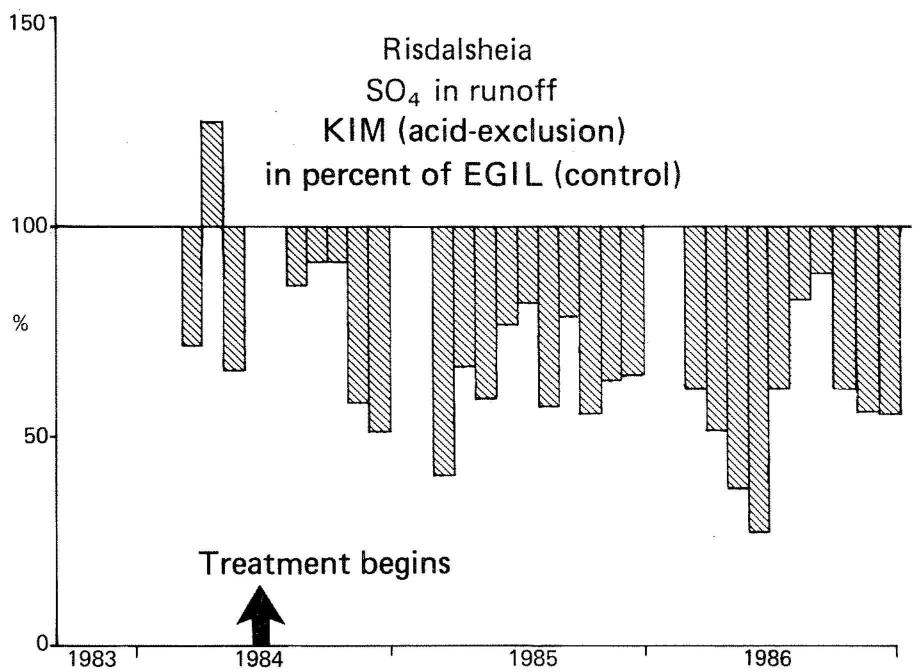
Acid Rain Research

REPORT 13/1987

RAIN project. Annual report for 1986.



Norwegian Institute for Water Research NIVA

NIVA - REPORT

Norwegian Institute for Water Research NIVA

Main Office
P.O.Box 333 Blindern
N-0314 Oslo 3
Norway
Phone (47 2) 23 52 80

Regional Office, Sørlandet
Grooseveien 36
N-4890 Grimstad,
Norway
Phone (47 41) 43 033

Regional Office, Østlandet
Rute 866
N-2312 Ottestad
Norway
Phone (47 65) 76 752

Regional Office, Vestlandet
Breiviken 2
N-5035 Bergen - Sandviken
Norway
Phone (47 5) 25 97 00

Report No.:	0-82073
Sub-No.:	4
Serial No.:	2025
Limited distribution:	

Report Title: RAIN project. Annual report for 1986	Date: August 1987
	0-82073
Author (s): Richard F. Wright	Topic group: Acid precipitation
	Geographical area: Norway
	Number of pages (incl. app.)

Contractor: NTNF, MD, Sveriges Naturvårdsverk, Environment Canada, Environment Ontario	Contractors ref. (or NTNF-No) NTNF-No: FK 03

Abstract:

Experiments with acid addition at Sogndal and acid exclusion at Risdalsheia continued in 1986, the third year of treatment. At Sogndal runoff exhibited chronic acidification between the acid pulses at each dose. About 30% of the added SO_4 now leaves the catchments (up from 15% in 1985). At Risdalsheia sulfur continues to bleed from KIM catchment. Total loss of sulfate after 2-1/2 years of treatment now amounts to about 1/3 of the pool of available sulfate in soils. Runoff at KIM appears increasingly influenced by organic acids with average charge density of 4.5 ueq/mg C and pK of about 4.2.

4 keywords, Norwegian

1. Sur nedbør
2. Vannkjemi
3. Reversibilitet
4. Nedbørfelt

4 keywords, English

1. Acid precipitation
2. Water chemistry
3. Reversibility
4. Catchments

Project leader

R F Wright
Richard F. Wright

For the Administration

Merete Johannessen
Merete Johannessen

ISBN 82-577-1281-7

REFERANSESIDE

PUBLIKASJONSDATA:

Publikasjonens tittel:

RAIN project. Annual report for 1986.

Publikasjonsnr.: 0-82073
Forfatter(e): Richard F. Wright

ISBN: ISSN:

Tilgjengelighet: Åpen [X]
Lukket [ ] inntil:
Lukket [ ]

Dato: August 1987
Pris: 100,- NOK
Antall sider:

Publikasjonsreferat:

Experiments with acid addition at Sogndal and acid exclusion at Risdalsheia continued in 1986, the third year of treatment. At Sogndal runoff exhibited chronic acidification between the acid pulses at each dose. About 30% of the added SO_4 now leaves the catchments (up from 15% in 1985). At Risdalsheia sulfur continues to bleed from KIM catchment. Total loss of sulfate after 2-1/2 years of treatment now amounts to about 1/3 of the pool of available sulfate in soils. Runoff at KIM appears increasingly influenced by organic acids with average charge density of 4.5 ueq/mg C and pK of about 4.2.

Engelsk referat: Ja [X]

Engelske emneord: Acid precipitation, Water chemistry, Reversibility, Catchments

Norske emneord: Sur nedbør, Vannkjemi, Reversibilitet, Nedbørfelt

Andre utgaver:

Målgruppe(r):

Publikasjonen distribueres fra: NIVA, Postboks 333, Blindern, 0314 OSLO 3

Sign.:

PROSJEKTDATA

Prosjekttittel: Reversing Acidification In Norway

NTNF-nr.: FK 03

Prosjektleder: R. Wright

Internt prosjektnr.: 0-82073

Oppdragsgiver(e). Miljøverndepartementet, NTNF, Environment Canada, Environment Ontario
Sveriges Naturvårdsverk

Oppdragsgiver(e)s kontaktperson(er):

Andre publikasjoner (se rettledning). Se siste side i rapporten.

RAIN PROJECT

Annual report for 1986

Oslo, August 1987

Richard F. Wright

ABSTRACT

Project Rain (Reversing Acidification In Norway) is a 5-year international research project aimed at investigating the effect on water and soil chemistry of changing acid deposition to whole catchments. The project comprises 2 parallel large-scale experimental manipulations -- artificial acidification at Sogndal and exclusion of acid rain at Risdalsheia.

The general trends in water chemistry caused by the treatments continued in 1986, the third year of treatment at both Risdalsheia and Sogndal. At Sogndal catchment SOG2 about 30% of the added sulfate left in runoff in 1986 (up from 15% in 1985). At catchment SOG4 about 40% of the added sulfate and 10 % of the added nitrate left in runoff in 1986; both figures are up from 1985 and 1984. The increase in strong acid anions in runoff was accompanied by increases in concentrations of base cations (50%) and decrease in alkalinity (50%). F-factor at both catchments was about 0.5.

At Risdalsheia the input-output budgets show increasing effect of acid-exclusion at KIM catchment. In 1986 the flux of sulfate in runoff at KIM was only 50% of that at EGIL, the roofed control catchment. Volume-weighted concentrations of most ions were lower in runoff at KIM than at either EGIL or ROLF (open reference catchment). Net loss of sulfate from KIM after 2 1/2 years of treatment now totals about 35 meq/m^2. Prior to treatment the soils contained 14 meq/m^2 adsorbed sulfate and 90 meq/m^2 water-soluble sulfate. Net loss of sulfate amounts to about 1/3 of the readily-available sulfate in soils at KIM.

Due to a technical failure in the ion-exchange system in November 1986, KIM catchment received a batch of hydrochloric acid with pH below 4. Both chloride concentrations and pH in runoff responded rapidly. This episode significantly affected the alkalinity budget but not the sulfate budget.

Runoff at KIM appears increasingly influenced by organic acids. The removal of strong acids by treatment has resulted in higher pH and increased dissociation of organic acids. Ion balance calculations indicate that these have a maximum charge density of about 4.5 µeq/mgC and pK of about 4.2.

PREFACE

A large number of individuals and institutes have cooperated in the RAIN project in 1986. The project scientists in 1986 include N. Christophersen, E. Lotse, E. Gjessing, H.M. Seip, A. Semb, and R. F. Wright. Technical staff includes S. Andersen, H. Efraimsen, R. Høgberget, T. Mindrebø, A. Rogne, B. Sletaune, and R. Storhaug. NILU, NIVA, and SI and the Department of Soil Sciences, SLU, provided technical support.

The RAIN project would not be possible without the generous cooperation of landowners at both sites. We thank N. Knagenhjelm, Sogn Televerk and Arendal Televerk for permission to use private roads. N. Dalaker, H. Haukås, and A. Risdal provided local assistance.

Financial support in 1986 came from the Norwegian Ministry of Environment, The Royal Norwegian Council for Scientific and Industrial Research, the Ontario Ministry of the Environment, Environment Canada, and the Swedish National Environmental Protection Board, and from internal research funds from NIVA and NILU.

In 1986 several auxiliary projects were associated with the RAIN project (Appendix 1). These include a study of water movement at EGIL catchment funded by the Norwegian Hydrologic Committee (M. Hauhs, NIVA, principal investigator), three projects financed by the Surface Water Acidification Programme (SWAP) (The Royal Society, the Norwegian Academy of Science and Letters, and the Royal Swedish Academy of Sciences), modelling the acidification process (N. Christophersen, SI, principal investigator), weathering studies in conjunction with the RAIN project (R. Wright, NIVA, and E. Lotse, SLU, co-principal investigators), and natural organic acids (E. Gjessing, NIVA, principal investigator), a study of aluminum in soils financed by the Electric Power Research Institute, USA, (EPRI) (R.A. Parnell, Northern Arizona University, principal investigator), fish toxicity tests financed by the Central Electricity Generating Board, UK, (CEGB) (R.F. Wright, NIVA, principal investigator), and heavy metals in soils and vegetation financed by the Royal Norwegian Council for Scientific and Industrial Research (NTNF) and the Swedish Envrionmental Protection Board (SNV) (E. Steinnes, University of Trondheim, principal investigator).

INTRODUCTION

Vigorous efforts to obtain reductions in the emissions of acidifying compounds SO_2 and NOx to the atmosphere are in part based on the premise that such reductions will restore acidified waters. The magnitude and rate of response of natural ecosystems to changes in acid loading is, however, not well known, largely because such effects have been difficult to document in the absence of large-scale reductions. Project RAIN (Reversing Acidification In Norway), a 5-year international research project, comprises two parallel experiments in which the response of soil and runoff chemistry to changes in loading of strong acids from the atmosphere are studied (Wright 1985, Wright and Gjessing 1986, Wright et al. 1986). The RAIN project builds on short-term pilot-scale experiments conducted in Norway by Seip et al.(1979) and Christophersen et al. (1982). The project provides information on reversibility of acidification, rate of response and target loadings.

At Sogndal, a "clean" area in western Norway, we are acidifying two pristine catchments by addition of sulfuric (SOG2) and a 1:1 mixture of sulfuric and nitric acids (SOG4), respectively (Figure 1, Table 1). At Risdalheia, an acidified area in southernmost Norway, we have excluded acid precipitation from a small catchment (KIM) by means of a roof and are watering with clean precipitation beneath the roof (Figure 1, Table 1).

Project RAIN is a 5-year study and began in June 1983. The project plan calls for approximately one year of pre-treatment data, 3 years of treatment and 1 year of post-treatment recovery data. The first year was devoted to selection of sites, collection of pre-treatment data, and design, construction and installation of roofs, watering systems, weirs and sampling devices. The scientific program currently includes measurements of precipitation volume and chemical composition, soil chemistry, and runoff volume and chemical composition. The RAIN project design, organization, site descriptions and results obtained through 1985 are described in the annual reports for 1984 (Wright 1985) and 1985 (Wright and Gjessing 1986). The first year's results were presented at the Muskoka '85 conference (Wright et al. 1986). We report here results obtained in 1986, the third year of treatment.

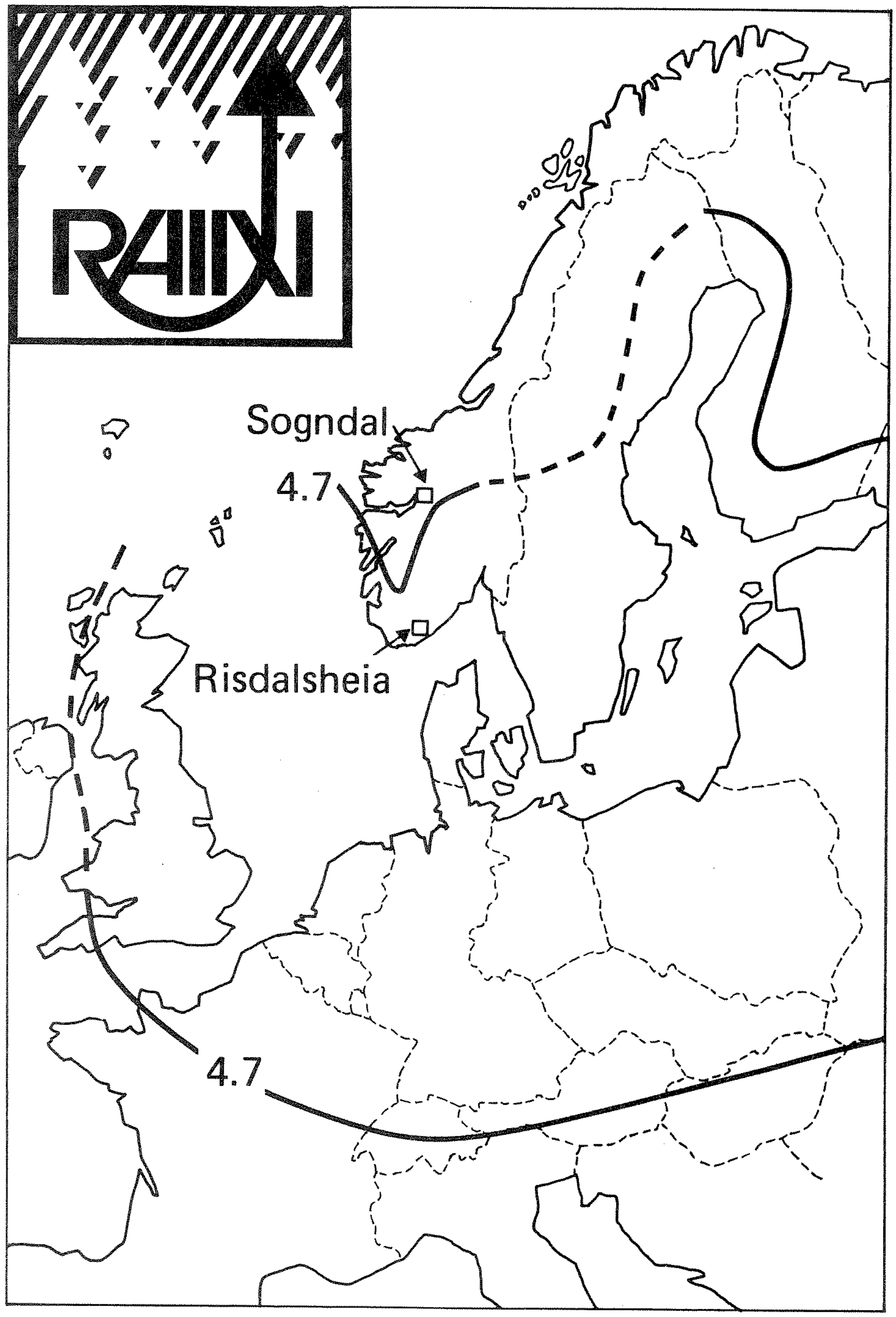


Figure 1. Location of the experimental catchments in project RAIN. Areas within the pH 4.7 isoline receive precipitation with a yearly weighted-average pH below 4.7.

Table 1. RAIN project. Overview of the experimental catchments and treatments.

Sogndal. Acid addition experiments.

Catchment	Treatment	Area
SOG1	control	96300 m^2
SOG2	H_2SO_4	7220 m^2
SOG3	control	43200 m^2
SOG4	$H_2SO_4+HNO_3$	1940 m^2

Risdalsheia. Acid exclusion experiments.

Catchment	Treatment	Area	Volume, runoff tank
KIM	roof, clean rain	860 m^2	0.39 mm
EGIL	roof, acid rain	400 m^2	0.93 mm
ROLF	no roof, acid rain	220 m^2	1.62 mm

TREATMENTS

Sogndal. At Sogndal treatments continued in 1986 using the same procedures as in 1984 and 1985 (Wright 1985, Wright and Gjessing 1986). The acid dose in 1986 was 100 meq/m^2 as in 1985 and added to the snowpack and in 5 episodes during the summer (Table 2).

Risdalsheia. Treatments continued at Risdalsheia in 1986 by the same procedures as in 1984 and 1985. A summary of major changes in operations is given in Table 3.

METHODS NEW FOR 1986

Carbon dioxide in soil air. CO_2 measurements at Risdalsheia were continued during the snow-free season in 1986 at monthly intervals. Measurements again show elevated CO_2 levels with maximum during August (Figure 2). Several measurements at EGIL recorded off-scale. CO_2 pressures appear to lie in the range 5-10 times atmospheric during the summer. These data are collected for use with predictive acidification models such as MAGIC.

Soil depths at Sogndal catchments. In 1986 the soil depths at SOG2 and SOG4 were measured. Depth was measured at 2-m intervals along transects running across the catchments. These data provide the basis for calculation of average soil depth, which when combined with the physical and chemical data given by Lotse and Otabbong (1986) give estimates of total soil mass and amounts of chemical components in the soils (Appendix 3).

Hydrologic measurements at Sogndal. Again in 1986 it was necessary to estimate various components of the hydrologic budgets for the Sogndal catchments. Measurement of both precipitation volume and runoff volume at the Sogndal catchments has been difficult since the start. There are substantial local variations in precipitation especially with elevation. Measurements at Haukås farm at 500 m elevation are not always representative for precipitation at the catchments at 900 m. For the winter periiod 851102-860618 we have discharge records, snowpack surveys taken April 1986, and measured weekly precipitation at Haukås (Table 4). Together these data indicate that discharge measurements at SOG4 are greatly in error (snowpack 384 mm, runoff 827 mm) and that precipitation at Haukås underestimates precipitation input at the experimental catchments. We thus assume that SOG1 discharge is accurate (458 mm) and equal to the discharge in mm at

Table 2. Summary of Sogndal treatments through 1986. The acid dose reported previously for 1985 (Wright and Gjessing 1986) was incorrect.

Catchment SOG2.

Date	Pre-treatment Time	mm	Acid application Time	mm	Post-treatment Time	mm	Acid dose meq/m^2 H^+	SO_4	NO_3
840401			to snowpack	0,01			25.0	25.0	0
840828	1200-1350	3.9	1353-1835	11.0	1840-1910	1.0	11.2	11.2	0
840912	1420-1520	2.2	1520-2005	9.8	2005-2045	1.7	11.2	11.2	0
840926	0720-0820	2.2	0820-1310	11.0	1320-1430	1.9	11.2	11.2	0
841002	0715-0810	2.2	0810-1255	11.0	1255-1350	2.2	11.2	11.2	0
	(total added in 1984 meq/m^2: H^+ 69.8, 3.2 Na, 0.2 K, 1.0 Ca, 0.7 Mg, 3.2 Cl, 69.8 SO_4; 60 mm H_2O)								
850329			to snowpack	0.01			45.0	45.0	0
850611	1335-1405	1.1	1410-1900	11.0	1930-2035	2.1	11.2	11.2	0
850821	0800-0900	2.2	0915-1415	11.0	none		11.2	11.2	0
850821	none		1630-2100	11.0	none		11.2	11.2	0
850828	1030-1125	2.2	1125-1655	11.0	1655-1735	1.9	11.2	11.2	0
851001	none		0645-1145	11.0	none		11.2	11.2	0
	(total added in 1985 meq/m^2: H^+ 101.0, 2.4 Na, 0.1 K, 0.7 Ca, 0.6 Mg, 1.7 Cl, 102.6 SO_4; 61 mm H_2O)								
860325			to snowpack	0.01			45.0	45.0	0
860619	none		1030-1515	11.0	1515-1600	2.1	11.2	11.2	0
860819	0800-0820	2.2	0820-1250	11.0	1250-1335	2.2	11.2	11.2	0
860820	0620-0720	1.8	0740-1220	11.0	1220-1335	1.0	11.2	11.2	0
860903	0620-0720	1.8	0720-1200	11.0	1200-1235	1.5	11.2	11.2	0
860930	1410-1500	1.4	1500-2010	11.0	none		11.2	11.2	0
	(total added in 1986 meq/m^2: H^+ 101.0, 2.7 Na, 0.1 K, 1.4 Ca, 0.7 Mg, 2.4 Cl, 103.0 SO_4; 68 mm H_2O)								

Table 2 (cont.)

Catchment SOG4.

Date	Pre-treatment Time	mm	Acid application Time	mm	Post-treatment Time	mm	Acid dose meq/m^2 H^+	SO_4	NO_3
840402			to snowpack	0.01			25.0	12.5	12.5
840829	0730-0840	2.6	0840-1325	11.2	1325-1400	0.5	11.2	5.6	5.6
840912	0730-0830	2.6	0830-1310	9.6	1315-1350	1.4	11.2	5.6	5.6
840926	1405-1450	1.8	1450-1935	11.2	1935-2010	1.8	11.2	5.6	5.6
841002	1400-1445	2.0	1445-1930	11.1	1930-2010	2.0	11.2	5.6	5.6
	(Total added in 1984 meq/m^2: H^+ 69.8, 3.1 Na, 0.2 K, 1.0 Ca, 0.7 Mg, 3.1 Cl, 33.6 SO_4, 22.4 NO_3; 58 mm H_2O)								
850329			to snowpack	0.01			45.0	22.5	22.5
850612	0815-0855	1.8	0930-1400	10.8	1410-1435	1.7	11.2	5.6	5.6
850822	none		0950-1450	10.8	1450-1550	2.0	11.2	5.6	5.6
850823	none		0715-1115	10.8	1115-1215	2.0	11.2	5.6	5.6
850827	1400-1500	1.8	1505-1930	10.8	1930-2030	1.8	11.2	5.6	5.6
851001	none		1235-1735	10.8	none		11.2	5.6	5.6
	(Total added in 1985 meq/m^2: H^+ 101.0, 2.5 Na, 0.1 K, 0.7 Ca, 0.6 Mg, 1.8 Cl, 52.3 SO_4, 50.5 NO_3; 65 mm H_2O)								
[illegible]			to snowpack	0.01			45.0	22.5	22.5
860619	1700-1745	1.7	1745-2200	10.1	2200-2300	2.2	11.2	5.6	5.6
860819	1700-1745	1.7	1745-2200	10.3	2200-2300	3.0	11.2	5.6	5.6
860803	1500-1540	2.0	1540-2020	11.0	2020-2105	2.0	11.2	5.6	5.6
860902	1450-1545	2.0	1545-2025	11.0	2025-2115	2.0	11.2	5.6	5.6
861001	0630-0715	1.4	0715-1320	11.0	1320-1405	1.8	11.2	5.6	5.6
	(Total added in 1986 meq/m^2: H^+ 101.0, 2.9 Na, 0.1 K, 1.5 Ca, 0.7 Mg, 2.6 Cl, 52.7 SO_4, 50.6 NO_3; 73 mm H_2O)								

Table 3. Risdalsheia. Major changes in operation

Date	Operation
23 March 1984	Runoff volume measurements begin at KIM and EGIL
13 June 1984	Treatment begins at KIM and EGIL
1 August 1984	New dam at EGIL; all runoff now collected
31 October 1984	Runoff measurements begin at ROLF
19 December 1984	Sprinkler systems closed for winter at EGIL and KIM
29 April 1985	Sprinkler systems opened again at EGIL and KIM
27 July 1985	New dam at KIM; all runoff now collected
15 November 1985	Sprinkler systems closed for winter at EGIL and KIM
10 May 1986	Sprinkler systems opened again at EGIL and KIM
12 December 1986	Sprinkler systems closed for winter at EGIL and KIM

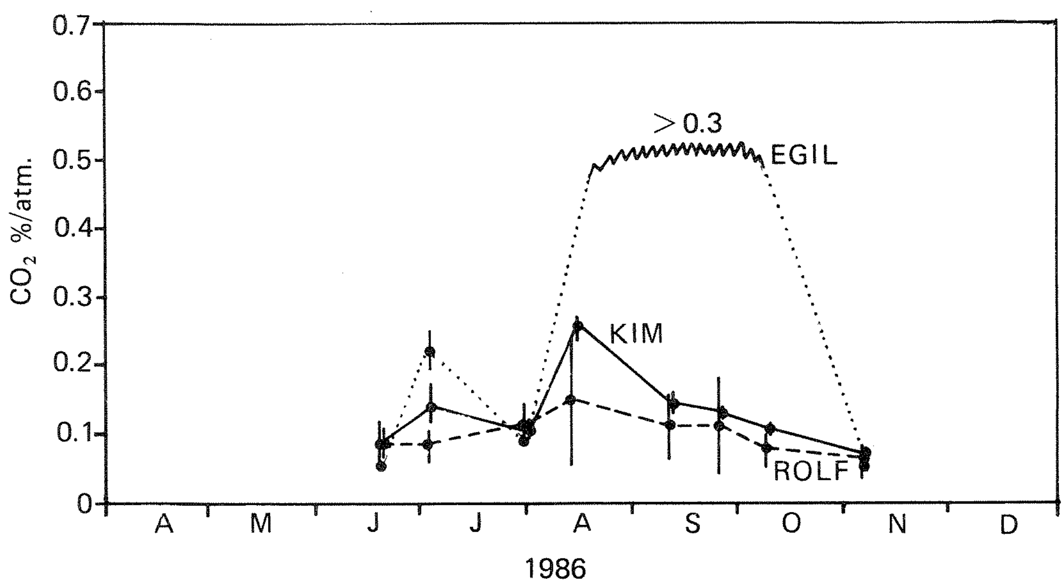


Figure 2. CO_2 content of soil air (mean and standard deviation of 3 samples) at the Risdalsheia catchments during the snow-free season 1986. Atmospheric CO_2 level is 0.035 %.

Table 4. Hydrologic budgets for the Sogndal catchments. SOG3 is assumed to have the same hydrologic budgets as SOG1.

	SOG1					SOG2							SOG4						
	IN				OUT	IN				OUT			IN				OUT		
	measured Haukås	snow-pack	corr.	factor		added	total	snow-pack	corr.	meas.	corr.	factor	added	total	snow-pack	corr.	meas.	corr.	factor
Period	mm	mm	mm		mm	mm	mm	mm	mm	mm	mm		mm	mm	mm	mm	mm	mm	
830901-831114	411	-	320	0.78	320	0	411	-	320	406	320	0.79	0	411	-	320	600	320	0.53
831115-840630	493	-	656	1.35	656	0	493	-	656	725	656	0.90	0	493	-	656	980	656	0.67
840701-841112	520	-	470	0.90	370	60	580	-	530	586	430	0.73	58	578	-	528	350	428	1.23
841113-850616	345	390	476	1.38	476	0	345	302	476	570	476	0.84	0	345	265	476	925	476	0.51
850617-851101	342	-	452	1.32	352	61	403	-	513	394	415	1.05	65	407	-	517	275	417	1.51
851102-860618	337	520	458	1.36	458	0	337	395	458	457	458	1.00	0	337	384	458	827	458	0.55
860619-861112	441	-	499	1.13	399	68	509	-	567	304	467	1.54	73	514	-	572	743	472	0.64

SOG2, SOG3 and SOG4, and that precipitation inputs to all catchments also equals 458 mm (Table 4). For the summer period 860619-861112 we again assume that discharge at SOG1 is correct, that evapotranspiration is 100 mm and obtain estimates of the natural precipitation inputs to the catchments (441 mm measured at Haukås; estimated to 499 mm at site).

Chemical budgets Sogndal. Inputs of major ions from precipitation at Sogndal is again estimated in 1986. First the volume of precipitation is obtained as described above. Then the chemical concentration measured in precipitation at Haukås are used to obtain fluxes. Finally the fluxes are multiplied by a factor such that Cl inputs equal Cl outputs for the year. This procedure assumes that the topographic gradient in precipitation volume is accompanied by a gradient in chemical concentration. The corrections are largest for the seasalt components.

Dry deposition at Risdalsheia. Dry deposit at Risdalheia was estimated by the same procedure used previously (Wright and Gjessing 1986). Dry deposit of seasalts is obtained for EGIL and ROLF catchments by assuming Cl inputs equal Cl outputs. Dry deposit of S and N compounds are obtained from data from the nearby Birkenes catchment (SFT in press). Daily mean concentration of SO_2 gas in 1986 was 0.7 $\mu g/m^3$; SO_4 particles were 0.8 $\mu g/m^3$; NO_2 gas was 1.1 $\mu g/m^3$. When combined with deposition velocities of 0.7, 0.4, and 0.25 cm/s, this yields dry deposit of 10, 6, and 6 $meq/m^2/yr$ for SO_2 gas, SO_4 particles, and NO_2 gas, respectively (Table 5).

SITE VISITS AND MEDIA COVERAGE IN 1986

The RAIN project continues to attract an unusually high level of attention among scientists, environmental managers, politicians, media andthe public. There was a steady stream of visitors to Risdalsheia in 1986 (Appendix 1). Visitors included scientists from Norway, Sweden, West Germany, UK, USA and Canada. The European Common Market held a workshop on Reversibility of Acidification in June 1986 at nearby Grimstad; RAIN project played a central role.

In 1986 RAIN project scientists served as advisors for comparable large-scale manipulation experiments under planning elsewhere in Europe and in North America. H.M. Seip acts as external reviewer to the US Environmental Protection Agency's new Watershed Manipulation Program. R. F. Wright and R. Høgberget participated in a workshop in Canada at which possible future experiments in Canada were discussed.

