AUSTRALIAN HYDROGRAPHERS ASSOCIATION

Australasian Hydrographer

River Rescue Training, Brady's Lake, Tasmania
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May 2003

The **Australasian Hydrographer is the Journal of the Australian Hydrographers' Association Incorporated. ISSN 0812-5090**

THIS ISSUE

EDITORIAL

Welcome to the May, 2003 edition of our quarterly Journal.

The International Year of Freshwater (IYF) continues on but in many parts of Australia the big dry continues and only tantalising showers pass through parched areas.

As I assemble this edition parts of Sydney are affected by flash flooding but the rainfall gradient falls off quickly as you move away from the coast. Hope it eventually decides to drop in the areas where it is needed most and that all our monitoring sensors are ready to get wet again!

Some of you may have noticed the absence of an intermediate newsletter between Journal editions. Well I won't apologise for that, as the newsletter would have been quite sparse with virtually no contributions in the period. Submissions are always welcome!

It appears after a period of hiatus, with a lot of to-ing and fro-ing between industry and OTEN, that the Hydrography Certificate IV has lurched out of the blocks. It was of concern in recent months to see OTEN holding back study materials from students, blaming delays on industry funding, when the units that they were holding back were units already developed and in use! I wouldn't have imagined it being very encouraging to new trainee hydrographers just out of school to find that the new school they had enrolled with - as a requirement of their employment - wouldn't provide them with the study materials to get started! I only hope that OTEN appropriately modifies the time lines for assignments and exams for our new crop of young hydrographers so they aren't disadvantaged by this delay.

Our profession owes many thanks to those in the industry who have had what could be described as a very frustrating time with the system in getting the course up and going again.

To those of you with many years of experience it is hoped that you support your new trainees, encouraging them, assisting them where you can and above all imparting your wealth of knowledge and in many cases hydrographic 'intuition' to these future hydrographers.

I don't know if I am imagining it but there have been quite a few jobs for people like us doing the rounds, those of you with emails would have noticed them. Next issue it is hoped to review what the positions are describing and to see if things are changing in how we are perceived.

Mic Clayton

The **Australasian Hydrographer** is the Journal of the **Australian Hydrographers' Association Incorporated**. The Journal is distributed quarterly to Members. **ISSN 0812-5090**

Visit our **Web Site** at: **http://www.aha.net.au** to download a Membership application and to find contact details for your state representative.

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e - mail michaelc@tassie.net.au or PO Box 843, COOMA, NSW, 2630.

Letters to the Editor

Hydrography Certificate

Hi all,

Well it is finally official, TAFE NSW (OTEN-DE) are offering enrollments in the Hydrographic Certificate IV.

This week a contract was finalised between OTEN-DE (NSW), NR&M (QLD), DWLBC (SA) and SWC (NSW). The above mentioned water authorities entered into a funding agreement with OTEN-DE. This agreement provides substantial industry funding, to develop approximately 20% of modules, that OTEN-DE could not fund.

At last year's AHA meeting I listened to quite a bit of debate from our industry with regard to an education program relevant to the Hydrographic discipline. At the end of the session the only thing I understood to emerge, was that opinions were widely split. Although, I would like to think that at least we all agree that some form of formal, accredited education package for Hydrographers is vital.

Legal and ethical reasons aside, I believe an accredited learning path is essential if we wish the term "Hydrographer" to remain.

Well, whether you agree with it (this course) or not, there is now such a package.

As I believe this course to be a "living" package, industry can provide input and over time develop and improve upon.

I encourage each of you to at least have a look at the course structure etc. on the OTEN-DE webpage www.oten.edu.au .

I cannot emphasise enough that success (or failure) of this course is solely dependant on enrollments.

For enrollment information please contact Neil Harper on (02) 97158485

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Ozwater Convention & Exhibition, Perth, 6-10 April 2003

Dear All,

I was interested in reviewing this conference for a few reasons.

Firstly because I had heard that the NSW (and Singapore) representative for the Australasian Hydrographers Association was doing a presentation there on the work she has been doing in Singapore.

Secondly because of the exciting new affiliation that has begun between AHA and AWA (Australian Water Association). I for one was stoked to get my copy of the AWA magazine in the mail. I read the article within written by Secretary Scott with combined feelings of delight and pride.

These feelings returned as I entered the Burswood convention complex in Perth. The theme for the 20th biennial event was 'Innovations in water' and 700 delegates and over 1100 trade visitors attended. The dome housed 126 exhibitors and over 100 poster papers for all to see. Altogether 115 papers covering a wide variety of topics relating to water where verbally presented over 3 days of the conference, as well as a number of Panel Discussions and Workshop Report Presentations.

The presentations were categorized into sessions such as Wastewater, Water treatment, Industrial & Mining, Sustainability and the Urban Water Industry, Asset Management, Irrigation and Water Markets, Rivers Lakes and Reservoirs, Catchments and the list goes on. This made it easier for listeners to choose which presentations to see by deciding which category was important to them and to then sit in on all of the presentations for those sessions. I am sure some tough decisions had to be though, as many excellent sounding presentations were often being held at the same time in different locations.

There were Workshops on the first day for those interested in a more interactive approach with some qualified facilitators. The last day saw Technical tours being run to provide a more practical look at some of the topics presented throughout the week. The Technical tours included a visit to some Water Treatment and Industrial Waste handling facilities for a closer look at recent upgrades and innovations. Another option was to view a Biosolids Composting application or the Golden Pipeline Dam & Museum up close and personal.

The lunches, afternoon teas and Ozwater Dinner were all fabulous events. Excellent food and beverages in addition to many interesting individuals in attendance helped make this aspect of

the Ozwater Convention & Exhibition in Perth a huge success. The dinner in particular was quite an impressive affair with Jazz music provided by the talented James Morrison.

Whilst enjoying being at Ozwater and all it had to offer in terms of learning and networking, I could not help but compare it to similar AHA events. I say similar because I believe there to be shared ideas and aspirations behind holding these events for each of our associations. However, I think that while the AHA wants to grow and increase it's following to that of AWA, in many ways we should be glad that our organization is small enough so that all of the presentations organized for our Conference can be held in the one room and watched by all.

Faye Edden

28th International Hydrology and Water Resources Symposium

Monday 10 to Thursday 13 November 2003
Novotel Northbeach
Wollongong NSW Australia

Why You Should Be There
The Hydrology and Water Resources Symposium brings together a diverse range of academics, researchers and practicing scientists and engineers from both the public and private sectors. The fundamental objective of the Symposium is to provide a forum for the exchange of ideas and experiences and discussion of issues relating to the broad field encompassing hydrology and water resource management.

Go To http://www.hwrs2003.org.au/ for more information.

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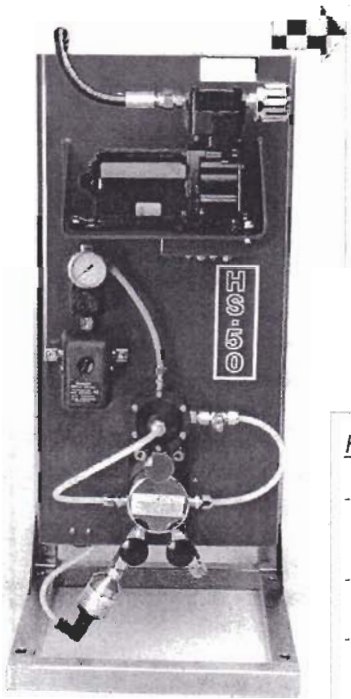

