8	004	.4	2.2	231	9.5	N	39	-5.7	0.0	7525	12
13	20.7	3.4	12.1	099	1.6	2.8	111	8.9	NNE	27	-10.0	0.0	7063	13
14	*****	*****	*****	***	****	3.0	019	8.3	NNE	37	-3.6	0.0	9609	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	18.8	4.3	11.5	031	.6	3.4	032	10.2	ESE	20	-10.1	0.0	10042	19
20	19.4	1.7	10.6	285	1.1	2.7	253	11.4	N	35	-6.3	0.0	5935	20
21	12.6	6.9	9.8	267	2.2	3.5	256	12.1	WSW	63	2.7	3.4	4423	21
22	17.0	6.5	11.8	321	1.7	2.9	252	8.9	N	48	.1	0.0	5068	22
23	16.5	3.4	10.0	098	.9	2.5	074	10.2	SW	48	-.3	1.2	6360	23
24	17.0	4.3	10.6	264	1.8	3.8	258	10.8	W	52	.3	2.0	5702	24
25	16.3	7.1	11.7	297	1.2	3.3	257	9.5	NNE	53	1.2	****	8255	25
26	9.4	5.5	7.4	032	3.1	3.4	026	7.6	NNE	77	2.9	.2	1908	26
27	5.5	1.9	3.7	018	1.8	2.0	023	5.7	NNE	82	1.3	15.6	1528	27
28	9.2	1.0	5.1	011	1.5	2.0	355	8.3	NNE	68	-.3	5.8	4143	28
29	9.8	2.1	5.9	123	1.0	2.6	139	9.5	SE	64	-.5	4.4	3195	29
30	9.5	-.5	4.5	328	1.5	2.9	032	11.4	NNE	61	-3.1	.6	5590	30
MONTH	20.7	-.6	8.5	018	.5	2.8	195	12.1	NNE	51	-2.5	41.4	141883	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 5.1

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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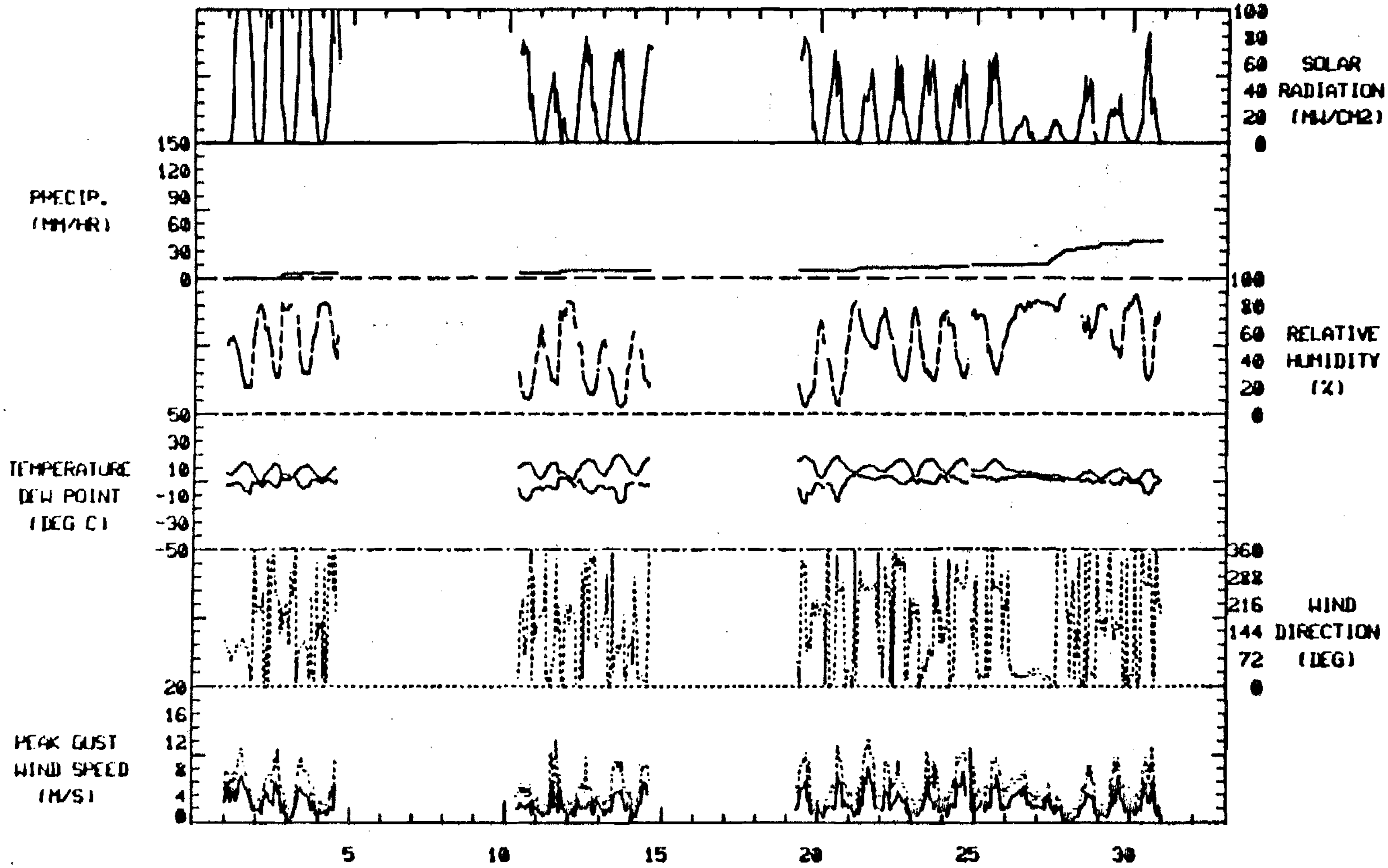
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   KOSINA CREEK WEATHER STATION

DATA START: 01   JUNE   ,   1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA WEATHER STATION
DATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	10.5	-.5	5.0	120	1.5	2.7	093	9.5	E	69	-3.1	.6	5543	1
2	10.0	4.2	7.1	336	4.1	4.5	321	8.9	NW	50	*****	*****	3972	2
3	13.2	4.4	8.8	322	4.1	4.3	320	8.9	NW	27	-9.9	0.0	5855	3
4	15.2	2.0	8.6	284	1.3	3.1	252	9.5	WSW	31	-8.0	0.0	6280	4
5	12.6	6.2	9.4	326	1.7	2.6	263	9.5	NNE	55	-.9	.6	2618	5
6	12.8	5.7	9.3	302	.7	2.4	261	8.3	NNE	67	2.3	1.6	3198	6
7	13.7	3.2	8.5	311	1.5	3.2	238	9.5	NNE	63	.6	5.0	3763	7
8	10.2	2.6	6.4	346	.5	1.2	358	3.2	N	76	3.3	1.2	2053	8
9	10.2	7.0	8.6	011	2.3	2.3	022	6.3	N	79	4.7	8.2	2233	9
10	9.9	6.2	8.1	351	.7	1.3	084	5.1	N	79	5.3	14.4	1683	10
11	12.7	6.5	9.6	026	2.7	2.8	042	8.9	NNE	76	4.6	7.0	3758	11
12	11.4	6.0	8.7	019	2.2	2.7	022	7.6	NNE	71	4.1	.6	3335	12
13	10.9	5.2	8.1	013	1.8	2.2	017	6.3	NNE	73	4.1	0.0	2450	13
14	10.6	7.1	8.9	019	2.0	2.4	023	6.3	NNE	73	4.6	.4	2913	14
15	13.2	7.5	10.4	080	2.5	3.0	083	8.9	E	74	6.0	2.8	2425	15
16	15.5	9.4	12.5	021	1.9	2.5	013	7.6	NNE	68	6.4	3.6	3635	16
17	15.3	9.3	12.3	007	1.9	2.0	336	5.7	N	74	6.9	13.0	3613	17
18	15.7	7.9	11.8	019	2.8	3.3	047	10.2	NNE	67	4.4	.4	4423	18
19	12.4	7.3	9.9	020	2.2	2.2	028	5.7	NNE	76	5.1	8.4	3003	19
20	11.1	7.6	9.4	019	2.1	2.2	020	5.7	NNE	75	5.4	3.8	2668	20
21	16.0	6.9	11.5	036	1.6	2.0	042	7.0	NE	59	3.3	0.0	3918	21
22	13.8	7.6	10.7	024	2.1	2.4	028	6.3	NNE	63	4.1	2.0	3440	22
23	14.0	8.4	11.2	009	.7	1.3	354	5.7	NNE	74	6.6	12.6	2920	23
24	14.4	9.2	11.8	086	2.8	3.3	107	10.8	E	66	4.7	1.2	3145	24
25	13.0	7.6	10.3	069	1.7	2.2	085	5.7	E	71	4.9	10.4	2738	25
26	15.3	6.3	10.8	330	1.4	2.2	349	8.9	WNW	56	.8	0.0	4705	26
27	16.0	6.6	11.3	014	2.1	2.6	022	8.3	NNE	54	1.9	0.0	5098	27
28	15.5	5.4	10.5	021	1.6	2.3	026	7.0	NNE	68	3.8	2.0	3225	28
29	16.2	7.7	12.0	338	1.3	2.7	274	8.9	NNE	54	.1	1.6	4930	29
30	14.4	5.7	10.1	007	1.1	2.0	012	7.0	NNE	56	1.1	.6	3488	30
31	14.4	5.7	10.1	007	1.1	2.0	012	7.0	NNE	56	1.1	.6	3488	31
MONTH	16.2	-.5	9.7	011	1.4	2.5	107	10.8	NNE	65	2.6	102.6	110508	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

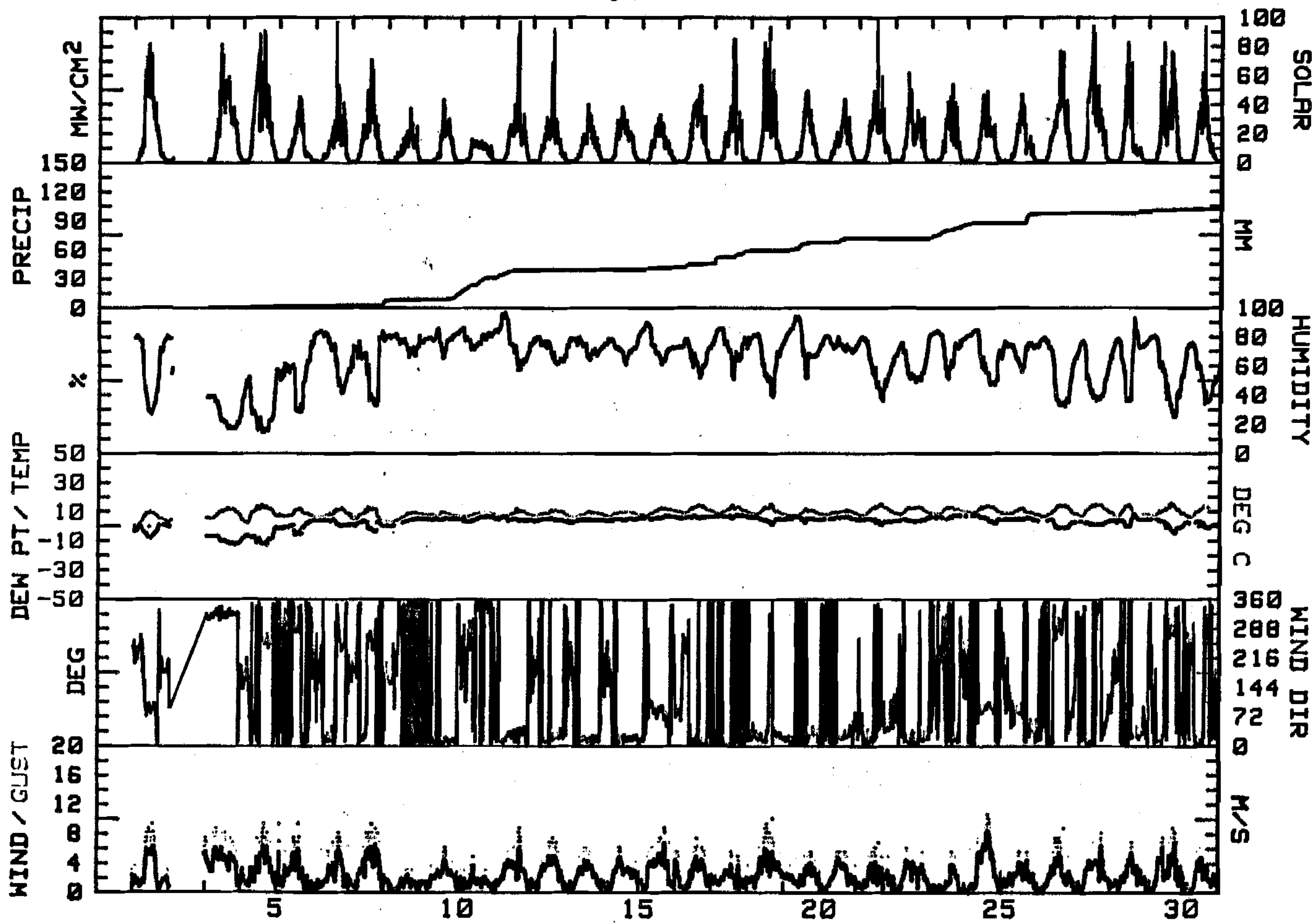
****: SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

KOSINA WEATHER STATION

July, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	12.1	7.2	9.7	065	1.4	2.0	080	7.0	ENE	71	4.8	6.2	1990	1
2	11.4	7.0	9.2	334	.7	1.5	358	5.7	N	69	3.5	12.0	2930	2
3	17.0	6.0	11.5	128	1.6	2.2	110	7.6	ESE	47	-.6	.2	5640	3
4	17.1	2.0	9.6	094	2.8	3.8	077	10.8	ENE	32	-6.7	0.0	6520	4
5	14.6	4.0	9.3	101	4.2	4.6	114	10.8	E	42	-1.6	.4	4040	5
6	15.6	7.7	11.7	102	5.0	5.2	092	12.1	ESE	45	-1.0	0.0	4025	6
7	11.3	7.9	9.6	103	4.7	4.8	097	11.4	ESE	61	2.3	3.0	1293	7
8	14.3	6.7	10.5	092	2.7	3.4	079	10.2	E	62	2.9	8.6	2695	8
9	13.5	6.8	10.2	037	2.1	2.9	087	8.9	N	67	3.2	4.2	3758	9
10	13.8	6.0	9.9	059	2.6	3.5	108	11.4	NNE	63	1.7	1.0	3473	10
11	11.9	5.1	8.5	027	1.2	2.1	092	7.0	N	62	.4	2.4	4263	11
12	9.7	4.5	7.1	049	1.5	2.6	091	8.3	N	72	2.1	9.0	1878	12
13	9.9	3.4	6.7	015	2.2	2.4	021	7.0	NNE	71	1.0	10.4	3530	13
14	11.1	2.7	6.9	077	1.7	3.0	092	10.2	N	63	-.8	2.8	2860	14
15	5.6	.4	3.0	011	1.3	2.2	346	7.0	NNE	74	-1.1	10.4	1863	15
16	6.0	-2.4	1.8	278	1.2	2.8	259	10.2	SSE	57	-6.4	1.0	3895	16
17	9.8	-5.0	2.4	107	2.4	3.3	089	8.3	E	41	-9.3	.2	4995	17
18	10.0	3.5	6.8	096	2.2	2.8	079	8.3	E	66	.4	1.0	3463	18
19	10.2	5.3	7.8	084	1.3	2.2	092	7.0	E	71	2.7	5.8	2088	19
20	10.0	5.5	7.8	069	2.1	2.9	055	10.8	ENE	66	1.7	13.2	1725	20
21	16.1	4.3	10.2	123	1.5	2.9	094	8.3	SE	55	-1.9	6.8	4210	21
22	7.5	4.3	5.9	020	1.8	2.2	021	5.1	NNE	73	1.5	4.4	2173	22
23	14.1	2.1	8.1	038	.5	1.9	033	6.3	SSE	54	-2.1	0.0	3968	23
24	17.4	-.1	8.7	317	.3	1.9	037	6.3	N	42	-4.9	0.0	5188	24
25	19.6	5.7	12.7	356	.5	1.9	358	5.7	N	38	-3.3	0.0	4450	25
26	24.7	5.0	14.9	103	.7	2.0	053	5.7	ESE	37	-1.2	0.0	5145	26
27	23.7	7.6	15.7	356	1.1	1.7	015	4.4	N	41	.0	0.0	5130	27
28	23.7	6.0	14.9	330	.7	1.7	312	5.1	N	45	-.3	0.0	4043	28
29	14.5	4.8	9.7	011	1.8	2.4	010	7.0	NNE	67	3.8	0.0	3183	29
30	14.4	7.4	10.9	022	3.3	3.3	026	7.6	NNE	61	2.6	.2	3038	30
31	14.4	3.1	8.8	341	2.3	3.5	340	10.8	NW	34	-9.7	.4	4928	31
MONTH	24.7	-5.0	9.0	067	1.4	2.8	092	12.1	N	56	-.5	103.6	112374	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 9.5
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

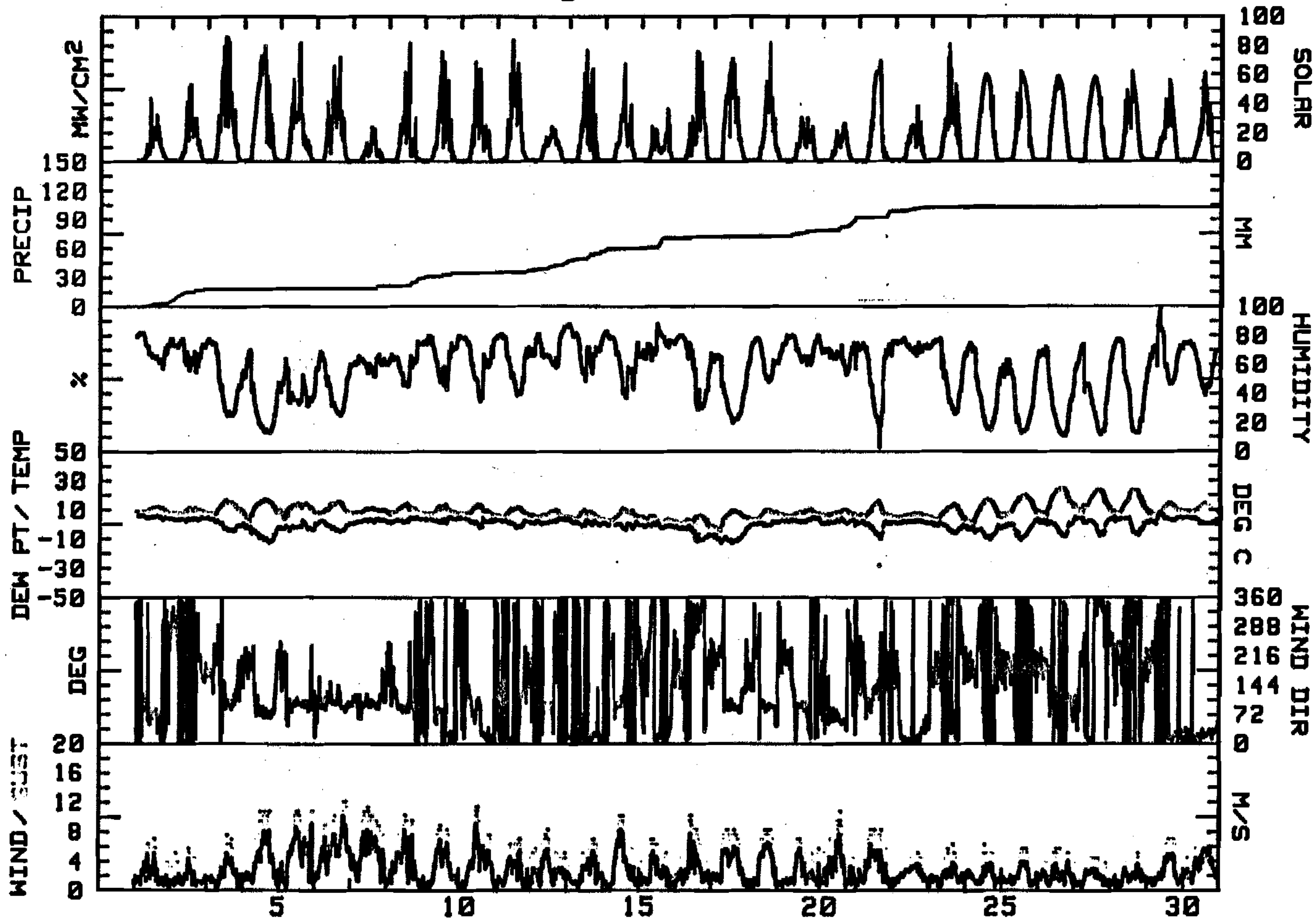
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

KOSINA WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR KOSINA WEATHER STATION
DATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	16.6	-.8	7.9	122	.2	2.1	134	5.1	N	21	-16.0	0.0	5185	1
2	11.7	2.3	7.0	026	1.4	2.5	003	8.3	NNE	52	-1.9	0.0	2783	2
3	12.2	5.1	8.7	116	.5	1.7	094	5.7	SE	51	-1.7	.8	2635	3
4	9.6	4.2	6.9	098	3.2	3.6	096	8.9	E	55	-1.6	0.0	2778	4
5	12.7	5.2	9.0	110	2.5	3.3	253	9.5	E	54	-1.8	.8	3600	5
6	10.1	1.6	5.9	111	1.9	3.0	113	9.5	ESE	55	-2.3	0.0	2085	6
7	7.6	-.9	3.4	147	1.2	1.9	087	5.1	SE	60	-3.1	.6	1963	7
8	11.2	1.0	6.1	166	.7	1.7	071	5.1	SSW	44	-6.0	.6	3308	8
9	11.1	.8	6.0	071	.1	1.7	054	5.7	S	53	-4.4	4.2	1710	9
10	9.3	1.6	5.5	336	.6	1.7	329	5.1	N	57	-3.2	1.0	2480	10
11	8.8	.7	4.8	337	.2	1.4	205	5.1	N	57	-3.6	.8	2053	11
12	9.1	1.8	5.5	118	1.7	2.3	085	6.3	ESE	47	-6.1	0.0	2270	12
13	9.1	-2.0	3.6	131	1.0	2.2	095	10.2	SSW	51	-6.7	1.8	3193	13
14	11.0	-2.7	4.2	143	1.4	2.3	087	8.3	S	43	-9.0	.2	2760	14
15	10.8	2.6	6.7	089	1.7	2.7	099	7.6	E	48	-4.9	.6	2333	15
16	9.3	.3	4.8	100	3.0	3.7	096	10.2	E	39	-8.4	0.0	2778	16
17	11.4	-.7	5.4	119	1.3	2.5	066	8.9	ESE	29	-12.7	0.0	3653	17
18	9.0	3.6	6.3	093	1.4	2.1	087	10.2	E	41	-6.6	.4	1590	18
19	7.7	2.1	4.9	117	1.6	2.6	078	8.3	E	58	-2.9	12.8	800	19
20	7.6	.1	3.9	191	1.2	2.1	203	6.3	SSW	58	-5.0	3.6	1985	20
21	6.3	-.4	3.0	323	2.2	2.9	320	8.3	NW	41	-10.5	0.0	2403	21
22	6.6	-3.7	1.5	178	.2	1.6	170	5.1	S	38	-12.3	0.0	3098	22
23	4.9	-3.3	.8	354	.6	1.6	015	5.1	N	51	-9.6	0.0	2235	23
24	-.1	-2.8	-1.5	326	2.4	2.9	311	10.2	NW	56	-11.5	0.0	1275	24
25	-.6	-9.1	-4.9	308	2.8	3.8	328	9.5	NW	42	-14.4	0.0	2163	25
26	-.6	-12.0	-6.3	204	1.9	2.1	187	5.1	S	36	-20.0	0.0	3190	26
27	-.3	-14.1	-7.2	198	1.2	1.6	165	4.4	S	34	-20.3	0.0	3245	27
28	-1.6	-9.1	-5.4	106	2.1	3.0	065	8.9	SE	42	-16.5	0.0	2370	28
29	-1.0	-10.4	-5.7	160	1.8	2.3	108	7.0	SSE	42	-17.1	0.0	2125	29
30	2.7	-6.8	-2.1	308	2.2	3.9	323	13.3	NW	38	-14.1	0.0	2058	30
MONTH	16.6	-14.1	2.9	110	.5	2.4	323	13.3	SSW	46	-8.5	28.2	76018	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.7

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

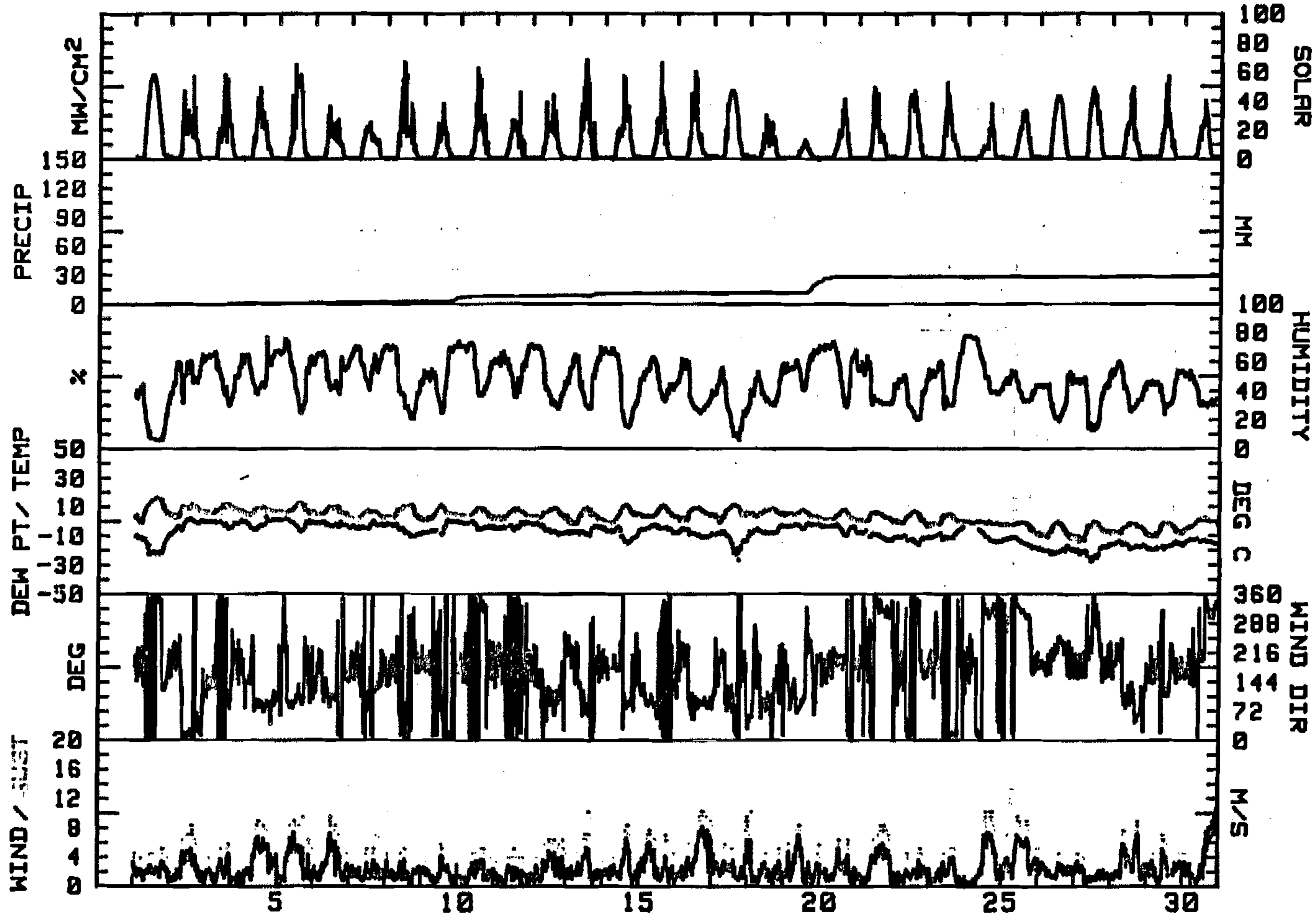
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

KOSINA WEATHER STATION

September, 1981



ATTACHMENT E.5, PART 5

WATANA CLIMATE DATA

susi11/k16

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING APRIL , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	4.0	-6.0	-1.0	***	****	3.4	072	7.6	ENE	54	-9.4	1.4	3840	08
09	5.0	-10.0	-2.5	039	2.1	2.3	068	5.1	NE	52	-10.5	0.0	4866	09
10	3.0	-8.0	-2.5	050	2.5	2.6	066	5.1	NE	56	-9.0	0.0	4240	10
11	2.0	-3.0	-.5	055	3.3	3.4	069	6.3	NE	76	-3.3	0.0	3025	11
12	3.0	-4.0	-.5	096	.7	3.5	231	8.9	ENE	76	-3.8	.4	2705	12
13	2.0	-5.0	-1.5	081	1.3	3.2	068	8.9	ENE	66	-22.3	.2	3430	13
14	2.0	-11.0	-4.5	344	2.1	2.1	308	5.1	NNW	58	-12.8	0.0	5245	14
15	0.0	-13.0	-6.5	039	2.5	2.7	075	7.6	NNE	52	-14.2	0.0	5010	15
16	1.0	-10.0	-4.5	031	2.6	2.8	052	5.7	NE	56	-12.4	0.0	4740	16
17	3.0	-10.0	-3.5	053	3.0	3.4	079	8.3	ENE	54	-11.1	0.0	5350	17
18	5.0	-9.0	-2.0	059	2.8	3.1	085	8.3	ENE	52	-10.0	0.0	4450	18
19	6.0	-6.0	0.0	329	1.2	1.9	287	6.3	WNW	53	-9.5	0.0	5245	19
20	6.0	-3.0	1.5	038	2.7	3.0	065	10.2	N	64	-5.3	1.0	5285	20
21	4.0	-2.0	1.0	083	6.5	6.8	097	15.9	ENE	61	-6.0	0.0	3585	21
22	7.0	-2.0	2.5	068	4.5	4.7	069	10.8	ENE	56	-7.3	0.0	4440	22
23	1.0	-7.0	-3.0	018	1.2	2.3	066	6.3	N	65	-8.0	.2	3125	23
24	5.0	-8.0	-1.5	009	2.1	2.3	359	5.1	NNE	48	-11.3	0.0	5505	24
25	4.0	-6.0	-1.0	056	3.2	3.5	074	8.9	ENE	55	-7.2	0.0	5290	25
26	7.0	0.0	3.5	074	3.7	4.3	101	12.1	E	55	-5.1	0.0	6035	26
27	9.0	-2.0	3.5	040	2.2	2.4	071	5.7	NE	53	-6.0	0.0	5645	27
28	8.0	-3.0	2.5	002	1.8	2.0	103	4.4	N	58	-5.8	0.0	6285	28
29	7.0	-4.0	1.5	070	2.1	2.9	083	9.5	N	54	-7.4	0.0	6377	29
30	8.0	-4.0	2.0	073	1.9	2.7	105	7.6	ESE	55	-6.1	0.0	5260	30
MONTH	9.0	-13.0	-.7	051	2.3	3.1	097	15.9	ENE	58	-8.9	3.2	108979	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 14.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 15.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 15.2
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.0

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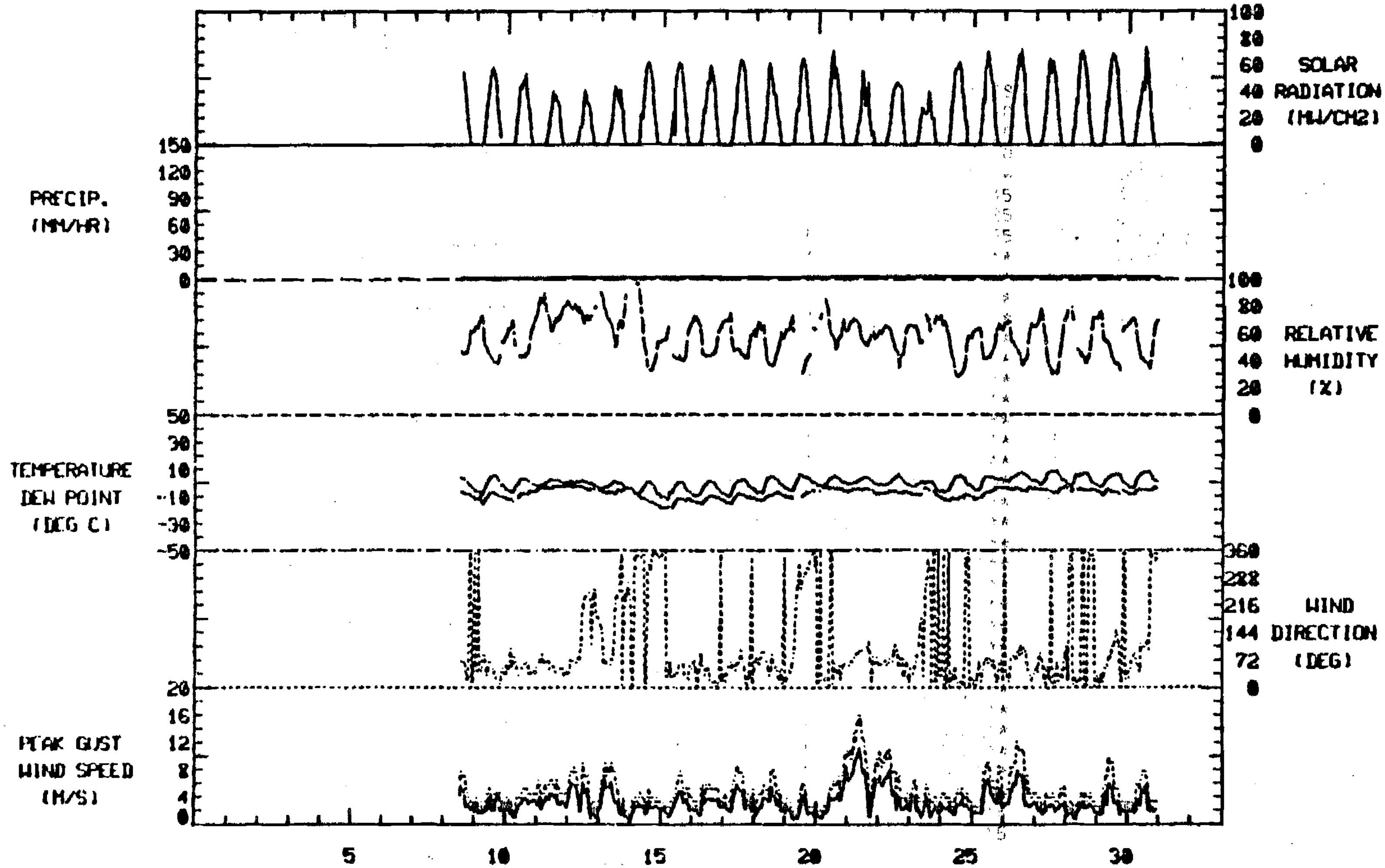
**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 08 APRIL , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING MAY , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	8.0	-3.0	2.5	035	2.4	2.9	078	8.3	N	54	-5.8	0.0	6270	01
02	7.0	-1.0	3.0	248	2.4	2.9	257	7.6	WSW	71	-1.7	0.0	4820	02
03	5.0	-3.0	1.0	263	1.3	2.2	246	6.3	WSW	65	-4.3	.6	4115	03
04	8.0	-5.0	1.5	055	2.8	3.2	092	10.2	NNE	56	-5.1	0.0	5825	04
05	11.0	2.0	6.5	068	2.8	3.5	097	9.5	E	47	-4.0	0.0	5295	05
06	10.0	1.0	5.5	103	2.0	3.4	116	9.5	ENE	62	-1.1	0.0	4850	06
07	9.0	0.0	4.5	014	2.2	2.5	017	5.7	NNE	52	-3.6	.2	5360	07
08	*****	*****	*****	242	1.6	2.3	226	7.6	WSW	41	-9.7	4.8	2843	08
09	9.0	*****	*****	238	1.6	2.7	228	8.3	SW	37	-8.3	0.0	7920	09
10	6.0	-1.0	2.5	241	1.7	3.2	226	8.9	WSW	42	-8.1	0.0	5730	10
11	6.0	-2.0	2.0	257	2.3	2.7	240	8.3	W	48	-8.0	0.0	5275	11
12	10.0	-4.0	3.0	078	1.2	2.8	062	8.3	ENE	48	-6.4	0.0	7175	12
13	10.0	-3.0	3.5	308	1.6	2.0	311	6.3	NNW	49	-5.0	0.0	6770	13
14	8.0	0.0	4.0	272	1.8	2.6	229	9.5	WSW	52	-5.6	0.0	4285	14
15	10.0	0.0	5.0	009	1.2	1.5	357	5.1	NNW	50	-4.1	0.0	5455	15
16	12.0	2.0	7.0	106	3.1	3.7	127	10.2	SE	45	-3.7	0.0	6555	16
17	9.0	3.0	6.0	103	6.3	6.6	122	14.0	ESE	41	-5.7	0.0	5400	17
18	10.0	2.0	6.0	083	6.2	6.5	098	16.5	E	45	-5.3	0.0	2530	18
19	13.0	-1.0	6.0	092	.3	2.4	075	10.8	NE	42	-5.1	0.0	5470	19
20	5.0	0.0	2.5	244	4.2	4.3	229	8.9	WSW	62	-3.4	2.4	2705	20
21	4.0	0.0	2.0	242	2.3	2.3	246	5.7	WSW	63	-4.9	1.4	2335	21
22	8.0	1.0	4.5	244	1.9	2.3	226	8.3	W	57	-3.1	.8	3265	22
23	10.0	2.0	6.0	246	2.2	2.3	263	8.3	WSW	54	-2.8	0.0	5515	23
24	11.0	0.0	5.5	078	2.5	3.6	084	8.9	ENE	51	-2.3	0.0	3375	24
25	12.0	3.0	7.5	249	1.1	2.7	245	8.9	W	52	-1.6	0.0	5290	25
26	13.0	3.0	8.0	247	2.1	3.1	249	8.9	WSW	51	-1.5	0.0	5495	26
27	16.0	0.0	8.0	042	.5	2.2	157	8.9	NNE	51	.1	.4	4625	27
28	8.2	1.0	4.6	232	2.9	3.4	163	8.3	SW	56	-2.7	1.6	2829	28
29	12.7	2.1	7.4	142	.3	2.3	070	8.3	SW	50	-2.2	0.0	5455	29
30	7.0	2.0	4.5	215	1.2	4.4	081	9.5	SW	56	-3.4	2.0	2272	30
31	8.0	1.0	4.5	248	3.3	3.5	246	10.2	WSW	55	-4.5	.4	3580	31
MONTH	16.0	-5.0	4.6	205	.2	3.1	098	16.5	WSW	52	-4.3	14.6	148684	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 13.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 15.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 15.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 14.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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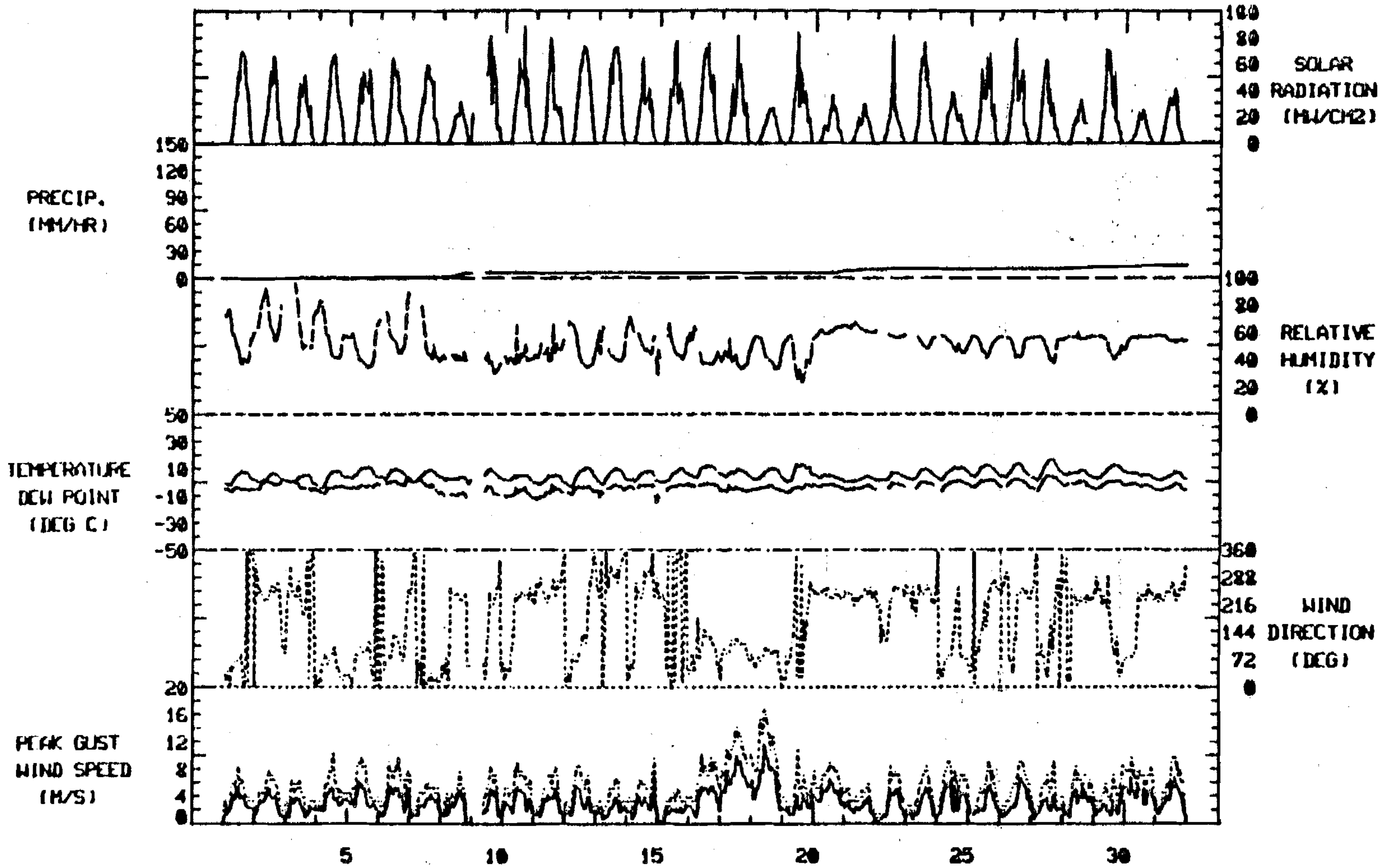
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01   MAY   , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING JUNE , 1980

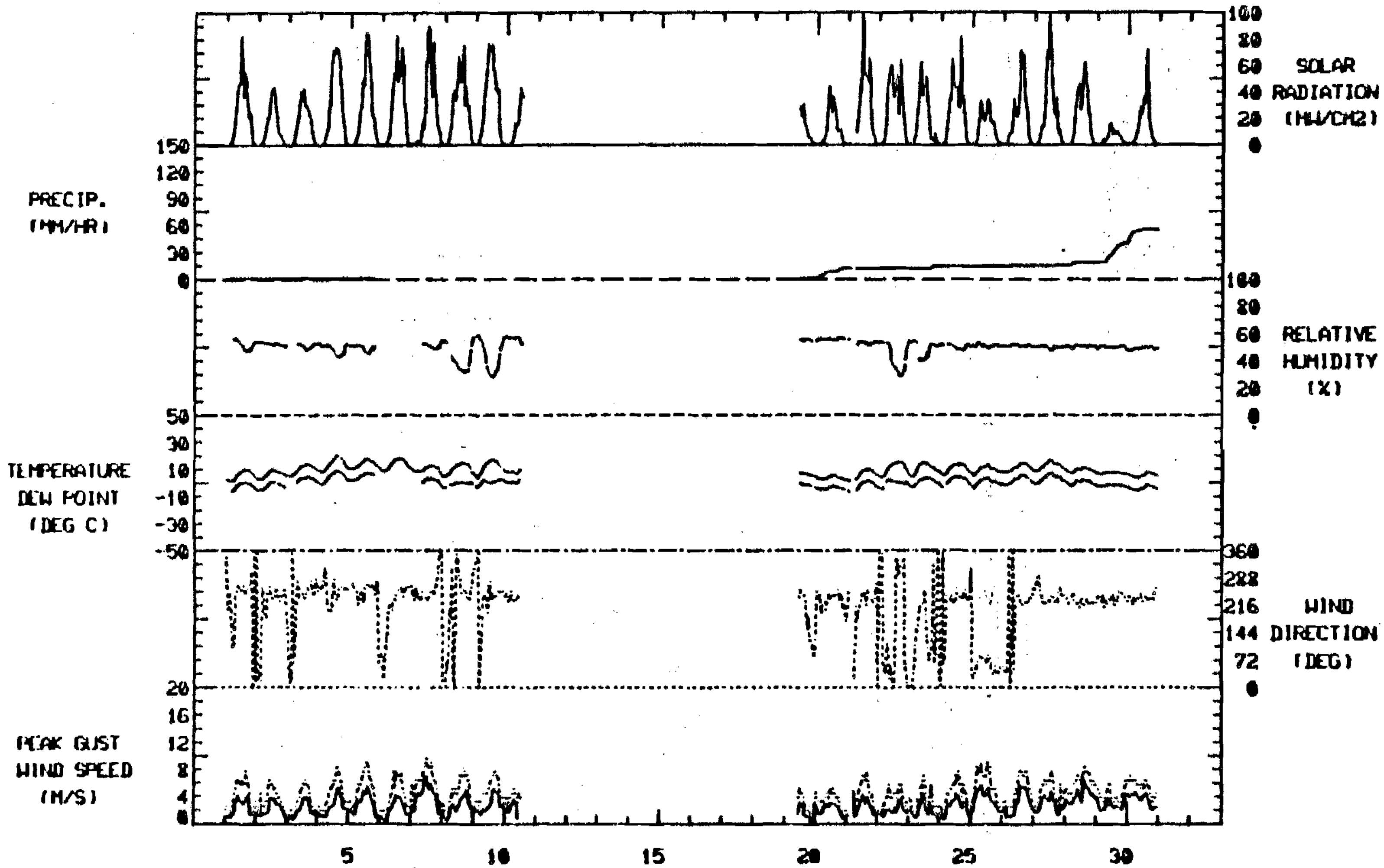
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	10.0	1.0	5.5	262	1.7	2.3	255	7.6	WSW	52	-3.4	1.2	5673	01
02	11.0	2.0	6.5	246	1.7	2.2	242	6.3	WSW	53	-2.8	0.0	3343	02
03	14.0	5.0	9.5	255	1.5	1.9	244	6.3	WSW	51	.8	0.0	3763	03
04	21.0	8.0	14.5	252	2.2	2.4	248	8.3	W	48	3.9	0.0	6935	04
05	13.5	10.0	11.8	255	2.7	2.9	264	8.9	W	50	3.8	0.0	6260	05
06	18.7	8.3	13.5	248	1.6	2.0	231	7.6	WSW	**	*****	****	6473	06
07	13.1	4.7	8.9	248	3.5	4.0	235	9.5	WSW	51	.2	****	6423	07
08	15.5	4.3	9.9	273	1.5	2.5	256	7.6	WSW	41	-1.7	****	6710	08
09	17.0	3.5	10.3	253	2.1	2.7	240	7.6	WSW	44	-.5	****	7353	09
10	*****	*****	*****	***	****	2.3	217	5.1	WSW	56	-.4	****	3835	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	7.6	4.6	6.1	***	****	1.5	240	5.1	WSW	56	-1.8	.8	2478	19
20	5.8	1.8	3.8	233	1.9	2.1	241	5.1	WSW	56	-4.7	10.2	3200	20
21	10.3	1.3	5.8	237	2.0	2.5	250	7.6	WSW	54	-1.6	0.0	7060	21
22	16.4	3.6	10.0	003	1.3	1.9	040	5.7	N	43	-2.0	0.0	6773	22
23	15.4	4.2	9.8	206	.2	2.0	259	7.0	N	49	-.0	2.6	4700	23
24	15.0	5.1	10.1	240	2.1	2.5	220	7.6	SW	51	2.1	0.0	6143	24
25.	16.4	1.3	8.9	064	3.3	3.6	083	8.9	NE	51	-.0	.4	3415	25
26	15.2	7.6	11.4	233	1.9	2.9	229	7.6	SW	51	1.4	.2	5238	26
27	17.4	8.2	12.8	237	2.6	2.8	244	7.6	SW	50	2.4	.4	6078	27
28	11.8	7.1	9.5	224	4.1	4.2	219	8.3	SW	51	-.5	3.4	5263	28
29	7.8	6.0	6.9	232	2.6	2.7	227	6.3	WSW	50	-2.8	22.0	1375	29
30	8.5	3.7	6.1	234	3.5	3.6	227	7.0	SW	49	-4.3	13.8	3710	30
MONTH	21.0	1.0	9.1	244	1.7	2.6	235	9.5	WSW	50	-.6	55.0	112196	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS	8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL	8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL	9.5
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS	8.9

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 01 JUNE , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING JULY , 1980

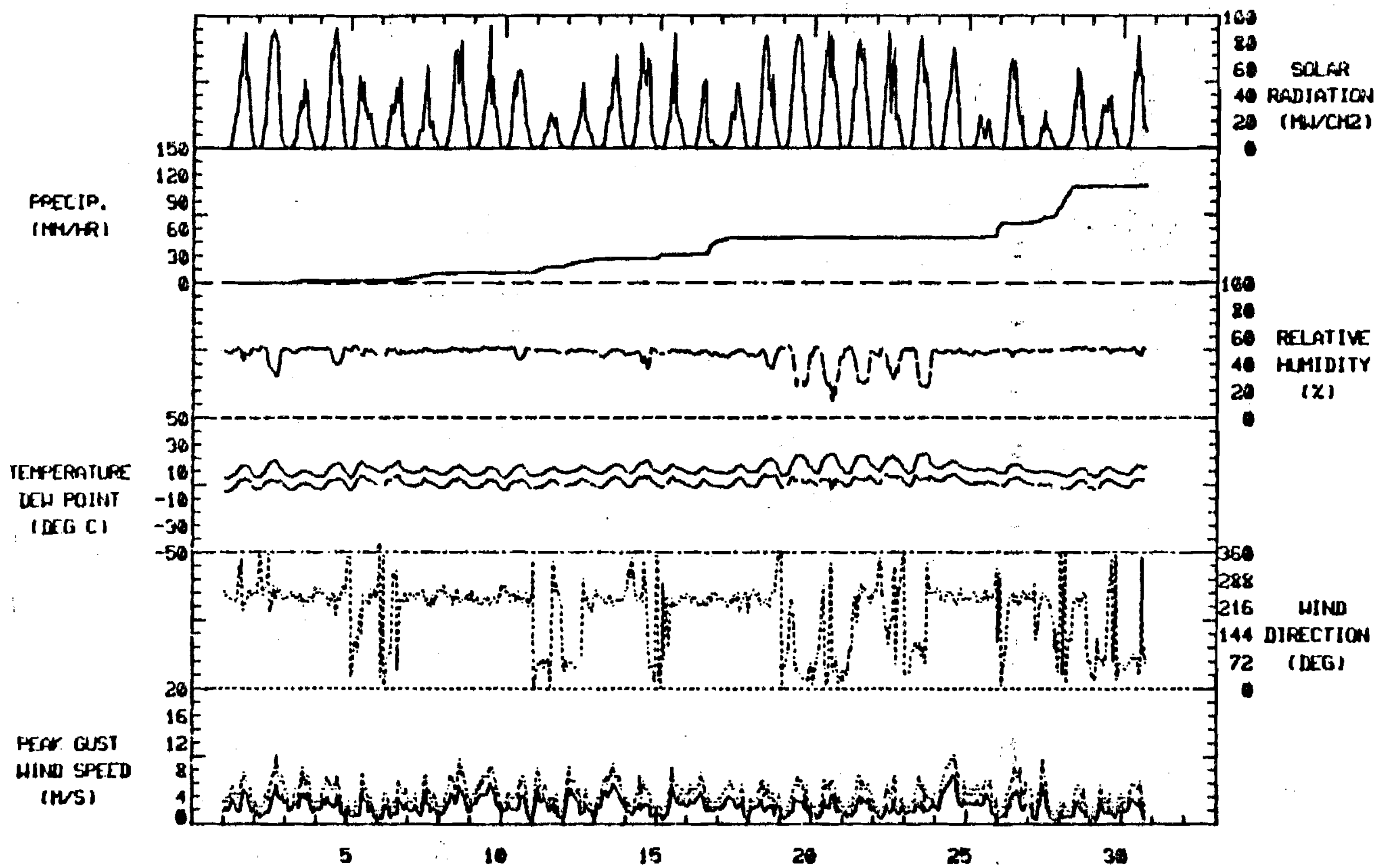
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	14.9	5.0	10.0	241	2.5	2.8	218	7.6	SW	49	-.8	0.0	6875	01
02	18.3	5.2	11.8	255	2.4	2.8	263	10.2	WSW	45	-.0	0.0	8515	02
03	10.8	5.9	8.4	238	2.9	3.0	208	8.3	WSW	50	-2.0	2.4	3855	03
04	17.0	6.0	11.5	242	2.5	2.7	214	7.0	WSW	47	-.3	0.0	8000	04
05	17.7	4.5	11.1	240	1.0	2.0	233	7.6	WSW	49	.8	.2	4600	05
06	17.6	9.3	13.4	251	.4	1.9	245	6.3	SW	49	1.9	2.8	4205	06
07	14.3	7.8	11.0	239	2.2	2.2	220	7.0	WSW	49	-.3	4.8	3455	07
08	15.2	6.8	11.0	240	3.1	3.2	234	9.5	WSW	50	.2	.8	6995	08
09	13.2	5.6	9.4	233	3.7	3.8	218	8.3	SW	51	-.5	0.0	5405	09
10	14.9	4.9	9.9	244	2.2	2.3	245	7.0	WSW	49	-.6	1.4	5800	10
11	13.2	6.7	10.0	051	1.4	2.6	066	8.3	ENE	50	-.3	6.6	2308	11
12	14.2	8.6	11.4	077	1.3	2.8	073	8.3	ENE	49	.8	6.6	3228	12
13	16.0	8.6	12.3	233	3.8	3.8	226	8.9	SW	48	1.0	.8	5123	13
14	18.9	7.6	13.3	284	.8	2.0	271	7.0	WSW	46	1.8	1.6	7105	14
15	16.1	8.3	12.2	230	1.9	2.6	220	8.3	SW	49	1.0	2.6	4543	15
16	13.6	8.3	11.0	233	2.9	2.9	221	7.6	SW	48	-.7	15.4	3035	16
17	15.3	8.7	12.0	232	2.6	2.7	232	6.3	SW	47	.1	3.6	3810	17
18	19.8	7.4	13.6	251	1.8	2.3	207	6.3	WSW	45	2.2	0.0	7148	18
19	22.4	6.5	14.5	041	1.4	2.1	053	7.0	NNE	39	1.9	.2	8045	19
20	23.9	7.6	15.8	041	1.5	2.2	083	6.3	NE	35	-3.1	0.0	8293	20
21	22.0	7.6	14.8	249	1.4	2.4	264	7.0	WSW	39	1.7	0.0	7682	21
22	22.0	10.2	16.1	277	.5	1.8	308	7.0	WSW	43	3.0	.2	6663	22
23	23.8	7.5	15.6	096	.6	2.2	116	7.0	WSW	39	1.8	0.0	7405	23
24	17.9	11.5	14.7	242	4.3	4.4	232	10.2	WSW	49	3.5	0.0	5938	24
25	12.4	9.1	10.8	242	2.7	2.9	246	6.3	WSW	48	.3	11.2	2098	25
26	15.6	8.1	11.9	236	2.1	2.6	246	8.3	WSW	49	1.5	5.4	5843	26
27	10.5	7.5	9.0	235	1.8	2.2	246	10.2	SW	50	-.9	17.2	1763	27
28	12.9	6.0	9.5	233	.7	1.6	217	5.7	SW	51	.5	23.0	4110	28
29	13.8	5.2	9.5	059	1.1	1.7	088	5.7	ENE	51	-1.1	.2	3673	29
30	*****	*****	*****	070	2.3	2.5	337	6.3	ENE	50	.7	.6	7253	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	23.9	4.5	11.9	240	1.3	2.6	263	10.2	WSW	47	.5	107.6	162765	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



WATANA WEATHER STATION

DATA START: 01 JULY , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

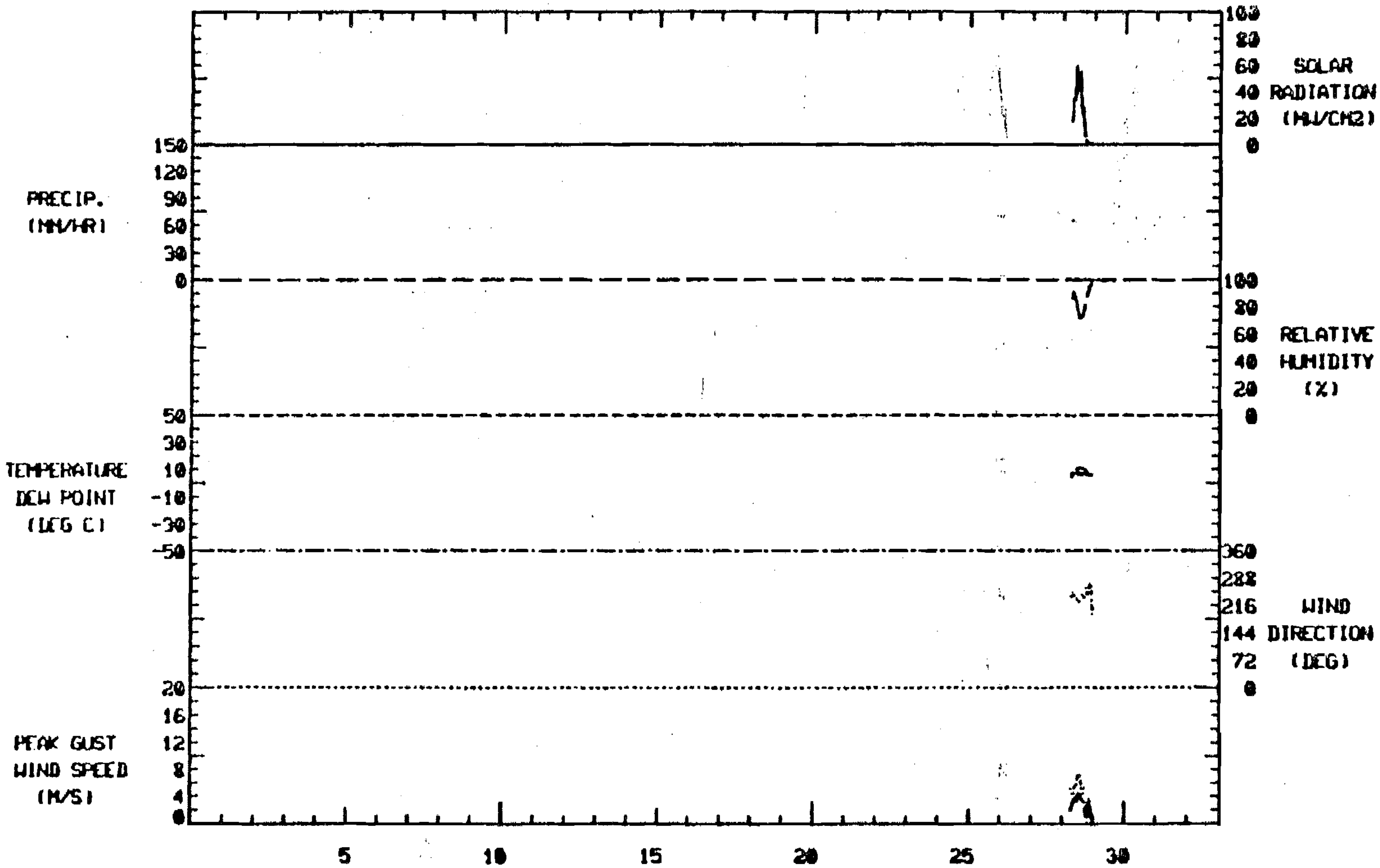
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	11.6	5.1	8.4	241	2.7	2.8	228	7.0	WSW	84	6.2	0.0	5068	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	11.6	5.1	8.4	241	2.7	2.8	228	7.0	WSW	84	6.2	0.0	5068	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 4.4
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 3.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 01 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	2.6	-4.5	-1.0	***	****	3.0	356	8.3	N	62	-7.5	0.0	4654	03
04	8.7	-3.9	2.4	073	2.4	2.6	080	7.6	ENE	63	-3.2	0.0	5670	04
05	12.4	-3.2	4.6	065	2.5	2.9	042	6.3	E	66	-1.3	0.0	4615	05
06	11.7	-.5	5.6	087	.7	2.4	054	6.3	NE	67	.2	0.0	4017	06
07	11.1	-1.8	4.7	072	3.1	3.5	109	9.5	E	72	.8	0.0	4290	07
08	12.7	4.4	8.6	073	3.8	4.2	089	11.4	E	68	2.7	0.0	3993	08
09	11.0	2.2	6.6	084	1.2	1.8	088	7.0	E	89	3.7	4.0	2583	09
10	10.6	-.2	5.2	351	.8	1.3	308	4.4	N	73	.7	0.0	3783	10
11	12.9	-3.5	4.7	073	1.1	1.9	134	5.7	ESE	70	-.4	0.0	4630	11
12	7.2	-2.1	2.6	065	3.8	4.0	080	10.8	ENE	79	-.1	7.6	1795	12
13	5.6	1.7	3.7	058	2.5	2.6	044	7.6	ENE	91	2.1	9.8	1458	13
14	7.7	4.2	5.9	063	2.3	2.6	073	8.9	E	78	-2.4	20.4	833	14
15	9.3	6.3	7.8	059	.4	1.4	088	3.8	E	47	-4.7	35.2	695	15
16	12.1	1.7	6.9	074	.9	1.9	110	4.4	N	70	-3.9	0.0	3630	16
17	11.3	-2.3	4.5	067	1.9	2.2	082	7.0	ENE	73	-.3	0.0	3960	17
18	9.7	-.1	4.8	050	1.3	1.9	052	5.7	ENE	67	-1.5	.2	2872	18
19	11.0	-.8	5.1	342	.8	2.1	302	8.3	NNW	67	-.7	0.0	3588	19
20	8.5	-.5	4.0	066	2.2	2.5	059	6.3	ENE	69	-.8	0.0	2085	20
21	*****	*****	*****	***	****	2.3	069	3.8	ENE	72	*****	.4	240	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
MONTH	12.9	-4.5	4.8	065	1.8	2.5	089	11.4	ENE	71	-.9	77.6	59388	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS	8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL	9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL	10.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS	10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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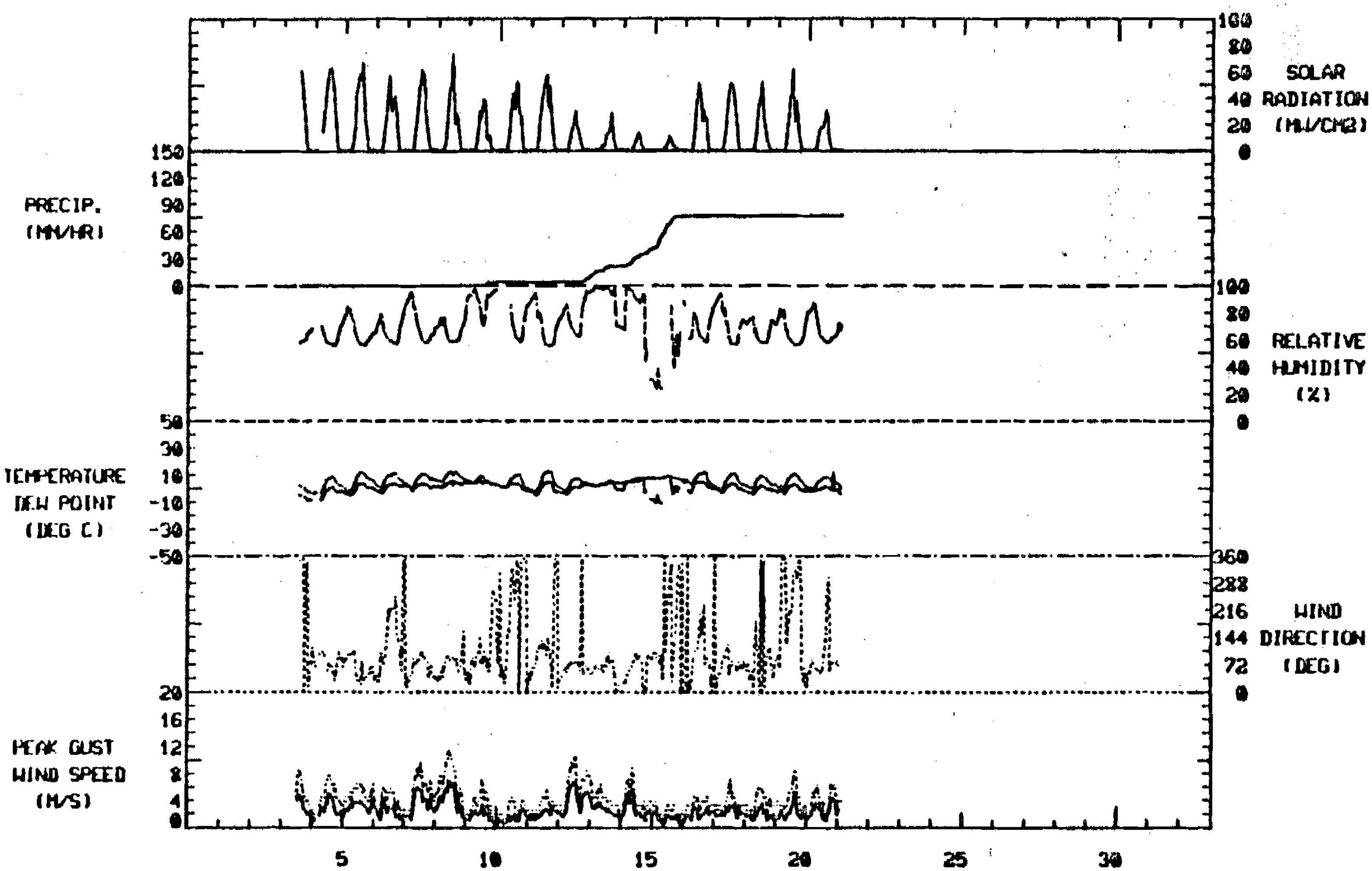
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01 SEPTEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

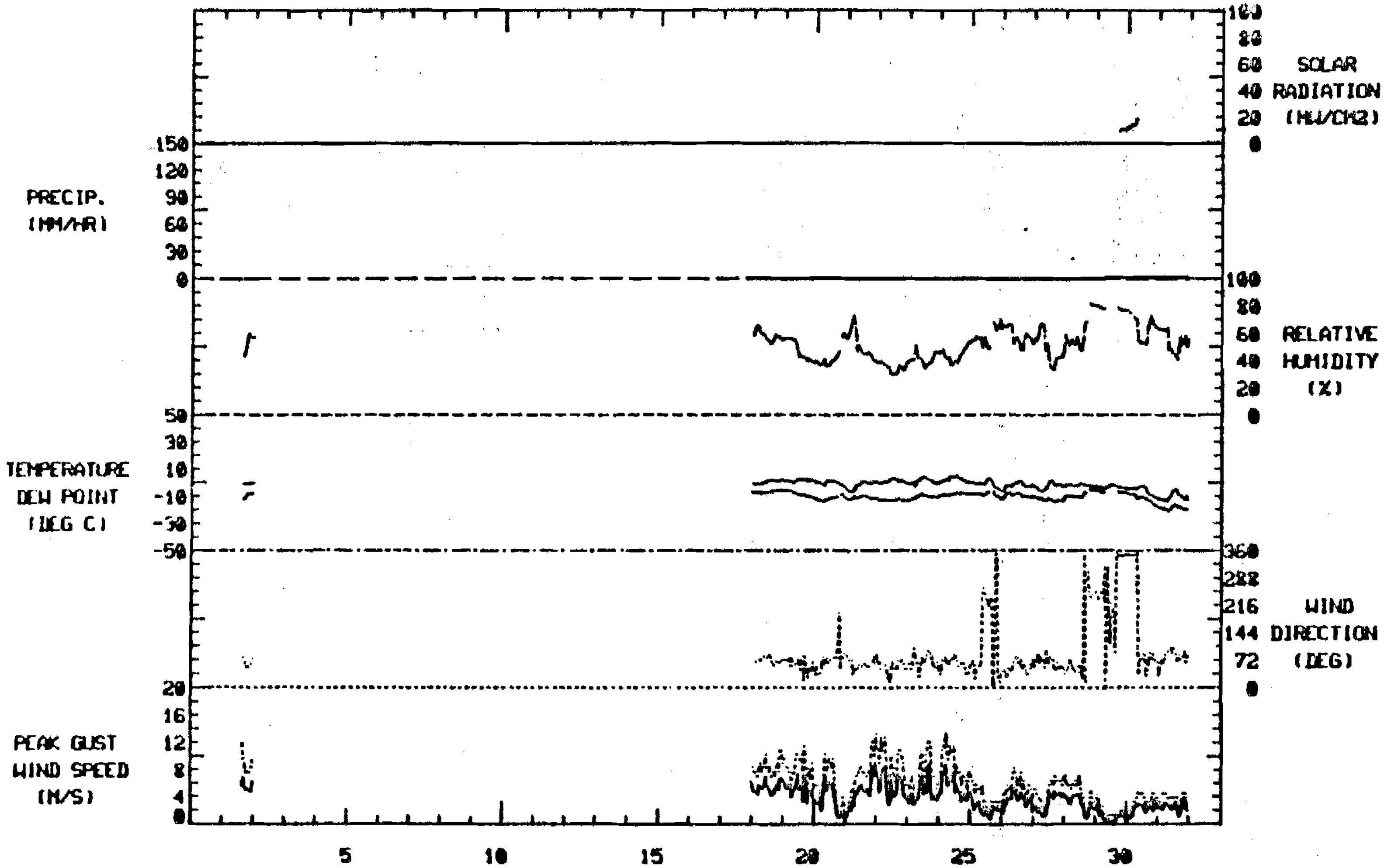
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	-.1	-1.5	-.8	***	****	5.4	080	12.1	ENE	54	-8.7	0.0	***	17
18	2.3	-1.4	.5	070	5.3	5.3	071	10.8	ENE	58	-6.8	0.0	***	18
19	2.9	.2	1.5	064	5.0	5.2	075	11.4	ENE	47	-8.9	0.0	***	19
20	2.0	-3.3	-.7	064	3.4	3.6	073	10.2	ENE	42	-12.2	0.0	***	20
21	1.1	-8.4	-3.7	060	4.2	4.3	070	12.1	ENE	50	-10.9	0.0	***	21
22	3.9	-1.3	1.3	059	5.5	5.8	081	13.3	ENE	35	-13.0	0.0	***	22
23	4.7	-3.2	.8	070	4.4	4.7	101	12.1	ENE	41	-10.6	0.0	***	23
24	5.1	-.4	2.4	063	5.3	5.5	085	13.3	ENE	44	-8.6	0.0	***	24
25	3.6	-6.5	-1.5	037	1.1	2.2	060	7.6	ENE	58	-9.3	0.0	***	25
26	1.7	-7.6	-3.0	055	3.4	3.5	074	8.3	NE	58	-9.3	0.0	***	26
27	2.0	-7.3	-2.7	061	3.0	3.1	059	7.0	ENE	49	-12.3	0.0	***	27
28	-.8	-3.3	-2.1	039	1.9	3.0	040	7.0	NE	61	-8.3	.2	***	28
29	-1.1	-4.4	-2.8	284	.5	1.0	236	4.4	NNW	78	-7.2	1.4	2606	29
30	-2.0	-11.7	-6.9	048	1.6	2.1	024	4.4	NNW	63	-12.4	0.0	3585	30
31	-4.5	-14.5	-9.5	079	2.3	2.4	043	4.4	E	54	-18.4	0.0	***	31
MONTH	5.1	-14.5	-1.8	061	3.3	3.8	081	13.3	ENE	53	-10.5	1.6	6191	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.9