Table 5. SO_2 gas, SO_4 particulate, and NO_2 gas concentrations measured at Birkenes (daily mean values) and estimated dry deposition of SO_4 and NO_3. Deposition velocities used are SO_2 gas 0.7 cm/s, SO_4 particulates 0.4 cm/s, and NO_2 gas 0.25 cm/s. Data from SFT (1985), SFT (1986), and SFT (in press).

Year	SO_2 gas conc. $\mu g/m^3$	SO_2 gas dep $meq/m^2/yr$	SO_4 part. conc. $\mu g/m^3$	SO_4 part. dep $meq/m^2/yr$	NO_2 gas conc. $\mu g/m^3$	NO_2 gas dep $meq/m^2/yr$
1984	0.7	10	1.3	10	1.1	6
1985	0.7	10	0.9	7	0.8	5
1986	0.7	10	0.8	6	1.1	6

Both UK and West Germany have recently expressed interest in similar large-scale experiments.

Risdalsheia was again visited by both Norwegian and British policymakers in 1986. At such visits the very latest results are presented to decisionmakers directly by the scientists actually doing the research.

The public continues to express great interest in the RAIN project. The enclosures at Risdalsheia offer an excellent pedagogic example of environmental research.

RAIN project results are also brought to the public directly through frequent national and international coverage on television, radio and the press. In 1986 the project was discussed in news sections of the scientific journals Nature and New Scientist.

NEW RESULTS IN 1986

Sogndal

At Sogndal 1986 was the third year of acid addition. Acid dose in 1986 remained at 100 keq/km^2. In 1986 runoff showed clear indications of chronic acidification in addition to the acid episodes which occur immediately following acid application. Catchment SOG2 (H_2SO_4) had negative alkalinity throughout the summer of 1986. Sulfate concentrations were also clearly higher than at the control catchments (Figure 3).

Input-output budgets also show contiued and increasing change in the chemical composition of runoff at the treated catchments (Tables 6 and 7). Relative to the mean of the 2 control catchments SOG1 and SOG3 runoff at SOG2 (sulfuric acid treatment) had higher levels of the base cations Ca and Mg, the acid cations H^+ and Al, and sulfate while bicarbonate flux was reduced (Table 7). Runoff at SOG4 (sulfuric plus nitric acid treatment) also showed these differences and in addition elevated nitrate levels (Table 7).

At both SOG2 and SOG4, however, at substantial fraction of the added acid is still retained in the catchment. At SOG2 about 30% of the added sulfate (55% of the total sulfate inputs -- natural plus added) left the catchment in runoff in 1986, up from 15% in 1985 and 20% in 1984. At SOG4 about 40% of the added sulfate and 10% of the added nitrate left in runoff. Again these values are up from 1985.

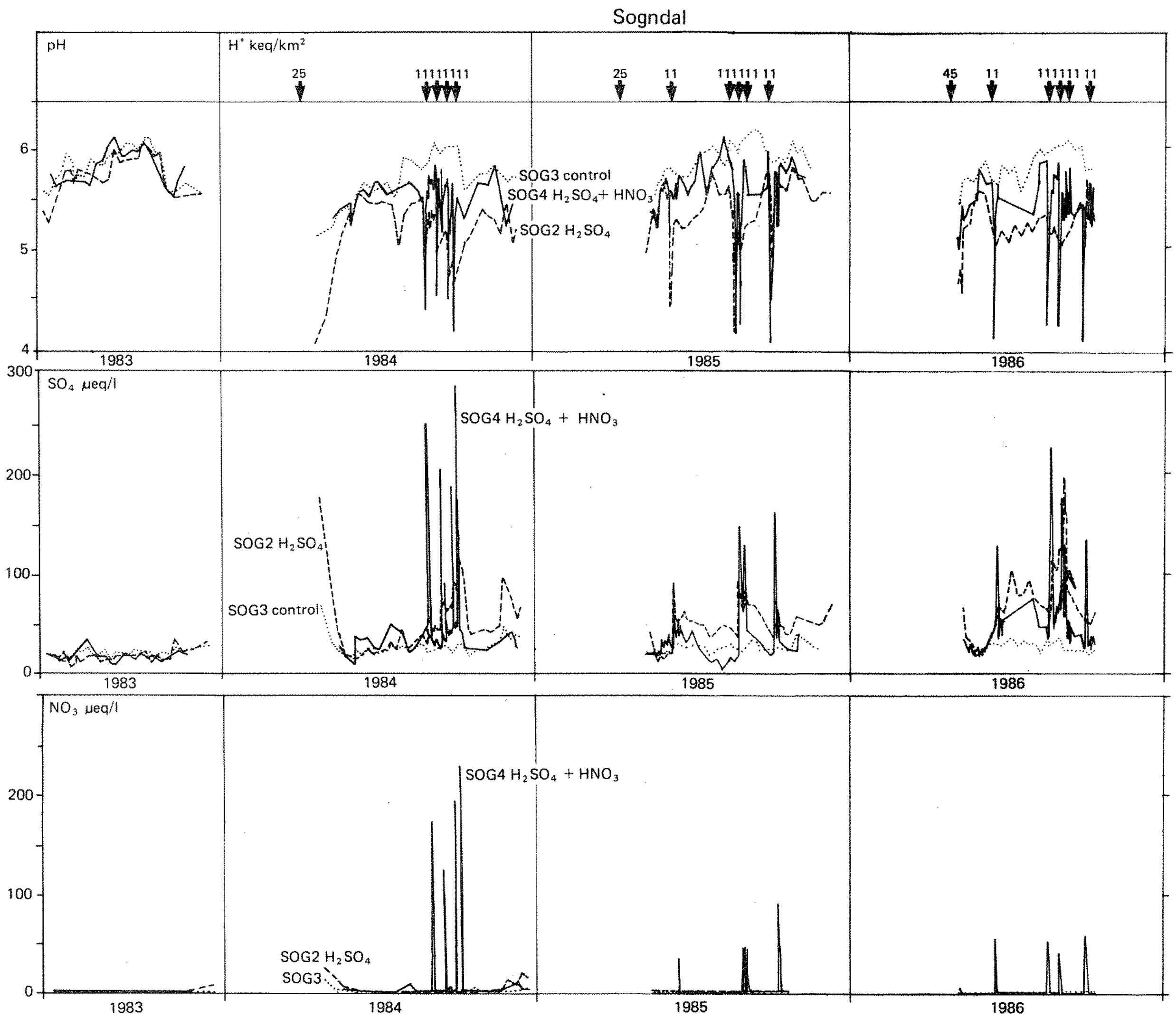


Figure 3. pH and concentrations of sulfate and nitrate in runoff from catchments SOG2, SOG3 and SOG4 at Sogndal over the period June 1983 - November 1986. Treatments began in April 1984 with the acid addition to the snowpack. Acid additions are indicated by arrows.

Table 6. Input-output budgets for water and major ions at the Sogndal catchments for the periods 831115-841113 (1984), 841114-851101 (1985), and 851102-861112 (1986). Precipitation inputs have been corrected such that inputs equal outputs for SOG1. Values thus differ somewhat from those in Wright and Gjessing (1986). Units: H_2O in mm; ions in meq/m^2/yr.; TOC in g C/m^2/yr; SiO_2 in g SiO_2/m^2/yr.

- 1984 -

	SOG1 control		SOG2 H_2SO_4		SOG3 control		SOG4 H_2SO_4 + HNO_3	
	In	Out	In	Out	In	Out	In	Out
H_2O	1126	1026	1186	1086	1126	1026	1186	1086
H^+	22	2	89	9	22	4	92	4
Na	81	90	84	64	81	80	84	55
K	7	11	7	4	7	2	7	2
Ca	10	21	11	24	10	21	11	28
Mg	18	15	17	14	18	19	18	13
Al	-	1	-	3	-	0	-	1
NH_4	10	6	10	3	10	1	10	1
NO_3	10	2	11	4	10	2	45	4
Cl	91	91	95	65	91	85	94	62
SO_4	35	29	105	43	35	25	70	28
HCO_3	0	15	0	5	0	1	0	7
Σ^+	148	146	218	121	148	127	222	104
Σ^-	136	138	211	113	136	113	209	101
TOC	-	4.4	-	2.7	-	0.8	-	2.9
SiO_2	-	-	-	-	-	-	-	-

Table 6. (cont.) Fluxes.

	1985							
	SOG1 control		SOG2 H_2SO_4		SOG3 control		SOG4 H_2SO_4 + HNO_3	
	In	Out	In	Out	In	Out	In	Out
H_2O	928	828	991	891	928	828	991	891
H^+	14	2	116	4	14	1	116	4
Na	30	29	32	28	30	27	33	37
K	4	2	5	2	4	1	5	1
Ca	4	13	5	20	4	13	5	18
Mg	4	7	4	10	4	7	4	8
Al	-	0	-	2	-	0	-	0
NH_4	6	4	6	0	6	0	6	1
NO_3	7	1	7	1	7	0	59	1
Cl	24	24	26	23	24	21	22	23
SO_4	15	18	118	34	15	18	66	21
HCO_3	0	11	0	2	0	4	0	6
Σ^+	62	58	168	64	62	49	169	69
Σ^-	46	54	151	59	46	43	147	51
TOC	-	1.2	-	1.4	-	0.8	-	2.5
SiO_2	-	0.7	-	1.2	-	0.8	-	1.6

Table 6. (cont.) Fluxes

1986

	SOG1 control		SOG2 H_2SO_4		SOG3 control		SOG4 H_2SO_4 + HNO_3	
	In	Out	In	Out	In	Out	In	Out
H_2O	957	857	1025	925	957	857	1030	930
H^+	11	1	112	7	11	1	112	6
Na	21	28	25	32	21	26	26	27
K	6	2	6	2	6	0	6	2
Ca	3	15	4	26	3	15	5	25
Mg	5	7	6	13	5	7	6	10
Al	-	0	-	2	-	0	-	1
NH_4	7	0	7	0	7	0	7	0
NO_3	5	1	5	1	5	0	55	6
Cl	24	24	26	31	24	23	26	24
SO_4	19	23	122	53	19	20	71	42
HCO_3	0	3	0	0	0	3	0	1
Σ^+	53	53	160	82	53	49	162	71
Σ^-	48	50	153	85	48	46	152	73
TOC	-	0.8	-	1.5	-	0.7	-	1.4
SiO_2	-	0.9	-	1.5	-	1.2	-	1.7

Table 7. Volume-weighted mean concentrations in wet precipitation (IN) and runoff (OUT) at the Sogndal catchments during the years 1984 (831115-841113), 1985 (841114-851101) and 1986 (851102-861112). Units: µeq/l; mgC/l; $mgSiO_2/l$.

– 1984 –

	SOG1		SOG2		SOG3		SOG4	
	In	Out	In	Out	In	Out	In	Out
H_2O	1126	1026	1186	1086	1126	1026	1186	1086
H^+	20	2	75	8	20	4	78	4
Na	72	88	71	59	72	74	71	51
K	6	11	6	4	6	2	6	2
Ca	9	20	9	22	9	19	9	26
Mg	16	15	14	13	16	17	15	12
Al	-	1	-	3	-	0	-	1
NH_4	9	6	8	3	9	1	8	1
NO_3	9	2	9	4	9	2	38	4
Cl	81	89	80	60	81	78	79	57
SO_4	31	28	89	40	31	23	59	26
HCO_3	0	15	0	5	0	1	0	6
Σ^+	132	143	183	112	132	117	187	97
Σ^-	126	134	178	109	126	104	176	93
TOC	-	4.3	-	2.5	-	0.7	-	2.7
SiO_2	-	-	-	-	-	-	-	-

Table 7(cont.). Weighted-mean concentrations.

1985

	SOG1		SOG2		SOG3		SOG4	
	In	Out	In	Out	In	Out	In	Out
H_2O	928	828	991	891	928	828	1030	930
H^+	15	2	117	4	15	1	109	6
Na	32	35	32	31	32	33	25	29
K	4	2	5	2	4	1	6	2
Ca	4	16	5	22	4	16	5	27
Mg	4	8	4	11	4	8	6	11
Al	-	0	-	2	-	0	-	1
NH_4	6	5	6	0	6	0	7	0
NO_3	8	1	7	1	8	0	53	6
Cl	26	29	26	26	26	25	25	26
SO_4	16	22	119	38	16	22	69	45
HCO_3	0	13	0	2	0	5	0	1
Σ^+	65	68	169	72	65	59	158	76
Σ^-	50	65	152	67	50	52	147	78
TOC	-	1.4	-	1.6	-	1.0	-	1.5
SiO_2	-	0.8	-	1.3	-	1.0	-	1.8

Table 7(cont.). Weighted-mean concentrations.

– 1986 –

	SOG1 In	SOG1 Out	SOG2 In	SOG2 Out	SOG3 In	SOG3 Out	SOG4 In	SOG4 Out
H_2O	957	857	1025	925	957	857	1030	930
H^+	11	1	109	8	11	1	109	6
Na	22	33	24	35	22	30	25	29
K	6	2	6	2	6	0	6	2
Ca	3	18	4	28	3	18	5	27
Mg	5	8	6	14	5	8	6	11
Al	-	0	-	2	-	0	-	1
NH_4	7	0	7	0	7	0	7	0
NO_3	5	1	5	1	5	0	53	6
Cl	25	28	25	34	25	27	25	26
SO_4	20	27	119	57	20	23	69	45
HCO_3	0	4	0	0	0	4	0	1
Σ^+	54	62	156	89	54	57	158	76
Σ^-	48	60	149	92	48	54	147	78
TOC	-	0.9	-	1.6	-	0.8	-	1.5
SiO_2	-	1.0	-	1.6	-	1.4	-	1.8

The changes in flux in runoff at the treatment catchments relative to the control catchments indicate that in 1986 about 50% of the change in mobile acid anions (sulfate plus nitrate) was accompanied by increased levels of base cations (Ca plus Mg) while 50% was compensated by decreased alkalinity (defined as difference between sum of strong acid anions and sum of base cations) (Table 6). The F-factor for both catchments in 1986 was thus about 0.5.

Risdalsheia

At Risdalsheia runoff in 1986 (hydrologic year 15 November 1985 - 18 December 1986) from the acid-exclusion catchment (KIM) had the lowest concentration of sulfate yet measured in the experiment (Figure 4). The difference in sulfate concentrations between EGIL catchment (untreated control roof) and KIM catchment continued to increase in 1986. KIM runoff now contains only 50% as much sulfate as does EGIL runoff (Figure 5). The difference in pH between the 2 catchments, howver, continues to be small.

In 1986 water flux at the roofed catchments was about 1/2 that at the unroofed ROLF catchment (Table 8b). The difference is due to (1) much higher snowfall outside relative to that made artificially at KIM or tranported under the roof at EGIL, (2) insufficient capacity of the watering systems to accommodate events with high rainfall, and (3) several technical failures of the watering system during the summer half-year. Evapotranspiration obtained by difference in the hydrologic budgets was 200 mm at EGIL, 135 mm at KIM, and 130 mm at ROLF.

Input-output budgets for 1986 at the Risdalsheia catchments show increasing effects of the treatment at KIM catchment. Sulfate flux and weighted-average concentrations in runoff at KIM in 1986 were lower than during the first 1 1/2 years of treatment 13 June 1984 - 14 November 1985 (Table 8a,b). At KIM in 1986 sulfate inputs were estimated to 24 $meq/m^2/yr$ (8 wet and 16 dry) while outputs were 37 $meq/m^2/yr$. These low fluxes contrast with the fluxes at the roofed control catchment EGIL (63 $meq/m^2/yr$ in and 76 $meq/m^2/yr$ out) at about the same water flux. In 1986 the flux of sulfate from KIM catchment was only 50% of that at EGIL. At ROLF catchment with about 2 times greater water flux the fluxes of sulfate were substantially higher at 132 $meq/m^2/yr$ in and 150 $meq/m^2/yr$ out (Table 8b).

Volume-weighted average concentrations of most ions were lower in runoff at KIM relative to EGIL in 1986 (Table 9b). Largest relative

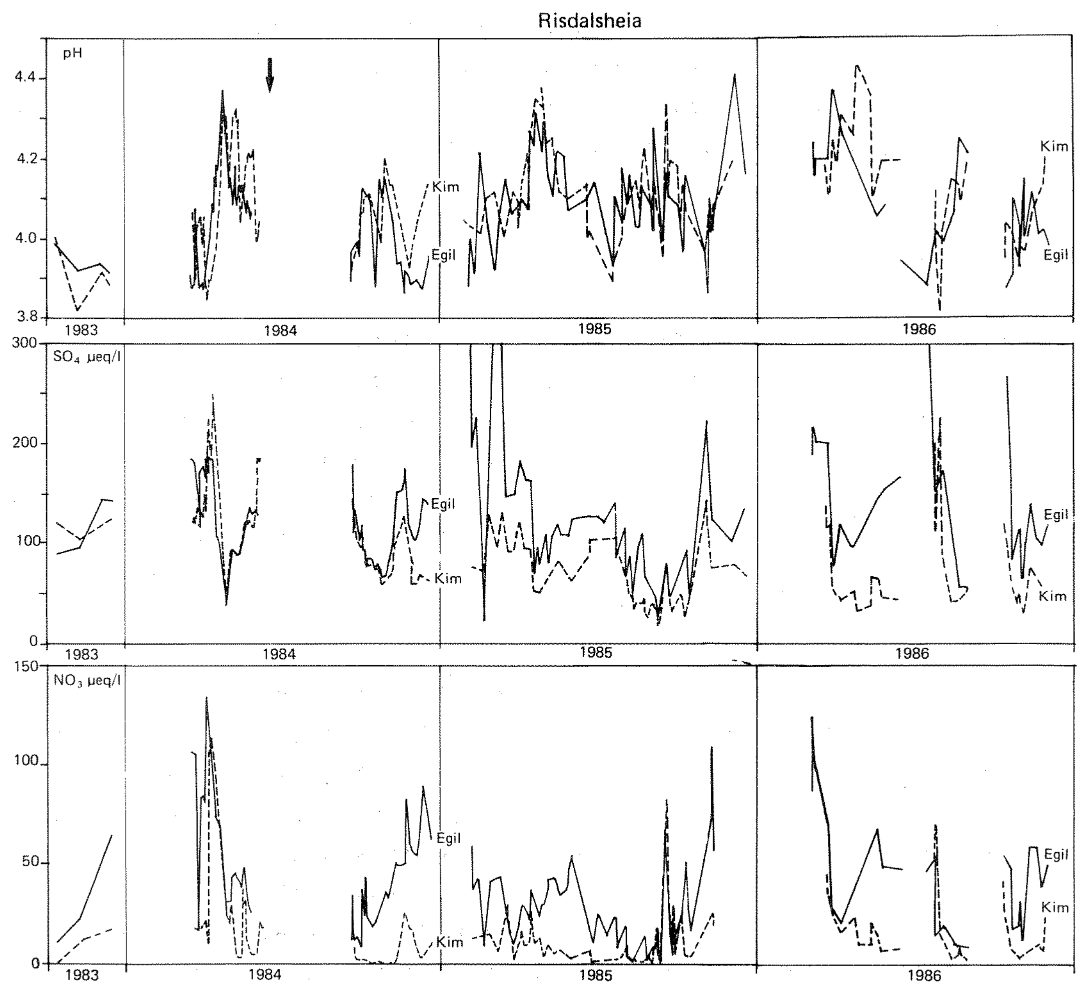


Figure 4. pH and concentrations of sulfate and nitrate in runoff from KIM and EGIL catchments at Risdalsheia over the period October 1983 - December 1986. Treatment began in mid-June 1984 (arrow).

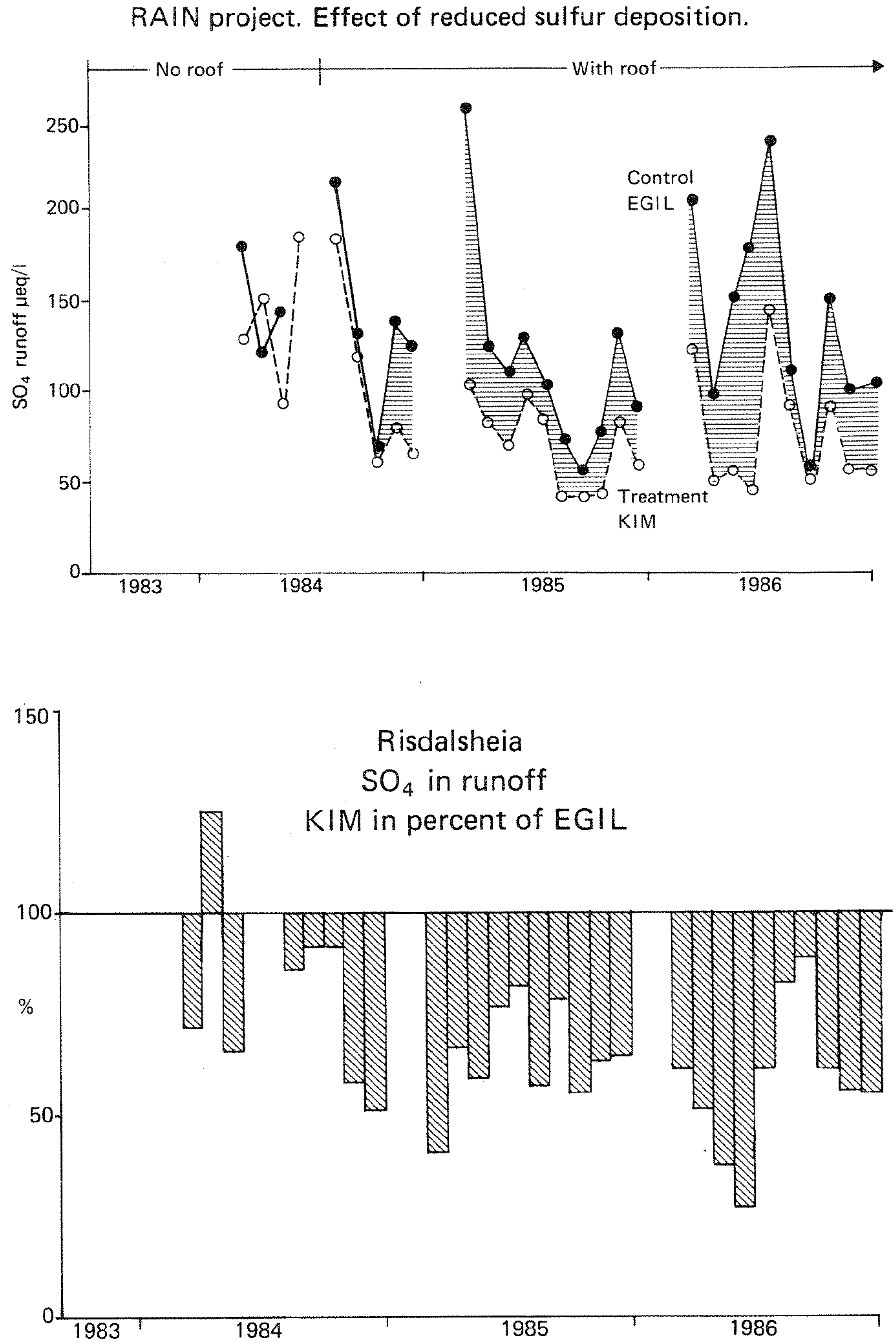


Figure 5. Monthly-average concentrations of sulfate in runoff at KIM and EGIL catchments. Hatched area in top panel indicates the effect of the treatment. Bottom panel shows the concentration at KIM relative to EGIL in %. Concentrations at KIM have decreased by about 50 % during the first 2 1/2 years of treatment.

Table 8a. Input-output budgets for water and major ions at EGIL and KIM catchments for the 1 1/2 year treatment period 13 June 1984 - 14 November 1985. Units: meq/m^2; NLAL mgAl/m^2; TOC gC/m^2. See text for details.

1984-85

	EGIL						KIM			
	Input					Out	Input			Out
	Wet	Dry			Total		Wet	Dry	Total	
		marine part.	Acid part.	gases						
H_2O (mm)	1346					1092	1102			835
H^+	64	0	2	23	89	102	10	25	35	72
Na	65	32	0	0	97	91	61	32	93	77
K	6	1	0	0	7	8	1	1	2	6
Ca	12	1	0	0	13	15	3	1	4	11
Mg	16	7	0	0	23	24	14	7	21	14
Al	0	0	0	0	0	18	0	0	0	11
NH_4	57	0	6	0	63	16	0	6	6	6
NO_3	50	0	0	8	58	32	1	8	9	6
Cl	70	38	0	0	108	108	72	38	110	104
SO_4	86	4	8	15	113	115	8	27	35	58
Org.anion	0	0	0	0	0	18	0	0	0	28
Σ^+	220	41	8	23	292	274	89	72	161	197
Σ^-	206	42	8	23	279	273	81	73	154	196
NLAL						229				238
TOC						12.7				15.5

Table 8b. Input-output budgets for water and major ions at EGIL, KIM and ROLF catchments for the period 15 November 1985 - 18 December 1986. Units: meq/m^2 ; NLAL mgAl/m^2 ; TOC gC/m^2 . See text for details.

1986

	EGIL				KIM				ROLF			
	Input			Out	Input			Out	Input			Out
	Wet	Dry	Total		Wet	Dry	Total		Wet	Dry	Total	
H_2O (mm)	771			570	727			592	1516			1388
H^+	47	17	64	50	15	17	32	45	100	17	117	129
Na	27	21	48	54	47	21	68	54	71	83	154	140
K	2	0	3	6	2	0	2	5	5	2	7	6
Ca	6	1	7	11	3	1	4	8	14	4	18	28
Mg	9	5	4	16	9	5	14	12	19	19	38	41
Al	0	0	0	10	0	0	0	6	0	0	0	16
NH_4	27	3	30	19	1	3	4	7	61	3	64	19
NO_3	27	6	33	22	0	6	6	9	62	6	74	40
Cl	39	24	64	64	55	24	79	70	84	97	181	181
SO_4	45	16	63	76	8	16	24	37	107	10	132	150
Org.anion	0	0	0	5	0	0	0	19	0	0	0	8
Σ^+	119	47	166	166	77	47	124	135	270	127	398	379
Σ^-	111	46	160	166	63	46	109	135	253	127	386	379
NLAL				109				138				174
TOC				6.1				9.0				14.0

Table 9a. Volume-weighted mean concentrations of major ions in wet precipitation (In) and runoff (Out) at EGIL and KIM catchments for the $1\frac{1}{2}$ year treatment period 13 June 1984 - 14 November 1985. Units: µeq/l; NLAL µgAL/l; TOC mgC/l.

1984-85

	EGIL		KIM	
	In	Out	In	Out
H_2O	1346	1092	1102	835
H^+	48	93	9	86
(pH)	4.32	4.03	5.05	4.07
Na	48	83	55	92
K	4	7	1	7
Ca	9	14	3	13
Mg	12	22	13	17
Al	0	17	0	13
NH_4	42	14	0	7
NO_3	37	29	1	7
Cl	52	98	65	125
SO_4	64	105	7	70
Org.anion	0	16	0	34
Σ^+	163	251	81	236
Σ^-	153	250	73	235
NLAL	-	210	-	285
TOC	-	11.6	-	18.6

Table 9b. Volume-weighted mean concentrations of major ions in wet precipitation (In) and runoff (Out) at EGIL, KIM and ROLF catchments for period 15 November 1985 - 18 December 1986. Units: µeq/l; NLAL µgAL/l; TOC mgC/l.

1986

	EGIL		KIM		ROLF	
	In	Out	In	Out	In	Out
H_2O	771	570	727	592	1516	1388
H^+	61	88	20	76	66	93
(pH)	4.21	4.06	4.70	4.12	4.18	4.03
Na	35	93	65	90	47	101
K	3	10	2	8	3	4
Ca	8	19	5	13	9	20
Mg	12	28	13	20	13	30
Al	0	17	0	10	0	12
NH_4	35	33	1	12	40	14
NO_3	35	38	0	15	41	29
Cl	51	111	76	119	55	130
SO_4	58	131	11	63	71	108
Org.anion	0	9	0	32	0	7
Σ^+	154	288	106	229	178	274
Σ^-	144	288	87	229	167	274
NLAL	-	191	-	233	-	125
TOC	-	10.7	-	15.2	-	10.1

Table 10. Differences in concentrations of major ions in runoff at KIM relative to EGIL for the 2 treatment periods 13 June 1984 - 14 November 1985 (1984-85) and 15 November 1985 - 18 December 1986 (1986); values expressed as % (KIM - EGIL) / EGIL, where negative values indicate decline due to treatment at KIM. Alkalinity (alk) is defined as sum of base cations minus sum of strong acid anions.

	1984-85 %	1986 %
H^+	- 8	0
Na	+11	- 5
K	0	-27
Ca	- 7	-32
Mg	-23	-26
Al	-24	-44
NH_4	-50	-64
NO_3	-76	-61
Cl	+28	+ 6
SO_4	-33	-53
Org.anion	+113	-
alk	+28	+44

differences were exhibited by nitrate and ammonium concentrations; both were 60% lower at KIM. Among the cations the largest difference was for Al (45% lower), followed by the divalent cations Ca and Mg (Table 10). The difference in sulfate concentrations was about 50% in 1986, up from 33% in 1984-85 (Table 10).

The SO_4 budget at KIM catchment indicates a net loss of about 23 meq/m^2 from KIM in 1984-85 and an additional 12 meq/m^2 in 1986. The 1984 soil survey data of Lotse and Otabong (1985) together with the soil depth information indicate that in 1984 prior to treatment the soils of KIM contained 5300 meq/m^2 total S (expressed here as SO_4), thereof 90 meq/m^2 of water soluble SO_4 and 14 meq/m^2 of adsorbed SO_4. Net loss of sulfate from KIM during the first 2 1/2 years of treatment is thus equivalent to > 2 times the original store of adsorbed SO_4, about 1/3 (35/104) of the readily-available SO_4, but < 1 % of the total amount of sulfur contained in the soil (Table 11).