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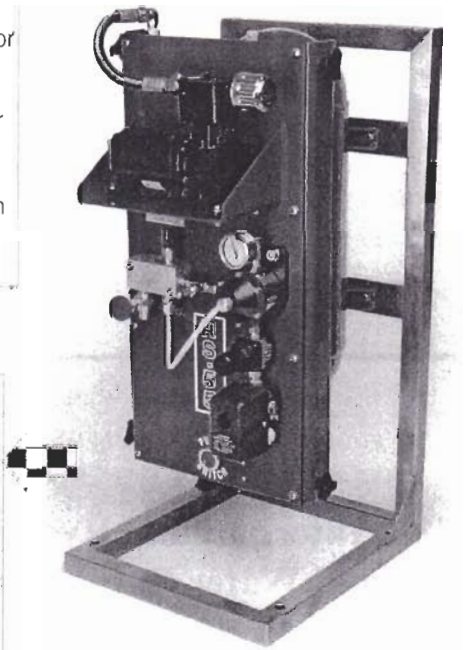

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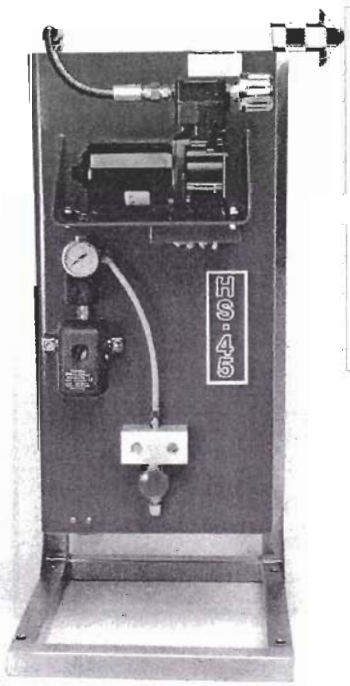

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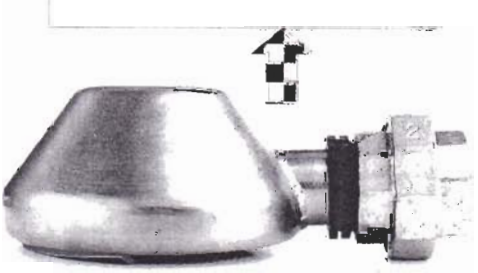

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The Effectiveness of Sampling Multiple Points using a Sensing Chamber

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(Presented at the 11th Australian Hydrographic Conference, July 2002)

SUMMARY
For environmental monitoring it is often desirable to have in-situ measurements with high temporal resolution. The traditional approach is to deploy a measurement instrument into a water body, which allows measurement at a single point. It is often desirable to have measurements at multiple points to understand the spatial variability of the system under study. Using the traditional approach this is not usually possible due to the high cost of such a system.

This paper describes an approach to overcome this problem by setting up a sub-sampling chamber containing a single set of water quality sensors that can take samples from multiple sources. The system uses an array of valves to select the desired sample point, and a peristaltic pump to deliver the sample to the measurement sensor array. Being able to use a single set of water quality sensors to automatically test multiple sampling points has the advantages of being cost effective, less prone to contamination and calibration procedures can be simplified and made safer in hazardous monitoring environments.

1. INTRODUCTION

The Multipoint Sensing Chamber (MSC) has been developed to test this approach of water quality monitoring, in real time and with multiple sampling points. The number of sample intakes depends on the required sampling frequency and the distance to sampling points. The initial test procedure of the MSC illustrated the limitations of the system and sensors used in relation to flow rate, pumping volume, sample suction lift height and length of sampling lines. This test did not consider long-term effects such as fouling, in which case regular cleaning and maintenance would be required.

Initial testing of the MSC showed contamination between samples was mainly due to residue in the sample chamber being left behind from the previous sample. Several changes where then made to the physical design and logger software and more accurate results where obtained.

The MSC is currently deployed on a runoff trial investigating the potential of using vetiver grass to stabilise sugar cane drains that are grown in predominately acid sulfate soils. The system samples from three points, a section of drain planted with vetiver, a section of drain planted without vetiver and contributing run off.

2. MULTIPOINT SENSING CHAMBER (MSC)

The multipoint sensor chamber (figure 1.) enables the sampling of multiple points. A Campbell Scientific data logger (CR10X) is used to control the overall operation of the sensor chamber. A logger program (figure 2.) has been written to control pump relays, select pinch values (sampling points) and to take readings from the sensors.

A Campbell Scientific CR10X data logger controls the MSC system. The system is currently set up for a run-off trial, sampling from three points. A float switch or a pressure transducer triggers event or data logging mode. Once event mode is set, the logger selects the first sampling line by triggering and opening the appropriate inlet pinch value, turning the pump on in a forward or chamber fill direction and opening the sensor chamber drain pinch value. If the appropriate conditions are met the sampler is now triggered and sampling data stored to data logger memory. The sensor chamber drain pinch value is closed after time *Lx* seconds, that also allows for 10 seconds of sensor chamber flushing. The sensor chamber then fills until a float switch in the sensor chamber is triggered or a preset time limit is reached. The flow rate of the intake line is then calculated using the volume of the sensor chamber and the time passed from closing the drain value to triggering the sensor chamber full float switch. The calculation of *Lx* is by using the flow rate and intake line volume, with 10 seconds added to give the initial flushing time for the sensor chamber. Lx is then used the next time the intake line is sampled. After the sensor chamber has filled for the first time the pump is turned off and the sensor chamber drain is immediately opened for 14 seconds. The sensor chamber has now had it's initial flush and the drain value is once again closed

and the pumped is turned on in a forward direction. After the sensor chamber fills again, the pump is turned off and sensors are allowed to stabilise for 60 seconds prior to readings being stored to data logger memory. The drain value then opens and the pump is turned on in a reverse direction for time Lx to empty the intake line. The system then proceeds to the next intake line.

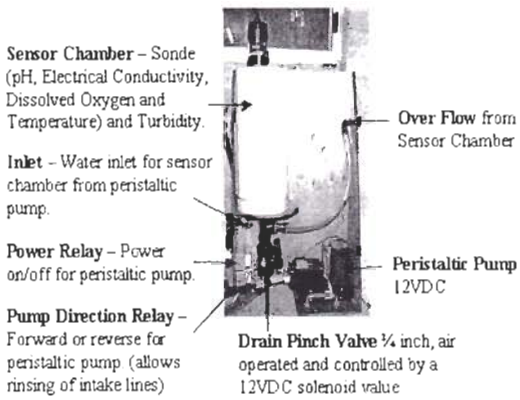


***Figure 1**: Multipoint Sensor Chamber - enables water quality monitoring from multiple sources using one set of sensors.*

1.Select a sampling point (Open an inlet pinch value)
2.Turn on Peristaltic pump in forward or chamber fill direction
3.Close sample chamber drain pinch value at Lx seconds
4.Trigger the pumping sampler if the absolute value of a delta change in height is greater then Z
5.Turn off Peristaltic pump when a float switch in sensor chamber indicates sensors are covered.
6.Open Drain Valve for 14 sec (Empty Chamber)
7.Turn on Peristaltic pump in forward or chamber fill direction
8.Turn off Peristaltic pump when a float switch in sensor chamber indicates sensors are covered.
9.Pause for 60 seconds to allow sensors to stabilise
10.Take sensor readings
11.Open sample chamber drain
12.Run pump in reverse Lx seconds to discharge the line

***Figure 2:** Pseudocode for data logger program.*

3. MSC SENORS

Two sensors have been obtained for the trial, a combination sensor and a turbidity probe. Both the sensors fit neatly into the 150mm PVC used for the Multipoint Sensor Chamber. The period between runoff events could be weeks or even months, in which the system will lay idle, so a biocide is used in the chamber to keep the sensors in working order.

3.1. Combination Sensor

The combination sensor that is used for the trial is a Greenspan CS4-1200 and measures Electrical Conductivity (EC), Dissolved Oxygen (DO), Temperature and pH. The combination sensor has SDI-12 (serial data interface at 1200 baud) output that allows connection to the SDI-12 serial / digital network widely used in hydrological and environmental monitoring (Campbell Scientific 1997). The EC was set at the highest range possible (0-60000uS) as the cane drains that the system would eventually be deployed in are often inundated with seawater. The combination sensor has a diameter of only 65mm and makes it suitable for use in the Multipoint Sensor Chamber.