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-3.6	-15.0	-9.3	069	3.6	3.8	065	8.3	ENE	47	-17.6	0.0	***	01
02	-4.6	-11.1	-7.9	034	2.0	2.3	061	6.3	NE	53	-15.5	0.0	***	02
03	-.8	-8.1	-4.4	062	3.2	3.4	066	8.9	ENE	65	-9.5	0.0	***	03
04	1.7	-3.9	-1.1	061	4.9	5.0	066	9.5	ENE	64	-7.2	0.0	***	04
05	.7	-7.1	-3.2	039	1.3	1.6	052	5.7	NE	76	-5.8	1.4	***	05
06	-2.4	-7.6	-5.0	053	.6	.8	076	1.9	ENE	77	-9.0	0.0	***	06
07	-2.9	-9.6	-6.3	064	1.7	1.9	107	5.7	E	55	-13.1	0.0	***	07
08	-6.0	-16.7	-11.4	077	1.5	1.9	115	5.1	ENE	43	-20.9	0.0	***	08
09	-9.3	-17.9	-13.6	059	3.7	3.9	069	10.2	ENE	45	-22.6	0.0	***	09
10	-8.5	-13.7	-11.1	045	5.2	5.2	054	8.3	NE	49	-19.4	0.0	***	10
11	-5.5	-13.9	-9.7	049	4.4	4.5	055	7.6	NE	42	-18.5	0.0	***	11
12	-4.8	-14.9	-9.9	059	5.4	5.6	069	12.7	ENE	47	-16.5	0.0	***	12
13	-2.7	-10.7	-6.7	064	2.9	3.1	058	9.5	ENE	58	-12.7	0.0	***	13
14	-3.1	-12.9	-8.0	060	2.7	2.8	052	7.0	ENE	62	-14.4	0.0	***	14
15	-3.2	-9.9	-6.6	066	3.4	3.6	077	7.6	E	58	-13.5	0.0	***	15
16	-1.8	-10.5	-6.1	073	2.6	2.8	068	8.3	ENE	61	-12.2	0.0	***	16
17	-4.3	-8.8	-6.6	060	1.7	1.9	053	6.3	E	66	-11.5	.2	***	17
18	-2.5	-10.2	-6.4	057	3.9	4.1	076	10.2	NE	52	-14.2	0.0	***	18
19	-.9	-6.8	-3.8	050	4.1	4.3	071	8.9	NE	54	-12.1	0.0	***	19
20	-2.2	-9.9	-6.1	063	1.8	2.0	055	7.0	ENE	56	-13.9	0.0	***	20
21	-6.1	-11.3	-8.7	057	2.0	2.2	040	6.3	E	64	-14.5	0.0	***	21
22	-1.9	-7.1	-4.5	050	3.9	4.1	071	9.5	NE	53	-12.8	0.0	***	22
23	-2.9	-7.5	-5.2	048	3.5	3.6	073	9.5	NE	58	-12.7	0.0	***	23
24	.9	-6.5	-2.8	053	4.1	4.5	052	9.5	ENE	49	-11.8	0.0	***	24
25	-.7	-4.2	-2.4	062	4.6	4.7	063	8.9	ENE	60	-9.5	0.0	***	25
26	-2.2	-5.2	-3.7	060	2.8	3.2	073	8.3	NE	63	-9.9	0.0	***	26
27	-3.5	-7.5	-5.5	042	1.9	2.1	020	5.7	NE	64	-11.7	.4	***	27
28	-6.7	-13.8	-10.3	074	1.7	1.9	048	5.7	E	49	-17.6	0.0	***	28
29	-10.4	-21.1	-15.8	023	1.7	2.1	346	4.4	ENE	46	-24.9	0.0	***	29
30	-8.0	-19.7	-13.9	070	3.5	3.5	076	8.9	ENE	35	-25.6	0.0	***	30
MONTH	1.7	-21.1	-7.2	057	3.0	3.2	069	12.7	ENE	56	-14.4	2.0	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.0
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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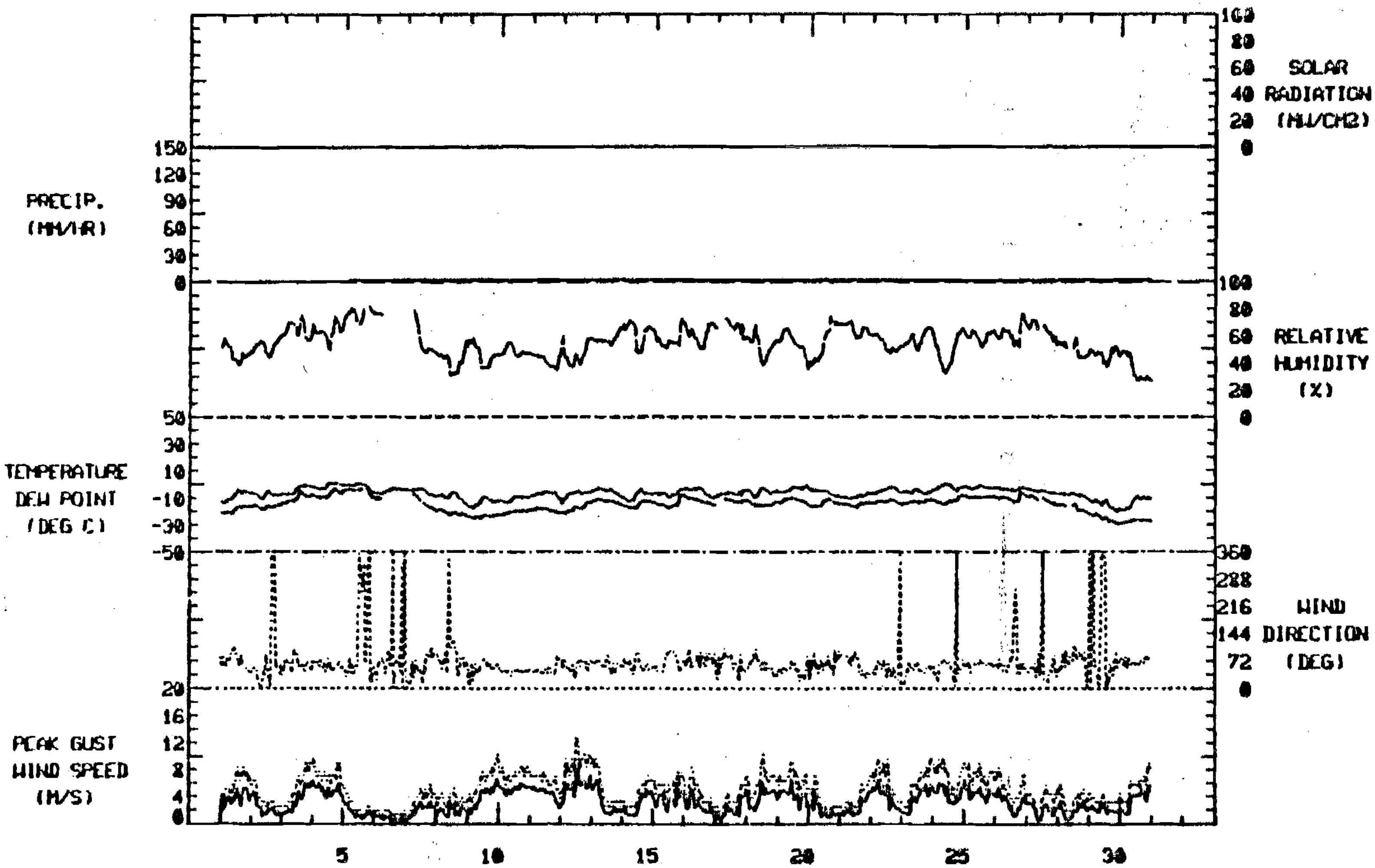
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01 NOVEMBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-9.0	-19.4	-14.2	069	2.8	2.9	081	9.5	ENE	40	-26.4	0.0	***	01
02	-15.8	-20.6	-18.2	061	1.7	1.8	085	3.8	ENE	48	-26.4	0.0	***	02
03	-12.4	-19.1	-15.8	073	1.7	1.7	088	5.7	ENE	48	-25.4	0.0	***	03
04	-14.1	-20.3	-17.2	063	1.7	1.8	058	4.4	ENE	51	-26.1	0.0	***	04
05	-15.2	-20.5	-17.9	072	1.8	1.9	043	3.8	ENE	55	-25.0	0.0	***	05
06	-13.4	-22.3	-17.8	081	3.2	3.3	079	8.9	E	42	-27.9	0.0	***	06
07	-16.6	-23.5	-20.0	071	3.0	3.2	077	8.3	ENE	39	-30.6	0.0	***	07
08	-15.6	-23.4	-19.5	076	3.4	3.6	077	8.3	E	27	-33.4	0.0	***	08
09	-16.1	-25.8	-21.0	063	2.9	3.1	065	7.0	ENE	29	-34.8	0.0	***	09
10	-21.5	-30.3	-25.9	087	3.5	3.5	085	7.0	E	40	-35.6	0.0	***	10
11	-23.6	-31.6	-27.6	081	3.2	3.2	067	8.3	E	39	-37.7	0.0	***	11
12	-25.7	-31.4	-28.6	068	3.9	4.0	068	8.9	ENE	37	-38.1	0.0	***	12
13	-18.5	-28.3	-23.4	072	4.1	4.3	072	10.8	ENE	42	-31.9	0.0	***	13
14	-22.0	-27.9	-25.0	317	1.5	1.9	267	3.8	NNW	34	-36.4	0.0	***	14
15	-26.4	-32.5	-29.5	344	1.9	2.0	341	4.4	NNW	30	-41.7	0.0	***	15
16	-27.6	-36.7	-32.2	065	1.9	2.1	082	7.0	ENE	29	-44.9	0.0	***	16
17	-22.3	-34.2	-28.3	077	5.8	5.9	065	11.4	ENE	23	-40.7	0.0	***	17
18	-19.4	-29.5	-24.5	076	5.7	5.8	067	12.7	ENE	21	-40.3	0.0	***	18
19	-17.8	-27.1	-22.5	065	4.3	4.5	054	10.2	ENE	22	-37.8	0.0	***	19
20	-16.6	-26.0	-21.3	069	3.7	3.9	062	8.9	E	22	-38.4	0.0	***	20
21	-19.5	-26.1	-22.8	069	2.8	2.9	080	5.7	ENE	22	-37.9	0.0	***	21
22	-12.7	-23.2	-18.0	082	2.5	2.5	094	5.7	E	21	-38.0	0.0	***	22
23	-15.1	-24.4	-19.8	078	2.6	2.7	037	5.7	ENE	22	-38.6	0.0	***	23
24	-15.6	-22.8	-19.2	085	3.3	3.4	089	8.9	ENE	21	-36.2	0.0	***	24
25	-14.8	-28.6	-21.7	095	4.0	4.1	096	8.3	E	24	-37.8	0.0	***	25
26	-20.0	-29.4	-24.7	085	3.6	3.7	073	7.6	E	25	-39.0	0.0	***	26
27	-18.6	-26.7	-22.7	068	5.5	5.6	065	11.4	ENE	22	-38.7	0.0	***	27
28	-21.7	-28.7	-25.2	061	3.7	3.9	064	10.2	ENE	24	-40.6	0.0	***	28
29	-13.6	-27.0	-20.3	080	5.5	5.8	064	12.1	E	27	-33.1	0.0	***	29
30	-4.2	-16.4	-10.3	066	2.8	3.0	060	9.5	E	40	-22.1	.2	***	30
31	3.8	-4.8	-.5	076	5.6	5.8	078	14.0	ENE	39	-11.6	0.0	***	31
MONTH	3.8	-36.7	-21.1	072	3.2	3.5	078	14.0	ENE	32	-34.0	.2	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 13.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 13.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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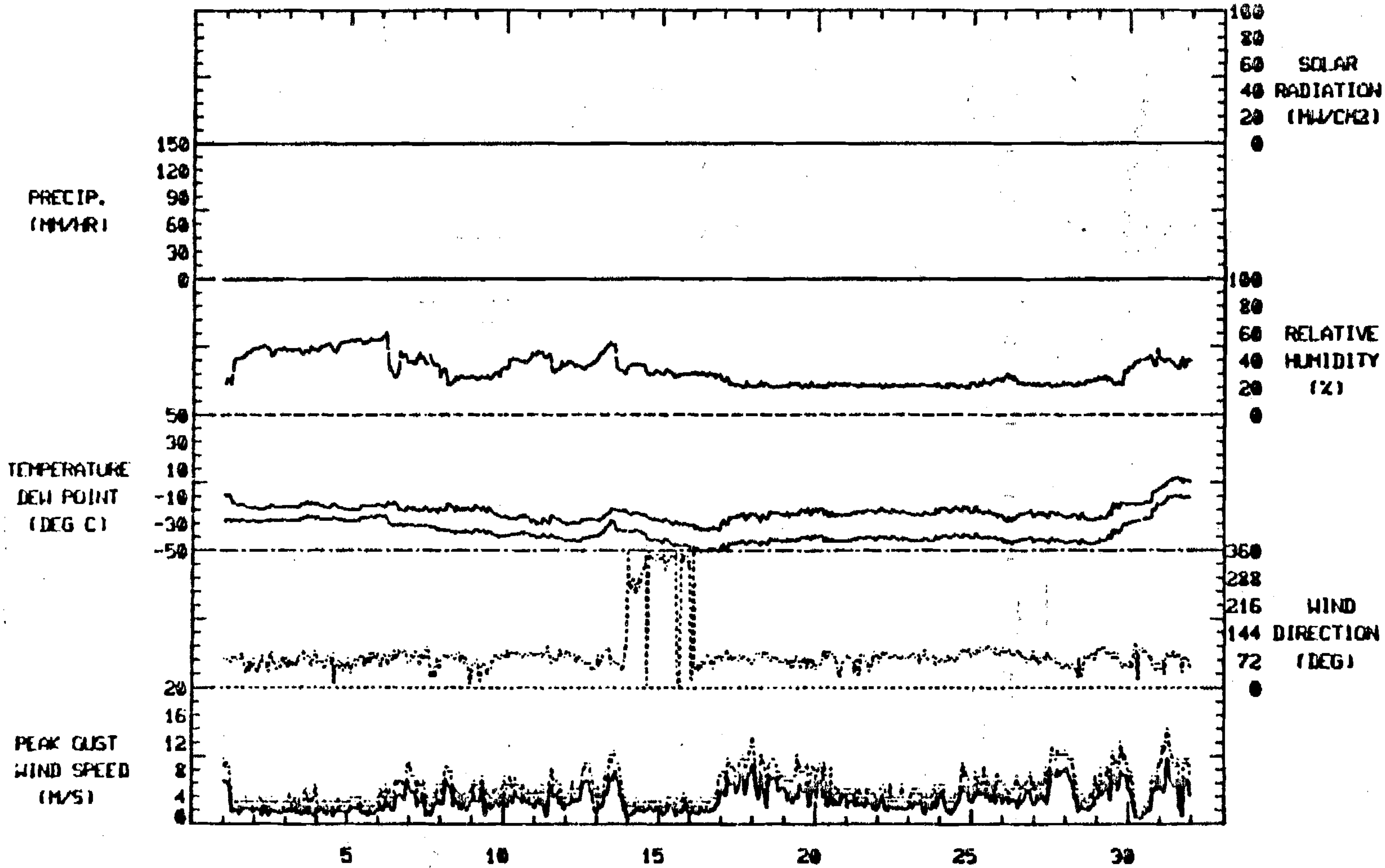
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01 DECEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	3.4	.4	1.9	071	5.7	5.9	085	14.6	ENE	37	-11.7	0.0	***	01
02	2.2	-11.6	-4.7	083	1.5	1.7	084	5.7	E	46	-16.6	0.0	***	02
03	-2.4	-13.3	-7.8	074	3.5	3.7	061	8.9	E	41	-18.3	0.0	***	03
04	-4.3	-9.0	-6.7	058	2.5	2.6	058	7.0	NE	49	-15.0	0.0	***	04
05	-5.8	-11.8	-8.8	074	2.2	2.4	081	5.7	E	51	-18.3	0.0	***	05
06	-3.6	-10.9	-7.3	068	7.2	7.3	077	14.6	ENE	37	-18.0	0.0	***	06
07	1.2	-4.8	-1.8	064	5.0	5.3	076	12.7	ENE	33	-16.0	0.0	***	07
08	-2.2	-9.4	-5.8	072	2.3	2.4	071	7.6	ENE	45	-15.9	0.0	***	08
09	-1.5	-6.7	-4.1	059	5.2	5.3	077	12.1	ENE	30	-19.1	0.0	***	09
10	-1.8	-9.2	-5.5	059	4.0	4.1	073	11.4	ENE	45	-14.8	.2	***	10
11	-1.1	-5.1	-3.1	062	4.8	4.9	075	10.8	ENE	47	-13.3	0.0	***	11
12	-1.9	-9.2	-5.6	053	2.0	2.1	071	7.6	ENE	48	-14.0	0.0	***	12
13	-1.2	-9.9	-5.6	049	3.8	4.2	099	12.7	ENE	33	-18.3	0.0	***	13
14	3.4	-3.5	-.0	061	5.3	5.6	075	14.0	ENE	46	-10.8	0.0	***	14
15	3.5	-.9	1.3	079	3.2	4.1	081	12.7	ENE	50	-7.6	.2	***	15
16	.1	-5.7	-2.8	050	2.9	3.2	071	12.1	ENE	44	-13.6	0.0	***	16
17	.9	-2.4	-.8	060	4.2	4.4	062	12.7	ENE	35	-15.1	0.0	***	17
18	.9	-3.6	-1.3	068	4.8	5.0	074	14.0	ENE	35	-14.3	0.0	***	18
19	1.3	-6.5	-2.6	109	.4	3.9	242	13.3	ENE	40	-15.3	.8	***	19
20	-5.8	-13.6	-9.7	062	4.3	4.4	075	8.9	ENE	38	-20.3	0.0	***	20
21	-4.8	-12.6	-8.7	057	5.0	5.1	078	9.5	NE	35	-20.1	0.0	***	21
22	-1.1	-5.3	-3.2	052	4.9	5.0	083	9.5	NE	34	-16.7	0.0	***	22
23	1.4	-5.1	-1.9	061	4.5	4.8	083	11.4	NE	39	-13.8	0.0	***	23
24	-.1	-5.0	-2.6	048	3.5	4.0	055	10.2	ENE	30	-18.3	0.0	***	24
25	1.6	-3.9	-1.2	067	4.6	5.0	090	12.1	ENE	23	-19.2	0.0	***	25
26	-4.2	-8.3	-6.3	342	.6	1.4	088	3.8	WSW	51	-14.5	.2	***	26
27	-6.2	-14.4	-10.3	062	1.0	1.2	059	3.2	ENE	51	-18.6	0.0	***	27
28	-11.3	-17.7	-14.5	065	4.5	4.6	065	14.6	ENE	43	-23.7	0.0	***	28
29	-2.2	-12.3	-7.3	058	6.2	6.4	070	13.3	NE	38	-19.7	0.0	***	29
30	1.7	-3.2	-.7	068	5.7	5.8	075	12.1	ENE	26	-18.3	0.0	***	30
31	-.1	-4.2	-2.2	053	2.8	2.9	045	7.6	ENE	38	-14.7	.2	***	31
MONTH	3.5	-17.7	-4.5	062	3.8	4.2	085	14.6	ENE	40	-16.3	1.6	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 13.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.1
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.7

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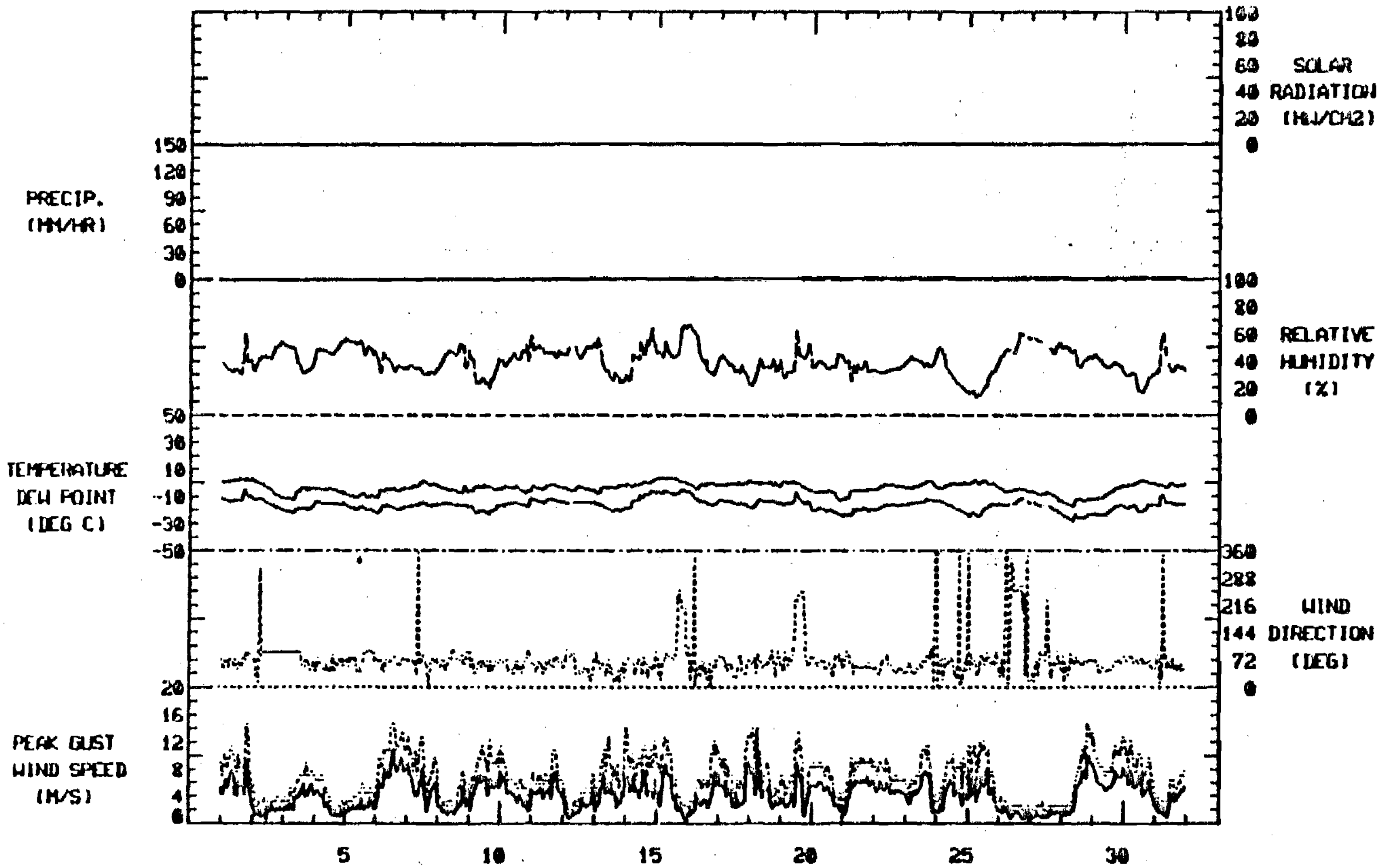
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

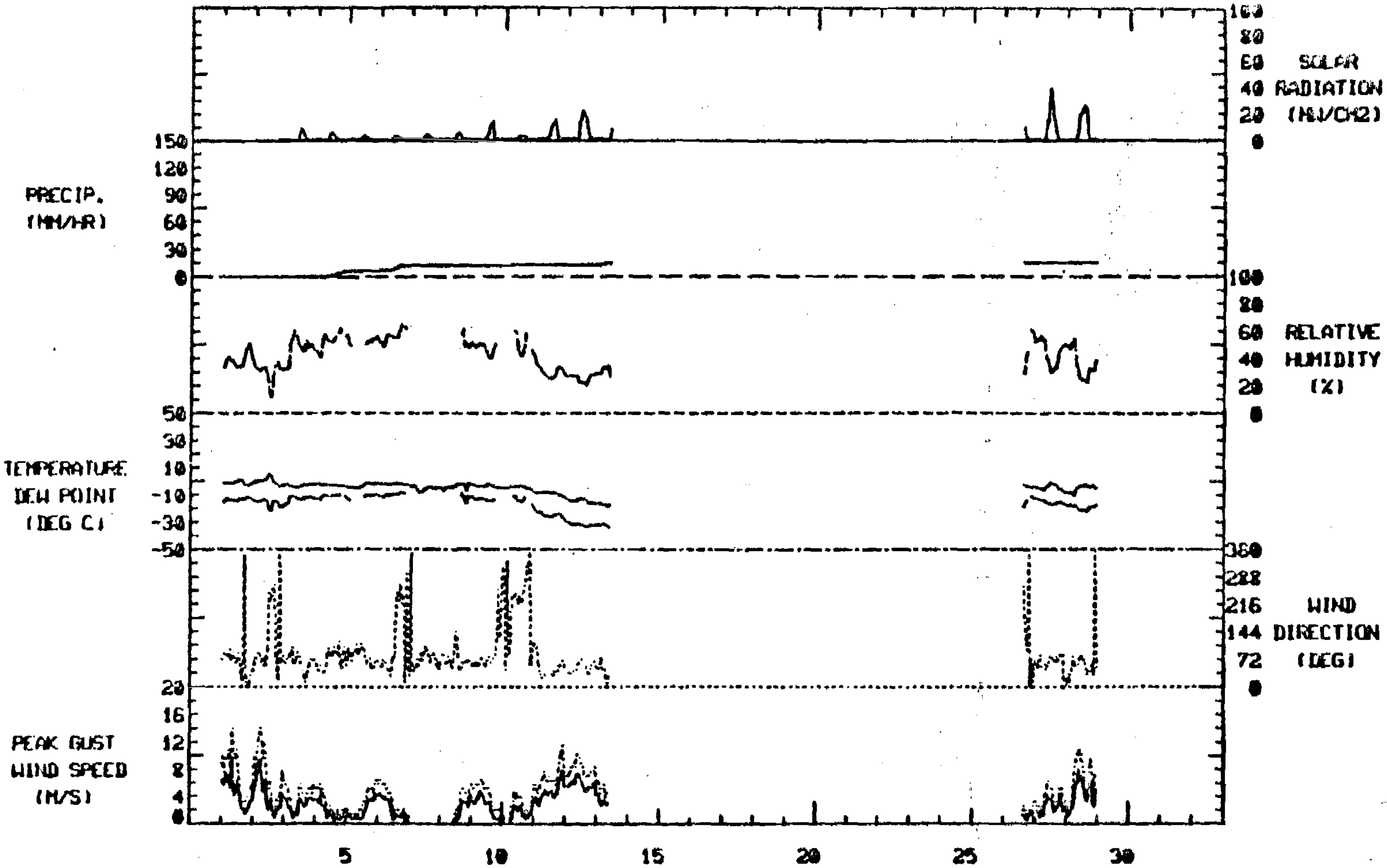
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	1.5	-4.8	-1.7	068	4.2	4.7	092	14.0	E	40	-13.5	0.0	***	01
02	6.8	-4.7	1.1	072	3.1	4.4	067	14.0	ENE	30	-15.4	0.0	277	02
03	-2.0	-5.0	-3.5	062	2.6	2.7	057	5.7	ENE	48	-12.3	.2	543	03
04	-1.9	-4.4	-3.2	060	1.6	1.7	057	5.7	NE	53	-11.2	5.8	430	04
05	-1.6	-5.8	-3.7	070	1.7	1.8	068	6.3	E	53	-10.7	.8	353	05
06	-1.0	-3.6	-2.3	055	1.5	2.1	065	6.3	ENE	56	-10.2	5.0	348	06
07	-3.3	-8.2	-5.8	066	0.0	0.0	054	0.0	E	**	*****	0.0	380	07
08	-1.6	-5.2	-3.4	063	1.2	1.2	062	5.1	ENE	52	-10.9	0.0	428	08
09	-1.9	-4.8	-3.4	064	2.3	2.6	065	6.3	ENE	49	-13.4	0.0	785	09
10	-3.3	-8.5	-5.9	230	.6	1.2	234	4.4	SW	49	-14.8	1.4	385	10
11	-7.6	-12.9	-10.3	049	4.2	4.5	067	11.4	NE	30	-24.3	0.0	1033	11
12	-12.3	-17.0	-14.6	052	5.7	5.9	064	10.2	NE	26	-30.2	0.0	1611	12
13	*****	*****	*****	***	****	3.3	061	7.0	NE	32	-30.6	2.0	555	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	-2.6	-11.6	-7.1	***	****	1.1	067	3.2	E	50	-14.3	0.0	638	26
27	-.9	-8.7	-4.8	065	2.3	2.4	083	6.3	ENE	45	-15.6	0.0	1893	27
28	-2.5	-10.2	-6.4	055	4.1	4.3	074	10.8	ENE	35	-18.6	0.0	1795	28
MONTH	6.8	-17.0	-5.0	060	2.4	2.8	092	14.0	ENE	43	-16.4	15.2	11452	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 10.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 9.5

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 01 FEBRUARY, 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING MARCH , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	1.1	-4.3	-1.6	073	5.8	5.9	069	13.4	ENE	31	-16.5	0.0	1713	01
02	-1.4	-10.8	-6.1	237	1.6	2.8	242	8.3	WSW	52	-12.5	.2	1398	02
03	-2.8	-15.8	-9.3	071	1.1	1.4	083	4.4	E	41	-22.7	0.0	2075	03
04	-6.7	-16.4	-11.6	058	3.6	3.7	073	9.5	ENE	34	-23.6	0.0	2685	04
05	-2.8	-8.0	-5.4	060	5.3	5.4	070	10.8	ENE	22	-24.0	0.0	1945	05
06	-2.3	-13.0	-7.7	036	1.6	2.0	044	5.1	N	25	-25.4	10.0	2563	06
07	-1.6	-15.9	-8.8	061	3.0	3.1	077	13.6	ENE	31	-24.6	3.0	1721	07
08	-2.4	-12.6	-7.5	***	****	3.6	068	7.0	NNE	21	-23.3	2.0	524	08
09	.6	-7.2	-3.3	063	4.5	4.6	079	10.8	ENE	28	-18.7	1.0	2168	09
10	0.0	-7.4	-3.7	055	4.5	4.6	073	8.9	ENE	38	-17.4	0.0	1821	10
11	3.8	-5.1	-.7	072	5.7	6.0	070	15.2	ENE	37	-14.3	0.0	1563	11
12	1.2	-4.8	-1.8	071	5.3	5.4	074	11.4	ENE	29	-17.6	0.0	2415	12
13	.5	-7.3	-3.4	053	4.3	4.7	070	14.0	NE	24	-21.7	0.0	2208	13
14	.1	-7.5	-3.7	055	3.6	4.0	070	10.8	ENE	24	-20.6	0.0	2033	14
15	3.4	-13.1	-4.9	024	1.4	1.8	342	4.4	N	28	-23.7	0.0	3368	15
16	-1.1	-4.2	-2.7	054	3.5	3.6	066	10.2	NE	25	-23.6	0.0	2857	16
17	2.8	-4.1	-.7	059	4.8	5.1	072	12.1	NE	16	-23.3	0.0	2290	17
18	7.4	-1.0	3.2	070	5.0	5.4	079	13.3	ENE	12	-24.1	0.0	2753	18
19	4.1	-7.5	-1.7	291	.9	1.8	212	4.4	WSW	31	-16.4	.6	2380	19
20	1.8	-9.5	-3.8	068	2.8	3.1	068	7.6	E	27	-21.6	0.0	3930	20
21	.2	-12.4	-6.1	068	3.1	3.5	077	7.6	E	21	-25.9	0.0	3798	21
22	-2.0	-11.8	-6.9	057	4.0	4.3	068	8.3	ENE	20	-25.4	0.0	3945	22
23	-.3	-6.9	-3.6	061	4.8	4.8	077	9.5	ENE	30	-19.0	0.0	3418	23
24	1.4	-9.0	-3.8	027	2.1	2.3	061	5.7	N	31	-18.9	0.0	3775	24
25	1.6	-10.7	-4.6	065	3.7	3.8	080	8.9	ENE	30	-19.5	0.0	4345	25
26	.8	-4.3	-1.8	050	3.1	3.4	053	7.6	NE	33	-15.8	0.0	1978	26
27	5.0	-6.7	-.8	257	.7	1.7	249	4.4	WSW	45	-13.0	1.2	2778	27
28	2.2	-10.1	-4.0	034	1.3	1.6	009	3.8	NNE	32	-20.4	0.0	3700	28
29	1.1	-11.2	-5.1	042	2.1	2.4	091	7.0	NE	26	-23.9	0.0	4528	29
30	2.0	-11.2	-4.6	014	1.1	1.5	054	3.2	N	26	-23.0	0.0	4795	30
31	-1.1	-11.8	-6.4	013	1.7	2.1	040	5.1	NNW	28	-22.6	.4	3718	31
MONTH	7.4	-16.4	-4.3	058	2.9	3.5	070	15.2	ENE	29	-20.7	18.4	85181	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 13.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 14.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 12.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 12.1

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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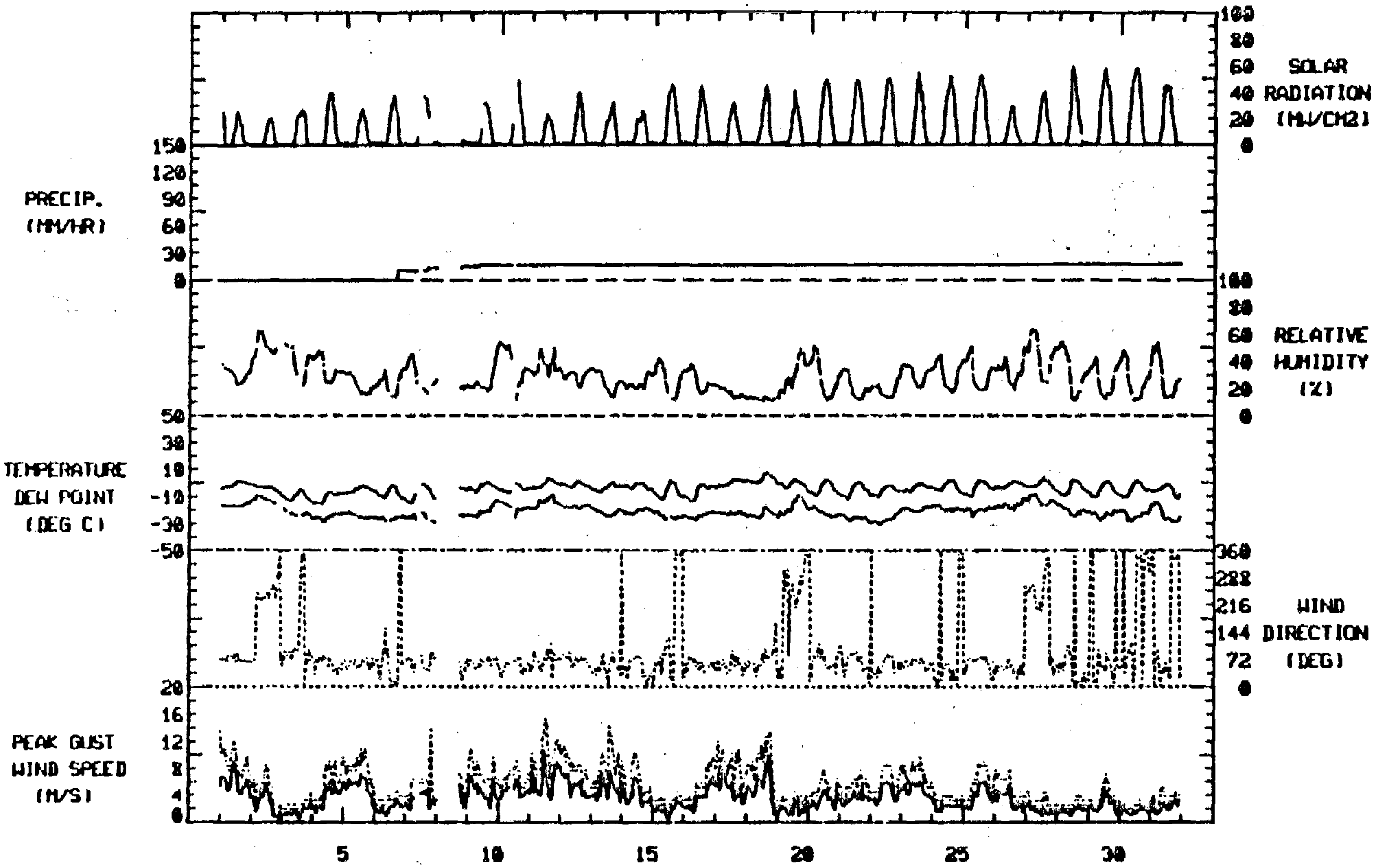
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 01 MARCH , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING APRIL , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-2.0	-9.1	-5.6	024	1.3	1.6	056	6.3	N	41	-16.7	.6	2378	01
02	-1.7	-11.1	-6.4	276	2.3	3.0	248	7.6	W	36	-20.2	0.0	3553	02
03	-3.1	-14.7	-8.9	011	2.0	2.2	010	5.1	N	25	-27.0	0.0	4883	03
04	1.7	-15.9	-7.1	337	1.3	2.0	287	5.1	NNW	23	-29.0	0.0	5168	04
05	.1	-16.1	-8.0	013	1.4	1.7	088	3.8	N	21	-28.2	0.0	4510	05
06	.9	-14.7	-6.9	016	1.2	1.6	326	3.8	NNW	22	-27.6	0.0	4578	06
07	2.3	-13.4	-5.6	022	.9	1.4	257	3.8	NNE	22	-26.0	0.0	5010	07
08	-1.2	-14.1	-7.7	264	1.6	2.6	244	8.9	WSW	21	-25.8	0.0	4845	08
09	-3.3	-12.0	-7.7	071	3.0	3.9	078	9.5	ENE	19	-26.9	0.0	5643	09
10	-3.9	-15.4	-9.6	047	3.4	3.6	045	8.3	NE	16	-30.5	0.0	5780	10
11	-.5	-15.3	-7.9	051	3.2	3.4	051	7.6	NE	17	-28.6	0.0	5925	11
12	-.2	-14.2	-7.2	045	2.8	3.1	080	8.3	NNE	17	-27.8	0.0	5880	12
13	-2.3	-15.1	-8.7	050	3.2	3.4	087	8.9	NE	17	-29.2	0.0	6060	13
14	-4.5	-16.8	-10.6	055	4.1	4.3	067	9.5	ENE	17	-30.6	0.0	5743	14
15	-2.7	-16.3	-9.5	047	3.1	3.3	079	8.3	NE	17	-29.6	0.0	6315	15
16	-3.0	-15.4	-9.2	046	2.5	3.0	100	7.6	ENE	18	-29.4	0.0	6345	16
17	-.9	-15.6	-8.3	059	3.4	3.5	059	7.6	ENE	16	-28.7	0.0	6368	17
18	1.2	-9.9	-4.3	061	4.1	4.2	073	10.2	ENE	15	-26.4	0.0	5853	18
19	3.2	-5.6	-1.2	054	3.4	3.5	051	7.0	NE	15	-24.8	0.0	6110	19
20	6.2	-5.9	.2	052	2.5	2.9	069	8.3	ENE	19	-21.1	0.0	5760	20
21	6.0	-5.9	.1	058	2.7	3.0	077	7.6	ENE	18	-22.3	0.0	6268	21
22	7.1	-5.4	.9	017	1.9	2.2	006	5.1	NNE	16	-22.7	0.0	6178	22
23	6.8	-5.5	.7	015	1.4	1.7	023	4.4	NNE	18	-21.1	0.0	6385	23
24	6.7	-4.2	1.3	048	1.1	2.0	089	6.3	NNE	21	-21.9	0.0	5518	24
25	6.0	-4.1	.9	313	.9	1.6	240	5.7	NNW	28	-17.4	0.0	5145	25
26	6.0	-6.5	-.3	339	1.6	1.8	318	4.4	NNW	24	-20.5	0.0	6288	26
27	6.8	-6.6	.1	358	1.1	1.6	344	3.8	NNW	19	-20.8	0.0	6818	27
28	6.9	-2.9	2.0	246	1.3	2.1	242	7.6	WSW	21	-19.4	.4	5250	28
29	7.4	-2.2	2.6	270	1.2	2.1	238	7.0	WSW	23	-17.8	.2	5733	29
30	9.4	-3.3	3.0	057	2.1	2.7	078	8.3	ENE	18	-19.9	0.0	5988	30
MONTH	9.4	-16.8	-4.3	037	1.7	2.6	073	10.2	ENE	21	-24.6	1.2	166270	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS	8.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL	8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL	8.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS	8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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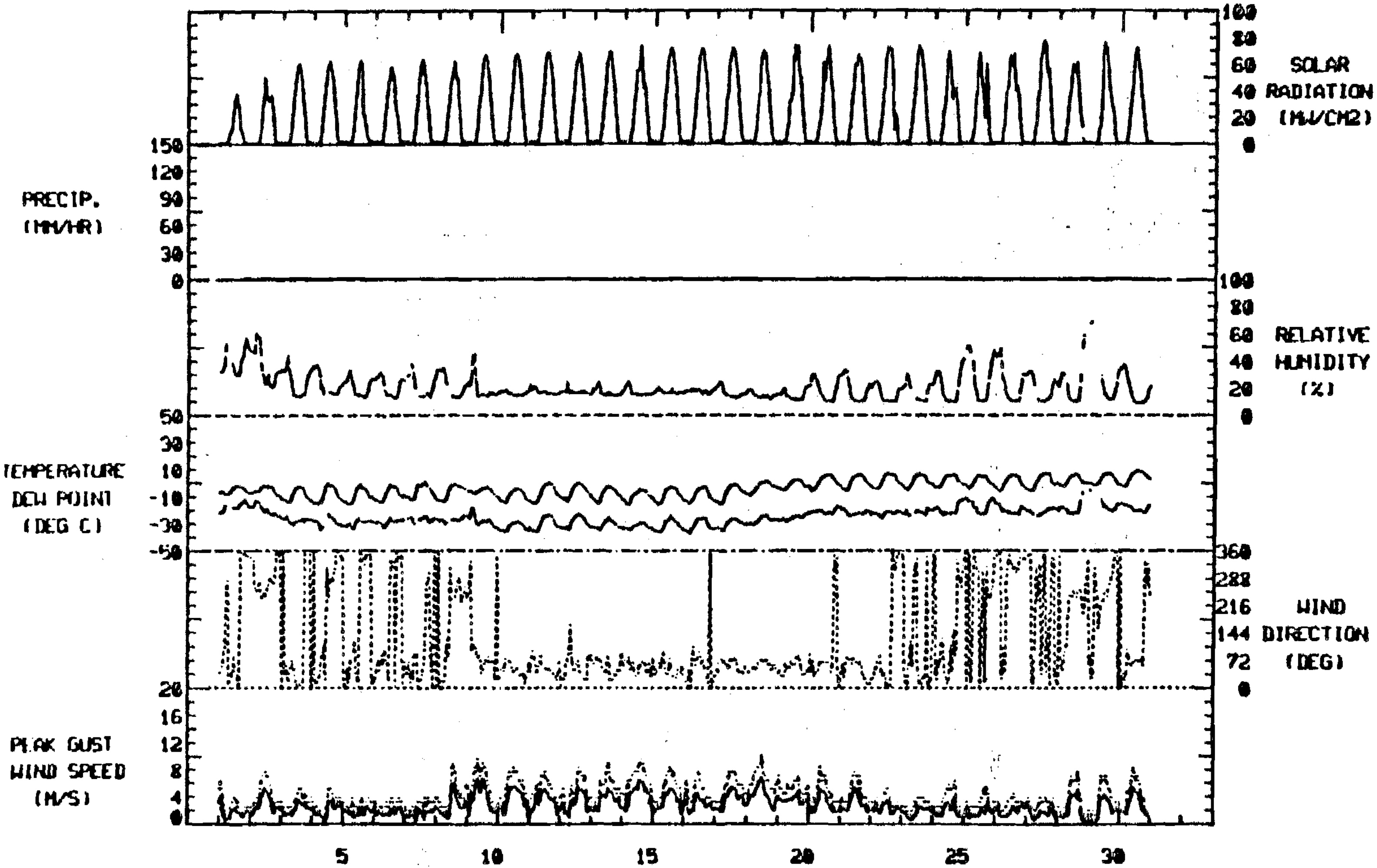
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   WATANA WEATHER STATION

DATA START: 01   APRIL   , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING MAY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	4.7	-.6	2.0	239	1.9	2.0	234	6.3	WSW	48	-8.2	3.2	3125	01
02	7.7	-2.1	2.8	272	1.5	1.9	286	8.9	WSW	17	-19.4	0.0	6838	02
03	7.8	-1.8	3.0	157	.5	1.9	238	7.0	E	29	-14.4	0.0	4095	03
04	10.2	-.1	5.1	077	4.5	4.9	112	10.2	ENE	18	-18.7	0.0	5895	04
05	9.8	-1.0	4.4	287	.8	2.1	224	7.0	WSW	20	-17.2	0.0	5110	05
06	15.3	-1.8	6.8	349	1.4	2.2	324	5.1	NNW	19	-17.8	0.0	7448	06
07	17.2	.2	8.7	028	2.7	3.2	026	8.3	NNE	15	-17.8	0.0	7483	07
08	18.2	1.8	10.0	047	2.3	3.0	074	8.9	E	12	-18.8	0.0	7635	08
09	13.2	2.7	8.0	253	2.2	2.9	249	8.9	WSW	12	-20.2	0.0	4243	09
10	8.5	3.6	6.1	254	2.6	2.7	261	6.3	W	32	-10.2	0.0	3208	10
11	11.9	.2	6.1	260	1.0	1.9	188	5.1	W	18	-20.0	0.0	5590	11
12	14.1	2.6	8.4	069	2.6	3.0	091	8.3	ENE	13	-19.4	0.0	5255	12
13	13.6	3.7	8.6	245	1.5	2.4	199	7.0	WSW	21	-15.8	1.0	5578	13
14	13.2	2.8	8.0	239	.8	2.0	222	5.7	WSW	34	-8.7	.6	4735	14
15	13.6	3.1	8.4	022	.9	2.2	025	8.9	NW	34	-7.9	6.8	4923	15
16	15.7	2.0	8.9	090	.3	2.2	063	8.9	ENE	25	-13.2	0.0	6288	16
17	15.0	2.6	8.8	245	2.9	3.0	231	9.5	WSW	26	-12.8	0.0	5220	17
18	11.0	3.7	7.4	238	.9	1.9	253	7.6	WSW	37	-8.5	3.6	5150	18
19	11.6	1.3	6.4	053	1.6	2.6	089	8.9	ENE	30	-11.3	0.0	3740	19
20	13.4	.4	6.9	102	1.1	4.0	248	12.1	E	31	-12.1	7.6	4723	20
21	9.3	0.0	4.6	254	.6	1.9	224	8.3	E	30	-14.0	0.0	6450	21
22	11.4	-2.2	4.6	206	.3	2.2	091	8.9	SW	25	-15.2	0.0	5653	22
23	14.0	2.9	8.5	058	1.2	2.3	088	10.8	ENE	23	-13.9	0.0	6663	23
24	16.6	1.4	9.0	119	.8	2.8	234	8.3	E	24	-12.8	1.2	5653	24
25	16.1	4.5	10.3	245	1.4	2.3	234	7.0	SW	22	-14.5	.2	6888	25
26	19.2	4.0	11.6	071	1.9	2.4	088	7.6	NE	17	-14.0	0.0	5993	26
27	13.6	6.9	10.3	231	2.6	3.0	229	7.6	SW	46	-1.7	.8	2605	27
28	7.6	4.1	5.9	232	2.4	2.9	229	7.6	SW	60	-1.5	6.6	2153	28
29	22.1	3.4	12.8	062	2.6	3.1	078	8.3	ENE	22	-13.3	.2	8618	29
30	19.2	8.3	13.8	239	4.6	4.7	236	10.2	SW	16	-13.7	.4	7725	30
31	12.5	6.2	9.4	237	2.2	2.5	247	7.0	WSW	46	-4.8	11.8	4040	31
MONTH	22.1	-2.2	7.6	255	.3	2.6	248	12.1	WSW	26	-13.3	44.0	168715	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 11.4
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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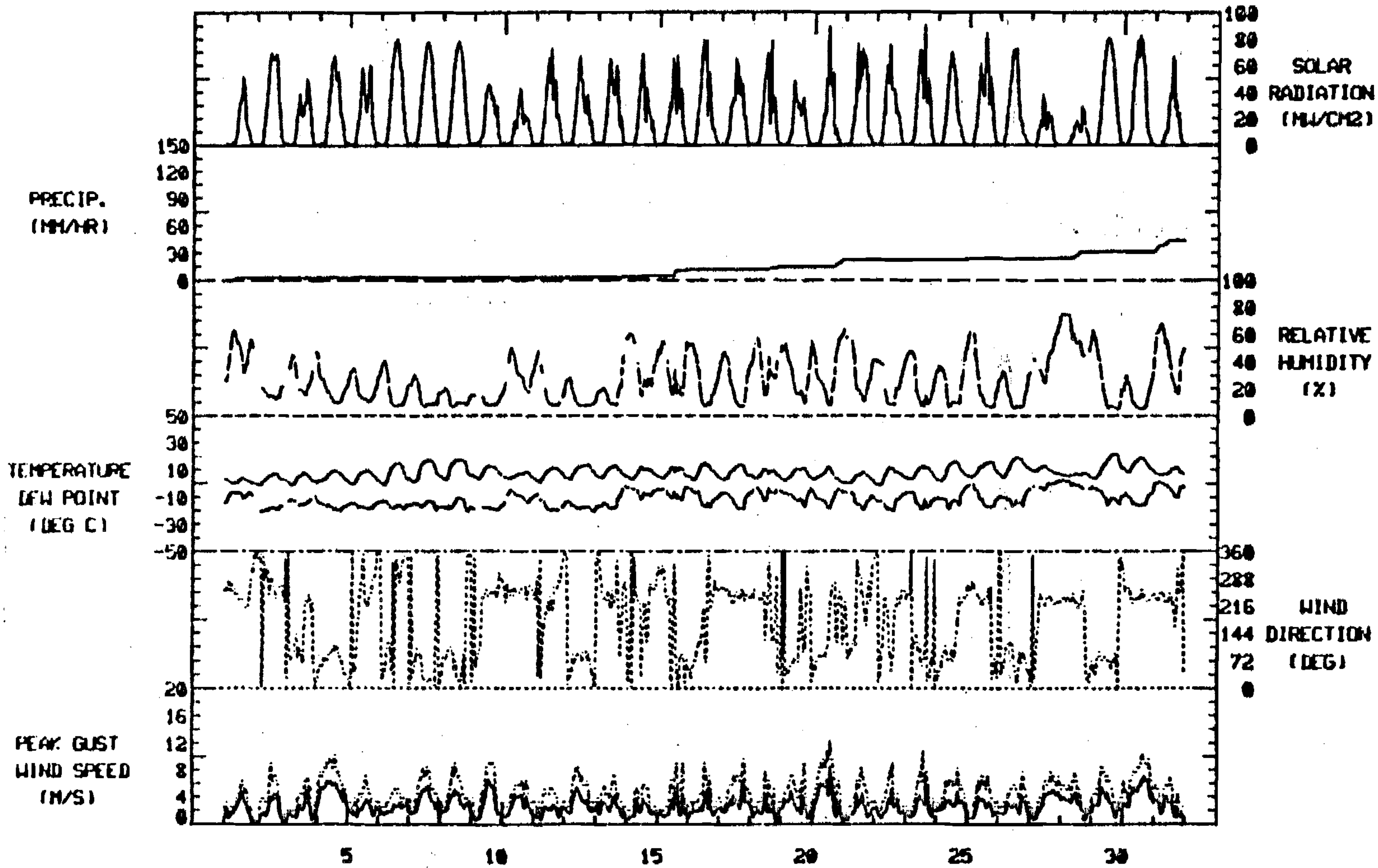
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH WATANA WEATHER STATION

DATA START: 01 MAY . 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

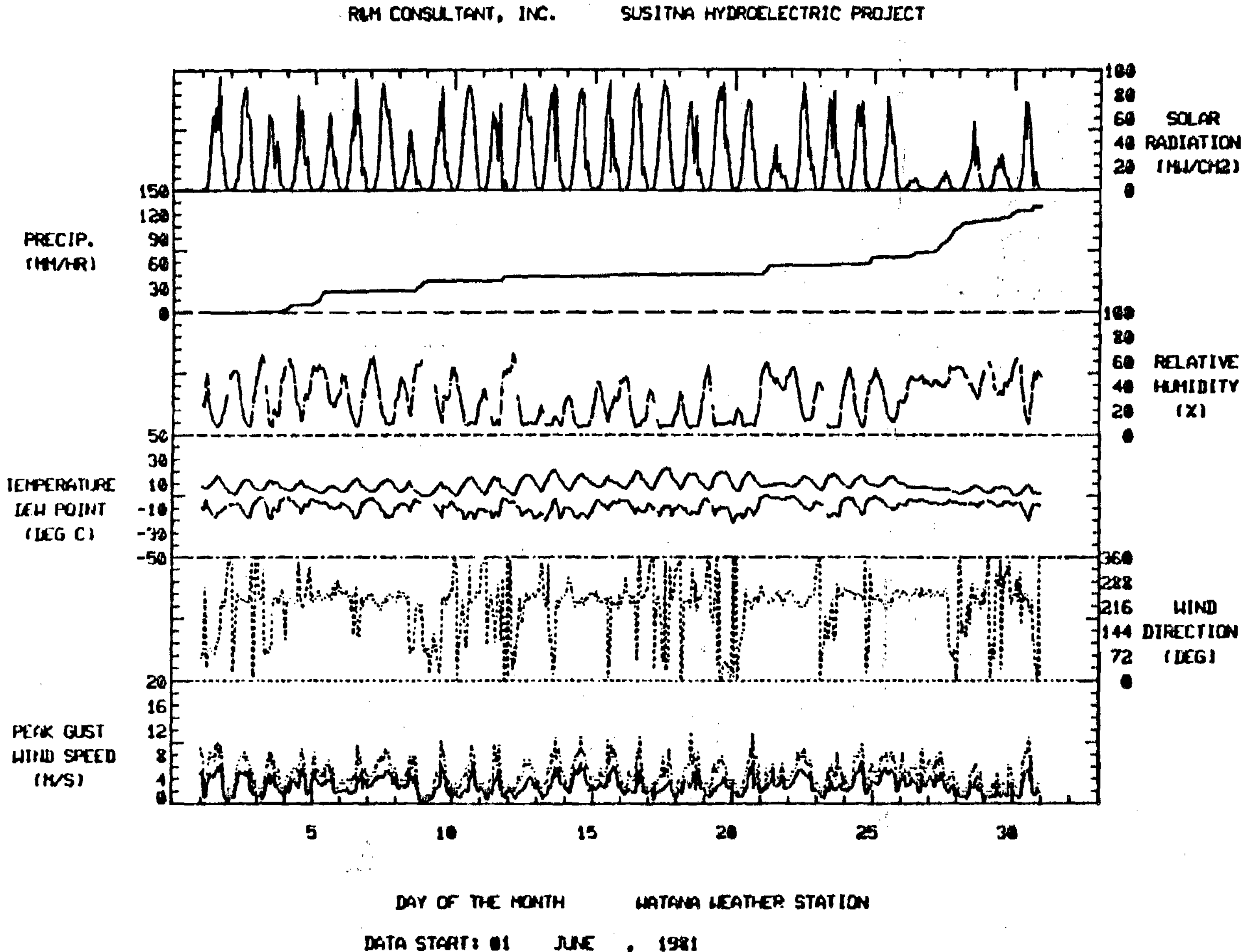
MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING JUNE , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	16.8	2.2	9.5	104	2.0	3.7	107	10.2	E	20	-12.5	0.0	7238	01
02	13.9	1.1	7.5	249	1.9	3.1	247	8.3	SW	30	-11.0	.6	7160	02
03	13.4	4.7	9.0	202	.7	2.4	107	8.3	WSW	33	-11.2	4.2	5178	03
04	12.9	4.3	8.6	240	2.5	3.0	236	8.9	SW	38	-7.0	6.8	5450	04
05	8.5	2.2	5.4	246	3.1	3.2	239	8.3	WSW	41	-7.6	13.6	4170	05
06	14.6	3.1	8.9	228	1.9	2.7	133	9.5	WSW	30	-10.0	1.0	6760	06
07	13.2	4.0	8.6	235	4.0	4.1	231	8.9	WSW	29	-12.1	0.0	8215	07
08	11.8	.1	5.9	214	1.2	2.8	086	7.6	WSW	41	-7.2	11.2	3173	08
09	11.7	0.0	5.9	234	.7	2.1	221	10.2	E	31	-10.1	.8	5605	09
10	15.4	-.1	7.6	238	1.3	2.4	220	9.5	WSW	21	-16.5	0.0	9145	10
11	16.4	1.7	9.1	274	.7	2.3	094	10.2	NNW	28	-12.9	5.2	5633	11
12	17.8	.3	9.0	243	1.4	2.4	248	7.0	WSW	22	-14.4	0.0	8698	12
13	22.3	4.1	13.2	240	1.1	2.9	223	10.8	WSW	14	-15.2	0.0	7618	13
14	18.5	4.4	11.5	238	3.5	3.7	241	10.8	SW	14	-16.6	0.0	7753	14
15	16.7	7.2	12.0	232	3.0	3.6	000	10.2	SW	30	-7.5	1.8	6260	15
16	21.2	6.2	13.7	258	1.8	2.4	282	10.8	WSW	23	-11.2	0.0	7513	16
17	22.7	5.1	13.9	326	.6	2.1	240	8.9	NNW	14	-14.4	0.0	8728	17
18	19.3	5.4	12.4	254	2.1	3.1	335	12.1	WSW	19	-13.0	.4	6476	18
19	20.2	4.2	12.2	017	1.5	2.4	341	7.6	NE	17	-15.0	0.0	8858	19
20	19.4	4.1	11.8	236	1.9	2.9	237	11.4	SW	15	-14.2	.6	6540	20
21	10.4	7.7	9.0	241	2.8	2.9	234	6.3	WSW	47	-2.2	10.6	2625	21
22	16.4	6.6	11.5	233	3.7	3.9	208	8.9	SW	30	-8.2	0.0	6775	22
23	18.7	4.0	11.4	226	.7	2.1	280	8.3	WSW	20	-13.4	1.6	6528	23
24	17.1	6.6	11.9	252	2.7	3.4	236	9.5	WSW	31	-7.3	8.4	6110	24
25	16.1	7.5	11.8	235	4.0	4.2	219	8.3	SW	28	-8.4	.2	6075	25
26	10.1	6.1	8.1	253	3.3	3.3	251	8.9	WSW	42	-5.0	6.2	953	26
27	6.5	2.5	4.5	247	1.9	3.2	247	8.3	WSW	45	-5.9	29.4	1223	27
28	8.2	1.3	4.8	246	1.2	2.0	272	6.3	SW	43	-6.9	10.8	3498	28
29	7.5	.8	4.1	299	.7	1.5	247	6.3	NNW	44	-6.6	8.8	2693	29
30	9.6	.4	5.0	241	1.6	2.6	213	10.8	WSW	40	-9.6	7.6	5178	30
MONTH	22.7	-.1	9.3	241	1.7	2.9	335	12.1	WSW	29	-10.4	129.8	177820	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 4.4
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 6.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****


R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT
SOLAR RADIATION (MW/CM2)
100 80 60 40 20 0
PRECIP. (MM/HR)
150 120 90 60 30 0
RELATIVE HUMIDITY (%)
100 80 60 40 20 0
TEMPERATURE DEW POINT (DEG C)
50 30 10 -10 -30 -50
WIND DIRECTION (DEG)
360 288 216 144 72 0
PEAK GUST WIND SPEED (M/S)
20 16 12 8 4 0
5 10 15 20 25 30
DAY OF THE MONTH   WATANA WEATHER STATION
DATA START: 01 JUNE , 1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	12.7	1.2	7.0	057	1.6	2.4	113	8.3	ENE	27	-13.5	0.0	6335	1
2	12.5	2.7	7.6	333	2.7	2.9	329	7.6	NNW	16	-19.5	0.0	5525	2
3	14.1	2.3	8.2	326	2.2	2.6	323	7.6	NW	23	-18.2	0.0	7728	3
4	15.0	3.4	9.2	243	1.8	2.8	272	9.5	SW	12	-18.2	0.0	6178	4
5	12.2	7.4	9.8	263	1.9	2.9	261	8.3	W	26	-10.4	1.4	2913	5
6	12.9	6.7	9.8	239	1.1	1.9	221	6.3	SW	39	-5.7	8.2	3893	6
7	12.2	3.5	7.9	239	3.0	4.0	228	14.6	WSW	37	-6.5	14.4	2158	7
8	9.9	4.3	7.1	083	.9	1.8	251	5.1	E	50	-2.9	15.2	693	8
9	9.9	7.8	8.9	224	.8	1.4	221	4.4	WSW	48	-2.1	20.4	1548	9
10	10.6	7.6	9.1	054	1.4	2.2	084	7.0	ENE	53	-.4	25.4	1833	10
11	11.1	7.7	9.4	243	3.4	3.5	257	8.3	WSW	45	-2.5	5.8	3225	11
12	13.0	7.5	10.3	228	1.8	2.5	231	8.9	WSW	43	-3.2	6.8	2855	12
13	11.9	7.7	9.8	244	2.1	2.3	238	7.6	WSW	41	-3.4	1.4	3145	13
14	12.3	7.7	10.0	238	1.7	2.1	240	7.0	SW	46	-1.9	1.6	3108	14
15	14.4	7.9	11.2	086	1.0	1.8	083	7.0	E	48	-1.5	6.2	3920	15
16	15.3	9.9	12.6	238	1.8	2.3	233	6.3	WSW	44	-.9	5.8	4118	16
17	16.5	9.8	13.2	244	2.6	2.7	251	7.6	WSW	39	-2.4	2.8	4963	17
18	14.0	8.5	11.3	249	3.2	3.3	250	8.3	WSW	40	-3.1	1.4	4060	18
19	12.9	7.9	10.4	235	2.1	2.2	224	7.0	WSW	44	-2.6	1.8	3260	19
20	12.4	8.6	10.5	240	2.1	2.2	232	7.0	WSW	48	-1.0	6.8	3165	20
21	16.3	8.2	12.3	244	2.9	3.0	235	7.6	WSW	35	-5.1	0.0	6025	21
22	14.3	8.5	11.4	241	2.4	2.5	235	7.0	WSW	38	-3.6	3.8	3793	22
23	14.0	9.5	11.8	220	1.1	1.5	251	4.4	WSW	50	.1	8.4	3195	23
24	16.5	-20.2	-1.9	094	1.5	2.8	087	8.9	ENE	47	-2.9	5.6	3620	24
25	13.8	-25.5	-5.9	267	.3	2.8	241	7.6	WSW	43	-2.8	11.2	3513	25
26	14.6	6.9	10.8	244	2.4	2.6	219	6.3	WSW	33	-7.8	0.0	4270	26
27	17.0	5.0	11.0	258	2.0	2.7	250	7.6	WSW	21	-14.8	0.0	6890	27
28	14.1	8.8	11.5	242	2.3	2.4	254	7.0	WSW	38	-4.1	2.8	2728	28
29	15.4	8.0	11.7	245	2.4	2.5	245	7.6	WSW	29	-12.3	5.2	4468	29
30	13.5	7.9	10.7	239	2.0	2.1	225	7.0	WSW	30	-13.7	4.6	3885	30
31	12.7	8.8	10.8	246	2.1	2.2	238	7.0	WSW	27	-12.1	3.6	2355	31
MONTH	17.0	-25.5	9.3	248	1.4	2.5	228	14.6	WSW	37	-6.4	170.6	119359	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 12.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 11.4

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

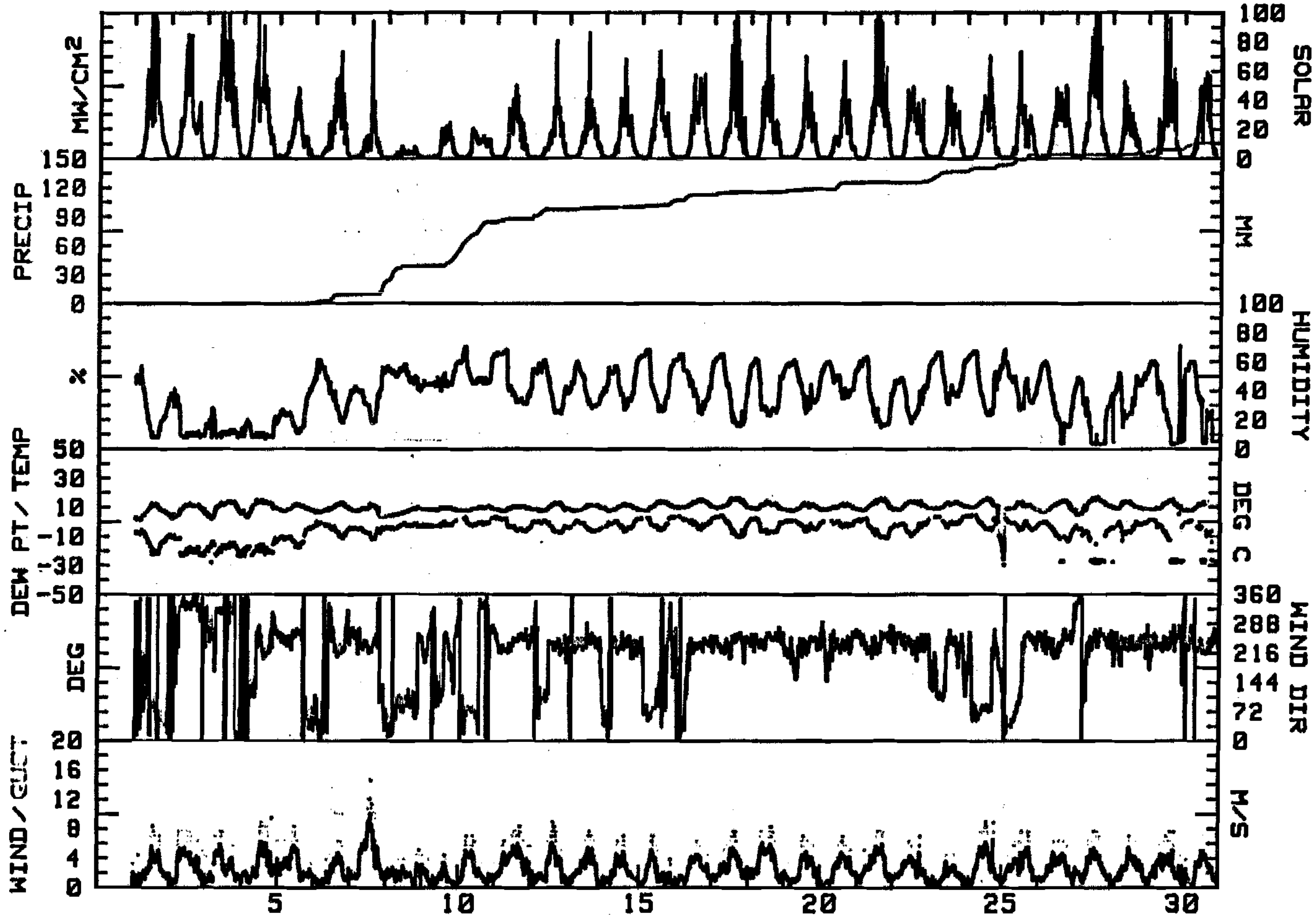
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

WATANA WEATHER STATION

July, 1981



MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	11.6	8.3	10.0	088	2.2	2.3	084	7.0	E	10	-24.6	35.6	1433	1
2	13.6	7.9	10.8	075	2.6	2.7	081	7.6	ENE	7	-26.2	7.4	3600	2
3	19.0	-1.1	9.0	078	1.9	2.3	354	7.6	ENE	10	-25.3	0.0	6258	3
4	19.3	-25.1	-2.9	020	2.3	3.5	344	9.5	N	23	-23.5	0.0	7130	4
5	13.2	10.0	11.6	355	4.0	4.8	349	11.4	NNW	33	-25.9	0.0	5568	5
6	10.4	9.3	9.9	352	3.6	4.7	327	10.8	NNW	28	-22.9	.8	3918	6
7	*****	*****	*****	335	6.0	6.0	335	10.8	NNW	37	*****	4.2	1338	7
8	*****	*****	*****	340	3.9	4.0	340	10.8	NNW	35	*****	8.6	3078	8
9	*****	*****	*****	340	1.9	1.9	345	7.6	NNW	34	*****	2.2	3553	9
10	10.3	-18.5	-4.1	319	1.4	1.9	338	6.3	NNW	24	-26.2	7.2	2935	10
11	12.9	5.8	9.4	224	1.1	1.3	250	5.1	WSW	7	-26.5	7.2	3378	11
12	5.7	4.3	5.0	343	1.5	1.8	343	5.7	N	30	-28.1	22.6	1918	12
13	*****	*****	*****	349	2.2	2.2	351	9.5	N	34	*****	8.2	2938	13
14	*****	*****	*****	345	2.0	2.0	351	7.6	NNW	35	*****	1.6	2263	14
15	-24.4	-37.3	-30.9	339	2.2	2.5	213	8.3	N	33	-44.9	19.4	1300	15
16	6.5	-2.2	2.2	326	1.4	2.1	237	5.7	NNW	23	-26.6	6.2	3930	16
17	6.8	-48.1	-20.7	010	2.2	2.8	077	7.6	N	33	-24.5	0.0	4990	17
18	*****	*****	*****	352	3.2	3.2	354	7.6	N	35	*****	1.6	2735	18
19	8.5	6.0	7.3	348	2.3	2.4	353	7.6	N	28	-27.3	12.8	2843	19
20	11.1	5.8	8.5	046	2.8	3.0	014	8.3	NE	6	-27.4	4.8	1183	20
21	11.7	6.0	8.9	026	2.5	3.1	070	8.9	N	25	-25.6	12.0	4358	21
22	*****	*****	*****	354	2.2	2.2	354	5.7	N	35	*****	2.4	1923	22
23	*****	*****	*****	353	1.5	1.5	355	5.7	N	35	*****	0.0	3945	23
24	*****	*****	*****	354	1.9	1.9	355	5.7	N	35	*****	0.0	5345	24
25	*****	*****	*****	355	1.7	1.7	353	6.3	N	36	*****	0.0	4453	25
26	*****	*****	*****	354	2.6	2.6	353	8.3	N	36	*****	0.0	5405	26
27	19.4	-45.6	-13.1	341	1.5	1.8	355	6.3	N	28	-26.5	0.0	5530	27
28	23.6	-17.1	3.3	008	1.0	1.6	100	4.4	N	24	-27.3	0.0	4690	28
29	13.5	7.5	10.5	243	2.3	2.6	239	6.3	WSW	16	-21.6	0.0	1553	29
30	13.5	7.5	10.5	234	4.0	4.0	220	7.6	SW	6	-26.3	.6	3040	30
31	16.2	-27.2	-5.5	273	1.5	2.6	253	6.3	WSW	18	-21.2	.2	5063	31
MONTH	23.6	-48.1	2.0	351	1.7	2.7	349	11.4	N	26	-26.4	165.6	111586	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 10.2
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 10.2