HCl episode at KIM catchment, October-November 1986

A technical failure in the ion-exchange system at KIM catchment resulted in a 2-week period during which about 41 mm of pH 3.75-4.10 chloride-rich rain was added to KIM. Apparently the batch of ion-exchange resin became ineffective much earlier than usual; incoming sulfate and nitrate acid precipitation thus entered the ion-exchange column and hydrochloric acid left the column. In this 2-week period about 6% of the annual water flux was added, and this contained about 10% of the annual Cl input and 30% of the annual acid input (Table 12).

Runoff chemistry responded dramatically to the HCl input (Figure 6). Cl concentrations jumped from about 130-150 µeq/l to 260-290 µeq/l, and pH levels declined to below 4. After renewal of the ion-exchange resin on 14 November precipitation again was "clean" with pH levels about 5 and Cl of about 50 µeq/l (added as seasalt), and runoff again responded with lower Cl levels and increased pH (Figure 6).

This HCl episode caused a major change in the H+ flux into and out of the catchment, and complicates the ongoing evaluation of effect of treatment on pH of runoff. The episode, however, significantly affected only the H+, Cl and inorganic Al budgets, and apparently only temporarily. The budgets of other major ions such as sulfate and nitrate were not affected, and thus for these ions the HCl episode did not affect the ongoing comparison between KIM and EGIL catchments.

Table 11. RAIN project. Sulfur pools and fluxes at treatment catchments over the first 3 years 1984-96 expressed as meq SO_4/m^2. Soils data from Lotse and Otabbong 1985.

		Risdalsheia KIM	Sogndal SOG2	Sogndal SOG4
soil pools prior to treatment	total S	5300	5200	11900
	water-soluble SO_4	90	80	90
	adsorbed SO_4	14	150	70
fluxes 1984-86	in	59	355	220
	out	96	130	90
	in-out=net retention (+) or net loss (-)	-37	+225	+130
	net retention/loss in % of water-soluble + adsorbed SO_4	-35%	+100%	+80%

Table 12. The HCl episode at KIM catchment, October-November 1986; concentrations (μeq/l) and fluxes (meq/m^2) of H+ and Cl in precipitation and runoff.

			concentration			flux	
	Period	mm	pH	H+	Cl	H+	Cl
	861031-1106	14.5	3.75	178	270	2.6	3.9
IN	861107-1113	26.8	4.10	79	141	2.1	3.8
	Sum	41.3				4.7	7.7
	Year 1986	727				15	79
	% of year	6%				30%	10%
	861107-1114	28.1	3.98	104	270	3.0	7.6
	861115-1120	33.5	4.05	90	215	3.4	7.2
OUT	Sum	61.6				6.4	14.8
	Year 1986	592				44	70
	% of year	10%				15%	21%

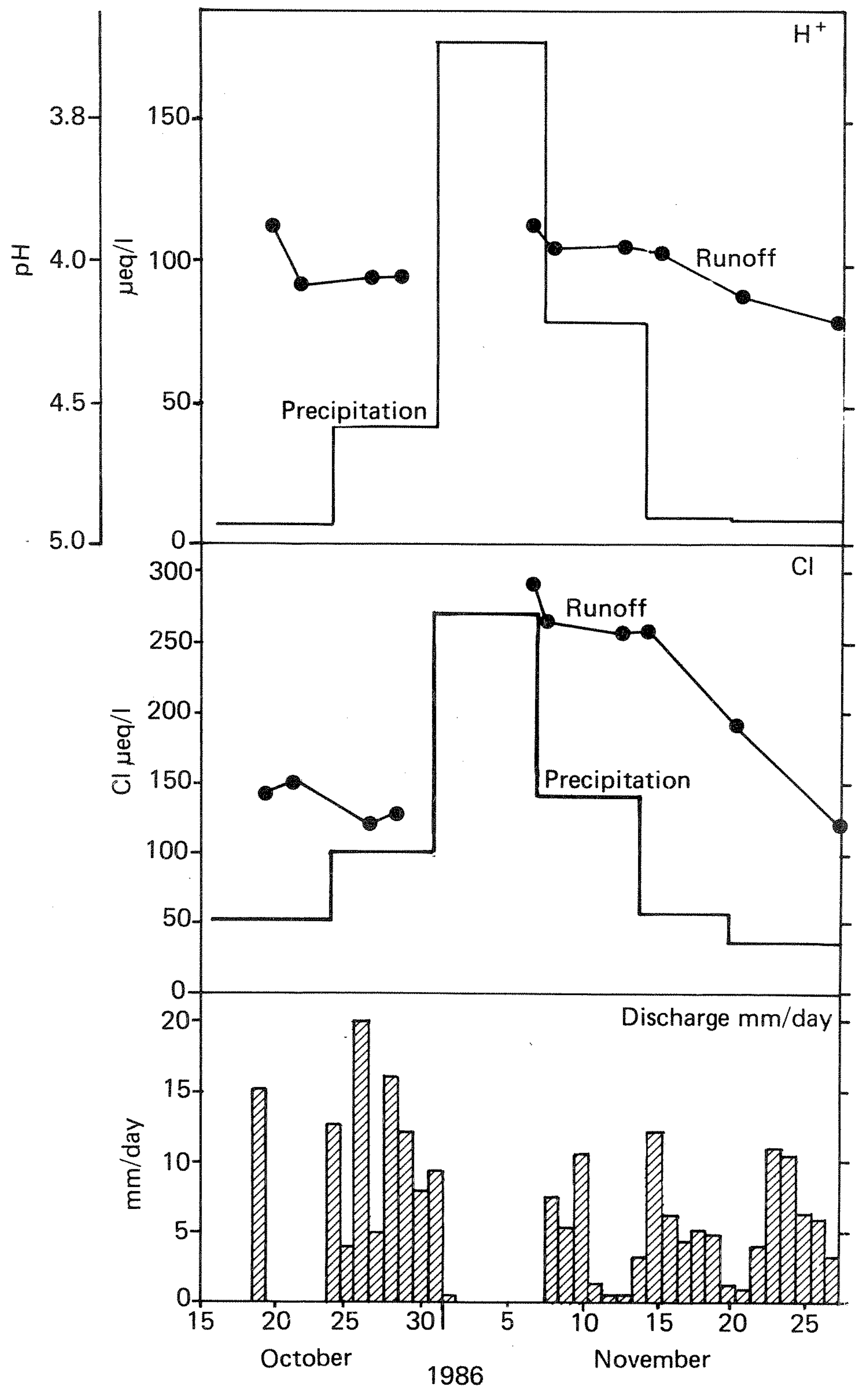


Figure 6. Discharge and concentrations of H+ and Cl in precipitation and runoff at KIM catchment during the technical failure October-November 1986, during which the catchment received an episode of HCl rain.

Organic acids at Risdalsheia

Runoff at all three Risdalsheia catchments is highly colored and contains high levels of total organic carbon (TOC) (Table 9). The concentration of organic anions can be estimated from the ionic balance. Based on the seasonal volume-weighted average concentrations the contribution of organic anions varies from 7 to 34 µeq/l. Organic anions thus can comprise a significant fraction of the anion sum (about 3-15%), and much higher if only the non-marine concentrations are considered.

The charge density of the organic acids in runoff varies from about 0.5 to 3.0 µeq/mgC (Figure 7). The charge density is obtained by dividing the organic anion concentration by the concentration of TOC. The data indicate that the charge density changes with pH; the higher the pH the higher the charge density. These relationships are approximated by assuming that the organic matter has a pK of about 4.2 and maximum charge density of about 5 at pH > 5. These values are similar to those obtained by Cronan and Aiken (1985) on soil solutions and surface waters in the ILWAS watersheds, Adirondack Mountains, New York. Henriksen and Seip (1980) found that the average charge density for 200 Norwegain surface waters was about 5.5 µeq/mgC.

Runoff at Risdalsheia can thus be considered as an admixture of seawater salts, strong acids and organic acids with a minor addition of base cations from weathering and ion exchange. At EGIL and ROLF catchments the strong acids dominate and at pH levels around 4.0 most of the organic acids are associated and thus the charge density is low. The treatment at KIM has significantly reduced the strong acid concentrations, and the organic acids dissociate to buffer pH increase. At charge density of 5 organic anion concentrations can reach 65-80 µeq/l. If the sum of non-marine concentrations of base cations in runoff at KIM remains at only 0-10 µeq/l, the TOC levels in runoff at KIM remain at 15-18 mgC/l, and the organic acids have a pK of 4.2 and maximum charge density of 4.5, the pH in runoff in the absence of strong acids will reach only about pH 4.4-4.5. Alkalinity defined as sum of base cations minus sum of strong acid anions, however, should reach about -30 µeq/l.

Satellite projects

The first results from two of the satellite projects connected to RAIN project became available in 1986 (Appendix 2). Wright and Cosby (1987) have made a preliminary application of the MAGIC model to the

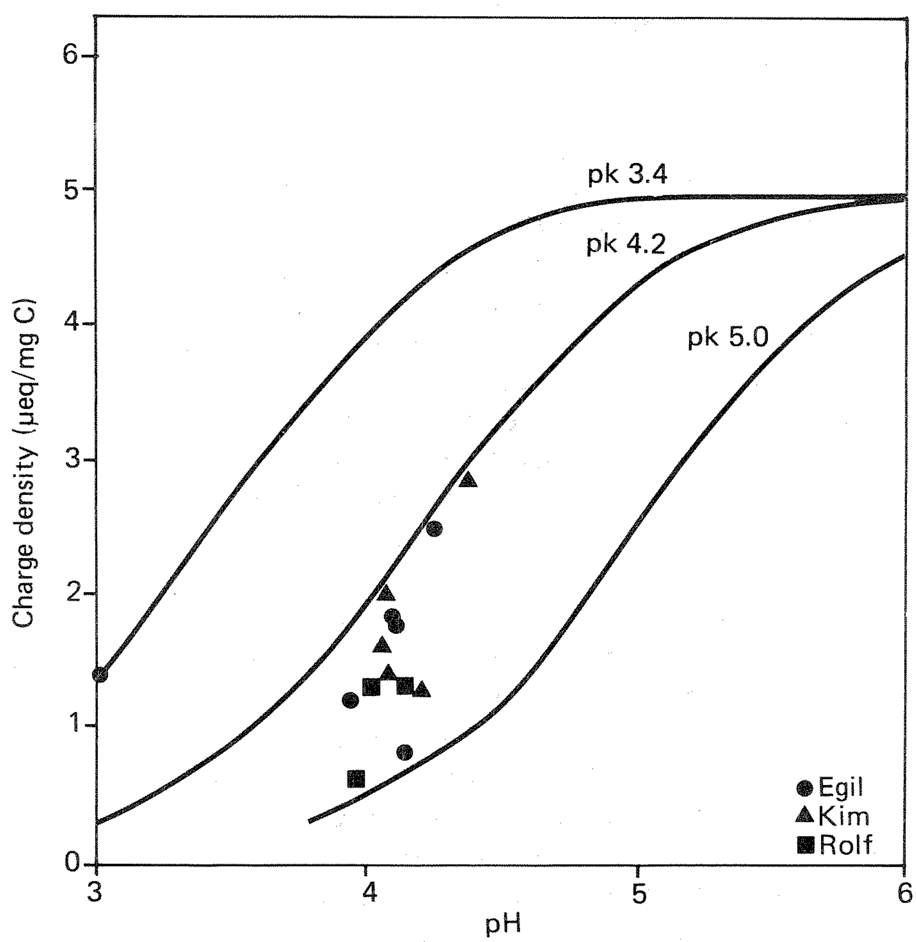


Figure 7. Charge density of organic matter in runoff at the Risdalsheia catchments calculated from the seasonal ionic balance and measured TOC levels. Also shown are theoretical curve for organic acids with maximum charge density of 4.5 µeq/mgC and pK of 3.4, 4.2, and 5.0, respectively.

RAIN project. This application was compared to results from the first 1 1/2 and 2 years of treatment at KIM and SOG2, respectively. The 1986 data now available indicate that the trends continue into the third year of treatment (Figures 8 and 9).

Hauhs (1986) reported on a comparison of hydrology and water chemistry at EGIL catchment with a catchment in West Germany. Both these satellite projects continue in 1987.

A total of 5 new publications and reports dealing with the RAIN project appeared in 1986.

REFERENCES

Christophersen, N., Stuanes, A.O., and Wright, R.F. 1982. Runoff chemistry at a mini-catchment watered with "unpolluted precipitation". Nordic Hydrol. 13: 115-128.

Cronan, C.S., and Aiken, G.R. 1985. Chemistry and transport of soluble humic subastances in forested watersheds of the Adirondack Park, New York. Geochim. Cosmochim. Acta 49:1697-1705.

Henriksen, A., and Seip, H.M. 1980. Strong and weak acids in surface waters of southern Norway and southwestern Scotland. Water Res. 14: 809-813.

Lotse, E., and Otabbong, E. 1985. Physiochemical properties of soils at Risdalsheia and Sogndal: RAIN project. Acid Rain Res. Rept. 8/85 (Norwegian Inst. Water Research, Oslo, Norway), 48pp.

Seip, H.M., Gjessing, E.T., and Kamben, H. 1979. Importance of the composition of the precipitation for the pH in runoff-experiments with artificial precipitation on partly soil-covered "mini-catchments". Internal Report IR 47/79, (SNSF-project, 1432 Ås, Norway), 34 pp.

SFT, 1985. Monitoring of long-range transported air and precipitation. Annual report 1984. Report 201/85 (Statens forurensningstilsyn, Oslo, Norway), 190pp. (in Norwegian).

SFT, 1986. Monitoring of long-range transported air and precipitation. Annual report 1985. Report 256/86 (Statens forurensningstilsyn, Oslo, Norway), 199pp. (in Norwegian).

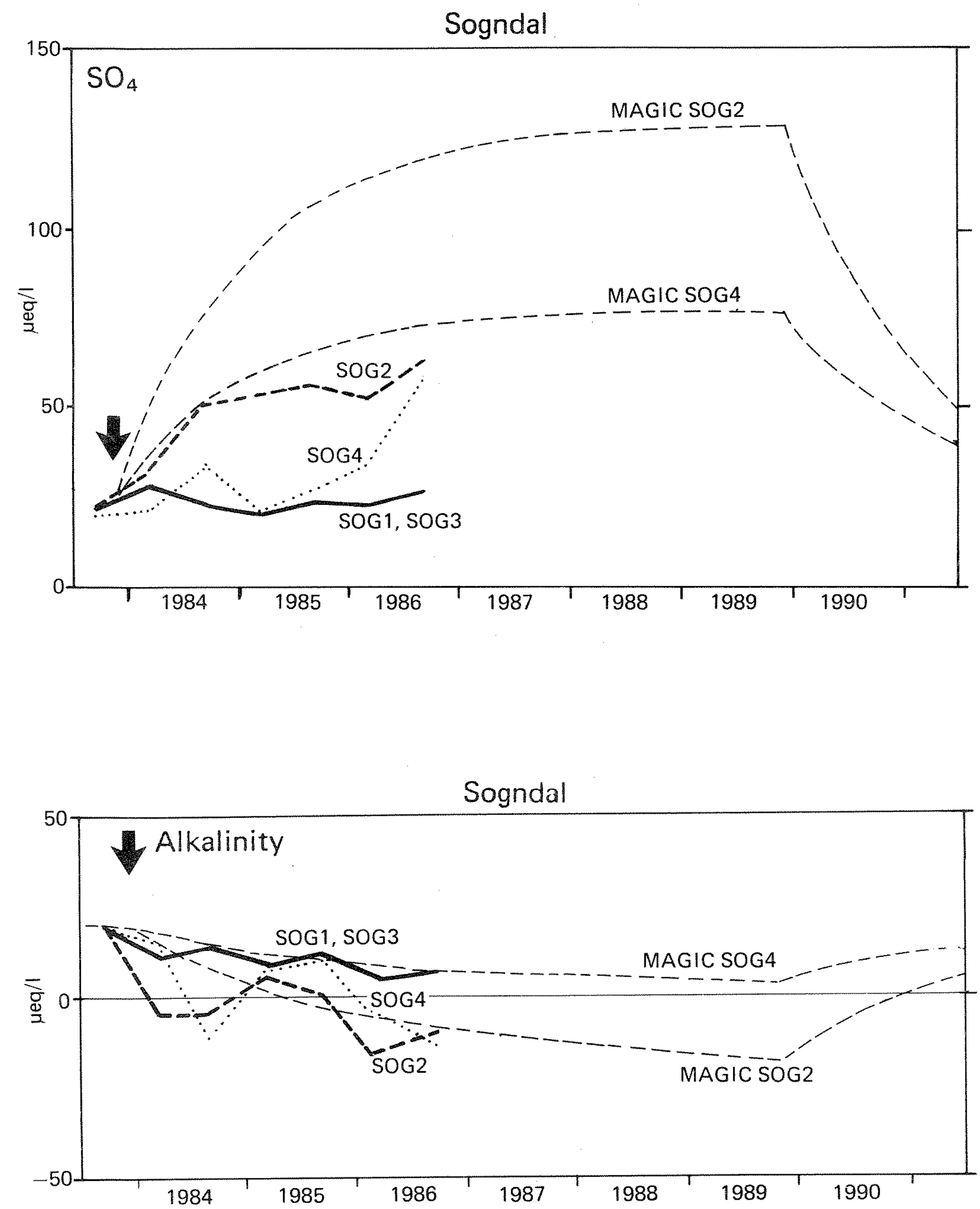


Figure 8. Sulfate-concentrations (upper panel) and alkalinity (bottom panel) in runoff measured (volume-weighted winter and summer averages) and predicted by MAGIC for the manipulated catchments at Sogndal (from Wright and Cosby 1987). Alkalinity is defined as sum of charges of base cations minus sum of charges of strong acid anions.

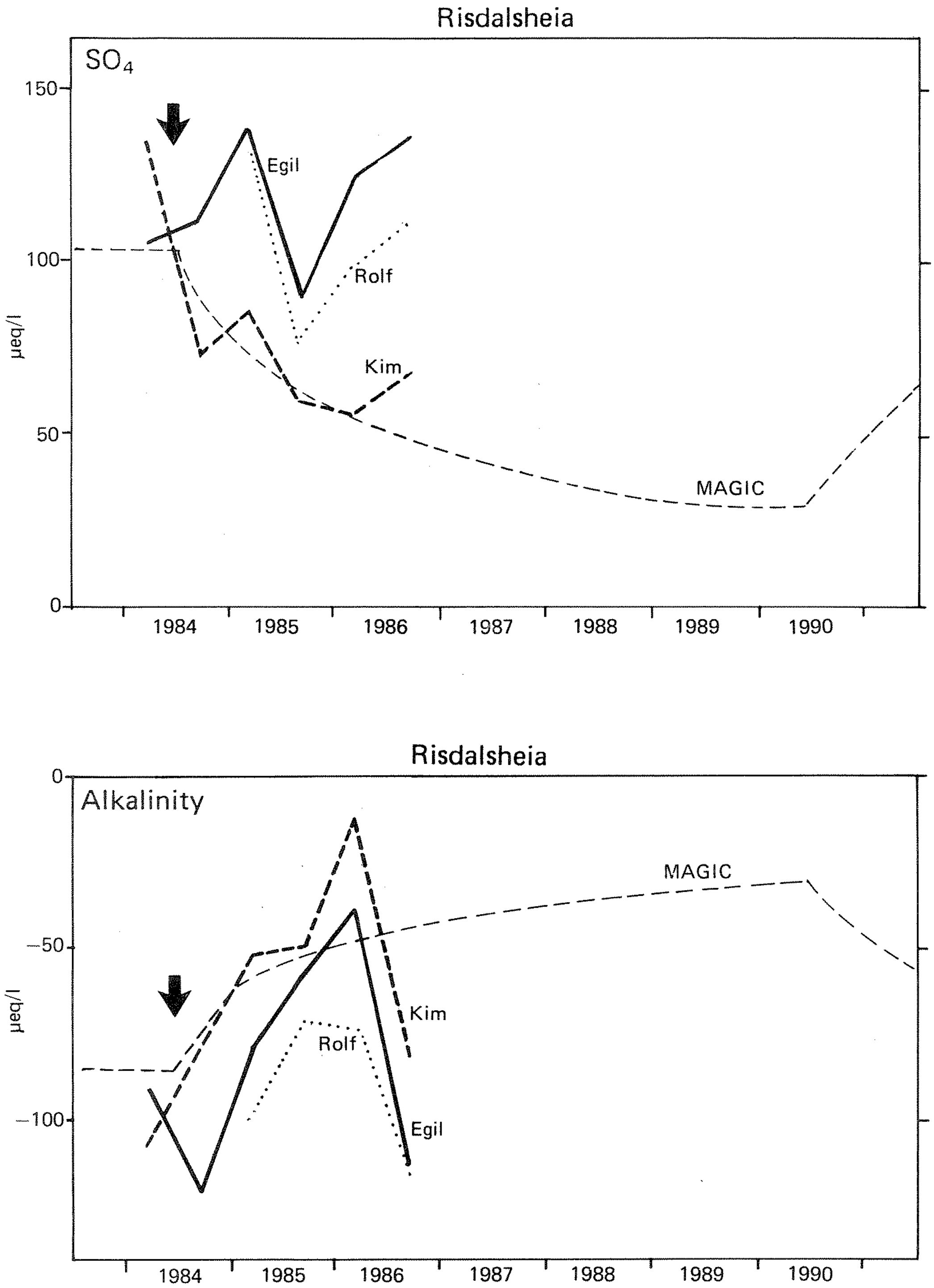


Figure 9. Sulfate-concentrations (upper panel) and alkalinity (bottom panel) in runoff measured (volume-weighted winter and summer averages) and predicted by MAGIC for the manipulated catchment at Risdalsheia (from Wright and Cosby 1987). Alkalinity is defined as sum of charges of base cations minus sum of charges of strong acid anions.

SFT, in press. Monitoring of long-range transported air and precipitation. Annual report 1986. (Statens forurensningstilsyn, Oslo, Norway) (in Norwegian).

Wright, R.F. 1985. RAIN project. Annual report for 1984. Acid Rain Res. Rept. 7/85 (Norwegian Inst. Water Research, Oslo, Norway), 39pp.

Wright, R.F., and Cosby, B.J. 1987. Use of a process-oriented model to predict acidification at manipulated catchments in Norway. Atmos. Environ. 21: 727-730.

Wright, R.F., and Gjessing, E. 1986. RAIN project. Annual report for 1985. Acid Rain Res. Rept. 9/1986 (Norwegian Insitute for Water Research, Oslo, Norway), 33 pp.

Wright, R.F., Gjessing, E., Christophersen, N., Lotse, E., Seip, H.M., Semb, A., and Sletaune, B. 1986. Project RAIN: changing acid deposition to whole catchments. The first year of treatment. Water Air Soil Pollut. 30: 47-63.

APPENDICES.

Appendix 1. Visitors to the RAIN project in 1986.

Appendix 2. Satellite projects to the RAIN project in 1986.

Appendix 3. Soil volume, depth, mass and chemistry for the RAIN catchments.

Appendix 4. Risdalsheia discharge data. mm/day.

Appendix 5. Risdalsheia runoff chemistry.

Appendix 6. Risdalsheia precipitation data.

Appendix 7. Risdalsheia input-output budgets and average concentrations.

Appendix 8. Sogndal discharge data. l/s.

Appendix 9. Sogndal runoff chemistry.

Appendix 10. Sogndal precipitation data.

APPENDIX 1.

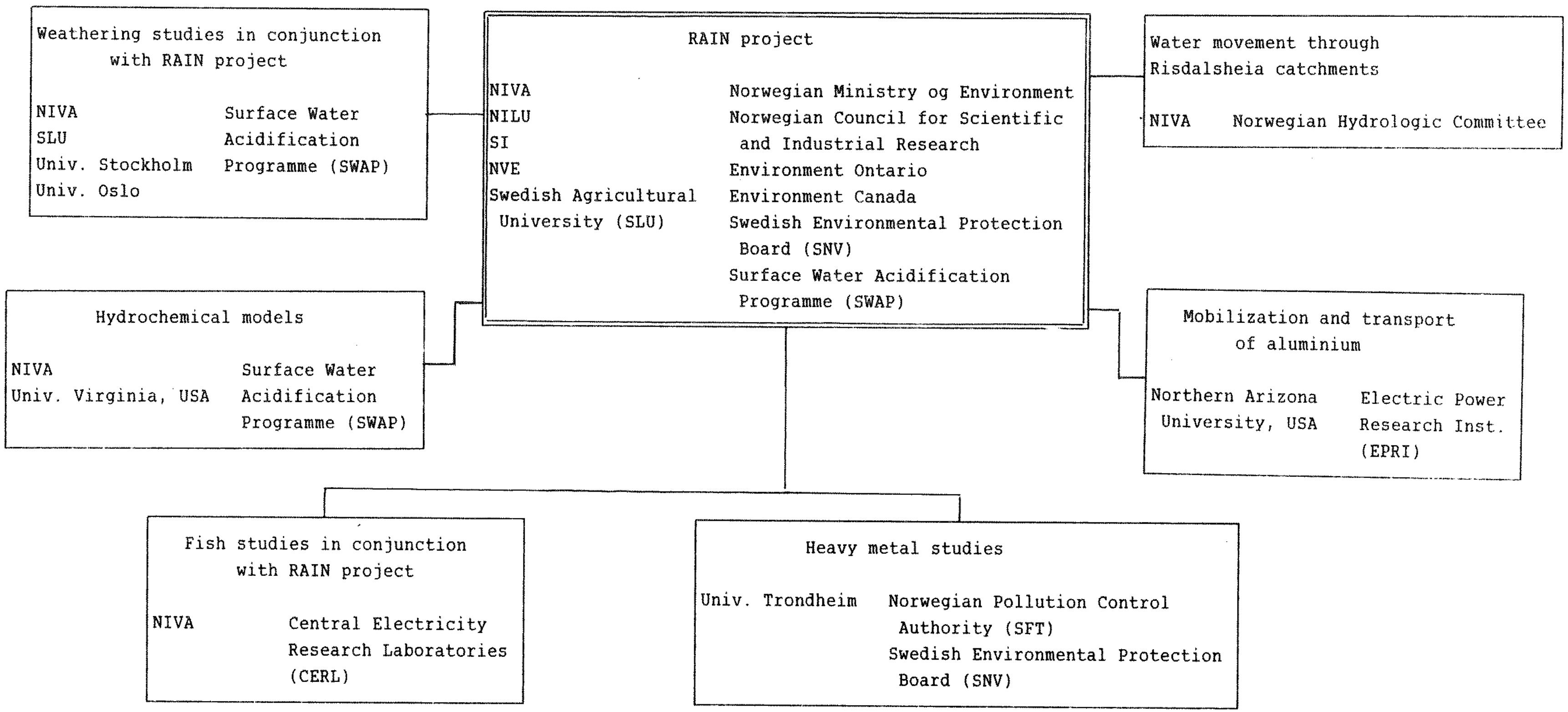
VISITORS TO RISDALSHEIA IN 1986

Date	Visitors and affiliation
25 April	Group of 30 students from Statens Gartnerskole, Grimstad
4 May	Drs. R. Linthurst and Dixon Landers, U.S. Environmental Protection Agency
6 May	Prof. P. Beneke, Universität Gottingen, West Germany
22 May	Group of 40 students from Statens Skogskole, Bygland
22 May	Group of 3 from Miljøvernavdelingen, Aust-Agder County
7 June	Group of 12 representing environmental organizations (Natur og Ungdom, Aust-Agder Naturvern, Grimstad Venstre, Informasjonsgruppe mot sur nedbør, Grimstad Sykkelklubb, Aust-Agder Senterungdom, Fremtid i våre hender)
9 June	Group of 34 scientists from Europe and North America in conjunction with Commission of European Communities COST 612 Workshop on Reversibility of Acidification
16 June	Television crew from Sweden
23 June	Lord Walter Marshall, Chairman UK Central Electricity Generating Board, Dr. P. Chester, Director UK Central Electricity Research Laboratories, Prof. L. Walløe, Dr. I. Muniz and accompanying persons
7 August	Group of 25 from Fremtiden i våre hender
20 August	Group of 30 from Board of Directors, Sparebanken Sør, Landvik
5 September	A. Fikkan og B. Herstad fra Miljøverndepartement and reporter from Norwegian national radio
9 September	Delegation of 6 Members of Parliment, UK, accompanied by 5 representatives of Aust-Agder county administration and Aust-Agder county forester
23 October	Drs. R. Malanchuk, U.S. Environmental Protection Agency and T. Haines, University of Maine
4 November	Group of 30 teachers from Pedagogisk Senter, Arendal
12 November	Two scientists from National Remote Sensing Centre, UK.

RADIO AND TELEVISION COVERAGE OF RAIN PROJECT IN 1986

Date	Program
March 1986	Canadian national Public television "The Nature of Things"
May 1986	UK BBC radio
October 1986	Norwegian national radio P1
November 1986	Swedish national television "Europa syrna"
November 1986	Norwegian national television "Europa syrna"

APPENDIX 2 RAIN PROJECT AND ASSOCIATED SATELLITE PROJECTS AS OF MAY 1987. Within each box are listed the participating institutions (left) and the funding agencies (right)



APPENDIX 3.

Total soil volume, depth, mass and chemical components for the Sogndal and Risdalsheia catchments. Values are based on soil depth maps combined with physical and chemical properties given by Lotse and Otabbong (1986).

