Public Works
Manly Hydraulics Laboratory

OEH MYALL RIVER
TIDAL DISCHARGE MEASUREMENTS
MARCH 2014 AND OCTOBER 2015

Report MHL2415
February 2016

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Foreword

The data presented in this report was collected in the Myall River estuary in March 2014 and October 2015 as part of the NSW Office of Environment and Heritage (OEH) Estuary Management Program. The data obtained will be used to monitor changes in the tidal flows resulting from the dredging of the Short Cut Channel in 2015.

A full set of the raw data collected in the field and calculations used in the preparation of this report are retained at NSW Public Works Manly Hydraulics Laboratory (MHL) and may be viewed upon application to the Environmental Data Services Manager. Work notes are stored in NSW Public Works MHL archive file no. 1273.

This report was prepared by Mr D Allsop under the supervision of Mr M Fitzhenry (OEH).

Executive Summary

The Myall River entrance into Port Stephens is open and untrained. The tidal flows in the Myall River, both the incoming flood tide and outgoing ebb tide, split around Corrie Island. The Corrie Creek Channel flows around the north side of Corrie Island while the Short Cut Channel takes a more direct route to Port Stephens along the eastern side of Corrie Island. The relative proportion of flow in these two channels is determined by the depth of the Short Cut Channel and the extent of shoaling that occurs where the Short Cut Channel enters Port Stephens.

Between 29 May and 30 October 2015 approximately 111,000m^3 of sand was removed from the Short Cut Channel at the entrance to the Myall River. Initial earthworks using a long reach excavator broke through the spit on 7 July 2015, while dredging of the channel did not commence until 7 September 2015. Of the total sand removed 28,000 m^3 was placed as nourishment on Jimmys Beach, while the remaining 83,000m^3 was placed on a stockpile on the adjacent Winda Woppa spit. The dredged channel was approximately 70m wide with a depth up to 3.5m below AHD (approximate mean sea level). A Google earth image (see Figure 1.2) taken on 17 November 2015 clearly shows the final dredged channel.

As part of OEH's Estuary Management Program, NSW Public Works Manly Hydraulics Laboratory was commissioned to undertake a data collection exercise on Myall River. The aim of this data collection exercise was to facilitate an understanding of the changes in tidal hydraulics and mixing processes at the Myall River entrance resulting from the channel dredging in 2015.

The results of the 2014 and 2015 pre and post dredging tidal gaugings show clearly that a larger volume of water is coming in and out the Short Cut Channel on the flood and ebb tides since the dredging took place. This is a direct result of the increase in channel depth and width in the Short Cut Channel. The volume of tidal water in the Short Cut Channel is approximately 3.9 times greater on the flood tide and approximately 5.2 times greater on the ebb tide post dredging.

While the maximum velocities in Corrie Creek Channel and the Upper Myall River remained similar for both the 2014 and 2015 gaugings, the maximum velocities for The Short Cut Channel have doubled on both the flood and ebb tide since the dredging has been completed.

The aim of this report is to describe the methodology adopted for each component of the data collection exercise and to present and discuss the results. Other studies undertaken by NSW Public Works MHL on the Myall River are listed in the references in Section 7.

Data Summary

In March 2014 and October 2015 tidal discharge measurements were undertaken at the entrance to the Myall River estuary with the aim of providing baseline data and developing an understanding of the hydraulic processes operating in the estuary. The locations of all the data collection sites are shown in Figures 1.1 and 1.2. Water level data was available from one permanent ocean tide site in Port Stephens as shown in Table A and one permanent site in Myall River at Tea Gardens as shown in Table B. In addition, temporary sites were established at two strategic sites within the study area but the data from these sites is documented in a separate report (MHL2286).

Table A Summary of Water Level Data - Port Stephens

Date	Low Water		High Water		Flood Range (m)	Low Water		Ebb Range (m)
	Time (EST)	Level (m AHD)	Time (EST)	Level (m AHD)		Time (EST)	Level (m AHD)	
31/3/2014	0230	-0.77	0830	0.65	1.42	1445	-0.84	1.49
29/10/2015	0245	-0.78	0938	0.92	1.70	1615	-0.92	1.84

Note The Port Stephens tide gauge was re-located in April 2014 from Tomaree to Shoal Bay.