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THA ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

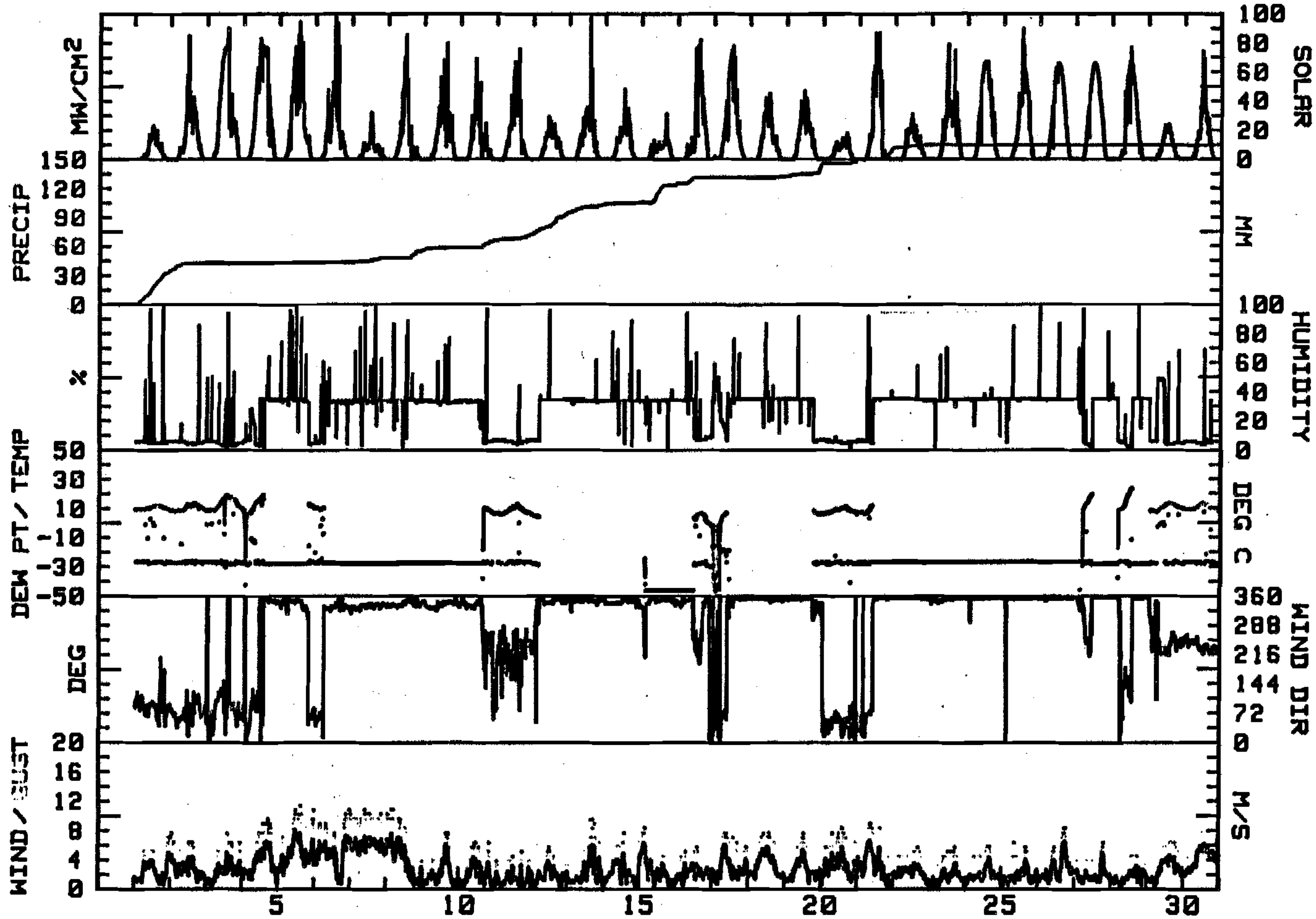
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

WATANA WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	17.4	-30.2	-6.4	321	.3	1.9	355	5.7	N	32	-37.3	0.0	5233	1
2	10.8	5.6	8.2	301	1.2	1.9	355	6.3	N	55	-4.4	1.8	1948	2
3	13.2	5.5	9.4	112	.3	1.2	338	3.8	ESE	29	-11.9	.4	2983	3
4	11.8	5.5	8.7	072	3.3	3.6	081	8.3	ENE	32	-9.0	.2	3098	4
5	14.5	6.4	10.5	067	2.7	3.2	081	8.3	ENE	33	-7.3	2.4	4190	5
6	12.9	3.7	8.3	052	2.3	3.2	217	10.8	NE	35	-8.2	4.4	2423	6
7	9.1	.8	5.0	072	2.0	2.2	075	6.3	ENE	35	-9.6	.2	2755	7
8	13.0	2.1	7.6	075	1.5	2.0	098	7.6	E	25	-15.1	0.0	4530	8
9	11.6	.3	6.0	069	1.3	1.6	085	5.7	ENE	32	-11.5	10.0	1983	9
10	9.6	2.5	6.1	334	.9	1.3	356	3.8	NNW	37	-8.9	2.6	2615	10
11	9.3	1.2	5.3	211	.2	1.4	202	5.7	S	36	-8.9	2.4	2220	11
12	10.9	2.2	6.6	075	2.6	2.8	089	7.6	ENE	26	-14.4	0.0	3768	12
13	9.5	.9	5.2	064	1.7	2.4	180	7.0	ENE	27	-13.8	1.0	2890	13
14	12.7	-1.3	5.7	072	2.8	3.0	090	8.3	E	23	-15.8	0.0	2823	14
15	10.9	3.2	7.1	062	2.2	3.1	074	10.2	ENE	27	-11.9	.8	2415	15
16	10.6	2.9	6.8	071	3.4	3.5	078	8.9	ENE	20	-16.5	.2	2695	16
17	12.5	3.7	8.1	058	3.8	4.1	067	8.3	ENE	13	-19.4	0.0	3625	17
18	9.2	5.1	7.2	067	3.6	3.7	072	8.9	ENE	17	-17.2	0.0	1573	18
19	7.5	3.3	5.4	054	2.5	2.8	075	9.5	ENE	38	-8.2	12.2	820	19
20	8.4	-.4	4.0	064	.9	2.0	337	5.7	E	42	-8.9	3.4	2315	20
21	6.8	-.3	3.3	024	1.4	1.8	004	6.3	NNE	34	-14.4	0.0	2200	21
22	7.7	-1.8	3.0	009	.4	1.5	030	3.8	NNE	15	-23.9	0.0	3140	22
23	4.0	-3.2	.4	036	.3	1.1	324	4.4	E	37	-14.9	3.0	1713	23
24	1.4	-4.2	-1.4	056	.8	.8	056	4.4	NE	43	-13.0	30.6	748	24
25	1.0	-8.7	-3.9	036	1.8	1.9	027	7.0	NNE	28	-20.5	.6	1533	25
26	2.0	-11.0	-4.5	031	1.6	1.8	019	4.4	NNE	23	-24.7	.2	3380	26
27	2.1	-13.3	-5.6	014	1.3	1.5	009	3.8	N	26	-23.2	.8	3728	27
28	-.8	-6.7	-3.8	054	4.2	4.4	064	8.3	NE	23	-22.7	0.0	2810	28
29	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	29
30	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	30
MONTH	17.4	-30.2	4.0	057	1.6	2.3	217	10.8	ENE	30	-14.8	77.2	76148	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 9.5
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 5.1

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAIL OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

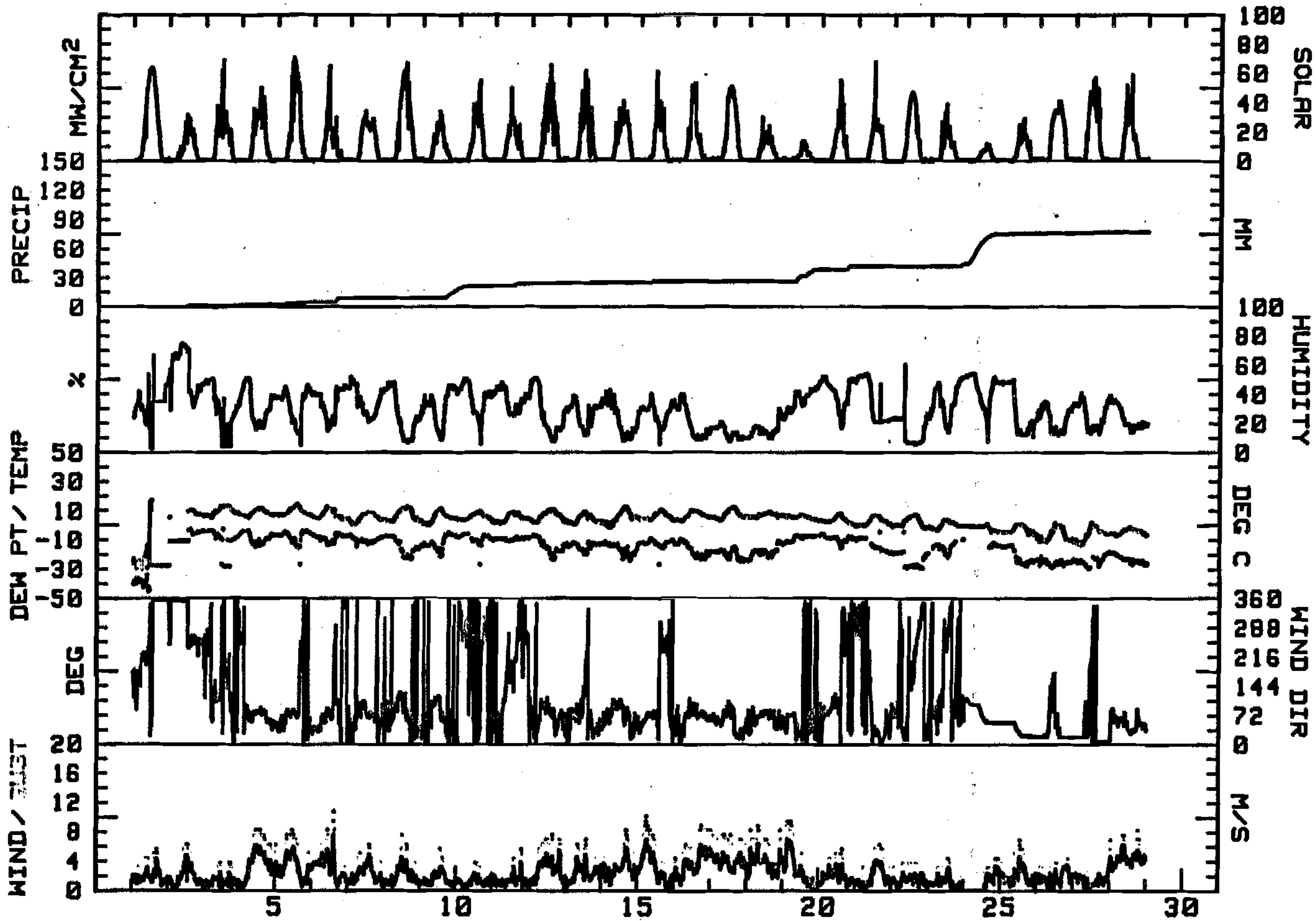
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

WATANA WEATHER STATION

September, 1981



ATTACHMENT E.5, PART 6

DEVIL CANYON CLIMATE DATA

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING JULY , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	15.9	11.9	13.9	***	****	1.0	087	3.2	WNW	57	*****	0.0	1920	17
18	22.1	9.1	15.6	291	.7	1.3	276	5.1	S	49	6.8	0.0	6868	18
19	24.2	6.3	15.3	016	.8	1.6	037	6.3	NNE	38	1.2	0.0	6983	19
20	24.3	8.6	16.5	037	1.1	1.7	052	5.7	NNE	40	1.0	0.0	7345	20
21	22.8	7.8	15.3	321	1.0	1.7	003	5.7	NW	53	6.6	0.0	7053	21
22	24.5	9.3	16.9	047	.3	1.2	359	12.7	N	57	8.0	3.0	6348	22
23	25.4	8.2	16.8	045	.5	1.4	015	5.7	NE	52	6.6	0.0	6305	23
24	17.8	12.0	14.9	301	1.6	1.8	330	5.7	NW	75	10.5	1.2	3303	24
25	12.1	10.8	11.5	286	.8	1.1	302	5.1	WNW	93	10.0	7.6	870	25
26	16.5	9.5	13.0	299	.6	1.2	317	5.7	NW	79	9.0	12.0	4062	26
27	11.8	8.4	10.1	256	1.1	1.4	238	8.3	W	88	8.1	37.0	1398	27
28	13.7	7.7	10.7	097	.1	.8	093	3.2	NNE	87	7.9	18.0	3048	28
29	12.1	7.5	9.8	358	.2	1.0	298	3.8	NNE	84	8.4	2.6	2870	29
30	17.5	7.4	12.5	082	1.1	1.5	020	8.3	E	57	-13.7	.2	6158	30
31	17.2	7.6	12.4	303	.4	1.2	298	7.6	NNW	60	5.5	3.2	4573	31
MONTH	25.4	6.3	13.7	330	.4	1.3	359	12.7	NW	65	5.4	84.8	69101	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 1.9
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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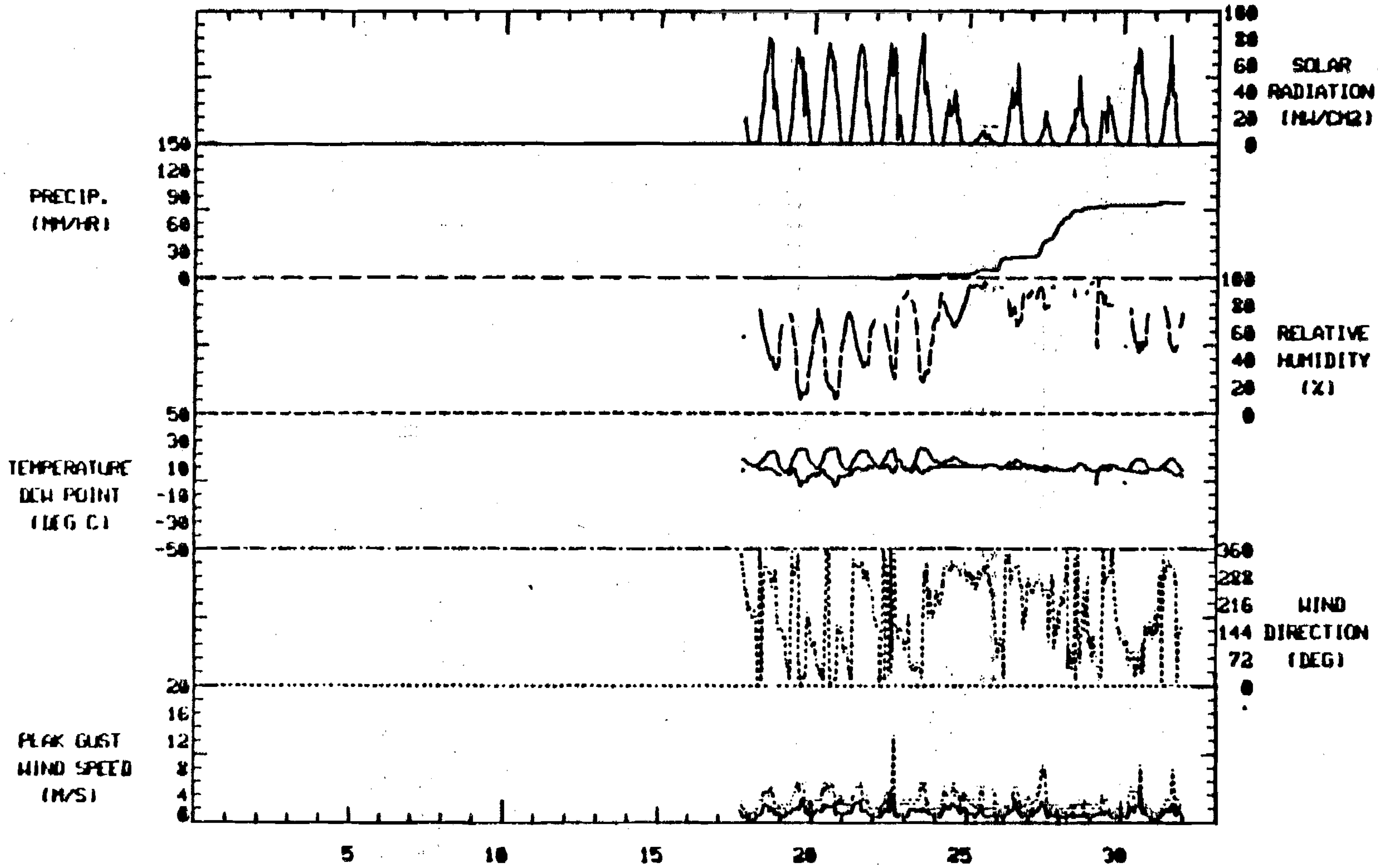
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 17   JULY   , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING AUGUST , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	19.2	3.9	11.6	294	.3	1.4	269	5.1	WNW	58	2.8	0.0	6528	01
02	11.6	6.5	9.1	224	.1	1.0	091	4.4	E	85	7.9	8.6	2033	02
03	16.9	6.1	11.5	303	1.0	1.5	335	7.6	NW	67	7.4	6.8	4640	03
04	17.7	7.4	12.6	260	.4	.9	260	3.2	WNW	63	8.3	3.0	4270	04
05	19.7	6.7	13.2	332	.7	1.5	322	5.1	NW	67	7.8	0.0	5215	05
06	16.1	9.7	12.9	305	1.1	1.4	313	5.7	NW	63	-7.0	.6	2038	06
07	11.0	8.5	9.8	281	.4	.8	303	3.8	WNW	82	6.9	4.4	2098	07
08	14.9	8.4	11.6	269	.4	.8	277	3.2	WNW	71	7.0	.8	3248	08
09	17.8	9.2	13.5	120	1.2	1.7	113	7.0	E	59	2.4	.4	2900	09
10	23.5	9.0	16.3	132	.3	1.3	103	5.1	ESE	34	-4.2	.2	5645	10
11	23.9	6.7	15.3	097	.5	1.4	110	5.1	ESE	41	-4.4	0.0	4938	11
12	17.0	7.7	12.4	306	1.4	1.9	304	7.6	WNW	09	-27.4	.6	4455	12
13	*****	*****	*****	304	1.2	1.3	309	3.8	NW	08	-27.6	5.4	1116	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
31	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	31
MONTH	23.9	3.9	12.5	301	.4	1.3	335	7.6	WNW	54	-1.5	30.8	49121	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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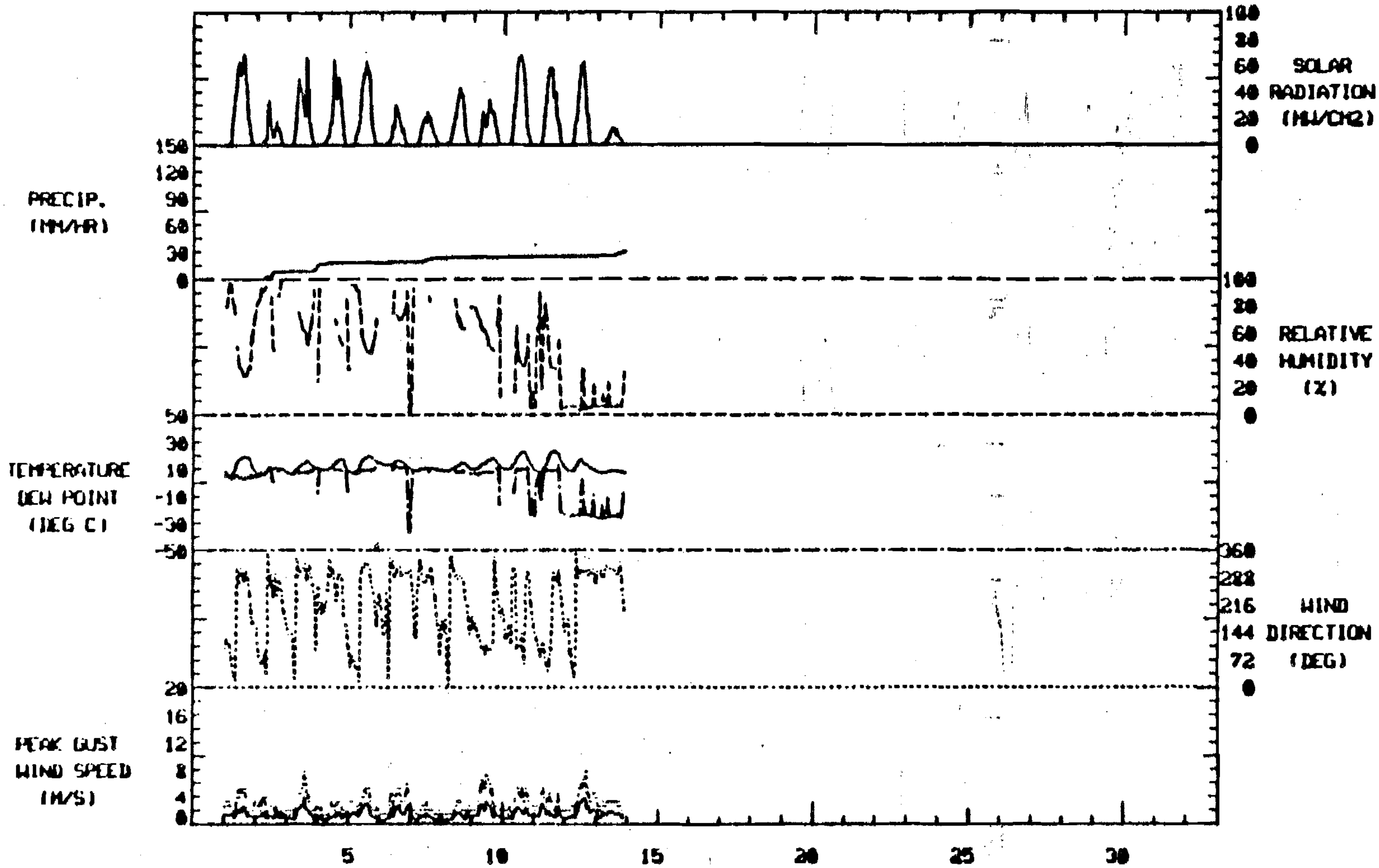
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 AUGUST , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING SEPTEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	01
02	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	02
03	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	03
04	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	04
05	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	05
06	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	06
07	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	07
08	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	08
09	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	09
10	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	10
11	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	11
12	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	12
13	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	13
14	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	14
15	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	15
16	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	16
17	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	17
18	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	18
19	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	19
20	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	20
21	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	21
22	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	22
23	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	23
24	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	24
25	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	25
26	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	26
27	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	27
28	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	28
29	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	29
30	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	30
MONTH	*****	*****	*****	***	****	****	***	****	MSG	**	*****	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS ****
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL ****
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS ****

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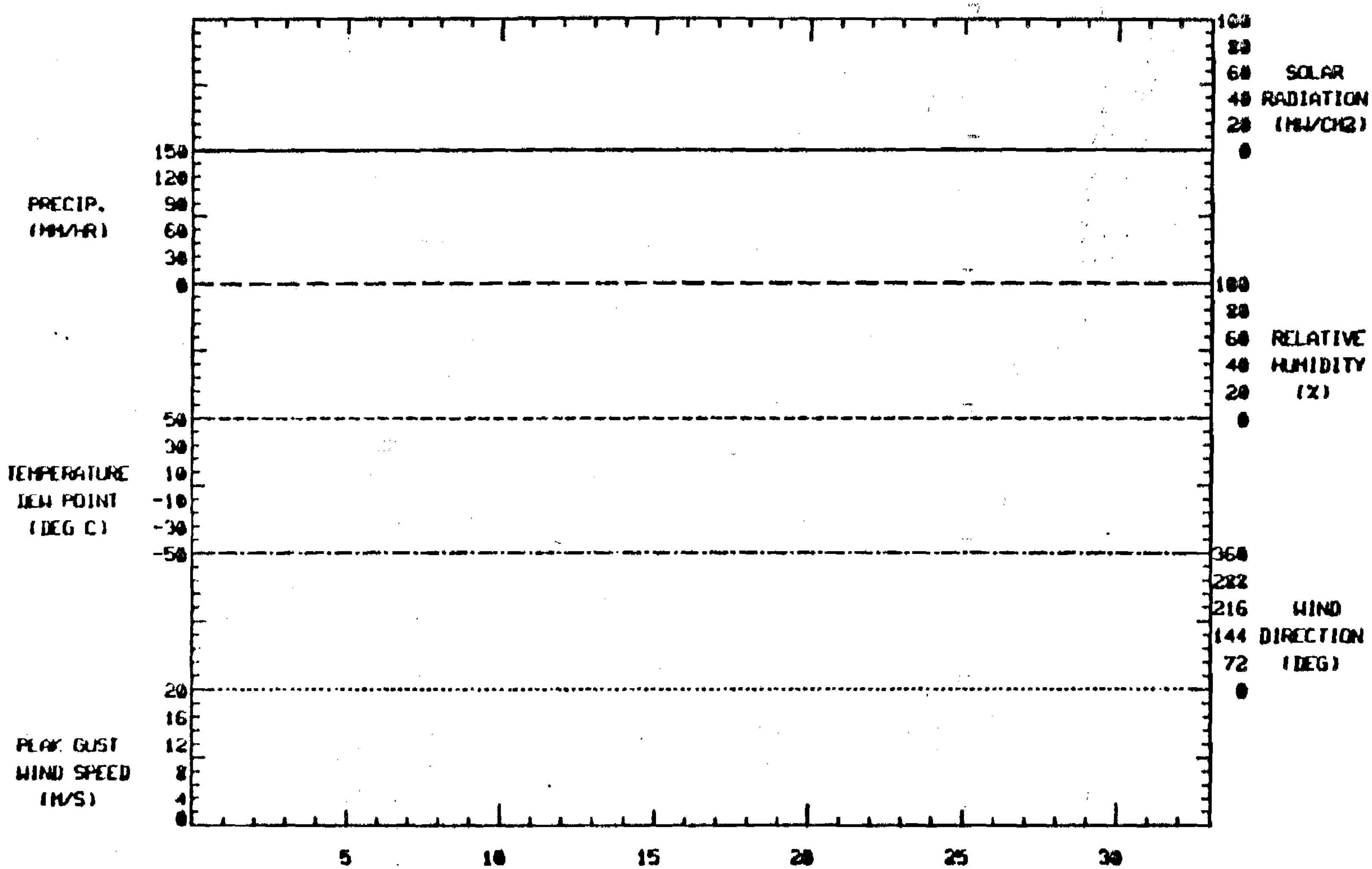
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 SEPTEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING OCTOBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	11.2	1.2	6.2	159	.8	1.0	103	5.1	S	56	-.8	****	2427	01
02	4.5	-3.0	.8	192	.1	.8	311	3.8	SSE	45	-21.2	****	1245	02
03	6.7	-4.9	.9	118	.1	.5	019	2.5	E	63	-.9	****	1560	03
04	6.4	.6	3.5	113	1.2	1.5	102	7.0	ESE	58	-8.3	****	1872	04
05	5.8	1.8	3.8	125	.7	1.2	082	7.0	E	59	-2.9	****	983	05
06	9.1	.9	5.0	125	1.1	1.4	107	7.0	ESE	66	-.3	****	1313	06
07	9.5	2.3	5.9	236	.6	1.1	317	4.4	S	36	-6.1	****	1040	07
08	2.0	-1.8	.1	282	.8	1.0	305	3.2	W	42	-12.1	****	563	08
09	-1.1	-5.2	-3.2	137	.2	.8	126	4.4	ENE	92	-5.0	****	763	09
10	-.1	-6.8	-3.5	143	.5	1.3	274	3.8	SSE	89	-5.7	****	780	10
11	-1.4	-9.7	-5.6	090	1.1	1.5	147	3.8	ENE	84	-9.3	****	1170	11
12	-1.3	-10.9	-6.1	092	1.2	1.5	065	3.8	E	80	-11.0	****	1338	12
13	-2.1	-11.7	-6.9	101	1.9	2.0	094	5.1	E	80	-9.2	****	1734	13
14	2.8	-3.8	-.5	122	1.5	1.7	099	8.3	ESE	65	-5.5	****	***	14
15	3.4	.4	1.9	222	.6	1.3	128	5.1	W	56	-9.8	****	***	15
16	1.5	-2.8	-.7	139	.8	1.0	104	5.1	ESE	66	-6.4	****	***	16
17	3.3	-4.6	-.7	130	1.3	1.6	097	6.3	ESE	60	-6.8	****	***	17
18	5.3	.8	3.1	135	1.3	1.5	103	4.4	SSE	61	-3.7	****	***	18
19	5.4	1.6	3.5	119	2.0	2.3	105	8.9	ESE	52	-5.2	****	***	19
20	6.0	.2	3.1	127	1.1	1.4	114	5.7	ESE	47	-7.4	****	***	20
21	3.9	-3.7	.1	111	1.6	1.8	110	8.3	ESE	61	-5.6	****	***	21
22	6.8	-.8	3.0	122	1.6	1.9	099	8.3	ESE	43	-7.8	****	***	22
23	8.0	-1.6	3.2	122	1.8	2.0	099	8.9	ESE	47	-6.2	****	***	23
24	8.6	-.1	4.3	135	1.7	2.0	109	7.0	ESE	52	-4.8	****	***	24
25	4.6	-2.5	1.1	149	.9	1.2	106	3.8	S	72	-4.1	****	***	25
26	4.3	-5.6	-.7	150	.9	1.2	110	5.1	S	72	-5.5	****	***	26
27	4.2	-2.5	.8	140	1.2	1.4	127	6.3	SE	51	-8.4	****	***	27
28	1.0	-2.3	-.7	216	.2	.9	101	3.8	W	51	-13.4	****	***	28
29	-1.0	-2.8	-1.9	246	.1	.4	286	2.5	S	49	*****	****	***	29
30	-1.5	-10.7	-6.1	105	1.1	1.2	089	3.8	ENE	83	-25.1	****	***	30
31	-3.5	-13.4	-8.5	134	1.3	1.5	093	3.8	SSE	82	-11.3	****	***	31
MONTH	11.2	-13.4	.2	127	.9	1.3	105	8.9	ESE	62	-7.6	****	16785	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

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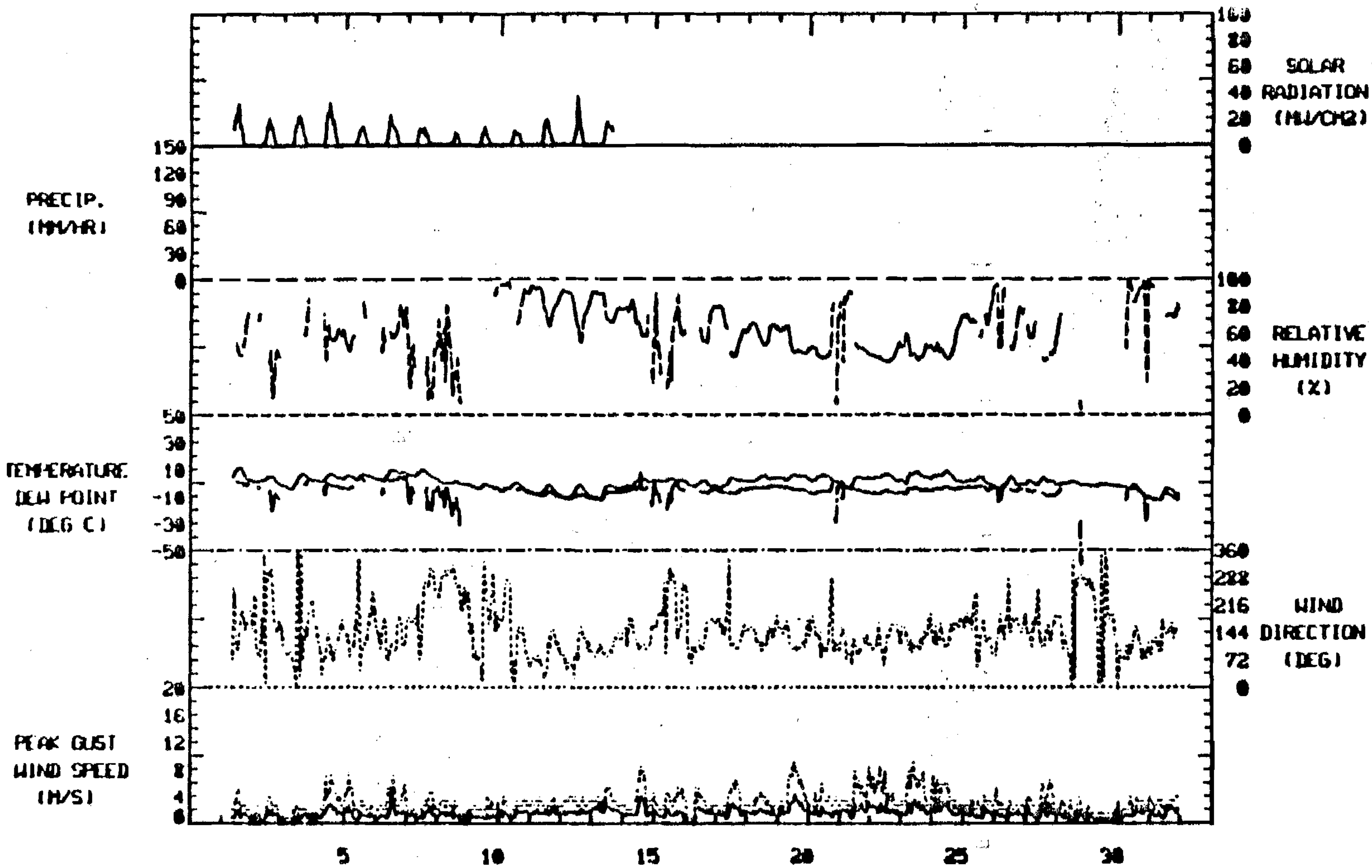
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 OCTOBER , 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING NOVEMBER , 1980

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-2.5	-10.6	-6.6	123	1.6	1.7	103	4.4	ESE	70	-10.6	****	***	01
02	-3.6	-7.3	-5.4	118	1.7	1.9	120	4.4	ESE	76	-8.6	****	***	02
03	1.7	-6.9	-2.6	109	1.1	1.4	146	6.3	E	80	-5.4	****	***	03
04	4.2	-2.2	1.0	138	1.5	1.6	116	5.1	SE	76	-3.2	****	***	04
05	1.8	-1.0	.4	110	.6	.8	124	2.5	SE	49	-9.8	****	***	05
06	-.8	-3.6	-2.2	***	****	****	***	1.9	MSG	77	-14.0	****	***	06
07	-1.6	-9.1	-5.4	***	****	****	***	.6	MSG	67	-25.5	****	***	07
08	-4.9	-11.3	-8.1	***	****	****	***	.6	MSG	68	-13.5	****	***	08
09	-9.2	-15.4	-12.3	***	****	****	***	.6	MSG	72	-16.1	****	***	09
10	-4.8	-10.3	-7.6	***	****	1.8	113	4.4	ESE	63	-12.9	****	***	10
11	-1.7	-10.1	-5.9	132	1.6	1.7	117	4.4	SE	58	-11.0	****	***	11
12	-1.3	-11.1	-6.2	120	1.8	1.9	107	7.0	ESE	61	-10.2	****	***	12
13	-.2	-8.6	-4.4	115	1.3	1.5	131	3.8	SE	85	-6.5	****	***	13
14	-6.4	-12.3	-9.4	094	1.7	1.7	100	4.4	E	90	-10.4	****	***	14
15	.1	-10.1	-5.0	132	1.2	1.3	105	6.3	SE	83	-6.2	****	***	15
16	.4	-5.5	-2.6	115	1.4	1.6	101	7.0	ESE	81	-4.7	****	***	16
17	-2.9	-6.4	-4.6	089	.9	1.2	115	3.2	NE	61	-15.9	****	***	17
18	-.6	-6.3	-3.5	151	1.2	1.3	136	3.2	SE	79	-7.1	****	***	18
19	2.1	-5.2	-1.5	137	1.3	1.4	122	5.1	SE	71	-6.5	****	***	19
20	1.4	-5.0	-1.8	116	1.3	1.5	152	3.8	ESE	73	-6.1	****	***	20
21	-4.9	-9.1	-7.0	076	1.6	1.7	062	3.8	ENE	92	-7.8	****	***	21
22	.8	-7.8	-3.5	130	1.3	1.5	102	6.3	ESE	74	-6.9	****	***	22
23	-1.1	-5.1	-3.1	106	1.4	1.6	120	5.1	E	84	-6.0	****	***	23
24	3.2	-4.3	-.6	112	1.6	1.8	100	10.2	ESE	61	-6.7	****	***	24
25	.4	-4.0	-1.8	152	1.1	1.2	143	3.2	SSE	83	-4.0	****	***	25
26	-.4	-5.4	-2.9	133	1.1	1.2	113	5.1	SE	84	-4.7	****	***	26
27	-.7	-5.1	-2.9	139	.6	.8	107	3.2	SE	91	-4.8	****	***	27
28	-5.0	-10.1	-7.6	120	1.3	1.4	114	3.8	ESE	81	-9.3	****	***	28
29	-10.3	-17.6	-13.9	083	2.1	2.2	084	5.7	ENE	83	-17.6	****	***	29
30	-12.6	-18.1	-15.4	084	2.2	2.2	075	5.1	E	74	-19.3	****	***	30
MONTH	4.2	-18.1	-5.1	115	1.3	1.5	100	10.2	ESE	75	-9.7	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.9

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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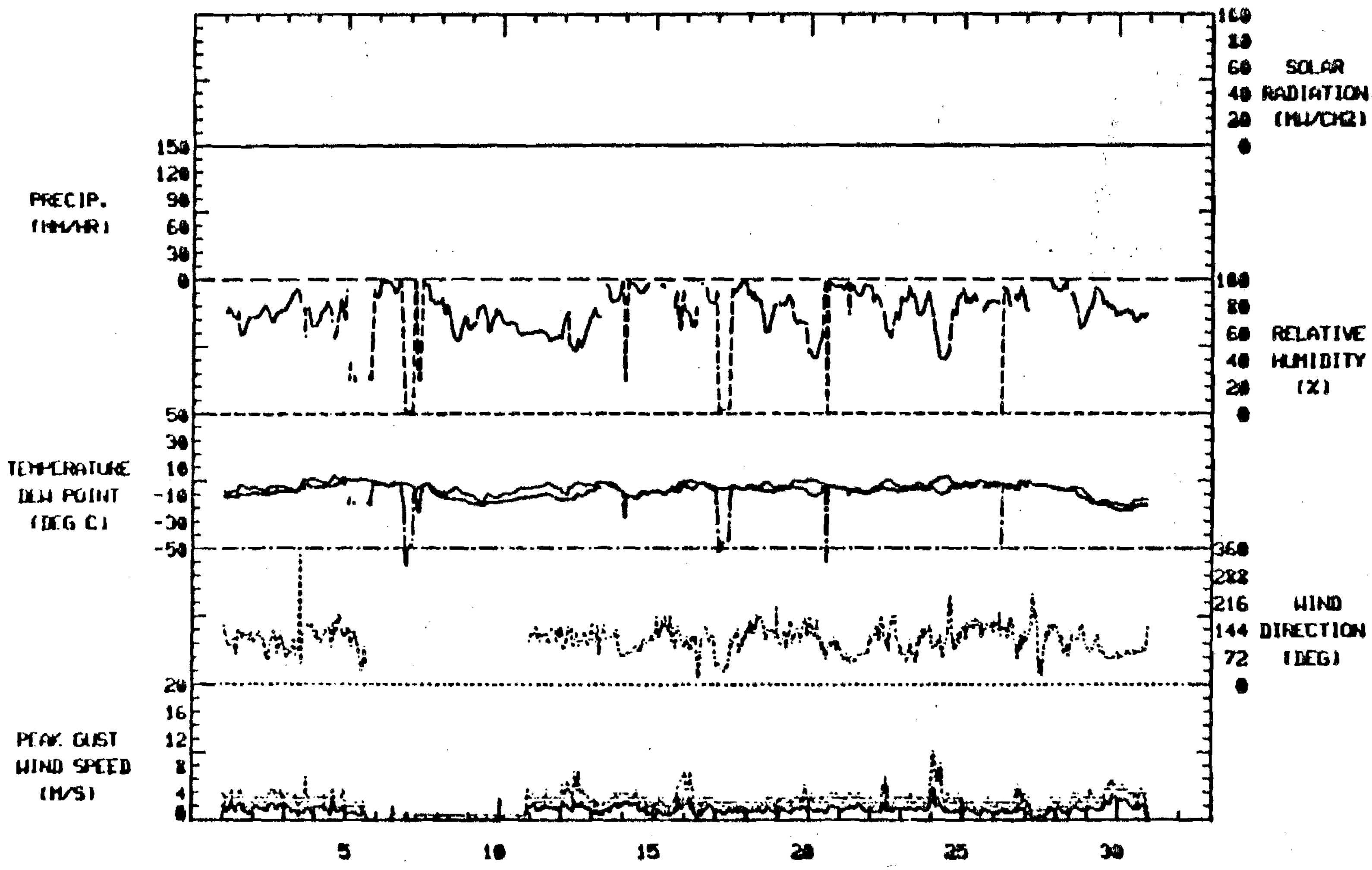
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DEVIL CANYON WEATHER STATION

DATA START: 01 NOVEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING DECEMBER , 1980

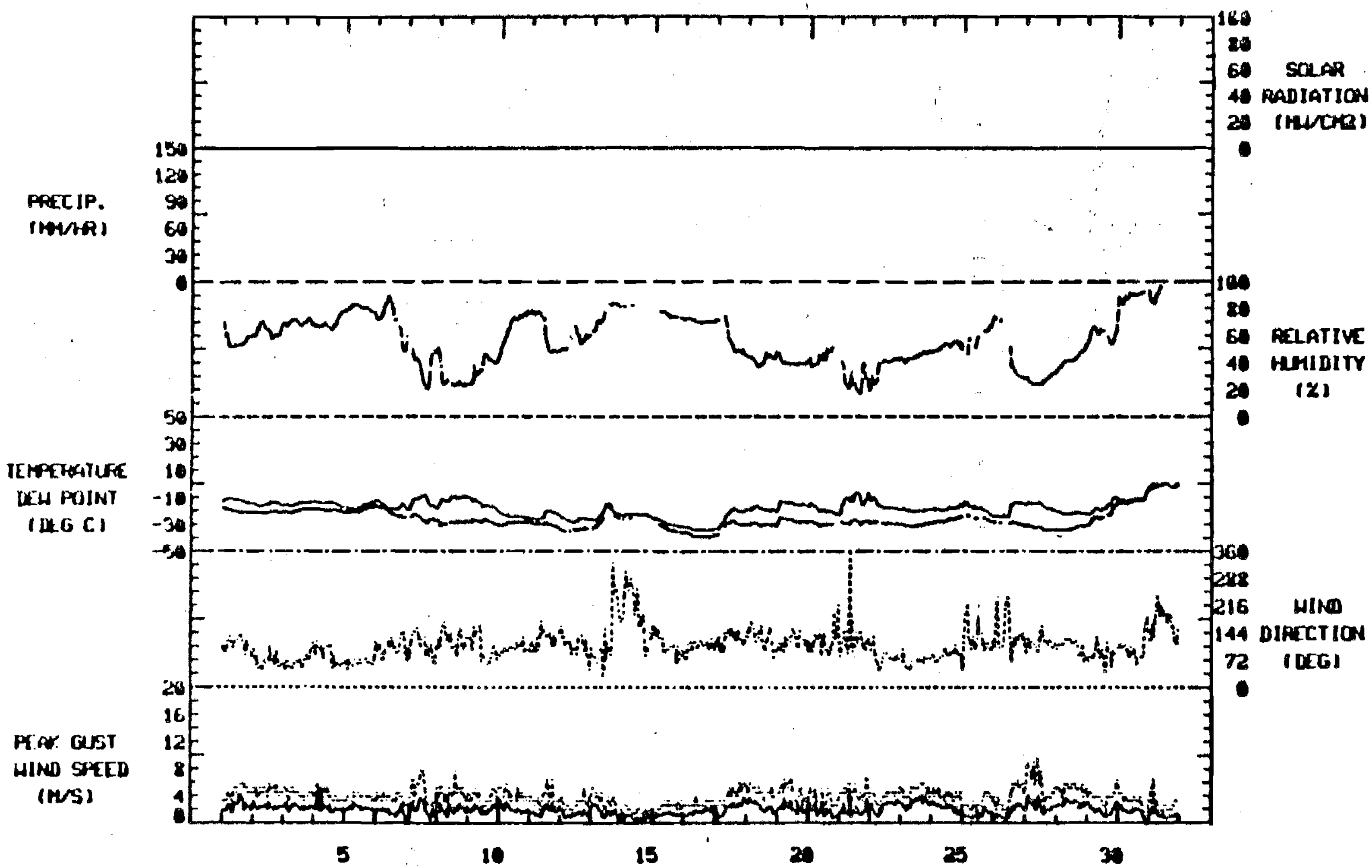
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-9.6	-15.3	-12.5	116	2.4	2.5	139	5.7	ESE	56	-19.6	****	***	01
02	-12.9	-17.0	-15.0	069	2.1	2.3	095	5.7	NE	64	-20.4	****	***	02
03	-12.3	-16.8	-14.5	068	2.1	2.2	053	5.1	ENE	70	-18.9	****	***	03
04	-13.1	-17.7	-15.4	090	1.8	2.1	126	5.7	ESE	70	-19.1	****	***	04
05	-12.3	-15.9	-14.1	067	2.1	2.1	078	4.4	ENE	80	-18.8	****	***	05
06	-12.1	-20.1	-16.1	109	1.5	1.6	114	4.4	E	73	-20.8	****	***	06
07	-8.1	-19.4	-13.8	118	1.7	1.9	129	7.6	SE	38	-25.1	****	***	07
08	-7.9	-18.4	-13.2	126	1.8	2.0	088	7.6	ESE	26	-27.2	****	***	08
09	-9.6	-21.4	-15.5	107	1.6	2.0	141	5.1	ENE	38	-26.7	****	***	09
10	-21.7	-25.6	-23.7	100	2.0	2.1	100	5.7	E	70	-28.1	****	***	10
11	-20.0	-26.9	-23.5	129	1.6	1.7	124	6.3	SE	59	-29.5	****	***	11
12	-25.2	-29.0	-27.1	112	1.1	1.3	144	5.1	ESE	58	-32.5	****	***	12
13	-14.5	-27.6	-21.0	093	.8	1.6	069	5.1	E	77	-25.4	****	***	13
14	-22.0	-26.0	-24.0	203	.3	.7	263	2.5	SSE	81	-26.9	****	***	14
15	-25.3	-32.0	-28.7	108	1.0	1.1	086	3.2	ESE	75	-32.8	****	***	15
16	-31.4	-34.4	-32.9	109	1.4	1.5	094	3.8	ESE	71	-37.3	****	***	16
17	-17.0	-33.4	-25.2	132	1.9	2.0	113	5.7	ESE	55	-28.4	****	***	17
18	-16.3	-21.2	-18.8	136	2.1	2.3	157	5.7	SSE	42	-28.1	****	***	18
19	-12.6	-18.3	-15.5	124	2.0	2.1	126	7.0	SE	40	-25.6	****	***	19
20	-14.4	-23.2	-18.8	116	1.4	1.6	117	5.1	E	45	-27.9	****	***	20
21	-6.2	-21.9	-14.1	122	1.4	1.8	142	7.0	SE	27	-26.7	****	***	21
22	-9.4	-19.4	-14.4	082	2.3	2.4	100	4.4	ENE	38	-27.8	****	***	22
23	-17.6	-21.0	-19.3	069	2.9	3.0	069	5.7	ENE	45	-28.8	****	***	23
24	-13.8	-20.0	-16.9	084	2.2	2.3	080	5.1	E	53	-25.7	****	***	24
25	-11.1	-24.6	-17.8	121	.8	1.1	108	4.4	ESE	62	-25.7	****	***	25
26	-13.7	-25.0	-19.4	130	1.3	1.5	120	6.3	SE	42	-27.9	****	***	26
27	-13.2	-19.9	-16.6	117	2.4	2.5	093	9.5	ESE	27	-30.9	****	***	27
28	-20.0	-22.7	-21.4	111	2.7	2.8	124	5.7	ESE	43	-30.6	****	***	28
29	-9.8	-23.0	-16.4	088	1.7	1.9	087	5.1	ENE	62	-21.2	****	***	29
30	-5.0	-12.7	-8.9	097	1.6	1.7	103	6.3	E	89	-13.2	****	***	30
31	1.2	-4.2	-1.5	169	.8	1.1	143	6.3	SSW	78	-2.1	****	***	31
MONTH	1.2	-34.4	-17.9	105	1.6	1.9	093	9.5	ESE	57	-25.2	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 3.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.0

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 DECEMBER, 1980

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING JANUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	5.2	-.3	2.4	146	1.4	1.8	108	9.5	S	72	-1.0	****	***	01
02	2.7	-10.7	-4.0	107	1.0	1.3	062	4.4	ESE	72	-26.2	****	***	02
03	-6.2	-14.0	-10.1	091	1.5	1.7	062	4.4	E	93	-11.9	****	***	03
04	-2.2	-9.1	-5.7	123	1.9	2.0	117	5.1	SE	88	-5.2	****	***	04
05	-4.2	-12.6	-8.4	092	1.2	1.5	065	4.4	ENE	61	-51.2	****	***	05
06	-.6	-10.4	-5.5	125	1.6	1.7	090	7.6	SE	68	-7.3	****	***	06
07	4.5	-1.2	1.7	125	1.6	1.7	080	7.6	ESE	58	-5.9	****	***	07
08	1.3	-5.9	-2.3	127	1.6	1.8	107	6.3	ESE	77	-5.8	****	***	08
09	2.8	-1.1	.9	112	2.0	2.2	108	9.5	ESE	47	-9.3	****	***	09
10	.2	-7.6	-3.7	120	1.2	1.3	122	4.4	ESE	77	-9.9	****	***	10
11	1.5	-4.8	-1.7	149	1.1	1.2	144	3.8	SE	84	-25.4	****	***	11
12	-1.4	-7.6	-4.5	095	1.0	1.2	120	3.8	E	52	-34.3	****	***	12
13	2.9	-7.5	-2.3	119	1.8	2.0	106	8.9	ESE	61	-7.1	****	***	13
14	5.1	-1.6	1.8	117	1.8	2.0	096	8.3	ESE	64	-3.1	****	***	14
15	5.6	-.8	2.4	132	1.0	1.7	109	7.0	ESE	54	-7.5	****	***	15
16	3.0	-3.1	-.0	144	1.5	1.6	147	6.3	SSE	77	-4.0	****	***	16
17	3.6	-1.3	1.2	147	1.3	1.5	088	5.7	SSE	64	-5.1	****	***	17
18	3.7	.6	2.2	135	1.9	2.1	123	8.3	SE	59	-4.9	****	***	18
19	4.0	-7.7	-1.8	176	.4	1.4	289	5.7	SE	67	-10.4	****	***	19
20	-3.1	-10.7	-6.9	127	1.3	1.4	120	4.4	SE	78	-9.4	****	***	20
21	-1.7	-11.0	-6.4	112	1.6	1.8	077	7.6	ESE	72	-8.7	****	***	21
22	2.3	-4.1	-.9	136	1.5	1.6	145	5.1	ESE	66	-4.9	****	***	22
23	2.6	-2.3	.1	127	.8	1.1	101	4.4	ESE	74	-3.3	****	***	23
24	3.4	-5.6	-1.1	125	1.2	1.5	112	7.0	ESE	65	-5.5	****	***	24
25	4.4	-1.7	1.3	137	1.6	1.7	099	8.3	SE	46	-7.6	****	***	25
26	-.7	-4.4	-2.5	072	.5	.9	120	3.2	NE	84	-5.8	****	***	26
27	-3.7	-9.2	-6.5	101	1.1	1.2	106	4.4	ESE	90	-20.1	****	***	27
28	-7.5	-16.5	-12.0	098	1.4	1.6	102	5.1	E	87	-13.6	****	***	28
29	-.3	-9.2	-4.8	118	1.2	1.3	085	5.1	ESE	82	-8.5	****	***	29
30	2.7	-2.5	.1	143	1.3	1.4	138	3.8	SE	66	-6.3	****	***	30
31	1.4	-3.4	-1.0	126	.8	1.0	105	6.3	ESE	82	-3.7	****	***	31
MONTH	5.6	-16.5	-2.5	123	1.3	1.6	108	9.5	ESE	70	-10.7	****	***	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 8.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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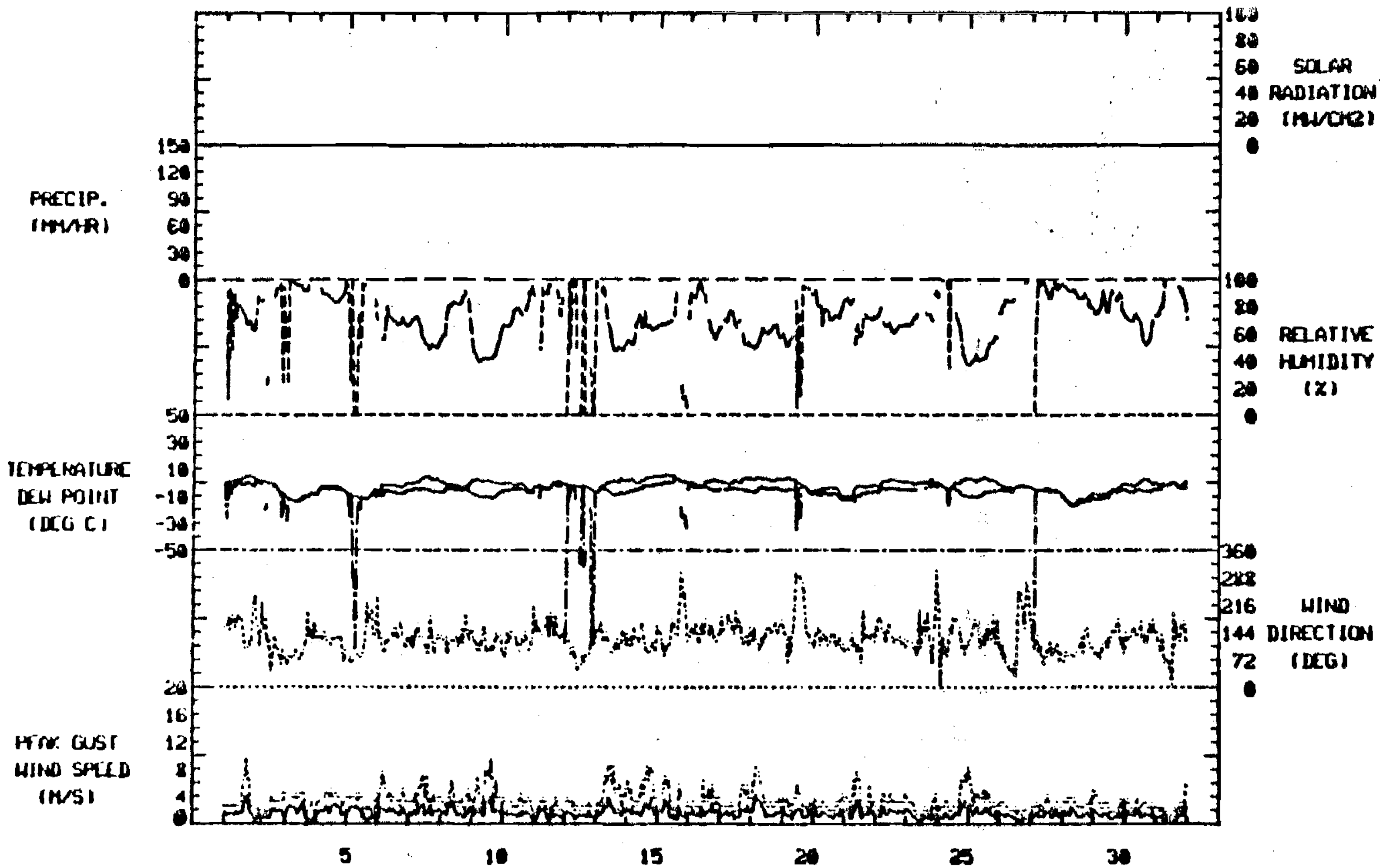
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DEVIL CANYON WEATHER STATION

DATA START: 01 JANUARY , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING FEBRUARY , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	3.6	-3.2	.2	105	1.9	2.0	095	8.3	ESE	69	-4.3	****	***	01
02	4.4	-5.3	-.5	122	.7	1.5	109	7.6	ESE	79	-3.1	****	***	02
03	-1.3	-2.8	-2.1	119	.4	.6	111	2.5	ESE	94	-2.8	****	***	03
04	-.8	-2.5	-1.7	***	****	.4	088	1.3	ENE	91	-17.6	****	***	04
05	-.5	-3.3	-1.9	***	****	****	***	.6	MSG	92	-2.2	****	***	05
06	.4	-1.9	-.8	***	****	****	***	0.0	MSG	93	-1.1	****	***	06
07	-1.8	-3.9	-2.8	***	****	****	***	0.0	MSG	95	-3.9	****	***	07
08	-.8	-4.6	-2.7	***	****	****	***	0.0	MSG	94	-3.0	****	***	08
09	-.6	-3.8	-2.2	***	****	****	***	0.0	MSG	93	-3.7	****	***	09
10	-2.8	-4.7	-3.8	***	****	****	***	0.0	MSG	96	-4.2	****	***	10
11	-4.4	-11.8	-8.1	***	****	****	***	0.0	MSG	86	-10.8	****	***	11
12	-9.7	-13.8	-11.8	***	****	****	***	0.0	MSG	66	-17.1	****	***	12
13	-10.2	-21.9	-16.1	***	****	****	***	0.0	MSG	69	-19.6	****	***	13
14	-12.6	-24.1	-18.3	***	****	****	***	0.0	MSG	64	-24.7	****	***	14
15	-17.0	-27.8	-22.4	***	****	****	***	0.0	MSG	64	-27.9	****	***	15
16	-15.7	-23.7	-19.7	***	****	****	***	0.0	MSG	74	-22.2	****	***	16
17	-13.1	-19.3	-16.2	***	****	****	***	0.0	MSG	70	-21.1	****	***	17
18	-11.9	-25.1	-18.5	***	****	****	***	0.0	MSG	70	-21.1	****	***	18
19	-3.4	-13.6	-8.5	***	****	****	***	0.0	MSG	69	-13.4	****	***	19
20	-.8	-11.2	-6.0	***	****	****	***	0.0	MSG	62	-11.1	****	***	20
21	-2.0	-9.6	-5.8	***	****	****	***	0.0	MSG	83	-7.5	****	***	21
22	-4.6	-11.6	-8.1	***	****	****	***	0.0	MSG	76	-12.6	****	***	22
23	-3.3	-10.6	-7.0	***	****	****	***	.6	MSG	82	-9.7	****	***	23
24	-4.7	-9.2	-7.0	***	****	1.5	***	5.7	MSG	89	-7.8	****	***	24
25	.9	-6.3	-2.7	***	****	1.3	***	4.4	E	83	-6.5	****	951	25
26	-.8	-11.0	-5.9	070	1.1	1.3	072	3.8	ENE	85	-9.0	****	1063	26
27	2.1	-5.8	-1.9	102	.9	1.5	112	3.8	E	87	-4.9	****	1153	27
28	1.6	-7.0	-2.7	116	1.2	1.5	075	5.1	ESE	70	-8.2	****	1295	28
MONTH	4.4	-27.8	-7.3	104	1.0	1.3	095	8.3	ESE	80	-10.8	****	4461	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.1
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 6.3

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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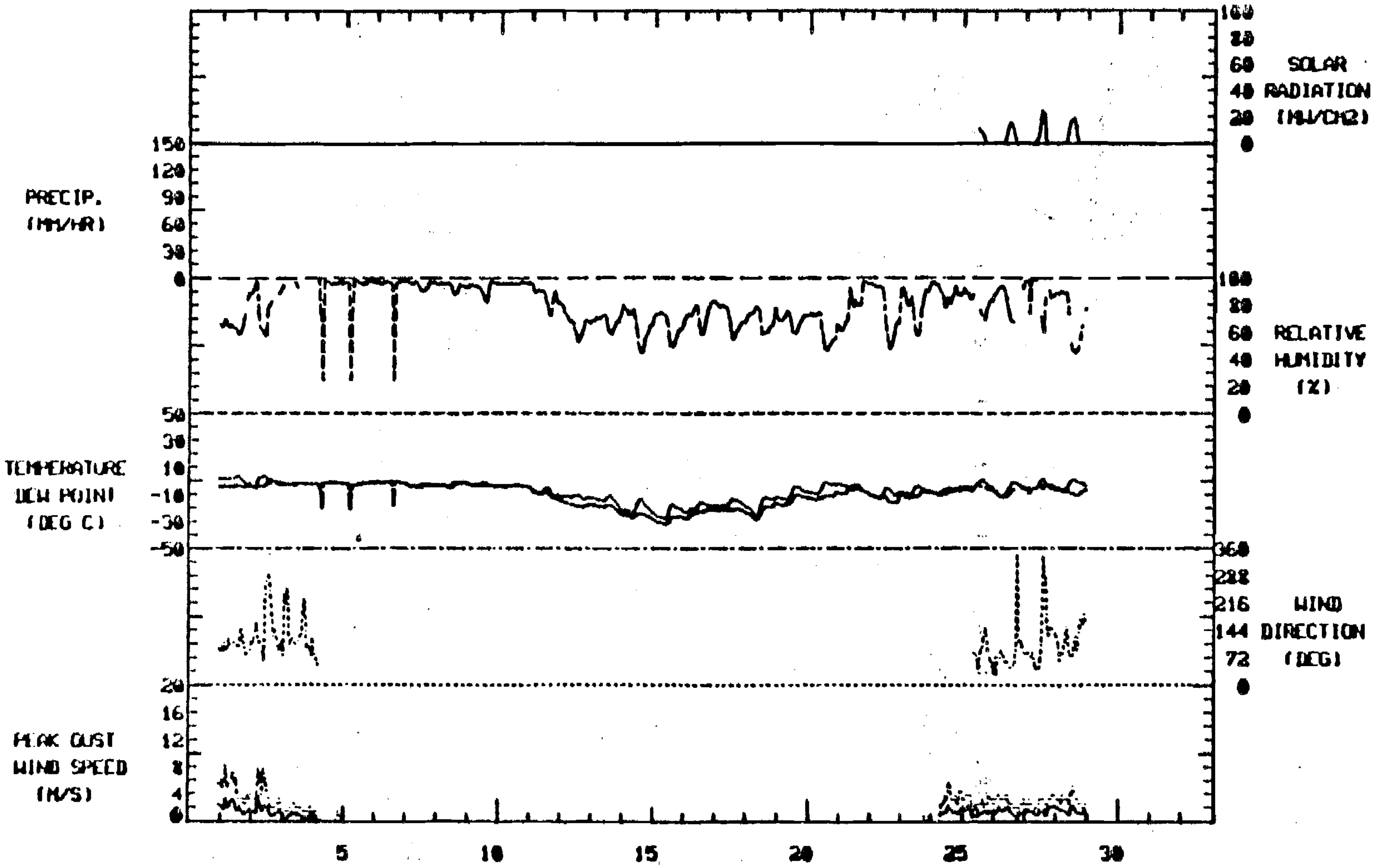
R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 FEBRUARY, 1981

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING MARCH , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	3.8	-3.5	.2	132	1.3	1.4	099	5.7	SE	65	-5.5	****	1263	01
02	-.1	-4.9	-2.5	294	.8	1.2	321	4.4	NW	95	-2.8	****	390	02
03	-2.3	-8.9	-5.6	085	1.1	1.4	056	3.8	NE	82	-9.1	****	578	03
04	-3.6	-14.2	-8.9	105	1.5	1.9	117	5.7	E	71	-13.0	****	1060	04
05	.8	-6.4	-2.8	124	1.3	1.6	077	6.3	SSE	55	-10.3	****	1370	05
06	.5	-9.2	-4.4	110	1.7	1.9	092	5.1	ESE	56	-11.8	****	1800	06
07	1.8	-14.8	-6.5	106	1.8	2.1	080	7.0	ESE	58	-13.6	****	1875	07
08	1.2	-5.8	-2.3	111	1.7	1.9	072	8.3	ESE	45	-12.3	****	1735	08
09	3.5	-2.9	.3	122	1.6	1.8	119	5.7	ESE	55	-8.1	****	1788	09
10	3.4	-6.7	-1.6	120	1.7	1.9	109	6.3	SE	69	-7.4	****	1825	10
11	5.4	-4.8	.3	105	1.8	2.0	074	8.9	ESE	67	-4.0	****	1135	11
12	3.1	-2.7	.2	120	1.3	1.6	053	4.4	SE	56	-7.1	****	1595	12
13	3.4	-5.4	-1.0	124	1.6	1.9	098	7.0	SSE	57	-9.1	****	1527	13
14	3.2	-5.5	-1.2	140	1.0	1.4	139	6.3	SSE	61	-7.7	****	1408	14
15	2.8	-10.1	-3.7	093	1.7	1.8	075	4.4	E	66	-10.9	****	2211	15
16	1.8	-2.7	-.4	092	1.8	2.1	095	5.7	ENE	61	-11.5	****	2150	16
17	5.5	-1.6	2.0	131	1.0	1.4	100	7.0	S	46	-8.4	****	1783	17
18	9.2	-.7	4.3	122	1.1	1.4	106	7.0	S	34	-9.9	****	2308	18
19	2.6	-4.5	-1.0	189	.2	1.1	131	4.4	ESE	83	-2.1	****	1563	19
20	5.1	-8.1	-1.5	103	1.6	1.8	106	6.3	ESE	54	-26.7	****	3278	20
21	2.9	-10.2	-3.7	104	1.9	2.0	110	7.0	ESE	55	-12.3	****	2978	21
22	.7	-8.3	-3.8	113	1.6	2.2	098	7.6	SSE	48	-12.8	****	3063	22
23	2.8	-8.7	-3.0	129	1.5	1.7	109	5.7	SE	66	-7.7	****	2615	23
24	4.2	-5.0	-.4	117	1.4	1.6	102	5.7	ESE	66	-6.0	****	2988	24
25	5.3	-9.4	-2.0	104	1.6	1.9	071	4.4	E	68	-8.0	****	3463	25
26	4.3	-2.0	1.2	102	.8	1.4	048	5.7	S	62	-5.1	****	2128	26
27	2.7	-2.4	.1	281	.3	.8	286	3.8	WNW	87	-1.6	****	1510	27
28	4.0	-4.9	-.4	088	.7	1.3	083	3.2	NE	69	-6.4	****	2475	28
29	3.4	-9.5	-3.1	113	1.6	1.9	075	5.1	SE	64	-9.2	****	3615	29
30	4.2	-9.6	-2.7	101	.8	1.6	074	4.4	ENE	61	-9.8	****	3635	30
31	2.1	-7.5	-2.7	113	.7	1.3	080	4.4	E	57	-9.8	0.0	2405	31
MONTH	9.2	-14.8	-1.8	112	1.2	1.6	074	8.9	ESE	63	-9.0	0.0	63510	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.6
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 5.1

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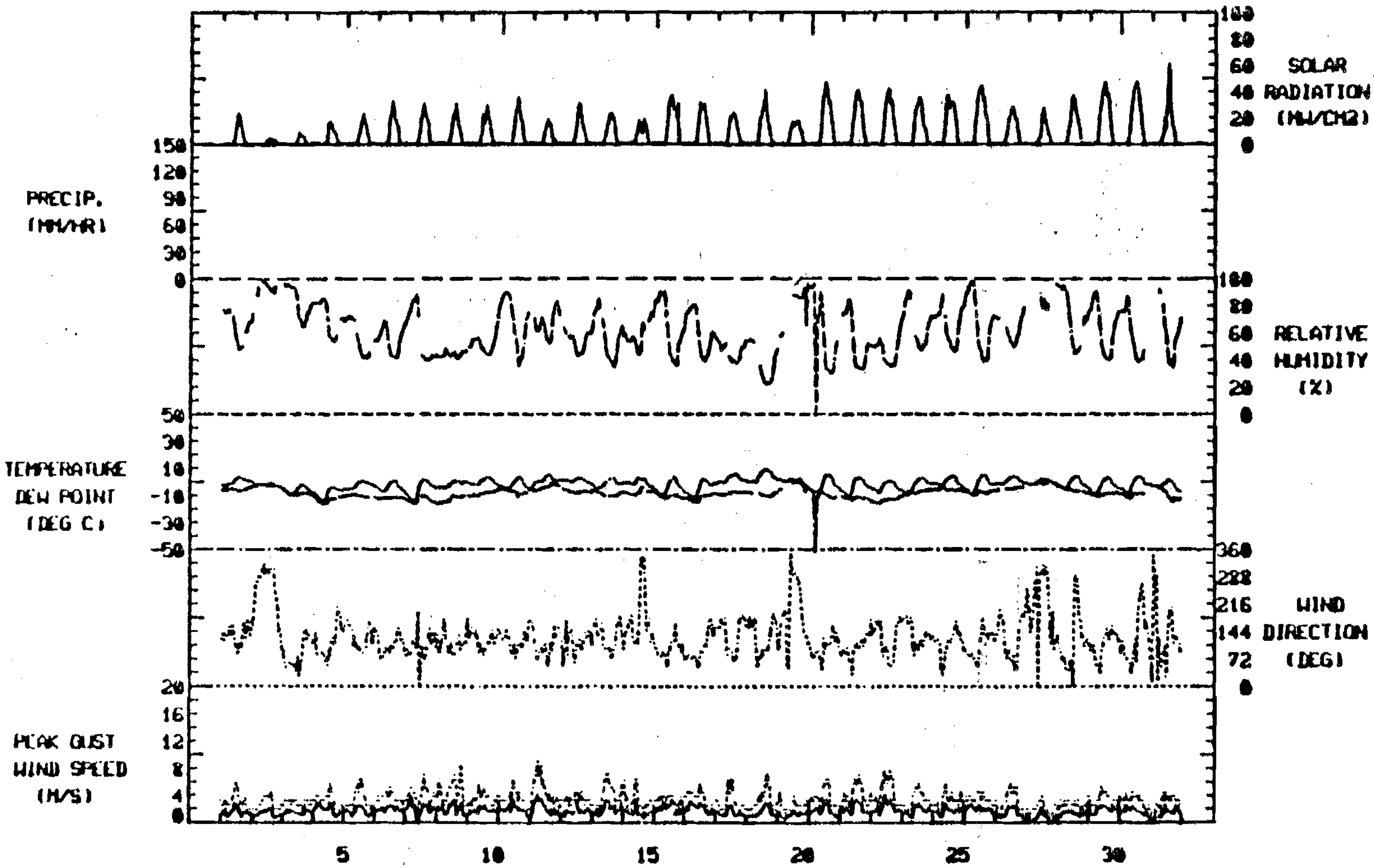
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DEVIL CANYON WEATHER STATION