3.2. Turbidity Probe

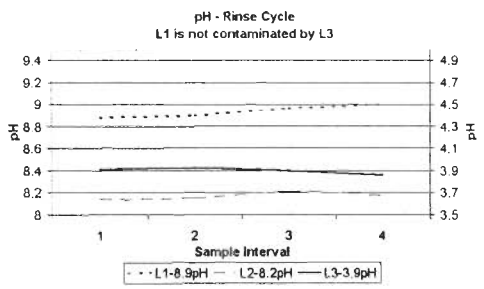
The turbidity probe that is used is a Seapoint Turbidity Meter. The Seapoint Turbidity Meter detects light scattered by particles suspended in water, generating an output voltage proportional to turbidity or suspended solids (Seapoint, 1995). The operating range is selected by two digital lines that will be controlled by the data logger, thereby selecting the appropriate range and resolution for measurement of clean to very turbid waters. The optical design confines the sensing volume to within 5cm of the sensor and with a diameter of only 25mm makes it ideal for use in the Multipoint Sensor Chamber.

4. RESULTS FROM INITIAL TESTING

The initial test was carried out to determine the effectiveness of the design and to apply any necessary modifications. The MSC has 4 air operated 3/4-inch pinch values that are normally closed and are opened by a 12VDC solenoid. The initial testing used three of the pinch values for the intake lines and the fourth as a drain on the sensor chamber. The larger 3/4 inch pinch vales where used to help prevent clogging. At each sample interval (figure 3a, 3b, 3c) the three intake lines L1, L2 and L3 are sampled in that order. After sampling L3 the MSC moves to the next sample interval and samples L1, L2 and L3 again, with this process repeating until the event ends. Two relays are used to control the peristaltic pump, one used for power and the other is used is control the pumps direction. The peristaltic pump is a TATE 12VDC 3/4-inch pump and has a flow rate of 13L/min with 5ft of head. The sensor chamber is 150mm PVC storm water pipe with an end cap glued to one end. The sensor chamber has an inlet on the bottom, to one side and a drain in the middle. The drain also has a tee section prior to the drain value that is connected

to an overflow is case the float switch in the sensor chamber fails.

The first prototype was not all that successful and modifications where made. Initial forward pumping of the intake line and the 10 seconds of flushing prior to filling the sensor chamber is enough to remove any residue in the line from the previous sample. The first testing of the MSC was without a sensor chamber flush cycle and results showed that residue left in the sensor chamber had considerable impact on the next sample taken. This became obvious when extreme conditions where applied (figure 3a,3b,3c). For example having one intake line in an acidic standard sample (4.0 pH) and then the next intake line in an alkaline standard sample (9.0 pH) or sampling from a salt water sample (EC 35000uS/cm) to a tap water sample of (500 uS/cm). Two changes where then made that had a significant impact on the effectiveness of the MSC, the flush cycle was introduced and the intake line into the chamber was angled to allow a whirlpool effect in the sensor chamber as it filled. Other influences such as intake line length and sample suction lift height had little impact on the accuracy of the MSC. It should be noted that suction lift height was limited to the ability of the peristaltic pump and a range of 0-5m was tested only. Sampling flow rate and volume are both related to the effectiveness of the peristaltic pump, and flow rates in all tests where greater then 0.2m per second. The testing of suction lift height also affected the flow rate, which varied from 12.2L per minute at 0m to 0.9L per minute at 5m. It was concluded that a flow rate in the range tested had little influence on the accuracy of sensors used.



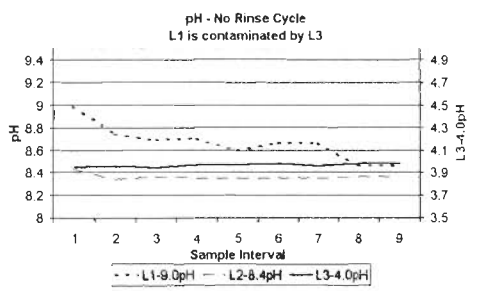
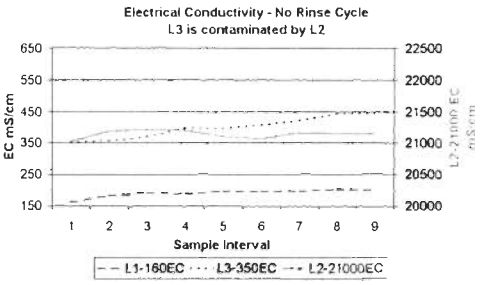


***Figure 3a**: MSC pH comparison, on second sampling interval with no rinse cycle L1 is contaminated by L3.*



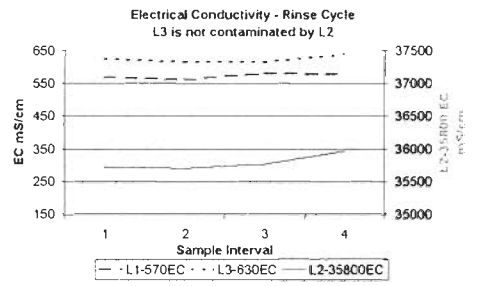


***Figure 3b**: MSC EC comparison, after second sampling interval, no rinse cycle L3 is contaminated by 12.*

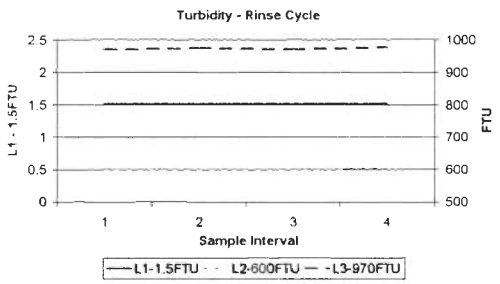


***Figure 3c**: MSC Turbidity with a rinse cycle.*

5. MSC DEPLOYED ON A VETIVER TRIAL

The drive behind developing and testing the MSC was a runoff trial (figure 4.) using Vetiver grass on cane drains in acid sulfate soils. Vetiver grass *(Vetiveria zizanioides L.)* is native to South and South-East Asia where its primary use is for soil and water conservation. Due to its special characteristics, vetiver has also been used very effectively for applications such as steep slope stabilisation and environmental protection, (Truong, 1999).

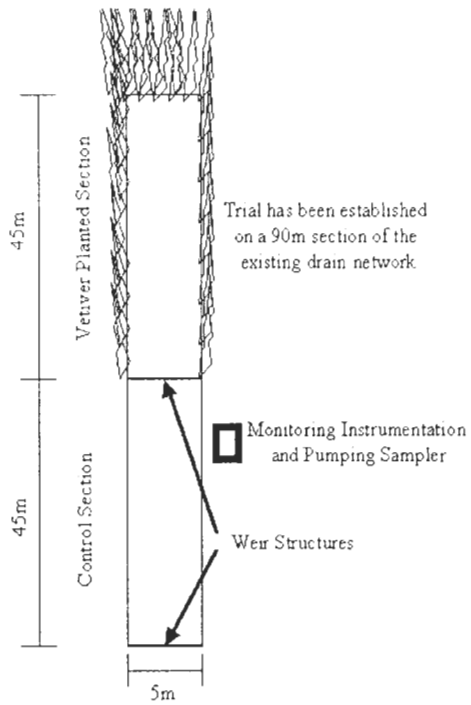


***Figure 4**: Top view of experimental layout showing the vetiver planted on a 45m section of existing drain.*

Vetiver is a sterile cultivar that was originally selected and registered in Queensland as Monto Vetiver, and does not self-seed, is non-invasive and has neither runners nor rhizomes. It can be eliminated easily by uprooting or Glyphosate spray. Vetiver has several characteristics that make it more suitable then other grasses for erosion control (figure 5.) and can be grown in a range of soil and climatic conditions:

- It can tolerate acidic, sodic, alkaline and saline soils that can even be loaded with very high levels of aluminium, iron, manganese and other heavy metals.
- It has a deep dense spongy root system (up to 5m) that binds soils together and is very tolerant to extreme climatic conditions. Vetiver can withstand frost (-10 degrees C.), heat (55 degrees C.) and drought but needs to be established in areas with an annual rainfall greater than 450 mm (Truong, 1996).
- It is resistant to most pests, nematodes and diseases. It can be slashed, trafficked and can withstand burning while green. It does though require full sun and is very sensitive to shade that retards growth.