Table B Summary of Water Level Data - Tea Gardens

Date	Low Water		High Water		Flood Range (m)	Low Water		Ebb Range (m)
	Time (EST)	Level (m AHD)	Time (EST)	Level (m AHD)		Time (EST)	Level (m AHD)	
31/3/2014	0430	-0.48	0945	0.64	1.12	1653	-0.55	1.19
29/10/2015	0430	-0.58	1030	0.87	1.45	1730	-0.63	1.50

The first discharge measurement was done on 31 March 2014 which was before dredging took place in The Short Cut Channel and the second was done on 29 October 2015 near the completion of the dredging. During both discharge data collections, tidal velocities were monitored at three sites near the river entrance over a spring, flood-ebb semi-diurnal tidal cycle. Details of the available velocity and discharge data are shown in Tables C and D.

Table C Summary of Available Velocity and Discharge Data - 31 March 2014

Site No.	Site Name	Instrument	Data Type	No. of Transects	31 March	
					From	To
1	Corrie Creek Channel	ADCP	Profile	45	0243	1720
2	The Short Cut Channel	ADCP	Profile	46	0304	1711
3a	Upper Myall River A	ADCP	Profile	47	0246	1722
3b	Upper Myall River B	ADCP	Profile	44	0253	1727

Note One boat monitored Site 1 and Site 3a and the second boat monitored Site 2 and Site 3b. This duplicate data collection at Site 3 was done for a QA check on data from two ADCPs doing the same monitoring location.

Table D Summary of Available Velocity and Discharge Data - 29 October 2015

Site No.	Site Name	Instrument	Data Type	No. of Transects	29 October	
					From	To
1	Corrie Creek Channel	ADCP	Profile	45	0352	1933
2	The Short Cut Channel	ADCP	Profile	44	0400	1858
3	Upper Myall River	ADCP	Profile	44	0406	1904

On the flood tide on 31 March 2014 the maximum current velocity recorded at Site 1 was approximately 0.96 m/s and on the ebb tide the maximum was approximately 0.94 m/s. At Site 2 the maximum was approximately 0.51 m/s on the flood and approximately 0.42 m/s on the ebb tide. At Site 3a the maximum was approximately 1.01 m/s on the flood and approximately 0.75 m/s on the ebb tide. Data from this exercise shows that there is typical vertical distribution of velocity. At Site 3b the maximum was approximately 1.09 m/s on the flood and approximately 0.80 m/s on the ebb tide. Data from this exercise shows that there is typical vertical distribution of velocity. A full summary of the maximum velocities recorded on 31 March 2014 is shown in Table E.

Table E Summary of Velocity and Discharge Data - 31 March 2014

Site No.	Maximum Velocity		Maximum Discharge		Tidal Prism	
	Flood (m/s)	Ebb (m/s)	Flood (m^3/s)	Ebb (m^3/s)	Flood ($m^3 \times 10^6$)	Ebb ($m^3 \times 10^6$)
1	0.96	0.94	232	204	3.33	3.59
2	0.51	0.42	126	116	1.40	0.99
3a	1.01	0.75	335	254	4.19	4.27
3b	1.09	0.80	325	243	4.07	3.98

Note The maximum velocities are the approximate highest velocities at peak discharge.

On the flood tide on 29 October 2015 the maximum current velocity recorded at Site 1 was approximately 0.81 m/s and on the ebb tide the maximum was approximately 0.91 m/s. At Site 2 the maximum was approximately 0.97 m/s on the flood and approximately 0.81 m/s on the ebb tide. At Site 3 the maximum was approximately 1.02 m/s on the flood and approximately 0.97 m/s on the ebb tide. Data from this exercise shows that there is typical vertical distribution of velocity. A full summary of the maximum velocities recorded on 29 October 2015 is shown in Table F.

Table F Summary of Velocity and Discharge Data - 29 October 2015

Site No.	Maximum Velocity		Maximum Discharge		Tidal Prism	
	Flood (m/s)	Ebb (m/s)	Flood (m^3/s)	Ebb (m^3/s)	Flood ($m^3 \times 10^6$)	Ebb ($m^3 \times 10^6$)
1	0.81	0.91	233	176	2.58	3.53
2	0.97	0.81	375	386	5.49	5.16
3	1.02	0.97	512	389	6.75	6.71

Note The maximum velocities are the approximate highest velocities at peak discharge.

