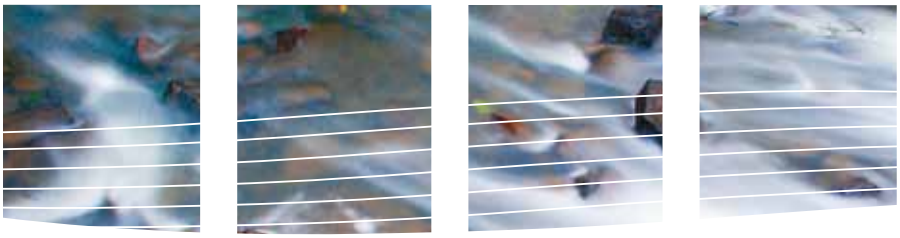
AUSTRALASIAN HYDROGRAPHER



August 2010

AHA 2010 Conference

Hydrography Basics' Training Program and Schedule

New ISO Standard Released

Flumes - for Irrigation Channel Flow Measurement

Training Updates

Hydrography Qualifications and Diplomas

AUSTRALIAN HYDROGRAPHERS ASSOCIATION

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Invitation to Editorial Contributors and Authors

If you are interested in writing editorial for Australasian Hydrography, please email secretary@aha.net.au

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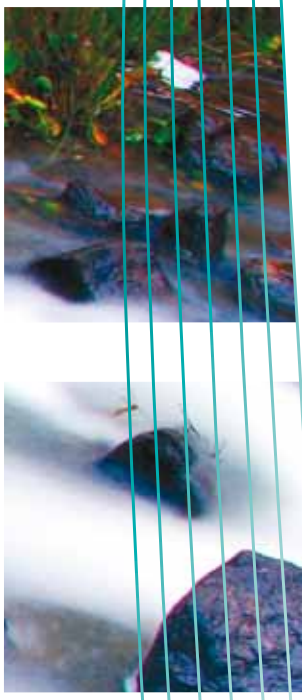

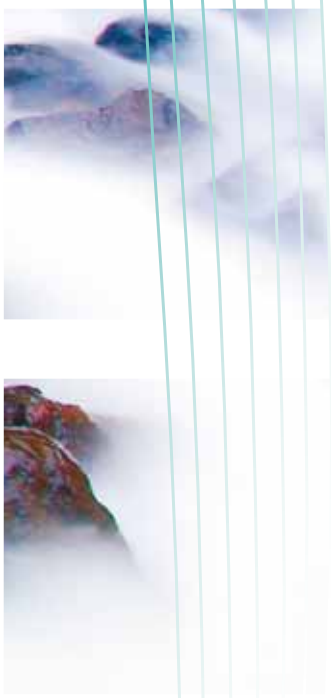

CHAIRMAN'S ADDRESS

The AHA must first apologise to members for the belated newsletter. As mentioned in our last newsletter Mic Clayton had resigned from the position of Publicity Officer and as yet the committee has not been able to find a replacement.

Mic did an absolutely fantastic job producing the newsletter and this was one of our main points of contact to the members. So if you are a budding publisher / journalist and would like to offer your services please contact the committee. See page 2 for details.

We have however tried to keep regular contact via email and as you will see this newsletter has come to you as a PDF. Once we find a new Publicity Officer we intend to send at least one major newsletter via the post but the remainder via PDF format.

Although the newsletter hasn't been as regular as it should be we definitely haven't been sitting on our hands. As you will see in this edition there has been a quantum leap in providing Hydrographic training courses whilst at the same time juggling the ongoing NWP40107 Water Operations Diploma (Hydrography).

The AHA conference is well underway and there is an update on page 11-15 in this newsletter.

We look forward to seeing you all in Perth in October.

Bill Steen
National Chairman
AHA

New ISO Standard Released

Hydrometry - Guidelines for the application of acoustic velocity meters using the Doppler and echo correlation methods.

Abstract

ISO 15769:2010 provides guidelines on the principles of operation and the selection and use of Doppler-based and echo correlation velocity meters for continuous-flow gauging.

ISO 15769:2010 is applicable to channel flow determination in open channels and partially filled pipes using one or more meters located at fixed points in the cross-section.

The new standard can be purchased from the ISO (International Organization for Standardization) website: www.iso.org/iso/home.htm

Funny Photos

This photo is from Al Chomica who is the Facilities Supervisor, Water Survey of Canada, Calgary, Alberta.

The Northern Territory might have crocodiles but Canada has bears….

Missing Newsletters

The AHA is in the process of obtaining a complete set of journals with the intent to make these available on the AHA website. The ones we have missing are numbers 1 to 27 and Sep 2001. If you happen to have a copy and would like to donate it to a good cause, please contact the committee.

AWA Water Magazine

The current AWA Water Magazine is due to cease and the committee need your feedback as to whether you wish the AHA to continue this subscription. It has been noted that many organisations already get this magazine through their corporate subscriptions. If you have any comments could you please send them to hydrography@aha.net.au

Training Update

Hi members,

I am writing with the aim to provide members with an accurate and up to date account of the current situation pertaining to training and specifically NWP40107 Water Operations Diploma (Hydrography).