DATA START: 01 MARCH , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING APRIL , 1981

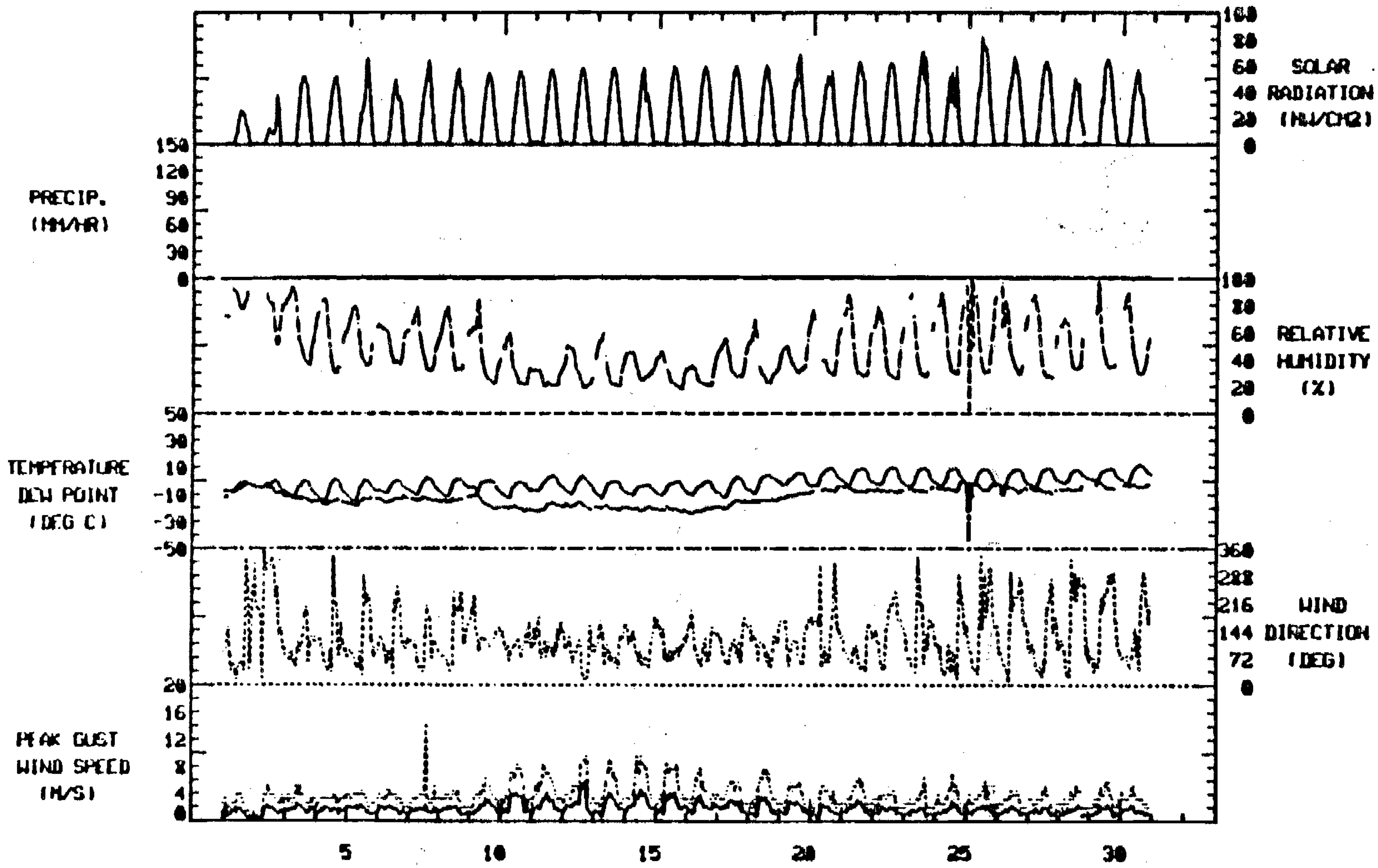
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	-.8	-7.8	-4.3	056	.8	1.0	039	3.8	NE	82	-6.3	0.0	2000	01
02	.6	-9.2	-4.3	301	.4	1.2	314	5.1	NW	74	-7.5	.8	1715	02
03	.5	-11.8	-5.6	102	1.3	1.7	084	5.7	ENE	63	-13.0	0.0	4214	03
04	1.1	-15.2	-7.1	093	.8	1.4	059	3.8	SE	55	-15.6	.4	4131	04
05	1.5	-15.1	-6.8	075	.8	1.6	029	4.4	E	57	-14.2	0.0	4002	05
06	.6	-9.5	-4.4	110	.9	1.6	097	4.4	ESE	52	-13.9	0.0	3597	06
07	2.6	-10.9	-4.1	096	1.0	1.5	***	13.9	E	51	-13.7	0.0	4302	07
08	1.7	-11.9	-5.1	110	.6	1.5	201	4.4	ENE	53	-13.6	0.0	4088	08
09	.8	-10.3	-4.8	127	1.6	1.9	130	6.3	ESE	40	-18.0	0.0	4358	09
10	-.7	-13.1	-6.9	104	2.3	2.4	119	8.3	ESE	34	-19.9	0.0	4679	10
11	4.0	-8.5	-2.3	111	2.0	2.3	112	8.3	ESE	26	-18.8	0.0	4943	11
12	3.8	-9.8	-3.0	066	1.9	2.6	019	9.5	ESE	33	-18.4	0.0	4960	12
13	-.3	-13.4	-6.8	090	1.8	2.2	106	9.5	ESE	34	-19.5	0.0	4963	13
14	-2.9	-12.2	-7.6	088	2.1	2.7	101	9.5	ENE	34	-20.1	0.0	4463	14
15	-.6	-12.0	-6.3	095	2.2	2.5	064	8.3	ESE	29	-21.0	0.0	5190	15
16	.7	-10.5	-4.9	105	1.6	2.2	038	7.6	SE	29	-20.1	0.0	5205	16
17	2.9	-12.5	-4.8	102	1.8	2.1	094	5.7	ESE	40	-16.2	0.0	5225	17
18	4.5	-10.0	-2.8	099	1.6	1.9	102	7.6	ESE	34	-14.2	0.0	4983	18
19	6.5	-4.0	1.3	110	1.4	1.9	118	5.7	SSE	43	-10.3	0.0	5275	19
20	9.5	-4.9	2.3	113	.7	1.3	071	5.7	SSE	45	-7.4	0.0	4778	20
21	9.4	-3.2	3.1	080	1.5	1.9	029	6.3	ENE	51	-7.1	0.0	5538	21
22	10.1	-3.9	3.1	153	.7	1.5	254	4.4	SW	47	-7.6	0.0	5573	22
23	9.8	-4.8	2.5	104	.4	1.2	099	6.3	NE	47	-7.0	0.0	5658	23
24	9.6	-3.7	3.0	068	.8	1.5	110	7.0	NE	59	-5.3	0.0	4385	24
25	9.4	-2.6	3.4	033	.1	1.5	203	5.7	NE	54	-5.1	0.0	6703	25
26	8.6	-4.1	2.3	196	.3	1.4	200	4.4	SSE	53	-5.9	0.0	5935	26
27	9.4	-4.7	2.3	089	.5	1.3	210	5.1	NE	52	-7.4	0.0	5690	27
28	8.4	-1.8	3.3	289	.2	1.3	252	5.1	ESE	51	-5.3	0.0	3972	28
29	9.2	.4	4.8	256	.3	1.4	241	5.7	ENE	53	-5.2	0.0	5795	29
30	12.3	-1.6	5.3	096	.6	1.5	117	5.1	ENE	54	-3.6	0.0	4833	30
MONTH	12.3	-15.2	-1.8	098	1.0	1.7	***	13.9	ESE	48	-12.0	1.2	141149	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.8
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 3.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01 APRIL , 1981

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING MAY , 1981

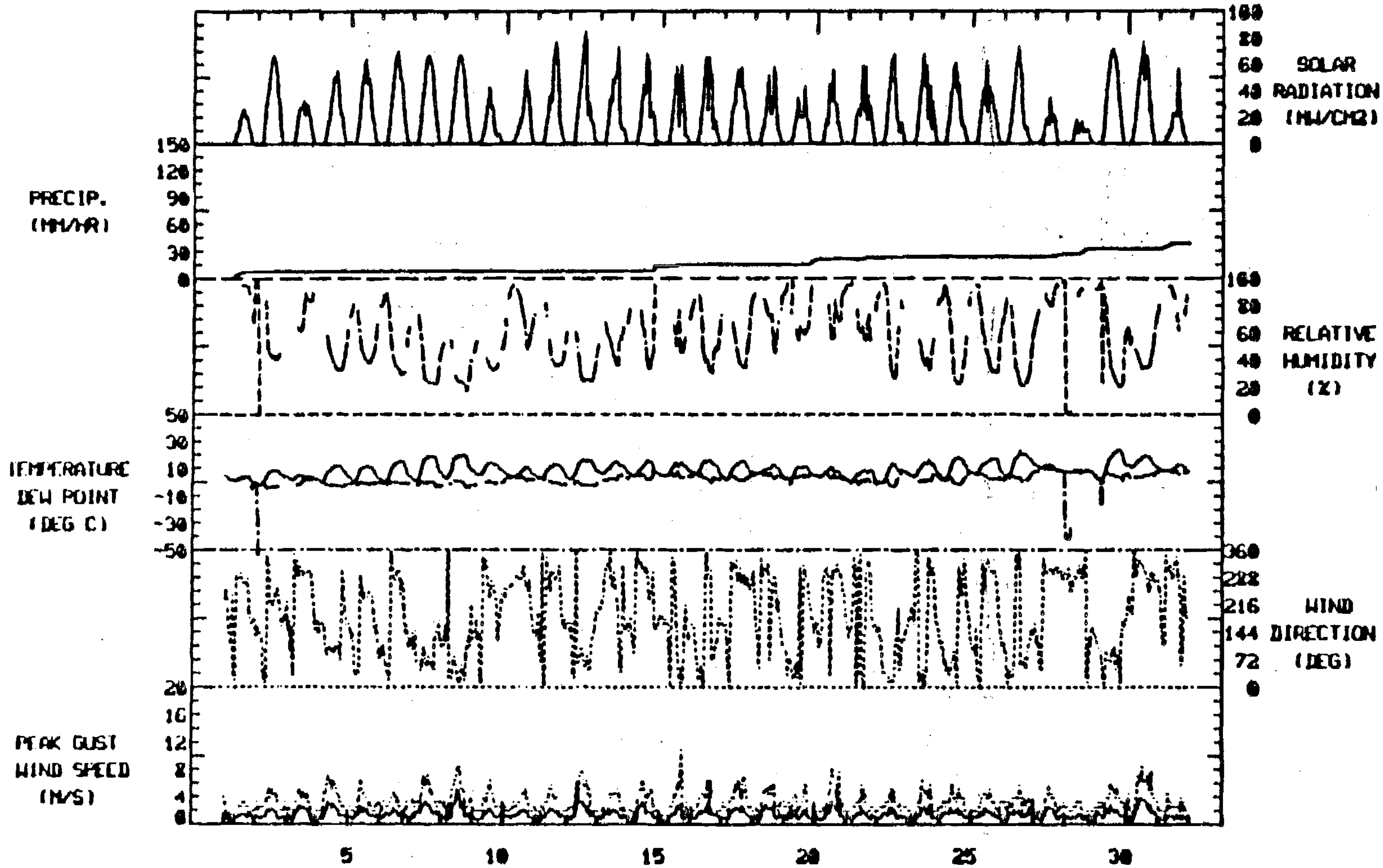
DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	5.6	-.6	2.5	244	.5	.9	243	3.8	W	79	1.6	7.6	2170	01
02	8.9	-2.8	3.0	218	.6	1.3	213	5.1	WSW	50	-3.5	0.0	5995	02
03	5.1	1.0	3.1	300	1.0	1.4	309	5.1	WNW	76	-.2	.4	3210	03
04	12.4	-.8	5.8	113	1.3	1.7	113	7.0	E	46	-2.8	0.0	4504	04
05	12.1	.1	6.1	224	.5	1.4	269	7.0	WSW	53	-1.6	0.0	5200	05
06	15.3	-.8	7.3	353	.3	1.3	306	4.4	W	53	-1.7	0.0	6120	06
07	19.2	-.4	9.4	084	1.5	1.9	110	7.0	ENE	40	-2.5	0.0	6313	07
08	19.8	2.0	10.9	050	1.4	1.9	019	8.3	NNE	33	-3.0	0.0	6318	08
09	14.5	4.9	9.7	253	.5	1.2	288	6.3	WSW	41	-1.3	0.0	2733	09
10	11.7	3.8	7.6	271	1.0	1.3	***	5.1	W	74	2.4	.2	3308	10
11	13.6	2.2	7.0	288	.5	1.3	291	5.7	NW	49	-.9	0.0	5360	11
12	17.0	1.7	9.4	079	1.4	1.9	103	7.6	ENE	36	-2.9	0.0	5669	12
13	15.9	6.1	11.0	258	.5	1.3	227	5.1	SW	55	2.9	.4	4788	13
14	15.7	4.3	10.0	292	.7	1.5	314	6.3	NW	63	-15.5	4.8	4568	14
15	14.7	4.3	9.5	079	.3	1.2	027	10.8	S	63	3.2	1.6	4315	15
16	16.6	5.5	11.0	054	.4	1.5	301	6.3	S	55	2.4	.4	5103	16
17	16.7	1.8	9.3	292	1.0	1.5	242	7.0	NW	58	2.2	0.0	5218	17
18	13.3	4.0	8.6	292	.6	1.5	311	6.3	WNW	73	4.2	0.0	4198	18
19	12.5	2.3	7.4	033	.4	1.3	283	5.7	NE	73	3.9	4.6	3043	19
20	12.5	3.1	7.8	294	1.0	1.6	275	8.3	WNW	78	3.0	1.8	3688	20
21	9.4	-.2	4.6	009	.1	1.2	324	5.7	SSE	71	.1	1.4	4290	21
22	14.1	-.4	6.9	072	.6	1.3	027	5.7	NNE	63	.7	.8	4694	22
23	16.2	4.2	10.2	357	.4	1.3	045	6.3	S	53	1.3	0.0	5343	23
24	18.7	1.4	10.1	047	.5	1.5	086	5.7	ENE	55	1.3	0.0	4763	24
25	17.8	5.3	11.5	323	.6	1.4	301	5.1	WNW	54	3.1	0.0	4963	25
26	21.5	3.6	12.5	063	.8	1.4	044	5.7	NE	46	2.2	0.0	5390	26
27	13.9	8.1	11.0	302	.8	1.5	305	5.7	NW	85	1.1	3.2	2168	27
28	9.1	5.8	7.5	294	.5	.9	292	3.2	WNW	63	-3.9	5.6	1673	28
29	24.0	2.2	13.1	090	1.2	1.6	089	6.3	E	51	3.0	0.0	7168	29
30	19.7	10.1	14.9	299	1.8	2.2	317	8.3	NW	47	3.5	0.0	6728	30
31	13.7	7.3	10.5	285	.4	.9	293	4.4	WNW	82	7.0	6.2	2943	31
MONTH	24.0	-2.8	8.7	341	.2	1.4	027	10.8	WNW	59	.3	39.0	141937	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 7.0
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 7.6
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 7.0
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 5.1

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

**** SEE GENERAL NOTES AT THE BACK OF THE REPORT ****

R&M CONSULTANT, INC.   SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH   DEVIL CANYON WEATHER STATION

DATA START: 01   MAY   , 1981

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING JUNE , 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
01	17.7	3.7	10.7	021	.1	1.7	305	9.5	E	63	3.5	.4	5583	01
02	14.9	1.3	8.1	301	1.2	1.6	325	6.3	NW	52	1.7	0.0	5610	02
03	14.8	5.8	10.3	296	.6	1.3	180	5.1	SW	64	4.3	49.2	4653	03
04	14.1	5.0	9.6	304	.6	1.5	313	6.3	NW	64	3.6	.2	4775	04
05	9.9	3.9	6.9	293	.8	1.3	301	4.4	WNW	86	4.4	8.8	3053	05
06	14.9	3.9	9.4	294	.5	1.4	302	5.7	WNW	64	3.5	1.6	5288	06
07	13.9	5.5	9.7	301	1.4	1.8	322	6.3	NW	59	2.0	.2	6079	07
08	8.2	.3	4.3	304	1.2	1.6	313	7.0	NW	91	3.9	10.4	2445	08
09	9.4	.5	4.9	349	.5	1.2	315	5.1	NNE	82	3.1	5.4	4465	09
10	16.3	-.4	7.9	316	.4	1.5	315	5.7	NW	58	-1.0	0.0	7450	10
11	16.7	2.4	9.6	345	.9	2.0	013	7.0	NW	64	3.8	.4	5078	11
12	18.2	3.6	10.9	317	.9	1.8	302	6.3	NW	53	1.2	0.0	7455	12
13	21.8	3.0	12.4	284	.7	1.4	353	7.0	S	48	2.6	1.6	6078	13
14	18.6	4.2	11.4	321	.8	1.6	300	5.7	NW	48	1.7	0.0	5997	14
15	16.5	7.8	12.1	293	.9	1.3	357	10.8	WNW	78	7.7	5.6	4530	15
16	20.5	7.4	14.0	277	.7	1.5	300	6.3	WNW	67	7.3	2.6	5480	16
17	24.1	4.8	14.4	298	.9	1.6	327	8.9	WNW	49	3.5	0.0	7035	17
18	22.0	6.9	14.5	293	.8	1.7	043	12.7	WNW	65	7.5	1.2	5607	18
19	22.0	4.3	13.1	013	1.1	2.0	319	7.6	NNE	35	-5.7	0.0	7640	19
20	20.3	4.8	12.5	009	.2	1.5	187	6.3	NE	51	1.4	2.8	4712	20
21	11.2	8.9	10.1	237	.2	.6	260	2.5	SW	90	*****	3.6	1017	21
22	18.4	7.4	12.9	283	1.1	1.5	253	6.3	NW	64	6.7	1.8	5379	22
23	21.3	4.9	13.1	311	.8	1.6	318	7.6	WNW	59	4.6	.8	6205	23
24	18.7	6.0	12.4	304	1.0	1.7	328	8.3	NW	59	6.0	7.4	5600	24
25	17.2	8.9	13.1	305	1.7	1.9	318	7.0	NW	61	5.8	0.0	5943	25
26	10.9	7.1	9.0	268	1.6	1.7	281	6.3	WSW	91	6.4	6.8	585	26
27	8.0	6.0	7.0	269	1.5	1.6	285	6.3	W	94	5.8	5.6	815	27
28	8.7	4.5	6.6	000	.4	1.0	298	4.4	NNE	92	5.0	2.4	2008	28
29	7.4	1.0	4.2	175	.1	1.1	269	7.0	ESE	93	2.8	38.6	1625	29
30	9.7	.9	5.3	302	.5	1.4	317	6.3	WNW	76	2.3	9.0	4958	30
MONTH	24.1	-.4	10.0	302	.7	1.5	043	12.7	NW	67	3.6	166.4	143143	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 3.2
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 11.4
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 4.4
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 2.5

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEED ARE <1.0 METERS PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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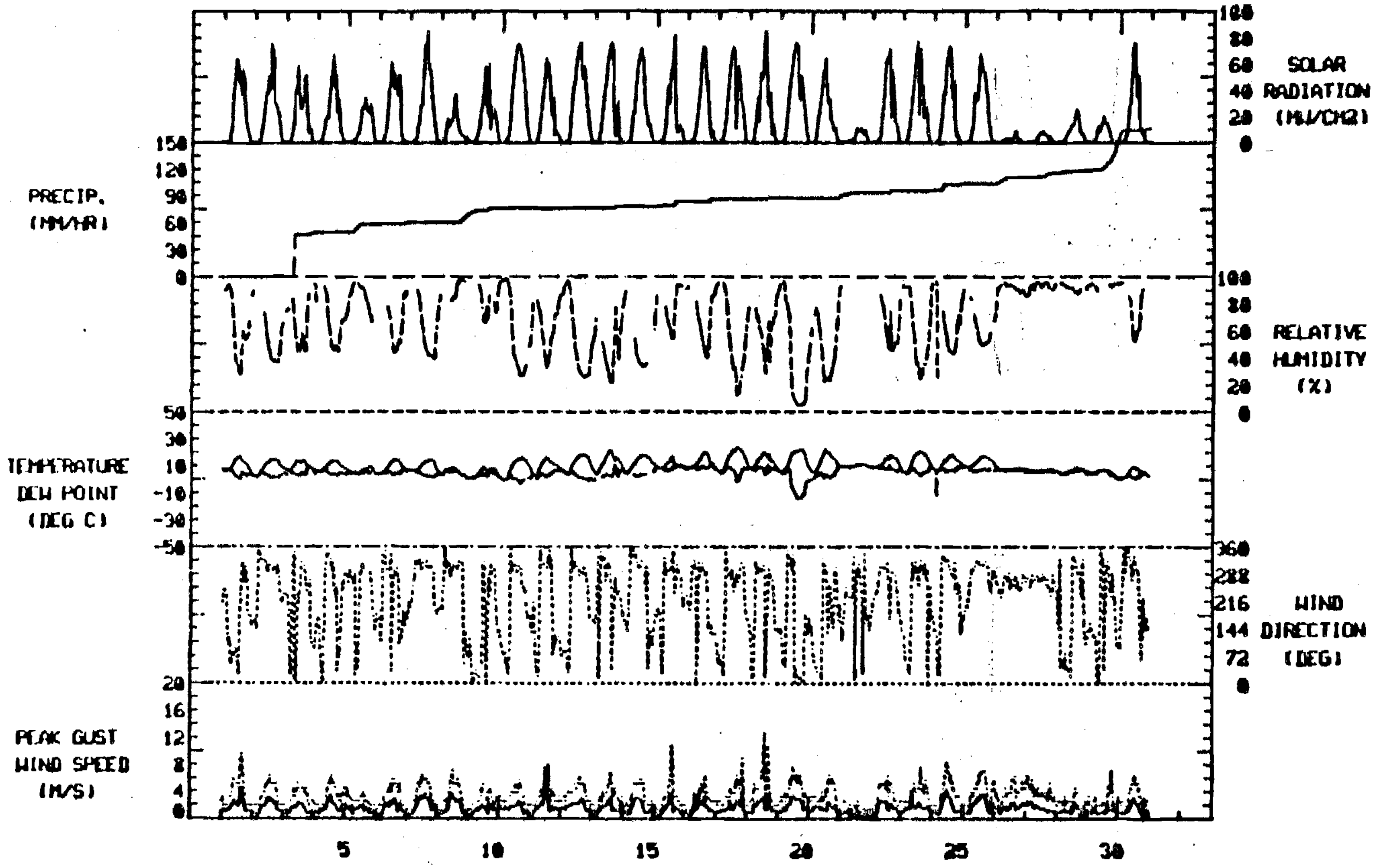
R&M CONSULTANT, INC. SUSITNA HYDROELECTRIC PROJECT



DAY OF THE MONTH DEVIL CANYON WEATHER STATION

DATA START: 01 JUNE , 1981

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

ONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
ATA TAKEN DURING July, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	14.5	2.6	8.6	046	.5	1.5	019	5.7	ENE	68	1.7	1.6	5898	1
2	15.0	1.1	8.1	010	.9	1.9	010	8.3	N	51	-2.7	0.0	5703	2
3	15.3	.3	7.8	015	.9	1.7	019	6.3	NNE	46	-3.9	0.0	5275	3
4	17.0	.2	8.6	300	.9	1.6	317	6.3	W	53	.8	0.0	4628	4
5	12.3	9.2	10.8	304	.8	1.2	312	4.4	NW	72	5.2	0.0	2270	5
6	15.3	.1	7.7	340	.2	.8	031	3.2	NNW	81	7.1	.8	3013	6
7	14.9	.6	7.8	269	1.3	2.1	252	10.2	W	80	6.6	17.2	2755	7
8	12.6	5.5	9.1	250	.3	1.3	302	6.3	WSW	91	7.7	1.0	760	8
9	11.0	.4	5.7	287	1.3	1.4	321	5.1	WNW	92	7.9	18.2	1105	9
10	12.0	8.4	10.2	013	.1	.8	127	3.8	W	68	9.3	25.6	1548	10
11	12.0	8.7	10.4	288	1.4	1.5	292	7.0	WNW	83	6.4	2.2	1575	11
12	13.2	3.4	8.3	272	.9	1.2	314	5.1	WNW	87	8.3	2.0	993	12
13	11.7	8.9	10.3	279	.8	1.0	299	5.1	WNW	90	8.7	2.6	1683	13
14	10.9	8.7	9.8	311	.8	1.2	307	4.4	NW	84	8.7	3.2	1438	14
15	12.8	.2	6.5	291	.7	.9	305	2.5	WNW	64	8.3	9.8	2885	15
16	15.2	1.0	8.1	290	.8	1.0	316	4.4	WNW	80	10.8	11.0	2695	16
17	17.4	11.3	14.4	303	1.1	1.4	311	5.1	NW	82	10.3	2.0	3810	17
18	14.6	1.5	8.1	294	1.0	1.3	305	5.7	WNW	87	8.8	1.0	1833	18
19	11.9	9.4	10.7	308	.8	1.0	336	4.4	NW	87	9.3	6.2	1660	19
20	11.3	9.8	10.6	303	1.0	1.1	308	3.8	WNW	88	9.0	8.8	1535	20
21	14.7	.4	7.6	293	.8	1.0	306	5.1	WNW	87	10.2	2.0	3050	21
22	15.4	1.0	8.2	297	.8	1.1	315	4.4	NW	83	10.1	2.8	2710	22
23	13.7	1.9	7.8	302	.4	.7	316	3.2	WNW	90	10.1	7.6	1840	23
24	19.9	10.2	15.1	035	.3	1.1	276	5.1	NNE	84	11.1	10.2	3273	24
25	14.7	9.5	12.1	323	.3	1.1	299	5.1	WNW	88	9.6	6.4	2290	25
26	17.0	4.0	10.5	290	.5	1.1	310	3.8	S	82	8.8	0.0	2775	26
27	15.9	1.0	8.5	304	.8	1.5	305	6.3	NW	77	8.1	0.0	3740	27
28	11.1	8.7	9.9	273	.6	.9	312	3.8	W	90	8.5	5.2	860	28
29	15.1	.4	7.8	283	.8	1.2	309	4.4	WNW	84	8.7	16.6	2695	29
30	14.4	0.0	7.2	293	.1	.7	032	2.5	NW	89	8.6	10.6	2428	30
31	13.9	9.0	11.5	279	.9	1.1	297	3.8	WNW	85	9.2	2.0	1705	31
MONTH	19.9	0.0	9.3	300	.6	1.2	252	10.2	WNW	80	7.5	176.6	80423	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 6.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 6.3
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 4.4

OTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

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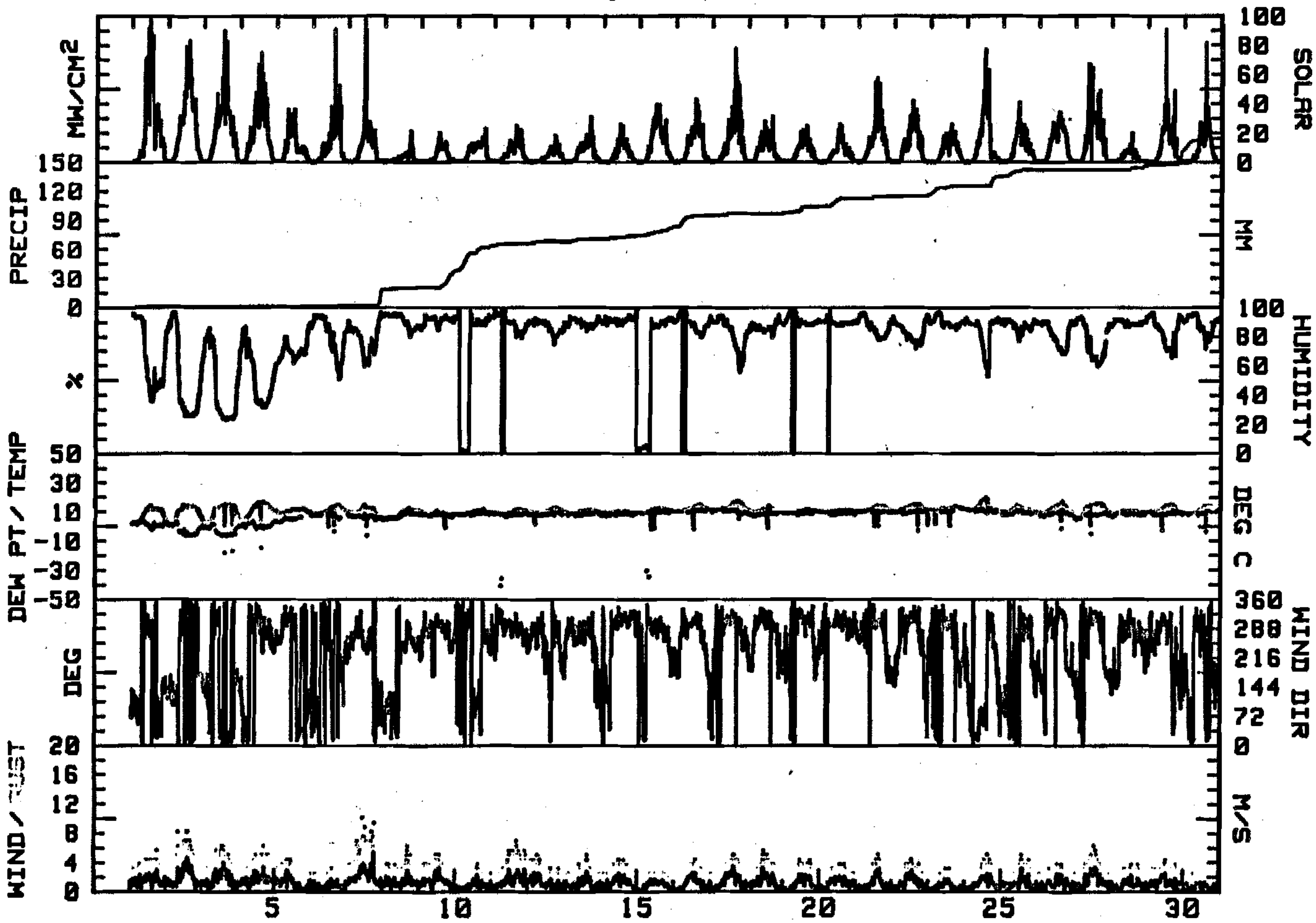
R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DEVIL CANYON WEATHER STATION

July, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
DATA TAKEN DURING August, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	12.2	1.0	6.6	291	.3	.8	092	3.2	WSW	92	9.5	32.2	913	1
2	14.4	9.0	11.7	053	.3	.9	137	3.2	NNE	84	8.8	10.2	3083	2
3	20.9	1.0	11.0	065	.1	1.1	156	5.1	SSE	70	6.0	0.0	4983	3
4	21.9	.3	11.1	106	1.6	1.9	098	57.0	ESE	60	.7	0.0	6248	4
5	20.4	1.0	10.7	111	1.0	1.5	071	33.2	S	67	4.0	0.0	3875	5
6	19.0	1.0	10.0	098	.7	1.5	067	10.8	ESE	86	7.3	.8	3439	6
7	17.6	.3	9.0	118	1.1	1.6	112	7.0	ESE	89	7.1	12.8	2458	7
8	16.4	8.7	12.6	160	.5	1.3	260	5.7	SE	82	9.0	15.0	3525	8
9	18.0	1.0	9.5	298	.5	1.0	292	4.4	NNE	97	9.0	2.2	1834	9
10	13.5	1.3	7.4	291	.6	1.2	317	5.1	WNW	87	8.5	8.0	2313	10
11	12.2	6.5	9.4	290	.6	1.1	304	5.1	W	87	6.7	12.2	2173	11
12	8.7	.6	4.7	095	.6	1.0	120	3.2	ESE	90	5.1	7.2	1798	12
13	6.6	6.5	6.6	126	.8	.8	127	1.9	ESE	89	4.7	*****	144	13
14	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	14
15	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	15
16	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	16
17	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	17
18	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	18
19	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	19
20	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	20
21	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	21
22	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	22
23	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	23
24	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	24
25	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	25
26	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	26
27	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	27
28	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	28
29	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	29
30	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	30
31	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	31
MONTH	21.9	.3	9.2	107	.3	1.2	098	57.0	ESE	82	6.7	100.6	36784	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.1
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 5.7
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 4.4

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

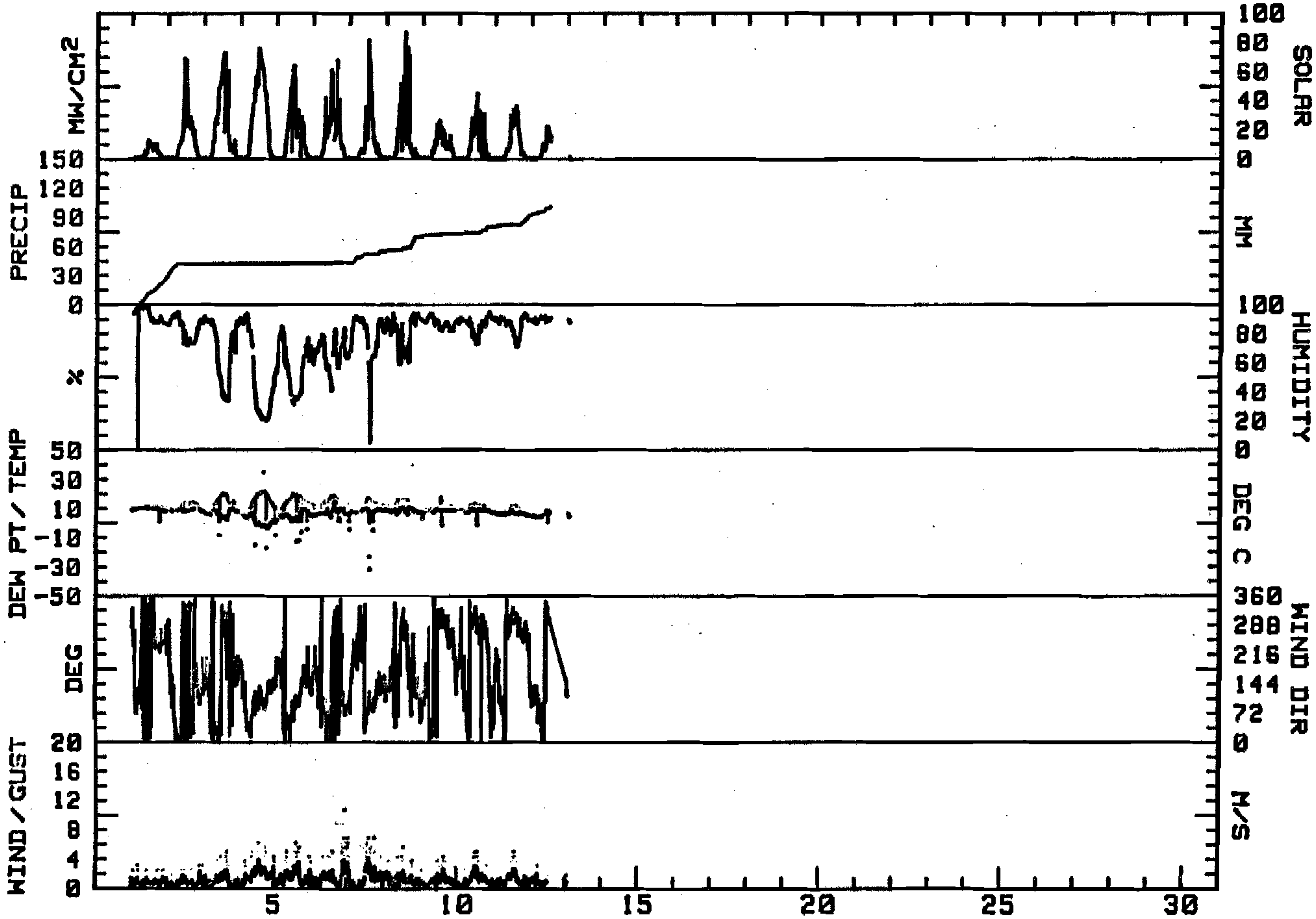
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DEVIL CANYON WEATHER STATION

August, 1981



R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

IONTHLY SUMMARY FOR DEVIL CANYON WEATHER STATION
)ATA TAKEN DURING September, 1981

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH %	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	1
2	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	2
3	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	3
4	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	4
5	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	5
6	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	6
7	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	7
8	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	8
9	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	9
10	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	10
11	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	11
12	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	12
13	*****	*****	*****	***	****	****	***	****	***	**	*****	*****	****	13
14	14.7	4.7	9.7	100	1.3	1.8	092	5.7	E	36	-5.0	0.0	2762	14
15	11.2	3.4	7.3	136	.6	1.0	035	3.8	S	78	3.1	4.6	1648	15
16	12.0	3.1	7.6	166	.2	1.0	270	4.4	E	72	1.6	.2	1865	16
17	15.3	4.0	9.7	077	.3	1.2	008	6.3	S	55	-3.1	0.0	3270	17
18	11.3	5.8	8.6	125	1.1	1.4	095	6.3	ESE	64	1.2	2.4	1643	18
19	8.9	3.8	6.4	160	.7	.9	195	3.2	SSE	89	4.9	8.6	870	19
20	8.7	.8	4.8	110	.9	1.2	248	5.7	ESE	85	2.5	4.2	1298	20
21	9.2	.2	4.7	055	.8	1.4	022	7.0	NNE	68	-2.3	.2	2148	21
22	8.5	-1.9	3.3	200	.5	1.0	287	3.8	SE	59	-5.2	0.0	2898	22
23	4.7	-.1	2.3	051	.5	.8	080	3.2	ENE	85	-1.4	3.6	990	23
24	2.9	-2.7	.1	126	.3	.6	118	3.2	SE	87	-3.5	7.4	798	24
25	5.2	-5.0	.1	111	.8	1.1	115	4.4	SE	64	-10.0	4.0	2223	25
26	1.6	-8.8	-3.6	102	1.5	1.8	091	4.4	ENE	61	-11.0	0.0	2808	26
27	.9	-9.4	-4.3	096	1.5	1.7	105	4.4	ESE	61	-10.9	0.0	2298	27
28	1.3	-7.9	-3.3	101	2.0	2.2	107	7.6	E	57	-10.0	0.0	2413	28
29	2.7	-3.8	-.6	110	2.0	2.3	103	9.5	ESE	43	-11.3	0.0	2513	29
30	7.2	-1.6	2.8	117	1.3	1.7	071	6.3	ESE	45	-7.5	3.2	2053	30
MONTH	15.3	-9.4	3.3	109	.8	1.3	103	9.5	ESE	66	-4.0	38.4	34492	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 8.3
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 8.9
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 7.6

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.

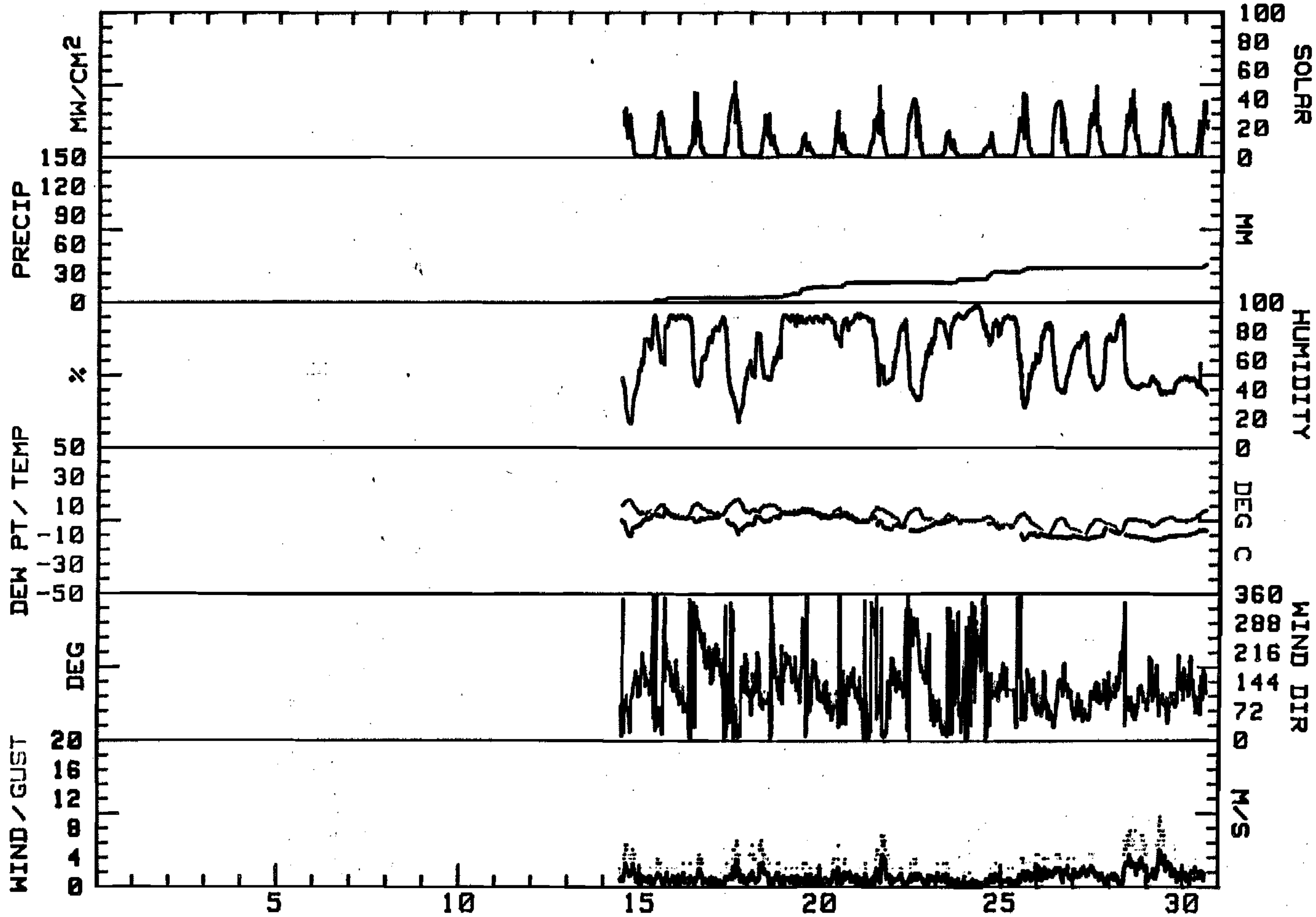
**** SEE NOTES AT THE BACK OF THIS REPORT ****

R&M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

DEVIL CANYON WEATHER STATION

September, 1981



ATTACHMENT E.6

WATANA ICE DETECTOR OBSERVATIONS (COUNTS)

TABLE E.6.1
SUSITNA HYDROELECTRIC PROJECT

Ice Detector - Watana Camp Site
Comparison of Ice Detector Counts and Recorded Camp Power Interruptions
April 20, 1981

Date	Number of Interruptions	Cumulative Since Reset	Ice Detector Counts (and Difference)	Comments
December 5, 1980	2*	2	0	Ice detector installed, 1:20 p.m.
December 6, 1980	0*	2		
December 7, 1980	1	3		
December 8, 1980	2*	5		
December 9, 1980	1	6		
December 10, 1980	0*	6		
December 11, 1980	2*	8		
December 12, 1980	3*	11		Generator problems
December 13, 1980	2*	13		Generator problems
December 14, 1980	3*	16		Generator problems
December 15, 1980	0*	16		
December 16, 1980	2	18		
December 17, 1980	1	19		
December 18, 1980	0	19		
December 19, 1980	0*	19		
December 20, 1980	2	21		
December 21, 1980	0	21		
December 22, 1980	4*	25		
December 23, 1980	1	26		
December 24, 1980	1	27		
December 25, 1980	1	28		
December 26, 1980	1	29		
December 27, 1980	1	30		
December 28, 1980	2	32		
December 29, 1980	2	34		
December 30, 1980	2*	36	41 (+5)	
December 31, 1980	0*	36		
January 1, 1981	2	38		
January 2, 1981	[illegible]*	[illegible]		

TABLE E.6.1 (continued)

SUSITNA HYDROELECTRIC PROJECT

Ice Detector - Watana Camp Site
Comparison of Ice Detector Counts and Recorded Camp Power Interruptions
April 20, 1981

Date	Number of Interruptions	Cumulative Since Reset	Ice Detector Counts (and Difference)	Comments
January 3, 1981	2*	40		
January 4, 1981	0*	40		
January 5, 1981	1	41		
January 6, 1981	1*	42		
January 7, 1981	0	42	52 (+10)	
January 8, 1981	1	43		
January 9, 1981	0	43		
January 10, 1981	8+*	51		Generator fuel problems
January 11, 1981	0	51		
January 12, 1981	0	51	72 (+21)	
January 13, 1981	0	51		
January 14, 1981	2	53		
January 15, 1981	0	53	74 (+21)	
January 16, 1981	0	53		
January 17, 1981	2	55		
January 18, 1981	1	56		
January 19, 1981	2	58		
January 20, 1981	2	60		
January 21, 1981	2	62		
January 22, 1981	2	64		
January 23, 1981	2	66		
January 24, 1981	2	68		
January 25, 1981	2	70		
January 26, 1981	2	72		
January 27, 1981	2	74		
January 28, 1981	2	76		
January 29, 1981	2	78		
January 30, 1981	2	80		
January 31, 1981	2	82		

TABLE E.6.1 (continued)

SUSITNA HYDROELECTRIC PROJECT

Ice Detector - Watana Camp Site
Comparison of Ice Detector Counts and Recorded Camp Power Interruptions
April 20, 1981

Date	Number of Interruptions	Cumulative Since Reset	Ice Detector Counts (and Difference)	Comments
February 1, 1981	2	84		
February 2, 1981	1*	85	114 (+29)	
February 3, 1981	1	86		
February 4, 1981	1	87	115 (+28)	
February 5, 1981	1	88		
February 6, 1981	1	89		
February 7, 1981	1	90		
February 8, 1981	1	91		
February 9, 1981	1	92		
February 10, 1981	1	93		
February 11, 1981	1*	94		
February 12, 1981	1	95		
February 13, 1981	1	96		
February 14, 1981	1	97		
February 15, 1981	1	98		
February 16, 1981	1	99		
February 17, 1981	1	100		
February 18, 1981	1	101		
February 19, 1981	0*	101		
February 20, 1981	5	106		
February 21, 1981	1	107	144 (+37)	Circuit breaker to ice detector off for unknown amount of time. Power turned back on and counter reset at '0'.
February 22, 1981	0*	0		
February 23, 1981	1	1		
February 24, 1981	0	1		
February 25, 1981	1	2		
February 26, 1981	0	2		
February 27, 1981	2	4		

TABLE E.6.1 (continued)

SUSITNA HYDROELECTRIC PROJECT

Ice Detector - Watana Camp Site
Comparison of Ice Detector Counts and Recorded Camp Power Interruptions
April 20, 1981

Date	Number of Interruptions	Cumulative Since Reset	Ice Detector Counts (and Difference)	Comments
February 28, 1981	1	5		
March 1, 1981	3	8		
March 2, 1981	0*	8		
March 3, 1981	1	9		
March 4, 1981	1	10	8 (-2)	
March 5, 1981	1	11		
March 6, 1981	0	11	9 (-2)	
March 7, 1981	1	12		
March 8, 1981	0	12		
March 9, 1981	1	13		
March 10, 1981	0	13		
March 11, 1981	1	14		
March 12, 1981	0	14		
March 13, 1981	0	14		
March 14, 1981	1	15		
March 15, 1981	0	15		
March 16, 1981	2	17	14 (-3)	
March 17, 1981	2	19	15 (-4)	
March 18, 1981	2	21		Counter apparently reset to zero somewhere between March 17 and March 24. Assumed reset date of March 19.
March 19, 1981	2	0	0 (0)	
March 20, 1981	2	2		
March 21, 1981	2	4		
March 22, 1981	2	6		
March 23, 1981	2	8		
March 24, 1981	2	10	16 (+6)	
March 25, 1981	2	12	16 (+4)	
March 26, 1981	1	13		

TABLE E.6.1 (continued)

SUSITNA HYDROELECTRIC PROJECT

Ice Detector - Watana Camp Site
Comparison of Ice Detector Counts and Recorded Camp Power Interruptions
April 20, 1981

Date	Number of Interruptions	Cumulative Since Reset	Ice Detector Counts (and Difference)	Comments
March 27, 1981	2	15	17 (+2)	
March 28, 1981	2	17		
March 29, 1981	2	19		
March 30, 1981	1	20		
March 31, 1981	1	21		
April 1, 1981	1	22	22 (0)	
April 2, 1981	1	23	23 (0)	
April 3, 1981	1	24		
April 4, 1981	1	25		
April 5, 1981	1	26		
April 6, 1981	1	27		
April 7, 1981	0	27		
April 8, 1981	1	28		
April 9, 1981	0	28		
April 10, 1981	1	29		
April 11, 1981	0	29		
April 12, 1981	1	30		
April 13, 1981	2	32		
April 14, 1981	1	33		
April 15, 1981	0	33		
April 16, 1981	1	34		
April 17, 1981			34 (0)	

* Estimated, since number of power shutoffs at camp either not logged in camp register or unable to determine number from camp notes.

ATTACHMENT E.7

SNOW SURVEY OBSERVATIONS BY SITE

TABLE E.7.1

SUSITNA HYDROELECTRIC PROJECT
SNOW SURVEY MARKERS INSTALLED BY R&M CONSULTANTS

1982 Sites	1981 Sites Abandoned for 1982
Butte Creek	
Butte Cr.	Moose
	Red Fox
West Fork Glacier	
Cirque	
Ice Cave	
West Fork Glacier	
Susitna Glacier	
Mt. Hayes	Crevasse
Caribou	Mt. Deborah
Malemute	Aurora Peak
East Fork Glacier	
Jatu Pass	
Pyramid	
East Fork @ 2850	
East Fork @ 3500 (new site for 1982)	
East Fork @ 5200 (new site for 1982)	
Clearwater Mountains	
Valdez Creek (new site for 1982)	
Boulder Creek (new site for 1982)	

TABLE E.7.2
SUMMARY OF SNOW SURVEY DATA COLLECTED BY R&M

Station	Elevation	Snow Depth on April 1, 1981 (inches)	Water Content on April 1, 1981 (inches)	Comments
Butte Creek Drainage				
Red Fox	2750	8(a)[1]	1.4(e)[2]	Poor location. Station abandoned for 1982.
Moose	2750	23(a)	4.1(e)	Poor location. Station abandoned for 1982.
Butte Cr.	3000	14(a)	2.8(e)	
West Fork Glacier				
Cirque	4700	43(a)	14.5(e)	
Ice Cave	4000	32(a)	10.0(e)	
West Fork Gl.	5050	95	33.1	Snow Course.
Susitna Glacier				
Crevasse	4100	19.5(a)	6.8(e)	Poor location. Station abandoned for 1982.
Mt. Hayes	4150	42	13.9	Snow course.
Caribou	4100	23(a)	8.0(e)	
Malemute	2600	18(a)	3.8(e)	
Mt. Deborah	4000	6(a)	-	Poor location. Station abandoned for 1982.
Aurora Peak	4400	0	0	Poor location. Station abandoned for 1982.
East Fork Glacier				
Jatu Pass	4500	65	21.9	Snow course.
Pyramid	4800	42(a)	14.7(e)	
East Fork @ 2850'	2850	17(a)	3.6(e)	Wind blown.
Climate Stations				
Devil Canyon	1500	29.7	7.0	Snow course.
Watana	2200	13	2.3	Wind blown. Snow course.
Kosina Cr.	2600	14.6	2.8	Snow course.
Tyone R.	2500	19.6	3.7	Snow course.
Denali	2700	5.9	1.6	Wind blown. Snow course

[1] '(a)' = aerial marker reading (also applies to following tables).

[2] '(e)' = estimated (also applies to following tables).

susi13/l

RED FOX (B-1)* TABLE E.7.3 SNOW SURVEY DATA BY SITE INDEX NO. 0818

ALASKA NO.

ELEVATION: 2750 REGION: Susitna

LAT. 63° 04' N LONG. 147° 40' W DRAINAGE: Butte Creek

YEAR	Jan			Feb			Mar			Apr			May			Depth Correc. Inches
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
81	1/7	8" a	1.1 e	2/2	5" a	0.8 e	3/6	13" a	2.3 e	4/1	8 a	1.4 e	4/30	6 a	1.7 e	0

* course exposed to wind — ABANDONED POOR LOCATION

MOOSE (B-2) TABLE E.7.3 (continued) INDEX NO. 5817

ALASKA NO. :

ELEVATION: 2750

REGION: Susitna

LAT. 63° 04' N LONG. 147° 41' W

DRAINAGE: Butte Creek

YEAR	Jan			Feb			Mar			Apr			May			Depth Correc Inches
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
1981	1-7	15"a	2.0e	2/2	16a	2.7e	3/6	24"a	4.1e	4/1	23a	4.1e	4/30	7a	2.0e	0

Abandoned - data from this location only needed for 1 year.

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BUTTE CREEK (B-3)

TABLE E.7.3 (continued)

INDEX NO. 0816

ALASKA NO. :

ELEVATION: 3000

REGION: Susitna

LAT. 63° 01' N

LONG. 147° 54' W

DRAINAGE: Butte Creek

YEAR	Jan.			Feb.			March			April			May			Depth Correc Inches
	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	
1981	1-7	15 a	2.0e	2-2	11a	2.0e	3-6	15 a	2.5e	4/1	14"a	2.8e	4/30	8a	2.0e	0
1982																

CIRQUE (W-1)

TABLE E.7.3 (continued)
ALASKA NO.

INDEX NO. 0802

ELEVATION: 4700'

REGION: Susitna

LAT. 63° 28' N LONG. 147° 27' W DRAINAGE: West fork Susitna R.

YEAR	Jan			Feb			Mar			Apr.			May			Depth Correc. Inches
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
1981	1-7	32"a	10.2e	2/2	32"a	10.5e	3/6	39"a	12.5e	4/2	43a	14.5e	4/30	39	15.0e	

ICE CAVE (ω-2) TABLE E.7.3 (continued) INDEX NO. 0803

ALASKA NO.

ELEVATION: 4000 REGION: Susitna

LAT. 63o 30' N LONG. 147o 125' W DRAINAGE: West Fork Susitna R.

YEAR	Jan			Feb			Mar			Apr.			May			Depth Correc Inches
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
1981	1/7	16.5 a	5.3 e	NO SURVEY			3/6	32.5" a	8.5 e	4/2	32 a	10.0 e	4/30	32.5 a	9.5 e	+1.5

Marker lost but reinstalled in same area but slightly more sheltered location.

WEST FORK GLACIER (ω-3) TABLE E.7.3 (continued) INDEX NO. 0804

ALASKA NO. :

ELEVATION: 5050 REGION: Susitna

LAT 63° 33' N LONG. 147° 10' W DRAINAGE: West Fork Susitna R.

YEAR	Jan			Feb			Mar			Apr			May			Depth Corre Inche
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
1981	1/7	53"	17"	2/3	93.7	31.4	3/6	94"	30.4	4/2	95	33.1	4/30	82.1	33.6	-1

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CREVASSE (5-1) TABLE E.7.3 (continued) INDEX NO. 0805.

ALASKA NO. :

ELEVATION: 4100 REGION: Susitna Glacier

LAT. 63° 32' N LONG. 147° 27' W DRAINAGE: Susitna River

YEAR	Jan	(inches)		Feb.	(inches)		March	(inches)		April	(inches)		May	(inches)		Depth Correc Inches
	DATE	SNOW DEPTH	WATER CONTENT	DATE	SNOW DEPTH	WATER CONTENT	DATE	SNOW DEPTH	WATER CONTENT	DATE	SNOW DEPTH	WATER CONTENT	DATE	SNOW DEPTH	WATER CONTENT	
1981	1/7	15 a	4.2 e	2/3	22 a	5.6 e	3/6	33" a	8.8 e	4/2	19.5 a	6.5 e	4/30	15 a	5.9 e	0

ABANDONED – POOR LOCATION -6/81

INDEX NO. 0806

MT. HAYES (S-2)

TABLE E.7.3 (continued)
ALASKA NO. :

ELEVATION: 4150'

REGION: Susitna Glacier

LAT. 63° 31'

LONG. 146° 54'

DRAINAGE: Susitna River

YEAR	Jan			Feb.			Mar.			Apr.			May			Depth Correc Inches
	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	
1981	1/7	23.5	6.6	2/3	39.8	10.2	3/6	46.5"	12.4	4/2	42	13.9	4/30	30.5	12.0	+2.5

CARIBOU (5-3)

TABLE E.7.3 (continued)

ALASKA NO.

INDEX NO. 0807.

ELEVATION: 4100'

REGION: Susitna Glacier

LAT. 63° 25' N

LONG. 147° 05' W

DRAINAGE: Susitna R.

YEAR	Jan DATE	Jan SNOW DEPTH (inches)	Jan WATER CONTENT (inches)	Feb DATE	Feb SNOW DEPTH (inches)	Feb WATER CONTENT (inches)	Mar DATE	Mar SNOW DEPTH (inches)	Mar WATER CONTENT (inches)	Apr. DATE	Apr. SNOW DEPTH (inches)	Apr. WATER CONTENT (inches)	May DATE	May SNOW DEPTH (inches)	May WATER CONTENT (inches)	Depth Correc Inches
1981	1/7	15 a	4.0e	NO SURVEY			3/6	21"a	6.5e	4/2	23a	8.0e	4/30	18a	6.5e	0

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MALEMUTE (S-4)

TABLE E.7.3 (conyinued)

ALASKA NO. :

INDEX NO. 0808

ELEVATION: 2600

REGION: Susitna Glacier

LAT. 63° 23' N LONG. 147° 11' W

DRAINAGE: Susitna R.

YEAR	Jan			Feb.			March			April			May			Depth Correc Inches
	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	
1981	1/7	13.5" 14a	2.0e	NO SURVEY			3/6	17.5 18a	3.4e	4/2	17.5 18a	3.8e	4/30	12.5		-2.5

MT. DEBORAH (s-5) *

TABLE E.7.3 (continued)

INDEX NO. 0809

ALASKA NO. :

ELEVATION: 4000'

REGION: Susitna Glacier

LAT. 63° 25' N

LONG. 147° 19' W

DRAINAGE: Susitna River

YEAR	Jan DATE	Jan (inches) SNOW DEPTH	Jan (inches) WATER CONTENT	Feb DATE	Feb (inches) SNOW DEPTH	Feb (inches) WATER CONTENT	Mar DATE	Mar (inches) SNOW DEPTH	Mar (inches) WATER CONTENT	Apr DATE	Apr (inches) SNOW DEPTH	Apr (inches) WATER CONTENT	May DATE	May (inches) SNOW DEPTH	May (inches) WATER CONTENT	Depth Correc Inche
1981	1/7	0" a	0" e	2/2	0" a	0" e	3/6	6" a	–	4/2	6 a	–	4/30	0 a	0 e	

* windblown - location to be changed - ABANDONED 6/81

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AURORA PEAK (s-6) * TABLE E.7.3 (continued) INDEX NO. 0810

ALASKA NO.

ELEVATION: 4400' REGION: Susitna Glacier

LAT. 63° 31' N LONG. 146' 50' W DRAINAGE: Susitna River

YEAR	Jan.			Feb.			Mar.			Apr.			May			Depth Correc Inches
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	
1981	1/7	0	0	2/3	0	0	3/6	0	0	4/2	0	0	4/30	0	0	+0.5

* Very windblown course - no snow near marker
location to be changed

COURSE ABANDONED

JATU PASS (E-3) INDEX NO. 0813

TABLE E.7.3 (continued)

ALASKA NO.

ELEVATION: 4500' REGION: East Fork Glacier

LAT. 63° 27' LONG. 146° 44' W DRAINAGE: East Fork Susitna R.

YEAR	Jan			Feb			March			April			May			
	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	Depth Correc Inches
1981	1/7	41	11.2	No Survey			3/6	42"	20.1	4/2	65	21.9	4/30	59.4	19.5	0

PYRAMID (E-1) TABLE E.7.3 (continued) INDEX NO. 08/2

ALASKA NO.

ELEVATION: 4800' REGION: East Fork Glacier

LAT. 63° 25' N LONG. 146° 53' W DRAINAGE: East Fork Susitna River

YEAR	Jan			Feb.			Mar.			Apr.			May			Depth Correc Inche
	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	
1981	1/7	23a	6.5e	2/2	24 a	9.0e	3/6	42" a	13.0e	4/2	42a	14.7e	4/30	35a	14.5e	+2

EAST FORK (E-2) * TABLE E.7.3 (continued) INDEX NUMBER 0811

ALASKA NO. :

ELEVATION: 2850' REGION: East Fork Glacier

LAT. 63° 24' N LONG. 146° 51' W DRAINAGE: East Fork Susitna River

YEAR	Jan DATE	Jan (inches) SNOW DEPTH	Jan (inches) WATER CONTENT	Feb DATE	Feb (inches) SNOW DEPTH	Feb (inches) WATER CONTENT	Mar. DATE	Mar. (inches) SNOW DEPTH	Mar. (inches) WATER CONTENT	Apr. DATE	Apr. (inches) SNOW DEPTH	Apr. (inches) WATER CONTENT	May DATE	May (inches) SNOW DEPTH	May (inches) WATER CONTENT	Depth Correc Inches
1981	1/7	9" corr. 12" obs.	2.5 1.6e	2/2	5"	1.0e	3/6	17"a	3.2e	4/2	17a	3.6e	4/30	9	3.0e	-3

*WINDBLOWN, marker not representative of area.

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DEVIL CANYON CLIMATE STATION

INDEX NO. 0835

TABLE E.7.3 (continued)

ALASKA NO. :

ELEVATION: 1350

REGION: SOUTHCENTRAL

LAT. 62°49'N

LONG. 149°18'W

DRAINAGE: SUSITNA

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)
1981	1/9	13	2.1	No Survey			3/5	29.1	6.1	3/31	29.7	7.0	4/30	21.0	5.1

WATANA CLIMATE STATION INDEX NO. 0834

TABLE E.7.3 (continued)

ALASKA NO. :

ELEVATION: 2200 FEET REGION: SOUTH CENTRAL

LAT. 62° 50' N LONG. 148° 24' W DRAINAGE: SUSITNA

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)
1981	1/9	7.4	1.5	2/2	8.3	1.6	No survey			4/2	13	2.3	4/30	0	0

KOSINA CREEK CLIMATE STATION TABLE E.7.3 (continued) INDEX NO. 0823

ALASKA NO. :

ELEVATION: 2600 FEET REGION: SOUTH CENTRAL

LAT. 62° 42' N LONG. 147° 59' W DRAINAGE: KOSINA CR.

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT	DATE	(inches) SNOW DEPTH	WATER CONTENT
1981	1/9	11.5	2.0	2/3	10.0	1.7	3/4	14.8	2.6	4/1	14.6	2.8	4/30	0	0

TYONE RIVER CLIMATE STATION INDEX NO. 0820

TABLE E.7.3 (continued) ALASKA NO.

ELEVATION: 2500 FEET REGION: SOUTHCENTRAL

LAT. 62° 40′ N LONG. 147° 06′ W DRAINAGE: TYONE RIVER

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT	DATE	(inches) SNOW DEPTH	(inches) WATER CONTENT
1981	1/8	13.4	1.3	2/3	18	2.6	3/4	18.1	3.0	4/1	19.6	3.7	4/30	0	0

Table: E.7.3 (continued) DENALI CLIMATE STATION INDEX NO. 0815

ALASKA NO.

ELEVATION: 2700 FEET REGION: SOUTH CENTRAL

LAT. 63°06′N LONG. 147°27′W DRAINAGE: SUSITNA

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)	DATE	SNOW DEPTH (inches)	WATER CONTENT (inches)
1981	1/7	10.3	2.3	2/3	5.7	1.5	NO SURVEY			4/1	5.9	1.6	4/30	0	

ATTACHMENT E.8

GLACIAL OBSERVATIONS

E.8 - Glacial Observations

All results of the 1981 Upper Susitna Glacier Study have been compiled and presented in a report prepared by Dr. William Harrison of the Geophysical Institute of the University of Alaska (Harrison, 1981). This report should be referred to for a complete discussion of field procedures and analytical results of glacier mass balance, glacier hydrology, volume changes, glacier sediment yield and glacier dynamics.

ATTACHMENT E.9

SNOW CREEP OBSERVATIONS

TABLE E.9.1

SNOW CREEP OBSERVATIONS

Date	Maximum Dynomometer Reading (lbs.)	Snow Depth (feet)	Comments
DEVIL CANYON SITE			
2-25-81	-	1.5	Installation date. Dyno reading 400 lbs.
3-5-81	515	2.5	
3-31-81	605	-	Last reading of season.
10-2-81	-	0.0	First visit of season Dyno reads 340 lbs.
11-3-81	400	1.0	
12-3-81	480	2.5	Dry snow, no ice layers or depth hoar.
TSUSENA BUTTE SITE (WATANA)			
2-26-81	-	2.5	Installation date. Dyno reading 440 lbs.
4-2-81	500	0.0	No snow around cylinder. Last reading of season.
10-2-81	-	0.5	First visit of season. Dyno reads 400 lbs.
11-3-81	480	0.5	Hard wind packed snow.
12-2-81	520	2.0	Dry snow. 8 inches of depth hoar. Ice crusts at 8 inches and at surface.

ATTACHMENT E.10

RIVER ICE OBSERVATIONS

susi11/k10

E.10 - <u>River Ice Observations</u>

River ice observations were made during 1980 and 1981 for the purpose of monitoring freezeup, winter, and breakup ice conditions. A large amount of data was collected on these processes and is contained in the report "Ice Observations" by R&M Consultants (R&M, 1981c). All of the data collected, including field notes and photos, are located at the offices of R&M Consultants.

The collection of freezeup observations is continuing into the winter of 1981-82.

ATTACHMENT E.11

EVAPORATION DATA

susi11/k11

TABLE E.11.1

EVAPORATION DATA COLLECTED AT WATANA CAMP, 1981

	May	June	July	August	September
1	-	.04	-	*	.14
2	-	.22	-	*	*
3	-	.16	-	*	.02
4	-	.10	.22	.17	*
5	-	.12	.20	.26	*
6	-	*	*	.24	*
7	Station Installed	.10	.10	.11	*
8	.02	.23	.20	*	*
9	.32	*	.08	*	*
10	.60	.08	.00	*	.42
11	.09	.23	.34	*	*
12	.14	.12	.02	*	*
13	.31	.22	.05	*	*
14	.13	.29	.03	*	*
15	.09	.22	.02	*	*
16	.27	.50	*	*	.28
17	.17	.20	*	*	.13
18	.17	.27	*	*	.14
19	.09	.18	*	*	*
20	.07	.29	*	*	.02
21	.11	.17	*	*	.01
22	.12	*	.30	*	Pan Frozen
23	.12	.15	.00	.00	"
24	.18	.16	.06	.11	"
25	.14	.23	.19	.09	"
26	.22	.28	*	.20	"
27	.19	*	.22	.19	"
28	.04	.25	.17	.00	"
29	.00	-	*	*	"
30	.27	-	*	*	"
31	.38		.00	.46	"
Total Evaporation	4.24	5.15[a]	2.44[2]	1.83	1.16
Mean Daily Evaporation	.18 (for 24 days)	.17	.08	.06	.06 (for 21 days)

All values are for 24-hour period ending at 0700 on date shown.

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* No pan observation on this date(s). Amount included in following measurement, time distribution unknown.

a Adjusted monthly value of evaporation. Total evaporation amount is divided by number of recorded days, multiplied by number of days in the month.

\- Missing data for this date.

ATTACHMENT F

SUMMARIES OF HISTORICAL DATA COLLECTED BY OTHER AGENCIES

s11/d9

susi11/m1

ATTACHMENT F
SUMMARIES OF HISTORICAL DATA COLLECTED BY OTHER AGENCIES

Contained herein are data summaries and some of the actual monthly values for several hydrologic parameters measured in the Susitna basin. These are summarized below.

General Parameter	Agency[1]	Site	Period Summarized
F.1 - Streamflow	(1) USGS	Susitna River near Denali	1957-1966, 1968-1980
	(2) USGS	Susitna River near Cantwell	1961-1972, 1980
	(3) USGS	Maclaren River near Paxson	1958-1980
	(4) USGS	Susitna River at Gold Creek	1949-1980
	(5) USGS	Chulitna River near Talkeetna	1958-1972, 1980
	(6) USGS	Talkeetna River near Talkeetna	1964-1980
	(7) USGS	Deception Creek near Willow	1978-1980
	(8) USGS	Willow Creek near Willow	1978-1980
	(9) USGS	Deshka River near Willow	1979-1980
	(10) USGS	Skwentna River near Skwentna	1960-1980
	(11) USGS	Susitna River at Susitna Station	1975-1980
F.2 - Water Quality	(1) USGS	Susitna River near Denali	1957-1961, 1968, 1976
	(2) USGS	Susitna River near Cantwell	1967-1970
	(3) USGS	Susitna River at Gold Creek	1949, 1950-53, 1954, 1955-57, 1958 1967-68, 1975, 1977, 1980-81
	(4) USGS	Susitna River at Sunshine	1975, 1977
	(5) USGS	Susitna River at Susitna Station	1955, 1970, 1975-1981
F.3 - Sediment Discharge	(1) USGS	Susitna River near Denali	1958-1966, 1968, 1974-1980
	(2) USGS	Maclaren River near Paxson	1958-1961, 1967-1968, 1975
	(3) USGS	Susitna River near Cantwell	1962-1972, 1980
	(4) USGS	Susitna River at Gold Creek	1952, 1953-56, 1957, 1962, 1967, 1974-80
	(5) USGS	Chulitna River near Talkeetna	1967-1972, 1980
	(6) USGS	Talkeetna River near Talkeetna	1966-1980
	(7) USGS	Susitna River at Susitna Station	1975-1980

General Parameter	Agency[1]	Site	Period Summarized
F.4 - Climate	(1) NOAA	McKinley Park	1925-1980
	(2) NOAA	Summit	1941-1980
	(3) NOAA	The Gracious House	1960-1978 (summers)
	(4) NOAA	Gulkana	1943-1980
	(5) NOAA	Talkeetna	1941-1980
	(6) NOAA	Matanuska	1917-1980
	(7) NOAA	Anchorage	1943-1980
F.5 - Snow Surveys	SCS	23 sites - See Table F.5.1	Various
F.6 - Ice Thicknesses	USGS[2]	13 sites - See Table F.6.1	Various
F.7 - Evaporation	(1) NOAA	McKinley Park	1967-1973, 1977-1981 (June-Aug.)
	(2) NOAA	Matanuska	1951-1981 (May-Sept.)

