Annual Data Summary

YUKON FLATS
NATIONAL WILDLIFE REFUGE
Poker Flat

2001

National Park Service
Gaseous Air Pollutant Monitoring Network

AIR RESOURCES DIVISION
RESEARCH AND MONITORING BRANCH
12795 West Alameda Parkway
P.O. Box 25287
Lakewood, Colorado 80225
Telephone: (303) 969-2820
Fax: (303) 969-2822

This Annual Data Summary was prepared under NPS Contract C2350010840 by:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, Colorado 80525
Telephone: (970) 484-7941
Fax: (970) 484-3423

For additional copies of this report or reports for other NPS units, contact:

National Park Service Air Resources Division
Information Management Center
c/o Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, Colorado 80525
Telephone: (970) 484-7941
Fax: (970) 484-3423
E-Mail: AIR-IMC@AIR-RESOURCE.COM

or

National Park Service
Air Resources Division
P.O. Box 25287
Lakewood, Colorado 80225-02587
Telephone: (303) 969-2130
E-Mail: AQ_INFO@AQD.NPS.GOV

ACKNOWLEDGEMENTS

The National Park Service Air Resources Division (ARD) recognizes the level of effort required by individual park units, site operators, auditors, cooperating state and local agencies, and ARD contractors. ARD sincerely appreciates the contributions of all participants in assisting with the collection, validation, and reporting of these air quality and meteorological data.

At Yukon Flats National Wildlife Preserve, the ARD recognizes Brian Lawson for performing the technical and administrative skills required to help produce the data presented within this report.

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1-1
1.1	The National Park Service Gaseous Pollutant Monitoring Network	1-1
1.2	Yukon Flats National Wildlife Refuge - Poker Flat	1-3
2.0	DATA SUMMARY	2-1
2.1	Overview	2-1
2.2	Meteorological Data Summary	2-7
2.3	Dry Deposition Data Summary	2-11
3.0	NATIONAL PARK SERVICE AIR RESOURCES DIVISION DATA SOURCES	3-1
4.0	GLOSSARY	4-1
4.1	Air Quality Glossary	4-1
4.2	Glossary of Units	4-3

LIST OF FIGURES AND TABLES

	Page
Map of National Park Service Gaseous Pollutant Monitoring Network Ozone and Sulfur Dioxide Monitoring Sites	1-2
Site Specifications	1-4
Data Collection Statistics	2-2
First Quarter Data Stackplot	2-3
Second Quarter Data Stackplot	2-4
Third Quarter Data Stackplot	2-5
Fourth Quarter Data Stackplot	2-6
Summary of Selected Meteorological Data	2-8
Quarterly Wind Roses	2-9
Annual Wind Rose	2-10

LIST OF FIGURES AND TABLES (Continued)

	Page
Quarterly and Annual Average Concentrations	2-12
Weekly Concentrations Report	2-13
Three Year Comparison of Maximum and Average Concentrations	2-14
Average Particulate Nitrate Concentrations	2-15
Nitric Acid Concentrations	2-16
Average Total Nitrate Concentrations	2-17
Average Ammonium Concentrations	2-18
Average Particulate Sulfate Concentrations	2-19
Average Sulfur Dioxide Concentrations	2-20
SO_4/SO_2 Ratio	2-21

1.0 INTRODUCTION

1.1 THE NATIONAL PARK SERVICE GASEOUS POLLUTANT MONITORING PROGRAM (GPMP)

Gaseous air pollutants, including ozone and sulfur dioxide, are of concern to the National Park Service (NPS). Pollutants like these can affect park unit biological resources as well as the health of park unit residents and visitors. The NPS established a gaseous pollutant monitoring program for several pollutants linked to effects on NPS resources. This program was designed to meet certain resource management objectives.

The primary objective of this monitoring program is to establish the status and trends of park unit air quality conditions and to determine if a park unit is exceeding the National Ambient Air Quality Standards established by the U.S. Environmental Protection Agency (EPA) to protect public health and welfare. In addition, such monitoring is designed to detect changes or trends in pollution levels over time. A monitoring station may also be established if there is documented biological injury due to air pollution in a park unit. Information on ambient air pollution levels is an important part of research on effects of air pollutants on NPS resources, and can help confirm suspected causes of observed effects.

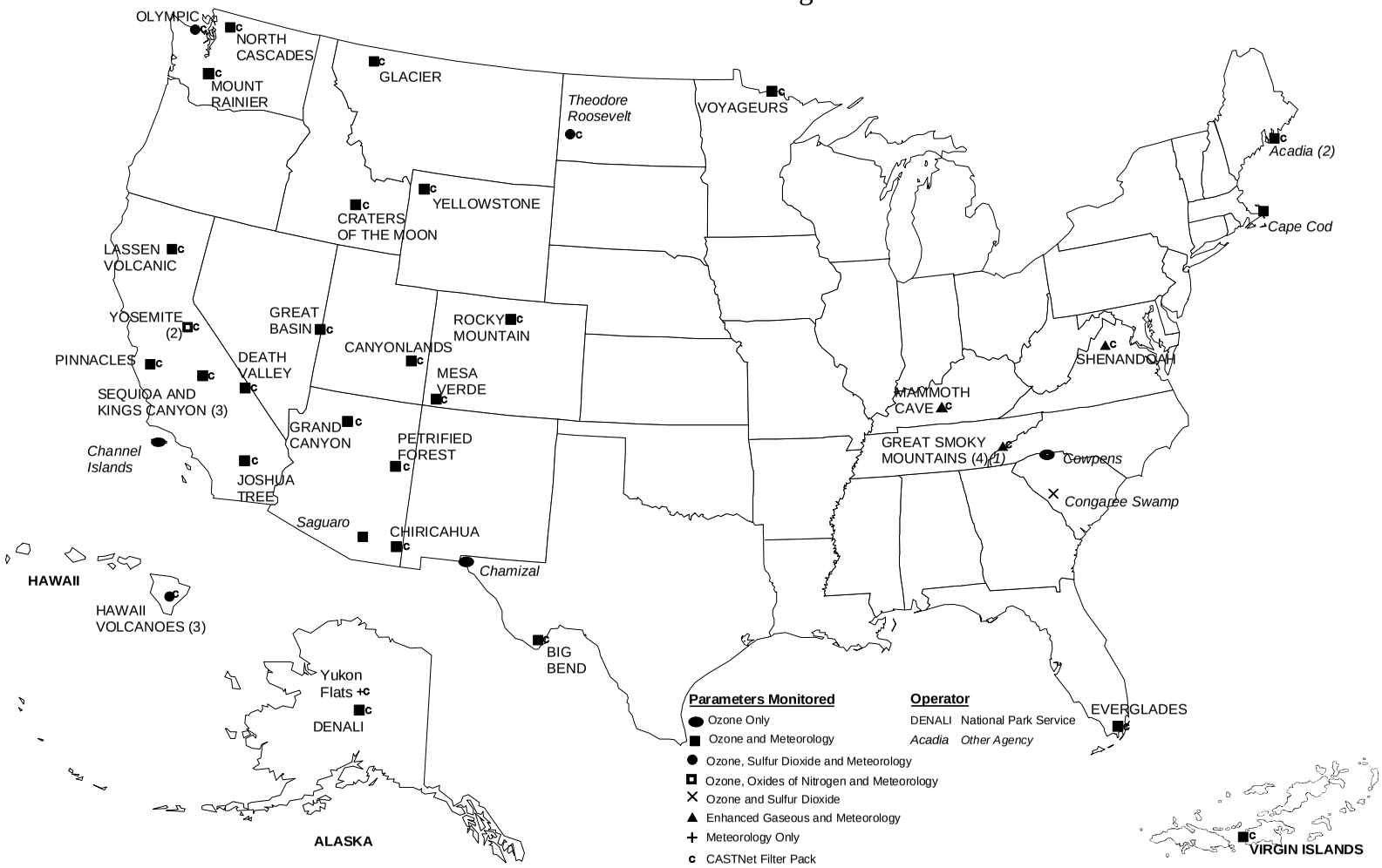
Other monitoring objectives call for the collection of data to support the National Park Service's required involvement in both the development of state air quality control plans, and the evaluation of permit applications for new or expanding air pollution sources wishing to locate near park units. The Clean Air Act gives federal land managers and superintendents an affirmative responsibility to protect air quality related values in Class I areas and to assess whether new sources will have an adverse impact on park unit resources and values. Information on air quality levels in NPS units can also be used to evaluate the performance of atmospheric models that simulate how pollutants are transported into park units and predict impacts on the park unit caused by air pollution sources.

The National Park Service Gaseous Pollutant Monitoring Program site locations and measured parameters collected in this reporting year are shown on the map on the following page. During this reporting period, 47 monitoring sites in 37 units of the National Park System had some combination of ozone, sulfur dioxide, nitrogen, meteorological, and Clean Air Status and Trends Network (CASTNet) dry deposition monitoring. Monitoring methods and quality assurance procedures used in the national park network meet the applicable 40 CFR Part 58 EPA requirements. This allows for the direct comparison of NPS collected data with that collected by the EPA, and state and local air pollution control agencies. Data collected by this network are incorporated in the EPA Aerometric Information Retrieval System (AIRS) database which is a national database of all air quality data collected throughout the country. These data are also stored in the NPS Air Resources Division’s Information Management Center (IMC) that allows for easy access and analysis of data.

This report includes a variety of data summaries for data collected at an individual monitoring site at a national park unit during this reporting period. These summaries highlight the average range and frequency of the data collected during the year. A digital copy of all data collected during the year and data summary products are available; see Section 3.0 for information on obtaining these data. Individual reports are generated for each site where monitoring was conducted in the national park network.