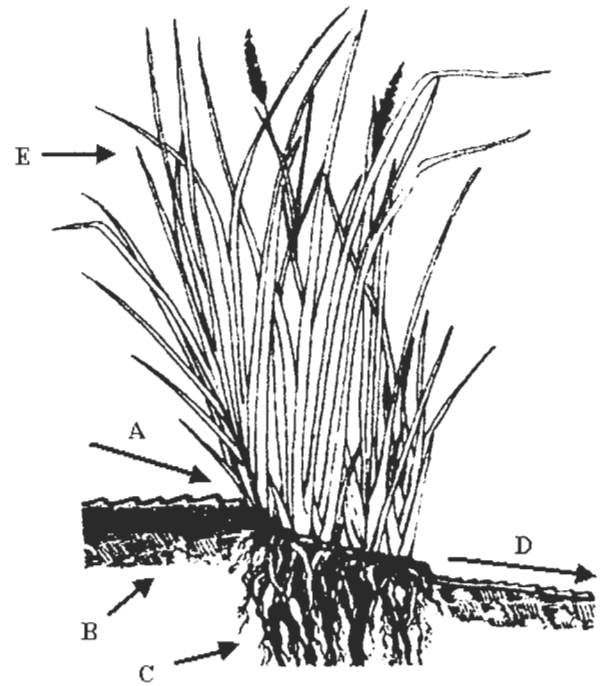


***Figure 5**: Vetiver Plant Sketch. Silt loaded runoff water is slowed down by the plants dense stems (A). Silt then drops out of the water behind the hedge (B) and reduced sediment water (D) is discharged. The dense root system (C) binds and stabilises the soil while the tall thick grass (E) acts as a windbreak, trapping airborne debris (cane trash).*

The vetiver site has two sample points (vetiver planted and control section of drain) sited 20m away with 2.5m of suction lift height and one (run-off) sited 10m from the MSC with 1m of suction lift height. The peristaltic pump with a 2.5m suction lift delivers 4-5 litres/minute. Rinsing the intake line from the 20m sampling point, flushing then filling the sensor chamber and taking the readings takes a maximum of 6 minutes (at maximum 2.5m head) while the 10m sampling point line takes a maximum of 3 minutes (at maximum 1m head). The system is able to take water quality readings from each of the 3 sample points every 20 minutes, with a 5-minute rest for the pump.

Pinch values are used to control the sampling lines. These are air operated and controlled by a 12VDC solenoid value. The compressed air for the pinch values can be supplied from a small 12VDC compressor and receiving tank as the pinch values use very little air in operation. A receiving tank of 100L with an initial pressure of 80psi with a regulated supply of 40psi would enable 4000 pinch value switches to be made before the air pressure drops below the switching threshold of 20psi. This allows the experiment to run for at least 12 hours in the case of a compressor failure.

6. Conclusions

The initial testing of the MSC was able to conclude that the MSC would work under extreme conditions of sample variability but the effectiveness of the MSC may also be affected by site-specific conditions that have not been tested here. The initial test procedure of the MSC illustrated that there was little effect from flow rate, pumping volume, sample suction lift height and length of sampling lines for the range of conditions tested. The main effect on the MSC was the contamination between samples due to the residue of the previous sample being left behind in the sample chamber and on the sensors themselves. Several changes where then made to the physical design and logger software and more accurate results where obtained.

The applications of the MSC could include real time measurements of the water quality of various depths in a dam, sampling multiple points in a surface runoff experiment, sampling in hazardous environments or even sampling shallow wells with varying depths. The MSC is currently deployed on a runoff trial investigating the potential of using vetiver grass to stabilise sugar cane drains that are predominately acid sulfate soils. The system samples from three points, a section of drain planted with vetiver, a section of drain planted without vetiver and contributing run off.
The vetiver project will also serve as a demonstration project to promote environmentally sensitive agricultural practices, targeted at the local canegrower community in particular and to land users on drained coastal ASS in general.

7. ACKNOWLEDGEMENTS

The authors would like to thank the support of Environment Australia's Coastal Acid Sulfate Soils Programme, Gold Coast City Council, CSIRO Land and Water, Veticon Consulting and L. and K. Mischke for providing expertise and funding for this trial.

8. REFERENCES

Campbell Scientific. 1997. CR10X Operators Manual, Campbell Scientific, Utah, U.S.A., OV-22

Grant, D.M., Dawson, B.D. 1995. ISCO Open Channel Flow Measurement Handbook, Fourth Edition, ISCO Environmental Division, Nebraska, U.S.A., 3, p33.

Seapoint Sensors. 1995. Seapoint Turbidity Meter Users Manual, Seapoint Sensors Inc., New Haven, U.S.A., p3

Truong, P. and Baker, D. (1996). Vetiver grass for the stabilisation and rehabilitation of acid sulfate soils. Proceedings, Second National Conference on Acid Sulfate Soils, Coffs Harbour, Australia. pp 196-8

Truong, P.N. (1999). Vetiver Grass Technology for land stabilisation, erosion and sediment control in the Asia Pacific region. Proc. First Asia Pacific Conference on Ground and Water Bioengineering for Erosion Control and Slope Stabilisation. Manila, Philippines, April 1999.

EVALUATION AND IMPROVEMENT OF THE FLOOD RAINFALL NETWORK

Canterbury Regional Council, New Zealand

(Presented at the 11th Australian Hydrographic Conference, July 2002)

Background

The Canterbury Regional Council operates a hydrometric network of 77 surface water level stations; 44 of which are telemetered. There are also 67 rainfall monitoring stations; 57 of which are telemetered. The Council has developed a Quality Assurance system, that outlines the frequency of visits, the acceptable amount of missing record in any year, and the quality of the data for the hydrometric network.

The present economic climate demands reduced costs while still providing the same level of service. At present the rainfall stations are visited every two months, with checks being carried out on the radio communication links, the rain gauge (tipping bucket) calibration and the storage gauge (total cumulated rainfall since the last site visit). All of these factors are important in the maintenance of rain gauge efficiency and the reduction of missing record. The aim is to reduce these site visits to every four months, hence significantly reducing the operational costs. This is to be achieved by automating the check gauges at the more critical sites.

The Hydrometric Network

The hydrometric network that is of most importance to Canterbury is the Waimakariri catchment network which monitors the rainfall for the Waimakariri River; the major river influence for the city of Christchurch. This network has 8 telemetered rain gauge stations and 3 telemetered water level stations to give early flood warning for Christchurch, all being transmitted through one repeater (which is proving to be unreliable).

Rain gauge stations

The Waimakariri Catchment has an area of 3564 sq km and is defined by surface catchment boundaries of the Waimakariri River and its tributaries. The river is about 140 km long and extends in a south-easterly direction from the Main Divide to its mouth on the east coast of the South Island (Figure 1). Two distinctive geographical regions are recognised. The upper catchment is mountainous and extends from the headwaters near the Main Divide downstream to the Kowai confluence, covering an area of 2490 sq km. This region is bounded by the Rakaia catchment to the west, the Main Divide to the north-west, the Hurunui catchment to the north-east and the Ashley catchment to the east. The headwater valleys are comparatively narrow but below the Crow confluence the river is wide and braided down to the Esk confluence. Below the Esk the river is confined to a narrow gorge as far as Woodstock. The lower catchment extends from the Kowai confluence across the Canterbury Plains to the river mouth in Pegasus Bay. It is bounded by the Selwyn catchment to the south and the Ashley catchment to the north. The river is wide and braided throughout most of this section but it becomes confined to a single channel downstream of the South Branch confluence. The river is affected by the tide in its lower 5.3 km and Brooklands Lagoon enters the river near the mouth. Near the sea the urban areas of Christchurch, Kaiapoi and their outliers flank the lower river.

