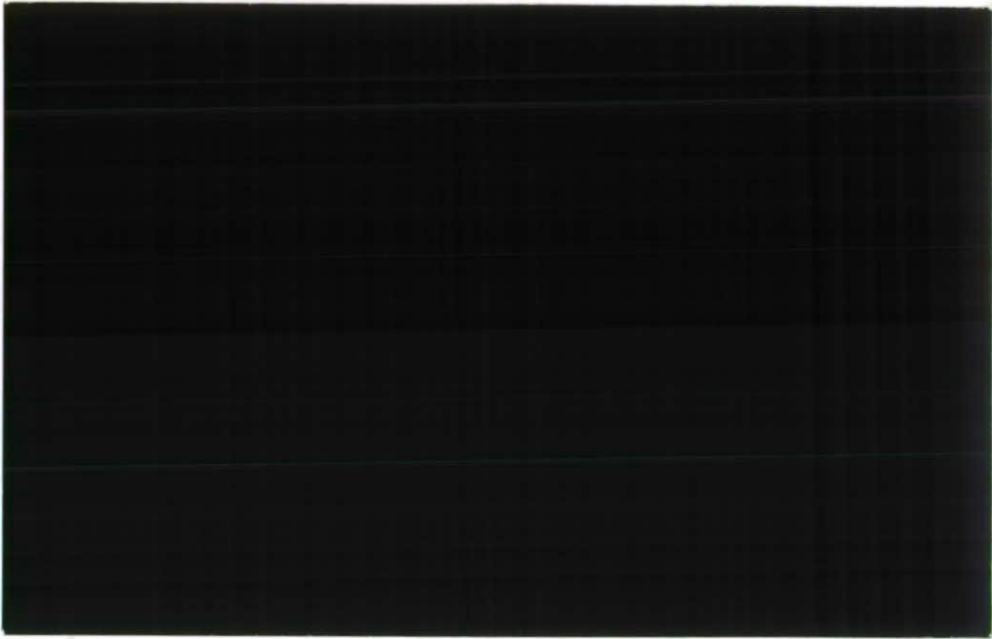




Institute of
Hydrology

1995/064



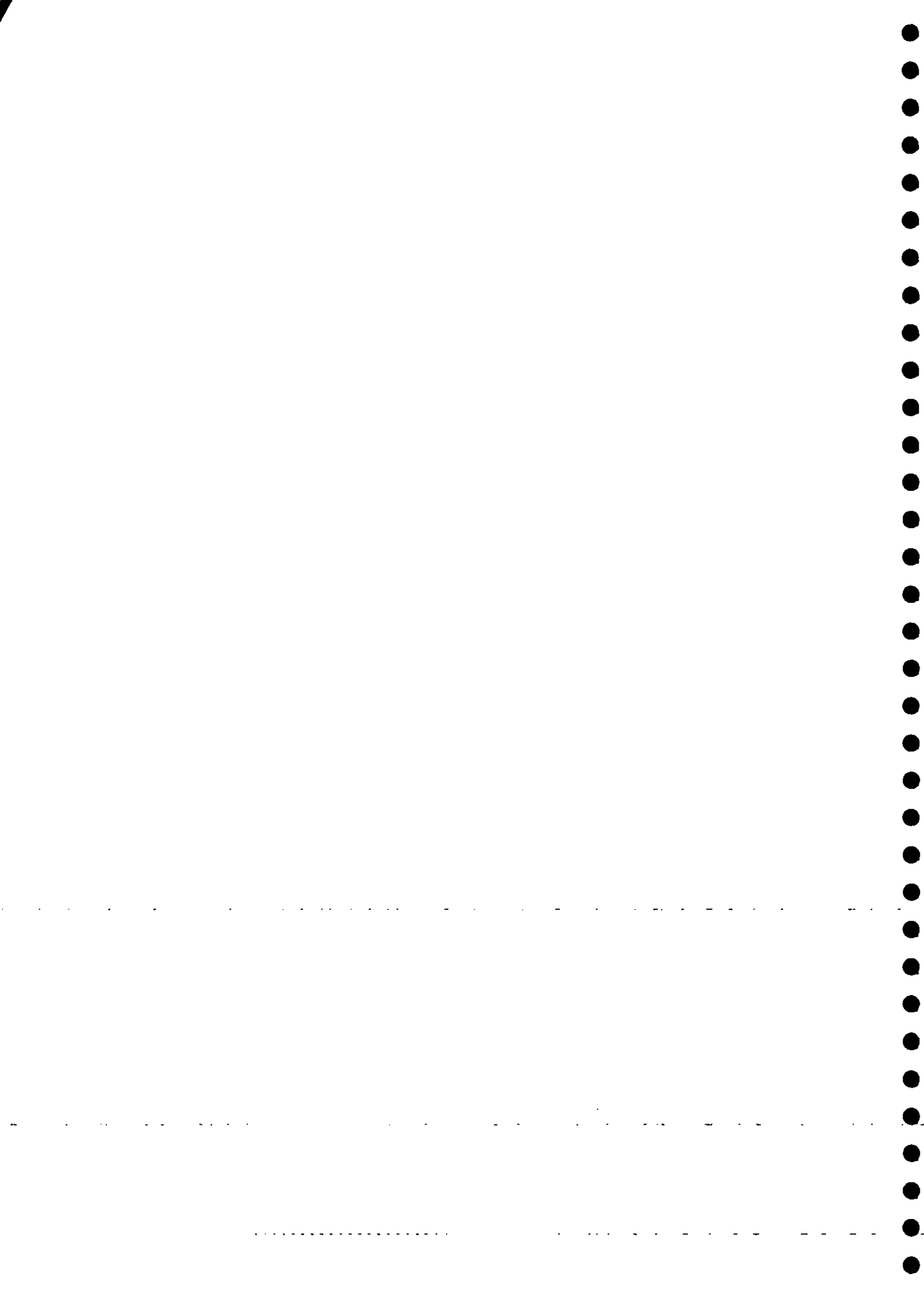
**INSTRUMENT REQUIREMENTS FOR
THE RIVER BASIN MANAGEMENT
PROJECT: CHILE**

J. R. Blackie

Institute of Hydrology
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB
UK

Tel: 01491 838800
Fax: 01491 692424
Telex: 444293 ENVRE G

January 1995



INSTRUMENT REQUIREMENTS

for the

RIVER BASIN MANAGEMENT PROJECT: CHILE

1. INSTRUMENTATION

In the Project Document a provisional list of instrumentation for the focus basin and gully study components of the Project was included, with the proviso that the final instrumentation requirements would be dictated to some extent by the choice of the basins to be used. Considerable progress was made towards identifying the basins during the visit to Chile in September 1994 by J. Bathurst from Newcastle and J. R. Blackie from the Institute of Hydrology. On that basis the following items have been identified as definite requirements. It should be noted however that requirements for some additional items may still be identified once the final site choices have been made and the surveys done.

Two separate lists have been made to cover the CONAF and La Serena requirements. Many items occur in both lists. For purchasing purposes the lists should be combined. This may give some cost savings but, more importantly, it will ensure that there is a base level of identical equipment common to all sites. This helps to ensure comparability of data between sites and will effect cost and time savings in training, operational and maintenance procedures. It also gives a degree of flexibility in the disposition of the instrumentation. Included in the CONAF list is a neutron probe soil moisture meter. This instrument is in fact to be purchased for the Austral University of Chile at Valdivia. They have staff who are familiar with this potentially hazardous equipment and the specialist storage, transport and field techniques it requires. Whilst they will be the main users, it will be made available for soil moisture sampling work on the CONAF basins in the area under their supervision.