NATIONAL PARK SERVICE
GASEOUS POLLUTANT MONITORING NETWORK

2002 Monitoring Sites

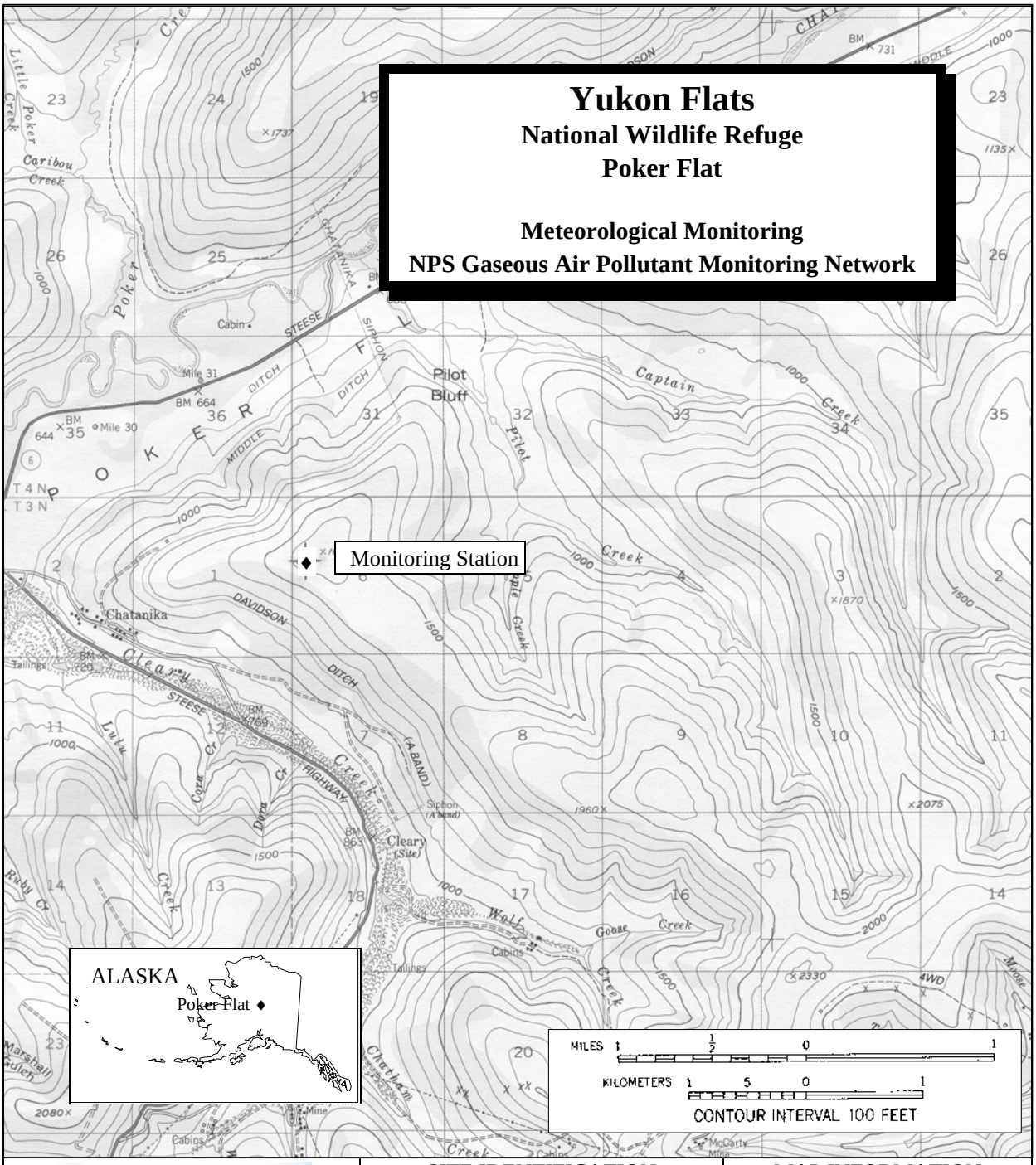


1.2 YUKON FLATS NATIONAL WILDLIFE REFUGE

Yukon Flats National Wildlife Refuge, a Class II area, is located along the Canadian border in central Alaska. Its location and site specifications are presented on the following page.

The refuge protects 115 miles of the 1,800-mile Yukon River and the entire Charley River basin. Numerous old cabins and relics are reminders of the importance of the Yukon River during the 1898 gold rush. Paleontological and archeological sites here add much to our knowledge of the environment thousands of years ago.

Peregrine falcons nest in the high bluffs overlooking the river, while the rolling hills that make up the refuge are home to an abundant array of wildlife.



SITE IDENTIFICATION	
Site Abbreviation:	YUFL-PF
AIRS ID NO.:	02-090-0030

INSTRUMENTATION	
Solar Radiation	Wind Direction
Temperature	Precipitation
Wind Speed	Relative Humidity
Delta Temperature	Filter Pack
Wetness	

MAP INFORMATION	
Mean Elevation:	495m
Longitude:	147º 26' 00" W
Latitude:	65º 07' 04" N
UTM Zone:	6
Easting:	479654m
Northing:	7221457m
Map Reference:	Livengood, AK 1:63,360

2.0 DATA SUMMARY

2.1 OVERVIEW

Based on the site specifications during this annual reporting period, data summaries and statistics are provided in this section.

Data Collection Statistics
Yukon Flats National Wildlife Refuge
Poker Flat

Final Validation

01/01/2002 - 12/31/2002

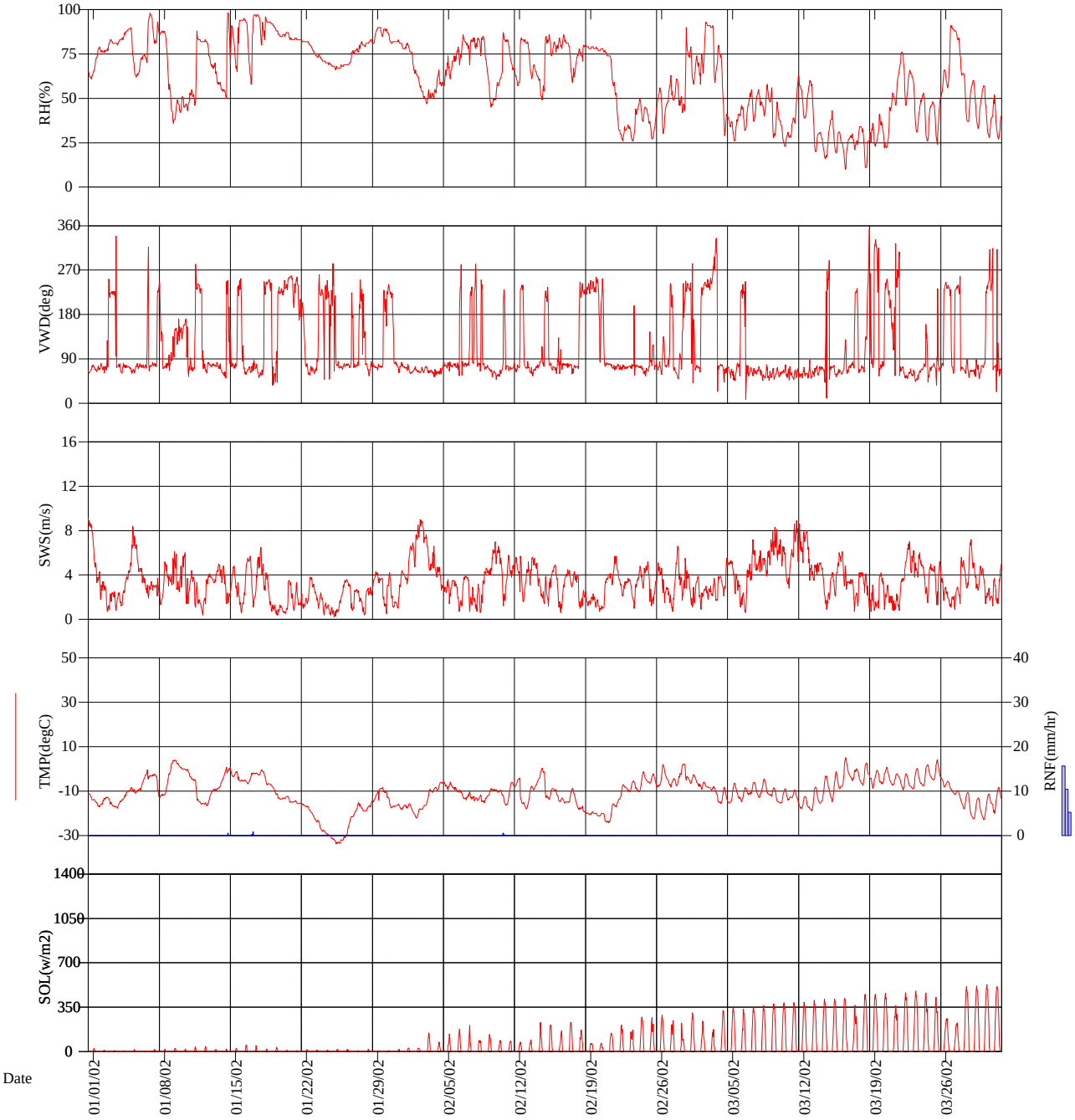
Parameter	Interval	Par Code	Data Recovery			Valid Data	
			No. Possible	No. Collected	% Collected	No. Valid	% Valid
Scalar Wind Speed	hourly	SWS	8760	8629	98.5	8629	98.5
Vector Wind Direction	hourly	VWD	8760	8629	98.5	8629	98.5
Standard Deviation for Wind Direction	hourly	SDWD	8760	8629	98.5	8629	98.5
Ambient Temperature (aspirated)	hourly	TMP	8760	8754	99.9	8749	99.9
Delta Temperature	hourly	DTP	8760	8754	99.9	8725	99.6
Relative Humidity	hourly	RH	8760	8758	100.0	8758	100.0
Precipitation	hourly	RNF	8760	8757	100.0	8757	100.0
Wetness Sensor	hourly	WET	8760	8758	100.0	8753	99.9
Solar Radiation	hourly	SOL	8760	8759	100.0	8759	100.0
Filter Pack Flow Rate	hourly	FLOW	8760	8720	99.5	8694	99.2

Notes: The percent valid is calculated against the number possible.
Automatic zeros and spans are performed daily on most ambient gas analyzers, therefore, no ambient data can be collected during this time. As a result, the maximum percent valid for ambient gas data typically can not be greater than 95.8.

Performance Goals:

Quarterly Criteria:	Monthly Criteria:
100% of sites, >= 85% valid data capture	100% of sites, >= 60% valid data capture
90% of sites, >= 90% valid data capture	90% of sites, >= 75% valid data capture
80% of sites, >= 95% valid data capture	80% of sites, >= 85% valid data capture