Historical Floods

Several noteworthy floods have occurred in the Waimakariri River since protection works commenced in 1881. In 1887 and 1905 two major floods occurred; however no flood waters reached Christchurch thanks to the protection works from just below Kimberley Cliffs to McLeans Island. Severe flooding continued however on Coutts Island and Kaiapoi Island, and the river was still encroaching on its northern bank.

In 1923 a large flood inundated Coutts Island, Kaiapoi, Chaneys and Kairaki causing considerable damage.

A flood of over 3500m3/s, the largest for 40 year, occurred on 4 December 1925, and there was a very big flood on 4 November 1926 followed by another sizeable flood in 1927.

Gaugings of flood peaks at the Old Highway Bridge site started in 1930; annual peaks since that time are listed in Table 1. The event in October 1936 measuring 2680m3/s resulted in no damage, however during the 3740m3/s event on 29 February 1940 breaks occurred in the protection works causing minor damage.

On 27 May 1950, following over 430mm of rain in 24 hours at Arthurs Pass, and a discharge of 2570m3/s at the Old Highway Bridge recorder, serious breakouts occurred badly flooding and causing the evacuation of Coutts Island, Stewarts Gully and Kaiapoi. There was some property loss at Kairaki.

The largest flood recorded in the Waimakairi occurred on 27 December 1957 measuring 3990m3/s, which breached the protection works. Water over 1.5m deep flowed through Kainga, and the "Christchurch Star - Sun" described the area from Englebrechts down to about the Belfast Hotel and downstream to nearly Brooklands as "one vast lake".

Site No	River	Site Name	Rainfall	Altitude	Record Start
310510	Waimakariri	Carrington	6900 mm	823	890302
218910	Waimakariri	Mt Byrne	5600 mm	1418	890301
219510	Waimakariri	Arthurs Pass	4500 mm	750	570101
219911	Waimakariri	Ranger Stream	2400 mm	625	780920
219910	Waimakariri	Bull Creek	1600 mm	745	621114
321710	Waimakariri	Cheeseman	1400 mm	880	900627
311810	Waimakariri	Grasmere	1100 mm	600	850501
311910	Waimakariri	Esk	1000 mm	400	900504

Water level stations

Site No	River	Site Name	Grid Ref	Cat. sq km	Record Start
66404	Waimakariri	Esk	L34:257872	1710	890301
66402	Waimakariri	Gorge	L35:331605	2460	220101
66401	Waimakariri	Old H/Way Bge	M35:818547	3210	641130

TABLE 1 MAXIMUM ANNUAL FLOODS IN THE WAIMAKARIRI RIVER AT THE OLD HIGHWAY BRIDGE, 1930 - 1998

Year	Maximum Instantaneous Discharge m3 s -1	Year	Maximum Instantaneous Discharge m3s-1	Year	Maximum Instantaneous Discharge m3s-1
1930	860	1954	1 610	1976	1 345
1931	1 490	1955	2 320	1977	1 142
1932	840	1956	2 210	1978	1 357
1933	1 700	1957	3 990	1979	2 910
1934	950	1958	1 440	1980	1 384
1935	810	1959	1 050	1981	1 462
1936	2 680	1960	1 390	1982	1 441
1937	1 800	1961	960	1983	1 660
1938	1 600	1962	1 100	1984	2825
1939	680	1963	1 280	1985	1083
1940	3 740	1964	1 420	1986	1 050
1941	1 060	1965	1 230	1987	1 390
1942	1 160	1966	850	1988	960
1943	710	1967	2 052	1989	1 100
1944	830	1968	1 088	1990	1 280
1945	1 010	1969	1 143	1991	1 420
1946	1 090	1970	2 505	1992	1 230
1947	1 790	1971	1 150	1993	850
1948	1 400	1972	1 574	1994	2 052
1949	940	1973	1 012	1995	1 088
1950	2 570	1974	1 128	1996	1 143
1951	1 790	1975	1 772	1997	2 505
1952	770	1976	1 345	1998	1 150
1953	1 300				

Surface Water Hydrology

The hydrological characteristics of the Waimakariri River are principally controlled by the climate of the upper catchment: other main variables, geology and topography, provide a relatively uniform contribution in this high country region. For example, large floods only result from intense rainfalls near the Main Divide; snow and ice storage in the mountains during winter followed by summer melt induces a marked seasonality in flows and notably influences their temporal variability, and rainfalls in the upper 70% of the catchment supply 90% of the mean annual runoff. In contrast, climate and topography are broadly constant in the lower catchment or plains where geology exerts a major influence through local controls on surface water

supply to and from groundwater reservoirs and aquifers.

Quality Assurance System

The Council have developed a Quality Assurance system to ensure the integrity of the data it collects. This system states that the frequency of site visits for rainfall stations will be every two months and the amount of missing record in any year will not exceed 2%. It should be noted that the rational behind the two monthly site visits is to assist in the 2% missing record being achieved.

The flood rainfall network is currently running at 97% efficiency, this equates to 3% missing record for last year. The 3% comprises of about 1% being a result of low voltage. As can be seen from the attached topographical maps, physical constraints also exist within the rainfall network, as it lies in a mountainous region of the South Island of New Zealand and is only accessible by helicopter.

Instrumentation

The current configuration at one of the council's flood rainfall stations is:

•Recorder (sensor) Ota tipping bucket with a bucket size of 0.5mm. This will measure the intensity of rainfall and also record the total amount of rain that has fallen.

Specifications:

Receiver:	Dia. 200mm (within +/-0.3mm)
Sensitivity:	One tip equal to 0.5ml of rainfall
Contact:	Reed switch
Contact time:	0.1 second
Measuring Range:	Max 150ml/hour
Measuring Accuracy:	Within 2% (100ml/hour)

•Logger Aquitel Remote logging rainfall at 7.5min intervals with alarm settings for high rainfall and low battery voltage which draws approximately 30mA.

Specifications:

Inputs:	Two channels standard - Water level and rainfall Channel 1. 16 bit BCD and handshake control lines-typically for connecting to existing float type water measuring device or similar. Channel 2. Direct connection to tipping bucket.
Recording Intervals:	10 sec 5, 7.5,15,30,60,120 or 240 minutes.
Capacity:	Two channel recording typically 8 days at 15 minute intervals.
	Data Output: Normally via communication device (radio telephone line) 300 baud PSK to microbase unit.
Power consumption:	Standby <10mA at 12VDC Active <300mA at 12VDC

•Radio Tait T198 drawing 190mA with a data interface which draws 3A when transmitting the data at 25 watts.

•PVC storage gauge 150mm PVC standard pipe that will collect the total rainfall that has fallen since the previous visit, known as the *check gauge*.

As can be seen from the specifications above, our radios draw a large amount of current, and in sites that rely solely on solar panels and a battery for power, this is a large amount (a total of 200mA continuously). It should also be noted that the *check gauges* are only measured at each site visit, so any failure of the Ota tipping bucket could potentially go undetected for several months. The council has a sparse coverage of the catchment, so any redundancy in the network could have serious implications if an extreme rainfall event was to happen.

The new configuration for one of the councils' flood rainfall stations is:

•Recorder (sensor) Ota tipping bucket with a bucket size of 0.5mm. This will measure the intensity of rainfall and also record the total amount of rain that has fallen.

Specifications:

Receiver:	Dia. 200mm (within +/-0.3mm)
Sensitivity:	One tip equal to 0.5ml of rainfall
Contact:	Reed switch
Contact time:	0.1 second
Measuring Range:	Max 150ml/hour
Measuring Accuracy:	Within 2% (100ml/hour)

•Starlogger — Starlogger logging rainfall on event logging with alarm settings for high rainfall and low battery voltage draws approximately 30mA.