As you would be aware industry representatives from around Australia have been working with Government Skills Australia (GSA) (a national skills council) for approximately 3 years to develop a nationally accredited course specific to hydrography.

The industry representatives were made up of managing hydrographers from 7 major water organisations that employ hydrographers, as well as the AHA and NSW TAFE OTEN. The water organisations represented were from both the private and public sector. This panel will be referred to in this document as the Hydrography Technical Reference Group (HTRG).
The reason for such representation was to achieve input from a broad cross section of our industry,

By around May 2009 the HTRG had identified competencies and from these competencies it then completed "Technical Writers Briefs" relevant to each competency. By early 2010 the GSA technical writer, using these "Writers Briefs", had developed "Learning Material" for each of the competencies and QA checks had been completed.

To my knowledge and that of the AHA and HTRG at that point in time, all was ready for endorsement.

Unfortunately this process has been delayed by Water Industry Advisory Committee (WIAC) deciding not to put the entire Water Industry Training package up for national endorsement.

The reasons and outcomes are probably best explained by reading the attached email that was recently issued to the HTRG by Wayne Morling (GSA) as a result of a national teleconference between the HTRG and GSA.

Basically, NSW TAFE OTEN can now purchase the Learning Material from GSA and begin to develop delivery material immediately.

On behalf of the AHA I remain in continuous discussions with OTEN regarding a timely delivery date of the Diploma course.

On a lighter note

In the mean time the AHA has remained active in the delivery of learning services to its members. This has been by way of the AHA working with industry and NSW TAFE OTEN to develop an accredited course No. 27743 titled Hydrography-Basics.

Since the inaugural trial course in September 2009 the AHA has continued to deliver this 5 day course with face to face practical and theory sessions.

This course is aimed at those people working in the hydrography industry with zero to around 2 years

experience or those with no formal qualification in hydrography or as simply a way to "jump start" progress through the Diploma course.

Successful completion of this course awards the student with a Certificate of Attainment and RPL to the first 3 units (30%) of the Diploma course in Hydrography.

AHA has now staged 5 of these courses, 3 in Sydney and 1 in Melbourne and recently 1 in Rockhampton Qld. Organisations that have assisted the AHA by hosting courses are:

- Hydrological Services (HS)
- Australian Laboratory Services (ALS)
- Thiess Environmental Services
- DERM Qld

With interest shown to host future courses from:

- DWLBC
- DPIW/Hydro Tas
- WA DoW

To stage a course, AHA requires a minimum of 10 students at a cost (from 1st July 2010) of $3,700/ student.

This cost includes:

- Comprehensive course notes;
- Classroom delivery by industry trained experts;
- AM/PM teas and lunches;
- A one day field excursion providing "hands on" training and assessment;
- Bus transport on field day;
- NSW TAFE enrolment to course No. 27743;
- Provision of delivery, tuition and marking of set assignments, practical and theory; and
- Collation of all assessment material to TAFE (OTEN).

It is the intention of the AHA to further develop face to face delivery material based on the required learning outcomes from the Diploma course. This is intended to provide members and employers with more options to gain qualifications in a timely manner (as opposed to distance learning) as well as

provide students with interaction and exposure to methodologies and practices outside their current working environment.

Please view the schedule of courses for the remainder of 2010 and early 2011 on page 16 and 17.

As you will see there are still time slots if your organisation is interested in enrolling students/ employees.
If members feel this course would benefit them and/or their employer, I would encourage you to approach management to seek approval to attend any of these courses.

I wish to highlight that by the end of June 2010 well over 70 students will have successfully gained this qualification.

Kind regards

Paul Langshaw
AHA National Training Coordinator

The photos in this article were taken during the week of Sydney and Melbourne based training courses.

HYDROGRAPHY BASICS' - TRAINING PROGRAM
MARCH 2010 SAMPLE ONLY

Time	Monday 22nd	Tuesday 23rd	Wednesday 24th	Thursday 25th	Friday 26th
0800-0830	Arrival at Training Venue - Tea/Coffee				
0830-1015	Travel Arrival Introduction from AHA & OTEN *P.Langshaw* Water Level Measurement (Theory)	Stream Station Survey/ Annual Inspection/Cross & Long Section (Theory)	Stream Station Survey (Practical)	Hydrometric Site Installation (Theory)	Introduction to Groundwater Monitoring
1015-1030	Morning Tea				
1030-1200	Current Meter Gauging (Theory)	Instrumentation - TBRG's/Shaft Encoders/ PressureTransducers/ Loggers/Telemetry/ Power Supply	Water Sampling (Practical)	Current Meter Maintenance and Calibration (Theory & Practical)	Acoustic Doppler Current Profilers ADCP (Theory & Practical)
1200-1230	Lunch				
1230-1400	Hydrometric Site Selection (Theory)	Instrumentation - TBRG's/Shaft Encoders/ PressureTransducers/ Loggers/Telemetry/ Power Supply	Current Meter Gauging (Practical)	Stream Discharge Curves (Theory)	Acoustic Doppler Current Profilers ADCP (Theory & Practical)
1415-1430	Afternoon Tea				
1430-1600	Sediment Sampling (Theory)	Water Sampling - Parameters/Methods/ Documentation/COC/ Storage/Handling (Theory)	Current Meter Gauging (Practical)	Stream Discharge Curves (Theory)	Collate Assignments and Course Assessment
1600-1700	Homework Assignments and Review				
			Field Day		

HELLO MEMBERS

Hello HRG members

At the March meeting of the Water Industry Advisory Committee it was decided to consolidate changes to NWP07 undertaken during continuous improvement in 2009, into the full review of NWP07 being undertaken during 2010.