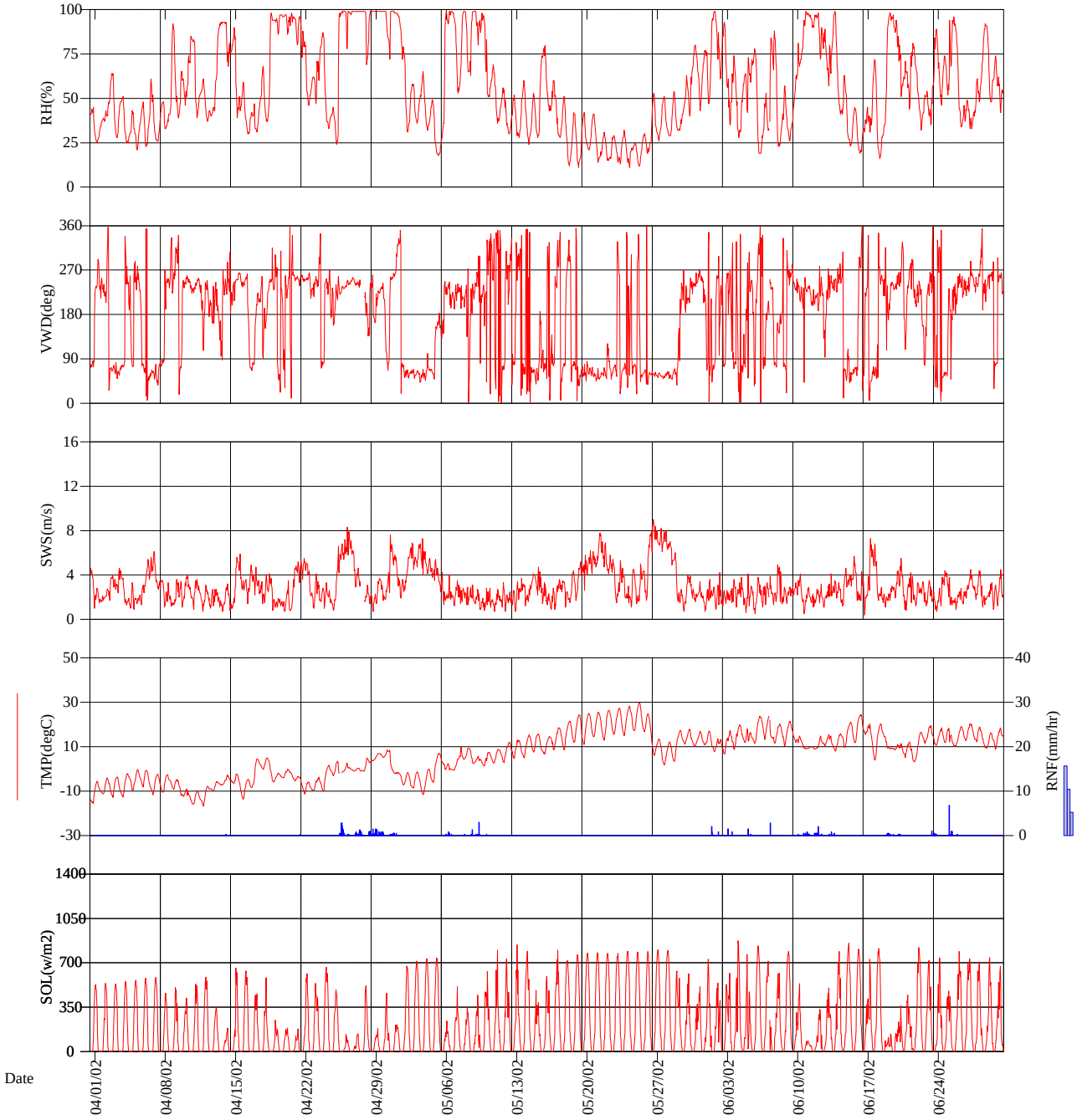
Yukon Flats National Wildlife Refuge - Poker Flats



Final Validation

First Quarter 2002

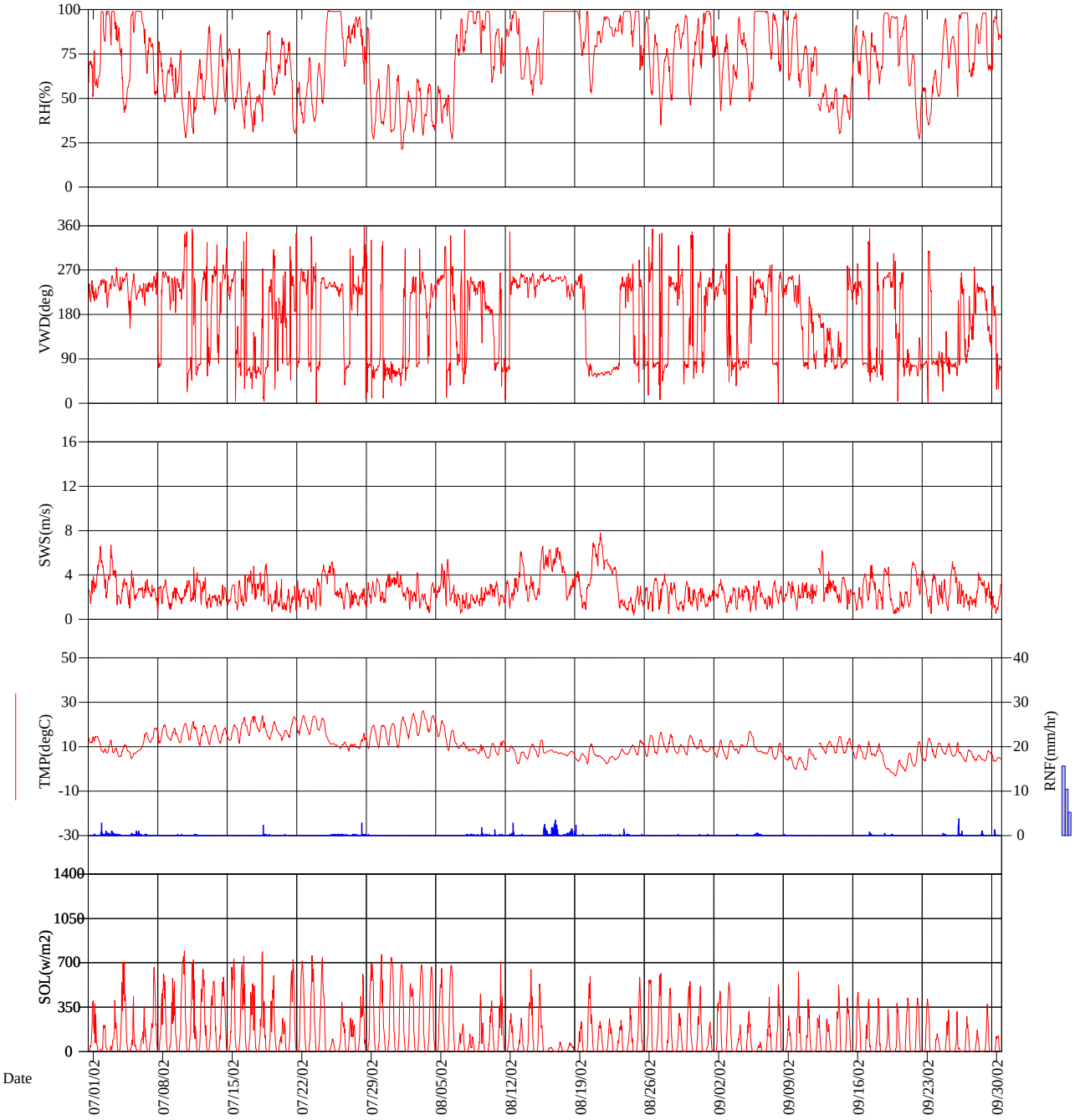
Yukon Flats National Wildlife Refuge - Poker Flats



Final Validation

Second Quarter 2002

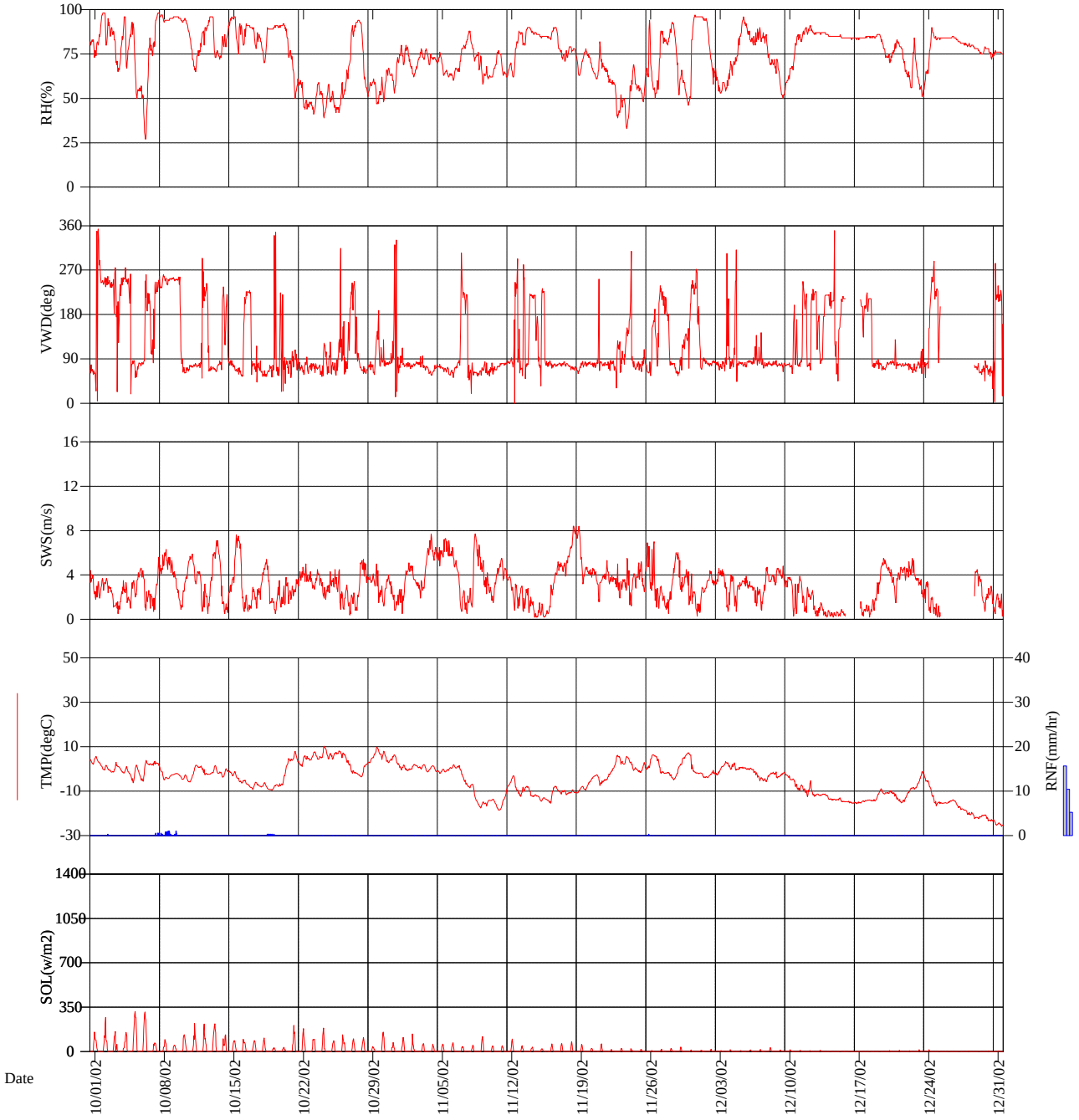
Yukon Flats National Wildlife Refuge - Poker Flats



Final Validation

Third Quarter 2002

Yukon Flats National Wildlife Refuge - Poker Flats



Final Validation

Fourth Quarter 2002

2.2 METEOROLOGICAL DATA SUMMARY

Summary of Selected Meteorological Data

Yukon Flats National Wildlife Refuge

Poker Flat

Final Validation

01/01/2002 - 12/31/2002

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	3.0	m/s	8629	1.6
Maximum	9.1	m/s		
Percent calm = 1.05				
AMBIENT TEMPERATURE				
Average	0.4	degC	8749	11.6
Maximum	29.7	degC		
Minimum	-33.8	degC		
RELATIVE HUMIDITY				
Average	66	percent	8758	22
Maximum	100	percent		
Minimum	10	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	.6	mm/hr	397	.7
Maximum non-zero rate	6.8	mm/hr		
Minimum non-zero rate	.3	mm/hr		
Accumulated during period	238.8	mm		
SOLAR RADIATION				
Average Daily Total	7,694,505	joules/m2day	364	7,550,679
Maximum Daily Total	26,747,741	joules/m2day		
Minimum Daily Total	39,158	joules/m2day		

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

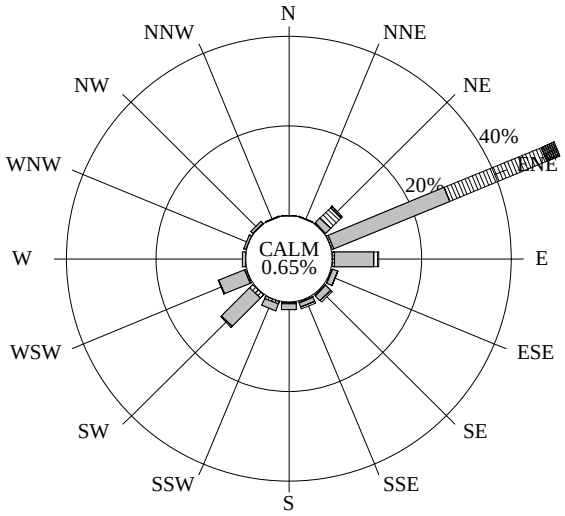
NA indicates instrument not available.