Specifications:

Inputs:	8 channels standard - Water level and rainfall 10 bit resolution. SDI 12 channel
Recording Intervals:	.125sec to 1 week.
Capacity:	128K.
Power consumption:	Standby <1mA at 12VDC Active (scan) <30mA at 12VDC

•Radio — Salcom TR460 simplex radio drawing 30mA with a data interface and 0.5A when fitted with power amp and transmitting data at 20 watts.

• Recording storage gauge — This ***new recording storage gauge*** which houses the capacitive water depth probe is constructed of PVC pipe as illustrated in Figure 2.

•PVC storage gauge — 150mm PVC standard pipe that will collect the total rainfall that has fallen since the previous visit, known as the *check gauge.*

The recorder and logger are similar as are presently being used, but improvements to the radios will result in a net saving in power consumption of approximately 80%, resulting in remote rainfall sites becoming more reliable.

The new *recording storage gauge,* which will house the 'Starlog' capacitive water depth probe (model 6521B) will allow an independent check to be made of the rainfall. The probe is designed for the high resolution measurement of small water depths using the dielectric characteristics of water versus air. The logger will log the water level in the *probe gauge* at 7.5 minute intervals so a direct comparison can be made with the tipping bucket results.

Specifications:

Range:	0 to 1.0 metres
Power Consumption:	5Vdc, 3.5mA
Output Signal:	0 to 2.55Vdc full range
Accuracy:	0.5% of full scale reading
Linearity:	0.1% of full scale reading
Resolution:	0.4% of full reading scale (using standard PDL)
Diameter:	48mm at widest point

The selection of the 'Starlog' capacitive water depth probe was based on four factors:

•Price — at $700NZ it was the cheapest available

•Availability — one of the New Zealand agents NIWA are based in Christchurch, so support is readily available

•Power consumption — requiring only 3.5mA power will not add much to the total power consumption for the site considering the savings that we are making on the radios

•Simplicity — the probe can be easily installed into the purpose built *probe gauge* and removal for cleaning is also simple

The main advantage that the above set up has over previously designed recording check gauges, is that this one is mounted from the top, hence the unit is completely watertight. Previous designs have had the sensors mounted at the base of the gauge making the sealing against leakage in extreme weather conditions, very difficult.

Cost Benefit

The benefit to the Canterbury Regional Council, in the reduction of site visits amounts to $761 per year, so in year two you are saving approximately $750 per year. This would allow you to increase the network for the same dollar input or reduce the cost of running the network by approximately 20-30%.

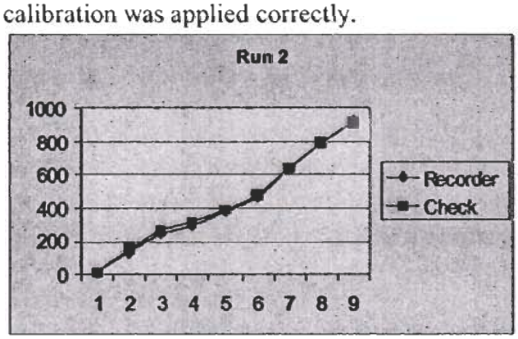
Instrument Evaluation

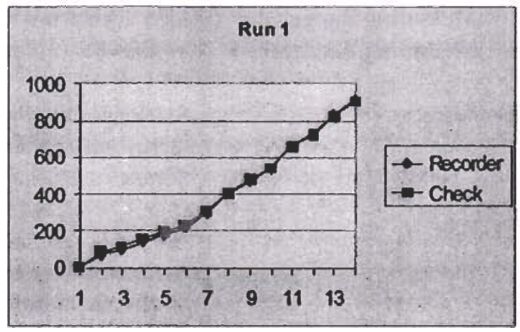
The selection of the capacitive water depth probe was assessed as being the best alternative devise to measure the water depth in the check gauge. The capacitve water depth probe provides an independent check on the performance of the Ota tipping bucket. Another alternative method to be considered, was to install a second Ota; but experience shows that Ota failure is generally a result of dust or wind blown material blocking the tipping buckets. Therefore any such foreign material would affect both Ota's at the same rate and the checking would become ineffective.

Method

The capacitve water depth probe was installed in the new recording storage gauge, a datalogger connected and a program installed to log water depth. The recording storage gauge was slowly filled with water and at random intervals the water depth was recorded via the logger and the depth measured manually, these two values were recorded. This process was repeated three times and the results recorded.

The graphs below give a visual comparison of the two runs and also the check run to verify the calibration was applied correctly.





Repeaters

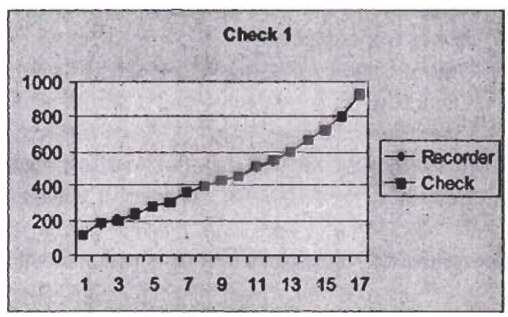
The Waimakariri flood network is all transmitted through one repeater, which has proven to be unreliable so it was decided to split the network in two by introducing another repeater site that we controlled. This resulted in the network being more reliable and assisted in reducing missing record.

Conclusions

The cost benefits and results indicate that the system will develop into an effective and efficient means of reducing operational costs and still maintain the quality of the data.

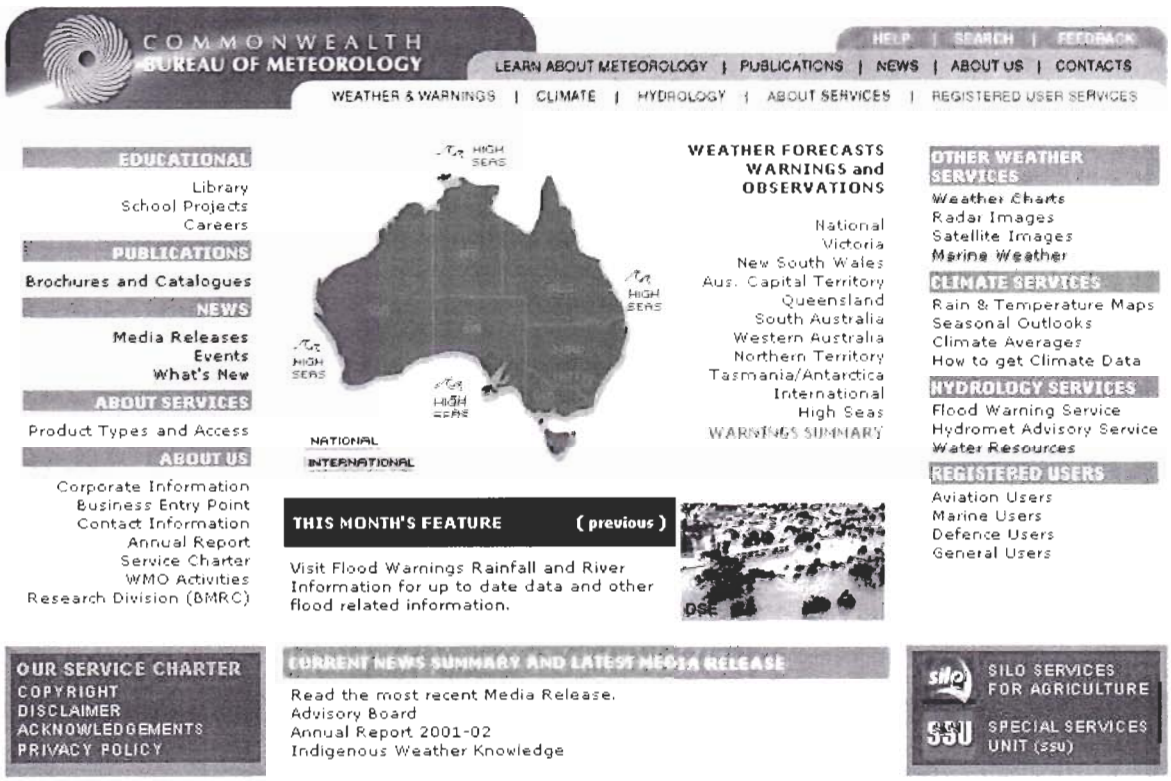
The cost benefit to the Canterbury Regional Council would allow for an increase in the network or a 20 - 30% reduction in the operational costs. The system will allow for instrumentation malfunction to be identified immediately instead of waiting for the two monthly inspections, hence reducing the amount of missing record.