In the CONAF and La Serena lists (sections 2. and 3.) the type of instrument and the numbers required are given. In section 4. a brief specification of each instrument, in terms of what it is required to do, is given. In a number of cases names of known suppliers are quoted. These are given simply to indicate possible sources and should not be regarded as implying that they should be used.

An exception to this occurs in specifying the loggers to be incorporated in the water level recorders, the automatic weather stations and the suspended sediment monitoring stations. It makes obvious good sense to use the same type of logger in each of these installations so that common programming, downloading and data handling software, hardware and field procedures can be adopted. The logger specified, the Campbell Scientific CR10, is known to have the flexibility to meet the requirements and its reliability has lead to its widespread use throughout the world.

2. INSTRUMENT REQUIREMENTS FOR THE CONAF FOCUS BASINS

(2 basins in Region X near Valdivia and a third basin, probably in Region VIII in the Contulmo area)

To be purchased in UK

- 3 streamflow recorders
- 3 automatic weather stations
- 3 rainfall event recorders
- 3 suspended sediment monitoring stations
- 4 manual suspended sediment samplers
- 2 bedload samplers
- 2 capacitance probe soil moisture meters (surface type)
- 1 neutron probe soil moisture meter (for Austral Univ., Valdivia. See Section 1.)
- 1 access tube installation system for the above
- 30 m, say, of access tubing for the above
- 2 current meters c/w wading gauging equipment
- 2 survey levels c/w tripod, staff and 50 m survey tape
- 2 infiltrometers
- 2 Guelph permeameters
- 3 well dippers for groundwater monitoring (10 m length)
- 2 shear vanes
- 2 soil augers (4 x 1 m handle sections) c/w selection of heads
- 2 logger keyboard/display units
- 3 logger storage module/downloading units
- 2 sets logger software