Instrument specifications, calibration and quality assurance procedures are on file at NSW Public Works MHL. ADCP transect filenames for Sites 1, 2 and 3 are in Appendix A.

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1. Site Details

Myall River and Myall Lakes comprise the largest coastal lake system in NSW, and are located on the mid-north coast approximately 240 km north of Sydney. The Myall River has a catchment that covers an area of 1660 km^2, extending approximately 40 km to the west and 40 km north to south. The Myall Lakes comprise a series of three interconnected water bodies with a total waterway area of approximately 123 km^2. The area of mangroves is 2.83 km^2, saltmarsh 2.78 km^2 and seagrass 2.11 km^2. The lakes are fully contained within Myall Lakes National Park and the area is popular as a holiday location. The lakes form an excellent boating waterway and have been declared a recreational fishing haven. Location maps of the study area are shown in Figures 1.1 and 1.2.

As part of the OEH Estuary Management Program's work to provide an understanding of the hydraulic processes operating in Myall River estuary, NSW Public Works MHL undertook tidal flow measurements in the area in March 2014 and October 2015. Descriptions of the data collection sites are listed in Table 1.1 and MGA coordinates of the sites are listed in Table 1.2. On 31 March 2014 both current metering boats did transects at Site 3 with the different datasets referred to as Sites 3a and 3b. On 29 October 2015 there was only one current metering boat.

Table 1.1 Description of Data Collection Sites

Site No.	Site Name	Site Description
1	Corrie Creek Channel	ADCP transect across Corrie Creek Channel, 1.3 km upstream from Pindimar Bay
2	The Short Cut Channel	ADCP transect across the Short Cut Channel, 540 m upstream from Port Stephens
3a-b	Upper Myall River	ADCP transect across the main river, 110 m upstream from the confluence of Corrie Creek Channel and Short Cut Channel

Table 1.2 Location of Data Collection Sites

Site No.	Site Name	Site Location MGA 56	
		Easting	Northing
1	Corrie Creek Channel	420255	6384660
2	The Short Cut Channel	420310	6384350
3a-b	Upper Myall River	420470	6384350

The coordinates for Sites 1,2, 3a-b are the approximate left bank starting point (looking downstream) of the ADCP current metering line, taken at low tide.

On both days velocities were measured with a vessel-mounted ADCP bottom-tracking profiling current meter. The cross-sections at the sites were determined from the ADCP data on a transect close to high water, but bank slopes were not surveyed.

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LOCATION MAP OF THE STUDY AREA

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Figure 1.1

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DETAILED LOCATION MAP OF THE STUDY AREA

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Figure 1.2

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2. Water Level Data

Water levels were monitored by permanent automatic water level recorders (AWLR) deployed in Port Stephens and Tea Gardens. In April 2014 the Port Stephens AWLR was moved from Tomaree to Shoal Bay. Details of the instrumentation deployed are presented in Table 2.1.

Table 2.1 Details of Automatic Water Level Recorders Deployed

Site No.	Type of Instrument	Recording Rate (minutes)	Type of Deployment	Accuracy (cm)	Resolution (cm)
Port Stephens	PSU	15	Permanent	± 1.0	1.0
Tea Gardens	Druck	15	Temporary	± 1.0	0.10

Note 1 The accuracy and resolution stated are the manufacturer's specification. This accuracy may vary according to field conditions and this resolution may not be plotted if it does not represent the appropriate accuracy.
Note 2 Monitoring at all sites was in accordance with NSW Public Works MHL's QA work instructions.

Comparisons of the predicted and actual water levels in Port Stephens and in the Myall River at Tea Gardens for 31 March 2014 and 29 October 2015 are shown in Tables 2.2 and 2.3, respectively. Comparison plots of the water levels are shown in Figures 2.1 and 2.2.