The improvements to the radio system and repeater network will result in a net saving in power consumption of approximately 80%, resulting in improved reliability and a reduction in missing record.



It is recognized however, that the system still requires extensive field testing in different conditions to ensure that the required accuracy is maintained and losses such as evaporation and instrument drift are at a minimum.

Bureau of Meteorology



ACCESS THE BUREAU WEB SITE AT : www.bom.gov.au

WOT IS IT?

STIL Gauging Logger

(Advertisement)

"Twelve hydrometric teams within the NSW Department of Sustainable Natural Resources are routinely using Stil GLoggers to log and process streamflow measurements. There are other types in use and some hydrographers are using handheld PC's for gauging input and processing. Users find the GLogger easy to set up and simple to use. It has proved very robust in the field. The initial problems with data loss and 'scrambling' on downloading have been overcome. We are now using the gLogger universally for all gauging and have found it utterly reliable in recent times. There are considerable time savings over manual methods and we're finding the consistency checks that the software provides (both yours and HYGAUGE) of immense benefit."

Paul Corbett
NSW Department of Sustainable Natural Resources.

The Taranaki Regional Council has recently purchased a second Gauging Logger (known affectionately as a Glogger) to add to its arsenal of gauging equipment. We have found, after the initial and almost inevitable teething problems with new products and software, the Glogger has made the 1-person gauging exercise very efficient and due to the enhancements of the latest software version arguably more accurate. The on-board software is plain and user-friendly and the end results can be easily transferred into most hydrological databases, eliminating the need for double handling. The Glogger being fully water-proof (we have recently done deep wade gaugings with the Glogger under about 400mm of water!) we have no hesitation in recommending it as another item for the Hydrologist's field tool box."

Grant Best,

Taranaki Regional Counci Hydrologist

... And finally some praise for the loggers filtration abilities in high conductivity geothermal streams around Rotorua. I actually carried out a successful gauging with the min/max values on the contact set at 93 and 95 respectively for a wiping contact Pygmy. It didn't miss any of the counts. Normally we would have had to do this gauging by visually timing the rotations.

Cheers
Glenn Ellery
Team Leader Environmental Data Services
Environment B O P

Good afternoon

I'm a hydrographer with DLWC and based in Dubbo NSW. I have heard nothing but good reports from the Armidale office who having been using your instrument. As I would like to put a submission to my management for one of the counters, could you please indicate the price per unit and freight charges. Thanking you for you time on this matter

Andrew Pearce

Natural Resource Officer (Hydrographer)
Hydrometrics Group - Resource Information Unit
Dept. Land & Water Cons. - Central West Region

And again:

Owen

Good morning. Have just spent the last couple of weeks in the field using our new GLOGGER for gauging. It is very versatile, robust easy and efficient in it's design and keystrokes. I have recommended to my supervisor that enough units be purchased that each team can have one for use. It is a great piece of gear and a must in every hydrometric vehicle.

Andrew Pearce

STIL have a couple of GLoggers available for loan to hydrographers in Australia.
Contact: ojm@scottech.net or +64-7-8470646 or see a full description on www.scotttech.net.

The Peewee and the Magpie.

Mic Clayton, previously Senior Water Information Officer, Department of Primary Industries, Water and Environment, Tasmania

The hydrometric monitoring network operated by The Department of Primary Industries, Water and Environment (DPIWE) in Tasmania is based on the Unidata data collection platform. In the mid 90's the network consisted of 6003A/B data loggers and a small smattering of 6004A loggers were appearing as well operating on Unidata's Starlog2 software. Some sites were still operating with A35 chart recorders and a handful of sites were measured by a quickly tiring band of Wesdata loggers.

As with many organisations staffing resources were very limited, in fact when the Water Information unit was established in 1996/7 only two staff were put on to maintain and operate the statewide network of the department. (in fact it was really a re established Hydrographic Group but you couldn't call it that as all the hydrographers had been redundacised during a heavy period of economic rationalism in the early 90's and, as far as the radar at HR was concerned, hydrographers no longer existed!)

To enable some sanity in this under resourced situation the decision was made to standardise the logger platform and it was decided to continue with the Unidata loggers and say goodbye to the A35's and Wesdata units. The facility to digitise the A35's was unavailable and contracting charts out was costing $700 per chart irrespective of the length of the chart!

By late 1997, Windows 95 appeared in the department and a worrying situation developed - DOS based software was beginning to have problems under the platfom imaging that IT were implementing. Unfortunately Starlog was amongst this group of softwares.

When approached about the problems and how IT could assist us the response was less than satisfactory - it suddenly became the software suppliers' fault that our core logger softwares were now not working. IT refused to recognise that everything worked fine prior to the implementation of Win95 and we were asking them to help us overcome the problems we were experiencing as a result - the Help Desk was less than helpful! With much hair pulling and frustration and help from others in our section we patched our way around the DOS problems and kept it Starlog going.

During this time the recently arrived new staff had heard via their database system supplier that a new software for Unidata loggers was being trailed as it enabled the Unidata loggers to be used with multibuffer capabilites, a feature not available under the Starlog2 platform and drivers for the database telemetry system would soon be available. The new software was Windows based as well. The new staff at DPIWE waited and waited, and waited some more. After 18 months it was found that the trailing of this new software hadn't really progressed and staff at DPIWE were now being threatened by IT with an upgrade to Windows 98!

The decision was made to give this new software a go and Magpie by Measurement Engineering Australia (MEA) was purchased as well as a couple of basic schemes - the Water Information unit even went the whole hog and asked MEA to prove their system in a telemetry setup using a GSM modem in a less than marginal GSM coverage area on the east coast of Tasmania.

To say DPIWE was delighted with what it got was an understatement! Magpie worked straight away and what's more it looked nice! It worked across platforms from Windows 3.1 up to the IT upgrade at that time of Win98. Data could be looked at more easily as the new data was appended to existing data in dBase files and specific dates and types of data are easily selected for viewing.

The GSM telemetry site worked straight away, the DPIWE staff found, with minimal tutoring over the phone and via email, that they could easily create operating schemes for a wide variety of monitoring situations.

Data collected by Magpie is appended to existing dBase files in the scheme folder. This aspect lends itself easily for extraction of data by other standard softwares such as Excel. To get the data into Time Studio a driver was developed for Time Studio that extracted the newest data from the dBase file and appended it to the time series file. It is understood that Hydstra is currently developing a driver that will enable Time Studio Scheduler to talk directly to the logger in the field.

A few non-telemetered sites were converted to the Magpie platform in early 1999 but it was very quickly realised that this was the way to go and a program was implemented to upgrade the whole network. Firstly though the older loggers had to be replaced, Magpie was designed for 6004 loggers with firmwares greater than Version 23 and Unidata started seeing the orders for new loggers!

With a very limited budget the upgrade had to occur gradually as funds became available. A staged approach was taken and simpler configuration installations (level only and rainfall) were upgraded first . By mid 2000 these were completed. This

gradual rollout also enabled DPIWE users to gain confidence and knowledge of the platform and soon came the more complex sites - water quality sensors, telemetry, data access by other entities and so on.