To be purchased locally in Chile

- 9 manually read raingauges
- Tubing for groundwater observation wells
(lengths, material and internal diameter to be decided on each site according to local conditions)

3. INSTRUMENT REQUIREMENTS FOR THE LA SERENA GULLY STUDY

To be purchased in UK

- 3 streamflow recorders
- 2 automatic weather stations
- 3 rainfall event recorders
- 3 suspended sediment monitoring stations
- 2 manual suspended sediment samplers
- 1 bedload sampler
- 2 capacitance probe soil moisture meter (surface type)
- 1 current meter c/w wading gauging equipment
- 1 set surveying equipment (total station c/w EDM)
- 1 infiltrometer
- 1 Guelph permeameter
- 1 shear vane
- 1 soil auger (4 x 1 m handle sections) c/w selection of heads
- 1 set soil sieves
- 3 well dippers for groundwater monitoring (10 m length)
- 1 logger keyboard/display unit
- 2 logger storage module/downloading units
- 1 set logger software
- 1 SLR camera and tripod
- 1 portable PC
- 2 portable radios

To be purchased locally in Chile

6 manually read raingauges

Tubing for groundwater observation wells

(lengths, material and internal diameter to be decided according to local conditions)

4. INSTRUMENT SPECIFICATIONS

Since the users of these instruments are not specialists the emphasis should be on identifying reliable, robust, user friendly equipment. Where relevant potential suppliers should be asked if they will provide training in the use of the equipment for the future users while they are in UK.

Where specialist batteries are required at least one set of spares should be included. Where battery chargers are required, or are an integral part of the instrument, these must be compatible with the Chilean electricity supply.

4.1 Streamflow recorders (6)

These are required to be mounted on stilling wells incorporated in the gauging structures at each basin outfall.

Each should consist of a float driven potentiometric water level sensor capable of ± 1 mm discrimination feeding to a CR10 logger, c/w rechargeable battery and solar panel. The CR10 is specified since it can be programmed to compute and store 15 min mean flows from the continuous readings of water level using the structure rating. For checking and other purposes it can also be programmed to log spot water level values at 5 min. intervals.

Possible suppliers:

Didcot Instruments, Environmental Instruments,

4.2 Automatic weather stations (5)

These are required to sense and record the meteorological parameters necessary to compute estimates of potential evaporation.

Each should consist of a robust but easily transportable and erectable superstructure on which are mounted the following sensors:

Screen dry bulb and wet bulb temperatures

Global radiation

Net radiation

Windspeed

Wind direction

Atmospheric pressure

Rainfall

The sensors should feed to a CR10 logger, complete with rechargeable battery and solar panel, programmed to produce and log hourly mean values of each of the variables and to compute daily values of Penman potential evaporation.

Possible suppliers:

Didcot Instruments, Environmental Instruments, Campbell Scientific,

4.3 Rainfall event recorders (6)

Tipping bucket type raingauges, with 0.2 mm tips and plug-in logging modules which can record either the time of each tip or the number of tips in a specified time. Depending on type, either 3 spare modules or 3 downloading units will be required so that the gauges remain continuously in operation. Suitable interfacing and software for transferring the data to a PC will also be required , 2 sets for CONAF and 1 for La Serena.

Possible suppliers:

Didcot Instruments, Environmental Instruments, Casella

4.4 Suspended sediment monitoring stations (6)

These stations are intended to produce near continuous records of suspended sediment concentration in selected reaches near the outfalls of each basin, especially over storm events of several hours to a few days.

Each shall consist of :

- 1 programmable automatic liquid sampler with a 24 x 500 ml sample bottle array.
- 1 pair turbidity sensors, one nephelometric and one absorptiometric.
- 1 pressure transducer to monitor river water level, 2 m range, ± 1 mm discrimination
- 1 Campbell CR10 logger c/w weatherproof enclosure, 12 V rechargeable battery and solar panel which can be programmed to control the operation of, and store data from, each of the above.

Possible suppliers:

Montec International (Epic) or Greenworld Instruments (Isco) for the samplers

Excalibur Environmental for turbidity meters

Druck for pressure transducers

or Institute of Hydrology for complete stations

4.5 Manual suspended sediment samplers (6)

USGS type wading rod mounted depth integrating samplers.

4.6 Bedload samplers (3)

Helley -Smith type pressure difference portable bedload sampler with 150 mm square nozzle.