Yukon Flats National Wildlife Refuge
Poker Flat

Quarterly Wind Rose

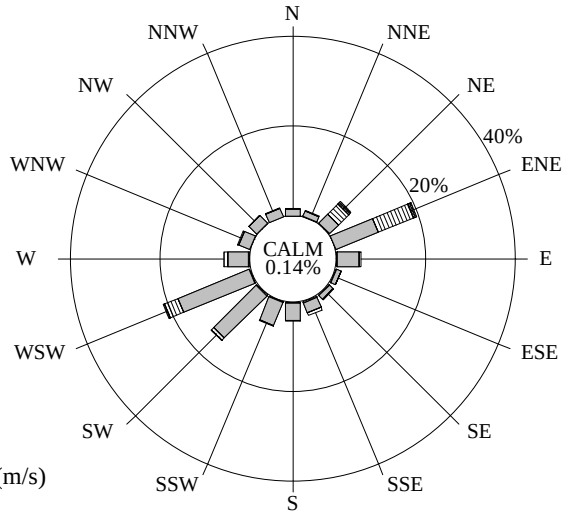
2002

FIRST QUARTER (JAN-MAR)



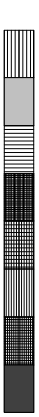
100.0% Collected 100.0% Valid
2160 Possible /2160 Collected /2160 Valid
(includes WS and WD)

SECOND QUARTER (APR-JUN)



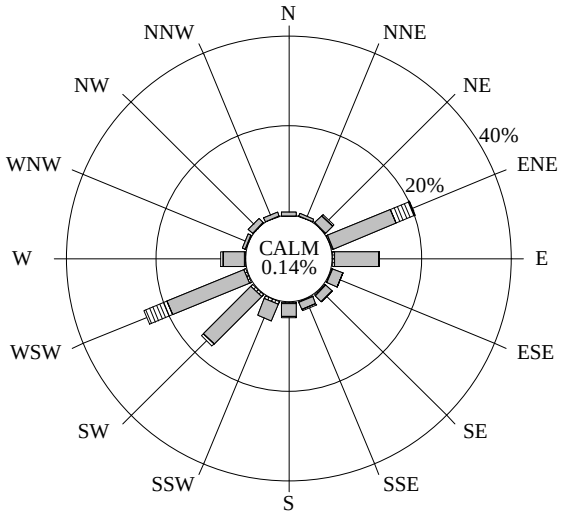
99.5% Collected 99.5% Valid
2184 Possible /2174 Collected /2174 Valid
(includes WS and WD)

Scalar Wind Speed (m/s)



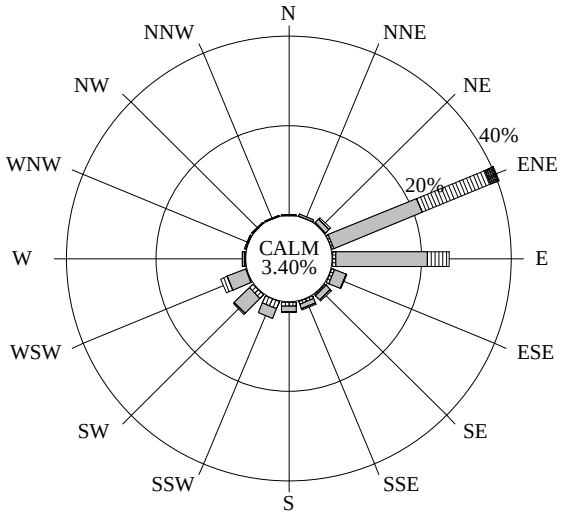
CALM < .5
0.5-0.9
1.0-3.9
4.0-6.9
7.0-9.9
10.0-12.9
13.0-15.9
16.0-18.9
19.0+

THIRD QUARTER (JUL-SEP)



99.9% Collected 99.9% Valid
2208 Possible /2205 Collected /2205 Valid
(includes WS and WD)

FOURTH QUARTER (OCT-DEC)

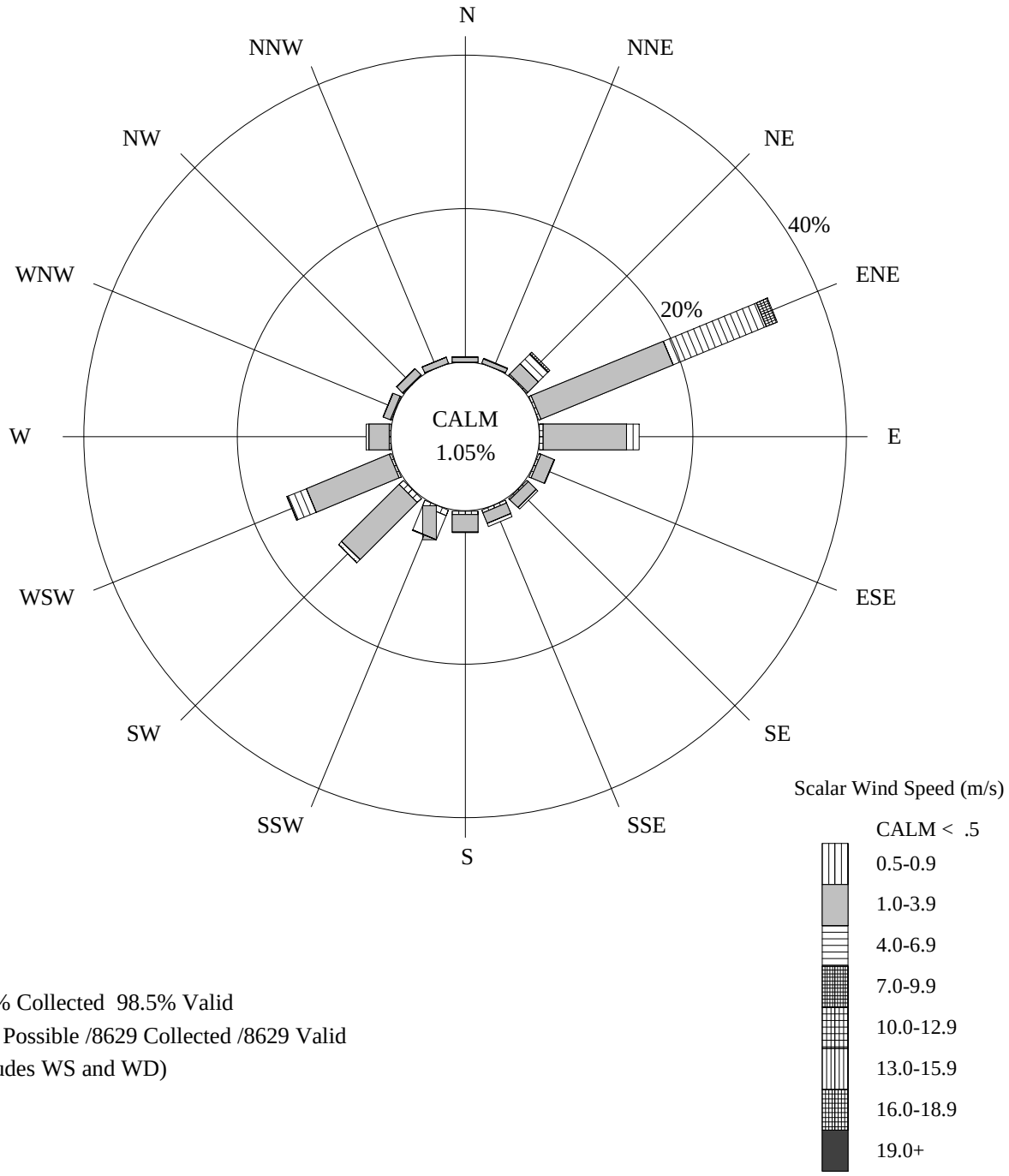


94.7% Collected 94.7% Valid
2208 Possible /2090 Collected /2090 Valid
(includes WS and WD)

Final Validation

04-18-2003

Annual Wind Rose



98.5% Collected 98.5% Valid
8760 Possible /8629 Collected /8629 Valid
(includes WS and WD)

2.4 DRY DEPOSITION DATA SUMMARY

Clean Air Status and Trends Network (CASTNet)
Dry Deposition Monitoring

In 1995, the National Park Service (NPS) and the Environmental Protection Agency (EPA) entered a partnership to jointly measure dry deposition in park units, mostly in the West. A portion of the 2000, 2001, and 2002 data collected from this partnership is presented in this section. These data are presented using local conditions. Data presented in reports prior to 2002 are based on standard conditions.

Atmospheric deposition of acidic species takes two pathways: wet deposition and dry deposition. Wet deposition is the result of precipitation events (rain, snow, or fog) that remove particles and gases from the atmosphere. Dry deposition is less event driven, but still involves the transfer of particles and gases from the atmosphere to surfaces and plants. Wet deposition has been well documented for many years. In the national parks, the National Acidic Deposition Program (NADP) measures and reports wet deposition (see the web site at http://nadp.sws.uiuc.edu for further information). Dry deposition is much harder to measure and a smaller network of monitoring stations is involved. The method used to measure dry deposition is sometimes called the "inferential method" because air quality concentration data are combined with meteorological measurements and land use functions to compute deposition velocities. The CASTNet program provides long-term estimates of total acidic deposition by adding dry deposition values to wet deposition values.

This annual summary report presents the air quality concentration portion of the dry deposition inferential method, which is the only currently available data set. These data were compiled from the analyses of filters collected by CASTNet deposition filter pack systems in the parks. The filter pack analyses yielded weekly average concentrations of particulate sulfate (SO_4^{2-}), particulate nitrate (NO_3^-), particulate ammonium (NH_4^+), sulfur dioxide (SO_2), and nitric acid (HNO_3). In some cases, the positive ions Na^+, K^+, Ca^{2+}, and Mg^{2+} were also measured from the filter samples. These concentration data for the individual ionic species are presented as annual bar charts and summarized by quarter and by year in this report. Concentration data can be used to compare sites and to indicate the amount of acidic species available for deposition. As with the continuous analyzer data, the filter pack concentration data are included on a computer diskette that accompanies this report.