This decision was reached taking into account the following factors:

- A full review of NWP07 is due in 2010;
- National Quality Council requires all training packages to incorporate "sustainability/green skills" and "flexible qualification" requirements into training packages by 31 December 2010;
- Submitting NWP07 Version 2 (incorporating continuous improvement changes) could require RTOs to adjust to two new versions of NWP in a 9 month period – NWP07 V2 and NWP10;
- Finally concerns were expressed by a couple of major water entities concerning removal of career pathways with the elevation of all units to Diploma level.

Consequently, at the HRG teleconference, it was agreed that a recommendation will be made to the WIAC proposing that all (Hydrography) Diploma level units developed and elevated as part of the continuous improvement process be quarantined during the full review. Recommendation to WIAC will occur on Monday with a response required by Friday May 7. Effectively this means the only changes to the units will be to incorporate sustainability/green skills requirements and any basic editing. Other than that, no changes will be made to the Hydrography Diploma units.

Consequently water training package NWP07 contains the current set of competencies as they appear at the various qualification levels.

During the full review of NWP07 a functional analysis will be conducted. As part of this analysis, the pathway needs for Hydrography beyond Diploma level, specifically Cert IV and other qualification levels. Broad industry consultation will be undertaken to determine needs and gather input into any potential development of units of competence. This will include consulting with water enterprises, BoM, HRG and RTOs.

Of course, RTOs may purchase the national learning resources for immediate use, although at this stage, and until the next version of the training package is endorsed, statements of attainment and qualifications can not be issued. This means it can be delivered but, qualifications can't be issued until endorsement of the package occurs.

Any queries, don't hesitate to contact me.

Regards

Wayne Morling
National Industry Manager Water

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AHA 2010 CONFERENCE

Perth 19-22 October 2010

HYDROGRAPHY

REFLECTION

REFINEMENT

RESURGENCE

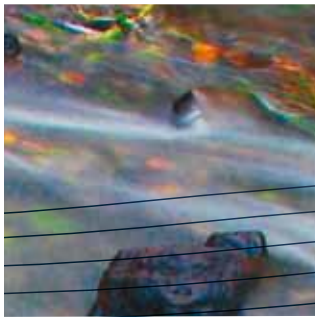
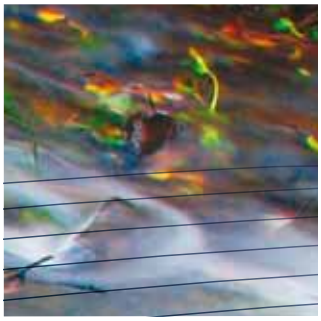
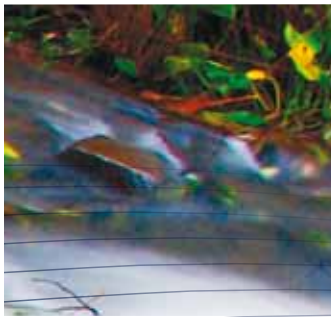
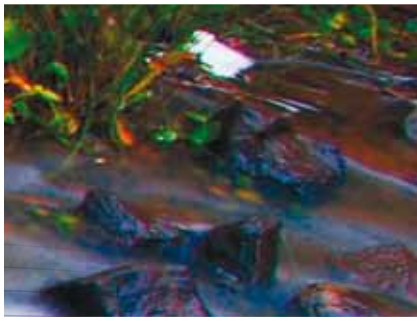
CONFERENCE PROGRAM