		Sogndal		Risdalheia		
		SOG2	SOG4	KIM	EGIL	ROLF
Volume, m^3	0-15 cm	806	201	50		14
	15-30 cm	663	159	29		5
	>30 cm	671	152	11		2
	total	2140	512	90		21
Catchment area, m^2		6450[A]	1938	856		220
Soil depth, cm		33	26	11		10
Bulk density	0-15 cm	680	830	720	660	690
kg/m^3	15-30 cm	590	1000[B]	1400	1210	1310
	>30 cm	1000[B]	1000[B]	1740		1740
Soil mass, 10^3 kg	0-15 cm	548	167	36		10
	15-30 cm	391	159	41		7
	>30 cm	671	152	19		3
	total	1610	478	96		20

Notes: [A] exclusive open water. Total area 7220 m^2.
[B] not measured. Assumed value.

Exchangeable cations, eq.

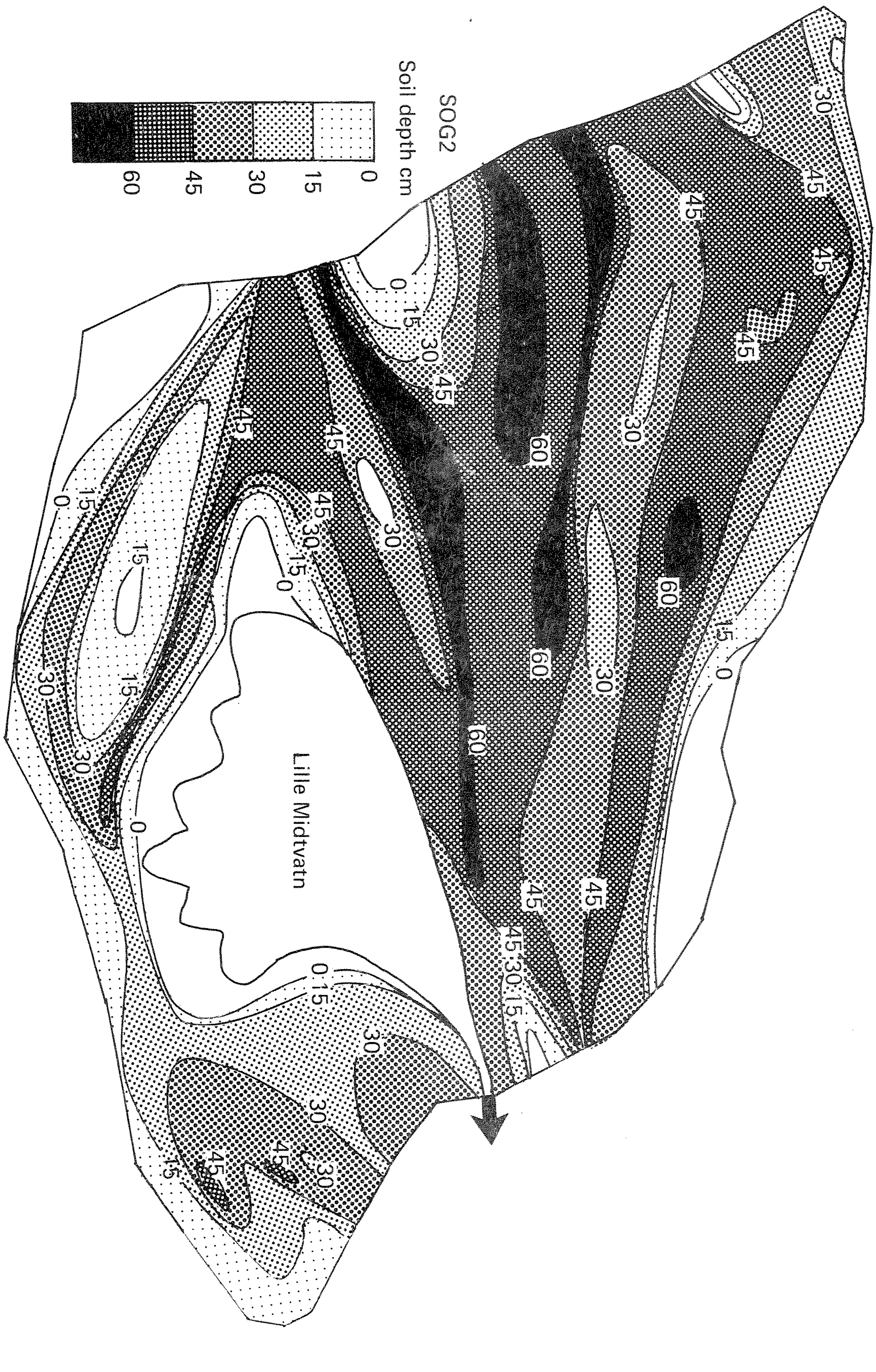
		Sogndal		Risdalheia		
		SOG2	SOG4	KIM	EGIL	ROLF
Ca	0-15 cm	6600	3000	630		
	15-30 cm	1600	500	90		
	>30 cm	1300	2100	15		
	total	9500	5590	730		
Mg	0-15 cm	2960	1300	370		
	15-30 cm	550	250	60		
	>30 cm	400	670	15		
	total	3910	2220	440		
Na	0-15 cm	1150	520	120		
	15-30 cm	820	190	80		
	>30 cm	540	590	30		
	total	2510	1300	220		
K	0-15 cm	1700	800	200		
	15-30 cm	860	400	70		
	>30 cm	600	590	15		
	total	3160	1790	280		
NH_4	0-15 cm	550	250	210		
	15-30 cm	350	240	100		
	>30 cm	470	330	30		
	total	1370	820	340		

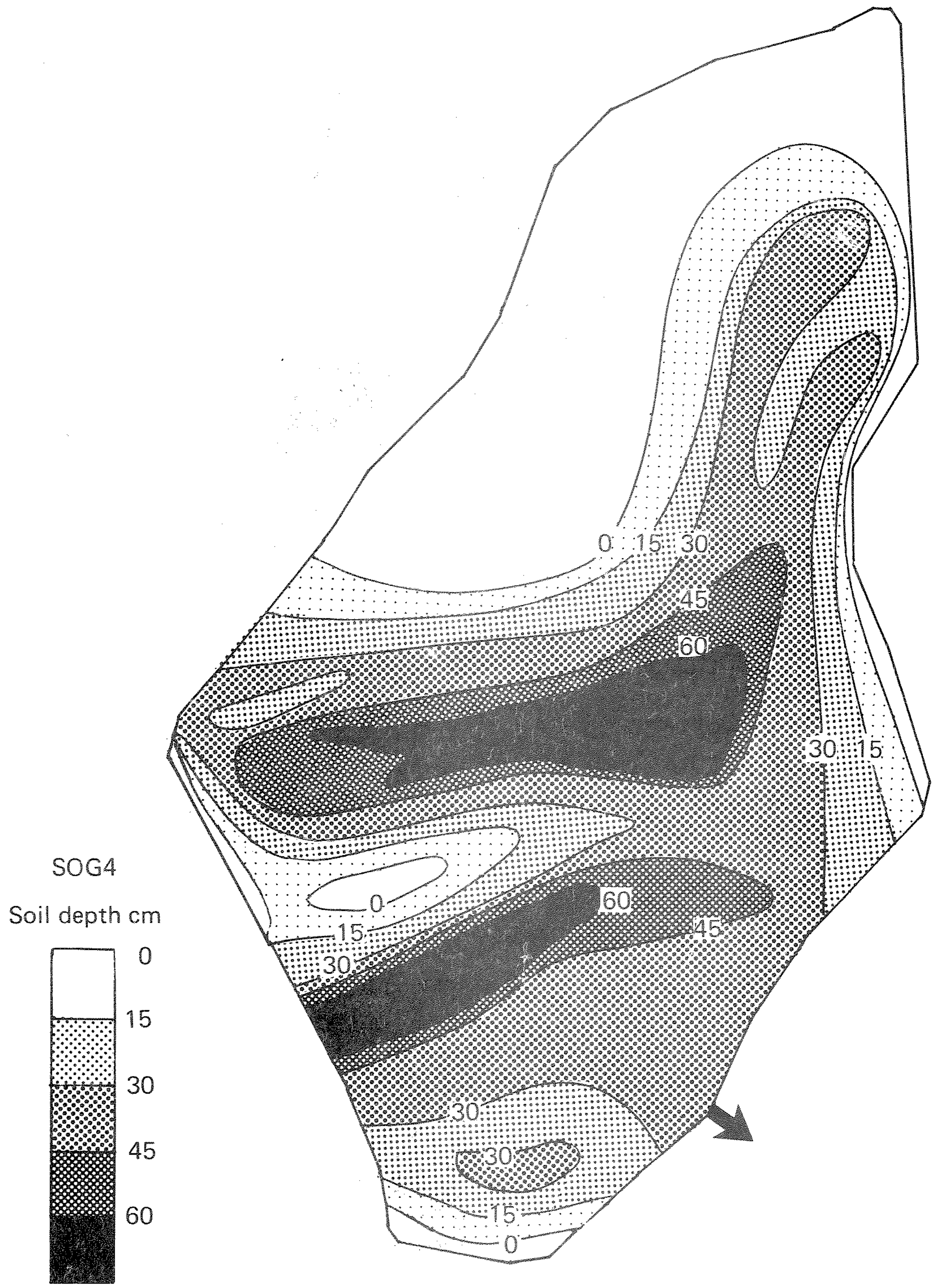
Exchangeable cations, eq. (cont.)

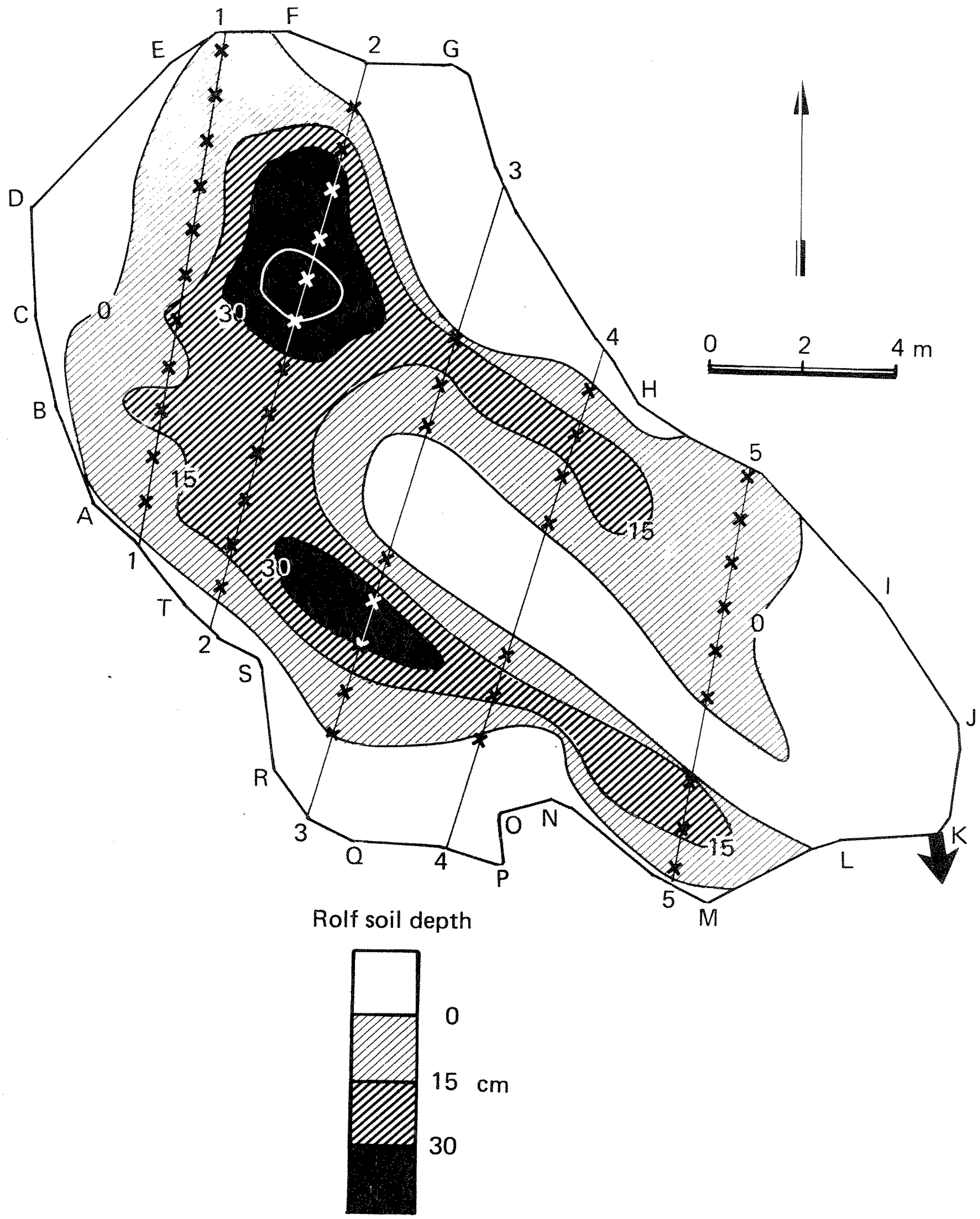
		Sogndal		Risdalheia		
		SOG2	SOG4	KIM	EGIL	ROLF
H^+	0-15 cm	17400	4200	1710		
	15-30 cm	9300	3400	1260		
	>30 cm	10100	2900	660		
	total	32900	10500	3630		
Al (AAS)	0-15 cm	20700	11900	3350		
	15-30 cm	7900	4700	1770		
	>30 cm	2100	3200	790		
	total	30700	19900	5910		
Al (total)	0-15 cm	12900	15900	3320		
	15-30 cm	6200	1500	1840		
	>30 cm	3200	4300	760		
	total	22300	11700	5930		
acidity (KCl)	0-15 cm	37400	16200	5000		
	15-30 cm	15400	8200	3100		
	>30 cm	12600	5800	1400		
	total	65400	30200	9600		
acidity ($BaCl_2$-TEA)	0-15 cm	178600	78600	22200		
	15-30 cm	86900	35100	13100		
	>30 cm	57100	45300	5300		
	total	322600	159000	40600		
CEC eq (KCl)	0-15 cm	50300	22100	6600		
	15-30 cm	22500	9700	3500		
	>30 cm	15800	10200	1500		
	total	98600	41900	11600		

Carbon, nitrogen and sulfur, kg.

		Sogndal		Risdalheia		
		SOG2	SOG4	KIM	EGIL	ROLF
loss on ignition kg	0-15 cm	135000	63000	13900		
	15-30 cm	69000	41000	7700		
	>30 cm	63000	19000	2900		
	total	267000	123000	24500		
C kg	0-15 cm	66000	36000	7700		
	15-30 cm	28000	24000	3700		
	>30 cm	21000	16000	1700		
	total	115000	76000	13200		
N kg	0-15 cm	2900	1500	330		
	15-30 cm	1400	1000	210		
	>30 cm	1100	900	100		
	total	5300	3400	640		
S total kg	0-15 cm	290	130	34		
	15-30 cm	150	90	24		
	>30 cm	100	150	15		
	total	540	370	73		
SO_4-S kg water-sol	0-15 cm	3.4	1.2	0.67		
	15-30 cm	3.4	0.9	0.44		
	>30 cm	1.3	0.8	0.17		
	total	8.1	2.9	1.28		
SO_4-S kg adsorbed	0-15 cm	5.1	0.7	0.09		
	15-30 cm	3.5	1.1	0.06		
	>30 cm	7.1	0.5	0.04		


SOG2
Soil depth cm
0
15
30
45
60
Lille Midtvatn


SOG4
Soil depth cm
0
15
30
45
60
0
15
30
45
60
30
15
0
60
45
15
30
30
30
15
0


1
F
E
2
G
D
3
C
0
30
4
H
0
2
4 m
B
5
15
A
15
1
30
T
I
0
2
S
J
R
3
O
N
15
K
Q
4
P
L
5
M
Rolf soil depth
0
15 cm
30

APPENDIX 4.

RISDALSHEIA DISCHARGE DATA. UNITS: MM/DAY.

DATE	KIM	EGIL	ROLF	DATE	KIM	EGIL	ROLF
				851201	0.00	0.00	0.00
				851202	0.00	0.00	0.00
				851203	0.00	0.00	1.62
				851204	0.39	2.79	29.16
				851205	0.39	0.00	3.24
				851206	0.00	0.93	0.00
				851207	0.00	0.00	1.62
				851208	0.00	0.00	0.00
				851209	0.00	0.00	0.00
				851210	0.00	0.00	0.00
				851211	0.00	0.93	0.00
				851212	0.00	1.86	3.24
				851213	0.78	5.58	32.40
851114	0.39	0.00	0.00	851214	1.17	1.86	1.62
851115	0.00	0.00	0.00	851215	0.39	1.86	8.10
851116	0.00	0.00	0.00	851216	0.39	0.00	1.62
851117	0.00	0.00	0.00	851217	0.00	0.93	1.62
851118	0.00	0.00	0.00	851218	0.39	0.00	0.00
851119	0.00	0.00	0.00	851219	0.00	0.00	0.00
851120	0.00	0.00	1.62	851220	0.00	0.00	0.00
851121	0.00	0.00	0.00	851221	0.00	0.93	27.54
851122	0.00	0.00	0.00	851222	1.17	0.93	4.86
851123	0.00	0.00	0.00	851223	0.39	0.93	3.24
851124	0.00	0.00	0.00	851224	0.78	0.93	21.06
851125	0.00	0.00	0.00	851225	0.78	0.00	3.24
851126	0.00	0.00	0.00	851226	0.39	0.93	0.00
851127	0.00	0.93	0.00	851227	0.00	0.00	0.00
851128	0.00	0.00	0.00	851228	0.00	0.00	0.00
851129	0.00	0.00	0.00	851229	0.00	0.00	0.00
851130	0.00	0.00	0.00	851230	0.00	0.00	0.00
				851231	0.00	0.00	0.00

DATE	KIM	EGIL	ROLF
860101	0.00	0.00	0.00
860102	0.00	0.00	0.00
860103	0.00	0.00	0.00
860104	0.00	0.00	0.00
860105	0.00	0.00	0.00
860106	0.00	0.00	0.00
860107	0.00	0.00	0.00
860108	0.00	0.00	0.00
860109	0.00	0.00	0.00
860110	0.00	0.00	0.00
860111	0.00	0.00	0.00
860112	0.00	0.00	0.00
860113	0.00	0.00	0.00
860114	0.00	0.00	0.00
860115	0.00	0.00	0.00
860116	0.00	0.00	0.00
860117	0.00	0.00	0.00
860118	0.00	0.00	0.00
860119	0.00	0.00	0.00
860120	0.00	0.00	0.00
860121	0.00	0.00	0.00
860122	0.00	0.00	0.00
860123	0.00	0.00	0.00
860124	0.00	0.00	0.00
860125	0.00	0.00	0.00
860126	0.00	0.00	0.00
860127	0.00	0.00	0.00
860128	0.00	0.00	0.00
860129	0.00	0.00	0.00
860130	0.00	0.00	0.00

DATE	KIM	EGIL	ROLF
860201	0.00	0.00	0.00
860202	0.00	0.00	0.00
860203	0.00	0.00	0.00
860204	0.78	0.00	0.00
860205	4.29	0.00	0.00
860206	3.90	0.00	0.00
860207	0.00	0.00	0.00
860208	0.00	0.00	0.00
860209	0.00	0.00	0.00
860210	0.00	0.00	0.00
860211	0.00	0.00	0.00
860212	0.00	0.00	0.00
860213	0.00	0.00	0.00
860214	0.00	0.00	0.00
860215	0.00	0.00	0.00
860216	0.00	0.00	0.00
860217	0.00	0.00	0.00
860218	0.00	0.00	0.00
860219	0.00	0.00	0.00
860220	0.00	0.00	0.00
860221	0.00	0.00	0.00
860222	0.00	0.00	0.00
860223	0.00	0.00	0.00
860224	0.00	0.00	0.00
860225	0.00	0.00	0.00
860226	0.00	0.00	0.00
860227	0.00	0.00	0.00
860228	0.00	0.00	0.00

DATE	KIM	EGIL	ROLF	DATE	KIM	EGIL	ROLF
860301	0.00	0.00	0.00	860401	5.85	3.72	3.24
860302	0.00	0.00	0.00	860402	7.41	4.65	4.86
860303	0.00	0.00	0.00	860403	7.41	5.58	4.86
860304	0.00	0.00	0.00	860404	6.24	3.72	4.86
860305	0.00	0.00	0.00	860405	4.29	1.86	3.24
860306	0.00	0.93	0.00	860406	3.12	0.93	1.62
860307	0.00	1.86	0.00	860407	2.34	1.86	3.24
860308	0.00	3.72	0.00	860408	2.73	2.79	4.86
860309	0.00	1.86	3.24	860409	7.41	3.72	8.10
860310	0.00	1.86	0.00	860410	3.90	2.79	4.86
860311	0.00	0.00	0.00	860411	1.17	0.93	3.24
860312	0.00	0.00	0.00	860412	2.73	1.86	3.24
860313	0.00	0.00	1.62	860413	2.73	0.93	3.24
860314	0.00	0.00	0.00	860414	1.95	0.93	3.24
860315	0.00	0.00	0.00	860415	0.78	0.93	1.62
860316	0.00	0.00	3.24	860416	0.78	0.00	1.62
860317	0.00	0.93	0.00	860417	0.39	0.93	1.62
860318	0.39	0.00	0.00	860418	1.95	2.79	1.62
860319	0.00	0.00	3.24	860419	4.29	2.79	1.62
860320	0.39	0.00	3.24	860420	4.68	2.79	3.24
860321	1.17	1.86	4.86	860421	2.73	1.86	1.62
860322	1.95	0.93	12.96	860422	1.56	0.93	3.24
860323	5.07	7.44	22.68	860423	8.58	2.79	25.92
860324	2.73	1.86	1.62	860424	7.80	1.86	11.34
860325	1.95	0.93	1.62	860425	5.85	0.93	14.58
860326	1.95	1.86	1.62	860426	8.97	1.86	17.82
860327	2.73	1.86	0.00	860427	10.14	0.93	19.44
860328	5.07	6.51	6.48	860428	7.41	0.93	17.82
860329	3.51	3.72	6.48	860429	5.85	0.93	17.82
860330	3.12	2.79	3.24	860430	5.46	0.00	16.20
860331	3.90	1.86	3.24				

DATE	KIM	EGIL	ROLF
860501	5.07	0.93	17.82
860502	6.24	0.93	8.10
860503	7.41	0.93	9.72
860504	6.24	0.00	1.62
860505	4.29	0.00	1.62
860506	1.95	0.93	0.00
860507	1.95	0.00	1.62
860508	0.78	0.00	1.62
860509	0.78	0.00	0.00
860510	0.78	0.00	16.20
860511	0.78	0.00	4.86
860512	0.78	0.00	1.62
860513	1.56	0.00	1.62
860514	0.78	0.00	3.24
860515	5.07	0.00	14.58
860516	12.48	0.00	16.20
860517	1.17	0.00	0.00
860518	1.95	0.00	8.10
860519	4.29	0.00	1.62
860520	0.39	0.00	0.00
860521	1.17	17.67	25.92
860522	1.56	3.72	6.48
860523	3.90	0.93	1.62
860524	0.78	0.93	0.00
860525	0.78	0.00	0.00
860526	0.00	0.93	3.24
860527	0.39	4.65	1.62
860528	0.00	2.79	0.00
860529	0.00	2.79	0.00
860530	0.00	0.00	1.62
860531	0.00	0.00	0.00

DATE	KIM	EGIL	ROLF
860601	0.00	0.00	0.00
860602	0.00	0.00	0.00
860603	0.00	0.00	0.00
860604	0.00	0.00	24.30
860605	1.17	0.93	3.24
860606	0.39	0.00	0.00
860607	4.29	0.00	29.16
860608	0.39	0.00	1.62
860609	0.00	0.93	1.62
860610	0.00	0.00	1.62
860611	0.00	0.00	0.00
860612	1.17	2.79	1.62
860613	0.39	0.93	0.00
860614	0.00	0.93	0.00
860615	0.39	0.00	0.00
860616	0.00	0.00	0.00
860617	0.00	0.00	0.00
860618	0.00	0.00	0.00
860619	0.00	1.86	1.62
860620	0.00	0.00	0.00
860621	0.00	0.00	0.00
860622	0.00	0.00	0.00
860623	0.00	0.00	0.00
860624	0.00	0.00	0.00
860625	0.00	0.00	0.00
860626	0.00	0.00	0.00
860627	0.00	0.00	0.00
860628	0.00	0.00	0.00
860629	0.00	0.00	0.00
860630	0.00	0.00	0.00

DATE	KIM	EGIL	ROLF	DATE	KIM	EGIL	ROLF
860701	0.00	0.00	0.00	860801	1.95	5.58	4.86
860702	0.00	0.00	0.00	860802	0.00	0.00	0.00
860703	0.00	0.00	0.00	860803	0.00	0.93	1.62
860704	0.00	0.00	0.00	860804	5.07	6.51	6.48
860705	0.00	0.00	0.00	860805	0.78	0.93	0.00
860706	0.00	0.00	0.00	860806	0.39	0.00	0.00
860707	0.00	0.00	0.00	860807	0.00	2.79	4.86
860708	0.00	0.00	0.00	860808	3.12	7.44	6.48
860709	0.00	0.00	0.00	860809	3.51	1.86	3.24
860710	0.00	0.00	0.00	860810	0.00	0.00	0.00
860711	0.00	0.00	0.00	860811	0.39	0.93	1.62
860712	0.00	0.00	0.00	860812	0.00	0.00	0.00
860713	0.00	0.00	0.00	860813	0.00	0.00	0.00
860714	0.00	0.00	0.00	860814	0.00	0.00	0.00
860715	0.00	0.00	0.00	860815	1.95	16.74	22.68
860716	0.00	0.00	0.00	860816	8.58	13.95	14.58
860717	0.00	0.00	0.00	860817	4.68	2.79	3.24
860718	0.00	15.81	0.00	860818	0.39	0.93	1.62
860719	0.00	0.00	0.00	860819	0.39	0.93	0.00
860720	0.00	0.00	0.00	860820	0.00	0.93	1.62
860721	0.00	0.93	0.00	860821	1.56	1.86	0.00
860722	0.00	0.00	0.00	860822	1.17	0.00	0.00
860723	0.00	0.00	0.00	860823	0.00	0.00	0.00
860724	0.00	0.00	0.00	860824	0.00	2.79	3.24
860725	0.00	0.00	0.00	860825	2.73	1.86	3.24
860726	0.00	0.00	0.00	860826	0.39	0.93	0.00
860727	0.00	0.00	0.00	860827	5.46	35.34	53.46
860728	0.00	0.00	0.00	860828	20.28	17.67	79.38
860729	2.34	25.11	12.96	860829	14.04	0.00	11.34
860730	7.80	8.37	8.10	860830	0.78	0.00	1.62
860731	1.17	5.58	1.62	860831	0.39	0.00	0.00

DATE	KIM	EGIL	ROLF	DATE	KIM	EGIL	ROLF
860901	0.00	0.00	0.00	861001	0.00	0.00	0.00
860902	0.00	0.00	0.00	861002	0.00	0.00	0.00
860903	0.00	0.00	0.00	861003	0.00	0.00	0.00
860904	0.00	0.00	0.00	861004	0.00	0.00	0.00
860905	0.00	0.00	0.00	861004	0.00	0.00	0.00
860906	0.00	0.00	0.00	861005	0.00	0.00	0.00
860907	0.00	0.00	0.00	861006	0.00	0.00	0.00
860908	0.00	0.00	0.00	861007	0.00	0.00	0.00
860909	0.00	0.00	0.00	861008	0.00	0.00	0.00
860910	0.00	0.00	0.00	861009	0.00	0.00	0.00
860911	0.00	0.00	0.00	861010	0.00	0.00	0.00
860912	0.00	0.00	0.00	861011	0.00	0.00	0.00
860913	0.00	0.00	0.00	861012	0.00	0.00	0.00
860914	0.00	0.00	0.00	861013	0.00	0.00	0.00
860915	0.00	0.00	0.00	861014	0.00	0.00	0.00
860916	0.00	0.00	0.00	861015	0.00	0.00	0.00
860917	0.00	0.00	0.00	861016	0.00	0.00	0.00
860918	0.00	0.00	0.00	861017	0.00	0.00	0.00
860919	0.00	0.00	0.00	861018	0.00	1.86	1.62
860920	0.00	0.00	0.00	861019	15.21	14.88	58.32
860921	0.00	0.00	0.00	861020	0.00	0.00	0.00
860922	0.00	0.00	0.00	861021	0.00	0.00	0.00
860923	0.00	0.00	0.00	861022	0.00	0.00	0.00
860924	0.00	0.00	0.00	861023	0.00	0.00	0.00
860925	0.00	0.00	0.00	861024	13.65	9.30	8.10
860926	0.00	0.00	0.00	861025	3.90	2.79	14.58
860927	0.00	0.00	0.00	861026	21.06	4.65	24.30
860928	0.00	0.00	0.00	861027	5.85	1.86	14.58
860929	0.00	0.00	0.00	861028	15.99	7.44	24.30
860930	0.00	0.00	0.00	861029	12.09	8.37	11.34
				861030	7.80	6.51	27.54
				861031	9.36	8.37	9.72

DATE	KIM	EGIL	ROLF	DATE	KIM	EGIL	ROLF
861101	0.39	0.00	1.62	861201	0.39	0.00	1.62
861102	0.00	0.00	0.00	861202	1.17	0.93	3.24
861103	0.00	0.00	0.00	861203	2.34	2.79	8.10
861104	0.00	0.00	0.00	861204	3.51	3.72	1.62
861105	0.00	0.00	0.00	861205	1.95	10.23	11.34
861106	0.00	0.00	0.00	861206	0.78	0.93	8.10
861107	0.00	0.00	0.00	861207	0.39	0.93	4.86
861108	7.41	6.51	12.96	861208	1.95	15.81	11.34
861109	5.07	1.86	3.24	861209	0.39	2.79	16.20
861110	10.53	13.95	35.64	861210	0.39	1.86	8.10
861111	1.17	3.72	8.10	861211	1.17	0.93	3.24
861112	0.39	2.79	1.62	861212	3.51	2.79	3.24
861113	0.39	0.93	1.62	861213	2.34	0.00	4.86
861114	3.12	3.72	21.06	861214	1.56	0.93	3.24
861115	12.09	0.00	14.58	861215	0.39	0.93	1.62
861116	6.24	0.00	3.24	861216	0.00	0.00	0.00
861117	4.29	0.00	4.86	861217	0.78	1.86	1.62
861118	5.07	0.00	14.58	861218	0.39	2.79	0.00
861119	4.68	0.00	3.24	861219	0.78	0.93	1.62
861120	1.17	0.93	6.48	861220	0.39	0.93	0.00
861121	0.78	0.93	1.62				
861122	3.90	6.51	21.06				
861123	10.92	13.95	11.34				
861124	10.53	13.02	16.20				
861125	6.24	8.37	4.86				
861126	5.85	7.44	8.10				
861127	3.12	10.23	1.62				
861128	1.17	7.44	0.00				
861129	0.39	0.93	1.62				
861130	0.39	0.00	0.00				

FIL: (SNSF)MAI-VANNF:DATA

APPENDIX 5.