1 Agency abbreviations:

USGS - U.S. Geological Survey
NOAA - U.S. National Oceanic and Atmospheric Administration
SCS - U.S. Soil Conservation Service

2 Ice thickness data were collected by USGS and compiled by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL). Table F.6.1 was reproduced from Bilello, Michael A., "A Winter Environmental Data Survey of the Drainage Basin of the Upper Susitna River, Alaska". U.S. Army CRREL, Hanover, New Hampshire, Special Report 80-19, April 1980.

F.1 - STREAMFLOW

15291000 SUSITNA RIVER NEAR DENALI
Table F.1.1

LOCATION - Lat 63°06'14", long 147°30'57", in NE¼ sec. 10, T.21 S., R.1 E., Matanuska-Susitna Borough, on upstream right pier of bridge on Denali Highway, 0.2 mi (0.3 km) downstream from Windy Creek, 3.3 mi (5.3 km) upstream from Butte Creek, and 5.3 mi (8.5 km) southwest of Denali.

BASIN CHARACTERISTICS - Drainage area, 950 mi^2 (2,460 km^2); main-channel slope, 56.6 ft/mi (10.7 m/km); stream length, 51 mi (82 km); area of lakes and ponds, 1 percent; mean elevation, 4,510 ft (1,370 km); glacier area, 25 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - May 1957 to September 1966, July 1968 to present.

GAGE - Water-stage recorder. Altitude of gage is 2,440 ft (744 m), from topographic map. Prior to May 27, 1965, water-stage recorder at site 1.9 mi (3.1 km) downstream at different datum. May 27, 1965 to September 30, 1966, nonrecording gage near right downstream end of bridge and July 4, 1968 to August 28, 1974, water-stage recorder on left upstream wingwall, at present datum.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1957									12210	11170	9769	4017	
1958	1277	610	288	219	150	120	210	1163	8367	9150	6536	1879	2514
1959	939	390	170	119	81.0	41.7	43.0	1782	8891	8333	7882	2498	2614
1960	1577	760	575	444	321	275	265	3349	5237	9039	7910	4817	2896
1961	1781	660	483	331	271	281	415	2959	6412	8078	7253	2695	2655
1962	1290	680	440	280	240	220	280	2197	9087	10220	9454	3649	3191
1963	1079	510	310	250	230	200	210	3253	6763	10500	10210	3949	3148
1964	925	290	185	140	140	110	130	910	11630	7577	6552	2633	2604
1965	1468	702	279	220	200	208	320	2464	4647	6756	5764	6955	2510
1966	920	300	240	210	200	200	280	1629	6850	8287	6432	3200	2411
1968										11840	9825	2192	
1969	700	304	172	145	140	145	229	1768	8146	9445	3919	2213	2290
1970	1002	501	339	265	221	193	319	2210	5013	8454	6216	1946	2243
1971	528	395	276	170	125	120	135	629	8099	10410	10400	3288	2903
1972	1039	478	380	339	307	286	270	3468	6562	10450	8664	2778	2937
1973	667	323	211	178	164	153	153	1042	5741	8346	7268	2445	2242
1974	876	462	366	310	271	235	262	2541	5642	9547	9292	5452	2960
1975	2135	673	381	300	200	200	200	1640	7040	12100	7295	3571	3003

TABLE F.1.1 (continued)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1976	1539	375	169	112	97.2	90.0	123	1805	5939	8558	10080	1822	2578
1977	894	467	331	266	240	231	246	1498	8253	10010	10180	3707	3048
1978	1148	652	439	348	300	246	263	2031	5250	8993	8644	3622	2683
1979	865	463	312	263	229	203	250	2791	7650	9504	9178	4512	3039
1980	2165	878	533	395	330	290	280	1889	6413	11750	7167	2643	2912
Mean	1182	518	328	253	212	193	233	2048	7266	9501	8082	3325	2732

1529150 SUSITNA RIVER NEAR CANTWELL
Table F.1.2

LOCATION - Lat 62°41'57", long 147°32'40", Matanuska-Susitna Borough, on right bank at lower end of gorge, 1.1 mi (1.8 km) downstream from small tributary, 13 mi (21 km) upstream from Jay Creek, and 65 mi (105 km) southeast of Cantwell.

BASIN CHARACTERISTICS - Drainage area, 4,140 mi^2 (10,720 km^2); main-channel slope, 10.0 ft/mi (1.89 m/km); stream length, 107 mi (172 km); area of lakes and ponds, 2 percent; mean elevation, 3,560 ft (1,090 m); glacier area, 7 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - May 1961 to September 1972, July 1980 to present.

GAGE - Water-stage recorder. Altitude of gage is 1,900 ft (580 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1961								9688	15710	14820	16700	6725	
1962	3281	1800	1400	1300	1000	940	1200	10000	28320	20890	16000	9410	7995
1963	4326	2200	1400	1000	850	760	720	11340	15000	22790	18190	9187	7372
1964	3848	1300	877	644	586	429	465	2806	34630	17040	11510	5352	6615
1965	3134	1911	921	760	680	709	1097	8818	16430	18350	13440	12910	6629
1966	3116	1000	750	700	650	650	875	4387	18500	12220	12680	6523	5190
1967	2322	780	720	680	640	560	513	9452	19620	16880	19190	10280	6843
1968	3084	1490	1332	1232	1200	1200	1223	9268	19500	17480	10940	5410	6131
1969	2406	1063	618	508	485	548	998	7471	12330	13510	6597	3376	4186
1970	1638	815	543	437	426	463	887	7580	9909	13900	12320	5211	4548
1971	2155	1530	1048	731	503	470	529	1915	21970	18130	22710	9800	6824
1972	4058	2050	1371	1068	922	881	876	9694	20000	16690	15620	9423	6907
1980									17370	20460	14870	8570	
Mean	3033	1449	998	824	722	692	853	7701	19176	17165	14676	7859	6295

15291200 MACLAREN RIVER NEAR PAXSON
Table F.1.3

LOCATION - Lat 63°07'10", long 146°31'45", Matanuska-Susitna Borough, near left bank on downstream side of bridge on Denali Highway, 1.5 mi (2.4 km) downstream from Boulder Creek, and 34 mi (55 km) west of Paxson.

BASIN CHARACTERISTICS - Drainage area, 280 mi^2 (730 km^2); main-channel slope, 133 ft/mi (25.2 m/km); stream length, 23 mi (37 km); area of lakes and ponds, 1 percent; mean elevation, 4,520 ft (1,380 m); glacier area, 19 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - June 1958 to present.

GAGE - Water-stage recorder. Datum of gage is 2,865.84 ft (873.508 m) above mean sea level (Alaska Department of Public Works bench mark). Prior to September 20, 1961, at site 1,200 ft (400 m) downstream at same datum. September 20, 1961 to June 7, 1964, at present site and datum; June 8, 1964 to August 22, 1968, nonrecording gage at present site and datum.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1958									3532	3525	2699	784	
1959	378	115	123	129	95.4	62.5	77.5	587	2879	2680	2083	856	843
1960	549	250	190	150	110	94.3	91.5	1742	2124	3359	3048	2439	1184
1961	687	195	149	110	93.9	96.0	145	1237	2678	3369	3299	1168	1111
1962	381	210	170	120	100	92.0	120	632	2916	3265	2927	1127	1011
1963	383	210	130	100	91.0	80.0	83.0	2131	3110	4649	3136	1213	1287
1964	416	140	98.0	85.0	88.0	71.0	72.0	386	4297	2764	2224	871	960
1965	379	147	49.3	44.0	42.0	41.0	62.0	984	2268	3223	2409	2098	985
1966	522	180	55.0	45.0	45.0	43.0	50.0	265	2990	2505	2095	954	816
1967	369	95.0	70.0	65.0	60.0	55.0	53.3	1023	3634	3255	3605	1416	1149
1968	417	130	100	97.4	95.0	95.0	95.0	208	3245	3427	2129	680	896
1969	265	121	68.5	58.2	55.0	57.6	95.3	849	2613	2692	974	470	697
1970	249	117	73.2	59.4	50.4	52.7	69.2	746	1751	2441	2367	773	735
1971	301	192	131	83.4	60.4	55.0	66.0	365	3414	3528	3659	1165	1092
1972	375	156	123	115	107	97.4	98.5	1218	3069	3255	2676	1366	1059
1973	550	243	136	87.4	65.2	53.4	51.2	576	2906	2856	2271	821	890
1974	307	123	82.6	68.5	61.8	56.6	56.7	649	2069	2634	2439	1543	846
1975	385	232	140	115	110	100	103	768	3178	3649	1982	1574	1033
1976	553	235	139	106	94.1	90.0	105	781	2870	2810	2604	600	920

TABLE F.1.3 (continued)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1977	302	168	119	97.3	92.0	90.0	92.9	366	3942	3834	3394	1297	1156
1978	512	265	186	162	140	121	134	709	2317	3196	2356	924	925
1979	307	192	142	122	110	100	111	634	2430	3056	2223	1137	886
1980	734	370	246	160	106	81.8	80.5	901	2516	3534	2471	917	1015
Mean	424	186	124	99	85.1	76.6	86.9	807	2902	3196	2568	1139	977

1529200 SUSITNA RIVER AT GOLD CREEK
Table F.1.4

LOCATION - Lat 62°46'04", long 149°41'28", in NW¼ sec. 20, T.31 N., R.2 W., Matanuska-Susitna Borough, near left bank under Alaska Railroad bridge, 0.1 mi (0.2 km) downstream from Gold creek, 0.9 mi (1.4 km) north of Gold Creek railroad station, and 2.0 mi (3.2 km) downstream from Indian River.

BASIN CHARACTERISTICS - Drainage area, 6,160 mi^2 (15,950 km^2); main-channel slope, 10.2 ft/mi (1.93 m/km); stream length, 189 mi (304 km); area of lakes and ponds, 1 percent; mean elevation, 3,420 ft (1,040 m); glacier area, 5 percent.

PERIOD OF RECORD - August 1949 to present.

GAGE - Water stage recorder. Datum of gage is 676.50 ft (206.197 m) above mean sea level. Prior to June 6, 1957, nonrecording gage at same site and datum. June 7, 1957 to June 2, 1964, water-stage recorder at site 0.3 mi (0.5 km) upstream at same datum.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1949											24250	15650	
1950	6335	2583	1439	1027	788	726	870	11510	19600	22600	19880	8301	8032
1951	3848	1300	1100	960	820	740	1617	14090	20790	22570	19670	21240	9106
1952	5571	2744	1900	1600	1000	880	920	5419	32370	26390	20920	14480	9529
1953	8202	3497	1700	1100	820	820	1615	19270	27320	20200	20610	15270	10090
1954	5604	2100	1500	1300	1000	780	1235	17280	25250	20360	26100	12920	9681
1955	5370	2760	2045	1794	1400	1100	1200	9319	29860	27560	25750	14290	10260
1956	4951	1900	1300	980	970	940	950	17660	33340	31090	24530	18330	11450
1957	5806	3050	2142	1700	1500	1200	1200	13750	30160	23310	20540	19800	10380
1958	8212	3954	3264	1965	1307	1148	1533	12900	25700	22880	22540	7550	9476
1959	4811	2150	1513	1448	1307	980	1250	15990	23320	25000	31180	16920	10560
1960	6558	2850	2200	1845	1452	1197	1300	15780	15530	22980	23590	20510	9690
1961	7794	3000	2694	2452	1754	1810	2650	17360	29450	24570	22100	13370	10810
1962	5916	2700	2100	1900	1500	1400	1700	12590	43270	25850	23550	15890	11570
1963	6723	2800	2000	1600	1500	1000	830	19030	26000	34400	23670	12320	11070
1964	6449	2250	1494	1048	966	713	745	4307	50580	23950	16440	9571	9774
1965	6291	2799	1211	960	860	900	1360	12990	25720	27840	21120	19350	10170
1966	7205	2098	1631	1400	1300	1300	1775	9645	32950	19860	21830	11750	9432

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TABLE F.1.4 (continued)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1967	4163	1600	1500	1500	1400	1200	1167	15480	29510	26800	32620	16870	11220
1968	4900	2353	2055	1981	1900	1900	1910	16180	31550	26420	17170	8816	9789
1969	3822	1630	882	724	723	816	1510	11050	15500	16100	8879	5093	5597
1970	3124	1215	866	824	768	776	1080	11380	18630	22660	19980	9121	7591
1971	5288	3407	2290	1442	1036	950	1082	3745	32930	23950	31910	14440	10250
1972	5847	3093	2510	2239	2028	1823	1710	21890	34430	22770	19290	12400	10860
1973	4826	2253	1465	1200	1200	1000	1027	8235	27800	18250	20290	9074	8087
1974	3733	1523	1034	874	777	724	992	16180	17870	18800	16220	12250	7630
1975	3739	1700	1603	1516	1471	1400	1593	15350	32310	27720	18090	16310	10280
1976	7739	1993	1081	974	950	900	1373	12620	24380	18940	19800	6881	8169
1977	3874	2650	2403	1829	1618	1500	1680	12680	37970	22870	19240	12640	10110
1978	7571	3525	2589	2029	1668	1605	1702	11950	19050	21020	16390	8607	8194
1979	4907	2535	1681	1397	1286	1200	1450	13870	24690	28880	20460	10770	10720
1980	7311	4192	2416	1748	1466	1400	1670	12060	29080	32660	20960	13280	
Mean	5693	2523	1794	2062	1243	1123	1377	13277	27970	24133	21547	13249	9647

15292400 CHULITNA RIVER NEAR TALKEETNA
Table F.1.5

LOCATION - Lat 62°33'31", long 150°14'02", in SE¼ sec. 32, T.29 N., R.5 W., Matanuska-Susitna Borough, on right bank 0.5 mi (0.8 km) downstream from Anchorage-Fairbanks Highway crossing, 4.5 mi (7.2 km) downstream from Troublesome Creek, 16 mi (26 km) northwest of Talkeetna, and 18 mi (29 km) upstream from mouth.

BASIN CHARACTERISTICS - Drainage area, 2,570 mi^2 (6,660 km^2); main-channel slope, 23 ft/mi (4.4 m/km); stream length, 87 mi (140 km); area of lakes and ponds, 1 percent; mean elevation, 3,760 ft (1,150 m); glacier area, 27 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - February 1958 to September 1972, May 1980 to present.

GAGE - Water-stage recorder. Altitude of gage is 520 ft (158 m), from topographic map. Prior to July 29, 1964, at site 4 mi (6 km) downstream at different datum.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1958					1044	948	1220	10460	23170	25010	20760	8000	
1959	4197	1883	1262	1097	1049	738	890	7413	23660	25650	22100	9957	8376
1960	4723	2283	1700	1448	1103	933	1000	13890	17390	23650	19320	12420	8363
1961	5135	1950	1745	1452	1100	1079	1600	10100	20490	27420	24580	16030	9451
1962	5777	2400	1500	1300	1000	930	1170	7743	20620	27220	21980	13490	8818
1963	3506	1500	1552	1600	1300	846	700	11060	17750	28950	18390	11330	8268
1964	8062	2300	1000	1007	820	770	1133	2355	40330	24430	20250	9235	9312
1965	5642	2900	2100	1600	1400	1300	1400	7452	20070	23230	22550	22260	9365
1966	6071	1620	1350	1200	1100	1100	1300	3971	21740	23750	27720	12200	8648
1967	4682	1680	1500	1458	1257	1045	972	12400	25520	35570	33670	12510	11110
1968	3483	1660	1397	1235	1200	1148	1347	10940	29000	30140	20710	7375	9172
1969	2898	1480	1139	974	900	824	1333	6001	18560	20820	11300	6704	6110
1970	4578	1887	1316	1200	1154	1100	1437	9643	19670	26100	24660	11330	8736
1971	3826	2210	1403	1113	950	934	982	4468	22180	27280	23810	11080	8406
1972	5439	2157	1432	1174	1041	939	893	9765	17900	25770	20970	12120	8340
1980								9142	22490	34950	20780	8240	
Mean	4859	1994	1457	1276	1095	976	1158	8550	22537	26869	22102	12255	8743

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15292700 TALKEETNA RIVER NEAR TALKEETNA
Table F.1.6

LOCATION - Lat 62°20'49", long 150°01'01", in NE¼ sec. 16, T.26 N., R.4 W., Matanuska-Susitna Borough on left bank 1.7 mi (2.7 km) downstream from Chunilna Creek, 3.5 mi (5.6 km) northeast of Talkeetna, and about 5 mi (8 km) upstream from mouth.

BASIN CHARACTERISTICS - Drainage area, 2,006 mi^2 (5,196 km^2); main-channel slope, 35 ft/mi (6.6 m/km); stream length, 90.3 mi (145.3 km); area of lakes and ponds, 0 percent; mean elevation, 3,630 ft (1,106 m); glacier area, 7 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - June 1964 to present.

GAGE - Water-stage recorder. Altitude of gage is 400 ft (120 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1964									17080	9820	8396	3815	
1965	3115	1568	1100	720	620	540	580	3474	11090	12180	11150	10610	4749
1966	4438	1460	876	711	526	395	422	2410	12970	10100	10730	5370	4221
1967	2388	897	750	637	546	471	427	4112	9286	12600	14160	6971	4470
1968	2029	1253	987	851	777	743	983	8840	14100	11230	7546	4120	4468
1969	1637	827	556	459	401	380	519	3869	5207	7080	3787	2070	2249
1970	1450	765	587	504	458	440	545	3950	7979	10320	8752	5993	3500
1971	2817	1647	1103	679	459	402	503	2145	19040	11760	16770	5990	5299
1972	2632	1310	845	727	628	481	519	3516	12700	12030	9576	8709	4479
1973	3630	1373	889	748	654	574	577	3860	12210	7676	9927	3861	3851
1974	1807	960	745	645	559	482	535	5678	8030	7755	7704	4763	3325
1975	1967	1002	774	694	586	508	522	4084	13180	12070	8487	7960	4336
1976	2884	773	558	524	480	470	613	3439	10580	9026	8088	3205	3398
1977	1857	1105	1069	700	549	506	548	4244	18280	9344	8005	5963	4355
1978	3268	1121	860	746	576	485	534	2950	7429	10790	7001	3567	3301
1979	1660	1138	932	762	652	577	710	7790	12010	14440	8274	4039	4446
1980	3379	1718	868	808	741	700	1038	4823	11380	13900	7224	5402	4345
Mean	2560	1182	844	683	576	509	598	4234	11918	10716	9152	5436	4049

SOUTH-CENTRAL ALASKA
15294005 WILLOW CREEK NEAR WILLOW
Table F.1.7

LOCATION - Lat 61°46'49", long 149°52'44", in NE¼SE¼ sec. 31, T.20 N., R.3 W., Matanuska-Susitna Borough, Hydrologic Unit 19050002, on left bank 0.7 mi (1.1 km) downstream from unnamed tributary, 5.7 mi (9.2 km) northeast of Willow, and 6.9 mi (11.1 km) upstream from Deception Creek.

DRAINAGE AREA - 166 mi^2 (430 km^2)

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - June 1978 to current year.

GAGE - Water-stage recorder. Altitude of gage is 350 ft. (107 m), from topograhic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1978									647	607	307	259	-
1979	232	90.9	110	83.4	74.3	75.0	99.5	1055	1430	1154	398	368	433
1980	402	364	152	112	85.4	73.2	102	473	1411	1287	955	700	511
Mean	317	227	131	97.7	79.9	74.1	101	764	1163	1016	553	442	472

15294010 DECEPTION CREEK NEAR WILLOW
Table F.1.8

LOCATION - Lat 61°44'52", long 149°55'59", in NE¼ SE¼ sec. 11, T.19 N., R.4 W., Matanuska-Susitna Borough, Hydrologic Unit 19050002, on right bank, 0.5 mi (0.8 km) downstream from unnamed tributary, 3.4 mi (5.5 km) east of Willow, and 5.0 mi (8.0 km) upstream from mouth.

DRAINAGE AREA - 48.0 mi^2 (124.3 km^2).

GAGE - Water-stage recorder. Altitude of gage is 250 ft (76 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1978									88.5	78.4	26.2	31.7	
1979	57.4	21.8	25.5	17.5	16.2	25.2	76.8	313	91.1	124	39.7	55.0	72.5
1980	79.2	149	46.0	33.1	23.5	22.2	73.4	141	165	110	102	113	88.0
Mean	68.3	85.4	35.75	25.3	19.9	23.7	75.1	227	115	104	56.0	66.6	80.3

1529410 DESHKA RIVER NEAR WILLOW
Table F.1.9

LOCATION - Lat 61°46'05", long 150°20'13", in SW¼ NE¼ sec. 3, T.19 N., R.6 W., Matanuska-Susitna Borough, Hydrologic Unit 19050002, on left bank 0.2 mi (0.3 km) upstream from unnamed tributary, 1.1 mi (1.8 km) downstream from unnamed tributary, 7.9 mi (12.7 km) upstream from mouth, and 10 mi (16 km) west of Willow, Alaska.

DRAINAGE AREA - 592 mi^2 (1,530 km^2)

PERIOD OF RECORD - October 1978 to present.

GAGE - Water-stage recorder. Altitude of gage is 80 ft (24 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1979	553	424	329	290	266	263	774	4295	876	717	547	790	850
1980	1366	2669	561	393	362	332	1215	2585	1648	1768	1113	904	1244
Mean	960	1547	445	342	314	298	995	3440	1262	1243	830	847	1047

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15294300 SKWENTNA RIVER NEAR SKWENTNA
Table F.1.10

LOCATION - Lat 61°52'23", long 151°22'01", in NW¼ sec. 31, T.21 N., R.11 W., Matanuska-Susitna Borough, on right bank 2 mi (3 km) downstream from Shell Creek, 8 mi (13 km) southwest of Skwentna, and 13 mi (21 km) upstream from mouth.

BASIN CHARACTERISTICS - Drainage area, 2,250 mi^2 (5,830 km^2); main-channel slope, 30.6 ft/mi (5.80 m/km); stream length, 98 mi (158 km); area of lakes and ponds, 5 percent; mean elevation, 2,810 ft (856 m); glacier area, 16 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - October 1959 to present.

GAGE - Water-stage recorder. Altitude of gage is 200 ft (61 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1960	3532	1850	1400	1097	961	843	835	10480	13440	16690	15990	9171	6387
1961	3889	1600	1597	1403	1154	1155	1700	11210	20570	16480	13910	12020	7255
1962	4605	2200	1400	1200	860	760	1000	6613	15630	14930	12080	6723	5699
1963	2801	1250	1100	1000	810	700	650	7765	14050	20430	12020	7180	5854
1964	5355	1550	840	970	750	600	840	1635	27250	16480	12680	6224	6266
1965	4425	1790	1300	920	800	740	770	4810	17160	19370	14010	13090	6628
1966	4122	1575	1150	1100	1100	1100	1300	4502	19550	14180	17320	9812	6427
1967	5576	1400	900	720	650	650	780	1794	14430	14740	15760	9517	5607
1968	3832	1560	1181	1023	1000	950	1293	13460	20770	17480	10560	3855	6438
1969	1929	678	624	600	600	626	1487	11070	19580	13650	7471	3783	5199
1970	5654	1607	832	766	700	650	728	11710	22880	21120	13030	6665	7241
1971	2919	2023	1184	865	721	613	607	5963	25400	20600	15920	6024	6937
1972	3020	1327	1103	989	898	811	742	8045	15330	16840	13370	9256	5998
1973	4551	2340	1316	910	702	606	727	6349	15200	13850	9874	6164	5243
1974	3540	1700	1265	1023	902	811	1005	6765	10650	11670	10480	11800	5156
1975	4557	2328	919	800	750	750	767	7852	19060	19520	11710	8471	6491
1976	4704	1973	1258	971	897	800	1270	8806	15120	14580	11120	8165	5823
1977	6196	2880	2871	2829	1821	1200	1200	8906	36670	25270	20160	10290	10060
1978	5799	2373	1548	1213	944	841	1023	9006	13840	18100	13740	7478	6372
1979	4936	1580	1555	1165	1036	981	1597	11660	14980	15830	16210	7448	6629
1980	7254	4195	2226	1781	1617	1352	1957	11850	24780	28620	13860	8785	9053
Mean	4438	1895	1313	1112	937	835	1061	8107	18878	17638	13397	8186	6513

15294350 SUSITNA RIVER AT SUSITNA STATION
Table F.1.11

LOCATION - Lat 61°32'41", long 150°30'45", in SE¼ SE¼ sec. 22, T.17 N., R.7 W., Matanuska-Susitna Borough, on left bank at Susitna Station, 1.5 mi (2.4 km) downstream from Yentna River, and 12.5 mi (20.1 km) upstream from Alexander Creek.

BASIN CHARACTERISTIC - Drainage area, 19,400 mi^2 (50,200 km^2) main-channel slope, 11 ft/mi (2.1 m/km); stream length, 289 mi (465 km); area of lakes and ponds, 2 percent; mean elevation, 3,200 ft (975 m); glacier area, 18 percent.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD - October 1974 to present.

GAGE - Water-stage recorder. Altitude of gage is 40 ft (12 m), from topographic map.

MONTHLY AND ANNUAL MEAN DISCHARGE, IN CUBIC FEET PER SECOND

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
1975	19520	10400	9419	8597	7804	7048	6867	47540	128800	135700	91360	77740	46100
1976	31550	9933	600	6529	5614	5368	7253	70460	107000	115200	99650	48910	42990
1977	30140	18270	13100	10100	8911	6774	6233	56180	165900	143900	125500	83810	55980
1978	38230	12630	7529	6974	6771	6590	7033	48670	90930	117600	102100	55500	42000
1979	36810	15000	9306	8823	7946	7032	8683	81260	11990	142500	128200	74340	53670
1980	58640	31590	14690	10120	9017	8906	12030	66580	142900	181400	126400	91200	63010
Mean	35815	16304	10007	8524	7677	6953	8017	61782	125905	139383	112202	71917	50625

F.2 - WATER QUALITY

r29/h3

TABLE F2.1

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey
Station: NR. DENALI - 1957-1981
Elevation: 2440 FT.

	Summer/Winter			
	Maximum	Minimum	Mean	Number Obser-vations
Field Parameters (1)				
Dissolved Oxygen	-	-	-	-
Percent Saturation	-	-	-	-
pH, pH Units	7.8/7.6	7.1/7.1	7.5/7.4	15/4
Conductivity, umhos/cm @ 25°C	205/467	121/194	157/349	18/4
Temperature, °C	10.5/-	0.5/-	5.5/-	50/-
Free Carbon Dioxide	5.8/25	1.5/4.5	3.2/10/8	11/4
Alkalinity, as $CaCO_3$	68/161	42/57	54/116	11/4
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	-	-	-	-
Organic Nitrogen	-	-	-	-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	.09/-	.00/-	.05/-	15/-
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	-	-	-	-
Ortho-Phosphate	-	-	-	-
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	11.0/30.0	2.0/3.8	4.8/19.0	11/4

TABLE F2.1 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter Maximum	Summer/Winter Minimum	Summer/Winter Mean	Summer/Winter Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	-	-	-	-
Hardness, as $CaCO_3$	87/181	50/84	64/139	11/4
Sulfate	23/39	9/31	15/36	11/4
Total Dissolved Solids	120/270	72/109	91/204	11/4
Total Suspended Solids	5690/-	5/-	1004/-	58/-
Turbidity, NTU	350/-	20/-	176/-	8/-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	-	-	-	-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	-	-	-	-
Bi, Bismuth	-	-	-	-
Ca, Calcium	29/51	17/23	21/40	11/4
Cd, Cadmium	-	-	-	-
Co, Cobalt	-	-	-	-
Cr, Chromium	-	-	-	-
Cu, Copper	-	-	-	-

TABLE F2.1 CONTINUED

	Summer/Winter			
	Maximum	Minimum	Mean	Number Obser- vations
ɔoratory Parameters (1) ɪntinued)				
Fe, Iron	4.0/.06	.03/0	1.0/.02	11/4
Hg, Mercury	-	-	-	-
K, Potassium	3.0/6.6	1.3/3.6	2.5/5.8	11/4
Mg, Magnesium	3.8/16	1.7/6.2	3.1/9.3	11/4
Mn, Manganese	.06/.02	0/0	.009/.01	10/3
Mo, Molybdenum	-	-	-	-
Na, Sodium	10/23	2.1/3.8	4.3/15	11/4
Ni, Nickel	-	-	-	-
Pb, Lead	-	-	-	-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	-	-	-	-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	-	-	-	-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE F2.2

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey

Station: VEE CANYON 1962 - 1981

Elevation: 1900 FT.

	Summer Values Only			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	-	-	-	-
Percent Saturation	-	-	-	-
pH, pH Units	8.1	7.2	7.7	10
Conductivity, umhos/cm @ 25°C	168	91	150	25
Temperature, °C	13.0	1.0	7.7	38
Free Carbon Dioxide	6.8	.7	2.6	10
Alkalinity, as $CaCO_3$	59	39	51	10
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	-	-	-	-
Organic Nitrogen	-	-	-	-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	0.88	0.0	.20	10
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	-	-	-	-
Ortho-Phosphate	-	-	-	-
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	9.2	2.1	5.5	10

TABLE F2.2 CONTINUED

Laboratory Parameters (1) (continued)	Maximum	Minimum	Mean	Number Obser-vations
	Summer Values Only			
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	40	5	14	9
Hardness, as $CaCO_3$	76	42	62	10
Sulfate	18	7.5	14	10
Total Dissolved Solids	110	66	90	10
Total Suspended Solids	2790	34	773	38
Turbidity, NTU	-	-	-	-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	-	-	-	-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	-	-	-	-
Bi, Bismuth	-	-	-	-
Ca, Calcium	27	14	21	10
Cd, Cadmium	-	-	-	-
Co, Cobalt	-	-	-	-
Cr, Chromium	-	-	-	-
Cu, Copper	-	-	-	-

TABLE F2.2 CONTINUED

Laboratory Parameters (1) (continued)	Summer Values Only: Maximum	Minimum	Mean	Number Obser-vations
Fe, Iron	12.0	.05	2.9	10
Hg, Mercury	-	-	-	-
K, Potassium	7.3	1.4	3.4	10
Mg, Magnesium	4.4	1.1	2.7	10
Mn, Manganese	.23	0	.12	2
Mo, Molybdenum	-	-	-	-
Na, Sodium	6.3	2.1	3.9	10
Ni, Nickel	-	-	-	-
Pb, Lead	-	-	-	-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	-	-	-	-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	-	-	-	-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

susi6/s1

TABLE F2.3

WATER QUALITY DATA SUMMARY
SUSITNA RIVER

Agency: U.S. Geological Survey
Station: GOLD CREEK 1949 - 1981
Elevation: 676.5 FT.

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Obser-vations
Field Parameters (1)				
Dissolved Oxygen	13.3/14.4/-	9.5/11.0/-	11.7/12.7/-	5/2/0
Percent Saturation	106/102/-	83/77/-	98/90/-	5/2/0
pH, pH Units	8.0/8.1/8.0	6.6/7.0/6.5	7.3/7.4/7.1	34/23/9
Conductivity, umhos/cm @ 25°C	227/300/280	90/164/82	161/248/121	63/27/7
Temperature, °C	14.0/0.5/8.0	1.0/0.0/1.0	8.6/0.5/3.4	22/5/7
Free Carbon Dioxide	20/16/24	1.1/1.2/5.6	5.6/6.3/8.0	61/22/5
Alkalinity, as $CaCO_3$	87/88/80	30/49/29	52/70/48	66/23/3
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.33/.08/-	.01/.03/-	.13/.06/-	4/3/-
Organic Nitrogen	.39/.44/-	.10/.27/-	.27/.36/-	4/3/-
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	.36/.32/.29	.02/.05/.05	.13/.14/.17	60/22/3
Nitrite Nitrogen	.03/.01/-	.02/0/-	.02/0/-	2/3/-
Total Nitrogen	.58/.66/-	.25/.51/-	.47/.57/-	4/3/-
Ortho-Phosphate	.03/.03/-	0/.01/-	.01/.02/-	9/2/1
Total Phosphorus	.04/.03/-	0/.03/-	.02/.03/-	5/2/1
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	15/35/4.5	1.4/9/1.8	5.5/22/3.2	62/25/4

TABLE F2.3 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	20/5/50	0/0/10	8/3.5/28	52/20/6
Hardness, as $CaCO_3$	107/114/113	35/60/32	61/97/60	60/24/3
Sulfate	28/38/27	1/13/5.5	17/21/16	65/22/2
Total Dissolved Solids	134/167/70	51/102/48	93/149/55	61/26/4
Total Suspended Solids	2620/76/1330	7/1/120	805/18/652	63/8/11
Turbidity, NTU	-	-	-	-
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	50/-/-	2.7/-/-	20/-/-	3/1/1
Total Organic Carbon	-	-	5.5/5/1.8	1/1/1
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	0/-/-	0/-/-	0/-/-	2/-/-
Al, Aluminum	-	-	-	-
As, Arsenic	-	-	-	-
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	0/-/-	0/-/-	0/-/-	2/-/-
Bi, Bismuth	-	-	-	-
Ca, Calcium	37/11/-	37/24/-	19/30/-	60/26/-
Cd, Cadmium	0/-/-	0/-/-	0/-/-	2/-/-
Co, Cobalt	0/-/-	0/-/-	0/-/-	2/-/-
Cr, Chromium	.01/-/-	0/-/-	.005/-/-	2/-/-
Cu, Copper	.005/-/-	.004/-/-	.004/-/-	2/-/-

TABLE F2.3 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	.46/.03/-	0/0/-	.16/.01/-	30/21/0
Hg, Mercury	.002/-/-	0/-/-	.001/-/-	2/-/-
K, Potassium	4.4/5.0/1.7	1.0/1.2/1.3	2.4/2.3/1.6	51/18/3
Mg, Magnesium	6.3/8.3/7.4	1.4/3.6/.3	3.2/5.7/2.5	57/27/4
Mn, Manganese	.18/.0/-	0/0/-	.010/0/-	26/2/0
Mo, Molybdenum	-	-	-	-
Na, Sodium	6.5/17.0/2.9	2.4/5.2/2.8	4.1/11.0/2.9	48/19/2
Ni, Nickel	0/-/-	0/-/-	0/-/-	2/-/-
Pb, Lead	0/-/-	0/-/-	0/-/-	2/-/-
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	0/-/-	0/-/-	0/-/-	2/-/-
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.01/-/-	.006/-/-	.008/-/-	2/-/-
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

TABLE F2.4

WATER QUALITY DATA SUMMARY
SUSITNA RIVER

Agency: U.S. Geological Survey
Station: SUNSHINE - 1971-1977
Elevation: 270 FT.

	Summer/Winter			
	Maximum	Minimum	Mean	Number Observations
Field Parameters (1)				
Dissolved Oxygen	12.8/13	10.6/13	11.8/13	3/1
Percent Saturation	-	-	-/90	0/1
pH, pH Units	7.6/7.2	7.1/7.2	7.4/7.2	3/1
Conductivity, umhos/cm @ 25°C	170/242	100/230	130/236	5/2
Temperature, °C	12/0	3.8/0	8.1/0	5/1
Free Carbon Dioxide	3.9/0	2.1/0	3.1/0	3/0
Alkalinity, as $CaCO_3$	43/71	25/63	37/67	3/2
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.28/.05	.09/.03	.18/.04	2/2
Organic Nitrogen	.77/.42	.24/.18	.5/.3	2/2
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	-	-	-	-
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	2.3/.7	.7/.4	1/.25	2/2
Ortho-Phosphate	.12/.12	0/.12	.06/.12	3/1
Total Phosphorus	.14/.01	.07/.01	.07/.01	2/2
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	7.3/21	2.2/17	4.2/19	5/2

TABLE F2.4 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter Maximum	Minimum	Mean	Number Obser-vations
Conductivity, umhos/cm @ 25°C				
True Color, Color Units	100/0	8/0	44/0	3/1
Hardness, as $CaCO_3$	72/91	37/89	52/90	5/2
Sulfate	13/18	3/17	9/17	5/2
Total Dissolved Solids	-	-	-	-
Total Suspended Solids	-	-	-	-
Turbidity, NTU	250/1.3	200/1.3	225/1.3	2/1
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	-	-	-	-
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	0/0	0/0	0/0	2/1
Al, Aluminum	-	-	-	-
As, Arsenic	.003/.001	.002/.001	.002/.001	2/1
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	.07/.04	0/.04	.04/.04	2/1
Bi, Bismuth	-	-	-	-
Ca, Calcium	23/29	12/29	17/29	5/2
Cd, Cadmium	0/0	0/0	0/0	2/1
Co, Cobalt	0/0	0/0	0/0	2/1
Cr, Chromium	.01/.01	0/.01	.005/.01	2/1
Cu, Copper	.004/.004	.002/.004	.003/.004	2/1

TABLE F2.4 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter Maximum	Summer/Winter Minimum	Summer/Winter Mean	Number Observations
Fe, Iron	.18/.01	.06/.01	.12/.01	2/1
Hg, Mercury	.001/.001	0/.001	.001/.001	2/1
K, Potassium	2.8/2.1	1.1/.19	1.6/2.0	5/2
Mg, Magnesium	3.5/4.5	1.6/4.1	2.5/4.3	5/2
Mn, Manganese	.02/.004	0/0	.009/.002	4/2
Mo, Molybdenum	-	-	-	-
Na, Sodium	4.4/11	1.9/11	2.8/11	5/2
Ni, Nickel	0/.002	.001/.002	.001/.002	2/1
Pb, Lead	0/.008	0/.008	0/.008	2/1
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	0/0	0/0	0/0	2/1
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.02/.03	.006/.03	.01/.03	2/1
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

susi6/s1

TABLE F2.5

WATER QUALITY DATA SUMMARY

SUSITNA RIVER

Agency: U.S. Geological Survey

Station: SUSITNA - 1955-1981

Elevation: 40 FT.

	Summer/Winter/Break-Up			
	Maximum	Minimum	Mean	Number Obser-vations
Field Parameters (1)				
Dissolved Oxygen	13/13.9/12.7	10.1/9.9/10.6	11.5/11.5/12.1	12/12/4
Percent Saturation	100/97/100	90/67/95	99/79/98	53/19/11
pH, pH Units	8.3/7.9/7.8	7/6.7/6.5	7.7/7.3/7.3	62/45/18
Conductivity, umhos/cm @ 25°C	168/225/120	90/179/85	120/205/94	21/20/6
Temperature, °C	12.5/0.5/8.0	3.6/0/4.5	8.8/0/6.3	109/52/33
Free Carbon Dioxide	-	-	-	-
Alkalinity, as $CaCO_3$	57/75/39	39/58/30	44/69/34	52/30/6
Settleable Solids, ml/l	-	-	-	-
Laboratory Parameters (1)				
Ammonia Nitrogen	.19/.09/.21	0.0/.01/.01	.04/.04/.08	15/7/3
Organic Nitrogen	1.5/.46/.70	.16/0.0/.16	.60/.27/.43	12/9/2
Kjeldahl Nitrogen	-	-	-	-
Nitrate Nitrogen	-/.19/-	-/.16/-	-/.18/-	0/2/0
Nitrite Nitrogen	-	-	-	-
Total Nitrogen	1.7/.99/1.2	.26/.24/.67	.72/.55/.87	22/17/5
Ortho-Phosphate	-/-/.03	-/-/.03	-/-/.03	0/0/1
Total Phosphorus	-	-	-	-
Alkalinity, as $CaCO_3$	-	-	-	-
Chemical Oxygen Demand	-	-	-	-
Chloride	6.7/18/4.6	1.2/5.7/3.1	2.8/12.9/3.6	23/21/6

TABLE F2.5 CONTINUED

Laboratory Parameters (1) (continued)	Maximum	Minimum	Mean	Number Observations
	Summer/Winter/Break-Up			
Conductivity, umhos/cm @ 25°C	-	-	-	-
True Color, Color Units	10/5/-	5/0/-	7.5/2.5/-	4/4/0
Hardness, as $CaCO_3$	60/96/48	46/73/36	55/84/40	20/20/6
Sulfate	22/20/7.7	1/10/3.7	13/17/7	23/21/6
Total Dissolved Solids	82/139/65	57/105/52	75/123/55	24/20/6
Total Suspended Solids	2980/12/683	151/2/257	745/4.4/461	67/22/5
Turbidity, NTU	790/3/160	30/1/25	286/2/74	13/10/4
Uranium	-	-	-	-
Radioactivity, Gross Alpha, pCi/l	-	-	-	-
Total Organic Carbon	11/9.3/9.1	2.3/.4/3.8	4.2/2.4/6.0	8/10/4
Total Inorganic Carbon	-	-	-	-
Organic Chemicals				
Endrin	-	-	-	-
Lindane	-	-	-	-
Methoxychlor	-	-	-	-
Toxaphene	-	-	-	-
2, 4-D	-	-	-	-
2, 4, 5-TP Silvex	-	-	-	-
ICAP Scan				
Ag, Silver	.003/0/-	0/0/-	.001/0/-	6/2/0
Al, Aluminum	-	-	-	-
As, Arsenic	.003/.003/.001	.001/0/.001	.017/.013/.001	10/8/5
Au, Gold	-	-	-	-
B, Boron	-	-	-	-
Ba, Barium	2.0/1.0/1.0	.3/.4/.1	.8/.6/.1	7/5/2
Bi, Bismuth	-	-	-	-
Ca, Calcium	22/31/15	14/24/11	18/27/13	23/21/6
Cd, Cadmium	.002/.002/.002	.001/.001/.002	.015/.015/.002	8/4/2
Co, Cobalt	.007/.003/-	.002/.002/-	.003/.003/-	9/6/0
Cr, Chromium	.030/.020/.020	0/0/.005	.014/.008/.013	8/4/2
Cu, Copper	.007/.004/.020	.002/0/.002	.003/.002/.008	10/9/4

TABLE F2.5 CONTINUED

Laboratory Parameters (1) (continued)	Summer/Winter/Break-Up Maximum	Minimum	Mean	Number Observations
Fe, Iron	.460/.160/.170	.010/.060/.110	.091/.091/.144	12/8/5
Hg, Mercury	.0005/.0005/.0005	0/0/.0001	.0003/.0002/.0003	12/8/5
K, Potassium	.0018/.0025/.0011	.001/.0014/.0008	.001/.002/.001	23/21/6
Mg, Magnesium	.003/.005/.003	.002/.004/.002	.003/.004/.002	25/20/5
Mn, Manganese	/020/.030/.070	.004/.010/.008	.009/.022/.010	16/8/5
Mo, Molybdenum	-	-	-	-
Na, Sodium	4.0/8.9/3.2	2.0/6.2/2.4	2.7/7.6/2.9	23/21/6
Ni, Nickel	.004/.003/-	0/.002/-	.001/.003/-	4/2/0
Pb, Lead	.009/.004/.011	.002/0/.002	.003/.002/.005	12/8/4
Pt, Platinum	-	-	-	-
Sb, Antimony	-	-	-	-
Se, Selenium	.001/.001/.001	0/0/.001	.0006/.0009/.001	11/8/5
Si, Silicon	-	-	-	-
Sn, Tin	-	-	-	-
Sr, Strontium	-	-	-	-
Ti, Titanium	-	-	-	-
W, Tungsten	-	-	-	-
V, Vanadium	-	-	-	-
Zn, Zinc	.020/.020/.020	.003/.003/.020	.012/.012/.020	0/7/4
Zr, Zirconium	-	-	-	-

(1) Table values are mg/l unless noted otherwise.

F.3 - SEDIMENT DISCHARGE

r29/h4

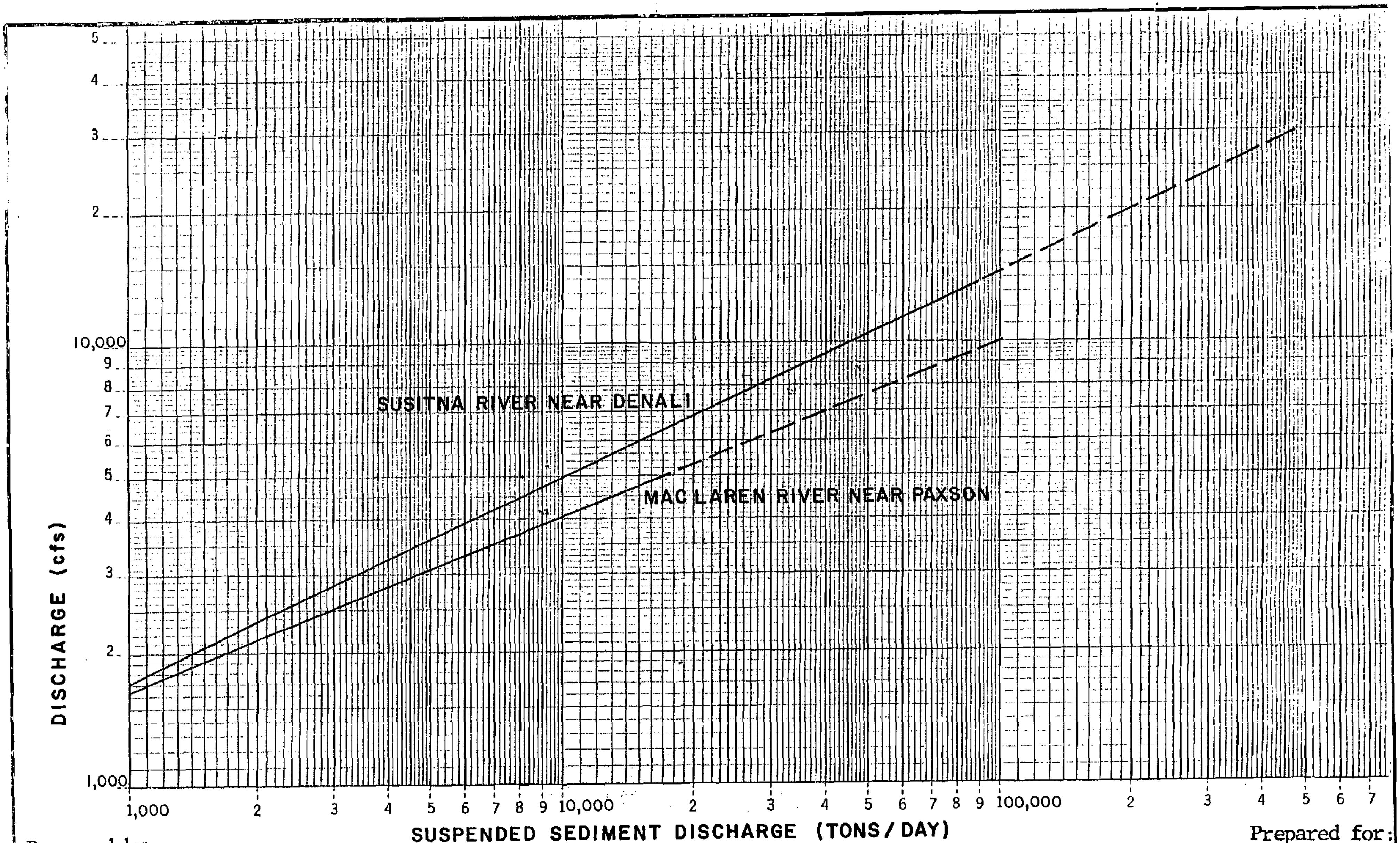
TABLE F3.1

SUSPENDED SEDIMENT DISCHARGE EQUATIONS SUSITNA RIVER BASIN

Station	Equation	Number of Samples	Coefficient of Determination (r^2)
Susitna River near Denali	$q_s = 1.43\ (10^{-4})\ q^{2.122}$	51	0.891
MacLaren River near Paxson	$q_s = 8.04\ (10^{-6})\ q^{2.523}$	32	0.931
Susitna River near Cantwell	$q_s = 6.33\ (10^{-8})\ q^{2.784}$	37	0.881
Susitna River at Gold Creek	$q_s = 2.39\ (10^{-6})\ q^{2.354}$	286	0.735
Chulitna River near Talkeetna	$q_s = 2.63\ (10^{-5})\ q^{2.151}$	20	0.948
Talkeetna River near Talkeetna	$q_s = 1.94\ (10^{-6})\ q^{2.409}$	63	0.832
Susitna River at Susitna Station	$q_s = 3.09\ (10^{-6})\ q^{2.146}$	22	0.885

q = Streamflow, cfs
q_s = Suspended sediment discharge, tons/day

susi8/e



Prepared by:

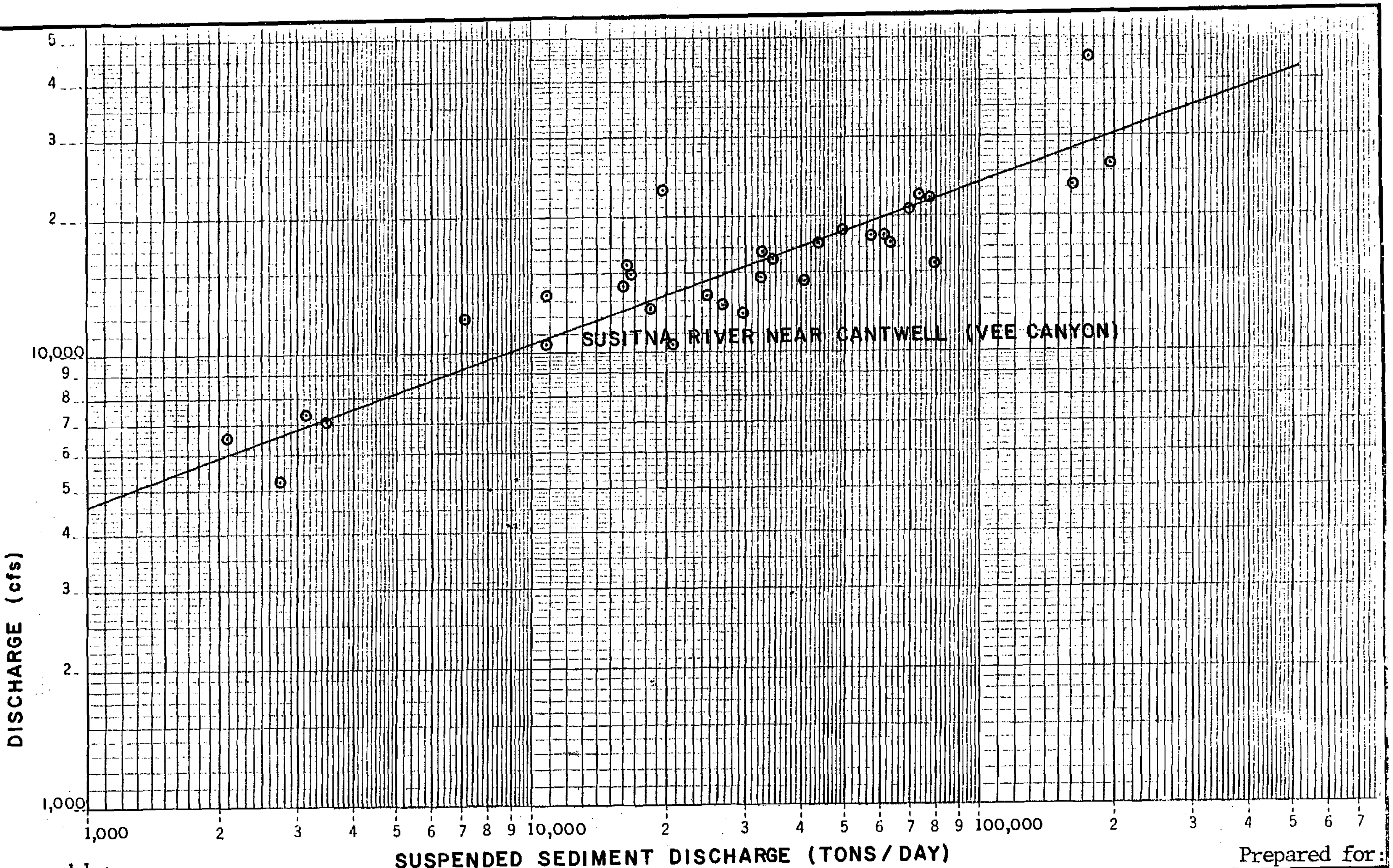
R&M CONSULTANTS, INC.

Prepared for:

ACRES

SUSPENDED SEDIMENT RATING CURVES
SUSITNA RIVER NEAR DENALI AND
MAC LAREN RIVER NEAR PAXSON

FIGURE: F3.1



Prepared by:

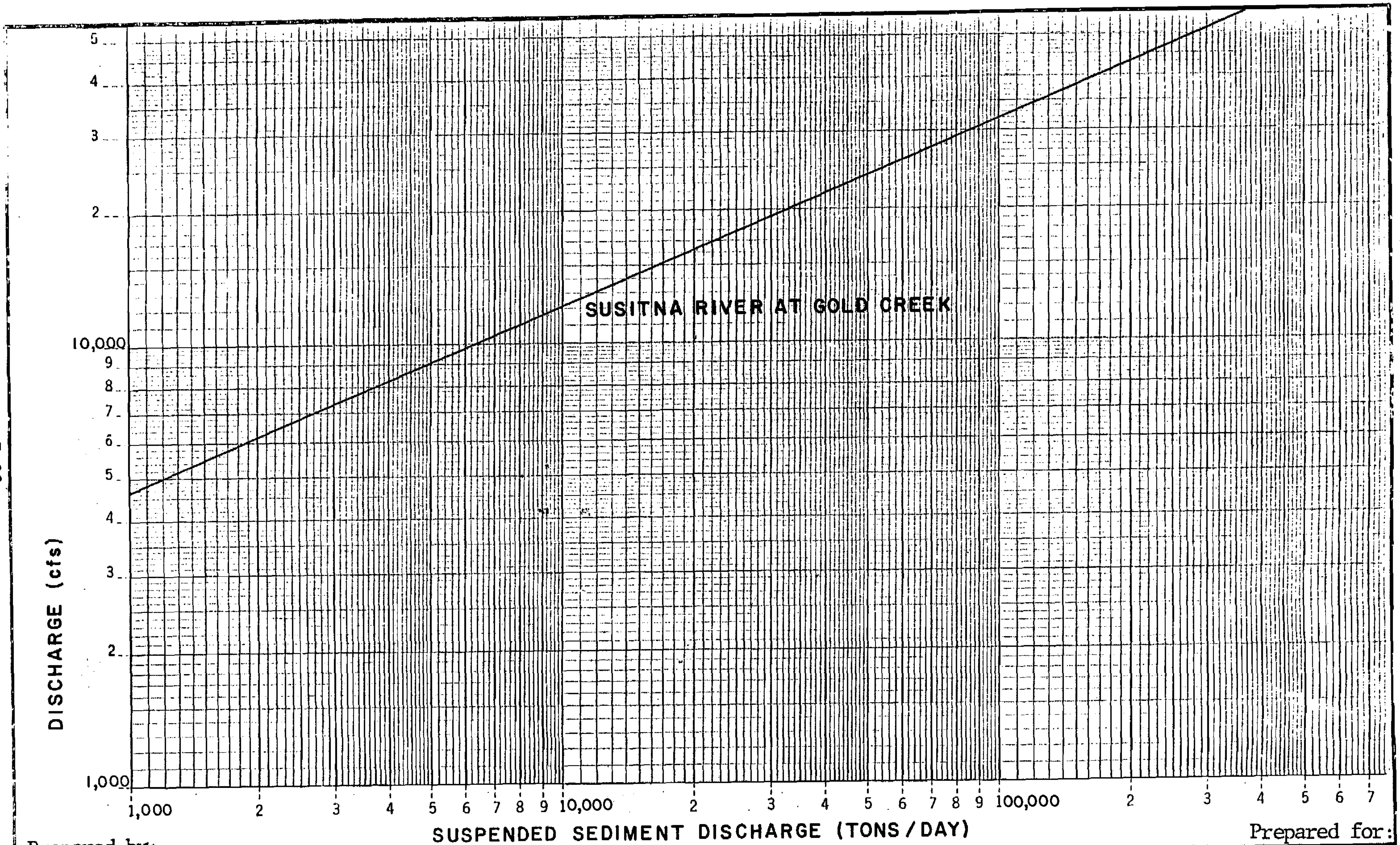
R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT RATING CURVE
SUSITNA RIVER NEAR CANTWELL (VEE CANYON)

Prepared for:

ACRES

FIGURE: F3.2



Prepared by:

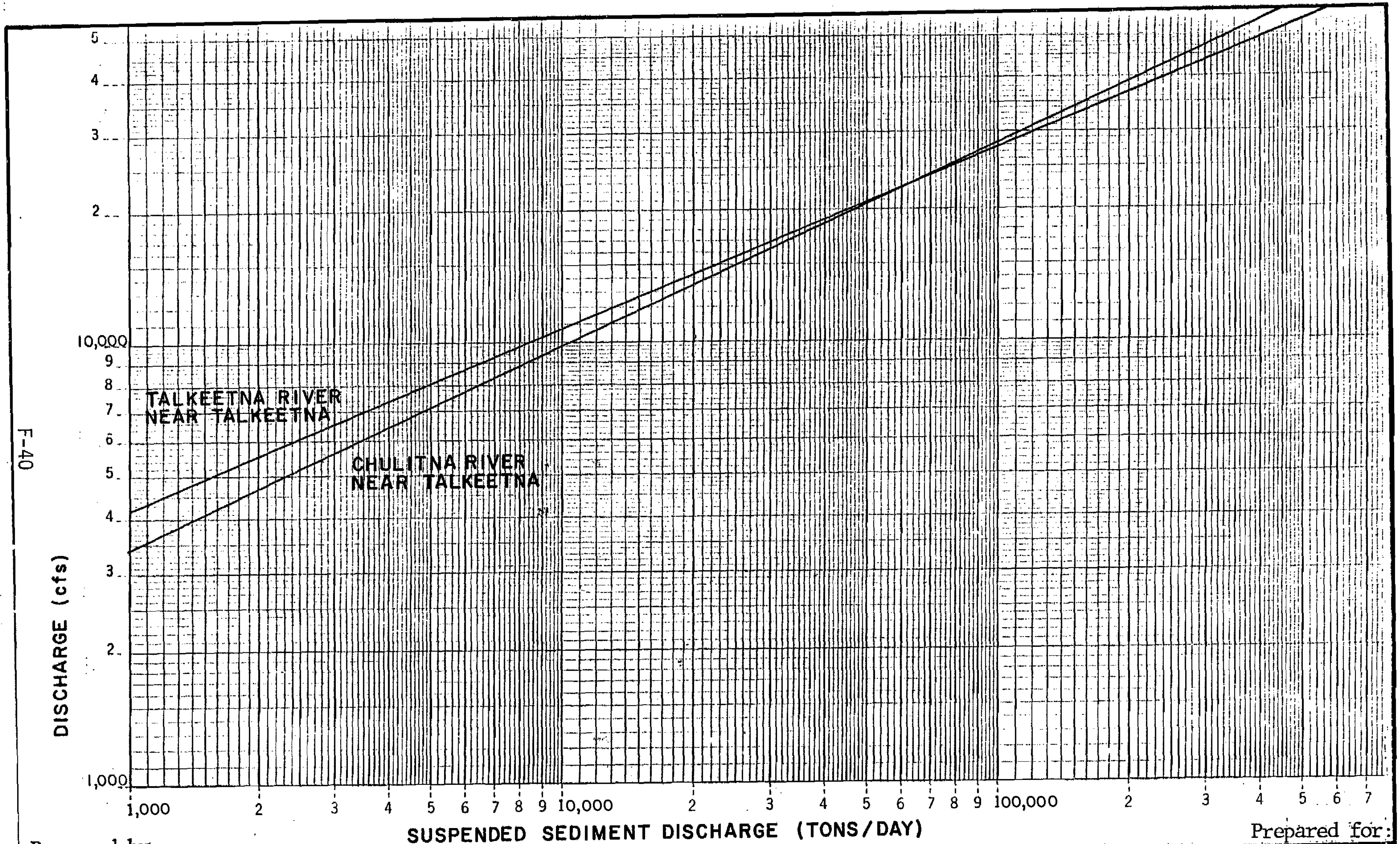
Prepared for:

R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT RATING CURVES
SUSITNA RIVER AT GOLD CREEK

ACRES

FIGURE: F3.3



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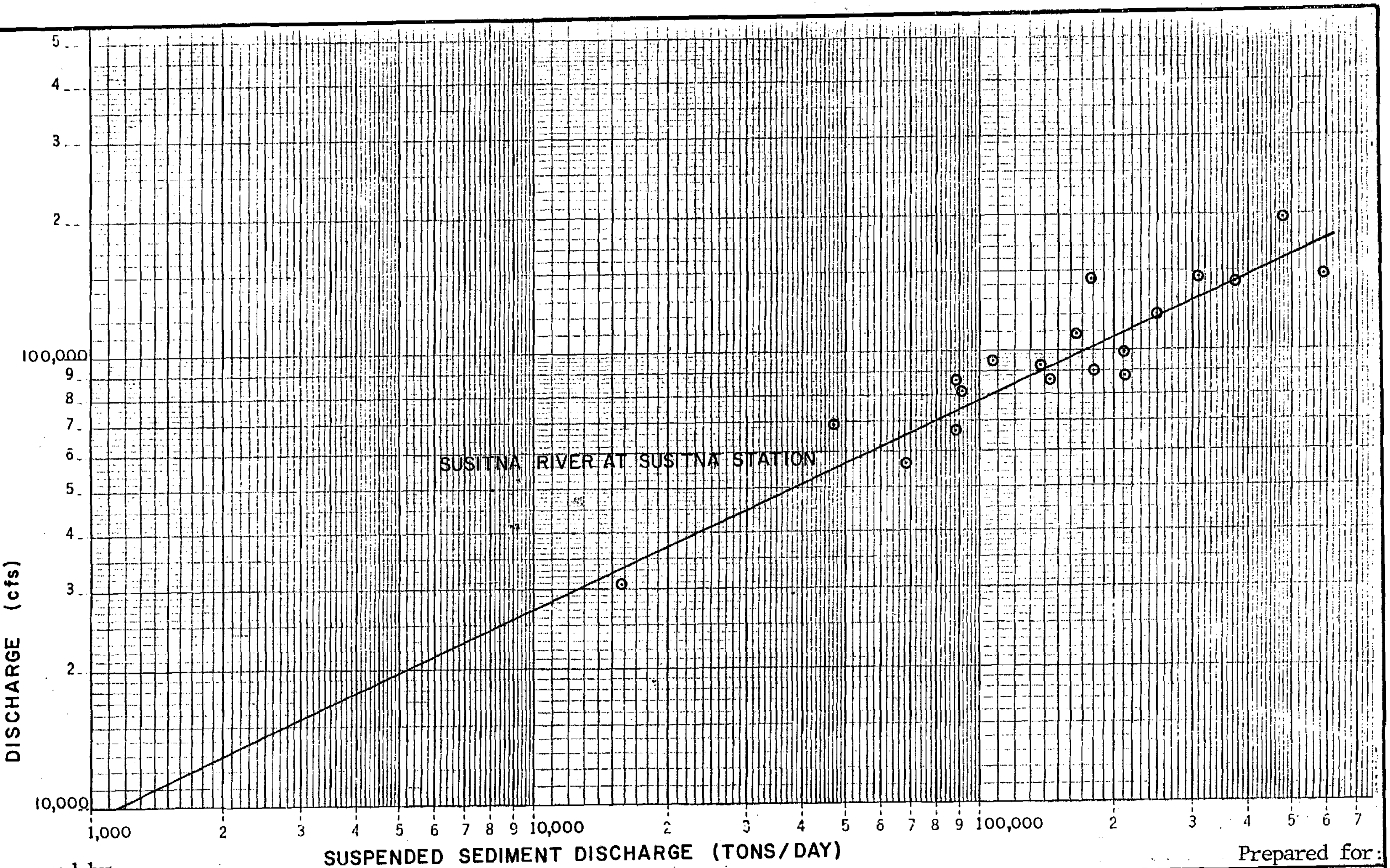
R&M
R&M CONSULTANTS, INC.

SUSPENDED SEDIMENT RATING CURVES
CHULITNA AND TALKEETNA RIVERS

Prepared for:

ACRES

FIGURE: F3.4



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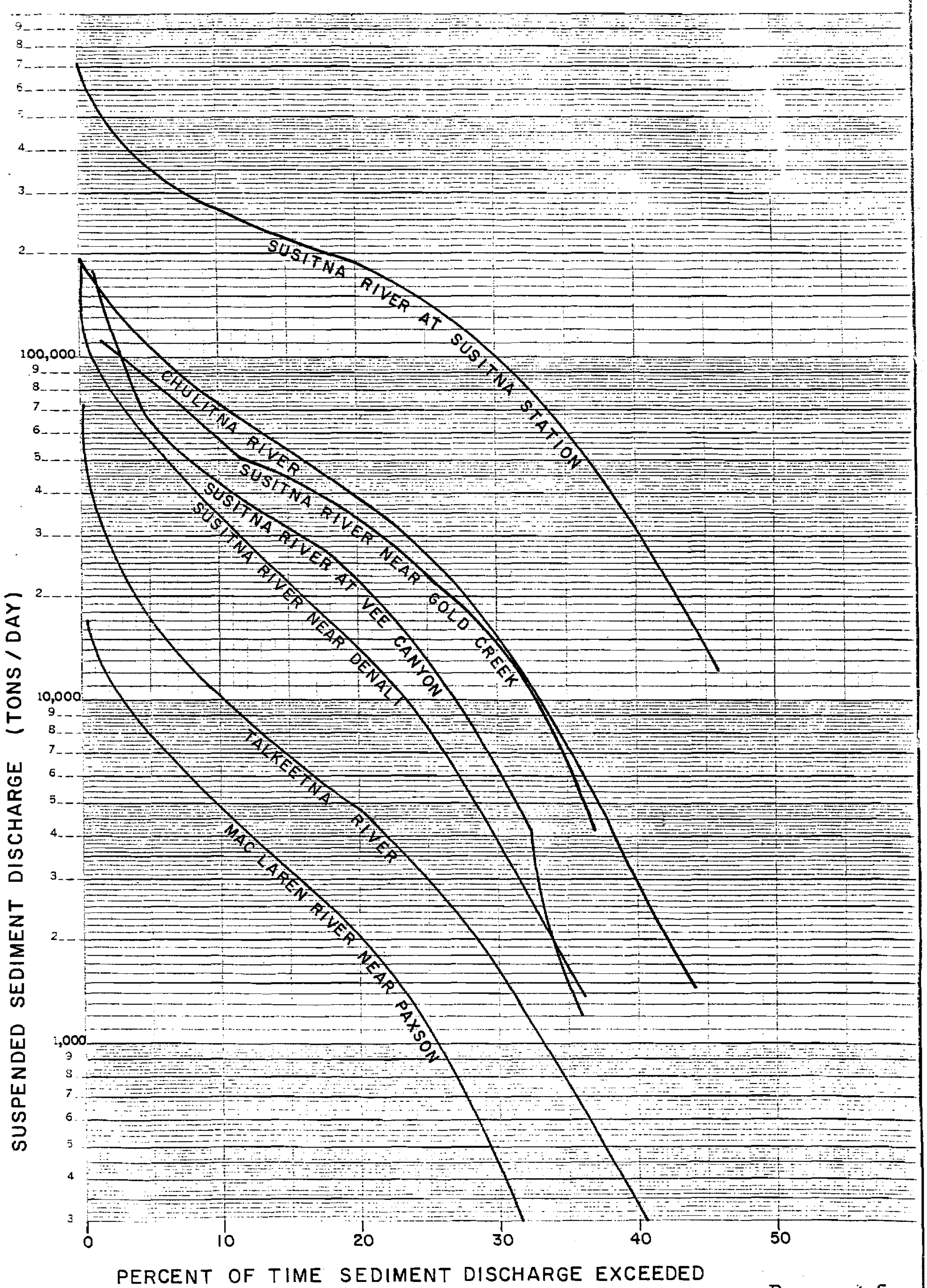
SUSPENDED SEDIMENT RATING CURVE
SUSITNA RIVER AT SUSITNA STATION

FIGURE: F3.5



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ANNUAL SUSPENDED SEDIMENT DURATION CURVES

FIGURE: F3.6

F.4 - CLIMATE

NOTABLE CLIMATIC STATIONS IN PROXIMITY TO THE SUSITNA BASIN

Table F.4.1

Station Name	Coordinates Lat. N.	Long. W.	Period of Record	Comments
McKinley Park	63°43'	148°58'	1925-Present	Second-order station. Evaporation pan located here.
Summit	63°20'	149°08'	1941-1976	First-order station
The Gracious House	63°08'	147°32'	1959-1978	Located near present (R&M Consultants) Denali Climate Station. Rainfall and temperature only
Gulkana	62°09'	145°27'	1942-Present	First-order station
Talkeetna	62°18'	150°06'	1917-Present	First-order station
Matanuska	61°34'	149°16'	1917-Present	Second-order station, Evaporation pan located here
Anchorage	61°13'	149°50'	1922-Present	First-order station

CLIMATOLOGICAL DATA SUMMARIES
FOR SUSITNA BASIN

Table F.4.2

Station Name	Type of Summary	
McKinley Park	1. Complete summary of all parameters	1922-67
	2. Complete summary of all parameters	1922-75
	3. Summary of monthly precipitation	1925-52
	4. Summary of monthly precipitation	1951-80
	5. Summary of monthly maximum temp.	1951-80
	6. Summary of monthly minimum temp.	1951-80
Summit	1976 NOAA LCD.	
The Gracious House	Monthly summaries for summer only:	
	1. Summary of temperature and precipitation	
	2. Monthly precipitation	
	3. Average monthly temperature	
	4. Greatest 24-hour precipitation	
	5. Maximum temperature	
	6. Minimum temperature	
Gulkana	1980 NOAA LCD.	
Talkeetna	1980 NOAA LCD.	
Matanuska	1. Complete summary of all parameters	1917-52
	2. Complete summary of all parameters	1941-70
	3. Summary of monthly precipitation	1951-80
	4. Summary of monthly maximum temp.	1951-80
	5. Summary of monthly minimum temp.	1951-80
Anchorage	1980 NOAA Local Climatological Data (LCD). Contains summary information for period of record.	