Tuesday 19th October

Time	
17:00	**Welcome Reception and Drinks**

Wednesday 20th October

Time	Presentation	Name	Agency/Company (State or Country)
09:00	**Conference Opening Address**	Bill Steen	Chairman, AHA
09:05	Key Note – Day One	Bill Bunbury	Author - "When the stream runs dry"
09:30	Reflection, Refinement, Resurgence - Hydro Tasmania perspective	Mark Johnston	Hydro Tasmania (TAS)
10:00	From Telemark to Internet	Neil Chapman	Department of Water (WA)
10:30	**Morning Tea**		
11:00	Can H-ADCP's replace traditional gauging stations?	Daniel Wagenaar	Department of Natural Resources, Environment, the Arts and Sport (NT)
11:30	Sediment Monitoring - Extending Hydrography in new areas	Andy Markham	Hydrobiology (QLD)
12:00	'How high is the Water?'	Ken Klassen	Department of Environment and Resource Management (QLD)
12:30	**Lunch**		
13:30	Continuous Flow Monitoring at Morgan, SA using Acoustic Dopplers	Daniel McCullough	Department of Water, Land and Biodiversity Conservation (SA)
14:00	Characterising Groundwater resources using new technology	Shao-Chih (Ted) Way	Insitu Incorporated (United States)
14:30	River station experience with up/side looking Acoustic Dopplers	Glen McDermott	Greenspan Pty Ltd (NSW)
15:00	**Afternoon Tea**		
15:30	The challenges of monitoring urban storm water flows	Peter Stephens	AWT New Zealand Limited (New Zealand)
16:00	Limitations of inflow computations from Pump Station data	Matthew Cooper	AWT New Zealand Limited (New Zealand)
16:30	Lake Argyle sedimentation survey	Renee Dixon	Department of Water (WA)
17:00	**1st Day Close**		
19:00	**Conference Dinner**		

Thursday 21st October			
Time	**Presentation**	**Name**	**Agency/Company (State or Country)**
08:30	**Australian Hydrographers' Association Annual General Meeting**		
09:30	Key Note – Day Two	Tony Boston	Bureau of Meteorology
10:00	Modernisation and Extension of Hydrological Monitoring Program	Alan Baker	Bureau of Meteorology
10:30	**Morning Tea**		
11:00	Harmonising Australia's Water Data – Reflection on first steps	Brett Anderson	Bureau of Meteorology
11:30	Flood Warning and ICT & Data Collection Systems	Robert Thompson	Bureau of Meteorology
12:00	Driving change in Australian water information standards	Linton Johnston	Bureau of Meteorology
12:30	**Lunch**		
13:30	Internet Protocol (IP) Telemetry Technology	Mathew Saunders	Unidata Pty Ltd (WA)
14:00	River Hydraulic Rating Analysis	Michael Harris Leith Bowyer	Department of Water (WA)
14:30	Theoretical Rating of WA's Northern Rivers	Ross Doherty	Department of Water (WA)
15:00	**Afternoon Tea**		
15:30	Hydrometric Information Quality – reflecting on past practices, refining standards and delivery for the future needs	Grant Robinson	New South Wales Office of Water (NSW)
16:00	'An aggressive attitude'	Mic Clayton	Snowy Hydro Limited (NSW)
16:30	'Passing the Waders' Succession planning for Hydrographers	Sarah Hesse	Manly Hydraulics Laboratory (NSW)
17:00	**Conference Close**		

Friday 22nd October - Field Day program to be finalised soon.

Saturday 23rd October – Social Golf Day at Burswood – depending on interest from Conference Delegates.

AHA 2010 CONFERENCE

HYDROGRAPHY | REFLECTION | REFINEMENT | RESURGENCE

About the Conference

The 15th biennial Conference of the Australian Hydrographers' Association is being held in Perth, Western Australia, at the Burswood entertainment Complex between the 19th and 22nd of October. The theme for the Conference is Hydrography - Reflection, Refinement, Resurgence.

The convening committee consists of representatives from various Hydrographic organisations and companies from Western Australia - Allan Deane (Water Corporation), Greg May (Department of Water), Kelvin Baldock (Hydro-smart), Russell Marks (Greenbase Pty Ltd), and Michael Whiting (Secretary, AHA).

The Conference has received an overwhelming response to the call for papers with over thirty abstracts submitted, for twenty one possible presentation time slots. The number along with the high standard of abstracts presented has made the conveners task in selecting potential presentations difficult, but very encouraging. Each abstract was assessed to ensure alignment to the theme, but also making sure the overall program represented the broad spectrum of work undertaken by hydrographers across Australia and internationally.

The high number of abstracts has meant unfortunately a number of abstracts weren't able to be selected for presentation; however the option of displaying a poster paper was provided to most of the remaining abstracts.
You can view the preliminary conference program on page 12 and 13.

The Field Day on the Friday will take in a number of interesting environmental monitoring projects and infrastructure in and around the Peel Region, south of Perth. There will also be a lunch along the way, and the possibility of early evening drinks and a meal at a picturesque location in the hills south east of Perth. Following a hectic week at the Conference, a social golf afternoon will be organised for those avid golfers amongst us, staying on in Perth.