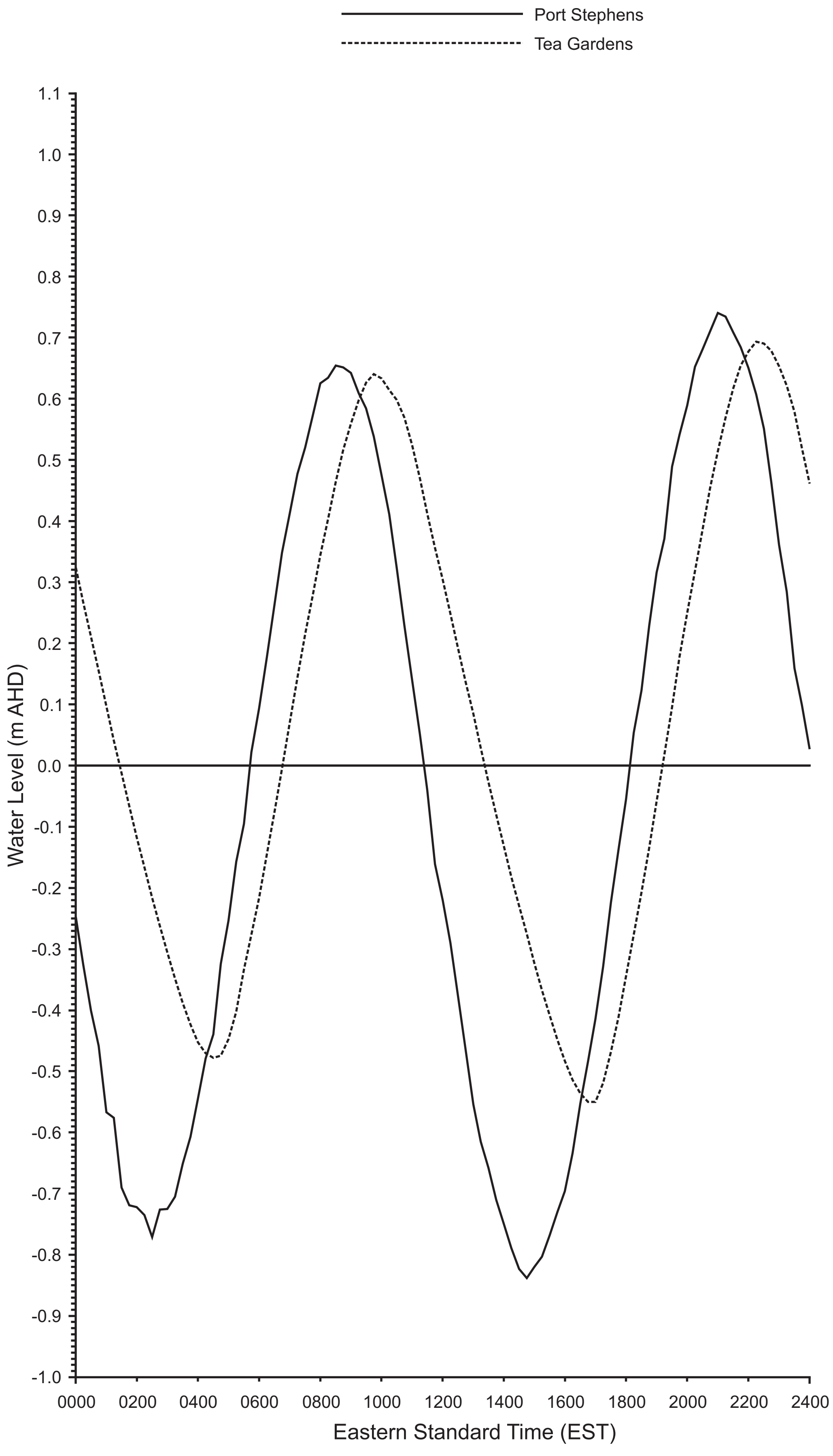
Table 2.2 Predicted/Actual Tide Levels - Port Stephens/Tea Gardens - 31 March 2014

Site	Tide Level	Predicted			Actual		
		Time (EST)	Height (m AHD)	Range (m)	Time (EST)	Height (m AHD)	Range (m)
Port Stephens	Low	0230	-0.731	-	0230	-0.771	-
	High	0845	0.735	1.466	0830	0.654	1.425
	Low	1445	-0.756	1.491	1445	-0.838	1.492
Tea Gardens	Low	0415	-0.457	-	0430	-0.478	-
	High	0945	0.677	1.134	0945	0.640	1.118
	Low	1630	-0.467	1.144	1645	-0.550	1.190