Estimated dry deposition values derived from EPA modeling will be reported at a later time to complete the inferential analyses. When available, these modeling results will be posted on the NPS Air Resources Division Internet web site at http://www.aqd.nps.gov/ard1 or on the EPA CASTNet site. Initial CASTNet results have shown that dry deposition can be a significant portion of total acidic deposition.

CASTNet Dry Deposition Monitoring
Quarterly and Annual Average Concentrations
Yukon Flats National Wildlife Refuge
1/1/02 - 12/31/02

Quarter	No.Valid Samples	p-NO_3 (ug/m^3)	HNO_3 (ug/m^3)	Total NO_3 (ug/m^3)	NH_4 (ug/m^3)	p-SO_4 (ug/m^3)	SO_2 (ug/m^3)	SO_4 /SO_2 Ratio
1	13	0.080	0.192	0.269	0.094	0.394	0.577	0.683
2	13	0.069	0.187	0.254	0.192	0.599	0.301	1.991
3	13	0.126	0.179	0.301	0.185	0.321	0.291	1.101
4	14	0.068	0.163	0.229	0.056	0.187	0.349	0.536
Annual Average		0.086	0.180	0.263	0.130	0.372	0.379	0.981
Standard Deviation		0.125	0.139	0.209	0.114	0.260	0.277	

Data Recovery Table			
Total No. Filters	No. Invalidated	Data Capture	No. Valid Hours
53	0	100.0%	8798.0

CASTNet Dry Deposition Monitoring Weekly Concentrations Report
Yukon Flats National Wildlife Refuge
1/1/02 - 12/31/02

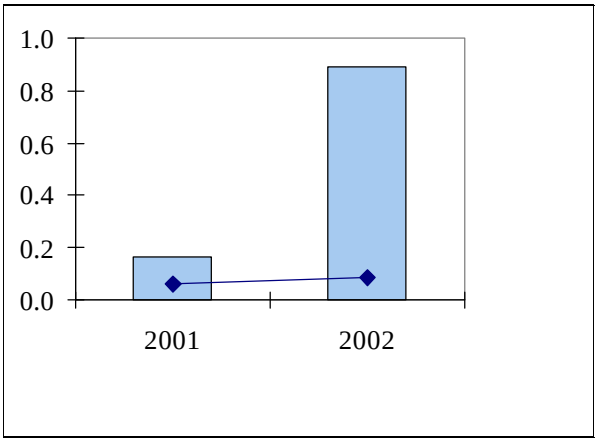
On Date	Off Date	p-NO_3 (ug/m^3)	HNO_3 (ug/m^3)	Total NO_3 (ug/m^3)	NH_4 (ug/m^3)	p-SO_4 (ug/m^3)	SO_2 (ug/m^3)	SO_4/SO_2 Ratio
12/25/01	01/02/02	0.060	0.072	0.131	0.055	0.124	0.195	0.635
01/02/02	01/08/02	0.152	0.257	0.404	0.074	0.379	1.400	0.271
01/08/02	01/17/02	0.185	0.065	0.248	0.039	0.212	0.308	0.687
01/17/02	01/23/02	0.043	0.080	0.122	0.032	0.096	0.346	0.278
01/23/02	01/29/02	0.065	0.656	0.711	0.075	0.351	1.172	0.299
01/29/02	02/05/02	0.051	0.119	0.169	0.063	0.205	0.219	0.938
02/05/02	02/12/02	0.073	0.410	0.476	0.045	0.194	0.723	0.268
02/12/02	02/19/02	0.056	0.140	0.193	0.050	0.227	0.496	0.458
02/19/02	02/26/02	0.045	0.102	0.145	0.132	0.506	0.390	1.299
02/26/02	03/06/02	0.059	0.128	0.185	0.083	0.432	0.474	0.912
03/06/02	03/13/02	0.062	0.063	0.124	0.171	1.123	0.674	1.666
03/13/02	03/19/02	0.069	0.236	0.301	0.208	0.689	0.573	1.202
03/19/02	03/26/02	0.122	0.168	0.287	0.193	0.589	0.536	1.098
03/26/02	04/02/02	0.124	0.078	0.201	0.165	0.750	0.357	2.101
04/02/02	04/09/02	0.145	0.138	0.281	0.261	0.877	0.483	1.814
04/09/02	04/16/02	0.140	0.158	0.295	0.243	1.063	0.671	1.584
04/16/02	04/23/02	0.058	0.131	0.186	0.177	0.700	0.311	2.253
04/23/02	04/30/02	0.035	0.141	0.174	0.162	0.645	0.192	3.355
04/30/02	05/07/02	0.029	0.114	0.141	0.190	0.815	0.180	4.527
05/07/02	05/14/02	0.030	0.088	0.117	0.132	0.348	0.194	1.797
05/14/02	05/21/02	0.033	0.166	0.196	0.312	0.744	0.183	4.074
05/21/02	05/28/02	0.043	0.204	0.244	0.219	0.564	0.206	2.742
05/28/02	06/03/02	0.100	0.604	0.694	0.194	0.399	0.412	0.969
06/03/02	06/11/02	0.048	0.142	0.188	0.088	0.197	0.209	0.944
06/11/02	06/19/02	0.051	0.110	0.160	0.119	0.233	0.213	1.095
06/19/02	06/25/02	0.064	0.361	0.419	0.235	0.455	0.302	1.507
06/25/02	07/02/02	0.147	0.209	0.352	0.155	0.243	0.321	0.756
07/02/02	07/09/02	0.030	0.142	0.169	0.180	0.801	0.316	2.537
07/09/02	07/16/02	0.028	0.160	0.185	0.152	0.406	0.163	2.483
07/16/02	07/23/02	0.029	0.215	0.241	0.121	0.168	0.338	0.497
07/23/02	07/30/02	0.028	0.167	0.193	0.105	0.212	0.174	1.220
07/30/02	08/06/02	0.257	0.494	0.743	0.441	0.377	0.819	0.461
08/06/02	08/13/02	0.888	0.335	1.217	0.700	0.635	0.271	2.340
08/13/02	08/20/02	0.063	0.077	0.138	0.070	0.152	0.178	0.857
08/20/02	08/27/02	0.030	0.092	0.121	0.089	0.236	0.145	1.634
08/27/02	09/03/02	0.033	0.121	0.152	0.147	0.332	0.236	1.404
09/03/02	09/10/02	0.033	0.122	0.152	0.110	0.318	0.263	1.213
09/10/02	09/17/02	0.039	0.082	0.120	0.074	0.130	0.310	0.421
09/17/02	09/24/02	0.029	0.108	0.135	0.060	0.163	0.257	0.637
09/24/02	10/01/02	0.030	0.102	0.131	0.047	0.146	0.284	0.513
10/01/02	10/08/02	0.030	0.122	0.150	0.069	0.180	0.260	0.693
10/08/02	10/15/02	0.048	0.145	0.191	0.049	0.162	0.175	0.921
10/15/02	10/22/02	0.031	0.082	0.112	0.053	0.129	0.081	1.593
10/22/02	10/29/02	0.081	0.074	0.155	0.098	0.261	0.211	1.238
10/29/02	11/05/02	0.029	0.070	0.097	0.030	0.078	0.197	0.399
11/05/02	11/12/02	0.042	0.043	0.085	0.071	0.250	0.093	2.684
11/12/02	11/19/02	0.032	0.376	0.402	0.079	0.312	0.472	0.660
11/19/02	11/26/02	0.031	0.047	0.078	0.051	0.119	0.180	0.660
11/26/02	12/03/02	0.051	0.139	0.188	0.032	0.189	0.266	0.709
12/04/02	12/10/02	0.035	0.154	0.187	0.065	0.128	0.134	0.953
12/10/02	12/17/02	0.123	0.470	0.586	0.063	0.291	0.845	0.345
12/17/02	12/23/02	0.270	0.105	0.373	0.026	0.138	0.609	0.227
12/23/02	12/30/02	0.125	0.356	0.476	0.044	0.236	1.080	0.219