You can view more information or register for the conference online at:

www.aha.net.au

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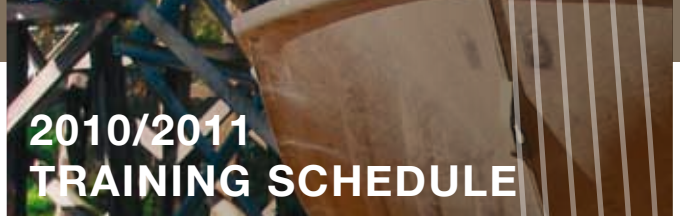

2010/2011 TRAINING SCHEDULE

DRAFT
HYDROGRAPHY BASICS' - TRAINING SCHEDULE 2010/2011

	February				March				April				May				May/June			
2010 W/C	1	8	15	22	1	8	15	22	5	12	19	26	3	10	17	24	31	7	14	21
BoM																				
DPIW Tas																				
DWLBC (SA)																				
ALS								6									5			
Environmine (Qld)				1																
Greenspan																				
Hydro Tas																				
Manly Hydraulics																				
NRETAS (NT)																				
NSW Office of Water																				
Qld DERM																	12			12
Sentinel (ACT)																				
Snowy Hydro				2																
SunWater (Qld)																				
Seqwater																				5
Sydney Water																				
Thiess				5				6												
WA DoW																				
WA Water Corp.																				
VENUE	Sydney (HS)				Vic (ALS)												Rocky/Bris (DERM)			
Totals	**8**				**12**				**Vacancies**				**Vacancies**				**18**			**17**

2010 W/C	July				August				September				October				November				December			
	5	12	19	26	2	9	16	23	6	13	20	27	4	11	18	25	3	10	17	24	7	14	21	28
BoM																								
DPIW Tas																								
DWLBC (SA)								12																
ALS				4																				
Environmine (Qld)																								
Greenspan																								
Hydro Tas																								
Manly Hydraulics																								
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NSW Office of Water																								
Qld DERM																								
Sentinel (ACT)																								
Snowy Hydro																								
SunWater (Qld)																								
Sydney Water																								
Thiess				12																				
WA DoW																9								
WA Water Corp.																3								
New Zealand										12+														
VENUE	Gisborn Vic (Thiess)				Adelaide (DWLBC)				Christchurch?				Perth											
Totals	16				12				12+				Vacancies				Vacancies				Vacancies			

2011 W/C	January				February				March				April				May					June			
	10	17	24	31	7	14	21	28	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27
BoM																									
DPIW Tas						6																			
DWLBC (SA)																									
ALS																									
Environmine (Qld)																									
Greenspan																									
Hydro Tas						6																			
Manly Hydraulics																									
NRETAS (NT)																									
NSW Office of Water																									
Qld DERM																									
Sentinel (ACT)																									
Snowy Hydro																									
SunWater (Qld)																									
Sydney Water																									
Thiess																									
WA DoW																									
WA Water Corp.																									
New Zealand																									
VENUE					Hobart (Tas)																				
Totals	Vacancies				12+				Vacancies				Vacancies				Vacancies					Vacancies			

ARTICLE

FLUMES- FOR IRRIGATION CHANNEL FLOW MEASUREMENT

By Glenn McDermott
Modelling Projects Manager, Greenspan Technology

1. Introduction

The National Water Initiative has funded flow measurement accuracy improvements in the non-urban irrigation industry, under the framework it developed for the purpose - National framework for non-urban water metering (December 2009).

In principle this requires each state to aim to have:

- All new meters installed from 1 July 2010 will comply with the National Framework;
- Existing meters that are within the ±5% tolerance limits may be deemed to be compliant; and
- Unless otherwise provided for in the State / Territory Implementation plans - all existing non compliant meters shall be upgraded.

Most of the "easy to identify and replace" single property meters, such as dethridge wheels, have been identified and replaced (or will soon be replaced) with compliant new flowmeters such as magnetic flow meters, or Rubicon flume-gate meters.

Flow measurement in the larger "flat" channels has required more thought, however, to identify the best technology or combination of technologies to suit the purpose, as flowmetering solutions for these channels cost substantially more. The costs and the accuracies and effectiveness achievable by the different competing technologies are now being investigated by the various state water authorities.

The focus of this article is to show how a long throated flume, although "old" technology, is practical and can be designed to suit flow measurement in mid-sized flat channels with less head-loss than, say, a bank of magflo meters.

2. A short history of flumes for measurement

Flow measurement weirs have been used for many years in the irrigation industry, from the early 1800's until now. Two practical concerns with such structures are the silt build-up and consequent maintenance requirement caused by the weir pool, and, the amount of head loss required to ensure that the weir rating is independent of downstream tailwater levels.

Long throated flumes were developed to sit lower in the channel, to be self-cleansing (ie no silt build-up), and to have a much lesser head loss requirement (relative to downstream tailwater levels) than weirs. The Parshall flume was one of the first successful examples of this type of long throated flume (circa 1920). Since the Parshall flume's development a wide range of long throated flumes have been designed and tested and are covered by International and Australian standards- with throat shapes including square, circular, parabolic and trapezoidal. These flumes are in common use in the flow measurement industry, in irrigation, water supply and waste water treatement.