1922 - 1967

CLIMATOLOGICAL DATA SUMMARY

DEPARTMENT OF COMMERCE

ESSA-ENVIRONMENTAL [illegible]

Station: McKinley Park Latitude: 63°44' LONGITUDE: 148°55' Elevation (ground): 2015'

TEMPERATURE (°F) — Normal / Extremes

Month	Normal Daily Maximum	Normal Daily Minimum	Normal Monthly	Extremes Record Highest	Year	Record Lowest	Year	Normal degree days
(a)	(b)	(b)	(b)	45	–	45	–	(b)
JAN	7.8	-6.9	1.4	51	1961	-52	1925	1972
FEB	[illegible]	-2.1	7.1	50	1947+	-48	1947	1621
MAR	24.4	2.0	13.2	56	1948	-41	1956	1606
APR	35.1	11.8	23.5	65	1958	-33	1924	1125
MAY	52.2	30.8	41.5	81	1960	-2	1964+	728
JUN	64.0	40.4	52.2	89	1926	19	1967	354
JUL	65.6	43.5	54.6	86	1942	29	1959+	327
AUG	60.7	39.9	50.1	83	1957+	19	1955	453
SEP	50.4	32.3	41.3	76	1957	2	1923	711
OCT	34.3	17.5	25.9	69	1927	-23	1935	1212
NOV	18.8	2.0	10.4	56	1926	-32	1943	1638
DEC	10.4	-6.2	2.1	52	1934	-54	1924	1950
ANNL	32.1	17.5	27.3	89	1926	-54	1924	13722

Precipitation TOTALS (Inches) — Snow & Sleet

Month	NORMAL TOTAL	MAXIMUM MONTHLY	YEAR	MINIMUM MONTHLY	YEAR	MAXIMUM IN 24 HOURS	YEAR	Snow MEAN TOTAL	MAXIMUM MONTHLY	YEAR	MAXIMUM IN 24 HOURS	YEAR
(a)	(b)	45	–	45	–	42	–	42	42	–	42	–
JAN	0.83	4.77	1937	0.04	1936	0.98	1937	12.4	78.0	1937	17.0	1944
FEB	0.69	5.12	1932	T	1934	2.02	1932	11.7	73.0	1932	32.0	1932
MAR	0.37	3.12	1967	0.00	1933+	1.93	1963	7.7	41.2	1967	26.0	1963
APR	0.47	7.15	1948	0.00	1932	1.90	1926	6.4	48.2	1948	17.0	1948
MAY	0.68	2.17	1957	0.00	1932	2.70	1929	2.3	24.0	1929	24.0	1929
JUN	1.93	5.83	1945	0.31	1943	1.74	1945	0.1	3.4	1955	3.2	1955
JUL	2.59	7.39	1967	0.76	1955	3.28	1967	0.0	0.0	–	0.0	–
AUG	2.81	6.84	1930	0.46	1926	2.40	1930	T	T	1962+	T	1962+
SEP	1.54	4.43	1935	0.00	1929	1.80	1932	2.0	12.7	1961	7.5	1961
OCT	0.98	4.26	1935	0.04	1923	1.75	1935	11.7	47.0	1935	21.0	1935
NOV	0.75	2.71	1935	0.00	1932	1.54	1935	10.8	45.5	1966	22.0	1935
DEC	0.65	3.01	1955	0.00	1912	1.67	1933	11.4	35.9	1965	33.0	1933
ANNL	14.29	7.39	1967	0.00	1933+	3.28	1967	77.0	48.2	1948	33.0	1933

Month	Mean hourly speed mph	Prevailing direction	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Month
(a)		22	14	17	17	17	17	(a)
JAN		S	2	0	27	31	22	JAN
FEB		S	3	0	24	28	17	FEB
MAR		S	3	0	22	31	15	MAR
APR		SE	2	0	7	29	3	APR
MAY		SE	2	1	*	21	*	MAY
JUN		SE	6	7	0	3	0	JUN
JUL		S	8	9	0	1	0	JUL
AUG		SE	7	4	0	3	0	AUG
SEP		SE	4	1	1	16	0	SEP
OCT		SE	3	6	14	29	5	OCT
NOV		S	2	0	24	30	14	NOV
DEC		N	3	0	25	31	*	DEC
ANNL		SE	45	22	147	253	97	ANNL

(a) Length of record, years (through 1967)
(b) Climatological Standard Normals (1931-1960)
\+ Also on earlier days, months or years
* Less than one half (0.5)

CLIMATOLOGICAL DATA SUMMARY
ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER
UNIVERSITY OF ALASKA

STATION: McKinley Park LATITUDE: 63°44'N LONGITUDE: 148°55'W ELEVATION: 2015'

MONTH	Temperature (°F) Means: Daily Maximum	Temperature Means: Daily Minimum	Temperature Means: Monthly	Temperature Extremes: Record Highest	Year	Temperature Extremes: Record Lowest	Year	Precipitation (in inches): Mean	Greatest Daily	Year	Greatest Monthly	Year	Snow, Ice Pellets: Mean	Greatest Monthly	Year	Greatest Daily	Year	Greatest Depth on Ground	Year	Wind: Mean Hourly Speed (mph)	Wind: Prevailing Direction	Mean Number of Days: Precipitation .10 Inches or more	Temperature Max: 70° and Above	Temperature Max: 32° and Below	Temperature Min: 32° and Below	Temperature Min: 0° and [below]
(a)	b	b	b	53		53		b	53		45		50	50		50		50			22	22	25	25	25	[illegible]
J	9.7	-8.0	0.9	51	1921	-52	1925	.70	1.05	1975	4.77	1937	12.9	78.0	1937	17.0	1944	44	1937		S	2	0	28	31	[illegible]
F	17.2	-2.8	7.2	50	1947+	-48	1968+	.60	2.02	1932	2.92	1932	10.7	73.0	1932	32.0	1932	51	1936		S	2	0	23	28	[illegible]
M	25.1	2.3	13.7	56	1938	-47	1971	.62	1.93	1963	3.12	1967	7.3	41.2	1967	26.0	1963	43	1943		S	2	0	21	31	[illegible]
A	37.5	15.5	26.5	65	1958	-33	1924	.58	1.90	1926	7.15	1948	6.0	98.2	1948	17.0	1948	43	1971		SE	2	0	7	29	[illegible]
M	52.3	29.9	41.1	81	1960	-2	1964	.82	2.70	1929	2.17	1967	2.4	24.0	1929	24.0	1929	31	1948		SE	2	1	*	22	[illegible]
J	64.1	40.0	52.1	89	1926	19	1967	2.28	1.82	1965	5.83	1945	0.1	3.4	1955	3.2	1955	0	–		SE	6	8	0	4	[illegible]
J	66.0	43.2	54.6	87	1971	29	1971+	2.95	3.28	1967	7.39	1967	0	0	–	0	–	0	–		S	8	10	0	1	[illegible]
A	61.1	39.6	50.4	87	1976	19	1974+	2.50	2.40	1930	6.84	1930	*	0.1	1973	0.1	1973	0	–		SE	7	4	0	5	[illegible]
S	51.0	31.4	41.1	76	1974+	2	1923	1.41	1.80	1932	4.43	1925	2.5	15.9	1972	7.5	1961	10	1972		SE	4	1	1	17	[illegible]
O	33.3	16.0	24.7	69	1927	-23	1975+	.93	1.75	1935	4.26	1935	12.3	47.0	1935	21.0	1935	34	1935		SE	3	0	14	28	[illegible]
N	17.9	1.3	9.6	56	1926	-37	1963	.88	1.61	1970	2.71	1935	12.1	45.5	1966	22.0	1935	48	1970		S	2	0	25	30	[illegible]
D	9.2	-7.5	0.9	52	1934	-54	1924	.85	1.67	1933	3.01	1955	12.1	35.9	1965	33.0 D	1933	50	1970		N	3	0	28	31	[illegible]
YR	32.0	16.8	26.9	89	6/1926	-54	1924	15.12	3.28	7/1967	7.39	1967	78.4	98.2	1948	33.0	1933	51	1936		SE	43	24	147	257	[illegible]

(a) Period of Record thru 1975
* Less than one half
\+ Also on earlier dates, months, or years
T Trace, an amount too small to measure

b. Climatological standard normals 1941-1970

D. DOUBTFUL DATA – 24 HR SNOW FALL DEC – 33.0 – DOUBTFUL – NEXT HIGHEST 20.0 1958

TOTAL PRECIPITATION

ALASKA

MC KINLEY PARK

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1925	-	-	-	-	-	-	-	2.13	4.43	-	-	-	-
1926	.34	.15	1.13	2.70	1.48	3.95	6.12	.46	2.78	2.75	.28	.52	22.66
1927	1.14	.11	.88	.50	T	1.06	1.20	1.61	.53	.48	.11	.83	8.45
1928	.17	1.41	.48	.14	.77	1.63	.79	3.72	1.00	.36	1.29	1.38	13.14
1929	2.43	.04	.02	.95	3.21	1.16	4.11	1.55	.00	1.05	-	1.05	-
1930	.28	.20	.55	.48	.00	3.57	.84	6.84	2.00	.40	-	-	-
1931	.00	-	.20	T	.72	2.08	1.10	4.79	2.23	.80	-	.06	-
1932	.15	2.92	.00	.00	.00	.49	1.93	1.97	1.88	.31	.00	.00	9.65
1933	.86	.02	.00	T	.51	1.82	1.26	1.09	1.91	.60	.97	1.67	10.71
1934	.28	T	.34	1.41	1.64	.75	3.35	5.26	2.90	.41	.27	.87	17.48
1935	.83	1.19	.63	.26	.96	1.33	2.52	1.15	2.37	4.26	2.71	.14	18.35
1936	.04	1.77	.36	.00	.48	1.79	3.35	3.75	1.13	2.60	.73	.90	16.90
1937	4.77	.67	.12	1.06	.00	3.21	3.46	5.37	1.05	1.36	.40	.45	21.92
1938	.38	1.22	.62	.15	.27	3.45	2.57	5.11	.63	.14	1.06	.43	16.03
1939	.29	.13	.58	.11	1.50	3.47	3.20	1.25	2.14	.78	1.03	.10	14.58
1940	3.09	.06	.09	T	1.68	1.86	1.27	.62	1.56	.36	1.06	.50	12.15
1941	.44	.27	.55	.25	1.80	2.28	3.48	3.34	1.81	.79	.62	.22	15.65
1942	.15	.05	.10	.10	.22	1.30	2.17	3.05	1.97	1.18	-	.21	-
1943	-	.07	-	-	-	.31	3.06	2.62	1.22	-	.31	1.52	-
1944	1.25	1.00	1.04	-	.33	1.80	1.31	6.27	3.57	1.07	.36	1.00	-
1945	.06	.93	.41	.34	.53	5.83	4.88	2.56	.95	1.75	1.07	.18	19.49
1946	.25	.43	.79	.30	.52	1.14	1.30	1.84	.78	.90	.43	1.46	10.14
1947	1.25	.08	.47	.20	.32	.85	1.21	2.55	1.58	.66	.84	.17	10.18
1948	.81	.36	.14	7.15	.03	1.05	2.51	2.98	.44	1.13	.74	.50	17.64
1949	1.31	.99	.09	.12	.76	1.88	1.30	.90	.35	.96	.09	.40	9.15
1950	-	.19	.41	.13	.72	.36	3.44	1.52	.88	.38	2.44	.37	-
1951	.42	.70	.24	.03	.31	1.27	1.74	2.32	.50	.86	.56	1.01	9.96
1952	.48	.13	.25	.06	.52	3.31	4.01	1.90	1.96	.93	.32	.11	13.98
G	.86	.58	.40	.66	.74	1.96	2.50	2.80	1.59	1.05	.77	.62	14.53
H	25	26	26	25	26	27	27	28	28	26	23	26	-

STATION: 50 5778 ?? MC KINLEY PARK TOTAL PRECIPITATION ???? ??????????? ????

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1951	.42	.70	.24	.03	.31	1.27	1.74	2.32	.50	.86	.54	1.01	[illegible]
1952	.48	.13	.25	.06	.52	3.31	4.01	1.90	1.96	.93	.32	.11	[illegible]
1953	.35	.66	.11	.06	.67	3.15	4.01	4.99	1.59	.45	.03	.38	[illegible]
1954	1.10	.22	.31	.20	.15	3.65	3.23	1.21	3.91	.34	.18	1.00	15.77
1955	.56	1.31	.57	.34E	2.05	1.10	.76	3.36	.60	1.300	.40	3.01	[illegible]
1956	.45	1.64	.10	.34	.06	2.96	2.47	5.29	.97	.54	1.47	.65	[illegible]
1957	1.22	1.41	.07	.25	.13	2.55	2.12	.47	1.85	2.02	.55	.42	[illegible]
1958	1.16	.33	.26	.33	1.77	.90	1.21	2.06	1.37	.59	.61	.89	[illegible]
1959	[illegible]	1.19	.80	.33	.63	.98	6.71	2.92	1.01	.78	.48	.61	16.53
1960	.58	.78	.25	.46	.29	1.08	2.57	1.64	.99	.39	.39	.26	9.16
1961	.19	.10	.36	.75	.50	2.89	2.94	2.11	2.51	.89	.47	.64	[illegible]
1962	1.15	.59	2.47	.47	.55	4.71	3.89	2.70	1.72	.65	.10	.59	19.59
1963	[illegible]	.37	2.40	.34	.43	4.63	2.91	2.33	.34	1.62	.11	.46	16.57
1964	.17	.64	.45	.92	.80	1.47	3.67	1.43	1.34	1.01	1.46	.87	[illegible]
1965	[illegible]	.22	.76	.41	.23	3.21	2.35	.95	2.66	1.32	.63	2.65	[illegible]
1966	.09	2.21	.42	T	.76	2.36	1.76	1.55	.67	.700	2.68	.69	[illegible]
1967	.670	.410	3.12	1.84	2.17	4.08	7.39	3.45	.79	.39	1.94	1.44	27.690
1968	1.790	.57	T	.76	2.95	2.18	3.71	1.67	.57	.750	.580	1.11	[illegible]
1969	1.65	.26	.370	.09	1.32	.08	2.86	3.63	.09	.92	.35	[illegible]	11.410
1970	.220	.41	.12	.71	2.52	5.10	3.34	1.29	3.21	1.880	5.290	2.26	[illegible]
1971	.60	.77	.58	.18	.58	2.16	1.17	4.17	1.40	1.660	.64	1.07	[illegible]
1972	.22	.40	.34	.09	.11	2.03	1.95	.93	3.32	.51	.29	1.22	11.54
1973	.70	T	.23	T	.62	1.43	4.53	2.24	.52	.57	.92	.16	[illegible]
1974	[illegible]	.25	.15	.14	.76	3.03	4.81	2.68	.63	1.39	.83	.94	[illegible]
1975	1.87	.26	.24	.35E	.16	1.96E	4.98	4.40	.77E	.69E	1.11	.17E	[illegible]
1976	[illegible]	[illegible]	.37	.04	1.60E	.45	3.75	1.19	.87	1.37	1.43	.16	17.11E
1977	1.30	.45	.53E	.36	1.01	3.25	1.52	1.53	3.21	1.16	.22	.53	[illegible]
1978	.25	1.10	.32	.11	.79	1.42	2.05	3.39	.88	.53	.53	[illegible]	[illegible]
1979	[illegible]	.42	.74	.21	.50	2.47	3.17	1.17	.78	.71	1.29	.34	[illegible]
1980	[illegible]	.36	.05	1.13	.32	3.80	.21	2.12	1.78	.73	.29	.13	[illegible]
1981						1.93	4.57	3.65					
SUM	22.13	17.60	17.03	11.33	24.65	73.66	91.90	71.29	43.01	27.67	26.15	25.22	[illegible]
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	[illegible]
MEAN	.74	.59	.57	.38	.82	2.46	3.06	2.38	1.43	.92*	.87	.84	[illegible]
EXT HI	1.87	2.21	3.12	1.84	2.85	5.10	7.39	5.29	3.91	2.02	5.290	3.01	[illegible]
EXT LO	.05	T	T	T	.06	.08	.21	.47	.09	.34	.03	.09	[illegible]
EST	4	2	2	2	1	1			1	6	2	2	[illegible]

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STATION: 50 5778 MC KINLEY PARK MAX TEMP

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1951	-.7	11.3	14.1M	40.1	56.1	62.7	67.1	61.7	51.4	31.5	23.4	5.4M	35.3M
1952	2.1	16.7	22.6	34.4	43.4	61.2	63.1	56.5	47.4	39.0	31.2	18.0	36.5
1953	2.4	19.5	23.7	44.1	56.6	66.8M	68.7	59.4M	51.2	32.1	19.7	13.2	38.1M
1954	2.6	4.1	29.6	33.8	55.0	63.0	61.7M	59.6	48.4	36.8	24.5	-3.4	34.7M
1955	22.1	9.7M	28.2M	31.5M	47.0	57.5	66.8	57.7	50.1	30.5	4.7	4.0	34.2M
1956	-1.9	8.1	19.0	37.6	49.5	60.1M	66.2	59.6	46.8M	24.2	11.1	-3.2	31.3M
1957	20.3	17.3	30.5	39.2	55.2	72.6	66.0	67.4	50.5	40.2	27.4	-1.1	40.3
1958	17.3	18.0	32.8	45.9	53.9	66.5	68.3	61.7	48.9	26.8	16.4	10.5	39.1
1959	-2.9	24.8	9.8	37.2	52.9	68.1	60.5	61.8	50.8	35.6	25.7	6.2	35.9
1960	17.2	27.3	18.6	35.3	60.7	62.1	65.8	61.2	47.4	33.7	14.7	28.0	39.3
1961	18.8	10.3	17.3	35.3	55.4	63.3	65.3	60.7	49.5	26.5	15.0	-5.3	34.3
1962	12.2	24.1	21.6	36.6	47.5	63.8	69.2	64.0	45.9	36.9	18.0	11.3	37.6
1963	19.0	22.1	22.0M	34.2	53.6M	55.9M	65.3	61.3	56.9	33.3M	1.0	26.5	37.6M
1964	17.9	14.5	19.9	35.8	43.6	66.8M	66.3	61.0	53.6	34.4M	18.2	-3.1M	35.2M
1965	5.6	6.0	38.2	38.0	47.6	59.6M	64.3	60.6	55.1	26.5	21.1	10.1	36.1M
1966	5.2	17.3	15.3	40.1	48.1	68.3	68.3M	62.5	55.1	26.9	17.8	8.7	36.1M
1967	14.8	15.3	29.3M	40.2	53.2M	66.8	64.7	63.5M	54.1M	32.3M	24.7	11.2M	39.2M
1968	7.5	16.8	33.0M	37.6	54.1M	63.4	71.2	65.2M	49.2E	29.9M	19.6	.7	37.3E
1969	-6.7M	14.8M	33.0M	44.6	57.7	70.9M	65.0M	55.6	58.4E	42.4	14.9	27.2	39.3E
1970	-3.9	29.3	36.4	36.3	56.6M	59.6	63.9M	59.2M	45.5M	26.0M	22.9M	2.6	36.2M
1971	-7.1M	16.7	11.8	34.1	48.3	67.1	64.5	61.1	48.6	31.9	13.9	11.2	33.5M
1972	-1.6	9.3	12.8	31.9	51.5	63.6	70.4	65.5	48.1	33.7	21.6	8.5	34.7
1973	-2.9	19.1	26.3	41.1	54.2	62.2	65.8M	58.2	51.4	30.3	11.7	13.4M	35.9M
1974	1.2	-1.0	27.7	42.7	57.0	63.1	65.6	63.6	57.0	33.5	16.1	7.9	35.8
1975	2.8	10.4	23.7M	36.2M	53.0M	61.1M	67.7M	60.0	51.5E	32.5M	4.8M	7.4M	34.3E
1976	7.1M	6.6M	24.8M	42.6M	52.9M	66.5M	69.0M	67.5M	55.0M	33.0	30.5	17.6M	39.4M
1977	29.4	30.0	21.2M	36.4M	51.8	64.2M	70.2M	70.7	51.0	33.5	3.9	3.2M	38.3M
1978	23.1M	20.1	29.3M	40.7	56.8	59.6M	67.5	67.4	53.9M	34.6	24.0	19.4M	41.3M
1979	19.6	-3.7	26.5	39.3	59.6	61.7	65.8	66.3	54.1	40.5	31.2	2.3	35.6
1980	5.6	26.1	22.9	43.8	55.8	60.7	65.6M	60.6	47.1	38.7	25.0	-12.4	37.1M
SUM	241.4	460.9	720.9	1146.6	1588.5	1911.0	1989.8	1863.1	1533.9	987.7	553.6	246.0	1103.7
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	30
MEAN	8.0	15.4	24.0*	38.2	53.0*	63.7*	66.3*	62.1	51.1*	32.9*	18.5	8.2*	[illegible]
EXT HI	29.4	30.0	38.2	45.9	60.7	72.6	71.2	70.7	58.4E	42.4	31.2	28.0	41.3M
EXT LO	-7.1M	-3.7	9.8	31.5M	43.4	55.9M	60.5	55.6	45.5M	24.2	1.0	-12.4	31.3M
EST	4	3	10	4	6	10	9	5	8	6	2	8	75
SD	9.99	8.43	7.35	3.82	4.38	3.88	2.46	3.42	3.51	4.63	8.05	9.74	2.32

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STATION: SD 5778 MC KINLEY PARK MIN TEMP

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1951	-16.5	-7.3	-9.0M	23.9	32.4	39.0	46.0	43.2	35.0	13.1	8.9	-7.3	16.8M
1952	-17.2	-2.4	2.5	13.7	25.3	39.6	43.2	38.4	29.2	22.8	13.9	.8	17.5
1953	-16.4	1.3	.0	22.2	33.1	46.0M	44.5	43.1M	32.6	13.8	3.5	-1.1	17.6M
1954	-12.9	-16.5	6.0	9.5M	29.5	36.6	41.6M	40.3	30.1	21.6	9.6	-19.2	14.6M
1955	4.1	-8.9	3.6M	9.0M	29.5	38.3	43.4	38.4	32.5	14.4	-10.0	-13.7	13.1M
1956	-21.3	-9.1	-3.1	16.7	31.1	38.6M	44.6	42.4	29.4M	7.7	-7.1	-17.5	12.7M
1957	1.2	-6.3	8.9	18.6	29.3	42.7	43.4	42.3	32.0	22.6	12.9	-15.8	19.3
1958	-.6	-4.2	8.8	20.0	30.4	41.9	43.8	41.2	30.6	6.3	.4	-6.2	17.7
1959	-18.2	5.4	-14.3	12.0	30.0	41.2	40.6	38.5	30.8	15.5	7.0	-10.7	14.9
1960	-.7	5.1	-5.6	11.1	33.4	38.3	42.8	40.9	30.9	17.0	-1.6	10.5	15.5
1961	-.2	-10.2	-9.9	15.7	30.8	39.8	41.8	40.0	33.2	11.0	-2.2	-20.6	14.1
1962	-8.3	5.1	-1.6	17.4	28.9	40.8	43.8	41.2	28.7	20.2	1.7	-4.3	17.9
1963	5.3	1.3	-.6M	13.3	30.2M	36.5M	43.0	41.2	30.7	18.4M	-11.7	5.8	16.0M
1964	-7.7	-4.1	-8.4	14.7	22.2	40.6M	42.5	40.7	32.5	19.8M	.0	-19.9M	14.3M
1965	-11.9	-15.0	22.6	18.4	27.7	37.6M	43.8	38.2	36.3	5.0	3.0	-8.9	15.4M
1966	-12.9	-3.4	-7.9	12.8	27.5	39.1M	42.8M	36.3	29.0	10.3	-1.8	-13.5	13.2M
1967	-9.3	-6.5E	2.0E	18.6	26.5M	37.7	40.8	37.7M	28.1M	10.2M	6.2	-7.9M	15.2E
1968	-12.5	-2.4	3.9M	14.3	28.7M	37.1	38.8	35.9M	24.5E	9.8M	.6	-16.4	13.5E
1969	-21.8M	-7.4M	5.8M	19.3	29.9	40.5M	39.6M	31.3	27.3E	23.7	-3.7	8.8	15.1E
1970	-21.4	2.8	11.0	10.4	26.5M	34.7	39.0M	36.7M	24.9M	2.9M	1.6M	-18.8	12.3M
1971	-28.6	-4.1	-14.9	9.2	28.1	37.5	41.2	38.2	28.1	10.8M	-8.4	-9.7	10.6M
1972	-18.4	-14.6	-13.1	3.5	29.8	37.3	41.4	40.2	25.8	16.7	3.7	-7.2	12.1
1973	-16.9	-5.5	2.1	19.1	27.5	37.9	42.1M	38.8	29.7	11.3	-5.2	-3.4M	14.5M
1974	-14.6	-19.9	-4.2	16.5	27.3	36.2	40.9	38.7	33.8	8.3	-3.4	-13.4	12.2
1975	-17.0	-14.9	-2.2M	12.6M	28.9	37.6M	40.1M	35.8	29.8E	11.2M	-12.9M	-13.9	11.6E
1976	-11.5M	-16.7M	-2.1M	16.9M	27.2M	39.1M	43.0M	41.4M	29.4M	13.6	10.7	-.7	15.9M
1977	11.9	9.8	-5.3M	14.4M	30.7	38.3M	40.5M	40.9M	30.8M	12.9M	-12.0	-13.5M	16.6M
1978	6.5M	.9	.6M	13.0	30.4	37.7	41.7M	39.5	31.2M	13.2	4.6	1.1M	18.4M
1979	.5	-28.3	2.2	15.8	28.4	38.9	42.6	42.9	31.7	22.7	14.7	-15.4	16.4
1980	-12.9	4.4	5.5	16.9	29.8	39.5	43.6M	39.5	28.3	18.9	6.4	-23.1	16.4M
SUM	-297.7	-171.3	-16.3	449.5	871.0	1168.6	1267.1	1183.8	906.9	424.6	28.4	-272.1	471.9
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	30
MEAN	-9.9	-5.7	-.5*	15.0	29.0	39.0*	42.2*	39.5*	30.2*	14.2*	.9	-9.1	15.4*
EXT HI	11.9	9.8	22.6	23.9	33.4	46.0M	46.0	43.2	36.3	23.7	14.7	10.5	19.3
EXT LO	-28.6	-28.3	-14.9	3.5	22.2	34.7	38.8	31.3	24.5E	2.9M	-12.9M	-23.1	10.6M
EST	3	3	10	5	5	10	10	6	9	8	2	5	76
SD	9.42	8.81	8.18	4.34	2.30	2.17	1.73	2.60	2.72	5.63	7.74	9.07	2.36

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Local Climatological Data

Annual Summary With Comparative Data

1976

SUMMIT, ALASKA

Narrative Climatological Summary

Summit, Alaska, is approximately 150 airline miles north of Anchorage. It is located near the ridge line but on the south side of the Alaska Range in a broad valley, oriented in a northeast-southwest direction. There are several lakes close to the station from the south through the east and north. Although the station is one of the highest in Alaska, the terrain close by is relatively flat with mountain ranges rising to 4,000 to 6,000 feet on either side of the valley. The valley slopes down toward the southwest.

Summit is accessible by air, the Alaska Railroad, and the Anchorage to Fairbanks highway which is completely paved from Anchorage to Summit.

The climate of the area is typical of any interior mountain station at this latitude. Record high temperatures are modified by the altitude. The record lows during January and February are representative of the lower elevation, flat interior to the northeast. However, the resemblance stops there, with average wintertime low temperatures much warmer than the area to the north of the Alaska Range.

The terrain sloping upward from the southwest adds lift to the moist air moving into Alaska from the south causing more rain and snow to occur than at lower elevations. Since the snow melts little in winter, and because strong winds cause continual shifting, it is necessary to place the precipitation gage on a high platform reached by an elevated walkway in order to keep it above the tops of snow drifts and to make it possible to reach the gage without shoveling a new path each time an observation is made.

Period of record surface wind data has not been summarized for this stations so only short term statistical data is offered. The orientation of the valley determines the direction of any significant flow, blowing either up or down the valley.

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA SERVICE / NATIONAL CLIMATIC CENTER ASHEVILLE, N.C.

Meteorological Data For The Current Year

Station: SUMMIT, ALASKA # 26414 SUMMIT AIRPORT Standard time used: ALASKAN Latitude: 63° 20' N Longitude: 149° 08' W Elevation (ground): 2397 feet Year: 1976

Month	Temp °F Averages: Daily maximum	Daily minimum	Monthly	Extremes: Highest	Date	Lowest	Date	Degree days Base 65 °F: Heating	Cooling	Precip. Water equivalent: Total	Greatest in 24 hrs.	Date	Snow, Ice pellets: Total	Greatest in 24 hrs.	Date	Relative humidity, pct. Hour 02	Hour 08	Hour 14	Hour 20 (Local time)	Wind Resultant: Direction	Speed m.p.h.	Average speed m.p.h.	Fastest mile: Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days, Sunrise to sunset: Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 2405 feet m.s.l.
JAN	9.0	-3.8	2.6	34	30	-26	9	1931	0	2.17	1.15	18-19	49.7	21.5	18-19	67	70	73	71				28	23	30		6.0	11	4	16	12	7	0	2	0	29	31	20	
FEB	4.2	-10.4	-3.1	33	5	-28	11	1975	0	1.11	0.50	4	19.6	8.7	5-6		65	65	68				31	07	23		3.9	17	4	8	7	6	0	0	0	27	29	24	
MAR	18.2	2.2	10.2	30	6	-14	15	1696	0	1.65	0.45	3-4	41.1	8.7	3		75	67					35	07	17		8.0	4	4	23	11	8	0	0	0	31	31	15	
APR	36.3	14.5	25.4	51	30	-3	15	1180	0	0.14	0.08	26	5.8	3.1	26		68						20	08	14		6.2	8	8	14	3	2	0	0	0	8	30	2	
MAY	43.8	29.4	36.5	54	2	17	7	878	0	2.98	1.90	8	8.7	2.6	8		69						17	24	18		7.5	5	6	20	7	4	0	0	0	0	27	0	
JUN	60.6	40.9	50.8	74	27	34	8	420	0	0.51	0.30	30	0.0	0.0			69						18	22	17		6.9	6	8	16	4	0	0	0	3	0	0	0	
JUL	62.1	43.6	52.9	76	23	33	6	368	0	1.05	0.33	23	0.0	0.0			81						29	23	27		8.1	3	7	21	14	0	0	1	4	0	0	0	
AUG	62.8	41.8	52.3	78	2	31	29	383	0	0.96	0.20	7	0.0	0.0			80						20	26	7						13	0			5	0	1	0	
SEP	49.8	31.7	40.8	59	14	16	30	718	0	1.59	0.48	9	0.4	0.3	20		76						25	25	19		7.6	3	9	18	13	0	0	2	0	0	17	0	
OCT																							20	08	12														
YEAR																																							

Normals, Means, And Extremes - THROUGH 1975#

Month	Temperatures °F Normal: Daily maximum	Daily minimum	Monthly	Extremes: Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F: Heating	Cooling	Precip. Water equivalent: Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs. $	Year	Snow, Ice pellets: Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 02	Hour 08	Hour 14	Hour 20 (Local time)	Wind @ Mean speed m.p.h.	Prevailing direction	Fastest mile: Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days, Sunrise to sunset: Clear	Partly cloudy	Cloudy	† Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperatures °F Max. (b) 90° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb. Elev. 2405 feet m.s.l.
(a)				35		35					35		35		35		34		35		5	7	7	6	8	5	7	7			7	7	7	7	20	8	8	8	34	34	34	34	2
J	7.9	-4.8	1.6	44	1945	-45	1971	1965	0	0.91	3.38	1948	0.09	1945	0.80	1948	64.8	1948	16.3	1973	68	68	69	68	15.1	NE	44	05	1968		5.2	13	5	13	9	4	0	*	0	30	31	20	921.4
F	13.5	--4	6.6	45	1942	-45	1947	1635	0	1.23	4.31	1951	T	1950	2.79	1951	44.5	1951	28.0	1964	76	75	75	76	11.9	NE	46	07	1974		7.0	6	5	17	10	5	0	1	0	26	28	15	918.8
M	19.4	3.0	11.2	49	1961	-35	1971	1668	0	1.04	4.53	1946	0.07	1961	~~1.07~~	~~1946~~	59.1	1946	18.1	1946	76	76	70	73	11.1	NE	48	10	1971		6.2	9	6	16	10	5	0	1	0	27	31	14	917.2
A	32.9	14.1	23.5	57	1956	-30	1944	1245	0	0.67	4.45	1966	0.06	1944	0.97	1963	28.7	1970	9.7	1963	80	75	65	75	7.6	NE	33	08	1971		7.2	5	7	18	7	4	0	1	0	13	30	3	922.9
M	45.7	29.1	37.4	76	1960	-14	1945	856	0	0.77	2.66	1966	0.04	1949	0.96	1946	17.4	1958	7.5	1946	83	70	58	67	7.7	W	28	07	1969		7.5	3	9	19	7	2	*	1	*	1	22	*	923.1
J	58.0	39.9	49.0	89	1961	25	1947	480	0	2.19	4.45	1949	0.41	1942	2.22	1967	9.4	1974	8.7	1974	84	73	57	65	8.3	SW	29	22	1970		8.2	2	6	22	12	1	2	1	3	0	2	0	924.7
J	60.2	43.8	52.0	81	1961	32	1970	403	0	3.09	5.58	1959	1.17	1955	1.95	1948	9.7	1970	9.7	1970	89	78	62	72	7.8	SW	30	23	1974		8.2	2	7	22	16	*	2	1	5	0	*	0	929.1
A	56.0	41.1	48.6	81	1968	20	1955	508	0	3.30	6.74	1944	0.70	1941	2.10	1944	9.0	1955	6.0	1955	88	81	62	76	7.4	SW	31	22	1975		8.3	2	6	23	18	0	*	1	1	0	2	0	930.3
S	47.1	32.6	39.9	75	1957	6	1956	753	0	2.81	6.55	1942	0.29	1969	2.07	1944	21.5	1958	14.0	1955	85	81	59	75	7.5	NE	32	23	1972		7.4	5	5	20	16	2	*	1	*	1	14	0	924.1
O	30.4	17.5	24.0	59	1969	-15	1975	1271	0	1.62	3.79	1952	0.12	1967	1.24	1963	54.8	1970	12.6	1970	83	85	76	81	8.0	NE	35	23	1970		7.6	5	5	21	13	7	0	2	0	18	30	2	916.7
N	15.7	3.7	9.7	44	1962	-29	1948	1659	0	1.23	4.85	1952	0.06	1963	1.30	1964	75.1	1967	21.9	1970	79	79	78	79	11.3	NE	39	25	1970		7.1	7	4	19	9	5	0	1	0	27	30	13	921.3
D	9.2	-3.4	2.9	42	1969	-43	1961	1925	0	1.20	4.63	1951	0.24	1945	1.09	1967	50.7	1970	27.4	1970	76	78	76	77	12.7	NE	44	11	1970		6.5	9	5	17	11	6	0	1	0	30	31	19	914.7
YR	33.0	18.0	25.5	89	JUN 1961	-45	JAN 1971	14368	0	20.06	6.74	AUG 1944	T	FEB 1950	2.79	FEB 1951	75.1	NOV 1967	28.0	FEB 1964	81	76	67	74	9.7	NE	48	10	MAR 1971		7.2	68	70	227	138	41	5	12	9	173	251	86	922.0

6.33 Aug 55

6.13 Sept 65

NOTE: Due to less than full time operation on a variable schedulé, manually recorded elements are from broken sequences in incomplete records. Daily temperature extremes and precipitation totals for portions of the record may be for other than a calendar day. The period of record for some elements is for other than consecutive years.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

$ For calendar day prior to 1968.
@ For the period 1950-1954 and January 1968 to date when available for full year.
† For the period 1942-1953 and January 1968 to date when available for full year.

\# Data for this station not available for archiving nor publication of summary effective October 1976.

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1941		13.0	17.7	30.7	37.0	50.4	49.2	56.2	41.9	21.1	5.8	5.9	
1942	11.2	18.1	10.8	26.6	42.2	50.8	53.2	48.4	44.0	25.6	0.4	-8.6	26.9
1943	-4.4	12.0	8.4	26.2	40.1	52.5	50.9	48.4	40.7	30.2	19.4	13.4	28.2
1944	7.1	15.4	8.8	18.6	37.1	49.8	53.5	47.8	39.2	26.6	11.0	7.5	26.8
1945	12.9	10.7	9.9	19.0	32.8	46.6	52.2	47.5	39.8	23.4	-2.6	4.6	24.7
1946	7.1	5.8	4.4	21.4	38.0	54.8	54.8	47.0	40.6	26.9	5.2	-7.3	24.9
1947	-11.0	10.0	19.4	24.2	37.6	46.8	54.5	46.4	37.8	25.2	19.2	14.0	27.0
1948	8.2	0.2	5.1	16.9	36.0	48.8	49.4	44.4	37.0	25.4	2.6	-5.0	22.4
1949	3.4	-4.8	18.4	19.4	34.0	43.0	51.0	48.7	43.3	24.7	17.6	-2.1	24.7
1950	6.0	-1.3	17.2	23.9	37.7	48.9	52.3	53.1		23.6	2.0	4.9	
1951	-5.1	0.8	3.2	28.8	40.4	47.9	54.8	49.3	41.1	19.8	14.5	1.6	24.7
1952	-7.0	8.9	19.5	22.2	32.4	47.9	51.8	46.8	38.4	29.9	20.2	9.6	25.9
1953	-6.3	11.5	7.7	29.3	41.0	53.8	55.1	48.0	40.1	22.8	10.0	7.2	26.7
1954	-0.7	-4.7	13.1	21.4	41.9	50.4	51.0	49.3	40.6	30.5	15.5	-5.8	25.2
1955	10.4	3.1	11.3	18.0	34.6	43.9	53.0	46.0	37.9	22.1	-0.7	0.0	23.3
1956	-6.0	-1.7	6.3	23.6	36.8	46.3	52.5	48.8	37.1	17.4	4.6	-4.7	21.8
1957	6.9	4.5	17.1	25.7	39.9	55.2	53.7	53.2	39.4	29.0	22.0	-1.2	28.8
1958	10.1	6.8	16.5	28.9	38.1	51.3	51.1	48.8	37.6	15.4	10.3	5.9	26.7
1959	-4.3	11.9	0.6	21.1	38.6	53.3	47.5	49.1	40.1	24.2	13.3	5.0	25.1
1960	7.6	12.5	6.7	23.0	43.8	48.0	51.1	48.6	36.9	24.1	9.8	17.6	27.5
1961	10.6	4.4	3.7	23.3	39.4	49.5	50.1	48.2	39.9	18.3	5.9	-7.7	23.7
1962	3.0	10.9	7.5	25.7	34.9	48.7	54.4	50.3	36.5	28.0	9.1	5.5	26.2
1963	12.4	13.2	9.2	20.0	37.8	42.7	52.4	48.0	43.8	26.0	-1.9	15.8	25.6
1964	3.3	7.4	2.6	21.3	29.8	48.5	52.2	48.5	41.8	25.8	10.8	-8.4	23.6
1965	-0.4	-2.3	24.8	25.4	32.7	43.8	51.1	46.5	43.2	16.7	9.5	0.9	24.3
1966	-3.2	4.4	3.0	22.0	35.0	50.3	51.4	47.5	40.6	19.8	10.3	3.1	23.7
1967	1.9	4.4	14.2	24.3	36.8	50.2	52.3	50.4	40.8	24.4	14.8	2.3	26.4
1968	-0.7	8.4	13.6	21.4	36.9	48.2	54.4	51.5	37.8	21.9	11.6	-3.8	25.1
1969	-7.7	7.1	15.2	29.6	40.8	53.7	51.1	44.1	42.6	33.2	9.4	18.7	28.1
1970	-5.7	18.2	22.2	21.3	38.5	45.2	49.3	46.8	36.0	18.0	12.0	-1.6	25.0
1971	-18.2	6.9	0.1	21.7	33.2	48.2	50.3	49.5	38.8	20.3	5.6	2.4	22.0
1972	-7.2	-0.8	0.6	13.5	37.2	46.8	55.9	51.6	36.0	22.4	12.5	2.2	22.6
1973	-8.3	3.6	13.9	26.4	36.9	48.2	51.2	46.4	39.1	19.6	3.3	8.3	24.1
1974	-4.6	-4.5	9.9	27.4	41.5	48.0	51.9	50.6	44.7	23.5	10.6	2.7	25.2
1975	-0.7	3.7	9.4	21.7	37.7	46.4	52.5	48.6	40.0	22.9	1.8	-0.3	23.6
1976	2.6	-3.1	10.2	25.4	36.5	50.8	52.9	32.3	40.8				
RECORD MEAN	0.9	6.0	10.4	23.4	37.4	48.8	52.1	48.8	39.9	23.7	0.0	0.0	24.3
MAX	7.3	12.7	18.7	32.7	45.6	57.9	60.3	56.3	47.2	30.1			30.7
MIN	-5.6	-0.8	2.0	14.0	29.1	39.7	43.9	41.2	32.5	17.2	0.0	0.0	17.8

Heating Degree Days

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1960-61	426	504	836	1265	1651	1463	1685	1697	1905	1243	788	461	13926
1961-62	452	511	768	1441	1773	2259	1918	1510	1780	1170	924	484	14990
1962-63	323	451	849	1138	1676	1844	1628	1446	1727	1343	839	661	13925
1963-64	381	521	629	1206	2004	1521	1909	1669	1935	1306	1084	486	14651
1964-65	396	503	687	1207	1623	2277	2030	1887	1242	1179	995	629	14655
1965-66	422	368	649	1492	1660	1989	2117	1694	1922	1284	926	433	15156
1966-67	418	537	723	1393	1638	1915	1955	1693	1568	1212	869	440	14361
1967-68	388	445	720	1252	1504	1947	2035	1640	1585	1302	860	497	14175
1968-69	323	412	810	1329	1598	2132	2258	1618	1540	1057	746	333	14156
1969-70	428	643	663	979	1669	1430	2193	1305	1319	1306	813	589	13337
1970-71	478	560	865	1452	1590	2060	2428	1626	2015	1289	926	498	15842
1971-72	449	674	779	1382	1781	1941	2240	1908	1998	1539	855	540	15886
1972-73	275	411	860	1314	1570	1946	2276	1722	1578	1150	861	498	14461
1973-74	419	571	772	1401	1852	1756	2155	1945	1708	1122	722	502	14925
1974-75	398	441	603	1279	1630	1932	2035	1715	1718	1293	840	549	14433
1975-76	383	501	745	1299	1897	2021	1931	1975	1696	1180	878	420	14926
1976-77	368	383	718		0	0							

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	0	0	0	0	0	1	0	0	0	0	0	0	1
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0		0	0	0	0		0	0	

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1941		0.68	0.72	1.66	1.86	1.70	2.44	0.70	0.34	1.47		1.31	
1942	0.96	0.74	0.47	0.31	0.31	0.41	2.70	4.64	6.55	1.29	0.31	0.49	19.18
1943	0.31	3.21	1.52	0.33	1.17	3.49	3.89	4.11	4.18	1.04	1.24	3.78	28.27
1944	0.84	2.86	1.40	0.06	2.00	2.24	3.11	5.74	3.75	2.58	1.32	2.72	29.62
1945	0.09	1.00	1.04	0.31	1.54	3.85	4.19	6.04	1.26	3.02	0.40	0.24	22.98
1946	0.16	0.56	4.53	0.18	2.23	0.84	2.18	2.96	2.14	3.11	0.83	1.89	21.61
1947	1.25	0.37	1.75	0.25	0.45	1.95	3.14	3.14	5.69	0.48	0.99	0.77	20.23
1948	3.38	0.67	0.61	1.08	0.09	1.86	3.01	2.50	2.73	2.26	1.47	0.54	22.20
1949	1.57	0.09	1.31	0.18	0.04	4.45	2.49	2.51	3.73	0.46	0.51	0.58	17.92
1950	0.36	T	0.07	0.13	0.28	1.19	2.22	1.39	3.96	0.70	1.48	0.71	12.47
1951	1.40	4.31	0.90	1.10	0.30	2.66	3.69	4.11	2.90	2.51	2.29	4.63	30.80
1952	0.84	1.51	1.47	0.84	1.54	0.95	3.55	1.63	2.81	3.79	4.85	0.53	26.31
1953	1.21	1.94	0.12	0.19	0.91	1.52	2.76	4.55	1.41	0.67	0.34	0.77	16.39
1954	1.88	1.21	1.08	0.15	0.16	3.74	4.23	3.37	1.61	1.57	1.80	1.70	22.50
1955	1.26	2.09	1.50	0.57	0.53	2.44	1.17	6.33	3.36	1.33	0.31	2.08	23.17
1956	0.54	1.19	0.61	0.68	0.92	2.54	2.21	2.88	3.10	1.08	1.89	0.67	18.51
1957	2.05	0.31	0.42	0.12	0.20	1.85	2.05	1.50	5.12	1.80	1.47	0.26	17.15
1958	0.73	0.02	1.03	0.34	1.76	0.67	2.65	2.64	1.79	2.14	0.37	0.32	14.69
1959	0.24	0.92	0.20	0.86	0.86	1.59	5.58	5.88	2.60	1.21	0.97	0.57	19.08
1960	1.11	0.74	0.18	0.31	0.57	1.47	3.38	2.75	2.93	1.15	0.22	0.99	15.80
1961	0.39	0.36	0.07	1.09	0.97	2.51	2.99	4.38	3.64	1.50	0.71	0.74	19.55
1962	0.85	1.24	0.84	0.29	0.11	2.25	3.25	3.57	2.45	1.29	0.23	0.64	17.01
1963	1.37	0.33	2.59	2.39	0.45	2.10	2.31	4.84	1.71	2.14	0.06	1.56	21.83
1964	0.43	2.14	0.44	1.91	0.63	1.31	3.43	1.95	1.78	2.66	2.87	0.43	20.18
1965	0.85	0.98	1.91	0.47	0.57	4.34	2.32	1.42	6.13	0.33	0.42	1.12	21.06
1966	0.17	2.32	0.43	0.46	0.44	1.47	1.75	3.66	1.90	1.29	0.85	0.45	17.19
1967	0.22	0.82	1.19	0.70	0.37	4.03	3.84	3.52	1.05	0.12	4.07	2.31	22.24
1968	0.89	1.60	0.14	0.72	1.02	0.97	1.50	0.99	1.13	0.52	0.18	0.28	9.94
1969	0.56	0.49	0.71	0.22	0.41	0.98	2.23	1.50	0.29	2.04	1.69	1.09	12.30
1970	0.96	2.30	2.08	2.14	0.53	3.99	4.30	3.01	1.91	2.53	1.69	1.93	27.37
1971	0.61	1.14	0.20	0.33	0.31	2.25	2.64	2.58	2.87	1.42	0.91	0.83	16.09
1972	1.16	0.10	0.52	0.23	0.33	1.18	1.55	1.65	3.38	2.29	0.79	1.07	14.25
1973	1.25	0.24	1.66	0.18	0.38	0.94	1.44	3.08	0.85	2.06	0.91	1.14	14.13
1974	0.13	1.19	0.77	0.89	0.16	4.10	3.18	3.21	2.21	0.86	2.28	0.81	19.79
1975	1.14	0.33	0.54	0.88	0.50	2.53	4.16	2.32	4.99	0.39	0.16	1.40	19.54
1976	2.17	1.11	1.65	0.14	2.98	0.51	1.05	0.96	1.59				
RECORD MEAN	0.92	1.14	1.00	0.64	0.71	2.19	3.02	3.23	2.81	1.59			17.25

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1941-42									7.1	4.4	T	0.0	
1942-43	0.0	0.0	6.0	13.3	4.9	9.8	5.4	29.6	23.8	0.9	0.6	T	96.3
1943-44	0.0	0.0	3.5	7.6	14.9	28.8	10.1	30.1	20.7	1.0	6.5	1.0	124.2
1944-45	0.0	3.0	4.6	36.1	16.3	30.5	3.4	19.6	22.8	4.0	9.5	T	149.8
1945-46	0.0	0.0	3.0	37.2	7.8	5.7	4.0	7.6	59.1	3.1	12.3	0.0	139.8
1946-47	0.0	2.0	0.1	54.0	18.0	45.3	27.9	7.2	25.3	6.9	10.7	0.0	197.4
1947-48	0.0	0.0	2.2	6.0	13.4	9.0	64.8	16.5	11.1	22.9	1.2	0.0	147.1
1948-49	0.0	T	9.9	30.9	23.9	8.3	28.3	4.0	34.3	5.0	1.3	T	165.9
1949-50	T	0.0	T	8.0	9.2	15.3	4.1	T	1.9	6.5	1.5	0.0	46.5
1950-51	T	0.0	3.0	11.4	25.0	7.3	15.7	44.5	9.1	11.0	0.2	T	127.2
1951-52	T	0.0	2.8	26.9	20.8	47.9	8.7	14.8	14.9	8.4	14.8	T	160.0
1952-53	T	0.0	3.0	21.9	47.3	5.3	15.4	33.3	2.3	2.0	3.0	0.0	133.5
1953-54	0.0	0.0	0.4	8.1	3.9	10.8	21.6	14.6	12.2	1.7	T	0.0	73.3
1954-55	0.0	0.0	0.0	11.4	27.7	15.8	25.8	33.3	28.1	10.1	5.1	6.7	164.0
1955-56	0.0	9.0	15.1	21.0	8.5	24.6	5.9	13.2	10.3	12.6	1.9	T	122.1
1956-57	0.0	0.0	0.1	7.8	23.8	7.6	20.3	3.0	4.9	1.1	T	0.0	68.6
1957-58	0.0	0.0	5.4	18.3	20.7	3.8	8.7	0.4	18.3	3.8	17.4	0.0	96.8
1958-59	0.0	0.0	21.5	16.7	8.9	4.5	4.4	19.5	6.6	15.8	1.2	0.0	99.1
1959-60	1.3	0.2	T	18.6	16.0	13.6	15.1	8.2	4.8	7.3	1.6	0.0	86.7
1960-61	0.0	0.0	10.1	17.0	5.8	27.4	4.8	6.7	1.3	8.7	T	0.0	81.8
1961-62	T	0.0	12.0	15.2	11.0	7.4	8.4	12.3	9.2	2.7	0.5	T	78.7
1962-63	0.0	T	5.6	16.5	5.2	5.9	13.4	3.3	26.7	24.0	1.2	4.9	106.7
1963-64	0.0	T	2.0	8.9	0.6	15.1	4.3	24.9	4.3	17.8	5.6	0.0	83.5
1964-65	0.0	0.0	T	13.0	24.3	4.4	9.5	9.9	16.4	4.6	4.5	0.1	86.7
1965-66	0.0	0.0	1.6	5.5	4.3	11.4	1.7	23.0	4.3	13.5	3.8	0.0	69.1
1966-67	0.0	T	T	9.6	17.2	4.2	3.3	20.1	20.2	9.2	0.7	0.0	84.5
1967-68	0.0	0.0	0.1	1.3	75.1	37.8	14.3	23.7	2.2	11.7	8.8	0.0	175.0
1968-69	0.0	0.0	2.5	8.9	2.1	4.0	6.6	8.2	10.7	3.9	2.8	T	49.7
1969-70	0.0	0.2	0.0	17.7	18.2	16.4	11.2	27.0	26.0	28.7	5.7	8.4	159.5
1970-71	9.7	0.0	12.5	54.8	48.9	50.7	14.1	30.5	5.9	9.8	9.3	1.2	247.4
1971-72	0.0	0.0	8.2	35.5	24.3	42.4	29.2	4.1	22.1	8.2	2.6	0.8	177.4
1972-73	0.0	0.0	16.7	23.4	19.9	17.2	29.7	6.1	42.3	5.8	3.4	5.4	171.9
1973-74	0.0	T	7.8	24.2	9.2	12.1	1.4	12.3	9.3	10.7	0.9	9.4	97.3
1974-75	0.0	0.0	0.9	9.2	38.7	23.4	28.7	3.6	7.8	13.8	7.6	0.5	154.2
1975-76	T	0.0	3.7	10.0	2.7	31.6	49.7	19.6	41.1	5.8	8.7	0.0	172.9
1976-77	0.0	0.0	0.4		0.0	0.0							
RECORD MEAN	0.3	0.4	4.8	18.5	0.0	0.0	14.2	15.6	15.5	8.9	4.3	1.1	83.6

# Indicates a station move or relocation of instruments. See Station Location table.

Record mean values above are means through the current year for the period beginning in 1941 for temperature and precipitation, 1943 for snowfall.

STATION LOCATION

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above: Sea level									Sea level	Remarks
							Ground									
						Ground at temperature site	Wind instruments	Extreme thermometers	Psychrometer	Telepsychrometer	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Pyranometer	
CAA Station Summit Airport	1/24/41	8/26/43	-	63°20'	149°08'	2395	32	5	Sling				3			
CAA Station Summit Airport	8/26/43	7/12/46	1/4 mi. E	63°20'	149°08'	2401	32	6	6				4			
CAA Station Summit Airport	7/12/46	12/12/59	Same Location	63°20'	149°08'	2401	32	11	11				8			Instruments elevated onto platforms because of snow depths.
FAA Station Summit Airport	12/12/59	10/15/74	Same Location	63°20'	149°08'	2401	35	16	16				10			Station became WBAS/FSS on 10/1/67.
NWS Office Building #107 Summit Airport	10/15/74	10/15/76	1/16 mi.SE	63°20'	149°08'	2397	32	8	8				8			
FAA RCO Building	10/15/76	Present	1/16 mi.NW	63°20'	149°08'	2407	30				4			a8		a - AMOS III-73 Automatic Station.

Requests for additional climatic information should be addressed to: Director, National Climatic Center, Federal Building, Asheville, N. C. 28801

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Daniel B. Mitchell
Director, National Climatic Center

USCOMM-NOAA-ASHEVILLE - 800

UNITED STATES DEPARTMENT OF COMMERCE, WEATHER BUREAU

CLIMATOLOGICAL RECORD

The Gracious House

I PRECIPITATION - (inches)

YEAR	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		ANNUAL	
	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +
61													3.32		3.39		2.26									
62															5.12											
63																										
64							1960 → In This row since no space above						4.86		3.59		1.23									
65																										
66											2.23		2.99		3.34		1.67									
67											1.62		2.84		7.54		1.79									
68											1.03		3.38		—		—									
69											1.05		4.66		.84		.68									
70											3.36		4.51		3.57		1.84									
71											1.74		1.99		7.05		2.53									
72											—		2.53		—		—									
73											1.46		—		—		—									
74											1.38		.90		.85		1.52									
75											—		—		1.98		3.21									
76											.49		1.76		3.24		1.16									
77											.70		—		.96		—									
78											—		1.72		1.11		2.38		3.07							
79																										
80																										
ns																										
ns																										

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UNITED STATES DEPARTMENT OF COMMERCE, WEATHER BUREAU

CLIMATOLOGICAL RECORD

The Gracious House

Temperature - Average monthly (°F)

AR	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
60						—	47.5	46.9	38.0				
61						—	49.0	48.8	36.7				
62						47.2	—	50.7	—				
63													
64													
65													
66						48.3	52.2	47.7	49.5				
67						50.2	52.6	49.0	40.4				
68						49.4	53.9	—	—				
69						53.5	51.7	41.9	39.0				
70						47.1	49.3	46.1	35.5				
71						48.4	50.6	49.6	38.7				
72						—	54.1	—	—				
73						49.3	—	—	—				
74						47.4	51.3	48.5	42.3				
75						47.2	52.3	48.2	41.9				
76						51.5	54.7	51.2	40.5				
77						—	—	53.3	—				
78						—	51.0	53.5	42.1	27.4			
79													
80													
MS.													
MDS.													

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UNITED STATES DEPARTMENT OF COMMERCE, WEATHER BUREAU

CLIMATOLOGICAL RECORD

THE GRACIOUS H[illegible]

Precipitation - Greatest in 24 hrs. (inches)

YEAR	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		ANNUAL	
	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +	32° −	90° +
61													.65	18	.90	5	.30	29								
62													—		1.93	29										
63																										
64			1960 → In this row since no space above										.81	11	1.00	24	.47	1								
65																										
66											.76	18	1.00	27	.80	18	.45	12								
67											.50	27	.97	20	1.63	1	.33	2								
68											.21	19	.46	14	—		—									
69											.38	21	1.26	12	.34	9	.55	4								
70											.55	19	.63	18	.58	22	.35	17								
71											.80	29	.34	27	1.23	20	.80	7								
72													.48	28												
73											.27	19														
74											.86	25	.18	11	.26	27	.40	19								
75															.71	26	1.02	11								
76											.15	17	.30	23	.57	3	.30	19								
77											.15	25	—		.25	6	—		—							
78											.90	16	.57	22	.46	12	.50	5	.89	13						
79																										
80																										
15																										
ms																										

W. B. Form 5322

UNITED STATES DEPARTMENT OF COMMERCE, WEATHER BUREAU

CLIMATOLOGICAL RECORD

[illegible]

TEMPERATURE—HIGHEST AND DATE (WHOLE NUMBERS) (°F)

YEAR	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		ANNUAL	
	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date	Highest	Date
1951																										
1952																										
1953																										
1954																										
1955																										
1956																										
1957																										
1958																										
1959																										
1960											–		67	1	71	11	57	11								
1961													72	27	70	18	62	17								
1962											78	20	–		76	10										
1963																										
1964																										
1965																										
1966											79	29	76	23	71	7	59	15								
1967											77	19	79	16+	69	8	67	18	50	8						
1968											72	12	79	25	–		–									
1969									68	25	86	15	72	4+	62	30+	61	9								
1970																										
Highest 1951 to 1970 and date																										

ORM 5323-Revised

UNITED STATES DEPARTMENT OF COM[illegible]CE, WEATHER BUREAU

CLIMATOLOGICAL [illegible]ECORD

The Gracious House

TEMPERATURE—LOWEST AND DATE (WHOLE NUMBERS) (°F)

EAR	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		SEASONAL	
	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date	Lowest	Date
)-51																										
1-52																										
2-53																										
3-54																										
1-55																										
5-56																										
6-57																										
7-58																										
3-59																										
)-60																										
)-61	30	19	25	7	12	16																				
1-62	31	6	26	30	18	21																	22	18		
2-63	–		25	31	–																					
3-64																										
1-65																										
5-66																							23	30+		
5-67	20	1	27	16	19	24																	25	9		
7-68	32	17	30	28+	12	14																	28	5		
3-69	34	12	–		–								2										29	6		
)-70	29	27	18	13	14	25																				
ent 1950 1969- d da																										

SUMMARY OF TEMPERATURE AND PRECIPITATION DATA
GRACIOUS HOUSE SITES, 1960-1978

	Temperature (°F)					Precipitation (inches)		
Month	Highest	Year	Lowest	Year	Average Monthly	Greatest in 24 hours	Year	Average Monthly
June	86°	1969	22°	1962	49.0	0.90	1978	1.51
July	79°	1967+	20°	1967	51.6	1.26	1969	2.96
August	76°	1962	18°	1970	48.9	1.93	1962	3.28
September	67°	1967	12°	1961+	39.6	1.02	1975	1.84

"+" means reading observed also in one or more subsequent years.

Local Climatological Data

Annual Summary With Comparative Data

1980

GULKANA, ALASKA

Narrative Climatological Summary

Gulkana Airport is located in the Copper River basin two miles west of the river itself, and nine miles south of the village of Gulkana. It is approximately 150 airline miles northeast of Anchorage and 200 miles south southeast of Fairbanks. The facility can be reached by both highway and air, and is near the junction point of the Glenn Highway (leading to Anchorage or Canada) and the Richardson Highway (to Fairbanks). Terrain surrounding the station experiences no rapid changes in elevation. To the east the ground drops off about 400 feet to the river bed then rises gradually to about 3,000 feet at a distance of 18 miles then rises abruptly to 12,000 feet at the top of Mt. Drum, about 25 miles away. Elevation changes in all other directions are small. Numerous small river and creek valleys give the appearance of a fairly rough terrain despite the small elevation changes. From a much larger scale viewpoint, mountain ranges exist in all directions. The Alaska Range lies about 75 miles to the north. Mt. Drum to the east is the western end of the Wrangell Mountains. Fifty miles to the south are the Chugach Mountains. To the west at a distance of about 100 miles the north-south oriented Talkeetna Mountains with their southern extension joining the Chugach Range, form a barrier between Gulkana and Anchorage. Elevations of the various mountain ranges vary from 6,000 feet to 12,000 feet and exert a significant influence on the climate of the Copper River basin.

There is no doubt that Gulkana Airport is under a dominant continental influence. Typical of this are the extremes of temperature in summer and winter, with a range between the all time maximum and minimum of 156 degrees. Also worthy of note is the effect of radiational cooling during winter months when the sun is making only a brief appearance above the horizon during the middle of the day. The result is a total of four months with average minimum temperatures below zero. In contrast to the cold winter months with short days, summer is pleasantly cool but warm enough for any and all outdoor activities, and with 18 to 20 hours of sunshine the days are long enough for both work and play.

The low annual precipitation is also representative of a continental climate. Mountains surrounding the Gulkana area remove a large portion of the moisture which might otherwise reach the valley, particularly that from off of the Gulf of Alaska which deposits annual amounts in excess of 60 inches on the windward slopes of the Chugach Range. There is no commercial agriculture in the Copper River basin, but with well over half of the annual total precipitation occurring during the four months of June through September, there is adequate moisture for gardening. The average length of the growing season is 78 days, and on the average begins with June 4th and ends August 22nd.

Cloud data are available for a short period, but the heaviest precipitation occurrence in summer may be indicative of maximum cloudiness occurring during these months.

Surface wind directions are prevailing southeasterly during spring, summer and early fall, and from the north during late fall and winter. Average monthly wind speeds are highest in summer. However, the infrequent occurrences of strong winds in excess of 40 m.p.h. have always been associated with the lighter wind months from October through April.

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA AND INFORMATION SERVICE / NATIONAL CLIMATIC CENTER ASHEVILLE, N.C.

Meteorological Data For The Current Year

Station: GULKANA, ALASKA # 26425 GULKANA INTERMEDIATE FIELD Standard time used: ALASKAN Latitude: 62° 09' N Longitude: 145° 27' W Elevation (ground): 1572 feet Year: 1980

Month	Temperature °F – Averages – Daily maximum	Daily minimum	Monthly	Extremes – Highest	Date	Lowest	Date	Degree days Base 65 °F – Heating	Cooling	Precipitation in inches – Water equivalent – Total	Greatest in 24 hrs.	Date	Snow, Ice pellets – Total	Greatest in 24 hrs.	Date	Relative humidity, pct. – Hour 02	Hour 08	Hour 14	Hour 20 (Local time)	Wind – Resultant – Direction	Speed m.p.h.	Average speed m.p.h.	Fastest mile – Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days – Sunrise to sunset – Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F – Maximum (b) 90° and above	Maximum 32° and below	Minimum 32° and below	Minimum 0° and below	Average station pressure mb Elev. 1579 feet m.s.l.
JAN	4.9	-14.1	-4.6	41	22	-45	13	2164	0	0.73	0.41	17	10.9	5.1	31		68	64	68												4	3			0	26	29	26	
FEB	25.9	6.4	16.2	42	11	-17	19	1412	0	0.27	0.18	1	4.7	2.6	1		68	59	71												5	1			0	19	28	11	
MAR	29.9	9.5	19.7	43	31	-20	14	1397	0	0.24	0.07	17	10.8	2.5	16		64	52	68												8	6			0	18	31	7	
APR	46.5	26.5	36.5	54	30	17	17	849	0	T	T	29	T	T	20		62	41	60												0	0			0	0	27	0	
MAY	57.0	35.2	46.1	68	27	25	4	577	0	0.15	0.12	20	T	T	1		49	31	45												3	0			0	0	9	0	
JUN	64.9	44.6	54.8	81	5	35	1	302	2	1.73	0.62	18	0.0	0.0			60	42	54												10	0			7	0	0	0	
JUL	67.4	47.2	57.3	79	23	34	2	231	1	2.60	0.86	30	0.0	0.0			68	50	65												15	0			9	0	0	0	
AUG	63.4	40.7	52.1	80	11	26	24	393	0	1.67	0.59	18	0.0	0.0			75	52	69												14	0			5	0	5	0	
SEP	52.6	31.8	42.3	62	1	20	6	675	0	0.77	0.20	22	T	T	3		78	52	74												7	0			0	0	14	0	
OCT	38.2	23.6	31.0	53	7	5	30	1049	0	0.69	0.45	9	5.4	2.9	9		82	68	78												5	2			0	8	25	0	
NOV	21.9	6.7	15.3	35	25	-15	30	1483	0	0.10	0.06	27	1.6	1.0	27		80	79	81												4	1			0	28	30	6	
DEC	-17.6	-32.2	-24.9	41	31	-51	19	2797	0	0.62	0.27	13	13.0	7.7	13		62	57	61												5	3			0	30	31	30	
YEAR	37.9	19.0	28.5	81	JUN 5	-51	DEC 19	13329	3	9.57	0.86	JUL 30	46.4	7.7	DEC 13		68	54	66												80	16			21	129	229	80	

Normals, Means, And Extremes

Month	Temperatures °F – Normal – Daily maximum	Daily minimum	Monthly	Extremes – Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F – Heating	Cooling	Precipitation in inches – Water equivalent – Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs. $	Year	Snow, Ice pellets – Maximum monthly	Year	Maximum in 24 hrs. $	Year	Relative humidity pct. – Hour 02	Hour 08	Hour 14	Hour 20 (Local time)	Wind – Mean speed m.p.h. @	Prevailing direction	Fastest mile & – Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset #	Mean number of days – Sunrise to sunset – Clear #	Partly cloudy	Cloudy	Precipitation .01 inch or more ¢	Snow, Ice pellets 1.0 inch or more	Thunderstorms %	Heavy fog, visibility ¼ mile or less %	Temperatures °F – Max. (b) 90° and above	Max. 32° and below	Min. 32° and below	Min. 0° and below	Average station pressure mb. Elev. 1579 feet m.s.l.
(a)				33		33					37		37		36		37		33		3	9	10	9	8	5	5	5			5	5	5	5	22	12	5	5	33	33	33	33	
J	1.9	-16.4	-7.3	46	1948	-63	1947	2241	0	0.58	1.56	1943	T	1974	0.76	1958	21.4	1943	7.5	1947	67	70	67	69	6.1	N	52	04	1971		4.7	15	4	12	7	2	0	*	0	29	31	25	
F	14.7	-6.9	3.9	46	1943	-65	1947	1711	0	0.47	1.65	1968	0.04	1943	0.96	1978	19.2	1974	14.0	1978	78	73	63	73	5.6	N	35	19	1970		7.0	6	4	18	5	2	0	1	0	24	28	19	
M	28.1	.8	14.5	49	1965	-48	1972	1565	0	0.34	1.32	1972	T	1950	0.78	1972	23.4	1944	10.6	1972	76	72	54	66	6.5	WNW	35	15	1970		6.0	9	7	15	5	3	0	2	0	19	30	16	
A	41.8	18.5	30.2	67	1958	-42	1944	1044	0	0.22	0.82	1945	0.00	1954	0.78	1961	6.9	1977	6.0	1977	75	64	46	60	8.6	SE	46	18	1970		6.8	5	10	15	3	1	0	*	0	4	29	2	
M	55.1	32.5	43.8	85	1960	5	1964	657	0	0.63	1.51	1967	T	1950	1.25	1946	5.0	1945	4.0	1977	76	57	39	52	8.8	SE	29	17	1972		7.2	3	10	18	5	*	1	*	1	*	14	0	
J	66.0	42.4	54.2	90	1969	28	1950	333	9	1.34	4.07	1962	0.08	1946	1.51	1945	T	1963	T	1963	75	60	42	51	8.8	SE	36	15	1971		7.4	2	10	18	9	0	2	0	9	0	1	0	
J	68.1	45.6	56.9	91	1953	29	1970	254	0	1.84	3.32	1975	0.48	1976	2.04	1972	0.0		0.0		84	70	50	60	8.2	SE	40	15	1971		7.2	4	9	18	13	0	2	1	13	0	*	0	
A	64.3	42.1	53.2	86	1977	20	1948	366	0	1.58	4.19	1947	0.40	1963	2.01	1971	4.0	1955	4.0	1955	84	72	48	66	8.0	SE	30	16	1970		7.4	3	9	19	11	0	1	2	7	0	3	0	
S	53.7	33.5	43.6	72	1963	7	1946	642	0	1.72	4.34	1951	0.07	1969	2.06	1951	6.4	1970	4.0	1972	82	76	51	70	7.6	SE	31	04	1972		6.8	6	7	17	9	*	0	3	*	*	13	0	
O	35.7	17.8	26.8	65	1969	-23	1958	1184	0	0.88	2.42	1965	0.11	1967	1.15	1959	22.7	1965	13.0	1978	83	83	67	79	6.3	SE	46	19	1970		7.8	3	7	21	7	3	0	4	0	11	28	3	
N	13.8	-1.6	6.1	46	1964	-44	1948	1767	0	0.75	4.11	1956	0.01	1975	2.02	1976	36.2	1956	8.3	1950	83	82	78	81	4.8	N	33	19	1969		7.5	5	4	21	6	3	0	3	0	26	30	17	
D	3.0	-13.1	-5.1	44	1943	-58	1964	2173	0	0.76	3.07	1955	0.07	1972	0.99	1955	30.0	1955	12.0	1976	70	73	72	72	3.6	N	40	17	1969		6.7	7	7	17	8	4	0	2	0	29	31	24	
YR	37.2	16.3	26.8	91	JUL 1953	-65	FEB 1947	13937	9	11.11	4.34	SEP 1951	0.00	APR 1954	2.06	SEP 1951	36.2	NOV 1956	14.0	FEB 1978	78	71	57	67	6.8	SE	52	04	JAN 1971		6.9	68	88	209	86	18	5	18	30	141	238	106	

NOTE: Due to less than full time operation on a variable schedule, manually recorded elements are from broken sequences in incomplete records. Daily temperature extremes and precipitation totals for portions of the record may be for other than a calendar day. The period of record for some elements is for other than consecutive years.

¢ 1943-1952 and January 1968 to date.

@ 1950-1954 and 1968-1970.

$ For calendar day prior to 1968.

% Through 1972. Station operated less than 24 hours daily. Data may be incomplete.

Through 1972.