Table 2.3 Predicted/Actual Tide Levels - Port Stephens/Tea Gardens - 29 October 2015

Site	Tide Level	Predicted			Actual		
		Time (EST)	Height (m AHD)	Range (m)	Time (EST)	Height (m AHD)	Range (m)
Port Stephens	Low	0300	-0.802	-	0245	-0.777	-
	High	0930	0.936	1.738	0930	0.924	1.701
	Low	1545	-0.865	1.801	1615	-0.917	1.841
Tea Gardens	Low	0445	-0.463	-	0430	-0.570	-
	High	1030	0.930	1.393	1030	0.881	1.451
	Low	1730	-0.471	1.401	1730	-0.620	1.501

The predicted data for Port Stephens was based on actual data from the 1995 to 2014 epoch. The Tea Gardens predicted data was an astronomical forecast based on actual data recorded during the relevant financial years then created using Foreman Analysis.



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COMPARISON OF WATER LEVEL CURVES
31 MARCH 2014

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Figure 2.1

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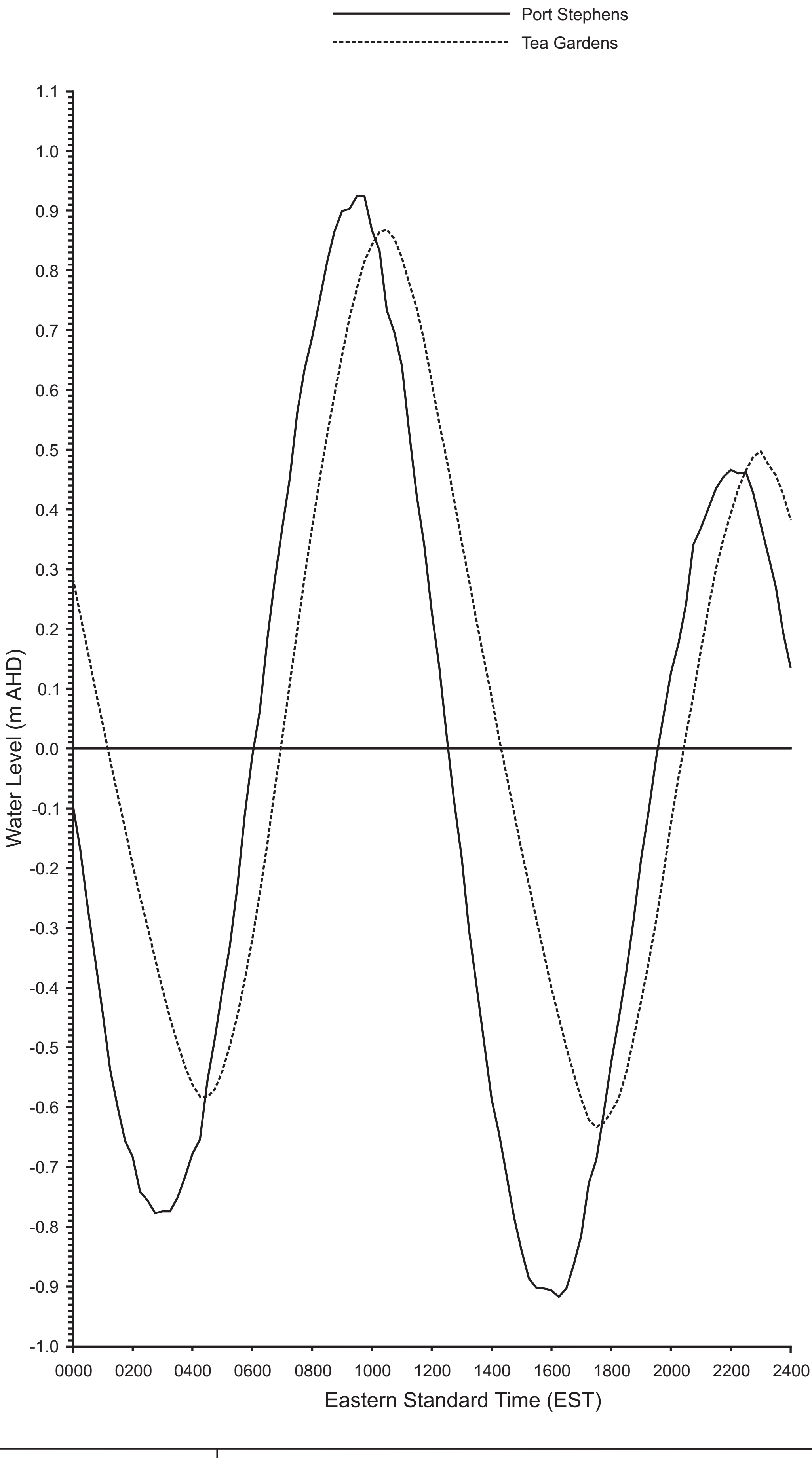