3. A north-western NSW example

The "map" shown in Figure 1 sets out a typical arrangement for an irrigation co-operative, with a pump-house, pumping from the river to the main channel, from which individual farms have their individual distribution channels. The flow released down each distribution channel is measured for billing purposes. The example here shows three distribution channels, all with the same trapezoidal cross section shape (D-D):

- Channel A-A; this shows the existing water release control arrangement, with a manually operated penstock at the start of the channel, releasing to the channel. The system operator sets the penstock opening at the beginning of a water order day, to deliver 20, 30, 50 or 80 ML/D (ie the standard water order magnitudes for these type of farms). This channel will be called the "pre-metering" arrangement.
- Channel B-B; shows the additional channel infrastructure required to convert the "pre-metering" arrangement to a magflo metering arrangement. The single magflo meter shown represents anything from one to four meters. To ensure the magflo "pipes" run full, a weir box is necessary just downstream of the magflo meters.
- Channel C-C; is the "flume" method of measurement, with the flume set well downstream of the penstock release point.

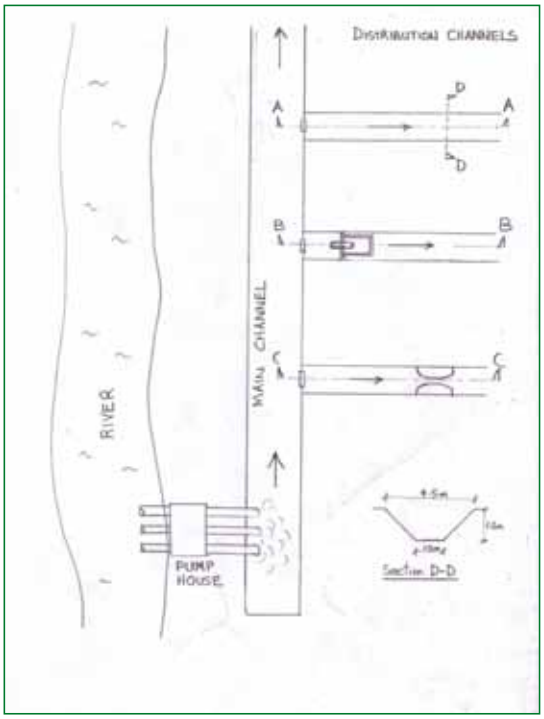


Figure 1- Typical irrigation distribution arrangement.

4. Pre-metering discharge rating in channel A-A

The discharge rating referred to is the depth in the main channel required to generate a range of flowrates in the distribution channel, taking account of the head loss through the penstock.

A section or profile view of channel A-A is shown in Figure 2. The rating table development was based on applying Manning's equation to the trapezoidal channel (for H1), then the orifice formula for the penstock (to calculate head loss, then H_2)- varying the penstock opening to keep head loss within reasonable limits.

The maximum flowrate possible to release was limited by the penstock size, the distribution channel, and/or the main channel bank height. In this example the practical release range was from 10 to 80 ML/D, with a theoretical maximum of 100 ML/D. This gives the farmer flexibility to plant greater areas in good years, and make use of the full 100 ML/D maximum delivery capacity.

The rating table for the supply arrangement shown in Figure 2 is as listed in Table 1.

Figure 2 - Channel A-A profile showing pre-metering water supply arrangement.

Table 1- Pre-metering rating table(s)

Discharge (ML/D) required by farmer	"H_1" Depth (m) in distribution channel	"H_2" Depth (m) in main channel
10.0	0.23	0.45
20.0	0.35	0.59
30.0	0.44	0.70
50.0	0.59	0.89
80.0	0.76	1.12
100.0	0.86	1.26

The head loss added to the "H_1" depth ranges from 0.2m to 0.4m, depending on discharge.

5. Magflow metering arrangement in channel B-B

Figure 3 shows how a single magflo meter could be used to measure flowrates to the distribution channel, after the existing penstock. It also shows the head losses at each item of new infrastructure. This arrangement requires a new chamber to be built just down from the penstock, from which flow exits via the magflo meter. Then follows another new chamber, with flow depths controlled by a new weir and chamber, with weir crest level sufficient to force full pipe flow through the meter, at all flows.

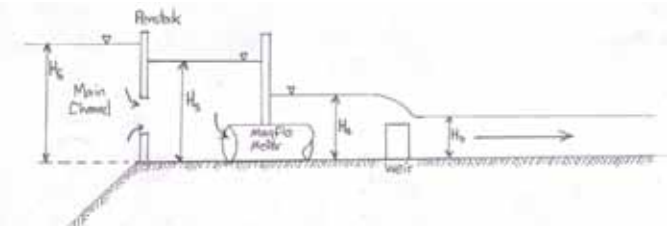


Figure 3 - Channel B-B profile view of Magflo metering arrangement.

Discharge rating relationships were derived for each point in the channel:

- "H_3" versus discharge- the same as for "H_1" in Table 1.
- "H_4" versus discharge- using a broad crested weir formula, with crest length 5m, but reverting to bernoulli's equation solution when tailwater level ("H_3") exceeds the weir's modular limit.
- "H_5" versus discharge- additional head loss calculated using the orifice formula, then added to "H_4".
- "H_6" versus discharge- additional head loss calculated using the orifice formula, then added to "H_5".

Applying these hydraulic methods using a 600mm magflo meter, gives the level profile and rating tables shown in Table 2.