& Through July 1973.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1964.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943	-12.0	9.2	14.0	31.8	45.2	57.4	55.2	52.4	44.2	29.8	18.5	13.8	30.0
1944	1.0	10.4	14.4	26.6	44.2	55.6	56.6	53.6	43.2	31.1	8.8	5.6	29.3
1945	4.0	10.9	16.8	25.2	41.6	51.2	55.1	52.7	43.8	29.3	-4.8	-4.6	26.8
1946	-2.3	5.7	9.6	29.6	44.9	58.6	58.0	52.0	43.2	32.1	1.3	-12.4	26.7
1947	-15.0	4.0	26.7	30.3	45.7	52.1	60.6	51.0	43.4	29.0	18.6	8.0	29.5
1948	6.5	-1.7	8.7	24.8	45.5	55.0	56.4	50.2	41.8	30.6	3.0	-10.4	25.9
1949	0.1	-10.0	22.9	30.2	42.2	47.8	54.6	52.6	45.5	26.1	13.1	-14.2	25.9
1950	-13.2	-12.7	16.1	28.0	43.8	54.3	54.4	55.3	44.2	23.6	-7.9	-2.7	23.6
1951	-12.6	-1.5	5.7	33.7	45.1	51.8	61.1	54.2	43.7	20.7	9.0	-6.3	25.4
1952	-15.6	2.8	14.0	27.8	39.0	53.1	57.2	52.0	42.8	34.6	25.0	-0.6	27.7
1953	-15.9	14.1	10.8	34.0	46.8	58.1	60.4	53.4	43.2	25.6	-0.3	-0.5	27.5
1954	-6.6	-5.7	16.9	24.9	46.0	54.5	56.0	54.8	44.1	32.3	15.2	-12.3	26.7
1955	5.6	3.8	14.5	26.6	40.5	50.8	58.6	51.6	43.4	25.5	-10.7	-9.7	25.0
1956	-14.9	-1.7	8.8	30.8	42.8	52.1	57.4	53.7	41.0	21.2	9.5	-12.9	24.0
1957	-4.3	0.9	20.0	29.8	45.6	59.7	57.6	58.6	44.5	32.0	20.1	-5.2	29.9
1958	-1.3	-1.3	17.6	35.4	45.9	58.0	57.8	51.1	43.1	16.9	6.2	-8.0	26.8
1959	-21.4	6.0	6.0	29.1	44.2	57.7	54.4	53.3	43.8	23.6	10.0	2.4	25.8
1960	-0.5	7.3	9.0	30.7	48.7	51.8	54.7	51.8	42.8	27.5	6.2	7.4	28.2
1961	-0.9	1.6	6.2	30.6	44.5	53.1	56.4	52.7	43.5	23.7	2.9	-16.4	24.8
1962	-6.3	3.5	10.3	33.3	41.8	53.6	58.7	56.3	41.2	31.7	5.0	3.0	27.7
1963	6.1	9.5	12.9	28.1	45.3	49.8	56.3	56.2	46.1	28.7	-7.1	3.7	28.1
1964	-9.3	13.7	4.4	28.5	35.7	54.5	55.4	52.0	44.7	30.4	10.3	-15.3	25.4
1965	-11.1	-6.7	30.3	32.8	41.6	49.6	56.9	52.1	47.8	21.7	-3.4	-8.7	25.2
1966	-20.0	1.5	7.4	31.3	40.7	55.8	57.7	52.2	43.0	22.9	2.1	-9.1	23.8
1967	-11.9	-0.6	14.8	21.5	42.5	56.2	58.0	55.1	43.9	25.2	16.1	-1.1	26.6
1968	-7.9	10.2	19.0	28.1	43.8	51.8	57.1	52.2	41.7	24.5	4.6	-18.9	25.5
1969	-20.5	-1.4	19.1	34.9	45.4	59.1	56.0	47.8	43.6	32.6	4.2	9.9	27.5
1970	-13.2	18.6	25.0	31.7	44.8	51.0	53.9	51.6	39.5	21.1	8.3	-10.8	26.8
1971	-19.5	8.0	9.1	29.3	40.8	53.8	56.3	52.5	41.9	24.3	-0.8	-5.7	24.2
1972	-18.6	-6.7	4.4	18.4	42.1	51.1	59.3	55.3	40.4	26.9	4.7	-8.4	22.4
1973	-15.3	-4.1	18.4	34.7	43.4	52.2	57.0					-5.3	
1974	-16.8	-2.6	10.4	32.4			56.4	54.0	45.7	30.1	10.9	1.2	
1975	-8.3	-3.3	10.3	30.2	44.5	51.8	58.1	52.6	46.2	28.8	0.1	-7.0	25.4
1976	-1.9	-5.0	15.0	32.8	42.3	55.0	57.8		43.3	29.5	21.1	4.5	
1977	16.3	20.5	14.2	32.2	42.5	52.9	58.0	57.6	45.6	31.1	-5.0	-12.8	29.4
1978	-4.5	7.2	16.4	31.0	43.1	50.5			46.1	32.6	10.8	0.3	
1979	-4.1	-17.8	20.8			52.2	57.9	57.7	46.7	34.3	24.1	-9.3	
1980	4.6	16.2	19.7	36.5	46.1	54.8	57.3	52.1	42.3	31.0	15.3	-24.9	28.5
RECORD MEAN	-7.7	2.7	14.2	30.0	43.7	53.8	57.1	53.3	43.6	27.7	7.2	-5.3	26.7
MAX	1.2	13.6	27.6	41.3	54.8	65.2	68.3	64.6	53.8	36.3	14.8	2.7	37.0
MIN	-16.5	-8.2	0.8	18.6	32.5	42.3	45.9	42.0	33.4	19.1	-0.5	-13.2	16.4

Heating Degree Days

GULKANA, AK

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1960-61	310	402	659	1153	1759	1763	2047	1776	1823	1024	824	352	13727
1961-62	262	375	637	1273	1862	2526	2210	1722	1694	947	709	334	14551
1962-63	195	263	710	1024	1799	2103	1824	1552	1629	1097	600	446	13227
1963-64	199	270	560	1120	2163	1899	2307	1488	1878	1059	902	309	14183
1964-65	291	397	602	1065	1636	2496	2360	2013	1066	960	730	456	14062
1965-66	247	394	507	1335	2055	2289	2643	1778	1794	1004	745	272	15054
1966-67	221	367	653	1301	1888	2301	2386	1836	1552	1057	698	257	14527
1967-68	211	301	624	1227	1467	2051	2262	1586	1420	1098	651	392	13290
1968-69	238	368	699	1247	1807	2605	2659	1862	1419	897	600	182	14594
1969-70	269	528	635	998	1824	1739	2427	1294	1233	994	620	414	12975
1970-71	340	410	758	1357	1699	2354	2624	1594	1730	1063	743	330	15032
1971-72	257	381	696	1254	1973	2195	2596	2082	1881	1391	709	410	15810
1972-73	172	295	729	1176	1808	2277	2490	1939	1437	932	654	377	14266
1973-74	240					2183	2543	1892	1692	973			
1974-75	261	331	573	1077	1620	1976	2271	1909	1693	1039	629	389	13768
1975-76	230	378	555	1117	1945	2233	2074	2034	1544	960	697	294	14061
1976-77	222		641	1093	1310	1874	1507	1242	1569	977	599	355	
1977-78	217	221	575	1046	2105	2415	2152	1620	1502	1013	671	429	13966
1978-79			559	995	1624	2009	2140	2324	1362			379	
1979-80	215	218	540	944	1220	2307	2364	1412	1397	849	577	302	12145
1980-81	231	393	675	1049	1443	2797							

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	0	0	0	0	0	11	0	0	0	0	0	0	11
1970	0	0	0	0	0	0	2	0	0	0	0	0	2
1971	0	0	0	0	0	1	11	0	0	0	0	0	12
1972	0	0	0	0	0	0	5	0	0	0	0	0	5
1973	0	0	0	0	0	0	0					0	
1974	0	0	0	0	0		1	0	0	0	0	0	
1975	0	0	0	0	0	0	22	0	0	0	0	0	22
1976	0	0	0	0	0	0	8		0	0	0	0	
1977	0	0	0	0	0	0	4	1	0	0	0	0	5
1978	0	0	0	0	0	0			0	0	0	0	
1979	0	0	0			0	1	0	0	0	0	0	
1980	0	0	0	0	0	2	1	0	0	0	0	0	3

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943	1.56	0.04	0.40	0.06	0.42	1.12	2.93	3.26	3.17	1.11	0.80	1.49	16.36
1944	0.40	0.31	1.20	0.05	0.07	0.60	1.51	1.73	2.49	1.14	0.20	2.24	11.94
1945	0.18	0.64	0.44	0.82	0.56	3.38	2.47	1.09	2.03	1.18	0.62	0.31	13.72
1946	0.98	0.72	0.14	0.07	1.32	0.08	1.81	1.50	0.31	0.54	0.94	1.12	9.53
1947	1.29	0.27	0.12	0.39	0.18	0.63	1.71	4.19	1.79	0.19	0.61	0.55	11.92
1948	0.47	1.03	0.29	0.05	0.25	0.83	1.07	2.10	0.98	0.53	0.61	0.50	8.71
1949	0.93	0.20	0.47	0.17	0.57	2.12	2.91	1.93	2.09	0.96	0.16	0.91	13.42
1950	0.86	0.39	T	0.06	T	0.81	2.61	0.53	1.75	0.44	0.87	0.73	9.25
1951	0.43	0.57	0.04	0.34	0.32	1.25	2.56	1.29	4.34	0.87	0.39	0.38	12.78
1952	0.82	0.07	0.64	0.06	0.40	1.12	1.41	1.10	2.39	0.46	1.39	0.08	9.94
1953	0.18	0.62	0.47	0.18	0.18	0.72	1.09	2.08	1.39	0.71	0.15	0.92	8.69
1954	0.33	0.52	0.22	0.00	0.39	0.69	1.94	1.48	1.75	0.86	0.61	0.84	9.63
1955	0.49	0.48	0.53	0.06	0.15	1.07	0.71	2.53	0.37	0.30	1.31	3.07	11.07
1956	0.24	0.84	0.04	0.32	0.62	1.03	2.26	2.43	1.02	0.46	4.11	0.67	14.04
1957	0.51	0.49	0.09	0.11	0.42	1.04	2.67	0.66	3.41	1.56	0.51	0.41	11.88
1958	1.02	0.24	0.33	0.01	0.33	0.29	1.73	2.02	1.10	1.66	0.84	0.87	10.44
1959	0.30	0.40	0.38	0.10	1.21	1.90	2.64	1.57	0.53	1.99	0.72	0.55	12.29
1960	0.41	0.16	0.04	0.21	1.08	1.87	2.35	1.85	3.09	0.64	0.74	0.41	13.05
1961	0.16	0.68	0.44	0.24	0.92	2.38	2.00	1.62	1.48	0.39	1.44	1.01	14.76
1962	1.49	0.07	0.56	0.02	0.63	4.07	0.85	1.01	1.74	1.19	0.13	0.59	12.35
1963	0.56	0.55	0.38	0.37	0.31	0.93	1.31	0.40	1.25	0.35	0.12	0.94	7.47
1964	0.31	0.59	0.44	0.61	0.64	2.02	1.72	0.73	0.98	1.40	0.07	1.22	10.73
1965	0.69	0.50	0.41	0.43	0.89	1.70	2.29	1.36	1.59	2.42	0.78	0.42	13.48
1966	0.37	0.39	0.19	0.11	0.99	1.92	1.76	1.07	0.97	0.47	0.87	0.37	9.48
1967	0.61	0.83	0.43	0.03	1.51	0.47	1.33	1.91	1.56	0.41	0.98	0.85	10.52
1968	0.59	1.65	0.17	0.26	1.40	1.52	0.95	1.26	0.66	0.87	0.60	0.11	9.75
1969	0.12	0.08	0.33	T	0.66	0.47	2.40	0.59	0.07	0.21	0.26	0.07	5.26
1970	0.22	0.21	0.13	0.26	1.05	1.91	1.34	1.17	1.73	1.39	0.31	0.50	10.22
1971	0.06	0.20	0.05	0.09	0.10	1.29	1.85	3.92	1.82	1.75	0.73	1.68	13.54
1972	0.80	0.11	1.32	0.27	0.57	1.57	3.05	0.74	0.81	1.18	0.41	0.07	10.90
1973	0.41	0.24	0.03	0.26	0.12	2.42	1.64					0.41	
1974	T	1.54	0.23	T	0.41	1.38	1.99	1.59	1.25	0.87	0.41	1.16	10.63
1975	0.22	0.26	0.05	0.37	0.41	2.56	3.32	1.84	1.28	0.23	0.01	0.30	10.85
1976	0.41	0.15	0.32	0.24	0.52	0.57	0.44	0.90	1.17	0.22	2.87	1.26	9.15
1977	0.42	0.41	0.45	0.44	1.45	2.10	1.22	0.55	1.30	0.46	0.48	0.23	9.52
1978	0.44	1.14	0.07	0.01	0.63	1.20	1.29	0.46	0.47	1.68	0.46	2.57	10.42
1979	0.10	0.37	1.15	0.21	0.37	0.91	1.51	1.61	0.32	0.95	0.61	1.11	9.22
1980	0.73	0.27	0.24	T	0.15	1.73	2.60	1.67	0.77	0.69	0.10	0.62	9.57
RECORD MEAN	0.53	0.49	0.16	0.19	0.60	1.39	1.89	1.56	1.55	0.88	0.73	0.84	11.01

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1942-43						4.4	21.4	0.4	4.0	0.5	T	0.0	
1943-44	0.0	0.0	1.2	5.3	10.2	19.0	9.9	4.5	23.4	1.0	0.0	0.0	74.3
1944-45	0.0	0.0	2.5	4.5	1.5	12.5	3.5	7.5	5.5	5.0	5.0	0.0	47.5
1945-46	0.0	0.0	0.0	5.5	13.1	2.0	7.5	7.6	2.0	1.0	0.0	0.0	38.7
1946-47	0.0	0.0	0.0	8.5	12.4	15.7	18.5	3.0	1.0	T	T	0.0	59.1
1947-48	0.0	0.0	1.3	1.1	4.5	5.3	4.8	10.5	6.4	1.8	T	0.0	35.7
1948-49	0.0	0.0	T	10.5	10.7	8.7	12.6	2.6	1.6	3.1	2.0	0.0	51.8
1949-50	0.0	0.0	0.0	12.0	2.6	12.7	10.2	5.1	T	0.9	T	0.0	43.7
1950-51	0.0	0.0	0.0	7.6	15.7	7.6	5.1	6.4	0.3	1.0	T	T	43.7
1951-52	0.0	T	3.7	17.2	4.2	7.2	12.6	0.9	7.5	0.4	2.0	0.0	51.7
1952-53	0.0	0.0	T	2.2	13.6	0.9	3.7	10.2	5.8	2.6	0.0	0.0	39.0
1953-54	0.0	0.0	0.0	9.7	1.8	15.6	7.4	6.5	2.7	0.0	T	0.0	43.7
1954-55	0.0	0.0	0.2	4.2	11.5	9.9	8.0	8.1	6.5	0.2	T	0.0	48.6
1955-56	0.0	4.0	T	3.3	12.7	30.0	3.8	11.4	0.4	2.7	T	0.0	68.3
1956-57	0.0	0.0	3.8	4.7	36.2	6.9	5.9	4.9	0.9	1.2	T	0.0	64.0
1957-58	0.0	0.0	4.8	4.2	2.7	4.6	9.6	3.6	3.6	T	T	0.0	33.3
1958-59	0.0	0.0	2.0	5.7	9.6	8.6	3.1	7.9	6.2	1.2	T	T	43.6
1959-60	0.0	0.0	0.0	13.4	10.6	7.7	4.4	4.2	0.7	1.0	0.0	0.0	42.4
1960-61	0.0	0.0	T	4.2	7.2	4.1	1.0	6.9	5.2	1.3	T	0.0	29.9
1961-62	0.0	0.0	T	5.4	15.5	11.4	17.5	0.9	6.2	0.2	T	0.0	57.1
1962-63	0.0	0.0	T	3.1	2.0	7.3	7.5	10.0	5.4	5.2	T	T	41.0
1963-64	0.0	0.0	0.0	3.0	1.7	10.3	4.4	5.9	4.8	5.8	1.8	0.0	37.7
1964-65	0.0	0.0	0.0	6.9	3.1	12.4	8.1	7.9	6.2	3.1	0.3	0.0	45.0
1965-66	0.0	0.0	1.5	22.7	9.3	3.7	3.8	3.5	2.3	0.1	T	0.0	46.9
1966-67	0.0	0.0	0.0	4.7	10.1	3.9	6.2	10.7	4.4	0.3	1.5	0.0	41.1
1967-68	0.0	0.0	0.0	3.0	3.7	7.3	6.5	12.6	2.5	3.8	T	0.0	39.4
1968-69	0.0	0.0	0.0	12.5	4.6	2.0	2.4	1.6	5.0	T	T	0.0	28.2
1969-70	0.0	T	0.0	1.1	6.4	3.1	4.9	5.3	2.9	6.3	1.0	0.0	31.0
1970-71	0.0	0.0	6.4	14.5	7.4	6.7	0.7	4.3	1.4	1.5	1.5	0.0	44.4
1971-72	0.0	0.0	T	19.7	12.5	21.3	10.9	1.8	18.6	4.0	0.4	0.0	88.8
1972-73	0.0	0.0	6.0	11.5	6.2	1.0	4.7	4.4	0.3	1.9	0.2	0.0	36.2
1973-74	0.0					4.4	T	19.2	4.1	T	T	0.0	
1974-75	0.0	T	0.0	3.8	7.9	17.7	3.2	4.4	0.3	5.2	T	0.0	42.5
1975-76	0.0	0.0	T	0.5	1.0	7.7	5.3	2.0	8.7	4.0	T	0.0	29.2
1976-77	0.0	0.0	0.0	2.7	3.0	29.3	3.4	1.0	7.0	6.9	4.0	0.0	61.6
1977-78	0.0	0.0	T	2.5	10.0	1.0	6.9	15.7	1.0	T	T	0.0	36.4
1978-79	0.0	0.0	0.3	15.2	9.0	29.4	2.1	10.4	12.9	3.1	1.0	0.0	85.1
1979-80	0.0	0.0	0.0	4.7	5.1	16.5	10.9	4.7	10.8	T	T	0.0	52.7
1980-81	0.0	0.0	T	5.4	1.6	13.3							
RECORD MEAN	0.0	0.1	0.9	7.2	6.2	10.4	7.0	6.2	5.1	2.0	0.6	T	47.7

\# Indicates a station move or relocation of instruments. See Station Location table.

Record mean values above are means through the current year for the period beginning in 1943.

STATION LOCATION

GULKANA, ALASKA

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above: Sea level: Ground at temperature site	Elevation above: Ground: Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	Remarks
Wilcott's residence	3/1/07	4/31/07	- - - -	62°18'	145°28'	- -		a								a - On pole 10 ft. from cabin (Coop station).
Signal Corps Station	2/8/09	5/31/20	unknown	62°18'	145°28'	1370		b4					3			b - On wall of cabin on a porch, then in Oct. 1916 moved to homemade shelter attached to a post in clearing near office. Shelter had no bottom, and holes in side for ventilation.
CAA Station Gulkana Airport	11/9/42	6/16/61	9 mi. S	62°09'	145°27'	1572	30	5	5				3			CAA became FAA in 1959.
FAA Station Gulkana Airport	6/16/61	present	100 ft. E (A)	62°09'	145°27'	1572	30 b20	5 c	5	NA	NA	NA	4	NA	M	(A) Instruments relocated. Office not moved. Station type changed to WBAS/FAA on 8/1/67. FAA effective 8/25/73. b - Effective 9/27/73. M - Commissioned 8/26/75. c - Removed 5/1980.

* Type
M = AMOS
T = AUTOB

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Daniel B. Mitchell
Director, National Climatic Center

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Local Climatological Data

Annual Summary With Comparative Data

1980

TALKEETNA, ALASKA

Narrative Climatological Summary

Talkeetna is located 80 airline miles north of Anchorage, and can be reached by both road and air. It lies in the upper end of a broad valley, on the southeast shore of the junction point of the Talkeetna and Susitna Rivers. The junction point of the Chulitna and Susitna Rivers occurs about three miles to the northwest of the station. The valley at this point has a gradual slope - from station elevation to the 1,000-foot level at a distance of 15 miles to the west-northwest, and five to seven miles from the northeast through the southwest. Elevation changes in these directions are more rapid beyond this point reaching heights of 4,000 to 6,000 feet at a distance of 25 to 30 miles. Except for isolated peaks (none close) of 2,500 to 4,000 feet there are no significant changes in elevation in the remaining directions. The area immediately surrounding the station is a composite of swampland and slightly higher ground which supports growth of birch and spruce trees.

The climate of Talkeetna varies in character between continental and modified maritime. Because of topography the annual precipitation of approximately 28 inches (which includes an average annual snowfall of 100 inches), is about half that measured on the Gulf of Alaska Coast, and over twice that of the continental regime found in the interior. Temperature with a record maximum annual range from minus 48 to 91 is definitely continental in nature. Like most areas of Alaska, Talkeetna experiences a "January thaw" with several days of above freezing temperatures. Although ground conditions become icy the thaw conditions lower the total snow depth enough to prevent the accumulation of excessive amounts during the winter snow season. The warmest period in summer with readings in the upper 60's and low 70's is from June through mid-July, with cooler weather after mid-July because of the cloudiness and precipitation maximums from late July through September.

Surface winds predominate north or south, depending on the season, because of the orientation of the valley. Velocity averages are relatively light.

Talkeetna is not a part of the agricultural area of Alaska. Normal moisture distribution results in a maximum rainfall at a time that crops should be maturing and the freeze-free period, which on the average is from mid-June to mid-August, results in too short a growing period.

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Meteorological Data For The Current Year

Station: TALKEETNA, ALASKA # 26528 TALKEETNA AIRPORT Standard time used: ALASKAN Latitude: 62° 18' N Longitude: 150° 06' W Elevation (ground): 345 feet Year: 1980

Month	Temperature °F Averages Daily maximum	Daily minimum	Monthly	Extremes Highest	Date	Lowest	Date	Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Total	Greatest in 24 hrs.	Date	Snow, Ice pellets Total	Greatest in 24 hrs.	Date	Relative humidity, pct. Hour 02	Hour 08	Hour 14	Hour 22 (Local time)	Wind Resultant Direction	Speed m.p.h.	Average speed m.p.h.	Fastest mile Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 356 feet m.s.l.
JAN	16.6	-1.9	7.4	16	19	-29	4	1790	0	2.76	1.26	21-22	23.2	8.4	16-17		72	70	73				29	07	9		5.3	14	0	17	8	6	0	0	0	27	31	19	
FEB	34.2	14.4	24.3	46	12	-9	17	1177	0	1.14	0.42	1	15.9	10.0	1		80	65	79				24	03	18		6.5	6	2	19	8	3	0	0	0	12	29	6	
MAR	34.5	12.9	23.7	44	30	-16	15	1273	0	0.89	0.26	31	10.5	3.4	20-21		75	65	73				23	02	16						9	5	0	1	0	12	31	8	
APR	48.8	26.6	37.6	58	30	15	15	816	0	0.62	0.21	12	2.9	1.8	12		66	51	68				21	23	21						4	2	0	0	0	0	28	0	
MAY	55.2	35.6	45.4	66	19	26	4	597	0	3.23	0.92	30	0.0	0.0			69	58	68				21	15	19						15	0	0	0	0	0	8	0	
JUN	61.0	46.0	53.5	72	4	40	8	334	0	5.73	1.54	20	0.0	0.0			82	68	73				17	16	28						16	0	0	0	4	0	0	0	
JUL	66.5	50.4	58.5	83	20	42	1	202	5	4.68	1.34	27	0.0	0.0			84	66	77				22	17	27						18	0	2	0	9	0	0	0	
AUG	62.5	44.8	53.7	73	11	35	24	345	0	3.43	0.65	21	0.0	0.0		97	85	66	85				18	19	29						17	0	0	1	7	0	0	0	
SEP	56.2	35.3	45.6	66	8	24	3	569	0	2.33	0.63	14-15	0.0	0.0			84	63	84				22	18	1						14	0	0	0	0	0	12	0	
OCT	42.5	29.0	35.8	56	1	9	31	899	0	2.14	0.67	7-8	4.3	1.7	8	84	83	70	82				21	03	21						12	3	0	0	0	0	24	0	
NOV	32.5	18.8	25.7	43	4	-3	30	1172	0	1.08	0.29	16-17	15.5	4.9	13	79	81	73	78				18	16	24		7.9	5	2	23	8	5	0	1	0	16	30	2	
DEC	4.1	-12.5	-4.2	33	31	-37	16	2144	0	0.56	0.30	31	8.1	4.8	29-30	64	65	61	66				22	05	8		2.5	22	3	6	3	3	0	0	0	30	31	25	
YEAR	42.5	25.0	34.0	83	JUL 20	-37	DEC 16	11318	5	28.51	1.54	JUN 20	80.4	10.0	FEB 1		77	65	76				29	07	JAN 9						132	27	2	5	20	97	224	60	

Normals, Means, And Extremes

Month	Temperatures °F Normal Daily maximum	Daily minimum	Monthly	Extremes Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 02	Hour 08	Hour 14	Hour 22 (Local time)	Wind $ Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	¢ Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	% Thunderstorms	% Heavy fog, visibility ¼ mile or less	Temperatures °F Max. (b) 90° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb. Elev. 356 feet m.s.l.
(a)				41		41					41		41		40		60		59		2	13	10	11	6	5	13	13			1	1	1	1	26	13	13	13	40	40	40	40	
J	19.1	-.4	9.4	49	1961	-48	1972	1724	0	1.63	5.56	1948	T	1974	1.95	1948	56.3	1949	24.0	1937	66	72	64	72	6.3	N	38	04	1972		6.2	9	8	14	8	5	0	*	0	27	31	16	
F	25.8	4.7	15.3	50	1945	-46	1947	1392	0	1.79	5.57	1951	T	1979	1.44	1953	71.2	1951	36.0	1928	76	73	64	74	5.0	N	29	03	1979		7.7	4	5	19	8	4	0	*	0	20	29	12	
M	32.8	7.1	20.0	53	1954	-43	1956	1395	0	1.54	4.03	1946	0.06	1950	1.38	1979	56.3	1946	20.7	1946	76	72	61	73	4.9	N	28	03	1974		5.5	13	6	12	9	6	0	*	0	14	31	11	
A	44.0	21.2	32.6	69	1958	-37	1944	972	0	1.12	4.51	1977	0.04	1958	1.37	1977	40.1	1964	18.0	1924	62	69	54	69	4.4	N	26	02	1975		7.0	5	7	18	7	4	0	*	0	2	29	1	
M	56.1	33.2	44.7	82	1958	-5	1945	629	0	1.46	3.48	1946	0.27	1949	1.39	1941	11.0	1957	10.0	1952	87	65	52	61	4.4	S	23	03	1979		7.2	6	6	19	11	*	*	*	2	*	14	*	
J	65.7	44.3	55.0	91	1969	28	1940	306	6	2.17	6.44	1970	0.21	1952	1.59	1955	T	1952	T	1952	85	71	57	65	4.5	S	21	16	1976		7.4	1	12	17	12	0	1	*	9	0	*	0	
J	67.5	48.2	57.9	90	1956	33	1941	220	0	3.48	6.50	1948	1.08	1977	1.74	1979	0.0		0.0		89	76	61	70	3.7	S	22	17	1980		7.4	5	7	19	14	0	1	0	13	0	0	0	
A	64.1	45.0	54.6	95	1977	25	1974	322	0	4.69	11.92	1945	0.96	1941	2.54	1945	T	1952	T	1952	90	81	61	81	3.0	S	23	18	1976		7.1	3	11	17	15	0	1	*	8	0	1	0	
S	55.6	36.6	46.1	78	1957	15	1970	567	0	4.52	9.92	1942	0.91	1969	3.12	1942	18.0	1923	18.0	1923	92	83	61	85	3.1	N	22	18	1980		6.2	9	4	17	15	*	*	*	1	0	9	0	
O	40.6	23.6	32.1	66	1954	-21	1956	1020	0	2.54	6.05	1946	0.81	1953	1.25	1952	32.4	1976	15.0	1927	86	83	71	55	3.5	NNW	31	03	1974		8.0	4	3	24	13	4	0	1	0	5	25	1	
N	26.1	8.6	17.5	48	1949	-41	1956	1425	0	1.79	7.04	1975	0.07	1975	1.59	1979	62.7	1967	19.5	1967	75	77	72	78	5.0	N	31	02	1976		7.7	5	3	22	10	5	0	*	0	21	29	10	
D	18.0	-.1	9.0	47	1960	-45	1970	1736	0	1.71	4.15	1946	0.34	1972	1.67	1941	48.9	1970	20.7	1970	71	75	71	75	4.9	NNW	35	36	1972		4.5	17	2	12	10	7	0	1	0	27	31	15	
YR	42.9	22.7	32.8	91	JUN 1969	-48	JAN 1972	11706	6	28.64	11.92	AUG 1945	T	FEB 1979	3.12	SEP 1942	71.2	FEB 1951	36.0	FEB 1926	81	75	62	74	4.3	N	38	04	JAN 1972		6.8	81	74	210	133	35	4	4	32	115	227	66	

NOTE: Due to less than full time operation on a variable schedule, manually recorded elements are from broken sequences in incomplete records. Daily temperature extremes and precipitation totals for portions of the record may be for other than a calendar day. The period of record for some elements is for other than consecutive years.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

¢ 1941-1953 and 1968 to date.

$ 1950-1954 and 1968.

% Station operated less than 24 hours daily. Data may be incomplete.

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1941	13.0	23.1	29.9	39.4	45.6	56.8	56.5	58.9	46.6	28.7	13.2	9.6	35.1
1942	17.4	26.1	14.0	34.0	49.4	55.4	58.7	56.2	50.7	36.4	14.6	2.0	34.9
1943	7.2	22.0	20.0	34.4	46.3	57.0	56.6	54.2	46.7	36.2	26.7	21.2	35.7
1944	14.3	24.5	17.0	30.0	44.8	56.5	59.0	54.9	47.0	36.0	21.6	14.2	35.0
1945	23.0	15.6	20.6	29.5	41.6	53.9	58.6	53.8	46.2	32.4	9.4	11.8	33.2
1946	11.8	14.4	10.9	29.8	43.4	56.6	59.2	53.0	47.3	34.4	11.8	1.3	31.2
1947	-9.6	19.7	29.2	33.0	45.4	53.9	59.8	54.1	45.0	33.8	25.6	20.6	34.1
1948	14.4	8.0	13.8	24.0	44.0	55.6	55.8	50.6	43.6	33.8	12.4	0.2	29.7
1949	9.0	1.4	25.5	27.8	41.2	50.3	56.4	53.6	47.6	30.6	23.4	1.0	31.0
1950	-1.1	9.0	26.7	35.1	45.0	53.3	56.9	57.8	46.9	30.3	7.9	11.1	31.6
1951	5.2	8.3	9.2	35.7	46.5	53.1	60.3	54.5	47.2	29.9	21.3	3.8	31.3
1952	2.0	17.6	17.2	30.8	39.1	53.4	57.2	53.5	44.5	36.4	28.8	16.2	33.1
1953	6.5	18.3	17.6	36.1	46.8	59.7	60.7	54.5	47.1	31.4	19.8	14.9	34.4
1954	6.3	3.2	20.3	31.8	47.3	55.9	56.7	55.1	47.4	37.0	24.1	1.0	32.2
1955	16.7	11.6	19.2	27.0	41.8	50.7	58.4	52.4	45.1	29.8	5.2	3.9	30.2
1956	7.7	6.9	16.8	33.0	43.9	53.2	57.9	55.4	44.3	24.9	10.2	-1.3	29.4
1957	7.7	10.7	25.4	35.4	47.2	61.0	59.4	58.5	46.9	36.8	30.4	4.1	35.3
1958	16.6	20.1	25.3	37.8	45.8	56.1	56.9	54.4	43.7	26.0	15.6	12.5	34.2
1959	10.3	17.7	13.5	33.3	46.6	59.2	54.7	56.0	46.1	32.0	22.5	12.9	33.7
1960	14.1	20.5	19.4	33.3	48.8	55.0	56.8	53.9	43.3	34.6	17.9	21.9	35.0
1961	19.4	14.4	12.3	33.5	46.0	55.2	56.9	53.6	44.6	24.8	11.5	1.2	31.1
1962	9.8	13.6	14.3	34.6	42.2	55.1	59.1	55.0	43.1	35.1	17.2	12.6	32.6
1963	17.7	23.1	20.9	28.7	44.5	50.3	58.2	54.9	50.1	34.2	10.1	21.6	34.5
1964	11.6	19.0	11.0	29.7	38.0	55.3	58.2	53.9	47.3	31.7	18.4	-1.8	30.6
1965	7.9	7.0	32.3	34.5	42.4	50.2	56.7	52.7	48.9	25.2	13.2	3.8	31.2
1966	8.4	9.7	14.3	33.9	43.0	56.2	57.2	53.8	45.5	30.3	15.9	11.5	31.6
1967	3.5	12.8	20.7	31.5	44.5	56.4	58.7	57.5	47.4	31.6	21.1	8.1	32.8
1968	6.4	19.9	24.1	30.0	45.2	54.8	59.6	56.8	44.1	30.9	17.5	-1.2	32.4
1969	-0.9	14.5	23.3	38.3	47.6	57.8	57.5	50.6	46.0	36.9	19.5	24.3	34.6
1970	4.2	27.5	31.4	32.6	45.5	51.8	56.3	52.6	43.1	26.6	17.6	5.7	32.9
1971	-7.5	12.6	10.3	31.1	40.2	52.6	56.5	55.9	44.9	27.7	10.5	7.8	28.6
1972	0.0	9.0	9.8	21.1	42.0	52.3	61.1	56.4	42.3	29.6	18.3	9.4	29.2
1973	-2.9	10.0	21.0	34.3	43.7	53.3	57.5	52.1	44.2	26.8	7.6	14.3	30.2
1974	1.2	11.5	19.4	35.8	47.6	56.3	56.7	56.0	48.7	32.3	18.2	10.2	32.8
1975	4.1	8.6	16.8	30.9	44.1	52.5	57.9	55.2	47.0	31.1	8.7	4.9	30.2
1976	8.5	7.0	18.8	33.7	49.2	55.9	59.0	56.3	45.7	29.6	28.0	19.3	33.8
1977	27.4	27.8	16.1	30.8	43.2	56.2	60.3	59.2	46.5	33.9	7.7	6.0	34.6
1978	17.9	23.3	25.6	35.6	47.6	52.4	57.2	57.8	47.5	34.0	20.5	14.5	36.1
1979	15.2	5.9	27.8	34.9	47.0	54.0	59.9	57.9	49.2	37.4	27.1	2.1	34.9
1980	7.4	24.3	23.7	37.6	45.4	53.5	58.5	53.7	45.8	35.8	25.7	-4.2	34.0
RECORD MEAN	9.6	15.2	19.9	33.3	44.6	54.7	58.0	54.9	46.0	32.4	18.0	9.2	32.9
MAX	18.5	26.0	32.8	44.6	56.3	65.8	68.3	64.9	55.9	40.8	26.5	18.3	43.2
MIN	-1.4	4.4	6.9	21.9	32.8	43.6	47.7	44.8	36.1	23.9	9.4	0.0	22.5

Heating Degree Days

TALKEETNA, AK

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1960-61	249	337	643	937	1407	1327	1408	1410	1634	939	542	291	12160
1961-62	244	368	676	1238	1601	1979	1708	1433	1566	935	700	291	12621
1962-63	150	304	651	921	1429	1622	1463	1167	1421	1079	629	459	11304
1963-64	205	307	434	950	1645	1339	1652	1477	1671	1052	829	284	11845
1964-65	201	336	524	1027	1392	2074	1766	1621	1007	908	694	439	11991
1965-66	254	376	474	1229	1549	1694	1752	1545	1572	926	675	254	12449
1966-67	239	343	573	1069	1465	1655	1908	1455	1367	999	625	250	11947
1967-68	169	226	520	1027	1313	1761	1814	1305	1260	1042	658	299	11354
1968-69	165	251	621	1049	1418	2056	2046	1812	1294	795	532	222	11951
1969-70	227	441	564	864	1358	1254	1686	1069	1036	969	601	393	10631
1970-71	268	379	651	1184	1419	1835	2249	1665	1693	1010	762	365	13280
1971-72	260	272	594	1149	1631	1772	2313	1621	1706	1312	703	376	13426
1972-73	131	257	675	1124	1396	1719	2103	1537	1354	914	651	342	12203
1973-74	229	394	617	1174	1720	1566	1979	1493	1407	869	530	256	12235
1974-75	249	273	491	1006	1399	1696	1889	1576	1497	1019	618	369	12081
1975-76	222	296	535	1044	1690	1862	1749	1679	1425	931	640	266	12340
1976-77	179	265	572	1091	1105	1409	1159	1034	1509	1020	669	256	10268
1977-78	145	178	551	958	1714	1930	1455	1159	1214	877	531	372	10984
1978-79	238	226	515	952	1328	1554	1536	1649	1145	894	553	319	10922
1979-80	152	216	470	857	1131	1949	1793	1177	1273	816	597	334	10757
1980-81	202	245	569	899	1172	2144							

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	0	0	0	0	0	11	1	0	0	0	0	0	12
1970	0	0	0	0	0	0	8	0	0	0	0	0	8
1971	0	0	0	0	0	0	3	0	0	0	0	0	3
1972	0	0	0	0	0	0	19	0	0	0	0	0	19
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	10	0	0	0	0	0	10
1976	0	0	0	0	0	1	0	4	0	0	0	0	5
1977	0	0	0	0	0	0	6	2	0	0	0	0	8
1978	0	0	0	0	0	0	2	6	0	0	0	0	8
1979	0	0	0	0	0	0	0	1	0	0	0	0	1
1980	0	0	0	0	0	0	5	0	0	0	0	0	5

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1941	0.41	1.88	0.97	1.87	3.26	2.45	4.11	0.96	1.80	2.95	1.59	1.95	24.20
1942	1.22	1.81	0.55	1.36	0.70	1.08	3.97	5.24	9.92	2.10	0.23	0.71	28.89
1943	0.68	2.96	1.15	0.07	1.01	1.19	3.28	6.35	7.26	1.61	1.11	3.65	30.52
1944	1.42	3.44	1.13	0.26	3.46	1.73	2.35	8.63	5.07	3.20	1.15	2.48	34.32
1945	0.40	2.29	1.83	0.56	1.81	3.59	1.92	11.92	3.54	4.48	1.62	0.39	34.35
1946	0.79	0.92	4.03	0.79	3.48	3.12	2.63	5.70	5.49	6.05	2.89	4.15	40.04
1947	3.05	0.85	2.97	0.79	1.79	1.11	1.65	2.70	9.63	1.54	4.49	2.28	34.85
1948	5.56	2.09	1.91	0.15	0.79	0.48	6.50	3.27	5.67	2.56	2.97	1.73	33.58
1949	4.55	0.78	2.46	1.78	0.27	1.09	2.37	4.39	4.60	1.58	1.99	1.25	27.11
1950	1.58	0.01	0.06	0.15	0.52	2.28	1.92	2.14	5.27	1.46	0.68	3.34	20.01
1951	2.25	5.57	0.65	0.87	0.31	2.52	3.21	4.76	6.16	1.17	2.15	2.33	31.95
1952	2.36	1.62	1.57	0.69	2.01	0.21	3.09	5.05	2.83	4.54	2.92	0.46	27.35
1953	0.60	3.93	3.30	0.37	1.21	1.92	2.14	8.03	2.32	0.81	0.49	1.33	23.45
1954	2.29	0.69	3.15	0.24	0.56	3.83	5.02	3.12	3.34	2.24	1.91	1.01	28.70
1955	2.01	2.35	1.83	1.58	0.29	3.88	1.54	10.44	2.66	2.17	0.98	2.13	31.86
1956	0.33	1.91	1.50	0.50	1.21	1.55	4.46	3.66	3.62	2.18	3.99	0.44	25.35
1957	4.87	0.62	0.62	0.08	0.57	1.11	1.72	3.09	6.16	1.54	1.73	0.40	22.83
1958	0.83	0.06	1.91	0.04	2.56	1.48	3.84	3.78	3.32	3.25	0.95	0.62	22.64
1959	0.04	2.09	0.38	1.24	0.92	0.80	4.42	6.23	2.64	2.11	1.40	0.89	23.16
1960	1.40	1.88	0.27	0.28	0.64	0.98	5.37	4.56	7.58	1.02	0.75	1.07	25.80
1961	1.21	0.62	0.45	1.94	1.35	1.78	3.47	3.52	5.45	4.10	1.20	1.70	26.79
1962	2.79	3.35	0.39	0.70	1.32	3.22	1.98	3.85	4.07	3.00	0.70	1.78	26.55
1963	3.01	0.91	7.23	3.43	1.74	5.09	5.52	7.84	3.05	3.85	0.08	3.20	44.95
1964	0.39	3.31	1.66	3.47	3.84	2.12	2.42	2.74	2.17	3.66	3.91	0.54	27.23
1965	0.63	0.44	1.63	1.16	2.10	2.36	2.81	6.66	8.20	1.97	1.02	1.13	30.57
1966	1.71	0.62	0.45	1.94	1.35	1.78	3.47	3.52	5.45	4.10	1.20	1.70	27.39
1967	0.60	0.92	3.07	3.12	1.04	4.20	5.72	5.98	2.66	0.26	7.25	4.07	38.79
1968	1.08	3.37	0.31	1.50	2.94	0.54	2.57	1.99	1.27	1.16	0.71	0.98	15.38
1969	0.44	0.92	0.30	0.24	2.10	0.66	3.75	1.71	0.91	2.18	0.87	1.19	15.50
1970	0.27	1.18	1.48	2.37	1.62	6.44	4.62	4.42	3.56	3.00	0.49	2.66	32.47
1971	1.17	2.72	0.84	0.81	1.18	2.38	4.23	7.77	3.99	2.65	1.39	2.09	31.22
1972	1.72	0.79	1.38	1.40	2.03	2.21	1.76	3.09	8.47	4.00	5.57	0.34	27.76
1973	1.74	0.40	1.65	0.18	1.04	2.25	1.57	7.14	1.51	2.59	0.61	0.74	21.82
1974	T	0.45	0.88	1.65	0.38	1.31	2.11	2.36	2.69	3.25	2.99	1.14	19.62
1975	1.45	0.54	1.18	2.18	1.07	2.92	3.47	2.40	6.44	2.45	0.07	1.73	26.40
1976	0.68	1.09	2.71	0.37	0.99	1.38	2.07	2.16	2.85	3.68	4.82	1.31	24.31
1977	2.65	0.86	1.45	4.51	2.52	2.32	1.04	1.34	8.16	1.54	0.24	1.56	28.23
1978	0.29	0.86	0.61	0.37	1.80	4.77	3.18	1.02	2.09	2.98	2.26	3.00	23.15
1979	0.86	T	3.82	2.76	0.77	3.31	4.65	1.77	3.00	5.07	7.04	1.32	34.57
1980	2.78	1.14	0.89	0.52	3.23	5.77	4.64	3.43	2.33	2.14	1.08	0.56	28.41
RECORD MEAN	1.60	1.55	1.53	1.14	1.42	2.27	3.24	4.70	4.32	2.47	1.80	1.59	27.96

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1941-42	0.0	0.0	0.0	2.4	13.5	4.0	4.3	13.5	8.0	1.5	0.0	0.0	47.9
1942-43	0.0	0.0	0.0	2.3	5.8	7.3	12.6	20.7	9.2	T	T	0.0	57.9
1943-44	0.0	0.0	0.0	11.4	12.9	27.6	22.5	27.9	9.2	1.4	0.0	0.0	113.3
1944-45	0.0	0.0	T	5.2	14.9	15.7	3.2	22.7	23.4	2.7	1.6	0.0	91.9
1945-46	0.0	0.0	0.0	17.0	21.1	6.2	13.2	20.0	56.3	10.4	0.9	0.0	145.1
1946-47	0.0	0.0	0.0	13.9	26.9	37.1	39.4	11.6	23.3	1.0	3.6	0.0	156.7
1947-48	0.0	0.0	T	4.5	16.3	21.1	47.9	15.3	32.1	2.6	T	0.0	139.8
1948-49	0.0	0.0	0.0	18.4	16.6	42.2	56.3	9.3	34.7	22.8	1.5	0.0	202.7
1949-50	0.0	0.0	0.0	4.7	10.9	27.3	23.2	0.5	1.2	1.0	T	0.0	64.3
1950-51	0.0	0.0	0.0	13.5	7.4	41.3	28.0	71.2	8.0	5.6	T	T	175.5
1951-52	0.0	0.0	0.0	5.9	17.5	34.1	27.8	20.7	20.6	9.0	11.0	T	146.1
1952-53	0.0	T	0.0	17.7	15.5	5.9	11.6	47.5	4.1	3.7	T	0.0	106.0
1953-54	0.0	0.0	0.0	4.3	8.3	17.4	27.7	12.6	47.6	0.7	0.0	0.0	118.6
1954-55	0.0	0.0	0.0	3.7	11.2	11.7	21.3	26.0	17.3	21.8	0.0	0.0	112.7
1955-56	0.0	0.0	0.0	11.4	10.1	34.4	3.8	22.6	12.3	2.4	T	0.0	97.0
1956-57	0.0	0.0	4.3	20.0	23.5	7.0	35.1	5.5	4.2	0.6	T	0.0	100.1
1957-58	0.0	0.0	0.0	T	7.3	4.8	14.7	1.1	13.5	T	0.0	0.0	45.9
1958-59	0.0	0.0	T	0.7	8.8	9.7	0.5	20.5	4.3	1.5	T	0.0	54.1
1959-60	0.0	0.0	0.0	1.7	14.3	10.7	9.7	29.4	5.2	1.4	0.0	0.0	63.8
1960-61	0.0	0.0	T	1.9	7.2	10.7	3.7	4.8	7.5	10.0	0.0	0.0	47.3
1961-62	0.0	0.0	0.0	27.4	15.4	5.1	27.0	35.7	3.5	5.7	0.0	0.0	123.8
1962-63	0.0	0.0	0.0	3.9	5.9	4.5	9.2	7.4	52.6	26.8	T	0.0	110.4
1963-64	0.0	0.0	0.0	1.4	0.6	26.5	3.4	32.6	17.1	40.1	8.1	0.0	130.1
1964-65	0.0	0.0	0.0	15.7	31.1	5.4	8.3	6.6	5.5	4.5	1.7	0.0	74.7
1965-66	0.0	0.0	0.0	15.6	10.2	13.5	5.5	6.6	5.4	2.6	T	0.0	61.9
1966-67	0.0	0.0	0.0	0.9	17.1	16.9	7.5	13.2	33.4	24.7	0.0	0.0	115.7
1967-68	0.0	0.0	0.0	2.7	62.7	11.1	13.1	31.7	2.9	13.9	0.0	0.0	137.3
1968-69	0.0	0.0	0.1	1.7	10.2	13.7	8.3	26.0	8.1	T	T	0.0	68.3
1969-70	0.0	0.0	0.0	1.7	5.9	12.4	6.3	10.7	8.1	11.5	T	0.0	57.2
1970-71	0.0	0.0	0.0	13.7	7.0	41.4	7.7	57.2	12.7	12.2	1.7	0.0	148.1
1971-72	0.0	0.0	0.0	25.1	24.3	37.5	27.5	11.4	30.1	28.1	T	0.0	184.0
1972-73	0.0	0.0	1.0	25.4	13.6	4.7	41.3	4.3	32.4	2.7	0.1	0.0	133.5
1973-74	0.0	0.0	0.0	23.9	13.7	16.2	T	19.4	21.1	17.0	0.0	0.0	104.2
1974-75	0.0	0.0	0.0	15.0	51.7	19.6	31.7	11.2	26.9	25.5	0.4	0.0	184.0
1975-76	0.0	0.0	0.0	15.5	2.3	24.7	14.0	19.1	49.7	5.1	0.0	0.0	130.4
1976-77	0.0	0.0	0.0	37.9	14.2	29.5	12.3	3.7	24.4	14.0	T	0.0	135.6
1977-78	0.0	0.0	T	17.9	4.6	24.7	5.0	17.1	13.2	4.3	0.0	0.0	89.5
1978-79	0.0	0.0	0.0	15.7	32.0	49.9	18.2	T	24.4	16.1	2.1	0.0	157.2
1979-80	0.0	0.0	0.1	5.9	25.2	23.0	27.2	15.9	10.4	2.9	0.0	0.0	176.7
1980-81	0.0	0.0	0.0	4.9	15.5	9.1							
RECORD MEAN	0.0	T	0.4	5.7	15.4	15.1	17.4	17.4	18.1	4.7	0.7	T	106.8

* Indicates a station move or relocation of instruments. See station location table.

Record mean values above are means through the current year for the period beginning in 1931.

STATION LOCATION

TALKEETNA, ALASKA

* Type
M = AMOS
T = AUTOB

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above										Remarks
						Sea level	Ground									
						Ground at temperature site	Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	
Alaska Railroad Depot	3/16/17	7/11/31	-	62°18'	150°06'	354		a8					b8			Exposure not good. a - 12 feet from building b - 13 feet from building
Railroad Section Foreman Residence	7/11/31	6/01/40	500' S	62°18'	150°06'	354		10					11			
CAA Station Talkeetna Airport	6/01/40	10/10/44	1/2 mi. SSE	62°18'	150°06'	345	32	5	5				3			
CAA Station Talkeetna Airport	10/10/44	Present	500' NW	62°18'	150°06'	345	34	5	5	NA	NA	NA	4	NA	NA	CAA became FAA in 1959. Station changed from FAA to WBAS/FAA on 10/01/67.

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I certify that this is an official publication of the National Oceanic and Atmospheric Administration, and is compiled from records on file at the National Climatic Center, Asheville, North Carolina 28801.

Daniel B. Mitchell
Director, National Climatic Center

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210

U.S. MAIL

FIRST CLASS

LATITUDE [illegible]° 34'N
LONGITUDE [illegible]9° 16'W
ELEVATION 150 feet

U. S. DEPARTMENT OF CO[illegible]RCE, WEATHER BUREAU

CLIMATOLOGICAL SUMMAR[illegible]ATANUSKA AGRICULTURAL EXPERIMENT STATION

MEANS AND EXTREMES FO[illegible]RIOD OF RECORD THROUGH 1952

	TEMPERATURE								PRECIPITATION														WIND	MEAN NUMBER OF DAYS					
	MEANS			EXTREMES												SNOW, SLEET, HAIL									Max temp		Min temp		
Month	Daily maximum	Daily minimum	Monthly	Record highest	Year	Record lowest	Year	Mean degree days	Mean total	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hours	Year	Mean total	Maximum monthly	Year	Maximum in 24 hours	Year	Max depth on ground	Year	Prevailing direction	Precip .01 or more	70° or abv	32° or blw	32° or blw	0° or blw	Month
(a)	32	32	32	32		32		32	32	32		32		32		32	32		32		32		32	32	32	32	32	32	(a)
JAN	21.4	3.7	12.6	51	1945	-40	1947	1618	0.94	2.89	1937	0.14	1920	0.92	1937	9.5	21.4	1944	9.0	1952	29	1951	NE	6	0	23	30	14	JAN
FEB	27.3	9.3	18.3	56	1943	-41	1947	1308	0.69	3.16	1932	T	1919	0.84	1932	7.0	36.0	1932	8.5	1932+	46	1932	NE	5	0	17	27	8	FEB
MAR	33.6	15.1	24.4	54	1930+	-22	1925	1259	0.51	1.42	1930	0.00	1932	0.80	1931	6.5	23.8	1930	15.0	1930	14	1922	NE	5	0	12	29	4	MAR
APR	45.5	26.9	36.2	66	1940	-16	1944	864	0.43	1.64	1937	0.00	1919+	1.10	1937	2.3	17.5	1937	10.0	1937	18	1951	E	3	0	2	23	1	APR
MAY	57.8	35.7	46.8	83	1947	8	1945	567	0.65	2.31	1931	T	1951	0.83	1940	0.3	5.3	1945	5.0	1945	1	1937+	SW	5	1	*	9	0	MAY
JUN	66.4	43.7	55.1	91	1936	27	1947	297	1.31	4.62	1949	0.16	1948	1.61	1949	0.0	0.0		0.0		0		SW	7	9	0	1	0	JUN
JUL	67.7	47.4	57.6	85	1951	31	1934	233	2.01	3.91	1917	0.55	1927	1.56	1926	0.0	0.0		0.0		0		SW	12	11	0	*	0	JUL
AUG	64.9	45.9	55.4	83	1923+	27	1947	298	2.84	6.37	1944	0.45	1940	1.20	1930	0.0	0.0		0.0		0		E	14	7	0	*	0	AUG
SEP	56.7	38.5	47.[illegible]	[illegible]	[illegible]	16	[illegible]	522	2.58	7.55	1925	0.51	1941	2.48	1925	0.2	7.0	1930	6.0	1930	*	1923	E	12	*	0	6	0	SEP
OCT	44.0	26.5	36.[illegible]	[illegible]	1923	- 4	1935	890	1.72	4.61	1936	0.39	1943	1.32	1921	3.5	18.0	1945	11.0	1945	11	1945	NE	9	0	3	21	*	OCT
NOV	30.0	15.[illegible]	[illegible]	58	1936	-22	1918+	1281	0.93	3.71	1931	0.04	1921	1.50	1931	6.9	23.2	1928	10.0	1937	15	1928	NE	6	0	17	28	5	NOV
DEC	[illegible]	[illegible]	[illegible]3.5	55	1934	-34	1917	1597	0.98	3.81	1934	0.04	1922	1.30	1934	9.2	27.5	1936	14.0	1925	18	1925	NE	6	0	23	30	11	DEC
Year	44.7	[illegible]	35.5	91	Jun 1936	-41	Feb 1947	10734	15.59	7.55	Sep 1925	0.00	Mar '32 Apr '19+	2.48	Sep 1925	45.4	36.0	Feb 1932	15.0	Mar 1930	46	Feb 1932	NE	90	28	97	204	43	Year

F-70

STATION HISTORY

The weather station was established July 1, 1917, with personnel of the Matanuska Agricultural Experiment Station taking the weather observations. The station was equipped with a standard eight inch rain gage and maximum and minimum thermometers in a cotton region shelter. The top of the rain gage has been about two-three feet above the ground and the floor of the shelter about three feet above the ground through the period of record. A cylindrical evaporation pan, four feet in diameter, and 10 inches deep, and an anemometer cups about two feet above the ground, were installed August 1, 1929, one of the two evaporation stations in Alaska. The instrumental equipment was originally located about 75 feet southeast of the administration building and continued in the general area until June 12, 1945 when the instruments were moved to a location about 150 feet north-northwest of the administration building. The station was moved about 100 feet west on July 18, 1950 to the present location just across the road from the Experiment Station near the experimental plots. All exposures are considered satisfactory and the entire period of record homogeneous.

AVERAGE MONTHLY EVAPORATION AND WIND MOVEMENT 1929-1952

	May	Jun	Jul	Aug	Sep	Oct
(a)	1	10	13	18	12	2
Evaporation (inches)	4.86	4.39	4.17	2.91	1.78	0.92
(a)	5	14	13	18	14	7
Average Wind Speed (mph)	4.3	3.5	2.7	2.4	3.0	4.2

REFERENCE NOTES

* Less than one half
(a) Average length of record, years

NARRATIVE CLIMATOLOGICAL SUMMARY

The Matanuska Agricultural Experiment Station is located approximately at the center of the Matanuska Valley agricultural area about four miles southwest of Palmer and 32 air miles northeast of Anchorage, Alaska. The surrounding country is rolling and wooded with spruce, aspen, birch and cottonwood with the general vicinity of the station being mostly cleared and cropped land. About 150 yards to the north a hill rises rather abruptly about 50 feet above the station. The Matanuska River flows into the northern end of Knik Arm about five miles south of the station. The Talkeetna mountains to the north and the Chugach mountains to the east and south protect the area against the extreme cold conditions observed in the winter over Interior Alaska but also act as a barrier to the southerly flow of warm moist air from the Gulf of Alaska, the only access to the moist Pacific air being to the southwest over Cook Inlet. The winters are long and moderately cold, however, occasionally southwesterly flow will bring moderately warm air into the valley even in the winter with the temperatures rising above the freezing point on an average of eight days in both December and January. Conversely, temperatures as low as -20 to -25 may be expected some time during each winter, however, these low temperatures usually are of short duration. Probably the phenomena for which the area is best known are the "Matanuska" and "Knik" winds. Matanuska winds are most common in the winter months but also occur frequently in the spring and fall. Although about 60 percent of the winter winds are from the northeast, or down the Matanuska Valley, "Matanuska" is reserved for a high gusty wind from the northeast. The Matanuska wind occurs on an average of 3-5 days in each of the winter months, generally after a period of cooling in the Copper River Basin with the cold air spilling into the Matanuska Valley, and the flow reinforced by a High over Interior Alaska with strong easterly gradient over the Copper and Matanuska River Valleys. About half of the Matanuska winds last only one day or less but, occasionally they may persist as long as 3-5 days. An idea of the speed of a strong Matanuska wind is afforded by the totalizing anemometer (cups only two feet above the ground) which recorded a total of 601 miles on April 4,

AVERAGE TEMPERATURE													
Year	Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	An'l
1917							55.3	56.6	45.3	32.6	13.8	-5.6	
1918	10.6	12.4	15.9	33.2	44.4	55.6	60.2	54.0	48.3	34.7	16.2	14.2	33.3
1919	8.8	21.3	23.0	37.8	47.0	53.6	58.1	54.6	46.8	33.3	14.9	8.4	34.0
1920	4.5	27.4	16.5	29.2	44.2	52.4	55.2	53.0	44.3	33.2	19.8	13.5	32.8
1921	4.6	12.4	26.8	36.2	45.6	56.3	55.8	55.1	46.3	33.8	18.9	14.2	33.8
1922	13.8	14.4	17.6	35.0	45.2	54.4	55.6	53.2	45.2	40.7	22.6	12.6	34.2
1923	6.0	23.7	22.2	38.0	48.0	56.6	60.8	61.0	50.4	45.0	27.2	11.0	37.5
1924	16.0	17.2	33.4	28.4	47.1	56.5	56.6	54.6	45.5	29.8	28.6	8.0	35.1
1925	1.9	9.4	24.0	36.6	47.6	53.5	58.4	57.0	49.9	43.2	32.2	11.6	35.4
1926	30.0	19.8	38.8	44.5	51.6	56.8		56.6	50.8	41.4	29.0	14.6	
1927	11.4	21.8	22.8	28.9	46.4	54.6	59.5	54.6	46.6	32.2	9.5	11.9	33.4
1928	17.4	25.6	20.8	36.5	46.6	55.6	57.0	54.4	44.7	35.4	26.2	24.0	37.0
1929	19.4	25.2	20.8	32.6	48.4	55.4	56.0	54.4	52.3	36.8	29.1	7.2	36.5
1930	11.4	6.0	21.8	35.0	45.3	53.4	58.2	57.0	44.8	32.4	20.0	26.8	34.3
1931	24.4	25.4	25.3	38.8	45.1	55.6	57.8	57.6	47.2	33.2	26.5	8.7	37.1
1932	-1.8	5.0	27.8	39.4				55.6	47.2	40.6	17.6	15.2	
1933		13.0	21.6	36.6	47.9	54.0							
1934							58.6	57.1	51.6	39.6	24.0	19.0	
1935							58.4	54.4	47.4	32.4	20.5	16.4	
1936	17.5	13.7	21.4	36.2	46.8	63.5	61.9	57.8	46.4	41.2	30.0	9.6	37.2
1937	19.4	8.8	24.6	35.5	46.1	54.8	56.8	53.0	50.0	41.0	22.7	13.2	35.5
1938	11.2	19.9	[illegible]	41.2	47.1	53.0	56.0	57.0	50.8	41.7	24.2	20.6	37.4
1939	12.2	20.4	[illegible]	37.0	46.0	54.8	57.4	52.6	47.0	29.6	18.4	20.5	34.9
1940	20.2	25.9	27.5	44.4	48.6	55.6	58.1	55.8	47.4	37.2	23.7	20.4	38.7
1941	12.0	28.4	33.5	42.1	47.0	56.4	56.2	59.0	48.6	30.9	18.0	17.2	37.4
1942	24.2	30.2	25.5	39.8	51.4	56.3	59.4	56.5	52.0	37.8	14.9	1.2	37.4
1943	7.1	25.4	24.0	37.8	48.2	57.6	56.9	55.0	47.9	39.6	31.8	26.6	38.2
1944	17.4	28.6	24.6	34.4	47.2	56.4	57.0	55.6	47.9	37.5	23.9	18.7	37.4
1945	25.7	24.4	24.1	33.0	43.8	53.0	56.0	53.2	44.8	33.7	13.2	13.0	34.8
1946	17.7	17.8	15.8	33.4	45.3	53.5	57.2	53.0	46.0	37.4	14.2	2.7	32.8
1947	-4.0	19.0	31.0	36.1	46.2	52.5	56.8	52.6	45.2	34.7	27.0	23.0	35.0
1948	16.8	13.2	22.8	33.7	48.1	56.4	56.6	53.0	45.4	36.2	15.4	4.6	33.5
1949	12.2	6.7	31.4	33.5	45.9	51.8	55.8	55.4		36.2	26.0	6.4	
1950	3.8	9.2	29.7			53.7	57.1	58.2	48.2	33.3			
1951		12.2	15.8	39.1	48.1	54.2	59.4	55.7	48.0	31.7	24.2	8.8	
1952	4.7	21.0	25.3	35.3	43.1	54.0	57.9	54.7	47.1	38.8	33.8	19.6	36.3

TOTAL PRECIPITATION													
ar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	ec	An'l
1917							3.91	0.67	2.12	1.69	0.55	0.12	
1918	0.72	0.61	0.34	1.41	1.10	0.64	0.82	4.27	2.34	0.54	0.77	1.60	15.16
1919	0.58	T	0.09	0.00	0.27	0.87	2.00	2.23	1.90	1.62	0.46	1.42	11.44
1920	0.14	1.76	0.72	0.06	0.49	1.77	2.50	1.90	0.58	0.66	0.67	0.43	11.68
1921	0.83	0.08	0.75	1.25	0.81	1.10	1.57	3.93	1.80	3.57	0.04	2.26	17.99
1922	1.45	0.59	1.17	0.80	0.28	0.92	3.27	2.41	1.54	1.77	1.01	0.04	15.25
1923	1.47	0.80	0.47	0.32	0.21	0.35	1.10	1.05	3.75	1.91	0.97	0.54	12.94
1924	0.79	0.41	0.26	0.92	0.83	0.71	0.61	4.18	2.08	1.86	0.07	0.98	13.70
1925	0.53	0.17	0.32	0.20	0.07	2.20	0.70	3.06	7.55	1.88	0.55	1.08	18.31
1926	0.66	0.10	0.12	0.05	0.29	0.65	3.57	2.32	2.21	1.36	0.35	1.72	13.30
1927	0.93	0.95	0.92	0.37	0.51	0.75	0.55	1.94	1.69	1.32	0.10	1.22	11.25
1928	0.55	1.23	1.34	0.44	0.29	1.33	1.71	2.05	3.29	0.63	2.06	1.15	16.07
1929	1.07	1.88	0.98	0.53	0.77	0.52	2.51	2.09	2.69	2.48	1.05	0.31	16.88
1930	0.87	0.46	1.42	0.57	1.12	2.72	2.08	6.21	5.42	1.49	2.18	1.24	25.78
1931	0.85	0.39	1.08	0.22	2.31	0.72	1.42	2.11	1.44	3.36	3.71	1.32	18.93
1932	1.45	3.16	0.00	0.00				4.12	2.72	1.52	0.17	0.85	
1933	1.16	0.87	0.23	0.09	1.04	1.05							
1934							1.77	5.09	1.54	0.70	0.14	3.81	
1935							2.09	3.18	1.72	3.08	2.01	0.54	
1936	0.68	0.48	0.65	T	0.02	0.50	2.88	1.72	0.91	4.61	3.18	1.53	17.16
1937	2.89	0.47	T	1.64	0.72	1.60	1.16	3.81	1.24	1.06	1.29	0.14	16.02
1938	0.29	0.85	0.73	0.04	0.02	0.71	1.26	2.10	1.64	1.58	0.91	0.48	10.61
1939	0.44	0.43	0.50	0.02	1.07	1.50	3.75	2.59	4.81	2.22	0.53	0.77	18.13
1940	0.53	0.07	0.14	0.66	1.54	1.23	1.15	0.45	4.20	1.06	0.11	1.34	12.48
1941	0.31	0.95	0.20	0.88	0.97	2.10	1.94	0.51	0.51	1.48	0.62	0.60	11.07
1942	0.36	0.93	0.64	0.75	9.47	1.07	2.45	3.05	4.53	1.47	0.10	0.30	16.12
1943	0.66	0.42	0.62	0.17	0.51	1.84	1.59	4.42	3.69	0.39	2.33	1.50	18.14
1944	2.00	0.43	0.33	0.08	0.74	1.84	2.28	6.37	3.58	1.51	0.23	1.74	21.13
1945	0.26	0.85	1.04	0.04	0.79	1.87	2.86	3.92	2.88	3.48	0.54	0.05	18.58
1946	0.44	1.20	0.23	0.15	1.71	0.96	1.47	2.78	0.78	1.52	0.88	0.48	12.60
1947	1.04	0.23	0.27	0.13	0.53	0.41	0.99	2.35	4.47	0.84	1.05	0.29	12.60
1948	1.38	0.51	0.67	0.24	0.17	0.16	2.76	2.19	2.40	2.31	0.96	0.57	14.32
1949	1.86	0.62	0.18	0.52	0.03	4.62	2.35	3.11		0.62	0.26	1.53	
1950	1.44	0.00	0.07			1.82	1.44	1.45	0.68	0.40			
1951		0.53	0.05	1.00	T	2.99	2.90	3.33	3.19	1.34	0.25	0.80	
1952	1.43	0.29	0.24	0.05	0.54	0.52	3.06	2.53	1.97	2.89	1.60	0.65	15.76

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1945, for an average 24-hour wind speed of 25 miles per hour. Although northeast winds are observed at the station in all months of the year (a minimum of about 10-15 percent in the summer months), there is little chance of a "Matanuska" in the summer months. The "Knik" is generally a warm dry or "chinook" type wind from the east or east-southeast. Knik winds generally occur when pressures are high in the Gulf of Alaska and may occur at any time in the year. Knik winds are most frequent in April, May, and June in which months they occur on an average of 4-6 days a month. Both the Matanuska and Knik winds "fan out" and are not generally as severe at the Experiment Station as they are closer to the mouths of respective valleys. Both winds, but primarily the "Matanuska", may remove almost all the snow cover from fields creating a hazard to any perennial or winter crops, and causing considerable soil erosion at any time in the year. The prevailing wind changes from the winter northeasterly regime to southwest in May with resulting precipitation increase from a minimum in April to a maximum in late summer, about half of the year's precipitation falling in July, August, and September. The dry spring and wet summer is the reverse of the desired climatic regime for grain and hay crops, and there are many overhead irrigation systems and an increasing amount of barn curing of hay in the Valley to combat the "reversed" precipitation pattern. For example, the chances for seven or more consecutive days without rain starting on June 1 at the Matanuska station are nearly one in three with the chances for 7 consecutive days without rain rapidly lowering through June and July to less than one in ten at the end of July and less than one in 20 at the end of August. Thunderstorms are infrequent and mild with an average of one or two a year occurring generally in the early summer. Hail of a destructive nature is practically unknown. The first snow generally falls in late October although occasionally light snow falls in September, reaching a median max. depth of four inches in November, about seven inches in January and decreasing to a median maximum depth of 7 inches in April. Spring break-up begins generally in early April and continues over a two or three week period. The average last date of freezing temperatures in the spring is May 28 with the latest date on record July 10, 1934. The average date of the first occurrence of 32 degrees or lower temperatures in the fall is September 10 with the earliest occurrence of freezing temperatures August 14, 1946. The average growing season is 105 days. The average last date of 24 degrees or lower temperatures in the spring is April 21 and the average first date of 24 degrees or lower temperatures in the fall October 4. Agricultural crops can be, and are, raised profitably in the Matamiska Valley. The principal climatic deterrents to agricultural activity in the valley are the relatively cool summers and the poor distribution of rainfall, however, the same cool summers which prevent the profitable outside production of the warm season crops such as corn, tomatoes, and melons can also be credited for producing large potato crops, some of the largest turnips and cabbages, and the most luxuriant greens in the world.

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WBO, Anchorage, Alaska--3/12/54--250

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CLIMATOLOGICAL DATA SUMMARY
ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER
UNIVERSITY OF ALASKA

STATION: Matanuska Experiment Station LATITUDE: 61°34'N LONGITUDE: 149°16'W ELEVATION: 150

MONTH	TEMPERATURE (°F) Means: Daily Maximum	Means: Daily Minimum	Means: Monthly	Extremes: Record Highest	Year	Extremes: Record Lowest	Year	PRECIPITATION (IN INCHES): Mean	Greatest Daily	Year	Greatest Monthly	Year	Snow, Ice Pellets: Mean	Greatest Monthly	Year	Greatest Daily	Year	Greatest Depth on Ground	Year	MEAN NUMBER OF DAYS: Precipitation .10 Inches or more	Temperature Max: 70° and Above	Max: 32° and Below	Min: 32° and Below	Min: 0° and Below
(a)	(b)	(b)	(b)	55	–	55	–	56	56		56	–	51	51		51	–	51	–	15	55	55	55	55
J	20.5	3.4	12.0	51	1961+	-40	1975+	0.85	1.36	1961	2.89	1937	8.3	20.0	1949	9.0	1952	29	1951	2	0	24	30	15
F	28.0	10.1	19.1	56	1943	-41	1947	0.67	1.09	1963	3.16	1932	8.6	36.0	1932	10.0	1963	46	1932	3	0	18	27	8
M	34.3	15.6	25.0	54	1938+	-22	1961+	0.52	0.80	1931	1.58	1966	6.2	23.8	1930	15.0	1930	21	1960	2	0	12	29	5
A	46.0	26.7	36.4	67	1958	-16	1944	0.51	1.10	1937	1.79	1975	2.4	17.5	1937	10.0	1937	18	1951	3	*	1	24	*
M	58.2	35.7	47.0	83	1947	8	1945	0.70	0.83	1940	2.54	1968	.2	5.3	1945	5.0	1945	1	1949	2	1	*	9	0
J	66.0	44.0	55.0	91	1936	27	1947	1.42	1.61	1949	4.62	1949	0.0	0.0	–	0.0	–	0	–	5	8	0	0	0
J	67.8	47.3	57.5	85	1967+	31	1934	2.15	1.56	1926	4.62	1959	0.0	0.0	–	0.0	–	0	–	7	11	0	0	0
A	65.1	45.2	55.2	87	1968	27	1947	2.74	2.05	1959	6.37	1944	0.0	0.0	–	0.0	–	0	–	7	6	0	*	0
S	56.9	38.4	47.7	75	1957+	16	1946	2.46	2.48	1925	7.55	1925	0.1	7.0	1930	6.0	1930	3	1956	6	*	0	6	0
O	42.8	26.2	34.5	69	1923	-7	1961	1.56	1.32	1921	4.61	1936	3.8	18.0	1945	11.0	1945	11	1965+	4	0	4	22	0
N	28.4	13.1	20.7	58	1936	-22	1927+	0.94	1.80	1964	3.71	1931	7.4	31.1	1956	18.0	1964	17	1956	3	0	18	27	6
D	20.6	4.2	12.4	55	1934	-35	1961	0.97	1.30	1934	3.81	1934	9.3	29.3	1974	16.2	1955	22	1955	3	0	24	30	12
YR	44.6	25.8	35.2	91	1936	-41	1947	15.49	2.48	1925	7.55	1925	46.3	36.0	1932	18.0	1964	46	1932	47	26	101	204	46

(b) Normal, based on period 1941-1970
* Amount Greater than zero but less than 0.5
+ Also occurred on earlier day, months or years
(a) Period of record
Extremes taken from period of record thru 1975.

3/12/76

STATION: 50 5733 ?? MATANUSKA AGR EXP STA   TOTAL PRECIPITATION   ???? ?????????? ????