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COMPARISON OF WATER LEVEL CURVES
29 OCTOBER 2015

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Figure
2.2

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3. Velocity Data

On 31 March 2014 tidal velocity readings at the metering sites began before low water slack at approximately 0245 hours (EST) and continued until reversal of flow following the next low water at approximately 1725 hours (EST). On 29 October 2015 tidal velocity readings at the metering sites began before low water slack at approximately 0350 hours (EST) and continued until reversal of flow following the next low water at approximately 1935 hours (EST). This was done so that velocity measurements were taken over a complete flood and ebb cycle, enabling the total flood and ebb volumes to be calculated (see Section 4). The typical maximum velocities at peak discharge on the flood and ebb tide are shown in Tables 3.1 and 3.2. These are representative velocities, and actual velocities recorded at one particular point may have been slightly higher.

Table 3.1 Typical Maximum Velocities at Peak Discharge - 31 March 2014

Site No.	Flood				Ebb			
	Velocity (m/s)	Distance from Left Bank (m)	Depth (m)	Time (EST)	Velocity (m/s)	Distance from Left Bank (m)	Depth (m)	Time (EST)
1	0.96	45	1.31	0837	0.94	17	1.06	1224
2	0.51	135	3.31	0743	0.42	55	0.81	1035
3a	1.01	118	1.81	0828	0.75	28	0.81	1204
3b	1.09	136	1.31	0749	0.80	30	1.06	1200

Note The maximum velocities are the approximate highest velocities at peak discharge.
The ADCP readings do not include the surface shadow zone where actual velocities may be higher.

Table 3.2 Typical Maximum Velocities at Peak Discharge - 29 October 2015

Site No.	Flood				Ebb			
	Velocity (m/s)	Distance from Left Bank (m)	Depth (m)	Time (EST)	Velocity (m/s)	Distance from Left Bank (m)	Depth (m)	Time (EST)
1	0.81	65	1.31	0931	0.91	6	1.81	1437
2	0.97	76	1.31	0752	0.81	84	1.56	1208
3	1.02	70	2.56	0852	0.97	35	1.56	1234

Note The maximum velocities are the approximate highest velocities at peak discharge.
The ADCP readings do not include the surface shadow zone where actual velocities may be higher.

3.1 Acoustic Doppler Current Profiling

An RD Instruments Workhorse Acoustic Doppler Current Profiler (ADCP) which has bottom-tracking capability was used to measure tidal velocities (see Figure 3.1). The technique involving the vessel-mounted ADCP facilitates direct, real-time measurement of discharge in the time taken for the vessel to traverse the section, with little or no previous site survey. The method is described in detail in Gordon (1989) and Simpson and Oltman (1990).

The technique of acoustic Doppler profiling is now commonly used in the study of three-dimensional flow structures. The ADCP transmits bursts of sound at a known frequency into the water column. The sound is scattered by plankton-sized particles (reflectors) carried by the water currents and some is received back by the ADCP which listens for echoes. As echoes are received from deeper in the water column the ADCP assigns different water depths (depth cells) to corresponding parts of the echo record. This enables the ADCP to define vertical profiles. The motion of the reflectors relative to the ADCP causes the echo to change frequency by an amount which is proportional to their velocity. The ADCP measures this frequency change, the Doppler shift, and thus constructs vertical current profiles.