Yukon Flats National Wildlife Refuge

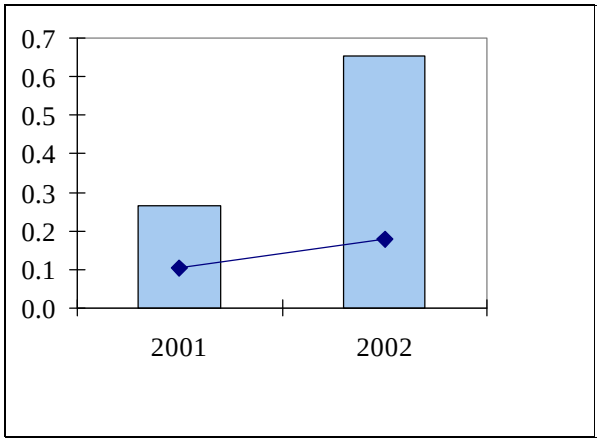
CASTNet Dry Deposition Monitoring

Three Year Comparison of Maximum and Average Concentrations

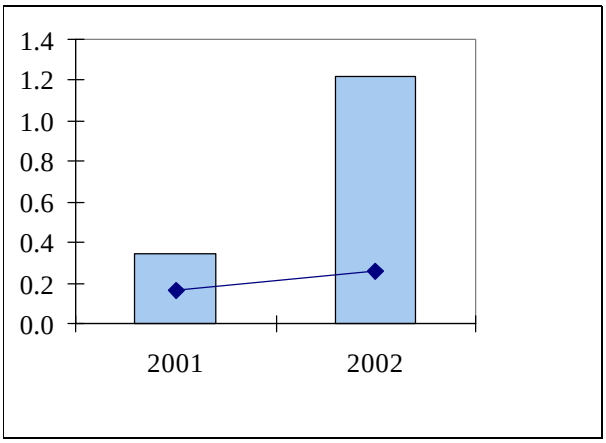
p-NO3



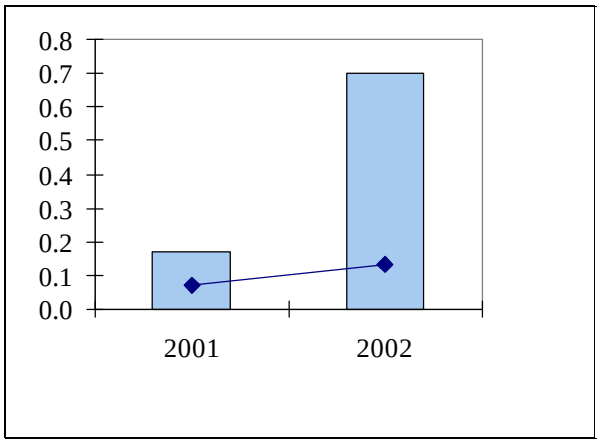
HNO3



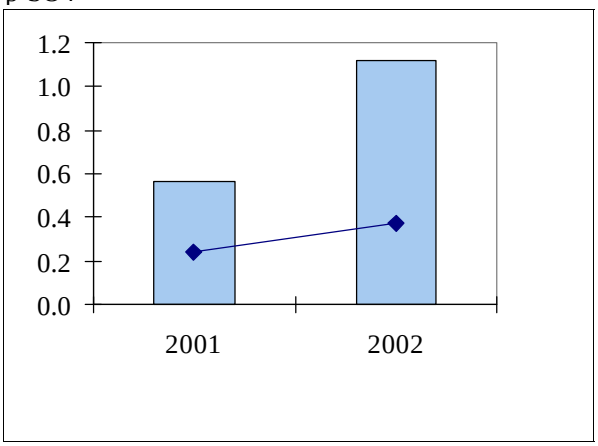
Total NO3



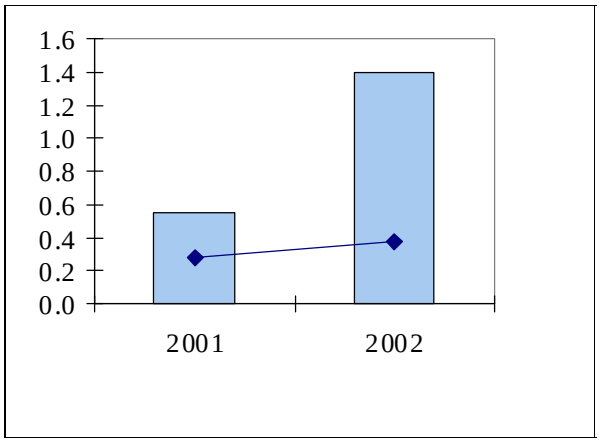
NH4



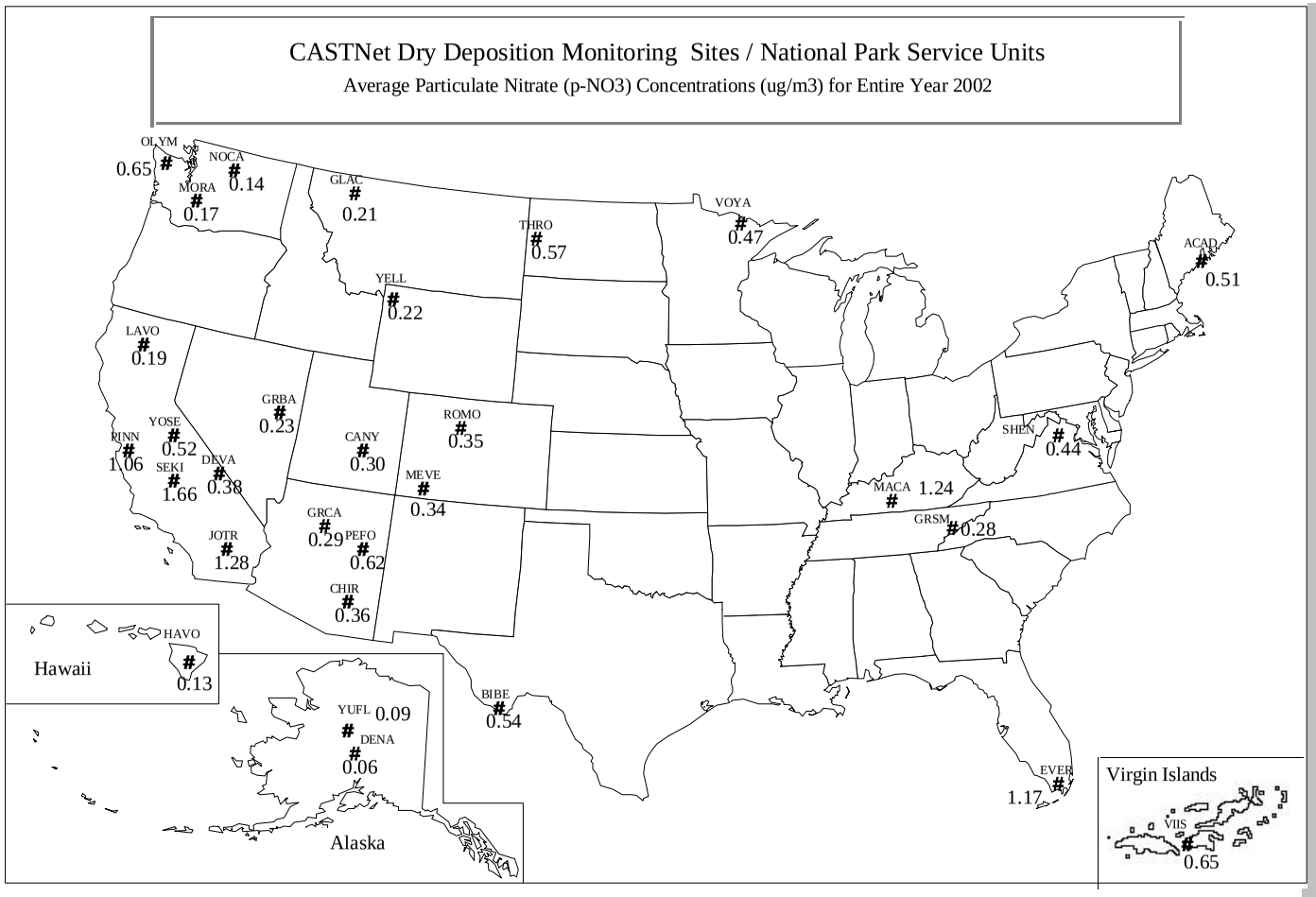
p-SO4



SO2

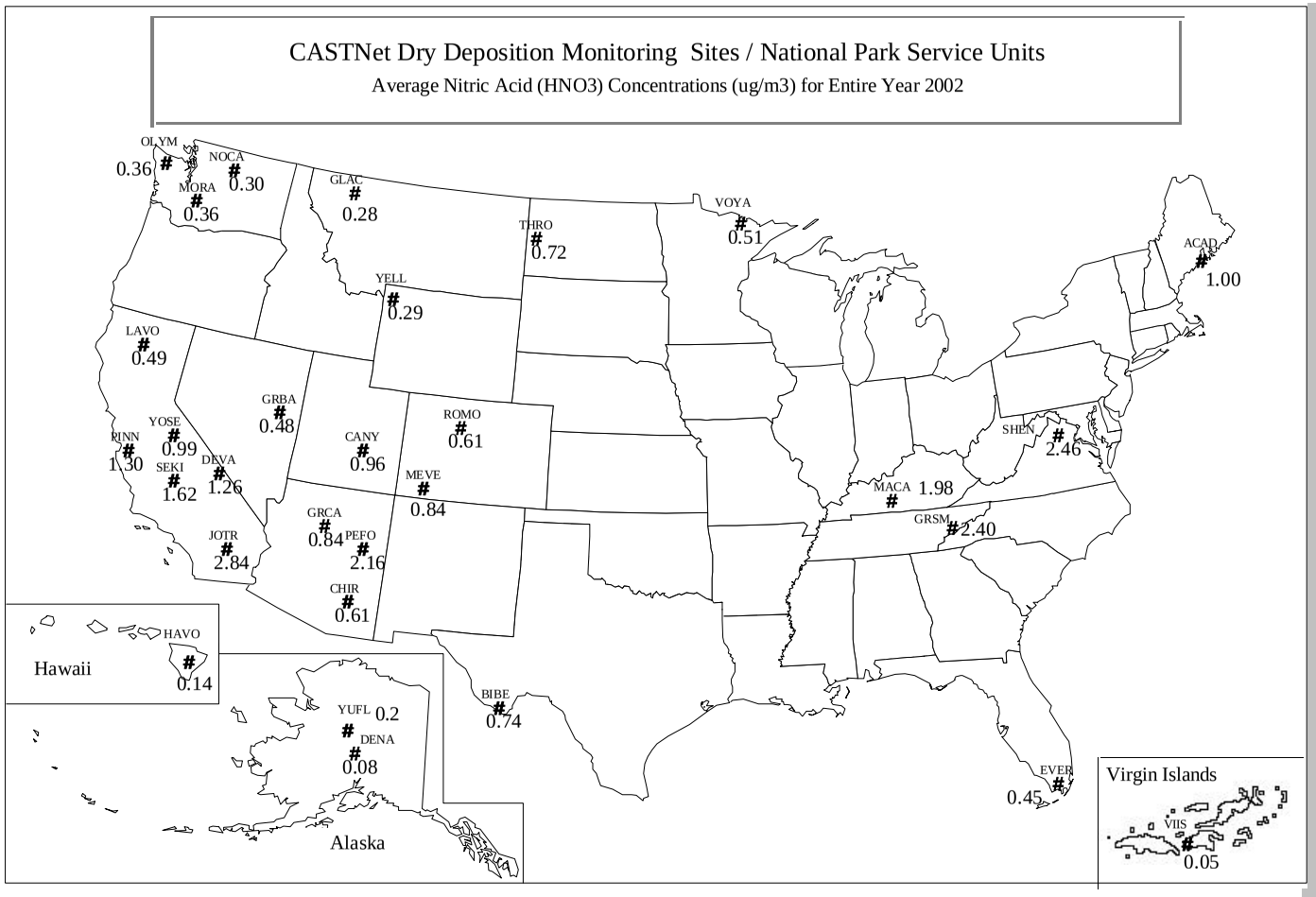


Maximum Concentration (ug/m3) Average Concentration (ug/m3)



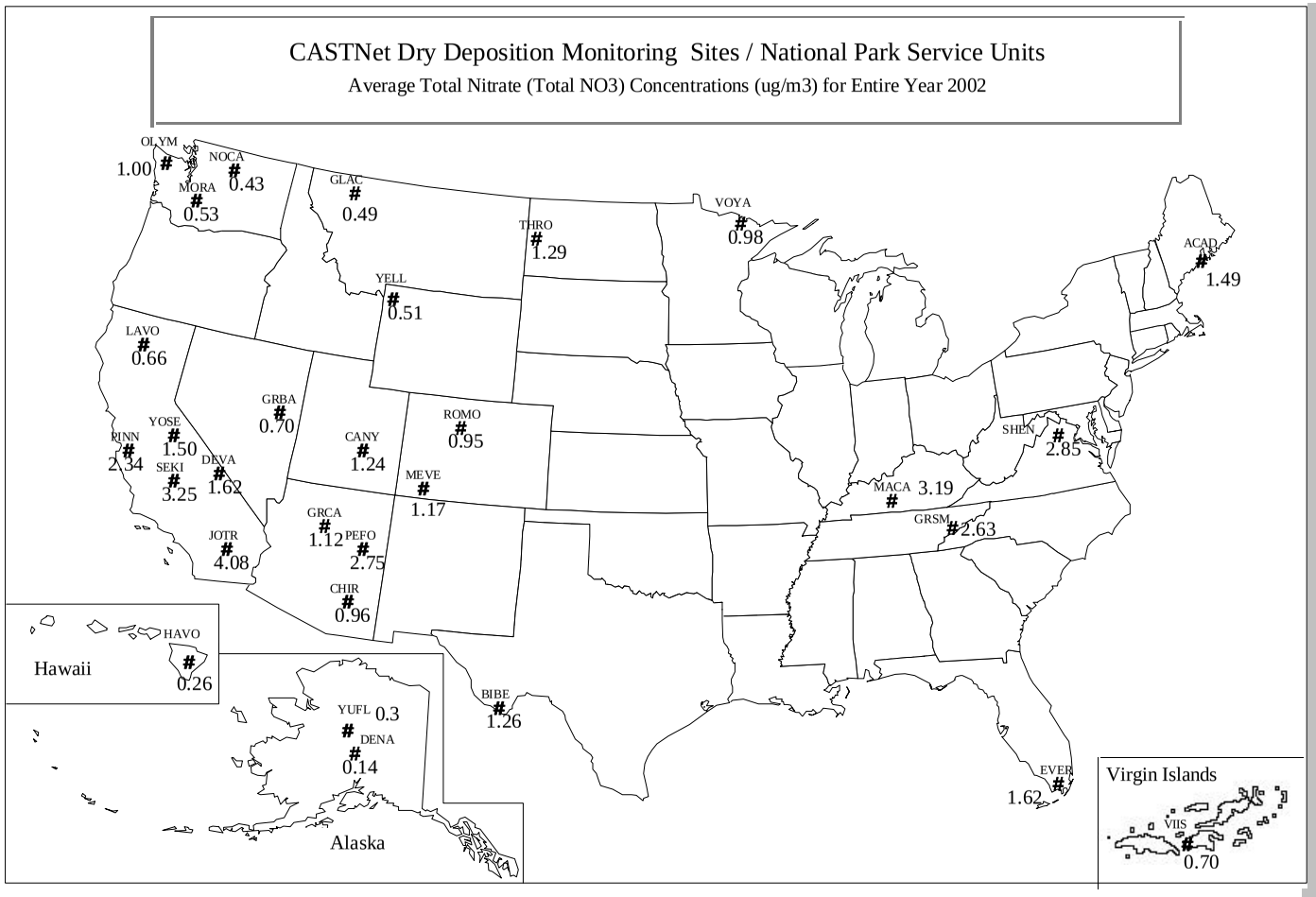
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