EGIL CATCHMENT RUNOFF DATA (UNITS: UEQ/L, AL IN UG/L, TOC AND SIO2 MG/L)
-99.0 = MISSING DATA.

DATE	PH	NA	K	CA	MG	NH4	NO3	CL	SO4	ILAL	LAL	TOC	SIO2
8511050307	3.93	124.4	13.6	25.0	42.8	68.9	75.3	200.3	145.7	347	245.	18.2	-99.
8511051617	3.85	147.9	21.0	33.4	58.4	66.8	107.1	248.2	170.7	268	288.	12.8	-99.
8511052009	3.97	94.0	16.1	22.0	32.9	50.0	69.6	146.7	135.3	191	145.	10.5	-99.
8511060058	4.03	92.2	14.1	17.5	26.3	40.7	56.8	126.9	133.2	188	115.	11.0	-99.
8511090000	3.97	123.1	11.0	18.5	32.9	35.7	46.1	225.7	104.1	176	174.	11.2	-99.
8511120000	4.01	114.8	9.2	17.5	32.1	21.8	45.0	197.5	93.7	200	214.	10.4	-99.
8512040000	4.27	104.4	7.4	14.5	37.8	35.0	42.5	152.3	79.1	208	310.	9.8	-99.
8512170000	4.08	109.6	9.2	19.0	28.0	42.1	63.2	104.4	102.0	188	276.	9.7	-99.
8603070000	4.24	144.4	33.8	35.4	60.0	92.8	88.5	186.2	193.6	178	352.	10.6	-99.
8603080000	4.16	167.0	46.0	46.4	65.0	132.1	124.9	197.5	216.5	114	87.	10.6	-99.
8603100000	4.20	154.0	41.9	43.9	59.2	128.5	101.0	189.0	204.0	114	83.	12.3	-99.
8603260000	4.20	119.6	36.8	37.9	49.4	117.8	72.1	118.5	202.0	106	59.	11.5	-99.
8604010000	4.37	87.0	13.3	11.0	18.1	50.0	28.6	90.3	97.9	135	140.	8.8	-99.
8604030000	4.36	61.8	12.8	8.5	13.2	34.3	27.1	64.9	66.6	120	35.	9.4	-99.
8604100000	4.27	70.9	12.3	31.4	16.5	42.8	22.1	73.3	118.7	183	70.	11.3	-99.
8604240000	4.19	80.9	12.3	10.0	17.3	50.0	36.1	84.6	97.9	166	204.	11.5	-99.
8605220000	4.06	105.3	17.4	19.5	25.5	67.8	68.2	95.9	145.7	243	157.	12.1	-99.
8605290000	4.08	107.0	18.7	25.4	29.6	92.8	50.0	143.9	154.1	256	124.	14.5	-99.
8606190000	3.94	130.5	7.7	21.5	33.7	34.6	48.6	118.5	166.6	215	237.	12.5	-99.
8607180000	3.88	127.9	6.6	27.4	42.0	29.3	47.8	70.5	395.6	263	277.	12.7	-99.
8607290000	4.02	78.3	3.8	23.5	30.4	31.8	55.3	42.3	156.1	264	131.	14.6	-99.
8607300000	4.01	74.8	2.8	14.5	22.2	9.6	15.7	42.3	158.2	272	123.	12.1	-99.
8608070000	3.99	83.1	4.1	19.0	26.3	13.6	18.9	67.7	177.0	273	212.	14.2	4.5
8608210000	4.07	67.9	3.3	11.0	17.3	11.1	10.3	64.9	95.8	334	181.	17.6	4.5
8608280000	4.25	38.7	3.8	8.5	9.0	9.3	8.6	39.5	58.3	124	21.	10.7	.8
8609050000	4.22	49.2	5.4	9.5	11.5	7.5	8.4	48.0	56.2	257	115.	16.4	2.0
8610210000	3.88	130.5	6.6	29.4	51.0	18.2	54.3	129.8	270.7	200	230.	9.0	6.3
8610280000	3.91	110.9	10.7	25.9	43.6	30.3	47.8	163.6	179.1	208	222.	9.9	3.3
8610300000	5.60	88.3	13.8	16.5	25.5	24.6	18.2	166.4	87.4	146	64.	10.3	1.1
8611060000	4.01	112.2	11.3	29.9	35.4	20.0	20.3	234.1	108.3	161	274.	8.8	2.1
8611070000	3.93	114.0	10.0	22.0	36.2	14.6	31.1	234.1	116.6	195	325.	8.7	3.5
8611100000	4.14	82.6	8.4	11.5	17.3	21.8	12.5	138.2	66.6	141	63.	10.6	1.2
8611120000	4.15	81.3	8.7	12.0	16.5	22.1	12.2	138.2	66.6	151	45.	11.3	1.1
8611140000	4.01	125.3	10.7	19.0	29.6	25.3	26.8	217.2	102.0	163	157.	8.6	1.8
8611200000	4.11	124.4	12.0	31.4	36.2	20.0	60.0	177.7	141.6	196	509.	6.8	1.7
8611270000	4.01	111.4	10.5	19.0	28.8	20.7	59.6	166.4	110.3	141	159.	6.4	1.2
8612040000	4.02	118.3	11.8	18.5	27.1	25.3	40.0	166.4	102.0	186	179.	8.1	1.8
8612041000	4.02	116.1	11.5	20.0	28.8	24.6	40.0	163.6	102.0	183	152.	8.0	1.8
8612110000	3.98	145.3	13.6	22.0	36.2	26.1	50.0	191.8	118.7	145	275.	5.5	1.4

KIM CATCHMENT RUNOFF DATA (UNITS: UEQ/L, AL IN UG/L, TOC AND SIO2 MG/L)
-99.0 = MISSING DATA.

DATE	PH	NA	K	CA	MG	NH4	NO3	CL	SO4	ILAL	LAL	TOC	SIO2
8511050000	3.96	127.9	8.2	16.0	27.1	12.5	24.3	160.8	97.9	347	189	26.1	-99.
8511060300	3.96	123.5	6.9	15.5	25.5	9.6	22.1	158.0	108.3	347	161	24.3	-99.
8511060900	3.98	120.9	5.6	15.5	24.7	8.9	20.0	160.8	91.6	347	145	24.1	-99.
8511061430	3.99	117.4	5.6	14.0	23.0	7.5	18.6	158.0	85.4	344	144	21.7	-99.
8511090000	4.01	111.4	7.2	12.0	20.6	8.6	13.9	169.3	66.6	293	99	22.1	-99.
8511091000	4.01	103.1	10.2	14.0	20.6	16.1	8.9	225.7	64.5	250	86	25.0	-99.
8511092000	4.01	100.5	7.9	13.0	18.9	7.5	14.3	225.7	58.3	235	71	20.9	-99.
8512050000	4.10	117.9	7.9	18.5	22.2	7.1	11.3	158.0	62.5	263	167	14.2	-99.
8512180000	4.11	109.6	4.9	12.0	18.9	12.5	8.6	141.0	54.1	264	104	18.6	-99.
8603230000	4.18	147.9	25.6	43.9	45.2	50.0	40.7	189.0	116.6	211	163	28.9	-99.
8603260000	4.12	169.7	19.4	28.4	42.0	46.4	40.0	200.3	118.7	245	135	18.3	-99.
8603860000	4.11	224.0	44.2	65.9	65.0	29.3	44.3	290.6	137.4	267	197	17.6	-99.
8604010000	4.25	101.8	14.3	17.0	19.7	28.2	25.0	112.8	64.5	183	63	16.5	-99.
8604030000	4.19	102.7	11.0	13.5	17.3	20.0	23.2	112.8	54.1	194	52	16.1	-99.
8604100000	4.31	77.0	7.2	7.0	10.7	18.2	16.1	64.9	43.7	234	23	12.7	-99.
8604250000	4.26	69.6	8.4	9.0	10.7	15.7	22.8	50.8	52.0	146	60	14.1	-99.
8604300000	4.44	47.0	6.6	4.5	5.8	10.7	10.6	31.0	31.2	169	12	13.0	-99.
8605150000	4.36	58.3	7.2	9.0	10.7	9.6	9.6	39.5	37.5	271	22	13.8	-99.
8605160000	4.10	79.6	10.2	11.5	17.3	15.4	21.4	76.2	68.7	260	28	17.2	-99.
8605220000	4.17	71.3	8.9	10.5	12.3	17.1	15.4	70.5	66.6	237	41	13.4	-99.
8605270000	4.20	70.9	8.7	11.0	12.3	10.7	6.5	84.6	45.8	267	73	14.7	-99.
8606160000	4.20	74.8	5.6	9.5	14.8	11.1	8.4	87.5	43.7	242	61	12.8	-99.
8607291312	4.06	136.6	9.7	38.9	41.1	46.4	41.8	155.2	204.0	251	269	14.2	-99.
8607291815	4.12	107.9	11.8	35.4	42.8	60.7	57.1	112.8	177.0	196	204	12.6	-99.
8607291943	4.11	104.4	12.5	35.4	43.6	60.7	64.3	110.0	179.1	187	198	12.6	-99.
8607292101	4.00	114.4	10.7	29.4	40.3	32.8	68.2	132.6	162.4	228	257	13.9	-99.
8607292221	3.97	114.4	7.2	21.0	35.4	18.2	66.0	155.2	116.6	278	247	15.4	-99.
8607292341	3.97	118.8	6.6	21.5	35.4	21.8	70.0	149.5	137.4	296	254	15.8	-99.
8607300217	3.96	118.3	5.9	20.0	35.4	17.1	70.7	163.6	122.8	306	254	14.5	-99.
8607300335	3.95	117.9	5.6	20.5	35.4	17.5	70.3	166.4	118.7	314	236	15.5	-99.
8607300443	3.95	118.3	5.4	20.0	35.4	16.8	69.3	174.9	112.4	315	245	15.0	-99.
8607300609	3.96	118.3	5.4	21.0	35.4	15.4	68.5	177.7	122.8	318	242	17.0	-99.
8608040000	3.81	119.6	6.4	30.9	51.0	13.6	15.7	126.9	229.0	191	269	14.0	5.2
8608060000	4.00	107.4	4.9	13.0	21.4	6.8	13.0	118.5	93.7	343	167	22.1	5.0
8608180000	4.15	85.7	3.8	8.0	14.8	5.4	3.5	104.4	43.7	303	162	19.0	4.1
8608260000	4.13	82.2	3.6	10.0	14.8	3.2	3.7	87.5	43.7	345	150	22.2	2.8
8608280000	4.09	74.4	4.6	12.0	14.8	5.0	6.2	70.5	45.8	288	18	24.3	2.0
8609050000	4.19	72.6	4.3	7.5	11.5	5.7	2.0	81.8	50.0	296	149	19.7	1.9
8610190000	3.95	134.8	13.0	21.0	34.5	13.2	42.1	143.9	120.8	326	124	19.0	4.2

8610210000	4.04	126.2	8.4	18.5	38.7	6.8	25.0	152.3	108.3	385	215	19.3	4.1
8610260000	4.02	97.4	5.4	12.5	22.2	5.4	14.1	129.8	77.0	271	89	16.3	2.8
8610280000	4.02	93.5	6.1	10.0	20.6	5.4	8.6	138.2	66.6	259	76	15.8	2.1
8611060000	3.95	112.7	6.9	16.5	29.6	4.6	3.8	290.6	41.6	226	224	11.7	2.3
8611070000	3.98	114.4	5.4	14.5	26.3	2.1	2.8	265.2	50.0	230	205	11.2	2.9
8611120000	3.97	98.3	9.2	14.0	27.1	4.6	5.1	256.7	33.3	226	129	11.5	1.4
8611140000	3.98	108.3	7.2	15.0	28.0	3.9	5.1	259.5	41.6	211	114	11.1	2.2
8611200000	4.05	98.7	7.7	15.0	26.3	2.1	7.9	191.8	77.0	221	139	11.0	2.2
8611270000	4.10	80.5	6.9	9.5	18.1	3.2	9.6	124.1	68.7	238	102	12.9	1.7
8611271000	4.09	80.0	6.9	9.0	18.1	3.2	9.4	124.1	70.8	235	100	13.0	1.7
8612040000	4.14	77.4	6.9	9.0	17.3	3.9	8.1	93.1	60.4	271	69	14.8	2.1
8612080000	4.21	79.2	6.4	16.5	18.1	12.1	23.9	93.1	58.3	152	97	7.9	1.4

ROLF CATCHMENT RUNOFF DATA (UNITS: UEQ/L, AL IN UG/L, TOC AND SIO2 MG/L)
-99.0 = MISSING DATA.

DATE	PH	NA	K	CA	MG	NH4	NO3	CL	SO4	ILAL	LAL	TOC	SIO2
8511050000	3.77	142.7	7.2	37.4	63.3	5.4	53.5	242.6	164.5	240	252	13.2	-99.
8511060000	3.86	124.4	2.6	26.4	45.2	3.6	37.1	191.8	147.8	198	142	11.1	-99.
8511090000	3.95	104.4	3.6	20.0	31.3	4.6	23.6	197.5	89.5	111	96	10.3	-99.
8511100000	3.98	98.3	2.6	17.0	26.3	2.5	15.4	197.5	77.0	123	96	10.7	-99.
8512040000	3.96	104.8	2.8	17.5	29.6	5.7	18.2	160.8	85.4	127	89	10.5	-99.
8512050000	4.06	78.3	1.8	12.0	19.7	8.2	20.7	104.4	64.5	119	64	10.1	-99.
8512130000	4.10	97.0	2.6	18.0	27.1	15.4	41.8	104.4	83.3	132	72	10.0	-99.
8512170000	4.13	73.1	1.5	11.5	18.1	7.5	28.2	73.3	62.5	114	63	8.5	-99.
8603080000	4.09	140.1	9.2	22.5	39.5	39.3	36.4	200.3	118.7	167	145	11.2	-99.
8603130000	4.10	133.1	8.7	21.5	35.4	46.4	26.1	200.3	114.5	155	105	10.6	-99.
8603220000	3.85	208.8	11.8	57.4	108.6	117.8	135.7	220.0	353.9	178	502	10.7	-99.
8604010000	3.97	152.3	7.4	25.9	47.7	30.0	45.0	189.0	141.6	114	168	7.1	-99.
8604030000	3.98	128.8	6.9	24.0	44.4	24.6	47.8	180.5	133.2	110	149	7.1	-99.
8604100000	4.14	96.6	5.1	15.0	26.3	20.7	37.1	104.4	97.9	134	67	8.6	-99.
8604250000	4.11	90.5	5.1	13.5	21.4	17.5	48.2	90.3	72.9	66	98	7.1	-99.
8605020000	4.49	30.5	2.3	4.0	4.9	9.3	9.6	25.4	27.1	80	1	7.6	-99.
8605140000	4.09	78.7	4.6	15.5	19.7	10.7	41.1	70.5	210.3	149	48	12.1	-99.
8605220000	4.06	77.9	4.1	13.5	18.1	5.0	25.3	56.4	108.3	118	50	11.1	-99.
8606050000	3.91	99.6	2.0	25.4	32.9	5.0	42.5	115.7	116.6	139	65	12.2	-99.
8606190000	4.05	78.7	1.0	13.0	18.9	2.9	13.4	62.1	83.3	131	41	12.8	-99.
8607290000	3.81	116.6	18.2	35.4	61.7	50.0	72.1	129.8	270.7	179	246	19.7	-99.
8607291427	3.84	118.3	18.9	36.9	65.0	50.0	70.7	112.8	353.9	171	279	17.5	-99.
8607291600	3.81	123.5	16.1	36.9	64.2	46.4	12.8	110.0	395.6	188	262	16.9	-99.
8607291840	3.81	122.7	13.0	36.9	68.3	46.4	67.1	112.8	333.1	187	298	15.6	-99.
8607291949	3.80	124.0	12.3	35.4	64.2	42.8	67.8	118.5	312.3	191	274	15.6	-99.
8608170000	4.02	84.0	2.0	13.5	22.2	5.0	3.9	93.1	112.4	206	92	16.1	3.5
8608270000	4.05	71.3	2.3	13.5	17.3	4.6	3.7	87.5	58.3	234	67	17.8	3.7
8608280000	4.23	40.0	1.5	6.5	7.4	4.3	3.6	33.9	47.9	85	13	11.1	.6
8609050000	4.26	41.8	1.0	7.0	8.2	1.8	2.4	39.5	45.8	154	46	14.5	1.1
8610190000	3.84	117.4	6.6	33.9	47.7	16.8	42.8	169.3	160.3	186	189	15.0	2.6
8610210000	3.83	134.8	1.0	28.4	49.4	2.9	16.1	163.6	210.3	172	168	10.5	3.5
8610290000	4.05	73.1	2.0	9.5	15.6	3.2	14.3	87.5	72.9	122	19	11.6	.8
8610310000	3.98	112.7	3.3	15.0	26.3	2.9	6.7	186.2	72.9	125	54	9.3	.9
8611060000	3.94	114.0	2.8	20.0	32.1	2.1	1.9	262.4	68.7	141	136	9.5	1.7
8611070000	3.90	119.6	2.6	20.5	35.4	1.4	.8	287.7	70.8	150	142	9.6	2.1
8611140000	3.95	125.7	3.3	19.5	32.1	6.1	12.3	256.7	79.1	121	107	8.4	1.2
8611200000	4.16	138.3	4.1	66.9	32.1	.7	18.9	214.4	120.8	108	123	7.3	1.0
8611260000	3.94	149.6	3.8	19.0	32.9	3.9	36.1	225.7	124.9	103	122	6.4	.9
8611270000	3.99	147.5	3.8	17.5	30.4	2.1	25.0	222.9	116.6	122	106	7.1	1.1

8612030000	3.98	146.2	4.6	20.0	30.4	4.3	13.1	194.6	91.6	127	87	10.3	1.2
8612040000	3.94	163.6	4.9	23.5	35.4	2.5	11.4	231.3	91.6	134	109	9.0	1.4
8612080000	3.88	191.8	6.4	30.4	50.2	6.8	33.2	282.1	108.3	101	179	6.0	.7

APPENDIX 6.

EGIL CATCHMENT PRECIPITATION DATA. UNITS: UEQ/L 1984-85
(VOLUME IS MM APPLIED BENEATH ROOF)

DATE ON - DATE OFF	MM	PH	NA	K	CA	MG	NH4	NO3	CL	SO4
841029-841107	24.3	4.11	43.5	4.1	10.0	10.7	55.7	64.3	48.0	87.4
841114-841121	58.2	4.13	113.1	6.6	15.0	28.8	94.2	60.7	141.0	134.9
841121-841129	64.3	4.16	113.1	5.1	5.0	26.3	50.0	57.8	143.9	81.2
841129-841206	22.2	3.93	56.5	5.6	15.0	14.0	128.5	115.0	67.7	156.1
841206-841212	14.2	4.18	73.9	6.6	10.0	16.5	31.4	47.1	93.1	73.7
841212-850429	114	4.42	47.8	5.1	5.0	10.7	7.1	61.4	62.1	43.7
850430-850507	16.2	4.60	4.3	0.2	5.0	0.8	20.0	16.4	2.8	31.9
850507-850515	1.2	4.78	8.7	7.9	74.8	14.0	107.1	42.1	8.5	189.9
850515-850523	17.7	4.31	4.3	1.3	20.0	3.3	51.4	25.7	2.8	93.7
850523-850530	9.2	3.73	21.8	4.6	20.0	7.4	121.4	112.8	25.4	216.7
850606-850613	20.0	4.40	21.8	6.1	5.0	7.4	35.7	25.0	19.7	45.0
850613-850620	34.5	4.49	8.7	5.1	5.0	0.8	14.3	12.9	2.8	48.1
850627-850704	17.7	6.40	30.5	22.0	25.0	10.7	164.2	15.7	19.7	63.7
850704-850711	11.1	3.96	13.0	2.6	10.0	4.1	14.3	13.6	11.3	110.6
850711-850719	39.7	4.01	13.0	0.7	5.0	2.5	34.3	41.4	11.3	76.8
850719-850725	3.4	4.37	30.5	3.6	5.0	8.2	2.9	0.7	31.0	38.7
850725-850801	39.1	4.40	4.3	0.2	5.0	0.8	2.9	3.6	2.8	36.2
850801-850808	20.5	4.63	21.8	1.5	5.0	4.9	4.3	1.4	16.9	18.1
850808-850815	57.4	4.00	26.1	2.6	5.0	7.4	54.3	50.7	31.0	100.6
850815-850822	32.5	4.08	17.4	0.7	5.0	5.8	4.3	14.3	19.7	46.8
850822-850829	18.6	4.27	43.5	1.8	5.0	10.7	31.4	33.6	53.6	43.1
850829-850905	45.8	4.25	13.0	1.5	5.0	3.3	22.8	31.4	16.9	44.3
850905-850911	28.0	5.09	4.3	1.3	5.0	0.8	2.9	2.1	5.6	10.0
850911-850919	42.2	4.08	43.5	5.4	10.0	9.9	63.5	70.7	56.4	76.2
850919-850927	14.6	4.08	21.8	4.3	5.0	4.9	25.0	35.7	31.0	59.3
850927-851002	7.7	4.10	4.3	4.1	20.0	4.9	25.0	15.7	11.3	84.9
851002-851011	52.0	4.25	39.1	2.8	10.0	8.2	62.8	62.1	42.3	69.3
851107-851114	54.8	4.21	91.3	6.1	34.9	24.7	72.8	44.3	112.8	134.3

FIL: (SNSF)WRI-RISN-EGIL:SYMB

RISDALSHEIA PRECIPITATION EGIL CATCHMENT (UNITS: UEQ/L) 1985-86

DATE ON OFF	MM	PH	NA	K	CA	MG	NH4	NO3	CL	SO4
851114-0514	107	4.65	17.4	2.0	5.5	4.1	39.3	22.9	34.8	37.4
860515-0521	29.6	4.16	19.1	2.0	10.0	4.9	61.4	45.0	23.4	95.5
860522-0529	14.6	3.89	120.1	3.8	13.0	28.3	57.1	81.4	115.6	137.9
860530-0604	0.3	4.15	13.1	1.8	3.5	3.5	70.0	55.7	9.6	85.5
860605-0611	2.6	4.08	7.2	2.0	12.5	4.9	42.8	43.6	11.3	101.9
860612-0618	17.5	4.03	10.2	9.7	18.0	9.1	125.7	60.0	16.9	178.9
860710-0716	6.2	4.11	9.6	2.6	12.0	4.4	12.8	35.7	14.7	89.2
860717-0723	33.6	4.09	15.7	.3	9.0	4.1	0.	0.	19.7	93.7
860724-0730	45.1	4.14	8.7	1.5	4.0	24.7	25.7	35.7	8.5	62.5
860731-0806	22.2	3.86	37.0	5.4	16.5	10.7	32.8	52.8	36.7	108.3
860807-0813	20.0	4.01	30.5	2.6	21.5	11.5	90.0	68.5	36.7	118.7
860814-0820	46.5	4.05	17.4	.5	7.0	5.8	12.9	23.6	22.6	56.2
860821-0827	77.0	4.29	16.5	.5	3.0	4.9	0.	1.4	22.6	31.2
860828-0904	42.4	4.41	26.1	2.3	3.5	6.6	18.6	27.1	31.0	41.6
860905-0910	1.4	4.66	21.8	7.7	8.0	3.8	0.	0.	28.8	14.4
860911-0917	5.8	4.55	26.1	2.6	5.5	5.4	28.6	0.	37.0	44.3
860925-1001	1.6	4.15	75.7	4.9	28.4	19.4	55.7	0.	77.9	139.3
861002-1008	4.4	4.31	52.2	2.6	20.0	13.0	0.	0.	63.5	87.4
861009-1015	6.0	3.67	26.1	13.0	20.5	9.4	38.6	101.4	42.0	183.6
861016-1023	27.5	4.13	39.1	5.1	4.0	10.0	65.7	49.3	54.7	97.4
861024-1030	58.2	4.27	63.1	2.8	6.0	14.8	22.8	42.1	81.2	51.8
861031-1106	10.8	4.56	45.7	3.3	3.5	9.7	5.7	8.6	55.3	24.4
861107-1113	48.5	4.29	75.7	3.1	8.5	18.1	19.3	31.4	93.4	39.3
861114-1119	38.0	4.31	48.7	4.9	11.5	12.0	72.8	50.7	61.2	88.7
861120-1126	51.7	4.14	93.1	5.6	11.0	22.4	57.1	75.7	110.0	79.3
861127-1203	14.8	4.28	134.0	5.4	8.0	31.9	17.1	31.4	162.8	61.8
861204-1210	39.1	4.43	80.5	4.4	15.0	19.1	52.8	36.4	87.4	80.5

KIM CATCHMENT PRECIPITATION DATA. WEEKLY BULK SAMPLES. UNITS: UEQ/L 1984-85
(VOLUME IS MM APPLIED BENEATH ROOF).