In the vessel-mounted configuration the ADCP measures current profiles continuously as the vessel traverses along a transect from one side of a channel to the other. The current profiles, which are initially measured relative to the ADCP, are converted to earth-referenced currents. This can be achieved because the ADCP also has the capability of measuring its own motion relative to the earth using the Doppler shift of echoes received from the bottom of the channel (bottom tracking). Bottom tracking also allows the ADCP to directly measure the distance travelled between individual current profiles along a given transect. The orientation of the transect is assumed to be at a right angle to the channel alignment, which enables the ADCP to calculate long-channel and cross-channel velocities. The long-channel velocity is used to calculate the discharge for each bin. The discharges for the bins are progressively summed as the vessel moves from one side of the channel to the other to give a total discharge through the cross-section.

All the transects started at the left bank (looking downstream). Details of the ADCP transects are shown in Tables C and D in the Data Summary and lists of the configuration, raw and ASCII filenames are shown in Appendix A.

3.2 Errors

Possible errors associated with measurements of water velocity arise from two sources: determining current speed and determining current direction. The standard deviation in current speed measured by an ADCP is ± 1.3 cm/s while the error in direction is ± 2°.

Site 1 - Looking downstream

Site 2 - Looking towards left bank

Site 3 - Looking towards left bank

Note Left and right bank is relative to an observer looking downstream

NSW GOVERNMENT **Public Works** Manly Hydraulics Laboratory	ADCP CURRENT PROFILING AT SITES 1, 2 AND 3 31 MARCH 2014	MHL Report 2415 Figure 3.1

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4. Discharge Data

The discharge at any time is calculated using the following equation:

$$Q(t) = \sum_{i=1}^{N} A_i(t).V_i(t)$$

where **Q(t)** is the discharge at time t, **N** is the number of metering areas in the cross-section, **A_i(t)** is the cross-sectional area of metering area i at time t, and **V_i(t)** is the depth-averaged velocity at metering area i at time t. A bottom tracking ADCP measures both velocity and area and calculates cumulative discharge as the vessel moves across the metering section.

The flood and ebb tidal prisms (tidal volumes) are shown in Tables 4.1 and 4.2.

Table 4.1 Tidal Prisms - 31 March 2014

Site No.	Site Name	Flood (m^3 x 10^6)	Ebb (m^3 x 10^6)
1	Corrie Creek Channel	3.33	3.59
2	The Short Cut Channel	1.40	0.99
3a	Upper Myall River A	4.19	4.27
3b	Upper Myall River B	4.07	3.98

Table 4.2 Tidal Prisms - 29 October 2015

Site No.	Site Name	Flood (m^3 x 10^6)	Ebb (m^3 x 10^6)
1	Corrie Creek Channel	2.58	3.53
2	The Short Cut Channel	5.49	5.16
3	Upper Myall River	6.75	6.71

