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**VISIT REPORT NUMBER 5**

**Visit to Chile During May - June 1996**

**Instrument Section  
Institute of Hydrology  
Natural Environment Research Council  
Crowmarsh Gifford, Wallingford  
Oxfordshire, OX10 8BB, UK.**

**July 1996**



# **1 VISITING STAFF**

Mr Jonathan G Evans, Institute of Hydrology (20 May - 17 June 1996).

## **2 VISIT OBJECTIVES AND PRINCIPAL ACTIONS**

### **2.1 Objectives**

The principal aim of the visit was to train CONAF staff in the use of hydrological and meteorological field instrumentation provided for the project:

- i.) the operation of Campbell Scientific CR10 data loggers, which are an integral part of each of the three data logging systems, namely the Automatic Weather Stations (AWSs), the WISER sediment monitoring stations and the water level recorders;
- ii.) the installation of the data logging systems and their subsequent maintenance;
- iii.) collection of data using a Campbell Scientific Storage Module, down-loading of data to a personal computer (PC) and quality control /data management procedures;
- iv.) the operation of other items of equipment, as required, but particularly the Surface Capacitance Insertion Probes (SCIPs) and the Environmental Measurements rain loggers.

Two secondary objectives had arisen due to the timing of the visit:

- i.) to take photographs of the new La Reina catchment in Region 10 and to gather any additional information about this catchment;
- ii.) to supervise the distribution of a consignment of equipment for the project, due to arrive in Santiago at the end of May.

### **2.2 Principal Actions**

- i.) CONAF staff have received extensive training in the use of Campbell Scientific data logging systems; the staff are now both competent and confident in this area of their fieldwork.
- ii.) Advice has been given on the installation and maintenance of the logging systems, particularly in the light of visits to the focus catchments.
- iii.) CONAF staff have been trained, and have demonstrated their ability, to collect data using a Storage Module, down-load this to a PC and to import the data file into a spreadsheet program running on the PC (Microsoft Excel). They have also had an introduction to the concepts of data quality management.

- iv.) Training has also been given in the operation of the Sheer Vane Tester, SCIPs, the Environmental Measurements ARG100 rain gauge and the 1LX ver.2 rain logger.
- v.) Some additional background information on the CR10 data loggers and the associated software was given as an introduction for CONAF staff to the potential use of these data logging systems.
- vi.) Photographs of La Reina catchment, Region 10, were taken and copies of aerial photographs obtained.
- vii.) Data logger programs supplied by Didcot Instrument Company (DICO) were modified to include the necessary instruction to automatically down-load data to a Storage Module. The water level recorder program was also modified to log data every five minutes instead of every hour.
- viii.) One AWS data logger was partly rewired on site due to severe damage caused by its battery shorting-out during shipping.
- ix.) CONAF staff concurred that there is a need for a brief field operations handbook, written in Spanish, to cover day-to-day operation of at least the three CR10 logging systems. Further, for long term maintenance of the equipment and the development of CONAF's instrument capability, they should have copies of the primary instrument manuals written in Spanish. The Institute of Hydrology's Instrument Section will advise CONAF on the availability of such manuals; significant deficiencies in this area may lead CONAF to commission their own translations.
- x.) The Institute of Hydrology Instrument Section has agreed to provide some minor modifications to the WISER and water level recorder data logger programs. These are required to allow more frequent logging of data and automatic water sampling for hydrological events occurring over very short time periods, which are expected at the Chosme gullies.
- xi.) DICO have very recently gone into liquidation; however CONAF have been assured that the Institute of Hydrology Instrument Section can provide a line of support for DICO supplied instrumentation. Whilst not able to undertake a full repair service for this equipment the Instrument Section can advise on fault-finding and suppliers of spare parts.
- xii.) Some of the DICO supplied loggers had deeply discharged lead-acid batteries because they had been in store without a solar panel attached to maintain the battery. 12 Volt lead-acid battery chargers were available within CONAF so the logger batteries could be re-charged. This led to contact with two radio communication technicians (one in Region 10, the other in Region 8) who support CONAF's extensive radio network. These personnel should be capable of providing a component-level repair service for most of the instrumentation, if this is required in the future.
- xiii.) The May consignment of equipment had arrived in Santiago during the visit but was not

released by customs until after the end of the visit; however now that CONAF are familiar with the equipment, there should be no difficulty for them to organise its appropriate distribution.

### **3 TRAINING PROGRAMME**

A visit programme was arranged in consultation with CONAF, the University of La Serena (ULAS) and the British Council in Santiago. This envisaged an overview of CR10 data logging, attended by all CONAF staff involved with the project at the field level, to take place at CONAF Central Office in Santiago and at the nearby Quebrada de los Almendros focus catchment in the Metropolitan Region; to be followed by extensive hands-on training, in smaller groups, at the focus catchments. However not all of the relevant staff were able to attend the overview training and delays in building the gauging structures at the focus catchments prevented the installation of the stream monitoring equipment, thus training was actually done at regional or provincial offices. Working indoors allowed faster progress, as time was not spent on minor installation details, and there was shelter from the poor weather during the visit.