DATE ON	DATE OFF	MM	PH	NA	K	CA	MG	NH4N	NO3N	CL	SO4
841029	841107	45.9	5.05	30.5	1.5	5.0	7.4	2.9	7.9	36.7	11.9
841107	841114	9.1	4.79	26.1	6.6	5.0	57.6	3.6	7.1	39.5	15.6
841121	841129	45.7	4.82	100.1	3.8	5.0	21.4	2.9	3.6	138.2	16.9
841129	841206	27.3	5.01	78.3	1.8	5.0	18.1	2.9	7.1	95.9	20.6
841206	841212	12.0	4.85	82.6	3.6	5.0	18.9	5.7	.7	107.2	12.5
841212	850429	114.0	4.80	56.5	2.8	5.0	13.2	0.0	.7	73.3	8.1
850430	850507	13.3	5.23	104.4	2.0	5.0	24.7	5.7	2.9	121.3	17.5
850507	850515	1.0	5.79	147.9	-99.	20.0	24.7	-99.	41.4	-99.	63.7
850515	850523	18.2	5.02	100.1	3.8	5.0	23.0	2.9	.7	115.7	15.6
850523	850530	14.0	5.38	117.4	5.6	10.0	27.1	7.1	2.9	129.8	20.6
850606	850613	12.1	5.30	56.5	8.2	5.0	14.8	12.9	.7	67.7	12.5
850613	850620	39.7	5.34	47.8	2.0	5.0	12.3	2.9	.7	76.2	10.0
850627	850704	12.7	5.31	56.5	3.1	5.0	14.8	2.9	.7	84.6	10.0
850704	850711	8.5	4.90	60.9	-99.	5.0	14.8	0.0	0.0	69.1	11.2
850711	850719	27.4	4.85	56.5	-99.	5.0	14.0	2.9	0.0	71.7	10.6
850719	850725	10.4	5.10	56.5	-99.	5.0	14.0	15.7	.7	71.7	8.7
850725	850801	26.9	5.27	52.2	-99.	5.0	13.2	0.0	.7	66.6	8.1
850801	850808	42.6	5.10	56.5	-99.	5.0	14.0	0.0	1.4	58.9	8.1
850808	850815	37.5	4.88	60.9	-99.	5.0	14.8	0.0	1.4	66.6	11.8
850815	850822	33.8	5.27	4.4	-99.	0.0	1.6	0.0	1.4	0.3	5.0
850822	850829	12.4	5.08	108.8	-99.	5.0	24.7	0.0	0.0	110.1	16.8
850829	850905	29.3	5.15	78.3	-99.	5.0	19.8	0.0	0.0	87.0	13.1
850905	850911	17.9	5.26	69.6	-99.	5.0	15.6	0.0	0.0	79.4	10.0
850911	850919	0.3	5.20	130.5	-99.	15.0	32.1	-99.	0.0	-99.	33.1
850919	850927	13.7	5.53	69.6	-99.	5.0	14.8	4.3	0.0	76.8	13.7
850927	851002	4.4	4.95	56.5	-99.	5.0	15.6	0.0	0.0	66.6	23.1
851002	851011	52.2	4.99	56.5	-99.	5.0	13.2	0.0	0.0	69.1	11.9
851031	851106	30.0	5.22	65.2	-99.	5.0	15.6	0.0	0.0	71.7	13.7
851106	851114	28.4	5.21	39.2	-99.	5.0	9.1	0.0	0.0	43.5	8.1

FIL: (SNSF)WRI-RISNIN:SYMB

RISDALSHEIA PRECIPITATION KIM CATCHMENT (UNITS: UEQ/L) 1985-86

DATE ON OFF	MM	PH	NA	K	CA	MG	NH4	NO3	CL	SO4
851114-0511	178	4.78	74.8	4.6	6.4	17.3	2.5	1.0	89.3	14.6
860512-0522	35.8	5.16	52.2	1.5	7.0	12.3	0.	1.4	67.7	10.4
860523-0529	11.0	4.92	39.2	2.3	3.5	9.9	0.	1.4	45.1	10.4
860530-0604	6.0	5.20	73.1	3.3	6.0	13.2	0.	0.	81.8	6.2
860605-0611	11.7	4.60	62.6	3.1	5.5	15.6	0.	1.4	70.5	10.4
860612-0618	9.4	5.47	66.1	9.2	18.0	14.0	14.3	0.7	76.1	12.5
860703-0709	1.7	5.35	67.0	11.8	16.0	24.7	0.	0.	84.6	10.4
860710-0716	0.9	5.51	60.9	7.7	18.5	23.0	0.	0.	73.3	25.0
860717-0723	23.0	5.26	47.8	.3	3.5	11.5	0.	0.	62.1	8.3
860724-0730	40.3	5.12	43.5	.8	2.5	10.7	0.	0.	53.6	8.3
860731-0806	22.2	5.08	50.0	1.8	4.5	11.5	0.	0.	55.3	10.4
860807-0813	18.6	4.64	54.4	4.6	4.5	11.5	0.	0.	70.5	10.4
860814-0820	35.8	5.12	39.1	1.3	5.0	9.9	0.	0.	45.1	8.3
860821-0827	41.0	5.35	29.6	.5	3.5	8.2	0.	0.	36.7	6.2
860828-0904	30.0	5.36	45.2	.8	3.5	11.5	0.	0.	56.4	8.3
860911-0917	4.0	5.37	51.3	3.6	4.0	10.2	0.	0.	63.5	8.1
860925-1001	1.3	5.58	65.3	4.1	9.0	15.5	20.0	0.	78.1	17.5
861002-1008	5.2	5.19	45.7	.8	4.0	11.7	0.	0.	60.9	11.2
861009-1015	7.3	4.97	45.7	1.5	5.0	12.3	0.	0.	57.5	21.2
861016-1023	36.3	5.12	39.1	.5	2.5	9.5	0.	0.	51.6	11.9
861024-1030	72.4	4.38	39.1	.8	3.5	8.9	0.	0.	99.0	10.6
861031-1106	14.5	3.75	56.5	.5	2.5	7.9	0.	0.	269.7	6.2
861107-1113	26.8	4.10	51.8	1.8	2.0	7.4	0.	0.	141.0	8.1
861114-1119	31.2	4.99	41.8	3.3	3.0	9.2	0.	0.	45.7	12.5
861120-1126	39.7	5.02	26.1	1.5	2.5	6.7	0.	0.	35.5	9.4
861127-1203	10.9	4.37	117.4	5.9	6.0	24.8	0.	0.	189.0	11.9
861204-1209	11.5	4.78	169.6	5.4	12.5	34.6	0.	2.1	192.3	33.1

ROLF CATCHMENT PRECIPITATION DATA. UNITS: UEQ/L 1984-85

DATE ON - DATE OFF	MM	PH	NA	K	CA	MG	NH4	NO3	CL	SO4
841029-841107	46.7	4.11	43.5	4.1	10.0	10.7	55.7	64.3	48.0	87.4
841114-841121	31.7	4.13	113.1	6.6	15.0	28.8	94.2	60.7	141.0	134.9
841121-841129	108.3	4.16	113.1	5.1	5.0	26.3	50.0	57.8	143.9	81.2
841129-841206	41.4	3.93	56.5	5.6	15.0	14.0	128.5	115.0	67.7	156.1
841206-841212	4.0	4.18	73.9	6.6	10.0	16.5	31.4	47.1	93.1	73.7
850115-850122	16.1	3.88	26.1	5.1	29.9	8.2	71.5	88.7	31.1	145.4
850122-850129	22.6	4.05	95.7	4.1	14.9	23.0	20.0	61.5	104.3	68.6
850129-850205	8.1	4.10	56.6	4.1	10.0	14.8	27.2	46.5	67.7	71.8
850219-850226	8.3	3.84	126.2	13.8	14.9	26.3	57.2	116.5	95.9	137.9
850226-850307	58.3	4.02	13.0	1.0	5.0	2.5	52.9	59.3	16.9	91.1
850307-850313	1.9	3.53	69.6	4.6	14.9	18.1	185.9	196.6	90.2	260.2
850319-850326	39.8	3.95	13.0	3.6	10.0	4.1	88.7	62.9	11.3	155.4
850326-850402	12.7	4.16	26.1	2.8	5.0	5.8	21.5	35.8	28.2	62.4
850402-850409	30.9	4.43	8.7	0.5	10.0	2.5	25.7	26.5	8.5	52.4
850409-850416	12.1	3.62	413.2	12.8	25.0	100.4	278.8	264.6	541.4	310.1
850416-850423	9.9	3.62	56.6	3.3	25.0	15.6	185.9	236.0	107.2	227.1
850423-850430	9.9	4.74	17.4	1.0	0.0	3.3	4.3	12.2	19.7	20.0
850430-850507	16.9	4.60	4.3	0.2	5.0	0.8	20.0	16.4	2.8	31.9
850507-850515	6.4	4.78	8.7	7.9	74.8	14.0	107.1	42.1	8.5	189.9
850515-850523	12.4	4.31	4.3	1.3	20.0	3.3	51.4	25.7	2.8	93.7
850523-850530	17.5	3.73	21.8	4.6	20.0	7.4	121.4	112.8	25.4	216.7
850606-850613	21.3	4.40	21.8	6.1	5.0	7.4	35.7	25.0	19.7	45.0
850613-850620	39.2	4.49	8.7	5.1	5.0	0.8	14.3	12.9	2.8	48.1
850627-850704	41.1	6.40	30.5	22.0	25.0	10.7	164.2	15.7	19.7	63.7
850704-850711	11.3	3.96	13.0	2.6	10.0	4.1	14.3	13.6	11.3	110.6
850711-850719	72.6	4.01	13.0	0.7	5.0	2.5	34.3	41.4	11.3	76.8
850719-850725	1.9	4.37	30.5	3.6	5.0	8.2	2.9	0.7	31.0	38.7
850725-850801	47.5	4.40	4.3	0.2	5.0	0.8	2.9	3.6	2.8	36.2
850801-850808	109.9	4.63	21.8	1.5	5.0	4.9	4.3	1.4	16.9	18.1
850808-850815	69.1	4.00	26.1	2.6	5.0	7.4	54.3	50.7	31.0	100.6
850815-850822	3.2	4.08	17.4	0.7	5.0	5.8	4.3	14.3	19.7	46.8
850822-850829	101.2	4.27	43.5	1.8	5.0	10.7	31.4	33.6	53.6	43.1
850829-850905	51.9	4.25	13.0	1.5	5.0	3.3	22.8	31.4	16.9	44.3
850905-850911	34.4	5.09	4.3	1.3	5.0	0.8	2.9	2.1	5.6	10.0
850911-850919	44.3	4.08	43.5	5.4	10.0	9.9	63.5	70.7	56.4	76.2
850919-850927	14.3	4.08	21.8	4.3	5.0	4.9	25.0	35.7	31.0	59.3
850927-851002	8.0	4.10	4.3	4.1	20.0	4.9	25.0	15.7	11.3	84.9

851002-851011	74.8	4.25	39.1	2.8	10.0	8.2	62.8	62.1	42.3	69.3
851107-851114	44.7	4.21	91.3	6.1	34.9	24.7	72.8	44.3	112.8	134.3

FIL: (SNSF)WRI-RISN-ROLF:SYMB

RISDALSHEIA PRECIPITATION ROLF CATCHMENT (UNITS: UEQ/L) 1985-86

DATE ON OFF	MM	PH	NA	K	CA	MG	NH4	NO3	CL	SO4
851114-1120	4.8	4.27	97.5	6.4	20.0	26.3	50.0	47.9	101.5	94.2
851121-1127	4.6	5.08	26.1	5.6	15.0	15.6	24.3	97.8	45.1	87.4
851128-1204	38.2	4.45	26.9	4.6	5.0	4.4	11.4	15.0	33.4	28.1
851205-1218	46.5	4.24	43.5	2.6	5.0	8.0	15.0	27.3	24.7	27.5
851219-0108	36.3	4.25	50.0	5.6	7.5	16.0	12.9	25.0	62.0	31.2
860109-0115	33.4	4.62	130.5	4.1	11.0	31.3	12.9	17.8	138.2	37.5
860116-0122	30.9	4.59	91.3	4.1	8.5	21.4	12.9	20.0	105.8	31.9
860123-0130	29.6	4.19	51.3	4.6	8.0	12.3	42.8	51.4	61.5	57.5
860227-0305	8.6	4.20	139.2	5.4	25.0	35.4	46.4	61.4	112.8	103.2
860306-0313	17.2	3.87	43.5	5.1	20.0	11.5	82.9	69.3	50.8	167.9
860314-0319	11.5	3.38	34.8	11.3	40.0	10.7	571.0	310.8	56.4	539.9
860320-0325	70.1	4.35	43.5	1.3	5.0	9.1	28.6	30.7	50.8	46.7
860326-0331	22.9	4.20	56.6	2.3	5.0	12.3	39.3	66.4	70.5	56.4
860418-0424	18.0	4.06	130.5	8.2	30.0	33.0	95.7	109.3	146.6	103.6
860502-0511	29.0	3.97	17.4	2.3	25.0	6.6	102.8	85.0	25.4	130.9
860512-0514	7.3	4.00	39.2	2.8	10.0	9.9	55.7	65.0	47.9	90.3
860515-0521	80.6	4.16	19.1	2.0	10.0	4.9	61.4	45.0	23.4	95.5
860522-0529	14.3	3.89	120.1	3.8	13.0	28.3	57.1	81.4	115.6	137.9
860530-0604	38.5	4.15	13.1	1.8	3.5	3.5	70.0	55.7	9.6	85.5
860605-0611	46.2	4.08	7.2	2.0	12.5	4.9	42.8	43.6	11.3	101.9
860612-0618	8.6	4.03	10.2	9.7	18.0	9.1	125.7	60.0	16.9	178.9
860710-0716	10.5	4.11	9.6	2.6	12.0	4.4	12.8	35.7	14.7	89.2
860717-0723	6.4	4.09	15.7	.3	9.0	4.1	0.	0.	19.7	93.7
860724-0730	58.0	4.14	8.7	1.5	4.0	24.7	25.7	35.7	8.5	62.5
860731-0806	26.1	3.86	37.0	5.4	16.5	10.7	32.8	52.8	36.7	108.3
860807-0813	27.1	4.01	30.5	2.6	21.5	11.5	90.0	68.5	36.7	118.7
860814-0820	67.2	4.05	17.4	.5	7.0	5.8	12.9	23.6	22.6	56.2
860821-0827	145.9	4.29	16.5	.5	3.0	4.9	0.	1.4	22.6	31.2
860828-0904	45.9	4.41	26.1	2.3	3.5	6.6	18.6	27.1	31.0	41.6
860905-0910	1.9	4.66	21.8	7.7	8.0	3.8	0.	0.	28.8	14.4
860911-0917	5.4	4.55	26.1	2.6	5.5	5.4	28.6	0.	37.0	44.3
860925-1001	2.7	4.15	75.7	4.9	28.4	19.4	55.7	0.	77.9	139.3
861002-1008	7.0	4.31	52.2	2.6	20.0	13.0	0.	0.	63.5	87.4
861009-1015	9.9	3.67	26.1	13.0	20.5	9.4	38.6	101.4	42.0	183.6
861016-1023	81.8	4.13	39.1	5.1	4.0	10.0	65.7	49.3	54.7	97.4
861024-1030	126.1	4.27	63.1	2.8	6.0	14.8	22.8	42.1	81.2	51.8
861031-1106	13.4	4.56	45.7	3.3	3.5	9.7	5.7	8.6	55.3	24.4
861107-1113	82.2	4.29	75.7	3.1	8.5	18.1	19.3	31.4	93.4	39.3

861114-1119	55.1	4.31	48.7	4.9	11.5	12.0	72.8	50.7	61.2	88.7
861120-1126	66.9	4.14	93.1	5.6	11.0	22.4	57.1	75.7	110.0	79.3
861127-1203	22.0	4.28	134.0	5.4	8.0	31.9	17.1	31.4	162.8	61.8
861204-1210	57.0	4.43	80.5	4.4	15.0	19.1	52.8	36.4	87.4	80.5

FIL:WRI-86RISNEDB:T 1/6-87

APPENDIX 7.

Input-output budgets for water and major ions at EGIL, KIM and ROLF catchments for the period 15 November 1985 - 10 May 1986. Units: meq/m^2 ; NLAL mgAl/m^2 ; TOC gC/m^2 .

winter 1986

	EGIL				KIM				ROLF			
	Input			Out	Input			Out	Input			Out
	Wet	Dry	Total		Wet	Dry	Total		Wet	Dry	Total	
H_2O (mm)	107			128	178			223	409			502
H^+	2	8	10	8	3	8	11	12	28	8	36	39
Na	2	10	12	12	13	10	23	19	24	42	66	47
K	0	0	0	2	1	0	1	2	2	1	3	2
Ca	1	0	1	3	1	0	1	3	4	2	6	9
Mg	0	2	2	4	3	2	5	4	6	8	14	15
Al	0	0	0	2	0	0	0	1	0	0	0	6
NH_4	4	1	5	8	0	1	1	4	20	1	21	13
NO_3	3	3	6	6	0	3	3	4	20	3	23	21
Cl	4	12	16	13	16	12	28	19	26	48	74	52
SO_4	4	8	12	16	3	8	11	12	29	12	41	50
Org.anion	0	0	0	4	0	0	0	10	0	0	0	8
Σ^+	9	21	30	39	21	21	42	45	84	62	146	131
Σ^-	11	23	34	39	19	23	42	45	75	63	138	123
NLAL				19				43				54
TOC				1.4				3.3				4.2

Volume-weighted mean concentrations of major ions in wet precipitation (In) and runoff (Out) at EGIL, KIM and ROLF catchments for period 15 November 1985 - 10 May 1986. Units: µeq/l; NLAL µgAL/l; TOC mgC/l.

winter 1986

	EGIL		KIM		ROLF	
	In	Out	In	Out	In	Out
H_2O	107	128	178	223	409	502
H^+	22	60	16	55	67	77
(pH)	4.65	4.22	4.79	4.26	4.17	4.11
Na	18	97	75	87	59	94
K	2	19	4	11	4	5
Ca	6	23	6	13	11	17
Mg	4	29	17	16	14	30
Al	0	16	0	6	0	13
NH_4	39	64	2	20	50	25
NO_3	23	48	1	20	49	42
Cl	35	104	89	85	65	103
SO_4	37	125	15	56	71	99
Org.anion	0	31	0	47	0	17
Σ^+	91	308	120	208	205	261
Σ^-	95	277	105	208	185	261
NLAL	-	152	-	191	-	108
TOC	-	10.9	-	14.7	-	8.4

Input-output budgets for water and major ions at EGIL, KIM and ROLF catchments for the period 10 May 1986 - 18 December 1986. Units: meq/m^2; NLAL $mgAl/m^2$; TOC gC/m^2.

summer 1986

	EGIL				KIM				ROLF			
	Input			Out	Input			Out	Input			Out
	Wet	Dry	Total		Wet	Dry	Total		Wet	Dry	Total	
H_2O (mm)	664			442	548			369	1107			886
H^+	45	8	53	42	12	8	20	32	73	8	81	91
Na	26	10	36	42	25	10	35	34	47	42	89	93
K	2	0	2	4	1	0	1	2	3	1	4	3
Ca	6	0	7	8	2	0	2	5	9	2	11	19
Mg	9	2	11	12	6	2	8	8	13	8	21	26
Al	0	0	0	8	0	0	0	4	0	0	0	10
NH_4	23	1	24	10	0	1	1	2	40	1	41	6
NO_3	24	3	27	16	0	3	3	5	42	3	45	19
Cl	36	12	48	50	39	12	51	51	57	48	105	130
SO_4	41	8	49	60	5	8	13	25	78	12	90	100
Org.anion	0	0	0	0	0	0	0	6	0	0	0	0
Σ^+	111	21	132	126	46	21	67	87	185	62	247	248
Σ^-	101	23	122	126	44	23	67	87	177	63	240	249
NLAL				90				95				120
TOC				4.7				5.7				9.8

Volume-weighted mean concentrations of major ions in wet precipitation (In) and runoff (Out) at EGIL, KIM and ROLF catchments for period 11 May 1986 - 18 December 1986. Units: µeq/l; NLAL µgAL/l; TOC mgC/l.

summer 1986

	EGIL		KIM		ROLF	
	In	Out	In	Out	In	Out
H_2O	664	442	548	369	1107	886
H^+	67	95	22	88	66	103
(pH)	4.17	4.02	4.67	4.06	4.18	3.99
Na	38	95	45	93	42	105
K	3	8	2	7	3	4
Ca	9	19	4	13	8	22
Mg	13	27	11	22	12	29
Al	0	19	0	12	0	11
NH_4	34	24	0	7	36	7
NO_3	36	35	0	12	38	21
Cl	54	114	72	139	52	146
SO_4	61	136	10	68	70	112
Org.anion	0	2	0	23	0	2
Σ^+	164	287	84	242	167	281
Σ^-	151	285	82	242	160	281
NLAL	-	203	-	258	-	135
TOC	-	10.6	-	15.4	-	11.1

APPENDIX 8.

Sogndal discharge data as measured by NVE and reported as daily means in l/s. Due to technical difficulties some of these data are inaccurate and must be corrected using the factors below.

correction factors for runoff from SOG2 and SOG4

Period	SOG2	SOG4
830901-831114	0.79	0.53
831115-840630	0.90	0.67
840701-841112	0.73	1.23
841113-850616	0.84	0.51
850617-851101	1.05	1.51
851102-860618	1.00	0.55
860619-861112	1.54	0.64

ÅRSBLOKK MED DØGNVERDIER: KD00 VANNF. 85 NVE S0G1

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	.2500	.2500	.2500	.1600	.2500	5.000	2.400	.9400	5.100	13.30	1.100	.4000
2	.2500	.2500	.2500	.1600	.2500	4.100	1.600	.8800	3.800	5.100	1.100	.4000
3	.2500	.2500	.2500	.1400	.2500	3.900	1.200	.8300	3.200	4.400	1.100	.4000
4	.2500	.2500	.2500	.1200	.2700	3.800	1.000	.7500	2.600	5.100	1.100	.4000
5	.2500	.2500	.2500	.1200	.2800	3.900	.8400	.6400	2.200	10.80	1.100	.4000
6	.2500	.2500	.2500	.1100	.3200	3.700	.7400	.5100	2.500	5.900	1.100	.4000
7	.2500	.2500	.2500	9.000-02	.3700	3.500	.6500	.7700	1.400	5.100	1.400	.4000
8	.2500	.2500	.2500	.1000	.4200	3.600	.7900	.9700	1.400	5.100	1.100	.4000
9	.2500	.2500	.2500	.1000	11.10	2.900	.9500	.9400	1.100	3.200	1.100	.4000
10	.2500	.2500	.2500	.1100	13.70	2.500	1.200	8.000-02	1.100	3.200	1.100	.4000
11	.2500	.2500	.2500	.1000	11.90	1.900	1.400	.9800	.8000	6.800	1.100	.4000
12	.2500	.2500	.2500	.1100	12.30	1.300	1.800	1.300	.8000	5.900	1.100	.4000
13	.2500	.2500	.2500	.1300	14.30	1.200	2.200	1.900	.8000	4.400	1.100	.4000
14	.2500	.2500	.2500	.1300	16.40	.9000	2.500	2.100	1.100	4.400	1.100	.4000
15	.2500	.2500	.2500	.1300	21.70	.8000	3.000	2.300	3.200	4.400	1.100	.4000
16	.2500	.2500	.2500	.1400	22.40	.7000	3.400	2.300	8.700	4.400	1.100	.2000
17	.2500	.2500	.2500	.1400	29.70	.7000	3.900	1.900	5.100	3.800	1.100	.2000
18	.2500	.2500	.2500	.1400	25.80	.6000	4.400	1.400	3.800	3.200	1.100	.2000
19	.2500	.2500	.2500	.1600	29.80	.5300	5.800	1.300	3.800	2.600	1.100	.2000
20	.2500	.2500	.2500	.1600	26.30	.5300	10.60	1.400	8.700	2.600	1.100	.2000
21	.2500	.2500	.2500	.1600	24.80	.5300	10.50	1.400	9.700	2.200	.8000	.2000
22	.2500	.2500	.2500	.1800	28.20	.4900	6.100	3.200	7.700	2.200	.8000	.2000
23	.2500	.2500	.2500	.1800	14.90	.4900	3.900	5.900	4.400	2.200	.8000	.2000
24	.2500	.2500	.2500	.1800	10.50	.4900	3.300	4.400	3.200	2.200	.8000	.2000
25	.2500	.2500	.2500	.2000	15.80	.4500	2.900	3.800	2.600	1.800	.8000	.2000
26	.2500	.2500	.2500	.2000	18.40	.4100	2.400	3.200	2.200	1.800	.8000	.2000
27	.2500	.2500	.2300	.2000	23.40	.4600	2.100	2.200	2.200	1.400	.8000	.2000
28	.2500	.2500	.2200	.2300	20.50	.7000	1.800	4.400	2.200	1.100	.8000	.2000
29	.2500		.1900	.2200	13.60	1.300	1.500	3.800	2.600	1.100	.8000	.2000
30	.2500		.1900	.2300	8.300	2.600	1.200	3.200	7.700	1.100	.8000	.2000
31	.2500		.1800		6.000		1.000	5.900		1.100		.2000
SNITT:	.2500	.2500	.2423	.1510	13.62	1.799	2.809	2.116	3.527	3.932	1.010	.2968
*2.627+06	6.566+05	6.566+05	6.363+05	3.966+05	3.577+07	4.726+06	7.377+06	5.557+06	9.263+06	1.033+07	2.653+06	7.795+05

ÅRSBLOKK MED DØGNVERDIER: KD00 VANNF. 85 NVE S0G2

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1						.2500	.1500	5.000-03	.3900	1.750	.2500	0.000
2						.1500	7.000-02	5.000-03	.3900	.3900	.2500	0.000
3						.1500	7.000-02	5.000-03	.2500	.3900	.1900	0.000
4						7.000-02	7.000-02	5.000-03	.2500	.3900	.2100	0.000
5						7.000-02	7.000-02	5.000-03	.1500	.5700	.3900	0.000
6						7.000-02	7.000-02	0.000	7.000-02	.3900	.8000	0.000
7						7.000-02	3.000-02	3.000-02	7.000-02	.5700	.4000	0.000
8						.1500	3.000-02	7.000-02	7.000-02	.2500	.4000	0.000
9						.1500	3.000-02	7.000-02	7.000-02	.2500	.4000	0.000
10						7.000-02	7.000-02	3.000-02	7.000-02	.2500	.4000	0.000
11						7.000-02	7.000-02	3.000-02	7.000-02	.5700	.4000	0.000
12						.3900	7.000-02	.1500	7.000-02	.5700	.4000	0.000
13						.2500	7.000-02	.1500	.1500	.3900	.4000	0.000
14						.1500	7.000-02	.1500	.1500	.3900	.2000	0.000
15						.1500	.1500	.1500	.3900	.2500	.2000	0.000
16						.1500	7.000-02	.1500	.8000	.1500	.2000	0.000
17						7.000-02	7.000-02	7.000-02	.3900	.1500	.2000	0.000
18						7.000-02	7.000-02	3.000-02	.2500	.2500	.2000	0.000
19						3.000-02	7.000-02	3.000-02	.3900	.3900	.2000	0.000
20						3.000-02	.2500	.1500	.8000	.3900	.1000	0.000
21						5.000-03	.5700	.5700	1.070	.3900	.1000	0.000
22					2.170	5.000-03	.3900	1.070	.5700	.3900	.1000	0.000
23					1.070	5.000-03	.2500	.5700	.2500	.2800	.1000	0.000
24					1.380	5.000-03	.1500	.3900	.1500	.2500	.1000	0.000
25					1.380	0.000	.1500	.3900	.1500	.2500	.1000	0.000
26					1.070	3.000-02	7.000-02	.2500	.1500	.1800	.1000	0.000
27					1.380	.1500	7.000-02	.1500	.2500	.1800	.1000	0.000
28					1.070	7.000-02	3.000-02	.8000	.2500	.1800	.1000	0.000
29					.8000	.1500	3.000-02	.5700	.1500	.1800	.1000	0.000
30					.5700	.2500	3.000-02	.3900	.3900	.5700	.1000	0.000
31					.3900		5.000-03	.5700		.3900		0.000
SNITT:					1.128	.1077	.1085	.2260	.2873	.3852	.2397	0.000
*2.627+06					2.963+06	2.828+05	2.851+05	5.935+05	7.547+05	1.012+06	6.295+05	0.000

ÅRSBLOKK MED DØGNVERDIER: KDOO VANNF. 85 NVE S054

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.000	0.000	0.000	3.000-02	3.000-02	3.000-02	7.000-02	5.000-03	1.300-02	4.600-02	5.000-03	0.000
2	0.000	0.000	0.000	3.000-02	3.000-02	3.000-02	3.000-02	5.000-03	3.000-03	1.900-02	5.000-03	0.000
3	0.000	0.000	0.000	3.000-02	.2500	3.000-02	3.000-02	0.000	8.000-03	1.300-02	5.000-03	0.000
4	0.000	0.000	0.000	3.000-02	.3900	3.000-02	3.000-02	0.000	5.000-03	1.900-02	5.000-03	0.000
5	0.000	0.000	0.000	3.000-02	.1500	5.000-03	3.000-02	0.000	5.000-03	1.900-02	5.000-03	0.000
6	0.000	0.000	0.000	3.000-02	.1500	5.000-03	3.000-02	0.000	5.000-03	1.300-02	5.000-03	0.000
7	0.000	0.000	0.000	3.000-02	.3900	7.000-02	3.000-02	3.000-02	5.000-03	1.300-02	5.000-03	0.000
8	0.000	0.000	0.000	3.000-02	.8000	3.000-02	3.000-02	3.000-02	2.000-03	8.000-03	5.000-03	0.000
9	0.000	0.000	0.000	3.000-02	.5700	3.000-02	3.000-02	5.000-03	2.000-03	8.000-03	5.000-03	0.000
10	0.000	0.000	0.000	3.000-02	.3900	5.000-03	3.000-02	5.000-03	2.000-03	8.000-03	5.000-03	0.000
11	0.000	0.000	0.000	3.000-02	.3900	0.000	5.000-03	3.000-02	2.000-03	1.900-02	5.000-03	0.000
12	0.000	0.000	0.000	3.000-02	.3900	3.000-02	5.000-03	3.000-02	2.000-03	1.300-02	5.000-03	0.000
13	0.000	0.000	0.000	3.000-02	.3900	7.000-02	3.000-02	7.000-02	5.000-03	8.000-03	5.000-03	0.000
14	0.000	0.000	0.000	3.000-02	.3900	3.000-02	5.000-03	7.000-02	5.000-03	8.000-03	5.000-03	0.000
15	0.000	0.000	0.000	3.000-02	.3900	3.000-02	7.000-02	7.000-02	1.300-02	8.000-03	5.000-03	0.000
16	0.000	0.000	0.000	3.000-02	.3900	3.000-02	3.000-02	3.000-02	1.900-02	8.000-03	2.000-03	0.000
17	0.000	0.000	0.000	3.000-02	.3900	5.000-03	3.000-02	3.000-02	8.000-03	8.000-03	2.000-03	0.000
18	0.000	0.000	0.000	3.000-02	.3900	5.000-03	3.000-02	5.000-03	8.000-03	8.000-03	2.000-03	0.000
19	0.000	0.000	0.000	3.000-02	.3900	0.000	3.000-02	5.000-03	1.300-02	6.000-03	2.000-03	0.000
20	0.000	0.000	0.000	3.000-02	.3900	0.000	.2500	0.000	1.900-02	6.000-03	2.000-03	0.000
21	0.000	0.000	0.000	3.000-02	.3900	0.000	.2500	0.000	3.600-02	8.000-03	2.000-03	0.000
22	0.000	0.000	0.000	3.000-02	.2500	0.000	.2500	2.700-02	1.300-02	5.000-03	2.000-03	0.000
23	0.000	0.000	0.000	3.000-02	7.000-02	0.000	.1500	3.600-02	8.000-03	5.000-03	2.000-03	0.000
24	0.000	0.000	0.000	3.000-02	7.000-02	0.000	7.000-02	1.300-02	5.000-03	5.000-03	2.000-03	0.000
25	0.000	0.000	0.000	3.000-02	.1500	0.000	7.000-02	8.000-03	5.000-03	2.000-03	2.000-03	0.000
26	0.000	0.000	0.000	3.000-02	.2500	7.000-02	3.000-02	8.000-03	5.000-03	2.000-03	2.000-03	0.000
27	0.000	0.000	0.000	5.000-03	.5700	3.000-02	3.000-02	1.300-02	5.000-03	2.000-03	2.000-03	0.000
28	0.000	0.000	0.000	5.000-03	.3900	3.000-02	3.000-02	3.600-02	5.000-03	2.000-03	2.000-03	0.000
29	0.000		5.000-03	5.000-03	.1500	7.000-02	5.000-03	8.000-03	8.000-03	2.000-03	2.000-03	0.000
30	0.000		5.000-03	3.000-02	7.000-02	7.000-02	5.000-03	8.000-03	1.300-02	5.000-03	2.000-03	0.000
31	0.000		5.000-03		3.000-02		5.000-03	1.900-02		5.000-03		0.000
SNITT:	0.000	0.000	4.839-04	2.750-02	.3045	2.450-02	5.548-02	1.923-02	8.400-03	9.710-03	3.500-03	0.000
*2.627+06	0.000	0.000	1271.	7.223+04	7.998+05	6.435+04	1.457+05	5.050+04	2.206+04	2.550+04	9193.	0.000