The Met Bureau's QNX system for Flood Warning had to be catered for - problem solved with a few lines in the scheme to enable them to access a data value from the header buffer of the logger. This also enabled DPIWE to standardise the buffer address where the data that BoM wanted resided. Previous schemes under Starlog had been developed with the addresses varying depending on who created the scheme, with BoM using these varying address points in their system. By standardising where the data points sat in the buffer made management of BoM access much easier - upgrades could be performed without impacting on the Flood Warning Network.

By late mid 2001 the whole DPIWE network was on Magpie.

As DPIWE staff used Magpie more, schemes with multiple buffers, SDI-12 capabilities, alarm dialouts, SMS messaging, short haul radio setups all started becoming the norm.

The telemetry side of things is extremely robust and allows a great deal of analysis of sensor signals remotely - enabling smart management of problems that might be occurring in the field by allowing the user to narrow down the possible causes of faults or problems then heading off to repair with adequate equipment to fix the problem. The telemetry facilities also enabled the team to set up a small digital modem setup, a wavecom carried in a small Pelican case that enables sites to be telemetered from a field computer - again allowing smart management of work while in the field such as re prioritising flood gauging while a flood event is continuing and so on.

Magpie has been found to be a valuable data platform for DPIWE, its ease of use and flexibility have helped improve the management of the DPIWE network has made the work of the Water Information unit all that easier during a time of tight resources and other operational constraints.

Contact the Senior Water Information Officer, 13 St Johns Ave, New Town Tasmania, phone Australia wide - 1300 368 550 if you want to find out more.

Contributions to the Journal and Newsletter

Member contributions to the Journal and newsletters are most welcome. You are the Association and hence it is helpful if you provide input into it.

At present the Editor is limited to steam driven Word 6.0 so if you have a contribution could you please submit in that format.

Advertisers could also assist by providing TIF, GIF or JPG images or similar of their ads - while PDF format is handy it means cut and paste has to be done - literally!

I look forward to getting summaries of papers from the conference from those who have indicated that they are willing to provide them. Summaries of the summaries are also welcome as I can use them as a precursor in the newsletters for items appearing in the next Quarterly Journal.

Photographs are also welcome for the cover of the newsletter - final use of a submitted photo will depend on how well the image transposes onto the cover of the Journal, so the clearer the better.

On The Web.

www.balloonartists.com.au/hobart2003/atrium.htm - A balloon benders convention with its theme as the International Year of Freshwater!

www.vicwaterdat.net - Victorian Water data via a data warehouse

www.nrm.qld.gov.au/watershed - HYDSYS base data

Corporate Membership

Corporate Membership of AHA includes the following "benefits"

- •Free full page ad in the quarterly Journal
- •Free quarter page ad in the monthly newsletter (mainly due to space requirements)
- •Free page and links on our web site.
- •Use of our name in a manner of the form "All of our hydrographers are members of the AHA" when advertising/tendering etc.

Individual members receive a 10% discount on there membership if their employer is a current corporate member

Application For-Renewal of Membership

The Secretary,
Australian Hydrographers' Association,
C/- PO Box 456,
BOWRAL,
NSW 2576

Dear Sir
I wish to become a Member/Renew my Membership of the Australian Hydrographers Association.

Name: _____

Address: _____

_____

Phone: _____

e-mail: _____

Employer: _____

Title: _____

Address: _____

_____

Declaration: My employer is an Australian Hydrographers Assn. Corporate member. Y / N

Membership Grade:
Individual Member ($100 to end of Year 2003)
Corporate Employee Member ($90 to end of Year 2003 only if your employer is a corporate member)
Retired/Student/Cadet ($50 to end of Year 2003)
Corporate ($500 to end of Year 2003)

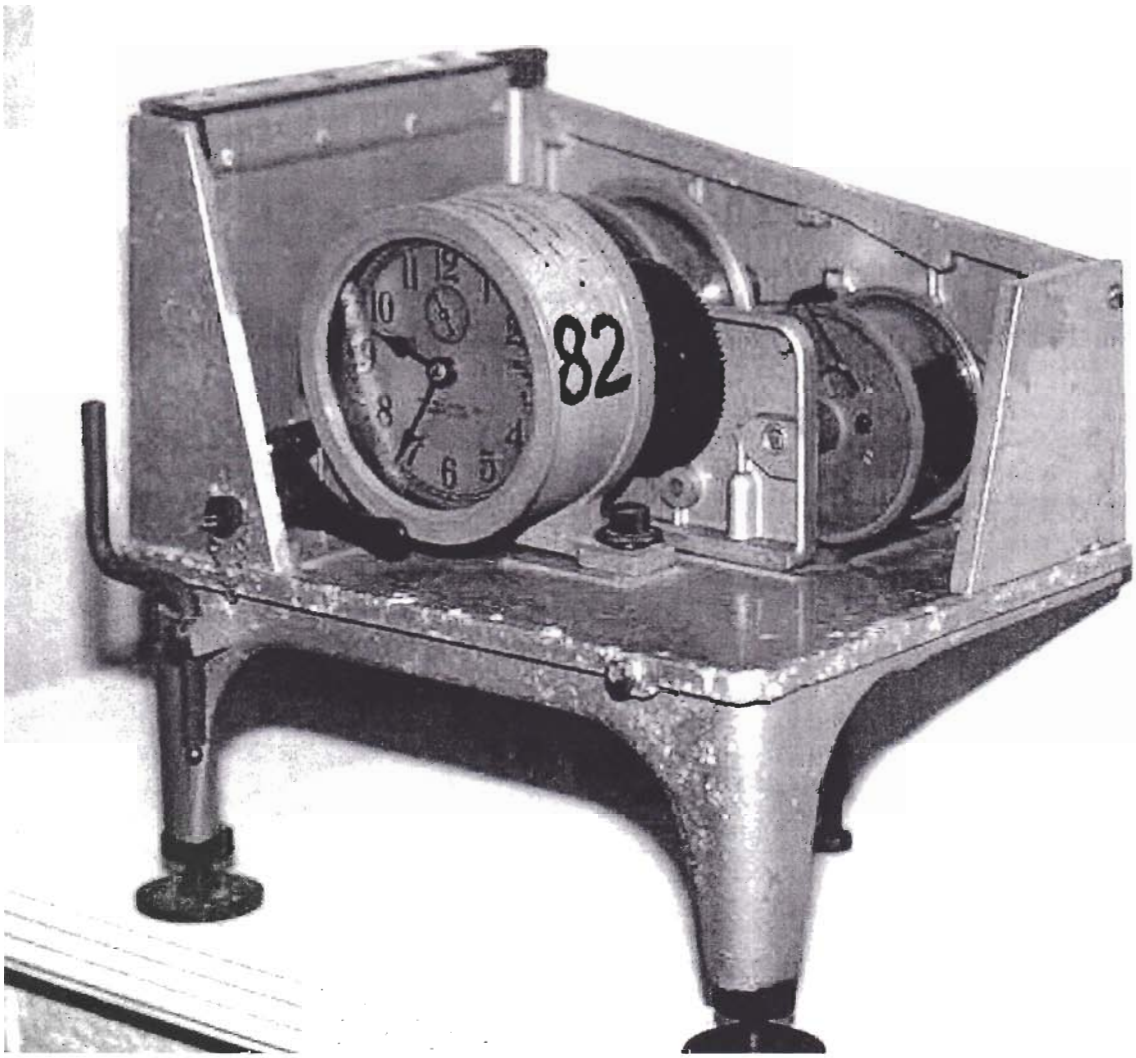
I enclose **$** .

Please make cheques payable the Australian Hydrographers Association

I wish to receive my monthly Newsletters by **e-mail / post / I will down-load from the web site**.
I wish to receive my quarterly Newsletter at my **Home / Work** Address.
I wish to receive my issues of *WATER* magazine at my **Home / Work** Address.
Signed: _____

Date Received _____ ***Member Number*** _____

Technology Shot



What to do with those old A35's.
Cut them in half for a nice mantle piece addition.
They actually keep good time when they don't have to drag those soggy charts across the metal plate!

OOPS!