Table 2 - Level profile and rating tables with a 600mm magflo meter

Discharge (ML/D) required by farmer	"H_3" Depth (m) in distribution channel	"H_4" Depth (m) in weir chamber	"H_5" Depth (m) in magflo chamber	"H_6" Depth (m) in main channel
10	0.23	0.65	0.67	0.89
20	0.35	0.69	0.74	0.98
30	0.44	0.71	0.83	1.09
50	0.59	0.76	1.08	1.38
80	0.76	0.82	1.64	2.00
100	0.86	0.87	2.15	2.55

The "H_6" levels shown above are considerably greater than the original (no magflo) levels shown in Table 1 as "H_2". To check how much these might come down if two(2) or three(3) or four(4) 600mm magflo meters are used, the calculations were repeated, and gave the results listed in Table 3.

Table 3 - Discharge rating in main channel for multiple magflo meters (all 600mm)

Discharge (ML/D) required by farmer	"H_6" Depth (m) in main channel			
	1 magflo	2 magflos	3 magflos	4 magflos
10	0.89	0.88	0.88	0.88
20	0.98	0.96	0.95	0.95
30	1.09	1.04	1.02	1.02
50	1.38	1.24	1.20	1.18
80	2.00	1.65	1.53	1.49
100	2.55	2.00	1.82	1.76

6. Flume arrangement shown in channel C-C

The long throated flume shown in Figure 1, is shown here in the channel C-C profile showing water level and head loss through the penstocks and flume, in Figure 4.

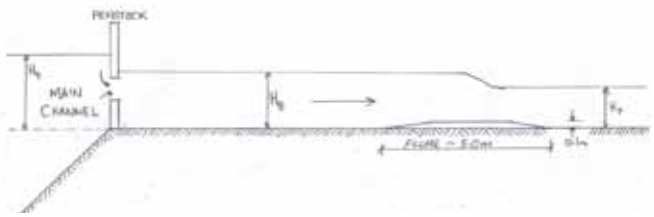


Figure 4 - Channel C-C profile view of flume metering arrangement.

The long throated flume throat has been sized to cause upstream level "H_8" to be "just" deep enough to conform with tailwater (H_7) modular limit considerations. The impact of the flume and penstocks on the level needed in the main channel (H_9), is shown in the form of the Table 4 discharge rating.

Table 4 - Discharge rating for long throated flume

Discharge (ML/D) required by farmer	"H_7" Depth (m) downstream of flume	"H_8" Depth (m) upstream of flume	"H_9" Depth (m) in main channel
10.0	0.23	0.25	0.47
20.0	0.35	0.39	0.63
30.0	0.44	0.52	0.78
50.0	0.59	0.73	1.03
80.0	0.76	0.99	1.35
100.0	0.86	1.15	1.55

The depth downstream of the flume (H_7) is the same as previously defined for the trapezoidal channel running free. The flume depth (H_8) was calculated using a flume throat width of 0.55m.

7. Comparing the three channel ratings

The channel ratings shown in Tables 1, 3, and 5 are shown plotted and compared in Figure 5 and Table 6.

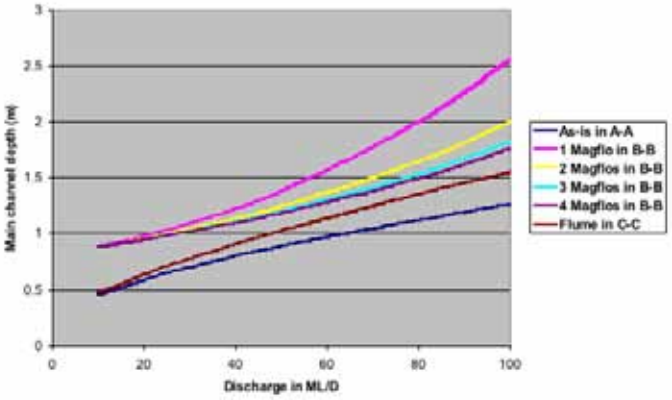


Figure 5 - Comparing discharge ratings.

The differences in the ratings are substantial, especially at the higher flowrates. For example at 100 ML/D with 1 magflo meter the main channel depth would need to be 1.0m higher than for a flume, while for 4 magflo meters the depth would still need to be 0.2m higher. These head loss (main channel depth increase) differences are detailed on the next page in Table 6.

Table 6 - Comparing channel ratings for head loss (increase)

Discharge in ML/D	Additional head loss (increase) required to push stated discharge through the channel (mm)					
	As-is channel A-A	600mm magflo meter arrangements in channel B-B				Flume in channel C-C
		1	2	3	4	
10.0	0	438	432	430	430	18
20.0	0	388	366	359	357	44
30.0	0	390	340	324	318	77
50.0	0	491	353	309	293	136
80.0	0	880	527	413	373	234
100.0	0	1292	741	562	499	293

8. Discussion

The flume designed for this example is capable of meeting the ±5% accuracy tolerance limit required by the non-urban water metering framework.