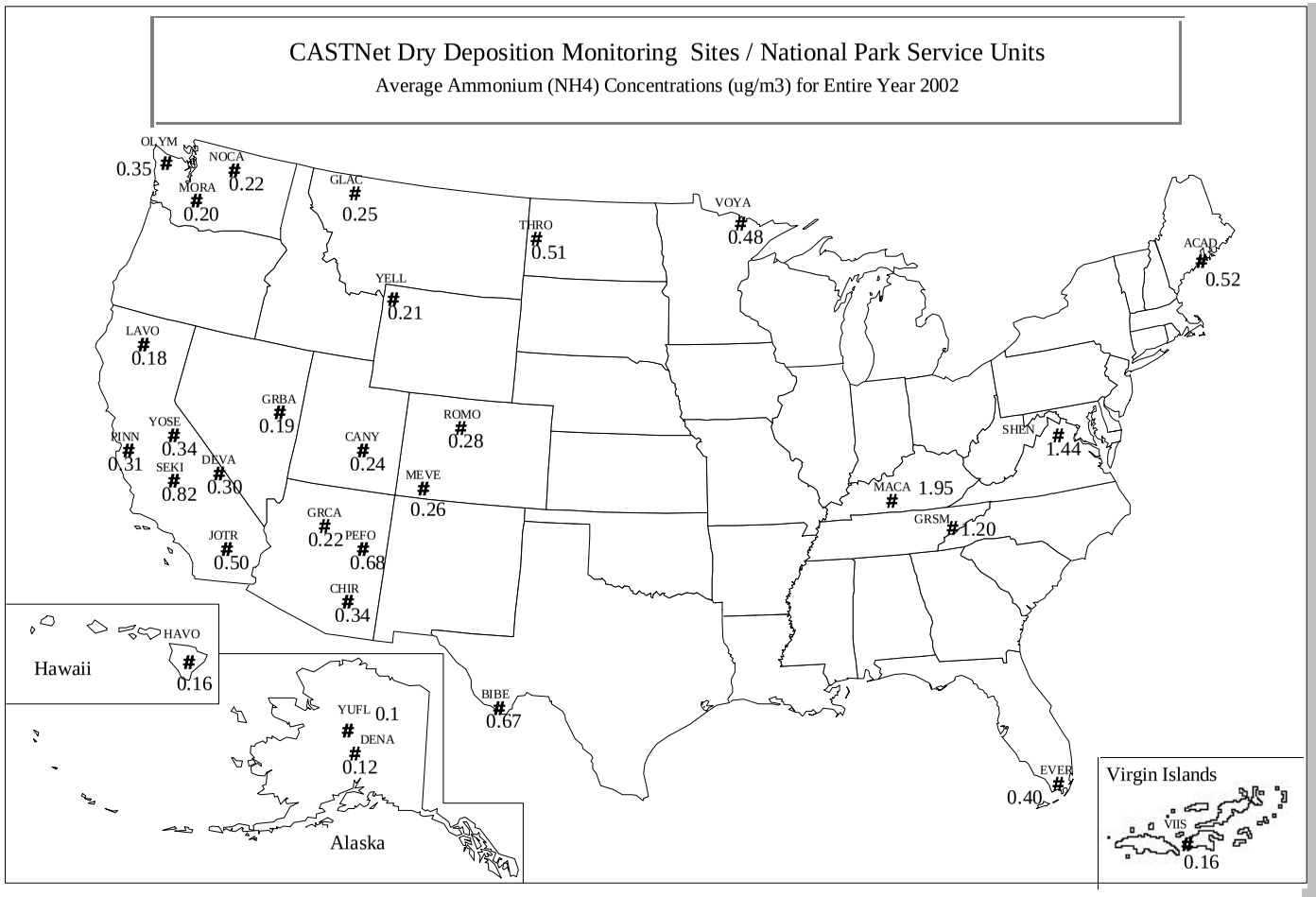
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



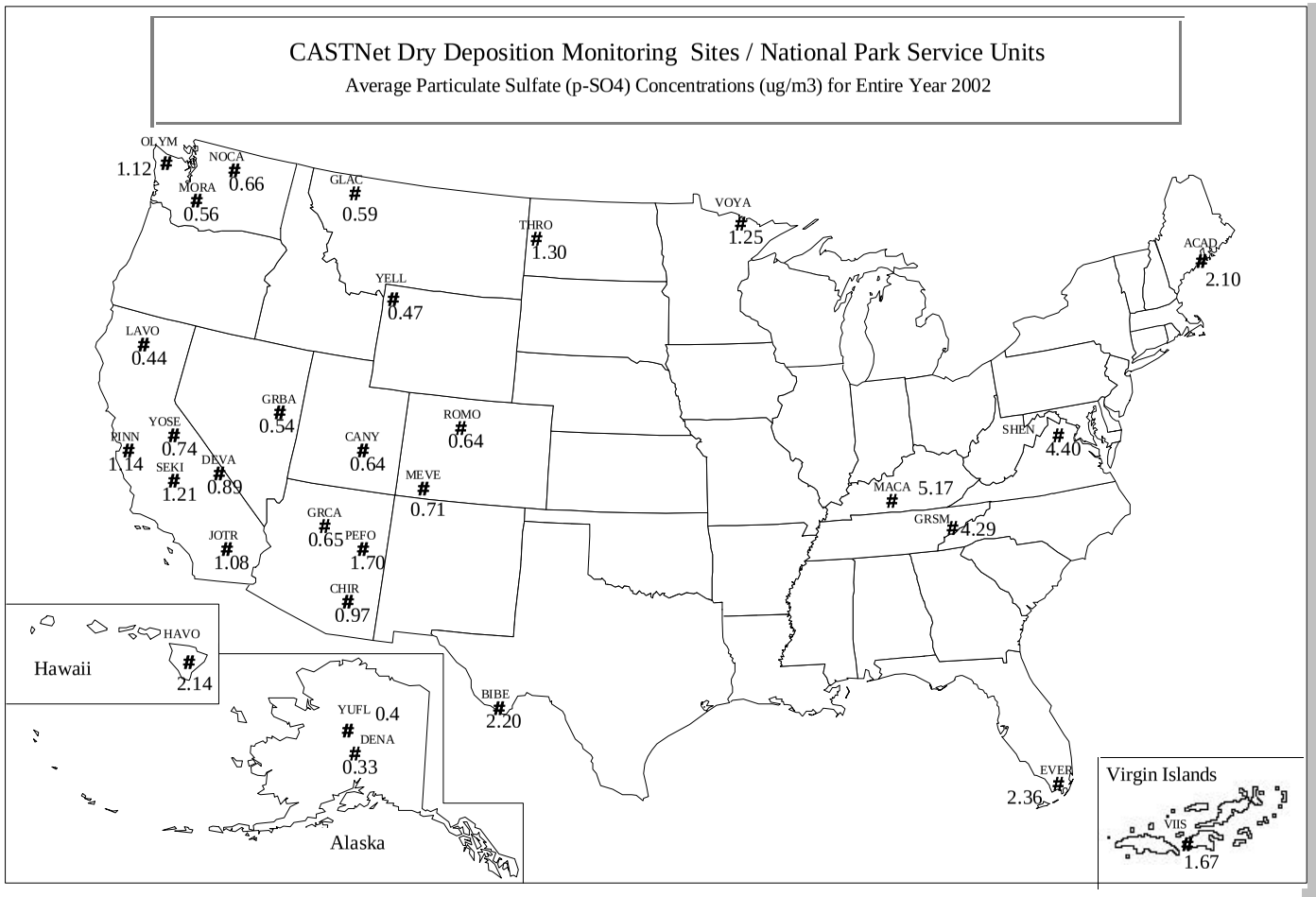
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