ÅRSBLOKK MED DØGNVERDIER: KD00 VANNF. 86 NVE S0G1

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	9.000-02	9.000-02	9.000-02	9.000-02	9.000-02	4.410	.2700	.8000	.8000	5.910	5.160	5.160
2	9.000-02	9.000-02	9.000-02	9.000-02	9.000-02	4.410	.1500	.8000	.6000	9.710	3.790	4.410
3	9.000-02	9.000-02	9.000-02	9.000-02	8.690	4.410	.1500	1.100	.6000	7.670	3.170	5.910
4	9.000-02	9.000-02	9.000-02	9.000-02	20.94	9.710	.1500	1.100	.3900	4.410	3.790	10.87
5	9.000-02	9.000-02	9.000-02	9.000-02	35.29	7.670	.1500	3.170	.8000	3.790	3.170	6.790
6	9.000-02	9.000-02	9.000-02	9.000-02	28.57	5.910	.1500	3.970	1.380	6.790	4.410	5.910
7	9.000-02	9.000-02	9.000-02	9.000-02	26.58	4.410	.1500	3.790	2.170	12.04	3.790	3.790
8	9.000-02	9.000-02	9.000-02	9.000-02	51.24	4.410	.1500	3.790	2.170	5.910	4.410	3.170
9	9.000-02	9.000-02	9.000-02	9.000-02	20.94	4.410	.1500	5.160	2.170	4.410	5.910	12.04
10	9.000-02	9.000-02	9.000-02	9.000-02	12.04	4.410	.1500	14.69	1.780	5.910	9.710	12.04
11	9.000-02	9.000-02	9.000-02	9.000-02	14.69	3.790	.1500	6.790	2.170	7.670	19.30	5.910
12	9.000-02	9.000-02	9.000-02	9.000-02	13.37	3.790	.1500	3.790	2.170	5.160	8.690	4.410
13	9.000-02	9.000-02	9.000-02	9.000-02	12.04	3.790	9.000-02	3.790	2.170	3.790	5.160	3.790
14	9.000-02	9.000-02	9.000-02	9.000-02	9.710	3.170	9.000-02	2.170	1.380	3.170	4.410	3.170
15	9.000-02	9.000-02	9.000-02	9.000-02	8.690	2.670	.1500	2.170	1.380	3.790	6.790	3.670
16	9.000-02	9.000-02	9.000-02	9.000-02	7.670	2.670	.1500	1.380	1.380	3.670	7.670	2.170
17	9.000-02	9.000-02	9.000-02	9.000-02	8.690	2.170	.1500	1.380	2.170	3.670	6.790	2.170
18	9.000-02	9.000-02	9.000-02	9.000-02	6.790	1.780	.1500	1.380	2.170	3.670	5.160	2.170
19	9.000-02	9.000-02	9.000-02	9.000-02	6.790	1.780	.1500	1.780	2.170	3.170	4.410	2.170
20	9.000-02	9.000-02	9.000-02	9.000-02	8.690	2.170	.1500	2.170	4.410	3.170	3.170	1.780
21	9.000-02	9.000-02	9.000-02	9.000-02	10.87	2.670	.1500	2.170	12.04	2.670	3.170	
22	9.000-02	9.000-02	9.000-02	9.000-02	12.04	2.170	.1500	2.170	5.160	2.170	2.670	
23	9.000-02	9.000-02	9.000-02	9.000-02	8.690	2.170	.1500	1.780	3.170	2.170	2.170	
24	9.000-02	9.000-02	9.000-02	9.000-02	6.790	1.380	.1500	1.380	3.170	2.170	2.170	
25	9.000-02	9.000-02	9.000-02	9.000-02	5.910	1.100	.1500	1.380	2.670	1.780	2.170	
26	9.000-02	9.000-02	9.000-02	9.000-02	5.910	.8000	.1500	1.380	2.170	1.780	2.670	
27	9.000-02	9.000-02	9.000-02	9.000-02	6.790	.6000	.1500	.8000	1.780	1.780	3.170	
28	9.000-02	9.000-02	9.000-02	9.000-02	6.790	.3900	.1500	.8000	4.410	2.670	8.690	
29	9.000-02		9.000-02	9.000-02	5.910	.3900	.1500	.8000	5.910	5.910	13.37	
30	9.000-02		9.000-02	9.000-02	5.910	.2700	.1500	.8000	4.410	5.910	6.790	
31	9.000-02		9.000-02		5.160		.1500	.8000		6.790		
SNITT:	9.000-02	9.000-02	9.000-02	9.000-02	12.33	3.129	.1500	2.562	2.644	4.622	5.530	5.075
*2.627+06	2.364+05	2.364+05	2.364+05	2.364+05	3.240+07	8.219+06	3.940+05	6.730+06	6.945+06	1.214+07	1.452+07	1.333+07

ÅRSBLOKK MED DØGNVERDIER: KDOO VANNF. 86 NVE SOG2

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.000	0.000	0.000	0.000	.2700	.1500	0.000	2.000-02	3.000-02	.6000	.2700	.3900
2	0.000	0.000	0.000	0.000	.8100	.2700	0.000	3.000-02	.1500	.6000	.1500	.2700
3	0.000	0.000	0.000	0.000	1.380	.3900	0.000	9.000-02	.1500	.2700	.1500	.3900
4	0.000	0.000	0.000	0.000	2.160	.6000	0.000	.1500	.1500	.1500	.1500	.6000
5	0.000	0.000	0.000	0.000	2.700	.2700	0.000	.2700	.2700	.1500	.1500	.3900
6	0.000	0.000	0.000	0.000	1.800	.2700	0.000	.1500	.2700	.2700	.2700	.3900
7	0.000	0.000	0.000	0.000	1.800	.1500	0.000	.1500	.1500	.3900	.1500	.2700
8	0.000	0.000	0.000	0.000	1.800	.3900	0.000	.2700	.1500	.2700	.3900	.2700
9	0.000	0.000	0.000	0.000	1.380	.2700	0.000	.6000	9.000-02	.1500	.6000	.6000
10	0.000	0.000	0.000	0.000	.8100	.2700	0.000	.3900	.1500	.1500	1.100	1.100
11	0.000	0.000	0.000	0.000	.8100	.2700	0.000	.1500	9.000-02	.2700	1.780	.6000
12	0.000	0.000	0.000	0.000	.8100	.2700	0.000	.1500	9.000-02	.1500	.6000	.3900
13	0.000	0.000	0.000	0.000	.6000	.1500	0.000	9.000-02	3.000-02	9.000-02	.3900	.2700
14	0.000	0.000	0.000	0.000	.3900	.1500	0.000	9.000-02	9.000-02	9.000-02	.2700	.2700
15	0.000	0.000	0.000	0.000	.3900	9.000-02	0.000	3.000-02	.1500	9.000-02	.3900	.2700
16	0.000	0.000	0.000	0.000	.6000	9.000-02	0.000	9.000-02	.1500	9.000-02	.6000	.2700
17	0.000	0.000	0.000	0.000	.3900	3.000-02	0.000	.1500	9.000-02	9.000-02	.3900	.2700
18	0.000	0.000	0.000	0.000	.3900	2.000-02	0.000	9.000-02	9.000-02	3.000-02	.3900	.1500
19	0.000	0.000	0.000	0.000	.6000	.3900	0.000	.3900	.1500	.1500	.2700	.1500
20	0.000	0.000	0.000	0.000	.8000	2.000-02	0.000	.6000	.2700	9.000-02	.2700	
21	0.000	0.000	0.000	0.000	.8000	9.000-02	0.000	.2700	.6000	9.000-02	.2700	
22	0.000	0.000	0.000	0.000	.6000	3.000-02	0.000	.1500	.2700	3.000-02	.1500	
23	0.000	0.000	0.000	0.000	.2700	3.000-02	0.000	9.000-02	.1500	3.000-02	.1500	
24	0.000	0.000	0.000	0.000	.2700	2.000-02	0.000	3.000-02	.1500	3.000-02	.1500	
25	0.000	0.000	0.000	1.500-02	.3900	0.000	0.000	3.000-02	9.000-02	3.000-02	.1500	
26	0.000	0.000	0.000	3.000-02	.3900	0.000	0.000	3.000-02	9.000-02	3.000-02	.2700	
27	0.000	0.000	0.000	.1500	.3900	0.000	0.000	2.000-02	9.000-02	3.000-02	.2700	
28	0.000	0.000	0.000	.1500	.3900	0.000	0.000	2.000-02	.2700	.1500	.6000	
29	0.000		0.000	.2700	.2700	0.000	0.000	2.000-02	.2700	.2700	1.100	
30	0.000		0.000	.2700	.2700	0.000	0.000	2.000-02	.2700	.3900	.6000	
31	0.000		0.000		.1500		0.000	2.000-02		.3900		
SNITT:	0.000	0.000	0.000	2.950-02	.8026	.1560	0.000	.1500	.1670	.1810	.4147	.3847
*2.627+06	0.000	0.000	0.000	7.748+04	2.198+06	4.097+05	0.000	3.940+05	4.386+05	4.753+05	1.089+06	1.011+06

ÅRSBLOKK MED DØGNVERDIER: KDOO VANNF. 86 NVE SOG4

DAG	MÅNED: JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.000	0.000	0.000	0.000	9.000-02	9.000-02	0.000	3.000-02	1.000-02	.2700	5.000-02	.1300
2	0.000	0.000	0.000	0.000	.2700	9.000-02	0.000	3.000-02	3.000-02	.2700	5.000-02	.1300
3	0.000	0.000	0.000	0.000	.4600	9.000-02	0.000	3.000-02	9.000-02	5.000-02	5.000-02	9.000-02
4	0.000	0.000	0.000	0.000	.7200	.1300	0.000	5.000-02	5.000-02	3.000-02	5.000-02	9.000-02
5	0.000	0.000	0.000	0.000	.9000	.1300	0.000	.1300	9.000-02	3.000-02	5.000-02	9.000-02
6	0.000	0.000	0.000	0.000	.6000	9.000-02	0.000	9.000-02	5.000-02	9.000-02	5.000-02	9.000-02
7	0.000	0.000	0.000	0.000	.6000	5.000-02	0.000	9.000-02	9.000-02	.1300	5.000-02	9.000-02
8	0.000	0.000	0.000	0.000	.6000	.1300	0.000	9.000-02	5.000-02	9.000-02	5.000-02	9.000-02
9	0.000	0.000	0.000	0.000	.4600	9.000-02	5.000-03	.2700	5.000-02	9.000-02	5.000-02	.1300
10	0.000	0.000	0.000	0.000	.2700	9.000-02	5.000-03	.2000	5.000-02	9.000-02	.1300	.2700
11	0.000	0.000	0.000	0.000	.2700	9.000-02	5.000-03	9.000-02	5.000-02	9.000-02	.2700	.1300
12	0.000	0.000	0.000	0.000	.2700	9.000-02	5.000-03	5.000-02	5.000-02	9.000-02	.2000	9.000-02
13	0.000	0.000	0.000	0.000	.2000	5.000-02	5.000-03	3.000-02	3.000-02	5.000-02	.1300	9.000-02
14	0.000	0.000	0.000	0.000	.1300	5.000-02	0.000	3.000-02	3.000-02	5.000-02	9.000-02	9.000-02
15	0.000	0.000	0.000	0.000	.1300	3.000-02	0.000	3.000-02	5.000-02	5.000-02	9.000-02	9.000-02
16	0.000	0.000	0.000	0.000	.1300	3.000-02	0.000	3.000-02	5.000-02	5.000-02	9.000-02	5.000-02
17	0.000	0.000	0.000	0.000	.1300	1.000-02	0.000	5.000-02	5.000-02	3.000-02	9.000-02	
18	0.000	0.000	0.000	0.000	.1300	1.000-02	0.000	3.000-02	3.000-02	5.000-02	9.000-02	
19	0.000	0.000	0.000	0.000	.1300	.1300	0.000	.2000	5.000-02	5.000-02	9.000-02	
20	0.000	0.000	0.000	0.000	.1300	9.000-02	0.000	.2000	.1300	5.000-02	.2700	
21	0.000	0.000	0.000	0.000	.2000	5.000-02	0.000	.1300	.2000	5.000-02	.7200	
22	0.000	0.000	0.000	0.000	.1300	3.000-02	0.000	5.000-02	.1300	5.000-02	2.270	
23	0.000	0.000	0.000	0.000	9.000-02	1.000-02	0.000	5.000-02	5.000-02	5.000-02	1.470	
24	0.000	0.000	0.000	0.000	9.000-02	5.000-03	0.000	3.000-02	5.000-02	5.000-02	9.000-02	
25	0.000	0.000	0.000	5.000-03	.1300	5.000-03	0.000	1.000-02	5.000-02	3.000-02	9.000-02	
26	0.000	0.000	0.000	1.000-02	.1300	0.000	0.000	1.000-02	3.000-02	3.000-02	9.000-02	
27	0.000	0.000	0.000	5.000-02	9.000-02	0.000	0.000	1.000-02	3.000-02	3.000-02	9.000-02	
28	0.000	0.000	0.000	5.000-02	9.000-02	0.000	0.000	5.000-03	.1300	3.000-02	2.000-02	
29	0.000		0.000	9.000-02	.1300	0.000	0.000	5.000-03	.1300	5.000-02	.2700	
30	0.000		0.000	9.000-02	9.000-02	0.000	1.000-02	5.000-03	.1300	5.000-02	.1300	
31	0.000		0.000		5.000-02		3.000-02	5.000-03		9.000-02		
SNITT:	0.000	0.000	0.000	9.833-03	.2529	5.533-02	2.097-03	6.645-02	6.700-02	6.903-02	.2410	.1087
+2.627+06	0.000	0.000	0.000	2.583+04	6.643+05	1.453+05	5507.	1.745+05	1.760+05	1.813+05	6.330+05	2.856+05

APPENDIX 9.

SOGNDAL 1 RUNOFF DATA. UNITS: MAJOR IONS UEQ/L, AL SPECIES UG AL/L, TOC MG C/L, SIO2 MG/L. -99=MISSING DATA.

DATE	PH	NA	K	CA	MG	NO3	CL	SO4	ALK	ILAL	LAL	TOC	SIO2
8511170000	6.04	47.4	4.1	25.0	10.7	.8	33.9	31.2	12.0	10	0	1.3	1.9
8511240000	6.08	43.5	2.0	25.4	10.7	.6	39.5	27.1	15.3	10	8	2.7	.9
8511300000	6.07	48.7	2.0	27.4	11.5	.9	36.7	37.5	20.7	10	2	1.1	1.8
8512110000	5.98	64.4	5.1	32.9	14.8	2.6	45.1	37.5	27.2	10	1	3.7	2.4
8605080000	5.30	23.5	2.3	13.0	7.4	2.1	19.7	25.0	.0	11	27	1.1	.9
8605110000	5.72	36.5	9.7	15.5	9.0	2.0	36.7	27.1	4.1	14	21	1.3	.8
8605140000	5.65	21.3	1.3	14.5	6.6	1.4	16.9	25.0	.0	10	4	.8	.9
8605180000	5.74	24.8	4.3	15.0	6.6	.1	22.6	25.0	2.9	10	9	1.0	.9
8605220000	5.59	19.1	1.0	11.0	4.9	1.3	11.3	20.8	.0	10	6	.8	.8
8605250000	5.64	15.7	1.0	12.0	4.9	1.6	25.4	18.7	.0	10	6	1.0	.7
8605290000	5.74	19.6	1.3	17.0	6.6	.9	19.7	22.9	.0	10	1	1.2	.9
8606020000	5.91	20.0	1.3	16.5	6.6	.6	19.7	20.8	.0	10	0	.7	.8
8606090000	6.03	20.9	1.3	16.5	6.6	.1	19.7	22.9	1.6	10	0	.9	1.0
8606160000	5.70	22.6	1.3	18.0	6.6	.7	19.7	25.0	.0	10	2	.8	1.0
8606250000	5.82	35.7	2.3	17.5	8.2	1.7	31.0	27.1	.0	10	0	1.0	1.0
8606260000	5.42	29.6	1.5	16.5	8.2	.7	22.6	29.1	.0	10	0	1.1	1.0
8606280000	5.63	34.8	1.8	18.0	9.0	1.1	25.4	25.0	.0	10	0	.9	1.0
8607060000	5.75	30.9	1.5	15.5	9.0	.3	22.6	50.0	4.1	10	18	4.3	1.3
8607130000	6.03	33.1	1.8	17.0	9.9	.2	25.4	33.3	.0	10	0	1.1	.7
8607200000	5.86	38.7	3.6	16.0	9.9	.4	31.0	35.4	.0	10	0	1.8	.8
8607270000	6.23	34.4	1.5	16.5	9.9	.3	28.2	35.4	5.3	10	0	1.8	.7
8608020000	6.05	36.5	3.3	16.0	9.0	.3	28.2	39.6	.0	10	0	2.6	.8
8608090000	5.92	45.7	3.1	18.0	8.2	.4	33.9	37.5	.0	10	0	1.4	1.0
8608160000	6.07	32.6	1.5	16.5	7.4	.1	22.6	39.6	.0	10	0	1.2	1.1
8608230000	6.10	40.9	3.1	19.0	9.0	.2	31.0	50.0	.0	10	0	1.1	1.1
8608300000	6.08	34.4	1.5	19.0	9.0	.1	22.6	29.1	1.6	10	0	.9	1.2
8609060000	6.00	38.3	4.6	21.0	9.9	.1	25.4	45.8	7.6	10	0	1.0	3.4
8609130000	6.24	36.1	1.5	22.5	9.9	.1	25.4	33.3	8.7	10	0	1.0	1.3
8609200000	5.99	34.4	1.0	22.0	9.9	.1	25.4	29.1	7.6	10	0	.7	1.5
8609270000	6.13	32.6	1.8	21.0	9.0	.3	25.4	27.1	9.8	10	0	.8	1.5
8610040000	6.14	46.1	6.6	22.0	9.9	.3	42.3	27.1	13.1	10	2	.8	1.5
8610100000	6.06	39.1	1.3	22.5	9.0	.2	33.9	29.1	8.7	10	0	.6	1.4
8610180000	5.94	45.2	4.9	25.9	12.3	1.4	39.5	29.1	14.2	11	-1	1.1	1.5
8610250000	5.86	41.8	1.3	24.0	11.5	.4	36.7	27.1	13.1	10	1	.8	1.8
8610310000	5.89	41.3	.5	18.5	9.9	.4	36.7	27.1	7.6	10	1	.5	1.5
8611060000	5.96	40.5	1.3	24.5	9.9	.4	39.5	27.1	7.6	10	0	.7	1.6
8611130000	5.70	42.2	1.3	22.5	12.3	.4	50.8	22.9	1.6	10	7	.5	1.3

SOGNDAL 2 RUNOFF DATA. UNITS: MAJOR IONS UEQ/L, AL SPECIES UG AL/L,
TOC MG C/L, SIO2 MG/L. -99=MISSING DATA.

DATE	PH	NA	K	CA	MG	NO3	CL	SO4	ALK	ILAL	LAL	TOC	SIO2
8511020000	5.75	33.5	.5	27.9	11.5	1.5	28.2	56.2	.0	10	8	.8	2.4
8511070000	5.75	38.7	2.0	28.4	13.2	1.4	36.7	56.2	1.6	10	3	2.9	2.4
8511170000	5.54	50.9	2.0	42.9	17.3	1.7	42.3	52.0	.0	12	20	9.4	3.2
8511240000	5.54	53.5	4.3	40.4	16.5	2.1	45.1	50.0	12.0	34	12	6.4	1.6
8511300000	5.60	50.9	2.3	40.9	16.5	3.2	42.3	52.0	14.2	25	18	1.2	2.8
8512110000	5.60	70.0	2.6	52.9	23.0	2.9	33.9	70.8	21.8	13	12	1.6	4.4
8605080000	4.69	24.4	1.8	22.0	14.0	2.7	22.6	68.7	.0	20	128	1.4	.9
8605090000	4.78	27.0	3.3	24.0	14.0	2.6	25.4	68.7	.0	23	107	1.3	1.0
8605100000	4.84	24.4	2.0	22.5	13.2	2.5	22.6	60.4	.0	21	83	1.3	.9
8605110000	4.84	31.8	4.6	26.9	14.8	2.9	31.0	68.7	.0	24	120	1.2	1.0
8605120000	4.59	24.4	7.4	12.5	6.6	4.2	25.4	47.9	.0	10	35	1.8	.2
8605130000	5.21	37.4	6.4	34.9	14.8	3.6	28.2	66.6	.0	31	44	1.9	1.5
8605140000	5.22	20.9	1.0	20.0	9.9	1.5	16.9	41.6	.0	21	35	1.1	1.0
8605170000	5.30	20.0	2.8	19.0	7.4	1.6	16.9	35.4	.0	14	35	.8	.9
8605180000	5.29	19.1	2.3	18.0	7.4	1.4	16.9	35.4	.0	15	29	.9	.9
8605220000	5.29	16.5	1.0	16.0	5.8	2.0	11.3	31.2	.0	10	29	1.5	.7
8605250000	5.45	16.1	.8	17.5	6.6	1.7	16.9	25.0	.0	10	27	1.5	.9
8605290000	5.60	17.0	.8	20.0	7.4	1.4	16.9	27.1	.0	10	5	1.1	1.0
8606020000	5.64	15.7	.8	19.0	6.6	1.1	16.9	25.0	.0	10	5	.8	.9
8606090000	5.61	18.3	.8	22.0	7.4	.4	16.9	31.2	.0	10	13	.8	1.2
8606160000	5.33	22.6	2.0	28.9	9.0	1.1	19.7	43.7	.0	10	30	1.2	1.4
8606190925	5.37	26.5	.8	25.4	11.5	.9	19.7	43.7	.0	14	35	1.2	1.4
8606191130	5.21	27.4	.8	25.4	11.5	1.1	19.7	47.9	.0	13	39	1.4	1.4
8606191230	5.27	27.0	.5	25.9	11.5	.9	19.7	45.8	.0	10	37	1.4	1.4
8606191330	5.29	26.5	.5	25.9	11.5	.8	19.7	43.7	.0	11	31	1.5	1.4
8606191430	5.22	27.0	.5	25.4	11.5	1.0	22.6	54.1	.0	11	35	1.4	1.4
8606191515	5.37	27.0	.5	26.9	11.5	1.0	19.7	45.8	.0	10	27	1.4	1.4
8606192030	5.04	30.0	.8	29.4	14.0	1.0	19.7	58.3	.0	13	64	1.4	1.4
8606200000	5.06	29.6	.8	30.9	15.6	.9	25.4	75.0	.0	13	89	1.3	1.5
8606210000	5.07	30.9	1.0	33.4	15.6	.3	22.6	70.8	.0	11	74	1.4	1.5
8606220000	5.10	30.9	1.3	33.4	15.6	.4	22.6	66.6	.0	11	74	1.3	1.6
8606230000	5.17	32.6	1.3	33.9	15.6	.4	25.4	68.7	.0	11	70	1.4	1.6
8606240000	5.19	33.9	1.5	35.9	15.6	.2	25.4	66.6	.0	10	58	1.3	1.6
8606250000	5.17	33.5	1.5	33.4	16.5	.2	25.4	66.6	.0	10	71	1.5	1.7
8606260000	5.13	34.4	1.3	36.9	17.3	.3	25.4	68.7	.0	10	41	1.7	1.9
8606270000	5.21	36.1	1.3	36.4	17.3	.4	25.4	68.7	.0	10	42	1.3	1.9
8606280000	5.22	37.4	1.3	36.9	17.3	.2	28.2	68.7	.0	10	41	1.4	1.9
8606290000	5.15	37.4	1.8	36.9	17.3	.3	25.4	64.5	.0	10	50	1.3	1.9
8606300000	5.17	37.4	1.8	38.4	17.3	.3	28.2	68.7	.0	10	50	1.3	1.9

8607060000	5.11	38.3	1.3	33.9	18.1	.4	33.9	104.1	.0	10	100	1.2	1.9
8607130000	5.28	41.8	1.3	33.9	18.1	.2	33.9	81.2	.0	10	46	1.2	1.8
8607200000	5.20	41.8	1.0	30.9	18.1	.3	33.9	81.2	.0	10	49	1.3	1.6
8607270000	5.31	43.5	1.3	34.9	18.1	.3	36.7	93.7	.0	10	41	1.2	1.6
8608020000	5.24	42.6	2.6	28.4	14.8	.6	33.9	79.1	.0	10	62	2.4	1.6
8608090000	5.35	39.1	1.5	27.9	12.3	.7	28.2	70.8	.0	11	34	1.6	1.7
8608160000	5.38	33.5	1.3	29.4	11.5	.4	25.4	66.6	.0	10	35	1.1	1.8
8608190730	5.46	61.3	1.8	44.4	20.6	.4	59.2	77.0	.0	10	29	1.1	1.7
8608190920	5.48	31.8	1.3	28.4	13.2	.4	25.4	58.3	.0	10	28	1.2	1.8
8608191020	5.54	32.2	1.3	29.4	13.2	.4	25.4	54.1	.0	10	25	1.2	1.8
8608191120	5.46	31.8	1.0	27.4	13.2	.6	25.4	64.5	.0	10	37	1.1	1.8
8608191220	5.37	32.2	1.0	26.4	13.2	.4	25.4	66.6	.0	10	42	1.1	1.8
8608191320	5.41	31.3	1.0	26.9	13.2	.4	25.4	60.4	.0	10	39	1.0	1.8
8608192100	5.29	31.3	1.0	31.9	14.8	.4	25.4	64.5	.0	13	60	1.2	1.8
8608200700	5.26	31.8	1.3	32.4	14.8	.3	25.4	66.6	.0	13	86	1.2	1.9
8608200830	5.22	31.8	1.3	32.9	15.6	.5	25.4	68.7	.0	11	98	1.2	1.9
8608200930	5.21	31.8	1.0	32.4	15.6	.2	25.4	68.7	.0	11	77	1.1	1.9
8608201130	5.16	32.6	1.3	34.4	15.6	.3	25.4	72.9	.0	11	124	1.2	2.0
8608201230	5.20	32.2	1.3	32.9	14.8	.3	25.4	75.0	.0	11	114	1.3	2.0
8608202100	5.14	32.6	1.3	40.9	17.3	.1	25.4	89.5	.0	13	156	1.1	2.0
8608211000	5.16	32.6	1.0	38.4	18.9	.2	25.4	93.7	.0	13	150	1.1	2.0
8608220000	5.14	33.1	1.5	38.4	17.3	.1	25.4	116.6	.0	12	155	1.0	1.9
8608230000	5.20	32.2	1.0	39.9	17.3	.2	22.6	108.3	.0	15	133	1.1	1.9
8608240000	5.20	35.2	1.8	41.9	17.3	.1	25.4	112.4	.0	15	134	1.1	1.9
8608250000	5.21	37.4	2.6	40.4	17.3	.1	28.2	110.3	.0	14	133	1.1	2.0
8608260000	5.20	35.7	1.8	41.9	17.3	.1	25.4	106.2	.0	11	123	1.0	2.0
8608270000	5.27	37.0	2.0	41.9	18.1	.1	25.4	108.3	.0	11	98	1.1	2.0
8608280000	5.25	35.7	1.5	42.4	18.9	.1	25.4	110.3	.0	12	90	1.1	2.0
8608290000	5.21	37.8	1.5	39.9	18.1	.1	25.4	108.3	.0	10	121	1.1	2.0
8608300000	5.17	36.1	1.5	39.9	18.9	.1	28.2	129.1	.0	11	104	.9	2.0
8608310000	5.14	36.1	1.5	38.9	18.9	.1	28.2	110.3	.0	11	126	.9	2.1
8609010000	5.15	43.1	1.3	40.9	18.9	.1	28.2	110.3	.0	11	100	1.0	2.2
8609020000	5.44	39.1	2.0	41.9	18.9	.3	28.2	95.8	.0	11	87	1.0	2.2
8609030630	5.18	86.1	2.0	53.9	30.4	.1	84.6	122.8	.0	11	78	.9	1.9
8609030815	5.20	36.5	1.3	39.4	18.9	.1	25.4	97.9	.0	11	96	.9	2.0
8609030915	5.17	36.1	1.3	38.9	18.1	.1	28.2	97.9	.0	10	107	.9	2.2
8609031015	5.16	36.1	1.3	38.9	18.1	.1	25.4	97.9	.0	10	104	.9	2.2
8609031115	5.16	35.2	1.0	38.4	18.1	.1	25.4	99.9	.0	10	114	.8	2.4
8609031220	5.16	35.7	1.0	38.9	18.1	.1	25.4	97.9	.0	10	107	.8	2.2
8609031340	5.12	35.7	1.0	38.9	18.1	.2	25.4	106.2	.0	10	147	.8	2.2
8609040000	5.03	40.9	2.8	41.4	19.7	1.4	33.9	197.8	.0	11	183	.9	2.2
8609050000	5.10	36.5	1.5	36.9	18.9	.5	31.0	170.7	.0	11	149	.8	2.2
8609060000	5.09	36.5	1.5	39.9	18.9	.4	31.0	127.0	.0	10	145	.8	5.4
8609070000	5.10	35.7	1.3	39.4	18.9	.4	31.0	131.2	.0	10	148	.8	5.5

8609080000	5.15	35.7	1.0	39.4	18.9	.4	31.0	164.5	.0	10	134	.7	5.5
8609090000	5.21	35.7	1.0	38.4	18.1	.2	31.0	147.8	.0	10	117	.9	2.1
8609100000	5.17	37.8	1.3	39.9	18.1	.4	33.9	83.3	.0	10	104	.9	2.1
8609110000	5.19	35.7	1.0	37.4	18.1	.2	31.0	83.3	.0	10	111	.6	2.1
8609120000	5.21	38.3	1.8	39.9	18.1	1.0	33.9	85.4	.0	10	112	.8	2.1
8609130000	5.20	36.1	1.5	40.4	17.3	.3	31.0	81.2	.0	10	97	.8	2.1
8609140000	5.20	37.0	1.3	40.4	17.3	.4	31.0	85.4	.0	10	104	.8	2.2
8609150000	5.25	36.5	1.3	39.9	17.3	.2	28.2	81.2	.0	10	93	.7	2.2
8609160000	5.21	33.9	1.3	39.9	17.3	.6	28.2	79.1	.0	10	70	.8	2.3
8609200000	5.36	34.8	1.0	38.9	17.3	.3	28.2	68.7	.0	10	54	.6	2.3
8609270000	5.52	32.6	1.3	36.4	15.6	.4	31.0	62.5	.0	10	29	.6	2.4
8609301445	5.41	27.8	.5	31.4	13.2	.4	31.0	54.1	.0	10	29	.6	2.1
8609301600	5.42	27.4	.8	31.4	13.2	.6	31.0	56.2	.0	11	28	.6	2.2
8609301700	5.49	27.4	.8	31.4	14.0	.3	28.2	58.3	.0	11	27	.6	2.2
8609301800	5.37	27.8	.8	32.4	14.0	.4	31.0	58.3	.0	10	38	.6	2.2
8609301900	5.27	27.4	.8	32.4	14.0	.4	31.0	62.5	.0	10	63	.6	2.2
8609302000	5.11	2.8	1.0	33.9	15.6	.4	28.2	75.0	.0	11	90	.6	2.2
8610011000	5.08	27.8	1.0	36.4	17.3	.3	28.2	79.1	.0	13	131	.6	2.2
8610011100	5.15	28.3	1.0	35.9	17.3	.6	31.0	77.0	.0	13	120	.6	2.1
8610040000	5.76	35.2	1.5	27.4	11.5	.4	36.7	33.3	5.3	21	9	.9	2.2
8610050000	5.49	47.0	5.6	30.9	18.1	.7	53.6	47.9	5.3	25	25	1.0	1.8
8610070000	5.33	45.7	6.6	32.4	18.1	.7	53.6	54.1	1.6	24	37	1.0	1.9
8610080000	5.36	28.7	1.0	21.5	11.5	.9	33.9	31.2	.0	13	25	1.3	1.3
8610090000	5.44	42.2	2.0	32.4	17.3	.4	45.1	58.3	.0	10	54	.8	1.8
8610100000	5.67	44.4	3.8	38.4	18.9	.2	42.3	52.0	17.5	10	18	.7	2.4
8610110000	5.49	42.2	2.6	34.4	16.5	.4	48.0	60.4	.0	10	38	.8	1.9
8610120000	5.36	37.4	1.0	34.9	17.3	.3	42.3	64.5	.0	19	54	.6	2.2
8610180000	5.66	58.3	7.7	39.9	20.6	.9	59.2	64.5	6.4	13	11	1.2	2.2
8610250000	5.40	49.6	1.8	33.9	18.1	.9	53.6	62.5	.0	10	28	.7	2.4
8610310000	5.50	41.3	.8	27.9	14.8	1.0	42.3	50.0	.0	10	25	.6	1.9
8611060000	5.48	39.1	.8	36.4	14.8	1.0	48.0	47.9	.0	10	28	.6	2.0
8611130000	5.60	54.4	5.1	31.4	18.1	2.1	64.9	39.6	9.8	10	9	2.8	1.3

SOGNDAL 3 RUNOFF DATA. UNITS: MAJOR IONS UEQ/L, AL SPECIES UG AL/L,
TOC MG C/L, SIO2 MG/L. -99=MISSING DATA.