Since some key staff could not attend the overview training there was necessarily some repetition in the material covered but this had the advantage of reinforcing the material and often raising new questions on the second presentation. The Metropolitan Region were unable to receive all their training in the allotted time but were able to attend in Region 8, to complete their training. Edmundo Gonzales of ULAS was trained along with the CONAF staff in Region 8. Attendance at training seminars and the subjects covered are listed in Table 1. In addition to the training seminars there were visits to the focus catchments and meetings with senior CONAF management, the British Council and the Agencia de Cooperación Internacional de Chile (AGCI); the full visit programme is in Appendix 1.

Note that Ruben Urzua is no longer the project Technical Coordinator since he has moved posts within CONAF and is now working for a different department; apparently this role has not been refilled, thus Wilfredo Alfaro (the Project Technical Manager) has had to take on this work.

### **4 PROGRESS OF THE FOCUS CATCHMENT GAUGING STRUCTURES**

#### **4.1 Metropolitan Region**

Wilfredo Alfaro has decided to use the lower site at Quebrada de los Almendros since construction will be far easier and less expensive than it would be at the upper site. The upstream water offtake will be monitored by a mechanical meter. The possibility of heavy rain at this time of the year has made the construction technically more difficult because of the risk of damage during the building work; CONAF have had to concede to accept some of this risk. This has resulted in a delay in appointing a contractor.

**TABLE 1 THE INSTRUMENT TRAINING PROGRAMME**

SUBJECTS COVERED	REGIONS & DATES			
	Central Office 22 May	Metropolitan Region 23-24 May	Tenth Region 28-30 May	Eighth Region 31 May 3-5 June
CR10 data logging overview	X			X
Loading a data logger program & setting the real-time clock		X	X	X
Installation and operation of the different sensors; checking readings with the keypad (CR10KD)		X	X	X
Data collection using a Storage Module, SMCOM & a PC; manual data dump (*8 mode)		X	X	X
Setting the WISER sampling regime parameters using *4 mode			X	X
Water Sampler (EPIC 1011), mechanical operation & maintenance, programming the sampler		X	X	X
Installation & Maintenance of the systems & power supplies; sensor calibration			X	X
Data quality management			X	X
Operation of the Sheer Vane Tester			X	
SCIP - operation, calibration & changing the batteries			X	X
11X ver.2 Rain Logger; programming the logger & collecting data using SOFT1; installation of the ARG100 rain gauge				X
<b>ATTENDEES</b>	H.Adriozola W.Alfaro S.Francke F.Moraga	H.Adriozola W.Alfaro C.Cerda S.Francke L.Garrido F.Moraga	H.Adriozola W.Alfaro F.Moraga	W.Alfaro A.Arancibia F.Castillo C.Cerda L.Garrido E.Gonzales P.Ragio J.Riffo

The only instrumentation that has been installed is the AWS. This is operating correctly but must be moved to a more representative site, higher in the catchment. At present it is located at a Meteorological Station near to the bottom of the catchment; this is too sheltered and not at a representative altitude.

#### **4.2 Tenth Region**

Shortly before the start of this technical visit CONAF had informed James Blackie, Institute of Hydrology, that a new catchment had had to be found in Region 10. This communication had been delayed because CONAF had endeavoured to find a new catchment before contacting the Consultant. The Rivaclavia catchment can no longer be used since the landowners have withdrawn their consent. The new catchment, named La Reina, is close to La Barra area, about 70 km NW of Osorno. La Reina has been selected by CONAF with agreement from Andres Iroume, Institute of Forest Management, University of Austral, but without consultation with the UK Consultants. CONAF had only provided very sketchy details of this catchment to the UK Consultants, before this technical visit, making it very difficult for them to provide any specific comments on the suitability of the catchment or the design of the structure.

The total extent of the catchment is just 25 ha, one quarter of that recommended for SHETRAN modelling, however rainfall in this locality is extremely high, with up to 5000 mm/year. The site is also on clay soil and CONAF are confident that the stream will not be dry in the Summer. The point selected for gauging has little hydraulic gradient and is generally suitable for a gauging station, although the channel is quite shallow and not particularly well defined. The catchment is under Radiata Pine, with the usual narrow belt of native species alongside the stream; the gauging site had been cleared for surveying and the final drawings were being completed by the appointed civil engineer during the visit. Access to the site is good, on all-weather forest roads and a compound trapezoidal flume is due to be completed in early July.

The length of the catchment is 1 km and has a total difference in altitude of 150 m. The maximum 24-hour rainfall ( $T=10$ ) is estimated to be 120 mm, giving an estimated (Ramsay Grunsky method) maximum flow of 0.94 m<sup>3</sup>/s, while the expected average Summer base flow is 0.0035 m<sup>3</sup>/s (in January). Photographs of the gauging site were taken and copies of aerial photographs of the catchment were received from CONAF.

#### **4.3 Chosme Gully Study**

Two visits were made to the Chosme gully study area, which is being instrumented and modelled by Edmundo Gonzales of ULAS. The first visit was made between training days whilst staying in Region 8; the second was arranged at Edmundo Gonzales' request and occurred immediately prior to returning to the UK. It was evident, on the first visit, that good progress was being made on the two gauging structures (V-notch weirs), one on each of the two gullies being studied. The construction work was nearing completion and Edmundo Gonzales expected to have all the instrumentation installed by the time of the second visit (two weeks later).