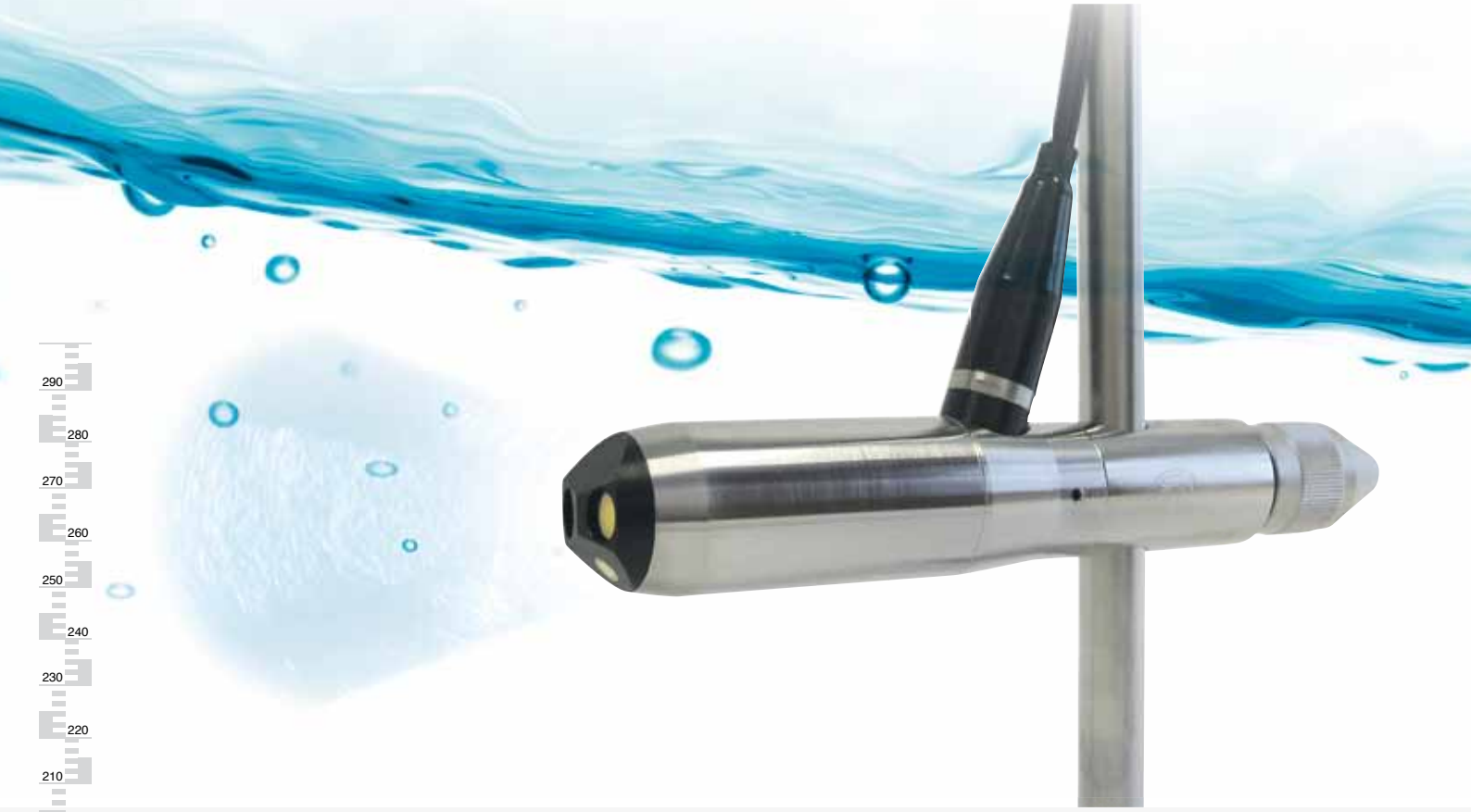
It's main advantage over magflo type installations is in the greater flexibility it would give the system operator- in terms of channel capacity usage. In good years when each farmer off the main channel plants a maximum area and asks for the maximum daily water order (eg 80 to 100 ML/D), then the capacity of the delivery system will be tested. If there was just one farmer off the main channel, then the additional head needed in the main channel for that 1 farmer is shown in Table 6.

However as there will be many consecutive farm offtakes off the main channel, the extra head required in the main channel is cumulative – forcing the operator to restrict maximum flowrate for those farmers towards the end of the channel. This capacity restriction is less severe for a flume type metering arrangement, by a significant amount. For example if there were 10 farms off the main channel each wanting the maximum discharge of 100 ML/D, the main channel would need to have higher banks at it's start by the following extents, compared with the existing (channel A-A) arrangements:

- 12.9m higher using single 600mm magflo meters;
- 4.99m higher using banks of four magflo meters per farm; or
- 2.93m higher using flumes.

If the main channel does not currently have this amount of freeboard available for maximum flow delivery, then either investment in main channel bank raising will be necessary or restricting the maximum flowrate that farmers can ask for.

One closing remark of interest for the hydrometric industry is that flumes, once installed and operating, would need to be subject to annual calibration checks (ie field gaugings with at least 20 verticals and 3 points per vertical) to attest to their ongoing accuracy.



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