The sole maker of this type of sampler in UK is:

AJ Instruments

Hafan Garden Suburb

Llanidloes

Powys

4.7 Capacitance type soil moisture meters (4)

The requirement is to measure rapidly surface (to 10 cm depth) soil moisture content at many points within the experimental sites. For this purpose the Surface Capacitance Probe developed by the Institute of Hydrology is the only known method currently available.

Institute of Hydrology
Crowmarsh Gifford
Wallingford, Oxon OX10 8BB

4.8 Neutron soil moisture meter (1)

This instrument is required to measure changes in volumetric soil moisture contents over the rooting depths of the vegetation types in the basins.

The requirement is for the meter complete with transport case plus a set of access tube installation equipment and , say, up to 30 m of duralumin access tubing.
It may be more cost effective to acquire the access tubing locally in Chile.

Possible suppliers:
Didcot Instruments, Troxler (USA)

4.9 Current meters (3)

The requirement is for a wading gauging kit for use in obtaining stream velocity profiles in small streams, with flow depths typically in the range 0.1 - 1.0 m, for the construction and/or checking of structure ratings.

Each set should consist of a small mechanical type current meter, a control display unit, a spare impeller and a set of gauging rods all contained in a suitable carrying case.

Possible suppliers:
Valeport Instruments, Dartmouth.

4.10 Survey level complete with tripod, extending staff and 50 m survey tape (2)

This is required for longitudinal and cross section channel surveys and for establishing and checking reference levels for water level recorders.

4.11 Survey total system, incorporating theodolite, EDM and accessories c/w spare batteries and a battery charger.(1)

This is required to carry out repeated three dimensional surveys of active gully systems to identify changes. These gullies may extend over 100-300 m horizontally and elevation ranges

of several tens of metres with local elevation differences of perhaps 5 m in 2 m.

4.12 Concentric ring infiltrometers (3)

These are required for measurements of the surface infiltration properties of the various soil types in the basins.

It may be more economic to have these simple instruments made up locally in Chile.

4.13 Guelph permeameters (3)

This well known design of equipment is required to measure the hydraulic conductivities of the various soil types in the basins.

4.14 Shear vanes (3)

These are required to test the shear strengths of the surface soils to depths of 10 - 20 cm. They must be capable of operation in both sand and clay soil types.

4.15 Soil auger sets (3)

These are required to investigate soil profiles and to insert shallow groundwater observation wells.

Each set should consist of :

4 x 1 m extension sections, 1 x 50 mm screw, 1 x 50 mm Jarret, 1 x 100 mm Jarret heads.

4.16 Set soil sieves (1)

These are required to analyze soil particle size distributions. A range of sizes suitable for analysis over the range from fine clays to coarse sands is required.

4.17 Well dippers (6)

These are required for manual monitoring of depths in shallow groundwater observation wells.

The miniature, battery operated type with 10 m range would be most suitable.

Possible suppliers:

Geotechnical Instruments

4.18 Campbell logger accessories (3 sets)

In addition to the CR10 loggers and the specified additional components to be incorporated in the streamflow recording stations, the automatic weather stations, and the sediment monitoring stations, each field working group (2 CONAF and 1 La Serena) will require a set of hardware and software accessories so that they can programme the loggers, download data from them and link them to PCs.

Items to be included in each set are:

Keyboard/display unit

Storage module for loading and downloading data

PC/ storage module connector

Software to enable PC and module to communicate.

Possible suppliers:

Campbell Scientific, Didcot Instruments,

Institute of Hydrology, for some specialist control software for use with streamflow recorders, automatic weather stations and suspended sediment monitoring stations

4.19 Camera and tripod (1)

This is requirement in the La Serena study to produce records of gully development by repeated photography from a series of fixed points.

A single lens reflex camera with reasonable fast (say, f 2.8), fixed focal length (50 or 55 mm) lens and a stable tripod are required.

4.20 Portable PC (1)

The operator of the La Serena study will be spending extended periods at his field sites and will require a PC for work there. A portable is necessary so that he can move data, etc. between his field site and the work station at La Serena.

The requirement is for a robust portable with a specification of at least 486SX , 4MB RAM and 80MB hard disk.

4.21 Portable radios (2)

These are necessary for safety and communication purposes for the single operator of the La Serena study when he is working on the isolated gully site.

The system to be used must be decided locally to ensure that it is the most efficient for conditions on the site.

4.22 Manually read raingauges (15)

These are required to provide volumetric checks on the recording raingauges and a means of assessing the spatial variability in rainfall over the sites.

The standard Chilean design of Manual raingauge manufactured by the Chilean Meteorological Office meets the requirements.

4.23 Tubing for groundwater observation wells

It is not possible to specify the length required or the most suitable type of material until the exploratory work has been done on each basin.

This material must be purchased locally once the specific requirements for each site have been established.

JRB.
Jan. 1995