DATE	PH	NA	K	CA	MG	NO3	CL	SO4	ALK	ILAL	LAL	TOC	SIO2
8511170000	5.86	43.9	.8	27.4	12.3	1.1	31.0	29.1	15.3	10	42	2.8	2.4
8511240000	5.86	45.2	.5	27.9	12.3	1.5	31.0	27.1	22.9	10	3	2.4	2.5
8605080000	5.45	21.8	1.3	13.0	7.4	1.6	16.9	20.8	.0	13	17	.8	.8
8605110000	5.57	23.1	1.3	14.5	8.2	1.3	19.7	22.9	.0	13	14	.6	1.1
8605140000	5.71	22.2	1.0	15.0	6.6	.8	16.9	20.8	.0	10	5	.5	1.1
8605180000	5.76	20.9	1.0	15.5	7.4	.6	16.9	20.8	.0	10	6	.5	1.0
8605220000	5.75	20.4	1.0	12.0	5.8	.6	11.3	20.8	.0	10	5	.8	1.0
8605250000	5.74	17.4	1.0	13.0	5.8	.1	16.9	20.8	1.6	10	4	.6	1.0
8605290000	5.77	20.4	1.0	15.0	6.6	.4	19.7	20.8	.0	10	2	.7	1.1
8606020000	5.83	20.4	1.3	16.0	6.6	.5	19.7	20.8	.0	10	0	1.0	1.1
8606090000	5.93	23.1	1.3	15.5	6.6	.1	19.7	22.9	.0	10	0	.7	1.4
8606160000	5.76	26.5	1.3	21.0	7.4	.4	22.6	31.2	.0	10	0	.9	1.5
8606250000	5.73	36.5	1.0	19.0	9.9	1.0	25.4	29.1	.0	10	6	1.3	1.5
8606260000	5.84	37.8	.8	19.5	25.5	1.2	25.4	31.2	7.6	10	2	1.4	1.3
8606280000	5.89	40.0	.8	22.0	12.3	2.6	25.4	31.2	8.7	10	2	1.3	1.4
8607060000	5.81	40.5	.8	21.5	10.7	2.2	31.0	37.5	19.7	10	5	1.1	.8
8607130000	5.87	43.5	1.0	15.5	9.9	.1	31.0	29.1	.0	10	6	1.9	1.3
8607200000	5.65	43.5	.5	15.5	9.9	1.0	31.0	33.3	.0	10	4	1.2	1.1
8607270000	5.77	45.7	.8	15.0	8.2	1.6	33.9	31.2	1.6	10	0	1.3	.9
8608020000	5.94	39.1	2.6	14.5	7.4	.3	28.2	31.2	1.6	10	0	1.1	1.5
8608090000	6.05	33.9	.8	18.0	7.4	.3	19.7	22.9	5.3	10	0	1.0	1.6
8608160000	6.00	34.8	.5	16.0	6.6	.6	22.6	35.4	.0	10	0	1.1	1.6
8608230000	6.04	33.5	.8	16.5	7.4	.1	19.7	31.2	.0	10	4	.9	1.7
8608300000	6.08	38.7	.8	18.0	8.2	.2	25.4	37.5	6.4	10	0	.8	1.8
8609060000	6.09	36.1	1.0	21.0	9.9	.3	25.4	25.0	9.8	10	0	.6	4.8
8609130000	6.15	35.7	1.0	18.0	8.2	.1	25.4	25.0	7.6	10	0	.5	1.8
8609200000	6.07	34.4	1.5	23.0	10.7	.1	28.2	25.0	7.6	10	0	.5	1.9
8609270000	6.08	32.6	.5	20.5	9.0	.1	28.2	25.0	.0	10	0	.5	2.1
8610040000	5.86	42.6	1.0	22.5	10.7	.6	50.8	20.8	6.4	10	2	.4	1.7
8610100000	5.87	37.8	.8	21.0	9.9	.1	42.3	25.0	4.1	10	0	.3	1.5
8610180000	6.06	40.5	.5	23.0	12.3	.3	39.5	25.0	7.6	10	0	.4	1.8
8610250000	6.06	41.8	.5	20.5	10.7	.1	42.3	22.9	8.7	10	0	.4	1.8
8610310000	5.92	38.3	.5	18.5	9.9	.1	42.3	22.9	2.9	10	0	.4	1.6
8611060000	5.87	37.4	.8	24.0	9.9	.1	48.0	20.8	.0	10	0	.5	1.5
8611130000	5.74	41.3	1.0	24.5	14.0	.1	56.4	20.8	.0	10	6	.6	1.4

SOGNDAL 4 RUNOFF DATA. UNITS: MAJOR IONS UEQ/L, AL SPECIES UG AL/L,
TOC MG C/L, SIO2 MG/L. -99=MISSING DATA.

DATE	PH	NA	K	CA	MG	NO3	CL	SO4	ALK	ILAL	LAL	TOC	SIO2
8605080000	5.15	22.2	1.8	19.5	9.0	8.3	16.9	35.4	.0	23	36	1.3	1.0
8605090000	5.06	20.4	2.0	20.5	9.9	7.9	16.9	37.5	.0	21	42	1.1	1.1
8605100000	5.23	20.9	1.8	19.0	9.0	6.8	16.9	35.4	.0	21	30	1.1	1.1
8605110000	5.16	23.9	2.6	21.5	9.9	7.4	19.7	35.4	.0	23	50	1.2	1.4
8605120000	5.33	34.4	7.7	22.0	10.7	6.9	31.0	35.4	.0	26	36	1.6	1.3
8605130000	5.48	30.0	2.6	30.9	12.3	7.1	19.7	37.5	.0	32	13	1.5	1.6
8605140000	5.36	22.2	1.5	20.0	8.2	5.5	16.9	33.3	.0	22	17	1.3	1.3
8605170000	5.38	19.1	1.5	19.0	7.4	3.6	14.1	27.1	.0	24	25	3.3	1.1
8605180000	5.41	19.1	2.0	18.5	6.6	3.1	16.9	25.0	.0	24	18	2.6	1.1
8605220000	5.49	20.4	1.8	17.5	6.6	3.4	14.1	29.1	.0	24	17	2.6	1.1
8605250000	5.52	14.8	1.5	15.0	5.8	2.5	14.1	20.8	1.6	22	23	2.7	.8
8605290000	5.54	17.0	1.5	19.0	6.6	2.1	16.9	20.8	.0	23	10	1.4	1.0
8606020000	5.84	17.4	2.6	21.5	5.8	1.9	16.9	18.7	4.1	11	12	1.3	1.0
8606090000	5.70	23.5	.8	22.5	7.4	.4	19.7	27.1	.0	16	20	1.2	2.0
8606160000	5.73	32.6	1.5	33.9	9.9	.3	28.2	41.6	2.9	13	11	1.6	2.8
8606191700	5.35	39.1	1.8	26.4	11.5	.9	19.7	39.6	.0	47	39	4.1	2.7
8606191800	5.28	39.1	1.8	25.9	11.5	2.6	22.6	43.7	.0	46	35	3.8	2.7
8606191900	4.70	40.0	1.8	28.9	12.3	14.3	19.7	62.5	.0	40	69	3.3	2.7
8606192000	4.40	41.3	1.8	37.9	16.5	32.5	19.7	87.4	.0	44	129	3.6	2.6
8606192100	4.20	41.8	1.8	46.9	20.6	47.8	19.7	114.5	.0	46	148	3.5	2.5
8606192200	4.23	42.6	2.0	58.9	25.5	57.5	19.7	131.2	.0	45	211	3.3	2.3
8606192300	4.15	43.1	2.0	53.9	23.9	56.8	19.7	129.1	.0	44	190	3.4	2.4
8606201100	4.76	46.5	2.0	55.9	24.7	22.1	19.7	108.3	.0	44	167	2.8	2.5
8606210000	5.39	34.4	1.3	29.9	11.5	.3	28.2	52.0	.0	16	21	1.7	2.4
8606220000	5.50	37.4	1.5	29.4	11.5	.1	28.2	45.8	.0	14	17	1.7	2.6
8606230000	5.70	72.2	22.8	35.4	13.2	1.3	56.4	58.3	14.2	21	38	4.2	3.2
8606240000	5.58	37.8	1.3	31.4	13.2	.4	28.2	41.6	.0	13	19	1.4	2.7
8606250000	5.55	53.1	2.6	37.9	14.0	4.9	39.5	45.8	9.8	17	20	1.6	3.5
8606260000	5.55	53.5	3.6	32.4	13.2	1.3	39.5	54.1	.0	13	18	3.7	3.6
8608020000	5.40	43.9	1.5	39.4	14.8	.1	25.4	77.0	4.1	36	32	2.5	3.6
8608090000	5.74	31.3	1.3	25.4	9.0	.6	22.6	47.9	.0	24	15	1.7	2.4
8608160000	7.80	36.1	1.3	29.9	9.0	.9	28.2	47.9	.0	20	17	1.5	2.9
8608191500	5.54	28.3	1.0	27.4	10.7	.4	19.7	29.1	.0	47	31	3.1	2.5
8608191600	5.81	28.3	.5	26.9	9.9	5.0	19.7	39.6	.0	46	57	3.1	2.5
8608191700	4.63	28.7	.5	32.9	12.3	20.3	19.7	68.7	.0	42	86	3.0	2.5
8608191730	4.68	239.3	3.8	59.9	48.5	21.8	245.4	183.2	.0	46	128	2.6	2.7
8608191800	4.44	29.6	.8	40.9	15.6	35.7	19.7	102.0	.0	47	130	3.1	2.4
8608191900	4.30	30.9	.8	48.9	18.1	46.1	19.7	120.8	.0	47	151	3.4	2.4
8608192000	4.28	31.8	1.0	56.9	21.4	52.8	19.7	135.3	.0	47	194	3.0	2.2

8608201500	5.03	33.9	.5	58.9	21.4	10.5	22.6	97.9	.0	61	116	2.5	2.7
8608201630	4.85	34.4	1.0	55.4	20.6	14.1	22.6	104.1	.0	51	119	2.5	2.7
8608201830	4.52	36.5	1.5	61.9	23.0	29.6	25.4	199.9	.0	43	157	2.4	2.7
8608201930	4.39	40.5	1.0	71.4	27.1	38.2	28.2	229.0	.0	45	172	2.4	2.6
8608202030	4.33	37.4	1.0	71.9	27.1	45.7	25.4	224.9	.0	47	208	2.4	2.6
8608211015	4.79	39.1	1.3	71.4	28.0	19.3	25.4	191.5	.0	55	198	2.3	2.8
8608220000	5.41	30.9	.8	31.9	11.5	.6	22.6	72.9	.0	26	33	1.3	2.6
8608230000	5.37	36.5	.8	51.9	19.7	.9	22.6	108.3	.0	41	58	1.8	2.8
8608240000	5.60	33.9	1.0	28.9	10.7	2.8	25.4	50.0	.0	20	23	1.3	2.7
8608250000	5.60	35.7	1.3	29.4	9.9	.9	28.2	66.6	.0	20	21	1.6	2.7
8608260000	5.62	37.0	1.5	33.4	12.3	.1	25.4	56.2	.0	19	24	1.2	2.7
8608270000	5.78	39.1	1.3	33.9	11.5	.9	28.2	52.0	4.1	15	10	1.5	2.8
8608290000	5.78	43.5	1.8	34.9	13.2	.8	31.0	66.6	6.4	12	16	1.2	3.2
8608300000	5.75	46.1	2.3	35.9	13.2	1.1	36.7	62.5	.0	4	26	1.2	3.5
8608310000	5.73	40.9	2.0	34.9	13.2	.4	31.0	68.7	.0	15	16	1.4	3.3
8609010000	5.91	43.9	1.5	34.4	12.3	.1	33.9	83.3	5.3	26	21	2.0	4.0
8609020000	5.80	44.8	2.6	36.9	13.2	.4	33.9	66.6	.0	15	18	1.5	3.6
8609021300	5.54	38.7	.8	39.9	16.5	.1	31.0	72.9	7.6	39	45	1.9	3.2
8609021630	5.20	38.7	1.0	42.4	16.5	7.1	33.9	75.0	.0	30	48	2.1	3.2
8609021730	4.79	40.0	1.0	44.9	17.3	13.3	31.0	81.2	.0	27	84	2.0	3.0
8609021830	4.57	40.5	1.0	51.4	20.6	22.8	31.0	131.2	.0	33	124	2.1	3.1
8609021930	4.38	41.3	1.3	59.4	23.0	32.5	33.9	166.6	.0	42	145	2.1	3.0
8609022030	4.28	42.2	1.3	63.9	24.7	37.4	33.9	181.1	.0	31	167	2.1	3.0
8609022130	4.34	42.2	1.5	68.9	27.1	40.3	33.9	177.0	.0	33	236	2.3	3.0
8609031000	4.63	43.9	1.5	76.8	31.3	25.3	33.9	174.9	.0	37	204	2.3	2.9
8609040000	5.10	43.1	1.0	59.4	25.5	5.0	33.9	118.7	.0	40	122	1.8	3.0
8609050000	5.63	33.5	.5	28.9	11.5	.4	31.0	62.5	.0	22	20	1.1	2.5
8609060000	5.35	37.8	.8	44.9	18.9	.4	31.0	122.8	.0	34	40	1.6	6.6
8609070000	5.56	30.0	.8	28.9	11.5	.9	25.4	58.3	.0	21	30	.8	5.7
8609080000	5.38	40.0	1.0	45.9	19.7	.4	33.9	131.2	.0	40	53	1.6	6.9
8609090000	5.40	38.7	.8	42.4	17.3	.4	31.0	129.1	4.1	33	33	1.4	2.8
8609100000	5.84	32.2	.8	29.4	11.5	.3	25.4	41.6	4.1	15	15	.9	2.5
8609110000	5.40	33.5	.8	37.9	15.6	.2	25.4	43.7	2.9	33	45	1.4	2.4
8609120000	5.61	29.6	.8	25.0	9.9	1.2	25.4	35.4	.0	25	19	1.4	2.3
8609130000	5.52	37.0	1.5	41.9	15.6	.3	31.0	56.2	4.1	33	30	1.5	2.6
8609140000	5.46	38.3	1.0	38.9	14.0	.3	28.2	52.0	7.6	29	35	1.2	2.9
8609150000	5.87	34.4	1.0	26.9	9.9	.7	25.4	37.5	1.6	13	13	1.1	2.9
8609160000	5.41	32.6	1.0	41.4	15.6	.1	25.4	47.9	5.3	39	41	1.6	2.8
8609200000	5.41	34.8	1.0	35.4	14.8	.2	33.9	41.6	.0	51	34	1.9	2.5
8609270000	5.48	34.8	.8	39.9	14.0	.1	36.7	43.7	14.2	39	37	1.3	3.3
8610010650	5.45	26.1	.8	29.4	10.7	.1	33.9	29.1	.0	49	32	1.9	2.2
8610010815	4.84	27.4	1.0	32.4	12.3	12.8	33.9	56.2	.0	41	90	1.9	2.3
8610010915	4.44	28.7	1.5	38.4	14.0	27.5	33.9	72.9	.0	37	92	2.1	2.1
8610011015	4.22	29.6	2.0	44.9	17.3	44.3	33.9	97.9	.0	36	121	1.9	2.2

8610011245	4.19	30.9	2.0	53.4	19.7	50.3	33.9	114.5	.0	34	176	2.0	2.2
8610011345	4.12	31.8	2.3	58.4	22.2	58.2	33.9	139.5	.0	31	204	2.0	2.2
8610011900	4.25	32.6	2.3	65.4	24.7	52.1	33.9	131.2	.0	36	226	1.8	2.1
8610040000	5.41	47.0	4.1	31.4	18.1	.9	53.6	54.1	2.9	21	35	1.0	1.7
8610050000	5.45	32.6	.8	26.4	11.5	.2	36.7	33.3	2.9	22	28	.6	2.0
8610070000	5.60	39.6	6.6	27.9	10.7	.3	45.1	31.2	9.8	22	23	1.0	2.1
8610080000	5.68	31.8	.8	27.4	10.7	.4	33.9	31.2	2.9	19	3	2.0	2.4
8610090000	5.71	33.1	.5	26.9	10.7	.4	33.9	33.3	.0	10	21	1.5	2.5
8610100000	5.53	32.6	.8	28.9	10.7	.1	36.7	37.5	4.1	10	21	.7	2.0
8610110000	5.28	47.8	1.0	40.4	15.6	.1	64.9	41.6	1.6	32	44	1.3	2.2
8610120000	5.67	31.3	.5	25.0	9.9	.1	33.9	35.4	.0	18	9	1.0	2.5
8610180000	5.63	37.0	.5	27.9	11.5	.6	31.0	35.4	6.4	13	11	.7	2.3
8610250000	5.57	37.0	.5	24.5	9.9	.8	33.9	33.3	5.3	12	13	.6	2.4
8610310000	5.35	39.6	.5	25.0	10.7	.4	42.3	33.3	.0	33	37	1.4	2.0
8611060000	5.70	32.2	.5	28.9	9.9	.2	39.5	29.1	.0	13	17	.9	2.0

FIL:(SNSF)WRI-1986-SOGNDAL:SYMB

APPENDIX 10.

SOGNDAL PRECIPITATION. WEEKLY-BULK SAMPLES. UNITS:UEQ/L

DATE ON	DATE OFF	MM	PH	NA	K	CA	MG	NH4N	NO3N	CL	SO4
851101	851104	2.9	5.88	47.8	21.2	5.0	90.5	13.6	4.3	59.2	80.4
851104	851111	26.4	4.45	34.8	4.9	5.0	65.8	14.3	19.3	39.5	54.0
851201	851209	14.3	4.72	13.0	3.6	5.0	2.5	6.4	12.2	14.1	19.7
851209	851216	43.9	5.08	26.1	14.3	5.0	3.3	12.2	10.0	31.0	21.2
851216	851222	36.9	5.14	17.4	3.1	0.0	2.5	2.9	5.0	16.9	11.6
860101	860106	8.9	4.88	26.1	5.6	3.5	4.9	2.9	9.3	28.2	14.6
860106	860113	16.6	4.81	27.0	8.2	6.0	4.9	10.0	14.3	28.2	15.6
860113	860120	7.3	5.98	180.1	53.7	13.5	11.5	72.8	13.6	177.7	20.8
860217	860224	8.9	5.43	118.3	36.1	11.5	9.9	44.3	28.6	110.0	37.5
860224	860301	2.9	5.02	100.1	22.2	9.5	11.5	31.4	20.0	98.7	35.4
860301	860303	9.6	5.44	63.5	22.2	8.5	5.8	23.6	7.9	70.5	14.6
860303	860310	11.8	4.63	28.7	5.1	4.5	4.1	15.7	23.6	33.9	20.8
860317	860324	21.0	4.80	37.4	10.2	8.0	4.9	22.1	19.3	39.5	27.1
860324	860331	2.9	4.94	89.6	46.0	14.0	12.3	27.8	28.6	93.1	31.2
860407	860414	2.5	4.63	27.0	6.4	8.5	3.3	16.4	15.0	31.0	29.1
860428	860501	21.0	4.58	2.6	2.3	9.0	2.5	30.0	16.4	5.6	50.0
860505	860512	10.0	4.66	6.1	2.0	12.0	1.6	2.9	.7	5.6	35.4
860512	860519	17.2	4.53	2.6	.3	3.0	.8	14.3	13.6	5.6	31.2
860519	860526	17.2	4.34	38.3	3.1	5.0	7.4	2.9	.7	36.7	50.0
860526	860602	19.1	4.56	13.1	1.5	3.0	4.1	14.3	15.7	14.1	31.2
860602	860609	26.8	4.59	1.7	1.8	2.0	.8	5.0	1.4	2.8	22.9
860609	860616	8.6	4.03	13.9	6.1	8.5	4.1	55.7	27.1	11.3	141.6
860616	860623	1.7	4.43	6.1	3.3	4.5	2.5	2.9	1.4	2.8	45.8
860701	860707	7.0	5.98	26.1	37.1	10.0	4.9	111.5	25.7	31.0	86.1
860707	860714	5.7	4.83	17.4	6.9	5.0	2.5	2.9	0.0	16.9	21.5
860714	860721	8.9	4.32	13.0	3.1	10.0	4.1	0.0	10.7	11.3	45.3
860721	860728	3.3	5.10	13.0	10.2	5.0	1.6	0.0	0.0	14.1	15.0
860728	860801	24.5	4.63	4.4	4.6	5.0	1.6	7.2	0.7	2.8	28.1
860801	860804	2.4	4.57	13.0	10.8	10.0	4.1	0.0	0.0	14.1	47.1
860804	860811	51.6	4.46	17.4	7.9	5.0	1.6	4.3	5.0	19.7	32.5
860811	860818	8.9	4.38	17.4	10.8	5.0	2.5	0.0	0.0	19.7	44.0
860818	860825	19.4	4.73	4.4	2.0	0.0	0.8	7.2	4.2	2.8	14.7
860901	860908	28.3	5.39	17.4	2.6	0.0	3.3	4.3	0.0	22.6	13.1
860908	860915	9.2	5.16	8.7	4.1	0.0	0.0	0.0	0.0	8.5	9.4
860915	860922	33.1	5.81	74.0	39.2	10.0	7.4	30.0	6.4	87.4	22.2
860922	860929	25.2	5.02	21.8	2.6	5.0	3.3	0.0	0.0	25.4	15.6
860929	861001	14.3	5.21	39.2	5.4	5.0	5.8	0.0	3.6	42.3	17.8
861001	861006	27.1	5.07	95.7	3.8	5.0	21.4	0.0	0.0	112.8	50.7
861006	861013	19.1	4.88	17.4	4.1	0.0	3.3	4.3	3.6	22.6	23.7
861013	861020	15.0	5.08	130.5	20.0	10.0	28.8	0.0	0.7	166.4	81.6

861020	861027	2.9	5.30	26.1	7.7	5.0	5.8	4.3	8.6	28.2	18.4
861027	861103	24.2	5.30	17.4	2.8	5.0	4.1	0.0	0.0	16.9	15.3
861103	861110	60.8	5.18	73.9	8.4	5.0	10.6	4.3	2.9	90.2	28.5
861110	861117	48.7	4.75	23.5	8.2	4.5	4.1	5.7	7.1	22.0	20.6

FIL: (SNSF)WRI-86SOGN:TEXT

RAIN PROJECT

Publications June 1987

Wright, R.F. 1985. RAIN project. Annual report for 1984. Acid Rain Res. Rept. 7/1985 (Norwegian Institute for Water Research, Oslo), 39 pp.

Lotse, E., and E. Otabbong; 1985. Physiochemical properties of soils at Risdalsheia and Sogndal.RAIN project. Acid Rain Res. Rept. 8/1985 (Norwegian Institute for Water Research, Oslo), 48 pp.

Wright, R.F. 1985. RAIN-prosjektet. Limnos nr. 1: 15-20 (in Norwegian)

Wright, R.F., E. Gjessing, N. Christophersen, E. Lotse, H.M. Seip, A. Semb, and B. Sletaune, 1986. Project RAIN: Changing acid deposition to whole catchments. The first year of treatment. Water Air Soil. Pollut. 30: 47-64.

Wright, R.F. and E. Gjessing 1986. RAIN project. Annual report for 1985. Acid Rain Res. Rept. 9/1986 (Norwegian Institute for Water Research, Oslo), 33 pp.

Wright, R.F., E. Gjessing, A. Semb and B. Sletaune. 1986. RAIN project. Data report 1983-85. Acid Rain Res. Rept. 10/86 (Norwegian Institute for Water Research, Oslo), 62 pp.

Wright, R.F. and B.J. Cosby, 1987. Use of a process-oriented model to predict acidification at manipulated catchments in Norway. Atmos. Environ. 21: 727-730.

Wright, R.F. 1986. RAIN project: Results after 2 years of treatment. p. 23-40, In Proceedings Workshop on Reversibility of Acidification 9-11 June 1986 (Commission of the European Communities, DG XII/G-I, 200 Rue de la Loi, 1049 Brussels), 202 pp.

Hauhs, M. 1986. Relation between chemistry of soil solution and runoff in two contrasting watersheds: Lange Bramke (West Germany) and Risdalsheia (Norway), p. 207-217, In S. Haldorsen and E.J. Berntsen (eds.) Water in the Unsaturated Zone (Nordic Hydrologic Programme Report 15, P.O. Box 5091, 0301 Oslo), 284 pp.

Hauhs, M. 1987. The relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway (RAIN-project), p. 173-184, In Acidification and Water Pathways, vol. I. (Norwegian national Committee for Hydrology, P.O.Box 5091, 0301 Oslo 3), 458 pp.

Norwegian Institute for Water Research NIVA

Acid Rain Research Reports

1/1982 Henriksen, A. 1982. Changes in base cation consentrations due to freshwater acidification. 50pp. Out of print.

2/1982 Henriksen, A. and Andersen, S. 1982. Forsuringssituasjonen i Oslomarkas vann. 45 pp. Out of print.

3/1982 Henriksen, A. 1982. Preacidification pH–values in Norwegian rivers and lakes. 24pp. Out of print.

4/1983 Wright, R.F. 1983. Predicting acidification of North American lakes. 165 pp.

5/1983 *Schoen, R.*, Wright, R.F. and *Krieter, M.* 1983 Regional survey of freshwater acidification in West Germany (FRG). 15 pp.

6/1984 Wright, R.F. 1984. Changes in the chemistry of Lake Hovvatn, Norway, following liming and reacidification. 68 pp.

7/1985 Wright, R.F. 1985. RAIN project. Annual report for 1984. 39 pp.

8/1985 *Lotse, E* and *Otabbong, E.* 1985. Physiochemical properties of soils at Risdalsheia and Sogndal: RAIN project. 48 pp.

9/1986 Wright, R.F. and Gjessing, E. 1986. RAIN project. Annual report for 1985. 33 pp.

10/1986 Wright, R.F., Gjessing, E., Semb, A. and Sletaune, B. 1986. RAIN project. Data report 1983–85. 62 pp.

11/1986 Henriksen, A., Røgeberg, E., Andersen, S., and Veidel, A. 1986 MOBILLAB–NIVA, a complete station for monitoring water quality. 44 pp.

12/1987 Røgeberg, E. 1987. A coulometric Gran titration method for the determination of strong and weak acids in freshwater. 28 pp.