On the second visit most of the instrumentation had been installed, although this work had been

hampered by heavy rains. The gauging structures were complete and operational. The water level recorders had been installed with the floats in the stilling wells, and the data loggers correctly recording the levels. The AWS and two Environmental Measurements raingauges had been installed in a separate chain-link fenced enclosure, at the head of the gullies. All the installations are of a professional standard, however the proximity of the AWS enclosure, which measures approximately 3 m x 3 m, may affect the raingauge catches, and it was therefore advised that the raingauges are sited outside of this enclosure. The AWS anemometer may also be affected although it is just above the level of the top of the fence.

The WISER sediment monitoring stations were installed but not yet operational, however they were to be made operational within a few days of the visit. It was noted that Edmundo Gonzales had had problems with water entering the gauging station instrument enclosures, before the stilling well inlets had been properly sealed. The enclosures are of rendered brick, with small vent bricks and a secure hinged steel lid; this presents a problem of inadequate ventilation should significant moisture enter the enclosure. If, for example, flooding occurs then the lid must be left open until the inside of the enclosure is thoroughly dry, otherwise there is likely to be instrument failure due to damp.

Some solar panel cables required extending on site, this was done using sealed connectors.

The particular data requirements of Edmundo Gonzales were discussed and it was concluded that some minor modifications to the CR10 data logger programs would be required. These are necessary due to the expected fast hydrological response of the gullies. Modifications will be made so that data can be recorded more frequently and also automatic water samples triggered more frequently. Some advice will also be given as to how Edmundo Gonzales can change some of these parameters himself.

#### **4.4 Eighth Region**

The gauging structure for Minas del Prado is most behind schedule. Wilfredo Alfaro was re-considering the design on the grounds of cost and ease of construction; therefore no contractor has been appointed yet. It is now the Chilean Winter and important data is being lost whilst construction will be complicated by rain. It also important that all the instrumentation is installed and that field staff begin to operate it, without delay, now that they are trained to do so.



## APPENDIX 1 VISIT PROGRAMME

19 May	Leave UK
20 May	Arrive Chile. Meeting at British council. Discussions at CONAF Central Office.
21 May	Work in hotel (Chilean national holiday).
22 May	Training seminar at CONAF Central Office.
23 May	Field training at Rio Clarillo National Reserve, Quebrada de los Almendros focus catchment.
24 May	Field training at Rio Clarillo National Reserve.
25 May	Rest day.
26 May	Travel to Puerto Montt.
27 May	Meeting at Region 10 CONAF office. Visit to La Reina Catchment. Travel to Puyehue National Park.
28 May	Field Training at Puyehue National Park.
29 May	Field Training at Puyehue National Park.
30 May	Field Training at Puyehue National Park. Work at Osorno Provincial Office. Travel to Concepcion via Puerto Montt.
31 May	Meeting at Region 8 CONAF office. Work at Escuadron training centre, including re-wiring of shorted-out CR10.
1 June	Visit to Chosme gullies and Minas del Prado catchment.
2 June	Rest day.
3 June	Training seminar at Escuadron training centre.
4 June	Field training at Escuadron training centre.
5 June	Field training at Escuadron training centre. Travel to Santiago.
6 June to 13 June	On leave.
14 June	Meeting at CONAF Central Office. De-briefing meeting at AGCI. Discussion at

CONAF Central Office.

- 15 June Rest Day.
- 16 June Second visit to Chosme gullies via Concepcion. Return to Santiago.
- 17 June Leave Chile.
- 18 June Arrive UK.

## **APPENDIX 2 PEOPLE MET**

### **CONAF**

*Central Office:* Mr Victor Venegas (Director, Forest Development and Support)  
Ms Aida Baldini (Head, Department of Projects and Programmes)  
Dr Samuel Francke (Head, Catchment Management Programme)  
Mr Wilfredo Alfaro (Catchment Management Programme)  
Mr Alex Arancibia (Catchment Management Programme)  
Mr Pedro Raggio (Catchment Management Programme)

*Metropolitan Region:* Mr Carlos Cerda (i/c Catchment Management Regional Programme)  
Mr Luis Garrido (i/c Forest Control, Santiago Provincial Office)

*Region 8:* Mr Juan Riffo (i/c Catchment Management Regional Programme)  
Mr Francisco Castillo (i/c Forest Development and Support, Chillan Provincial Office)

*Region 10:* Mr Fernando Moraga (i/c Forest Development and Support, Region 10)  
Mr Hector Adriaola (i/c Forest Development and Support, Osorno Provincial Office)

### **University of La Serena:**

Mr Edmundo Gonzales (Department of Civil Engineering)

### **AGCI:**

Mr Pedro Ramirez (Area Coordinator)

**British Council, Santiago:**

Mr Robin Evans (Director)

Ms Clare McVeigh (Assistant Director)

Ms Anne St-Laurent (Projects Officer)