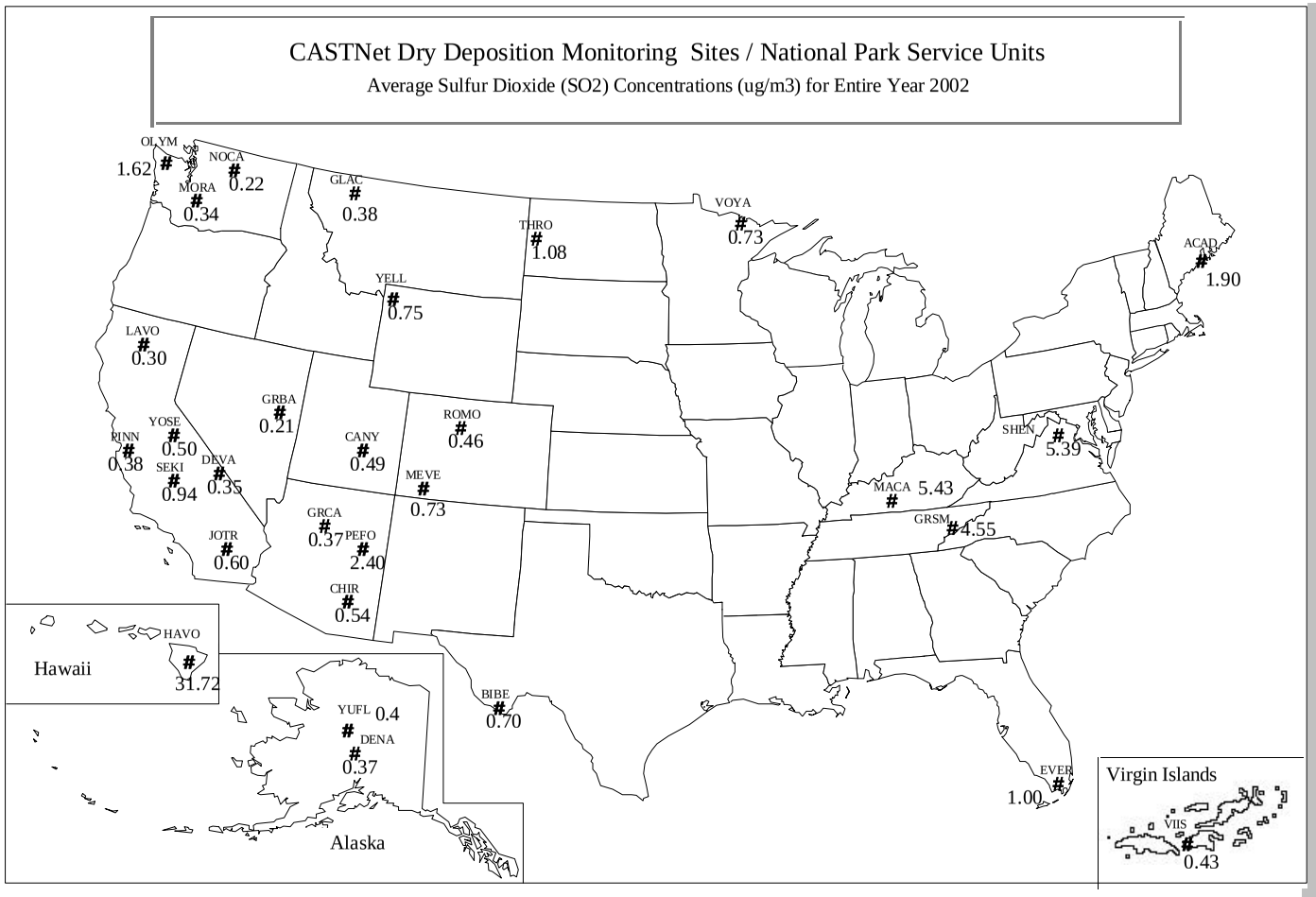
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



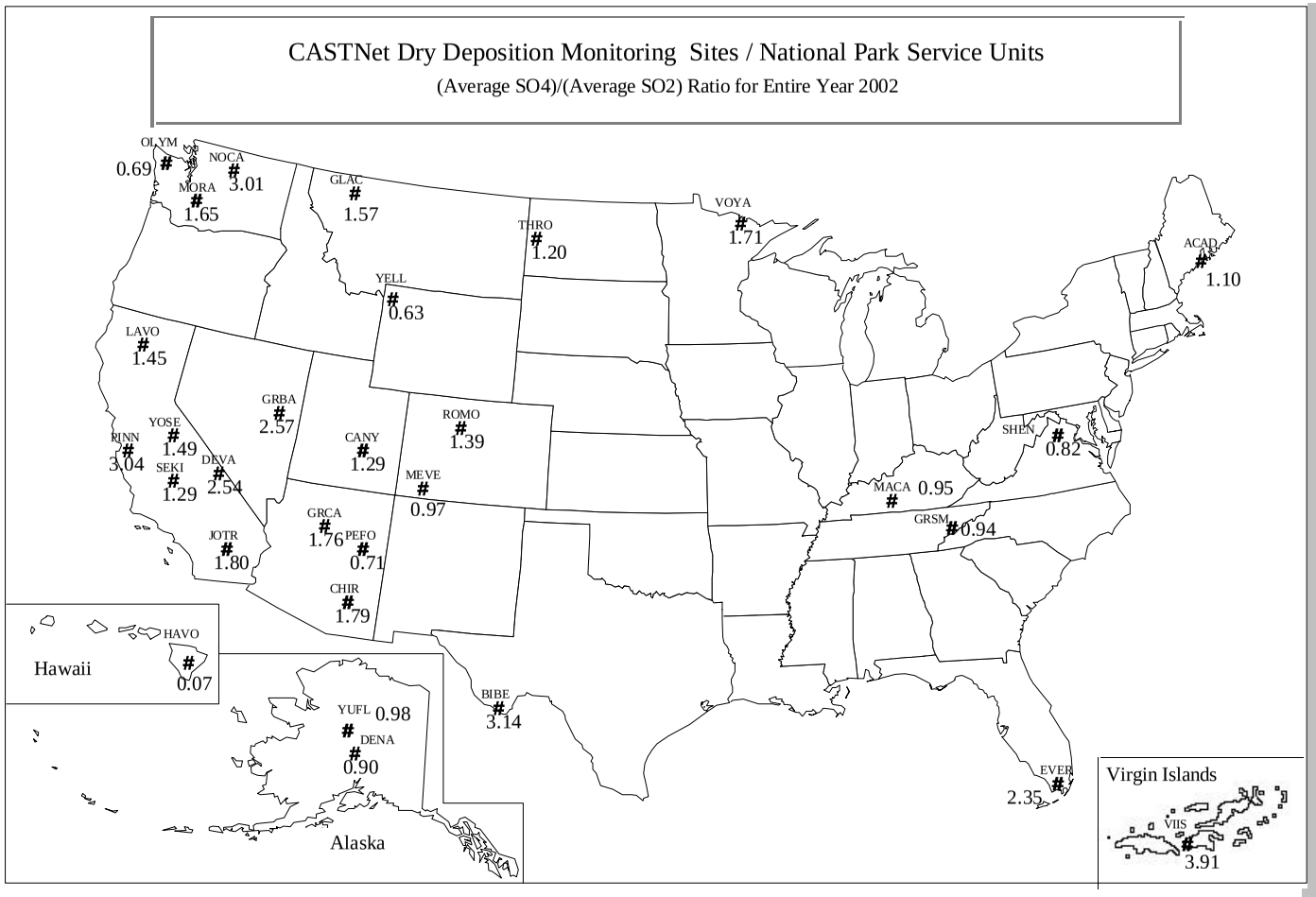
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR



Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Havaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIIS	Virgin Islands NP
VOYA	Voyageurs NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR

3.0 NATIONAL PARK SERVICE AIR RESOURCES DIVISION DATA SOURCES

Meteorological and hourly gaseous data contained in this report may be obtained from the following sources:

- National Park Service AIRWeb (http://www.aqd.nps.gov/natnet/ard)
- EPA AIRS database
- Data requests directed to:

NPS Air Resources Division
Information Management Center
c/o Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, Colorado 80525
Telephone: (970) 484-7941
Fax: (970) 484-3423
E-Mail: AIR-IMC@AIR-RESOURCE.COM

CASTNet concentration data may be obtained from the following Web site:

http://www.epa.gov/castnet/data.html

4.1 AIR QUALITY GLOSSARY

Acid Deposition: Air pollution produced when acid chemicals are incorporated into rain, snow, fog, or mist.

Aerometric Information Retrieval System (AIRS): A computer-based database of U.S. air pollution information administered by the EPA Office of Air Quality Planning and Standards (U.S. Environmental Protection Agency).

AIRWeb: Air Resources Web, an air quality information retrieval system for U.S. parks and wildlife refuges developed by the Air Resources Division of the National Park Service and the Air Quality Branch of the Fish and Wildlife Service.

Air Pollutant: An unwanted chemical or other material found in the air.

Air Pollution: Degradation of air quality resulting from unwanted chemicals or other materials occurring in the air.

Air Quality: The properties and degree of purity of air to which people and natural and heritage resources are exposed (in the context of national parks).

Air Pollution Control Permitting Process: Process by which facilities are permitted to emit specified types and quantities of air pollutants.

Air Quality Related Values (AQRVs): Values including visibility, flora, fauna, cultural and historical resources, odor, soil, water, and virtually all resources that are dependent upon and affected by air quality. "These values include visibility and those scenic, cultural, biological, and recreation resources of an area that are affected by air quality." *(43 Fed. Reg. 15016)*

Ambient Air: Air that is accessible to the public.

Class I: Areas of the country set aside under the Clean Air Act to receive the most stringent degree of air quality protection.

Class II: Areas of the country protected under the Clean Air Act but identified for somewhat less stringent protection from air pollution damage than Class I, except in specified cases.

Clean Air Act: Originally passed in 1963, our current national air pollution control program is based on the 1970 version of the law. Substantial revisions were made by the 1990 Clean Air Act Amendments.

Continuous Sampling Device: An air analyzer that measures air quality components continuously.

Criteria: Information on health and/or environmental effects of pollution (in the context of criteria air pollutants).

Criteria Air Pollutant: A group of very common air pollutants regulated by EPA on the basis of criteria and for which a National Ambient Air Quality Standard is established (SO_2, NO_2, PM_{10}, Pb, CO, O_3).

Emissions: Release of pollutants into the air from a source.

Environmental Protection Agency (EPA): The federal agency responsible for regulating air quality.

Monitoring: Measurement of air pollution.

National Ambient Air Quality Standards (NAAQS): Permissible levels of criteria air pollutant established to protect public health and welfare.

Ozone (O_3): A criteria air pollutant that is a strong oxidizing agent, reactive with many other compounds and surfaces, and a health hazard in high concentrations. Ozone is formed by nitrogen oxides and organic compounds reacting in sunlight.

Source: Any place or object from which air pollutants are released. Sources that are fixed in space are stationary sources; sources that move are mobile sources.

Sulfur Dioxide (SO_2): A criteria air pollutant that is a gas produced by burning coal and some industrial processes.

---

* Recent updates to this glossary may be found on the NPSARD AIRWeb - http://www.aqd.nps.gov/natnet/ard/glossary.htm.

4.2 GLOSSARY OF AIR QUALITY UNITS

Units Conversion Table			
Parameter Type	Multiply	By	To Obtain
Pollutant	ppm	1000	ppb
	ppm	1960	$\mu g/m^3$ Ozone (at 25°C)
	ppm	2615	$\mu g/m^3$ Sulfur Dioxide (at 25°C)
	ppb	0.001	ppm
	ppb	1.960	$\mu g/m^3$ Ozone (at 25°C)
	ppb	2.615	$\mu g/m^3$ Sulfur Dioxide (at 25°C)
	$\mu g/m^3$ Ozone (25°C)	0.0005102	ppm
	$\mu g/m^3$ Ozone (25°C)	0.5102	ppb
	$\mu g/m^3$ Sulfur Dioxide (25°C)	0.0003824	ppm
	$\mu g/m^3$ Sulfur Dioxide (25°C)	0.3824	ppb
Wind Speed	m/s	2.05	mph
	mph	0.489	m/s
Solar Radiation	ly/min	697	w/m^2
	w/m^2	0.00143	ly/min
Precipitation	mm/hr	0.0394	in/hr
	in/hr	25.4	mm/hr
Temperature	°C + 17.78	1.8	°F
	°F - 32	5/9	°C

Where:
ppm = parts per million
ppb = parts per billion
$\mu g/m^3$ = micrograms per cubic meter (at 25°C)
m/s = meters per second
mps = miles per hour
ly/min = langleys per minute
w/m^2 = watts per square meter
mm/hr = millimeters per hour
in/hr = inches per hour
°C = degrees centigrade
°F = degrees fahrenheit