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1951	.56E	.53	.05	1.03	T	2.99	2.90	3.33	3.19	1.34	.25	.60	17.24E
1952	1.43	.29	.24	.05	.54	.52	3.06	2.53	1.97	2.88	1.60	.65	15.76
1953	.03	.52	.19	.25	.45	.47	1.93	5.01	1.01	1.45	.16	.46	[illegible]
1954	.13	.40	1.06	T	.46	1.45	3.18	1.69	2.49	1.32	1.01	.75	14.50
1955	.71	1.760	1.09	.41	.18	2.00	1.41	3.91	1.14	1.01	.85	1.930	16.600
1956	.31	1.30	T	.23	.37	1.68	3.69	1.34	2.37	.90	2.10	.11	14.33
1957	1.76	.92	.03	.01	.00	1.35	3.35	1.72	4.10	.62	1.05	.46	15.37
1958	1.19	.09	.25	.47	.64	1.26	1.93	1.14	1.19	2.32	.73	.40	11.61
1959	.05	.44	.64	2.08	1.08	.88	4.62	6.07	1.08	1.77	.96	.96	[illegible]
1960	.90	.48	.10	.39	2.04	.56	4.38	3.02	5.60	.16	.44	1.28	19.75
1961	1.45	.18	.16	1.06	.43	2.21	3.19	1.77	5.01	1.99	.93	1.34	15.72
1962	1.32	.98	.25	.25	2.04	3.73	.75	3.42	1.09	.79	.15	.45	[illegible]
1963	2.52	1.98	1.24	.57	.47	2.27	2.32	3.79	.78	.92	T	1.07	17.73
1964	.49	.370	1.00	1.080	.82	2.46	1.57	1.85	.90	2.210	2.570	.365	16.620
1965	.45	.43	.31	.12	.28	2.53	2.29	3.03	5.31	1.73	.54	.53	17.55
1966	.15	.54	1.58	.82	.95	1.30	2.59	2.38	1.33	1.07	1.150	.52	14.780
1967	.460	.44	.94	.85	.93	1.36	2.70	2.86	3.17	.41	2.50	2.13	19.750
1968	.60	.23	.24	.47	2.54	1.66	1.74	.67	.62	.75	1.10	.15	11.55
1969	.23	.44	.98E	.02	1.02E	.40	3.28	.30	.46	1.27	.62	2.38	11.40E
1970	1.030	.19	.22	.34	.08	1.36	1.88	2.15	.94	1.95	.92	1.03	11.990
1971	.920	.60	.33	.98	.27	1.79	2.10	4.90	2.48	2.23	.40	1.510	13.490
1972	.73	.35	.41	.570	1.23	1.35	1.60	1.05	4.93	2.29	1.78	.35	16.340
1973	.52	.04	.62	1.05	.39	1.62	.20	4.56	.89	1.25	.32	.57	17.15
1974	.70	1.030	.26	.57	.79	.70	1.15	1.31	2.19	1.90	1.07	2.16	13.130
1975	.37	.560	.610	1.79	.24	2.35	2.30	1.41	3.30	.28	.00	.65	[illegible]
1976	.760	.24	.51	1.39	.62	.30	1.80	.68	1.29	1.630	2.50	2.13	[illegible]
1977	.77	.78	.41	.97	.89	.87	1.64	.91	4.24	1.68	.22	.39	17.77
1978	.55	1.345	.15	.05	.80	1.98	2.39	1.01	1.74	1.18	.93	2.03E	[illegible]
1979	.38	.98	1.56	.93	.25	1.56	5.39	.75	1.22	2.05	3.54	1.51	29.12
1980	1.62	.80	.21	.13	.99	2.61	3.72	2.84	3.78	1.46	.22	.35	15.74
1981						4.23	4.78	3.83					
SUM	23.03	19.93	15.84	18.96	22.28	47.57	75.05	71.40	69.90	42.71	30.61	29.68	[illegible]
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	[illegible]
MEAN	.77	.66	.53	.63	.74	1.59	2.50	2.38	2.33	1.42	1.02	.99	[illegible]
EXT HI	2.52	1.98	1.58	2.08	2.54	3.73	5.39	6.07	5.60	2.88	3.54	2.38	[illegible]
EXT LO	.00	.04	T	T	.00	.30	.20	.30	.46	.16	.00	.11	11.40E
EST	5	5	2	2	1					2	2	4	[illegible]

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STATION: 50 5733 MATANUSKA AGR EXP STI MAX TEMP

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1951	13.7E	22.4	27.4	47.9	60.2	64.2	70.9	64.4	56.6	40.1	30.9	17.9	43.1E
1952	13.8	30.1	33.6	44.4	53.7	64.9	67.8	65.4	57.5	46.5M	40.2	26.6	45.4M
1953	1[illegible].9	32.4	34.2	49.9	59.2	71.9	72.0	64.0	55.4	41.2	29.9	25.0	46.1
1954	17.6	13.8	33.9	45.7	61.0	66.9	67.1	65.0	57.3	46.6	34.2	10.5	43.7
1955	2[illegible].5	24.5	33.4	41.0	54.5	60.7	69.9	62.6	55.8M	39.2	14.6	16.1	41.7M
1956	1[illegible].3M	19.1	31.1	45.9	55.1	63.1	67.2	65.4M	55.0	36.1	24.3	10.5	41.0M
1957	[illegible].5	21.7M	32.6	49.4	63.2M	72.3	68.4	70.6	56.6M	49.2	39.4	15.1M	47.1M
1958	25.5M	30.4M	39.7	51.4	58.4	67.2M	66.9	64.5	55.3	37.0	26.6M	23.8	48.6M
1959	1[illegible].8	30.5M	26.1M	44.2M	60.9	71.7	64.4	65.2	58.3	43.3M	32.0	26.0	45.6M
1960	24.3	34.3	32.1M	44.6	61.6	66.8	67.3	64.8	54.4	45.6	29.1	33.4	46.5M
1961	30.3	26.4	25.9	44.8	60.4	65.6	66.6	64.3	56.4M	37.8M	24.4	10.5	43.3M
1962	20.5	27.5	30.8	47.2	56.0	66.0	69.9	65.4	54.8	45.7	27.4	23.2	44.5
1963	26.0	33.6	33.1	41.4	60.5	61.3	68.9	66.3	62.0	45.1	19.1	32.9	45.9
1964	2[illegible].2	29.2	28.8	42.8	53.5	67.2	67.8	63.5	59.5	42.4	29.9	11.0	43.2
1965	1[illegible].7	19.8	42.2	47.9	54.1	59.1	65.9	62.9	58.6	36.4	26.2	19.7	42.7
1966	16.9	24.4	26.9	46.7	53.5	66.8	68.1	61.9	58.7	39.5	26.4	19.6	42.5
1967	15.6	25.5	36.2	45.6	60.1	65.2	69.0	65.7	56.7	44.4	34.3	21.5	45.0
1968	17.2	31.2	39.1	44.9	59.2	66.7	69.5	69.2	57.1	39.6	29.4	9.9	44.3
1969	1[illegible].5	27.0	37.7	51.0M	60.3E	70.8	68.3	65.0	60.1	49.7M	29.0	36.3	47.2E
1970	14.5	37.5	43.3	44.3	60.1	63.5	66.5	63.0	54.4	38.7	28.1M	19.1	44.4M
1971	9.2	27.4	27.6	43.6	51.7	63.6	66.6	63.9	54.3	39.1	24.8	21.5	41.1
1972	15.2	24.5	26.1	38.3	53.7	60.1	70.8	67.2	53.6	40.5	30.5	19.2	41.6
1973	11.3	26.3	34.3	47.0	57.1M	61.6	66.9M	62.2	53.0M	39.3M	19.6	24.6	41.9M
1974	17.9	20.9	34.8	48.9	61.9	66.3	66.5	68.6	59.9	43.7	30.5	22.5	44.9
1975	16.7	23.0	32.6	42.3	57.5	61.1	67.3	65.1	55.3M	42.6	21.3M	18.0	42.0M
1976	21.4	22.2	33.7	46.2	56.6	66.4	69.0	66.3M	56.5	42.0	39.8M	30.7	45.9M
1977	38.9	39.4	32.5	44.1	55.3	67.8M	71.2	66.6M	57.4	44.7	21.9	13.9	45.3M
1978	27.1	32.4	38.7	48.8	59.4	51.4	64.8	68.4	58.1	44.8	31.7	25.3	46.8
1979	26.5	17.0	39.0	47.3	59.9	63.9	66.5	67.0	60.4	47.5	41.0	14.9	45.5
1980	20.8	36.2	37.8	51.5	56.5	62.1	66.2	62.4	56.4	45.0	35.2	5.0	44.6
SUM	597.4	815.6	1012.4	1379.0	1735.1	1956.2	2038.2	1958.8	1705.4	1273.3	871.1	605.5	1328.6
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	30
MEAN	19.9	27.2	33.7	46.0	57.8	65.2	67.9	65.3	56.8	42.4	29.0	20.2	44.34
EXT HI	38.9	39.4	43.3	51.5	63.2M	72.3	72.0	70.6	62.0	49.7M	41.0	36.3	47.2E
EXT LO	9.2	17.0	26.1M	38.3	51.7	59.1	64.4	61.9	53.0M	36.1	14.6	5.0	41.0M
EST	3	3	2	2	3	2	1	3	5	5	4	1	34
SD	6.56	5.84	4.68	3.17	3.11	3.54	1.87	2.21	2.18	3.76	6.42	7.68	1.69

STATION: 50 5733 MATANUSKA AGR EXP STN MIN TEMP

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1951	-.6E	1.9	4.2	30.2	35.9	44.2	47.9	46.9	39.3	23.2	17.4	-.3	24.2E
1952	-4.5	11.6	16.6	26.1	32.5	43.1	47.9	44.0	36.6	31.0M	27.3	12.6M	27.1M
1953	1.5	14.8	14.0	28.3	36.8	46.7	47.9	46.7	37.8	26.3	13.5	9.2	27.0
1954	.2	-3.8	11.8	23.3	36.9	42.5	46.2	44.7	37.8	30.1	19.1	-7.9	23.4
1955	10.9	6.4	15.3	21.4	35.6	42.9	46.3	45.2	37.3M	25.4	-2.5	.3	23.9M
1956	-1.6M	3.8	10.5	27.0	37.0	43.4	48.6	46.1M	36.1	20.5	6.8	-5.8M	22.7M
1957	4.7	2.0M	23.4	28.3	36.0M	46.4	47.9	46.0	42.7M	29.8M	27.5	-.3	27.9M
1958	9.7	14.1M	20.6	27.5	37.1M	43.7M	46.9	44.7	36.5	19.7	12.0M	9.2	26.6M
1959	-.4	13.6M	4.0M	27.6M	36.5	45.5	48.0	45.9	37.9	25.9M	18.3	9.4	26.0M
1960	9.3	16.7	15.0M	27.9	33.7	43.0	47.5	44.7	38.7	28.1	13.6	16.8	28.4M
1961	14.7	10.5	3.9	28.2	35.3	44.1	47.2	44.7	38.3M	22.1M	8.4	-6.1	24.3M
1962	2.6	9.0	11.3	28.6	35.4	44.7	47.6	46.4	34.4	29.0	12.5	6.7	25.7
1963	10.5	17.4	15.4	24.6	35.6	41.8	48.9	45.2	40.4	28.2	1.4	18.3	27.4
1964	4.9	11.8	7.4	27.1	30.5	45.4	46.3	44.9	39.9	26.8M	16.3	-5.3	24.6M
1965	3.2	2.2	29.0	28.3M	33.2	42.8	47.9	44.5	43.9	19.4	9.5	2.7	25.6M
1966	-1.2	5.5	6.4	26.9	34.8	44.8	47.1	46.1	40.3	24.9	9.5	.7	23.3
1967	-4.3	4.5	16.9	26.6	35.3	45.6	49.2	49.3	41.3	24.2	20.5	5.0	26.2
1968	2.7	15.6	20.0	24.7	36.9	43.5	47.1	45.2	34.7	24.1	14.5	-6.5	25.2
1969	-5.6	9.0	20.0M	29.0M	37.8E	46.8	48.9	40.6	37.4	30.4M	13.4	21.9	27.5E
1970	-2.3	23.7	23.3	25.9	35.0	43.8	46.3	45.4	35.5	20.7	14.1M	2.4	26.6M
1971	-10.1	10.0	3.3	26.9	33.1	42.9	46.9	48.0	37.1	24.9	8.1	3.4	22.9
1972	-2.6	6.7	3.9	17.2	34.7	42.3	48.0	46.5	36.6	26.3	15.0	4.7	23.3
1973	-6.8	5.7	16.6	29.6	36.3M	43.9	47.6	44.5	39.8M	24.5	1.6	6.5	24.2M
1974	-2.1	4.0	14.1	30.3	35.9	44.5	48.3	46.6	42.0	30.0	14.0	7.0	26.2
1975	-1.2	4.1	13.6	24.7	36.2	43.6	48.1	46.6	39.9	25.9	2.0M	.5	23.7M
1976	5.2	1.6	16.4	27.4	35.6	42.8	48.4	46.2	38.6	25.7	24.4M	16.5	27.4M
1977	25.7	26.2	14.2	27.1	35.2	46.2	48.5	49.3	38.9	30.2	3.7	-4.4	29.4
1978	9.3	19.1	21.9	29.9	37.9	43.6	47.8	45.9	39.3	31.0	16.4	10.1	29.4
1979	9.9	-2.3	23.8	29.8	38.5	43.7	50.1	47.8	41.1	33.2	24.5	-2.9	28.1
1980	4.0	21.0	19.7	30.6	37.4	45.3	49.0	44.7	37.4	29.8	20.5	-12.0	27.3
SUM	86.9	286.8	442.9	811.2	1073.6	1323.7	1434.3	1373.3	1157.5	791.3	403.5	113.9	775.2
NO YRS	30	30	30	30	30	30	30	30	30	30	30	30	30
MEAN	2.9	9.6	14.8	27.0	35.8	44.1	47.8	45.8	38.6	26.4*	13.5	3.8	25.8M
EXT HI	25.7	26.2	29.0	30.8	38.7	46.9	50.1	49.3	43.9	33.2	27.5	21.9	29.4
EXT LO	-10.1	-3.8	3.3	17.2	30.5	41.8	46.2	40.6	34.4	19.4	-2.5	-12.0	22.7M
FST	2	3	3	3	4	1		1	4	6	4	2	33
SD	7.44	7.54	7.16	2.83	1.77	1.37	.94	1.66	2.29	3.68	7.70	8.54	1.29

Local Climatological Data

Annual Summary With Comparative Data

1980

ANCHORAGE, ALASKA

Narrative Climatological Summary

Anchorage is in a broad valley with adjacent narrow bodies of water. Cook inlet, including Knik Arm and Turnagain Arm, lies approximately 2 miles to the west, north and south. The terrain rises gradually to the east for about 10 miles, with marshes interspersed with glacial moraines, shallow depressions, small streams, and knolls. Beyond this area, the Chugach Mountains rise abruptly into a range oriented north-northeast to south-southwest, with average elevation 4,000 to 5,000 feet and some peaks to 8,000 or 10,000 feet. The Chugach Range acts as a barrier to the influx of warm, moist air from the Gulf of Alaska, so the average annual precipitation is only 10 to 15 percent of that at stations located on the Gulf of Alaska side of the Chugach Range.

The Alaska Mountain Range lies in a long arc from southwest, through northwest, to northeast, approximately 100 miles distant from Anchorage. During the winter, this Range is an effective barrier to the influx of very cold air from the north side of the Range. Extreme cold winter weather, associated with a high pressure system over interior Alaska, may lead to a succession of clear days in Anchorage, with temperatures dropping to -15° to -30°, as contrasted to the -50° and even -60° readings in the interior. There are some factors, however, which tend to offset the sheltering effect of this mountain barrier. Chief among these is cold air entrapment in various suburban areas during periods of light winds. This results occasionally in temperatures on the outskirts of Anchorage as much as 15° to 20° colder than observed at the official observation sites.

The four seasons are well marked in the Anchorage area, but in length, and in some major characteristics, they differ considerably from the usually accepted standards in middle latitudes.

Winter is considered to be the period during which the ponds, streams, and lakes are frozen; this normally extends from mid-October to mid-April. The shortest day of the year has 5 hours and 28 minutes of possible sunshine. Periods of clear, cold weather normally alternate with cloudy, mild weather during the Anchorage winter. The clear, cold weather is frequently accompanied by significant fog because of the important low-level moisture source provided by the arms of Cook Inlet which surround the area on three sides; while considerable floating ice is prevalent, the high tides maintain some open water throughout the winter. Visibilities of 1/2 mile, or less, occur about 5 percent of the time during December and January, and most of these low visibilities are associated with fog. Snow visibilities generally range from 1 to 3 miles though heavier snowfalls will, of course, restrict visibilities to less than a mile on a few occasions. The first measurable snow occurs, on the average, on October 15, but has been as early as September 20; latest measurable snow in the spring averages April 14, but has been as late as May 6. Snow occurs on 20 to 25 percent of the midwinter days, and most of the snow falls in relatively small daily amounts, with only 2 percent of the midwinter days having more than 4 inches. The heavier snows occur in conjunction with vigorous storm centers moving northward across south-central Alaska. Normally, the depth of snowfall on the ground does not exceed 15 inches. Strong, gusty, north winds which occur, on the average, once or twice during the winter will, under favorable snow conditions, cause drifting and packing of snow cover. Although normally an area of light winds, strong "Northers" at Anchorage occasionally result from the rapid deepening of storms in the nearby Gulf of Alaska at a time when the interior is covered by an extensive mass of quite cold air.

Spring is the period immediately following the famed Alaska "Break-up." This season is characterized by warm, pleasant days and chilly nights; the mean temperature rises rapidly; precipitation amounts are exceedingly small.

Summer comprises the period from June through early September, and is, in reality, two seasons of about equal length, the first of which is dry, the second wet. At the time of the summer solstice, possible sunshine in Anchorage amounts to almost 19-1/2 hours, and the sound of singing birds and pounding hammers is nearly as common at midnight as at noon. About the middle of July average cloudiness increases markedly, and the remainder of the summer usually accounts for about 40 percent of the annual precipitation.

Autumn is brief in Anchorage, beginning shortly before mid-September and lasting until mid-October. The frequency of cloudy days and precipitation drops sharply in early October. Measurable amounts of snow are rare in September, but substantial snowfalls sometimes reaching 10 or 12 inches occasionally occur in mid-October. Some of the stronger southerly winds, a few with damaging effects, occur in the late summer or fall; these are post-frontal winds following the movement of a storm from the southern Bering Sea or Bristol Bay, northeastward across the Alaskan interior. Somewhat less frequent, but more damaging, are the southeasterly "Chugach" winds which are funneled down the creek canyons on the northwestern slopes of the Chugach mountains east of the city; gusts estimated at 80 to 100 mph have caused considerable damage to roofs, power lines and trailers on a few occasions. The growing season in Anchorage averages 124 days, with the mean daily temperature above freezing from April 8 to October 23. May 15 is the average date for the last occurrence in spring of a temperature as low as 32°, while September 16 is the average first date with 32° in the fall. The latest date with 32° in spring has been June 6, and the earliest with 32° in the fall August 14.

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA AND INFORMATION SERVICE / NATIONAL CLIMATIC CENTER ASHEVILLE, N.C.

Meteorological Data For The Current Year

Station: ANCHORAGE, ALASKA # 26451 INTERNATIONAL AIRPORT Standard time used: ALASKAN Latitude: 61° 10' N Longitude: 150° 01' W Elevation (ground): 114 feet Year: 1980

Month	Temperature °F Averages Daily maximum	Daily minimum	Monthly	Extremes Highest	Date	Lowest	Date	Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Total	Greatest in 24 hrs.	Date	Snow, Ice pellets Total	Greatest in 24 hrs.	Date	Relative humidity, pct. Hour 02 (Local time)	Hour 08	Hour 14	Hour 20	Wind Resultant Direction	Speed m.p.h.	Average speed m.p.h.	Peak Gust Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 132 feet m.s.l.
JAN	20.9	7.6	14.3	46	20	-17	1	1568	0	1.28	0.43	21-22	12.0	3.8	16-17	74	73	68	73	01	5.1	5.9	59	NE	29	44	6.2	10	5	16	12	4	0	5	0	25	30	7	1006.1
FEB †	33.7	21.1	27.4	46	23	6	19	1083	0	1.18	0.75	31-1	18.7	12.3	31-1	76	78	74	76	36	1.2	7.3	40	SE	4	†38	7.6	7	2	20	7	3	0	6	0	13	26	0	997.0
MAR	34.0	20.4	27.2	47	31	2	17	1164	0	0.30	0.09	8	3.4	1.1	8	72	70	60	68	02	1.5	6.9	43	E	31	44	7.7	3	7	21	8	1	0	0	0	10	29	0	1001.4
APR	47.6	31.6	39.3	51	30	23	15	764	0	0.19	0.13	11-12	0.8	0.8	12	77	70	51	64	17	2.7	7.9	43	SE	21	41	8.2	2	6	22	6	0	0	1	0	0	19	0	994.6
MAY	52.3	39.2	45.8	58	25	30	4	592	0	1.68	1.18	29-30	0.0	0.0		72	66	53	63	16	5.6	9.5	43	S	10	27	9.2	1	3	27	11	0	0	1	0	0	2	0	1006.8
JUN	59.4	47.0	53.2	66	26	40	9	347	0	2.73	0.81	17-18	0.0	0.0		77	72	62	68	21	3.1	8.3	32	S	20	25	9.0	0	5	25	14	0	0	0	0	0	0	0	1012.2
JUL †	63.4	50.6	57.0	75	20	42	2	243	0	2.27	0.48	27	0.0	0.0		83	76	66	73	23	1.6	7.1	40	SE	11	†37	7.8	4	6	21	13	0	1	0	3	0	0	0	1007.5
AUG	61.1	47.7	54.4	68	11	39	24	320	0	3.06	0.74	15-16	0.0	0.0		82	77	63	76	19	2.2	7.1	35	S	9	41	7.5	6	5	20	19	0	0	0	0	0	0	0	1009.1
SEP	54.2	39.2	46.7	60	11	29	4	542	0	2.53	0.49	12-13	0.0	0.0		78	76	60	70	07	0.7	6.9	36	NE	1	39	7.2	6	5	19	15	0	0	1	0	0	4	0	1004.4
OCT	42.5	31.8	37.2	54	24	19	31	855	0	3.05	1.17	7-8	10.2	5.7	7-8	74	73	68	74	36	1.4	7.3	44	S	15	25	8.5	3	4	24	13	3	0	0	0	1	15	0	996.6
NOV	32.4	22.8	27.6	39	15	3	30	1115	0	0.49	0.22	13	4.2	2.9	16-17	75	78	72	77	36	3.7	6.1	46	N	15	23	8.5	3	3	24	9	1	0	7	0	12	30	0	993.9
DEC	7.9	-6.3	.8	43	31	-23	17	1990	0	0.41	0.32	31	1.4	1.4	29-30	66	66	67	65	03	2.7	4.8	35	NW	31	57	4.3	17	3	11	3	1	0	10	0	30	31	24	1008.8
YEAR	42.5	29.3	35.9	75	JUL 20	-23	DEC 17	10583	0	19.17	1.18	MAY 29-30	50.7	12.3	FEB 31-1	76	73	64	71	07	0.2	7.4	59	NE	JAN 29	36	7.6	62	54	250	130	13	1	31	3	91	186	31	1003.2

† DATA CORRECTED AFTER PUBLICATION OF THE MONTHLY ISSUE.

Normals, Means, And Extremes

Month	Temperatures °F Normal Daily maximum	Daily minimum	Monthly	Extremes Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 02 (Local time)	Hour 08	Hour 14	Hour 20	Wind Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year $	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperatures °F Max. (b) 80° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb. Elev. 132 feet m.s.l.
(a)				27		27					27		27		27		27		27		19	19	19	19	27	10	26	26		27	27	27	27	27	16	16	27	27	16	16	16	14	8
J	20.0	3.5	11.8	50	1961	-34	1975	1649	0	0.84	2.09	1963	0.02	1974	1.19	1961	21.1	1955	10.5	1955	71	72	71	71	6.0	NNE	61	03	1971	41	6.6	8	5	18	7	3	0	7	0	27	31	12	1003.8
F	26.6	8.9	17.8	48	1977	-26	1956	1322	0	0.84	3.07	1955	0.07	1958	1.16	1956	48.5	1955	12.4	1956	73	73	67	70	6.6	N	52	04	1979	45	7.0	7	3	18	8	3	0	4	0	20	27	8	999.6
M	32.8	14.6	23.7	49	1974	-24	1971	1280	0	0.56	2.76	1979	0.10	1969	0.78	1979	31.0	1979	14.5	1959	71	70	58	68	6.7	N	35	34	1963	54	6.7	7	6	18	9	3	0	1	0	13	28	3	1001.4
A	43.8	26.8	35.3	65	1976	3	1972	891	0	0.56	1.91	1977	T	1969	0.69	1975	27.6	1963	9.1	1955	72	68	55	65	7.1	N	35	15	1964	52	7.2	5	7	18	7	2	0	1	0	2	20	0	1004.2
M	55.2	37.2	46.2	77	1969	17	1964	583	0	0.59	1.68	1980	0.02	1957	1.18	1980	3.9	1963	3.9	1963	73	64	50	59	8.4	S	33	35	1964	52	7.6	4	7	20	6	0	*	*	*	0	3	0	1005.1
J	62.9	46.2	54.6	85	1969	33	1961	312	0	1.07	3.40	1962	0.18	1969	1.84	1962	0.0		0.0		76	69	58	63	8.2	S	30	17	1971	47	8.0	3	6	21	9	0	*	*	3	0	0	0	1009.0
J	65.6	50.1	57.9	81	1977	38	1964	220	0	2.07	4.44	1958	0.42	1972	2.06	1956	0.0		0.0		81	74	62	69	7.1	S	29	16	1957	45	7.8	4	6	21	11	0	*	*	7	0	0	0	1009.4
A	63.8	48.0	55.9	92	1978	33	1969	282	0	2.32	3.40	1973	0.33	1969	1.68	1955	0.0		0.0		83	79	65	75	6.5	S	30	23	1955	42	7.9	4	5	22	12	0	*	1	4	0	0	0	1009.1
S	55.7	40.4	48.1	73	1957	20	1956	507	0	2.37	5.43	1961	0.76	1973	1.92	1961	4.6	1965	3.5	1965	83	82	64	78	6.1	NNE	33	16	1956	41	7.8	4	5	21	14	*	*	1	*	0	3	0	1003.4
O	41.8	27.8	34.8	61	1969	-5	1956	936	0	1.43	3.05	1980	0.35	1960	1.17	1980	21.3	1955	9.8	1955	77	76	66	75	6.4	N	40	03	1966	38	7.7	5	5	21	12	2	0	2	0	4	19	*	996.0
N	26.3	13.9	21.1	53	1979	-21	1956	1317	0	1.02	2.84	1976	0.10	1975	1.66	1964	32.4	1956	16.4	1964	77	77	73	76	6.1	NNE	41	04	1978	36	7.3	6	4	20	10	3	0	4	0	20	28	3	1000.0
D	20.0	-5.3	13.0	47	1969	-33	1964	1612	0	1.07	2.67	1955	0.19	1956	1.62	1955	41.6	1955	17.7	1955	74	74	74	75	5.9	NNE	41	05	1964	34	7.1	7	4	20	11	5	0	5	0	26	31	10	999.7
YR	43.1	26.9	35.0	85	JUN 1969	-34	JAN 1975	10911	0	14.74	5.43	SEP 1961	T	APR 1969	2.06	JUL 1956	48.5	FEB 1955	17.7	DEC 1955	76	73	64	70	6.8	N	61	03	JAN 1971	45	7.4	64	63	238	116	21	1	27	14	112	188	36	1003.4

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 86 in June 1953; lowest temperature -38 in February 1947; maximum monthly precipitation 5.91 in August 1934; minimum monthly precipitation 0.00 in December 1933.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

$ Through 1979.

F-77

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943		22.0	23.6	34.8	46.2	54.6	55.9	53.6	46.0	36.4	28.1	22.4	36.1
1944	14.6	25.8	20.6	31.9	45.0	54.4	56.2	55.4	47.0	36.8	22.5	17.3	35.6
1945	22.6	21.5	23.6	31.8	42.4	52.4	57.3	54.2	46.6	34.8	12.4	13.0	34.4
1946	15.8	17.8	15.9	32.8	44.8	53.7	58.4	53.2	47.4	39.4	17.2	5.0	33.4
1947	-1.0	18.1	30.3	36.1	46.6	53.4	59.6	55.2	47.2	36.0	27.8	22.7	36.0
1948	18.0	12.2	19.8	31.4	46.2	53.9	56.2	53.2	45.6	35.8	14.2	5.8	32.7
1949	12.6	6.0	29.4	31.4	44.8	50.6	56.0	56.8	49.6	35.2	26.0	6.8	33.6
1950	5.1	7.5	27.5	35.2	45.1	53.1	56.7	58.0	48.8	33.2	12.0	12.1	32.9
1951	5.1	13.2	12.5	37.3	46.9	52.9	59.4	55.9	47.3	31.6	22.7	10.8	33.0
1952	3.8	18.6	22.6	33.0	42.0	51.9	57.2	55.1	46.2	38.0	31.3	17.7	34.8
*1953	6.9	20.4	21.8	38.0	47.3	59.1	60.5	56.6	47.1	34.4	20.6	17.9	35.9
1954	9.8	6.7	22.4	33.3	48.4	54.7	57.9	56.1	48.5	39.8	27.6	6.0	34.3
1955	18.2	15.4	23.1	31.1	43.9	51.2	57.5	54.4	46.3	31.6	9.4	8.1	32.5
1956	5.1	10.3	19.6	34.7	44.0	52.4	56.3	56.0	46.1	28.4	16.5	4.3	31.1
1957	15.0	13.5	28.7	37.1	48.6	58.0	58.1	58.5	49.9	39.1	33.0	9.4	37.3
1958	18.6	19.1	28.9	38.8	47.5	55.1	56.4	55.5	46.4	29.5	19.5	15.4	35.9
1959	10.1	20.8	14.0	33.7	47.6	56.6	55.7	55.8	47.7	32.5	23.4	18.0	34.7
*1960	17.0	22.7	21.0	34.1	49.1	55.1	57.6	55.3	47.1	37.0	22.5	25.2	37.0
*1961	20.9	17.9	16.3	36.0	47.8	54.9	57.7	54.5	48.5	29.0	16.5	4.2	33.7
1962	13.5	19.5	19.9	36.9	44.7	53.5	58.4	56.8	45.6	37.8	22.3	16.6	35.4
1963	19.2	23.5	24.0	31.9	46.9	51.6	58.6	57.0	52.0	36.8	12.1	24.8	36.5
*1964	14.1	20.1	17.3	33.7	41.2	55.9	57.1	54.6	48.7	35.0	21.3	1.0	33.3
1965	10.0	10.3	36.5	39.7	45.4	52.9	59.0	56.3	53.7	30.7	20.5	13.1	35.7
1966	9.7	14.7	16.7	35.3	44.2	55.4	57.9	54.4	46.3	32.3	17.5	10.8	32.9
1967	7.1	14.4	23.2	35.1	47.1	56.1	59.3	58.3	48.1	35.7	30.0	16.0	35.9
1968	12.5	23.1	25.4	35.0	48.2	54.8	59.9	58.2	47.1	33.1	22.1	6.3	35.7
1969	4.6	17.9	28.6	39.4	47.7	57.7	59.3	54.2	48.9	41.2	23.7	28.4	37.7
1970	9.2	29.6	35.4	36.4	48.1	54.8	57.1	54.6	46.4	32.5	24.9	14.9	37.0
1971	2.7	20.6	14.2	33.4	41.6	51.2	55.4	55.0	46.1	32.3	18.3	16.2	32.3
1972	6.4	13.5	15.7	26.9	43.3	51.9	59.0	56.6	44.5	31.7	21.3	12.4	31.9
1973	2.9	13.1	24.2	35.8	43.6	51.4	57.8	53.8	45.7	32.2	13.6	18.3	32.7
1974	6.8	14.1	23.3	37.9	47.9	55.5	57.3	56.3	49.8	39.5	22.6	18.8	35.4
1975	11.9	12.9	22.5	32.9	46.3	53.0	58.6	56.6	49.3	34.6	14.2	11.6	33.7
1976	17.1	12.8	24.1	34.8	44.9	53.7	58.9	56.3	47.4	33.4	30.6	23.1	36.4
1977	32.0	32.7	24.7	35.7	46.9	57.8	62.6	60.3	50.7	38.3	15.3	11.3	39.0
1978	21.2	26.3	29.3	39.1	49.0	54.5	58.8	59.8	51.5	39.3	26.3	21.4	39.7
1979	22.3	10.6	31.6	38.8	50.2	55.9	60.4	58.8	52.0	41.1	33.5	10.0	38.8
1980	14.3	27.4	27.2	39.3	45.8	53.2	57.0	54.4	46.7	37.2	27.6	0.8	35.9
RECORD													
MEAN	12.3	17.6	23.4	35.0	46.0	54.2	57.9	55.9	47.9	34.9	21.6	13.6	35.0
MAX	19.7	25.7	32.0	42.9	54.9	62.1	65.4	63.3	55.2	41.3	28.1	20.3	42.5
MIN	4.8	9.4	14.8	27.1	37.6	46.2	50.4	48.4	40.5	28.5	15.1	6.9	27.5

Heating Degree Days

ANCHORAGE, AK

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1960-61	227	295	530	860	1267	1226	1359	1312	1530	865	576	294	12261
*1961-62	221	318	499	1112	1450	1584	1593	1267	1394	837	621	338	11524
1962-63	197	249	578	836	1274	1499	1415	1155	1266	986	557	393	11406
*1963-64	192	242	393	866	1583	1237	1573	1297	1476	936	733	263	10731
1964-65	240	315	495	927	1303	1980	1701	1530	879	754	598	157	11064
1965-66	178	261	333	1055	1328	1603	1713	1402	1493	882	641	285	11174
1966-67	214	324	553	1008	1419	1674	1791	1411	1292	890	547	261	11334
1967-68	172	200	501	901	1042	1513	1625	1209	1129	894	512	301	9997
1968-69	153	208	530	987	1220	1816	1869	1312	1124	761	527	217	10779
1969-70	168	330	476	737	1235	1128	1722	963	910	852	515	298	9351
1970-71	239	312	552	1007	1201	1553	1934	1238	1574	940	717	410	11670
1971-72	291	302	561	1008	1396	1508	1614	1469	1521	1138	666	384	12077
1972-73	185	252	608	1025	1308	1627	1925	1468	1258	866	654	399	11555
1973-74	216	342	573	1017	1532	1440	1797	1416	1295	805	526	279	11223
1974-75	235	263	452	937	1263	1425	1643	1454	1313	954	575	354	10868
1975-76	192	252	463	937	1517	1654	1445	1911	1260	897	615	332	11115
1976-77	184	262	521	972	1028	1294	1017	897	1241	872	554	208	9050
1977-78	75	144	421	620	1486	1659	1349	1077	1120	771	491	308	9701
1978-79	186	160	430	792	1153	1344	1321	1515	1029	781	458	268	9403
1979-80	138	184	384	735	937	1704	1568	1083	1164	764	592	347	9600
1980-81	243	320	542	855	1115	1990							

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	0	0	0	0	0	5	1	2	0	0	0	0	8
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	1	0	0	0	0	0	1
1972	0	0	0	0	0	0	5	0	0	0	0	0	5
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	1	0	0	0	0	0	1
1975	0	0	0	0	0	0	2	0	0	0	0	0	2
1976	0	0	0	0	0	0	3	0	0	0	0	0	3
1977	0	0	0	0	0	0	8	3	0	0	0	0	11
1978	0	0	0	0	0	0	1	7	0	0	0	0	8
1979	0	0	0	0	0	0	4	0	0	0	0	0	4
1980	0	0	0	0	0	0	0	0	0	0	0	0	0

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943		0.28	0.39	0.17	0.64	1.20	2.54	3.27	3.97	0.47	1.27	1.39	
1944	1.29	0.47	0.44	0.23	0.51	0.86	2.53	4.01	2.50	1.20	0.33	1.08	15.45
1945	0.36	1.13	1.23	0.34	1.27	1.62	1.49	3.88	2.70	2.32	0.59	0.13	17.06
1946	0.51	1.22	0.32	0.18	1.23	0.74	0.97	1.69	1.24	0.80	1.39	0.97	11.26
1947	0.96	0.12	0.47	0.33	0.57	0.30	1.27	2.92	4.28	0.89	1.23	0.68	13.69
1948	1.04	0.43	0.67	0.08	0.03	0.42	3.28	1.86	2.34	1.75	1.36	0.50	13.76
1949	2.13	0.69	1.05	0.02	0.61	2.94	1.26	1.80	2.45	1.25	0.62	1.45	16.87
1950	0.83	T	0.29	0.04	0.10	1.90	0.97	0.92	1.07	0.52	0.26	1.71	8.61
1951	0.71	0.84	0.42	0.53	0.05	2.51	1.83	2.41	5.16	0.88	0.27	1.02	16.63
1952	1.47	0.50	0.65	0.62	0.32	0.44	2.47	2.95	2.32	3.80	0.96	0.79	16.99
*1953	0.20	0.48	0.21	0.15	0.76	0.57	1.14	5.06	1.85	0.61	0.11	1.11	12.45
1954	0.56	0.18	0.97	0.03	0.15	0.91	2.08	2.13	1.66	2.02	0.93	1.00	12.62
1955	1.12	3.07	0.51	1.32	0.02	1.18	1.72	3.26	1.27	1.82	0.59	2.67	18.55
1956	0.52	2.49	0.28	0.50	0.44	0.52	3.07	1.60	2.00	2.19	2.33	0.19	16.13
1957	1.36	0.67	0.20	0.01	0.02	0.56	1.69	2.02	3.21	0.93	1.51	0.36	12.49
1958	1.05	0.07	0.19	0.25	1.05	2.19	4.44	1.67	1.31	1.93	1.41	0.54	16.10
1959	0.27	0.95	0.85	1.32	0.49	0.26	4.43	3.11	1.42	1.12	0.67	1.34	16.23
1960	0.72	0.45	0.22	0.27	0.44	0.26	2.71	2.70	4.79	0.35	0.56	1.04	14.51
1961	1.51	0.46	0.34	1.38	0.47	1.12	2.23	1.94	5.43	2.81	0.64	0.95	19.27
1962	0.88	0.74	0.58	0.25	1.52	3.40	0.72	1.92	1.45	1.56	0.49	1.06	14.57
1963	2.09	1.35	1.48	1.78	0.44	1.82	2.75	2.80	0.98	1.01	0.12	1.89	18.11
*1964	0.35	1.15	1.07	0.89	0.97	1.73	1.08	2.16	0.83	2.31	2.71	0.64	15.89
1965	0.57	0.67	0.83	0.30	0.51	0.96	1.74	1.58	4.60	1.44	1.86	1.44	16.50
1966	0.63	0.80	0.44	0.70	0.75	0.27	0.71	2.47	2.85	0.86	1.11	1.06	12.25
1967	1.25	1.01	0.29	0.49	1.07	1.44	2.47	2.96	2.86	0.51	1.72	2.40	19.16
1968	0.83	1.67	0.29	0.85	1.60	0.62	1.34	0.69	1.05	1.61	1.08	0.45	12.08
1969	0.28	0.73	0.10	T	0.66	0.18	2.14	0.33	0.78	0.90	0.84	0.94	8.08
1970	0.86	0.57	0.29	0.27	0.43	0.85	2.03	2.23	1.11	1.62	1.21	1.62	13.09
1971	0.24	1.49	0.70	0.63	0.52	0.37	2.86	2.58	1.79	2.16	0.67	0.87	14.88
1972	0.54	0.63	0.68	0.77	0.81	0.61	0.42	1.40	4.47	2.89	0.76	0.72	14.63
1973	0.72	0.11	0.65	0.33	0.14	1.07	0.60	3.40	0.76	1.74	0.78	0.38	10.68
1974	0.02	1.15	0.60	0.61	0.34	0.69	1.22	1.62	1.53	2.63	1.01	2.00	13.42
1975	0.43	0.77	0.54	1.71	0.40	0.47	1.33	1.19	4.52	0.69	0.10	0.89	13.04
1976	0.94	0.33	1.77	0.74	0.16	0.33	0.60	0.97	3.50	1.29	2.84	1.03	14.54
1977	1.35	0.52	0.84	1.91	0.66	0.49	1.37	1.35	4.06	1.92	0.53	0.69	15.51
1978	0.39	1.19	0.45	0.02	0.03	3.09	1.78	0.54	2.16	1.65	0.85	2.60	14.75
1979	0.23	0.69	2.76	0.94	0.15	1.79	3.84	1.56	2.73	2.54	2.77	1.15	21.15
1980	1.28	1.18	0.30	0.19	1.68	2.73	2.27	3.06	2.53	3.05	0.49	0.41	19.17
RECORD													
MEAN	0.83	0.82	0.66	0.57	0.57	1.14	1.93	2.20	2.53	1.59	1.03	1.07	14.91

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1942-43								3.3	2.4	3.1	T	0.0	
1943-44	0.0	0.0	0.0	T	6.8	14.4	24.6	7.4	15.2	1.4	0.0	0.0	69.6
1944-45	0.0	0.0	T	T	5.4	16.2	2.7	14.7	9.0	3.1	8.8	0.0	57.9
1945-46	0.0	0.0	0.0	10.6	9.5	2.1	9.4	19.0	5.8	1.9	0.0	0.0	58.3
1946-47	0.0	0.0	0.0	0.4	17.9	16.7	11.1	1.3	7.1	T	1.7	0.0	56.2
1947-48	0.0	0.0	0.4	3.7	11.5	14.9	14.9	8.1	14.0	T	0.0	0.0	67.5
1948-49	0.0	0.0	0.0	7.8	10.4	11.1	36.1	12.4	12.9	16.4	3.9	0.0	111.0
1949-50	0.0	0.0	0.0	7.3	8.2	25.9	13.6	T	4.9	T	0.0	0.0	59.9
1950-51	0.0	0.0	0.0	T	1.9	27.9	12.2	14.3	7.7	T	0.0	0.0	64.0
1951-52	0.0	0.0	0.0	3.6	3.3	19.7	20.1	5.9	13.1	3.2	0.4	0.0	69.3
1952-53	0.0	0.0	0.0	12.6	8.4	13.3	6.0	6.6	4.6	1.5	T	0.0	51.0
*1953-54	0.0	0.0	0.0	0.9	2.0	20.0	8.1	2.5	14.9	0.7	0.0	0.0	49.1
1954-55	0.0	0.0	0.0	8.7	8.0	19.0	21.1	48.5	8.6	18.7	0.0	0.0	132.6
1955-56	0.0	0.0	0.0	21.7	11.8	41.6	5.9	33.1	4.6	10.5	0.0	0.0	128.8
1956-57	0.0	0.0	T	13.4	32.4	2.7	3.9	11.5	3.2	T	0.0	0.0	67.4
1957-58	0.0	0.0	T	T	5.7	4.3	16.3	0.6	2.5	1.0	0.0	0.0	30.4
1958-59	0.0	0.0	T	4.4	24.3	10.8	6.5	13.7	26.1	8.7	0.0	0.0	94.5
1959-60	0.0	0.0	0.0	7.1	11.7	31.2	14.2	9.5	5.1	3.5	0.0	0.0	81.3
1960-61	0.0	0.0	T	0.5	9.6	4.9	1.7	9.6	5.8	6.4	0.0	0.0	38.5
1961-62	0.0	0.0	0.0	18.5	13.9	11.0	12.1	1.4	14.2	3.0	0.0	0.0	74.1
1962-63	0.0	0.0	0.0	3.0	3.0	4.9	15.5	19.8	11.4	27.6	3.9	0.0	89.1
*1963-64	0.0	0.0	0.0	4.0	2.6	9.6	7.6	17.9	15.1	6.8	0.4	0.0	64.2
1964-65	0.0	0.0	0.0	16.6	25.8	14.2	6.5	11.5	3.0	2.8	0.2	0.0	78.6
1965-66	0.0	0.0	4.6	16.7	17.9	23.9	9.7	10.7	5.2	6.1	T	0.0	94.8
1966-67	0.0	0.0	0.0	1.9	13.5	13.4	16.7	16.3	8.8	4.0	0.0	0.0	74.6
1967-68	0.0	0.0	0.0	4.8	2.5	26.5	7.3	26.1	3.2	7.8	T	0.0	78.2
1968-69	0.0	0.0	1.3	15.1	14.7	7.9	6.5	10.6	1.1	T	0.0	0.0	57.2
1969-70	0.0	0.0	0.0	0.7	2.6	8.7	16.1	8.7	1.4	4.1	0.0	0.0	41.8
1970-71	0.0	0.0	T	4.7	4.2	11.2	1.2	18.5	11.1	9.3	T	0.0	58.7
1971-72	0.0	0.0	0.0	11.9	8.2	11.4	9.6	8.9	12.0	12.6	T	0.0	74.6
1972-73	0.0	0.0	1.5	3.3	10.7	6.5	8.1	1.3	16.1	1.1	0.0	0.0	48.5
1973-74	0.0	0.0	0.0	6.6	10.6	6.7	0.5	23.3	8.2	1.9	0.0	0.0	57.8
1974-75	0.0	0.0	0.0	4.4	8.4	29.2	5.7	15.4	8.3	16.1	0.4	0.0	87.9
1975-76	0.0	0.0	0.0	T	2.0	11.5	9.7	1.9	30.7	5.6	T	0.0	61.3
1976-77	0.0	0.0	0.0	11.4	11.1	13.4	6.1	2.1	9.5	14.0	0.0	0.0	68.0
1977-78	0.0	0.0	1.0	13.2	12.6	10.6	7.3	20.8	9.5	T	0.0	0.0	75.0
1978-79	0.0	0.0	0.0	3.7	8.5	35.2	3.6	6.2	31.0	2.8	0.0	0.0	91.2
1979-80	0.0	0.0	0.0	4.3	13.7	16.0	12.0	14.7	3.4	0.8	0.0	0.0	68.9
1980-81	0.0	0.0	0.0	10.0	4.2	1.4							
RECORD													
MEAN	0.0	0.0	0.2	6.5	12.0	15.1	10.5	12.1	9.4	5.4	0.5	0.0	70.2

* Indicates a station move or relocation of instruments. See Station Location table.

Record mean values above are means through the current year for the period beginning in 1943.

STATION LOCATION

ANCHORAGE, ALASKA

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above Sea level	Ground									Remarks
						Ground at temperature site	Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	* Type M = AMOS T = AUTOB
CITY																
1000 ft. north of mouth of Ship Creek	9/3/14	12/14/22	NA	61° 14'	149° 52'	40	a30	5					5			a - Originally 12 feet. Raised after February 1916 (date unknown).
Government Hill	12/16/22	3/21/23	1 mi. NE	61° 15'	149° 51'		63	5					5			
NW cor. 4th Ave. & F St.	3/21/23	5/25/26	1.25 mi. SW	61° 13'	149° 52'	118	b25	5					5			b - Not in use from 6/1/25.
South side 4th Avenue between F and G Sts.	5/25/26	11/4/38	75 ft. S	61° 13'	149° 52'	118	c40	5					5			c - In use beginning 7/1/29.
SE cor. 4th Avenue and F St.	11/4/38	10/21/40	150 ft. E	61° 13'	149° 52'	118	40	5					5			Elevations of thermometers and rain gages prior to 10/21/40 are approximate. Wind instrument elevations are approximate for period 3/21/23 to 10/21/40.
Roof of Federal Bldg. 4th Avenue & F St.	10/21/40	2/3/43	300 ft. NW	61° 13'	149° 52'	118	47	36					34			Climatological record continued with Airport data Feb. 1943-June 1964 using instrument shelter temperatures. Park Strip data beginning 7/1/64.
CLIMATOLOGICAL STATION																
Park Strip 0.6 mi. SSE of Anchorage P. O.	11/5/63	Present	NA	61° 13'	149° 52'	85		6 d7				3	3	e8		d - Effective 6/24/74. e - Added 7/1/64 adjacent to thermometer shelter and commissioned 1/1/65. Data summarized and published through 1966.
AIRPORT STATION																
Merrill Field, CAA Administration Bldg.	2/3/43	11/1/53	1.75 mi. E	61° 13'	149° 50'	134	44	6			5	5	5			Weighing rain gage discontinued May 1, 1952.
Anchorage International Airport (International Express Air Terminal)	10/30/53	3/27/64	6 mi. SW	61° 10'	149° 59'	192 j114	41 f22	k6	6	18		k4	3 g	h6	23	f - Effective 3/2/61. g - Removed 12/31/53. h - Telepsychrometer(6') 10/30/53 - 6/1/60. Hygrothermometer comm. 6/1/60; relocated 2500' SW 10/6/61. Moved 1500' NE 2/1/64. i - Thermometer shelter site. j - Approximate value for hygrothermometer field sites. k - Maintained to 7/7/64, data source through 6/30/64.
Point Campbell Observation Site Anchorage International Airport	4/2/64	Present	(A)	61° 10'	150° 01'	114	p22	q6	q6	18 n30	NA	m3	r21	p6	NA	(A)- Office reestablished 1.1 mile west of previous location following earthquake of 3/27/64. m - Continued at Air Terminal site to 7/7/64. n - 18 ft. to 4/15/65. p - Same site as prior to earthquake until moved 1000 feet W 7/27/72. q - Added 3/24/71. r - Effective 12/7/78.

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Daniel B. Mitchell
Director, National Climatic Center

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F.5 - SNOW SURVEYS

HISTORICAL AVERAGE OF APRIL 1 SNOW DEPTHS
(THROUGH 1981)
Table 5.1

Course Name	SCS Map Number	Years of Record	Average Snow Depth (inches)	Average Water Content (inches)	Drainage Basin
Fog Lakes	24	12	28	6.4	Fog Cr.
Devils Canyon	124	5	39	9.0	Susitna R.
Talkeetna R.	135 (New)	2	38	4.8	Talkeetna R.
Chunilna Cr.	137 (New)	3	52	13.6	Talkeetna R.
Talkeetna	22	15	31	7.7	Susitna R.
Rainbow Lake	136	2	36	8.2	Talkeetna R.
Bald Mt.-Lake	23	18	33	8.0	Talkeetna R.
Talkeetna R. Pass	133 (New)	2	32	7.9	Talkeetna R.
Sheep River	132	2	35	8.3	Sheep River
Upper Kashwitna R.	130 (New)	2	39	9.1	Kashwitna R.
Kashwitna R. Cirque	129	2	55	16.3	Kashwitna R.
Little Willow Cr.	128	2	45	12.9	Kashwitna R.
Independence Mine	33	15	67	20.5	Willow Cr.
Willow Airstrip	32	17	27	6.5	Willow Cr.
Tokositna Valley	(New)	0	-	-	Kahiltna R.
Ramsdyke Cr.	(New)	1	74	26.6	Kahiltna R.
Dutch Hills	(New)	2	81	28.9	Kahiltna R.
Peters Hills	21	13	59	16.0	Kahiltna R.
Chelatna Lake	20	16	40	10.2	Kahiltna R.
Skwentna	19	15	38	10.1	Yentna R.
Alexander Lake	18	18	40	10.5	Yentna R.
Haggard Cr.	48	18	28	6.0	Copper R.
St. Anne Lake	28	18	24	5.0	Copper R.

TABLE F.5.1 (continued)

Course Name	SCS Map Number	Years of Record	Average Snow Depth (inches)	Average Water Content (inches)	Drainage Basin
Fielding Lake	49	19	46	12.1	Nushugak
Monahan Flat	25	18	31	6.8	West Fork Susitna
Clearwater	26	17	25	5.3	Maclaren R.
Lake Louise	29	18	23	4.1	Tyone R.
Little Nelchina	31	14	27	5.7	Oshetna R.
Oshetna Lake	30	18	21	3.8	Oshetna R.
Fog Lakes	24	12	28	6.4	Fog Creek
Devils Canyon	124	5	39	9.0	Susitna R.
Chunilna Cr.	137 (new)	3	52	13.6	Talkeetna R.
Talkeetna R. Pass	133	2	32	7.9	Talkeetna R.
Talkeetna R.	135	2	38	4.8	Talkeetna R.
Middle Fork Iron Cr.	134	1	45	10.7	Iron Cr.
Rainbow Lake	136	2	36	8.2	Talkeetna R.
Sheep River	132	2	35	8.3	Sheep River
Sheep Cr. Cirque	131	0	-	-	Sheep River
Talkeetna	22	15	31	7.7	Susitna R.
Bald Mt. Lake	23	18	33	8.0	Talkeetna R.
Upper Kashwitna R.	130 (new)	2	39	9.1	Kashwitna R.
Kashwitna R. Cirque	129	2	55	16.3	Kashwitna R.
Little Willow Cr.	128	2	45	12.9	Kashwitna R.
Independence Mine	33	15	67	20.5	Willow Cr.
Willow Airstrip	32	17	27	6.5	Willow Cr.
Mt. Bullion	141	1	46	13.3	Deception Cr.

TABLE F.5.1 (continued)

Course Name	SCS Map Number	Years of Record	Average Snow Depth (inches)	Average Water Content (inches)	Drainage Basin
Deception Cr.	142	1	48	13.7	Deception Cr.
Capital Site	140	1	42	11.7	Deception Cr.
Dutch Hills	New	2	81	28.9	Kahiltna R.
Ramsdyke	New	1	74	26.6	Kahiltna R.
Tokositna Valley	New	0	-	-	Kahiltna R.
Peters Hills	21	13	59	16.0	Kahiltna R.
Chelatna Lake	20	16	40	10.2	Kahitna R.
Skwenta	19	15	38	10.1	Yentna R.
Alexander Cr.	18	18	40	10.5	Yentna R.
Haggard Cr.	48	18	28	6.0	Copper R.
St. Anne Lake	28	18	24	5.0	Copper R.

F.6 - ICE THICKNESSES

Table F6.1 Ice thickness observations across Alaskan rivers.*

CANTWELL
Measurements made on Susitna River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Greatest
10 Apr 1962	320	0.6	4.7	12 Mar 1964	220	2.6	4.3
7 Jan 1963	Missing	1.3	3.8	8 Feb 1965	250	2.7	4.2
19 Feb 1963	Missing	1.5	4.0	21 Jan 1967	280	3.0	5.3
4 Apr 1963	220	1.8	3.2	28 Mar 1967	80	2.3	5.2
2 May 1963	290	2.1	2.7	23 Mar 1970	212	3.1	4.2
23 Dec 1963	100	1.1	3.2				

COPPER CENTER
Measurements made on Klutina River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Greatest
18 Jan 1950	38	open water	1.9	19 Dec 1961	Missing	3.0	3.4
5 Apr 1950	75	open water	1.6	13 Mar 1962	Missing	2.5	5.0
20 Dec 1950	17	2.7	3.9	5 Dec 1962	Missing	2.5	3.5
14 Mar 1951	26	3.5	4.2	5 Feb 1963	Missing	2.0	4.5
24 Mar 1953	38	2.8	5.0	18 Mar 1963	90	1.1	5.5
8 Jan 1954	50	2.4	4.7	28 Apr 1963	88	1.2	4.8
28 Feb 1954	49	3.1	4.0	13 Jan 1964	Missing	4.2	4.5
17 Dec 1960	50	slush	3.3	2 Mar 1964	52	2.9	4.9
13 Jan 1961	49	1.7	3.3	12 Apr 1964	46	Water on ice	4.9
20 Feb 1961	70	2.7	4.0	18 Jan 1967	40	3.2	3.8
7 Apr 1961	57	0.5	2.0	24 May 1967	36	slush on ice	4.8

GAKONA
Measurements made on Gakona River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Greatest
12 Jan 1950	70	0.9	1.8	14 Feb 1961	46	2.9	4.0
7 Apr 1950	50	3.8	4.2	3 Apr 1961	48	0.1	3.1
7 Dec 1950	90	1.7	2.4	14 Dec 1961	Missing	2.0	3.5
27 Nov 1951	72	0.9	1.5	12 Mar 1962	Missing	1.1	3.8
26 Mar 1952	75	open water	2.8	9 Dec 1962	Missing	0.1	3.3
21 Dec 1952	75	1.2	2.6	2 Feb 1963	Missing	0.6	3.1
16 Dec 1953	81	2.7	3.5	15 Mar 1963	70	0.1	2.5
3 Feb 1954	50	1.4	2.7	25 Apr 1963	67	open water	3.0
12 Nov 1954	35	0.1	0.1	17 Nov 1963	Missing	0.6	1.5
11 Feb 1955	64	2.1	2.6	12 Jan 1964	Missing	1.2	4.1
13 Apr 1955	36	1.4	3.9	6 Dec 1964	51	1.4	2.6
7 Dec 1956	125	0.8	3.1	21 Jan 1965	36	3.5	5.6
29 Dec 1956	55	1.1	2.8	27 Dec 1965	120	1.6	2.6
15 Dec 1960	74	0.9	1.8	19 Jan 1967	40	open water	3.7
10 Jan 1961	67	2.2	3.3	23 Mar 1967	18	0.1	3.1

GLENNALLEN
Measurements made on Tazlina River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Greatest
20 Jan 1950	120	1.9	4.5	12 Mar 1962	Missing	1.6	2.9
6 Apr 1950	120	2.6	4.5	2 Feb 1963	Missing	0.1	3.6
19 Dec 1950	134	0.5	1.7	16 May 1963	72	1.5	3.8
12 Mar 1951	80	1.9	4.0	14 Jan 1964	Missing	1.7	3.5
19 Mar 1952	55	0.7	4.9	1 Mar 1964	85	2.7	2.8
25 Mar 1953	110	1.4	4.5	11 Apr 1964	88	2.3	2.8
8 Jan 1954	178	0.6	4.6	14 Jan 1965	110	1.0	2.8
1 Mar 1954	117	0.5	3.5	21 Jan 1966	93	1.9	3.6
16 Mar 1955	116	1.8	4.5	18 Jan 1967	145	2.5	4.0
17 Jan 1956	130	2.3	4.0	23 Mar 1967	103	1.0	3.0
12 Mar 1956	101	2.6	4.0	19 Dec 1968	165	0.3	2.6
18 Feb 1961	220	1.2	2.6	16 Mar 1971	118	slush	3.1
6 Apr 1961	185	0.5	3.3	16 Dec 1971	41	1.1	3.2
19 Dec 1961	Missing	1.0	3.5				

GOLD CREEK
Measurements made on Susitna River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Greatest
18 Mar 1950	210	2.1	3.9	15 Mar 1961	310	1.5	4.0
28 Dec 1950	80	1.3	3.2	4 Jan 1963	Missing	2.3	3.1
21 Feb 1951	95	2.1	4.2	20 Feb 1963	Missing	3.0	4.6
1 Apr 1952	360	1.9	4.2	5 Apr 1963	220	3.4	5.7
18 Mar 1953	332	1.1	3.9	23 Dec 1963	Missing	1.5	3.4
19 Dec 1953	299	0.4	3.4	19 Feb 1964	270	1.8	3.7
11 Feb 1954	472	2.0	4.6	12 Jan 1965	170	1.6	3.8

Table F6.1 (cont'd.) Ice thickness observations across Alaskan rivers.

GOLD CREEK
Measurements made on Susitna River
(continued)

Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest
30 Mar 1954	424	3.4	4.8	19 Jan 1967	130	2.3	2.8
24 Apr 1955	360	1.6	4.3	8 Apr 1967	155	2.7	3.9
5 Jan 1956	155	1.9	4.6	15 Apr 1969	582	1.6	4.2
17 Apr 1956	130	1.5	4.1	1 Apr 1970	290	2.5	3.8

LIGNITE
Measurements made on Teklanika River

Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest
9 Nov 1965	160	slush	1.5	18 Feb 1969	77	1.9	3.3
15 Mar 1966	66	0.3	0.9	19 Mar 1970	68	5.5	6.0
21 Feb 1968	70	1.2	2.7	8 Dec 1971	50	1.3	2.3

PALMER
Measurements made on Little Susitna River

Date	River width (ft.)	Ice Thickness (ft) Least.	Ice Thickness (ft) Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest
26 Jan 1950	21	0.1	1.5	28 Dec 1964	34	0.4	0.9
16 Feb 1950	27	1.1	1.7	14 Jan 1965	34	0.3	0.6
6 Feb 1953	19	0.2	1.2	24 Feb 1965	29	open water	0.7
2 Mar 1954	29	0.5	1.8	26 Nov 1965	45	open water	1.2
20 Jan 1956	28	0.3	1.1	28 Dec 1965	36	0.1	0.5
26 Dec 1961	21	1.2	1.4	30 Jan 1966	22	0.4	0.9
10 Dec 1962	44	open water	0.8	24 Feb 1966	33	0.5	0.8
21 Dec 1962	35	open water	1.3	27 Dec 1967	26	0.2	0.5
4 Jan 1963	34	open water	0.9	25 Nov 1968	26	0.2	1.9
9 Jan 1963	Missing	0.5	1.0	27 Dec 1968	34	0.3	0.9
15 Jan 1963	37	open water	0.8	27 Jan 1969	30	0.4	1.0
5 Feb 1963	Missing	0.4	2.7	25 Mar 1969	41	0.2	1.3
12 Feb 1963	Missing	0.8	2.3	27 Jan 1970	45	open water	0.9
12 Nov 1963	48	0.3	1.6	23 Mar 1970	40	0.5	0.9
21 Nov 1963	35	0.1	1.1	28 Dec 1970	46	0.3	1.2
27 Nov 1963	30	open water	1.7	25 Jan 1971	29	1.1	2.1
9 Dec 1963	46	0.2	1.3	26 Mar 1971	32	0.1	0.5
11 Dec 1963	43	open water	0.6	22 Dec 1971	29	0.5	1.1
13 Nov 1964	40	0.1	1.8	26 Jan 1972	38	0.6	1.1
14 Dec 1964	34	0.7	2.0	24 Feb 1972	41	0.5	1.0

PALMER
Measurements made on Matanuska River

Date	River width (ft.)	Ice thickness(ft) Least	Ice thickness(ft) Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest
11 Jan 1951	135	1.2	3.4	15 Jan 1963	65	1.2	4.5
13 Feb 1951	130	1.6	3.0	29 Nov 1963	Missing	2.1	2.7
20 Mar 1951	130	0.8	2.8	10 Dec 1963	Missing	1.7	2.5
17 Jan 1952	195	0.6	3.5	20 Dec 1963	Missing	2.0	2.8
30 Dec 1952	108	0.8	2.2	17 Feb 1964	145	1.4	2.5
31 Dec 1954	308	0.5	1.4	1 Dec 1964	165	0.2	1.0
16 Dec 1955	180	1.3	2.5	5 Jan 1965	175	1.6	2.2
3 Jan 1956	214	1.8	3.5	19 Dec 1965	120	slush	2.8
24 Jan 1956	210	1.7	3.8	28 Jan 1966	190	0.8	2.9
11 Jan 1961	300	slush	3.0	3 Mar 1966	176	0.3	2.2
28 Dec 1961	135	slush	5.3	15 Jan 1968	202	0.8	2.1
30 Jan 1962	Missing	1.8	3.8	26 Nov 1968	135	0.2	1.2
14 Feb 1962	Missing	1.0	3.0	28 Jan 1969	150	2.7	4.1
10 Dec 1962	275	1.3	2.8	30 Jan 1970	155	1.0	1.8
12 Dec 1962	Missing	1.4	2.6	14 Dec 1970	280	0.3	3.2
31 Dec 1962	75	1.5	4.0	13 Jan 1972	105	0.2	1.6
9 Jan 1963	Missing	1.8	3.2	28 Mar 1972	100	1.2	2.2

PAXSON
Measurements made on Maclaren River

Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest	Date	River width (ft.)	Ice thickness (ft) Least	Ice thickness (ft) Greatest
17 Nov 1960	50	slush	1.1	6 Dec 1963	Missing	2.2	2.8
3 Jan 1961	48	slush	2.7	12 Mar 1964	45	4.7	5.2
1 May 1961	17	slush	2.0	4 Dec 1964	48	1.7	4.0
26 Nov 1961	Missing	0.8	1.4	8 Feb 1965	46	3.0	3.6
20 Jan 1962	Missing	2.0	2.5	21 Jan 1967	50	1.5	2.4
7 Jan 1963	Missing	2.0	2.3	27 Mar 1968	108	2.4	3.4
19 Feb 1963	Missing	2.8	3.3	16 Apr 1969	60	4.7	5.2
4 Apr 1963	50	3.3	4.2				

Table F6.1 (cont'd.)

SKWENTA
Measurements made on Skwenta River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
14 Mar 1961	270	slush	2.9
3 May 1961	320	1.9	3.8
18 Jan 1962	Missing	2.4	3.1

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
16 Mar 1964	200	slush	2.9
13 Jan 1965	95	0.8	1.9
19 Mar 1965	85	2.9	4.4

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
9 Mar 1962	Missing	2.3	2.9
2 Jan 1963	Missing	1.5	2.5
18 Feb 1963	Missing	3.2	3.7
5 Apr 1963	235	2.9	4.1
27 Nov 1963	Missing	1.0	1.6
23 Jan 1964	Missing	1.9	2.7

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
1 Feb 1966	250	slush	2.8
14 Feb 1967	220	slush	2.7
29 Mar 1967	120	2.3	3.1
26 Mar 1968	230	2.2	4.0
1 Apr 1969	118	1.9	3.0
19 Jan 1972	165	slush	4.5

TALKEETNA
Measurements made on Chulitna River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
15 Mar 1961	125	slush	5.0
27 Nov 1961	Missing	0.7	1.8
2 Feb 1962	Missing	2.0	3.0
29 Mar 1962	Missing	2.8	3.0
3 Jan 1963	Missing	2.4	3.5
18 Feb 1963	Missing	2.8	4.2
27 Nov 1963	Missing	0.2	1.8
23 Jan 1964	Missing	1.8	3.1
12 Jan 1965	180	1.3	4.2

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
18 Jan 1967	170	1.2	4.9
9 Apr 1967	190	2.4	4.4
26 Mar 1968	260	slush	3.1
23 Dec 1968	278	open water	2.2
4 Apr 1969	165	0.2	3.0
31 Mar 1970	190	0.9	3.5
1 Apr 1971	200	2.2	5.3
18 Jan 1972	195	0.5	2.4
17 Apr 1972	145	2.2	5.0

TALKEETNA
Measurements made on Talkeetna River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
14 Jan 1966	182	slush	3.2
29 Jan 1966	155	1.0	3.2
16 Mar 1966	135	0.7	3.0
7 Apr 1967	170	1.7	2.9
10 Jan 1968	245	0.7	2.3

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
21 Dec 1968	207	1.4	2.1
3 Apr 1969	210	open water	3.3
1 Apr 1970	218	1.3	2.3
31 Mar 1971	285	1.1	2.8

WINDY
Measurements made on Nenana River

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
7 Feb 1951	80	1.3	4.3
22 Dec 1951	142	0.8	2.5
26 Jan 1953	105	1.7	3.3
19 Mar 1953	63	0.5	3.5
17 Feb 1954	92	0.8	3.5
26 Mar 1954	94	1.0	3.8
16 Nov 1954	147	0.5	1.2
12 Jan 1955	117	1.5	3.9
17 Feb 1955	140	1.5	3.5
23 Apr 1955	95	0.2	4.0
6 Jan 1956	160	1.3	3.7
18 Apr 1956	60	0.9	4.5
4 Jan 1961	152	1.0	1.9
16 Mar 1961		1.1	3.8
2 May 1961	85	open water	3.1

Date	River width (ft.)	Ice thickness (ft) Least	Greatest
28 Nov 1961	Missing	open water	2.2
19 Jan 1962	Missing	1.0	3.4
10 Apr 1962	140	0.1	4.8
20 Feb 1963	Missing	0.1	3.3
5 Apr 1963	70	0.7	3.5
4 Dec 1963	Missing	0.6	3.0
9 Jan 1964	Missing	0.7	3.7
9 Apr 1964	45	open water	2.0
5 Dec 1964	[illegible]	1.5	2.9
18 Jan 1964	174	1.4	3.9
28 Jan 1966	75	0.1	3.9
17 Feb 1967	[illegible]	0.8	3.3
28 Mar 1967	77	0.4	4.1
27 Mar 1968	120	0.3	3.1
2 Apr 1970	158	0.2	2.4
7 Dec 1971	150	1.8	3.2
18 Apr 1972	52	0.4	3.6

*Source: Bilello, Michael A., "A Winter Environmental Data Survey of the Drainage Basin of the Upper Susitna River, Alaska". U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, Special Report 80-19, April 1980.

F.7 - EVAPORATION

TABLE F.7.1
HISTORICAL EVAPORATION* (INCHES)
MCKINLEY PARK

	June	July	August
1967	3.97	3.20	2.42
1968	3.31	3.67	2.25
1969	-	3.48	2.39
1970	-	3.35	2.20
1971	6.38	3.75	2.06
1972	3.97	4.10	2.61
1973	3.37	3.25	1.55
1974	-	-	-
1975	-	-	-
1976	-	-	-
1977	3.77	4.02	3.37
1978	3.02	3.46	3.31
1979	2.81	2.97	2.73
1980	4.04	2.92	1.88
1981	3.24	1.89	2.18
Average	3.78	3.35	2.41
Maximum	6.38	4.02	3.37
Minimum	2.81	1.89	1.55

* From NOAA Climatological Data Reports.

TABLE F.7.2
HISTORICAL EVAPORATION* (INCHES)
MATANUSKA AGRICULTURAL EXPERIMENT STATION

	May	June	July	August	September
1951	-	-	4.16	2.21	1.79
1952	-	4.45	-	2.98	1.64
1953	3.99	4.96	4.88	2.58	1.71
1954	4.74	4.80	4.10	3.03	2.23
1955	-	3.48	4.91	3.96	2.50
1956	4.83	4.32	4.44	-	1.47
1957	6.41	5.45	4.80	3.59	2.03
1958	4.35	5.00	3.97	3.53	2.00
1959	4.76	5.23	2.79	2.82	1.46
1960	3.76	4.44	3.59	2.47	1.08
1961	5.18	4.17	3.40	2.41	1.62
1962	3.66	4.09	3.85	2.81	1.66
1963	-	3.56	3.42	2.50	1.48
1964	-	4.04	-	3.06	1.60
1965	-	4.18	7.19	4.34	-
1966	3.56	4.08	4.36	2.60	2.25
1967	4.35	3.07	3.99	2.91	1.76
1968	-	4.57	3.56	3.30	1.66
1969	-	5.42	4.38	3.53	2.07
1970	-	-	5.03	3.13	2.36
1971	5.34	4.93	4.90	2.68	1.57
1972	3.43	4.06	4.90	3.79	2.63
1973	5.05	3.56	4.38	3.52	-
1974	5.06	4.96	3.96	3.79	2.20
1975	4.20	3.56	3.16	3.17	1.73
1976	4.22	5.34	4.55	3.21	2.13
1977	4.11	5.20	5.24	3.18	1.84
1978	4.60	3.01	3.33	3.23	1.70
1979	4.84	3.90	4.01	3.73	2.54
1980	3.72	2.98	3.27	2.74	-
1981	4.41	3.98	2.82	2.25	
Average	4.48	4.30	4.18	3.10	1.88
Maximum	6.41	5.45	7.19	4.34	2.63
Minimum	3.43	2.98	2.82	2.21	1.08

* From NOAA Climatological Data Reports.