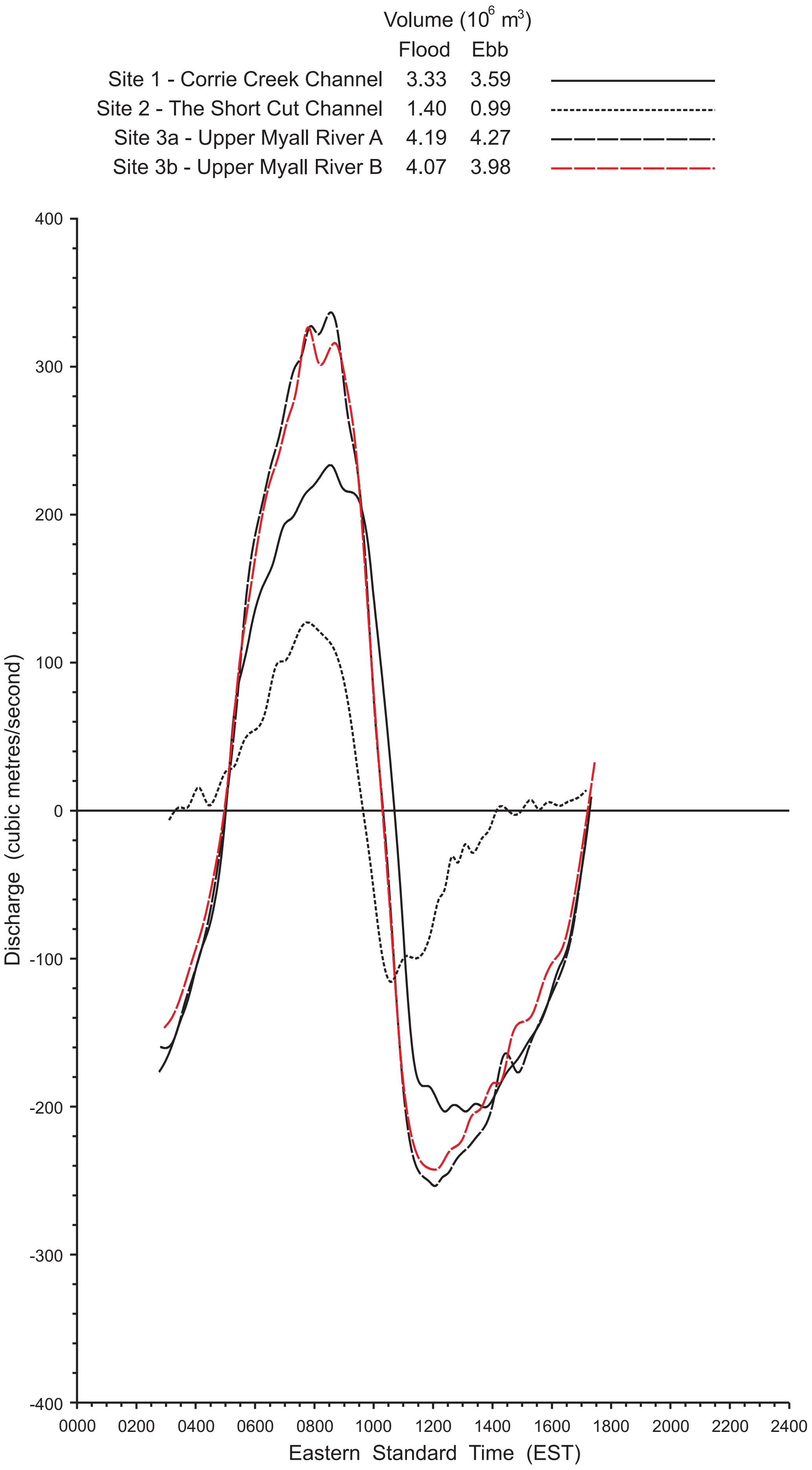
A comparison of discharges on 31 March 2014 is shown in Figure 4.1. A comparison of discharges on 29 October 2015 is shown in Figure 4.2.The total flood and ebb discharge volumes are calculated through integration of the discharge curve above and below the zero discharge line. This calculation assumes that the zero crossing of the discharge curve represents full reversal of the tide.

The tidal discharge is a function of channel cross-sectional area and tidal velocity, thus the possible errors in its calculation can be grouped according to these two variables. The use of an ADCP reduces the sources of errors in discharge calculations, as measurements of cross-sectional areas are taken simultaneously with the velocity measurements. However, there are some other aspects to be considered.

The ADCP's profiling range is limited at the top, bottom and sides of the channel which results in shadow zones where no data are available. The bottom part of the water column (usually 15% of the water depth) is contaminated by ‘side-lobe’ interference (RDI 1989) due to strong reflections from the channel bed. The top part of the water column is lost due to the immersion depth of the ADCP transducers, a blanking period to allow the transducer to stop ringing after transmission and the duration of the transmit pulse (RDI 1989). The sides of the channel are lost due to the limitations on how close to the banks the vessel can manoeuvre.

To estimate the discharge in the top and bottom zones a one-sixth power curve is fitted to the measured data. This curve is then used to extrapolate discharge values for the missing top and bottom layers (Simpson and Oltman 1990). Discharge at the sides of the channel can also be extrapolated using an empirical method described in Simpson and Oltman (1990). Pollard (1992) found that typically, of the total discharge, extrapolation in the top layer accounted for 15%, in the bottom layer for 14% and at the sides for 2%.

Therefore, the total error in discharge calculations when using ADCP data is considered to be in the order of ± 5%.



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COMPARISON OF DISCHARGES
SITES 1, 2 AND 3
31 MARCH 2014

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Figure 4.1

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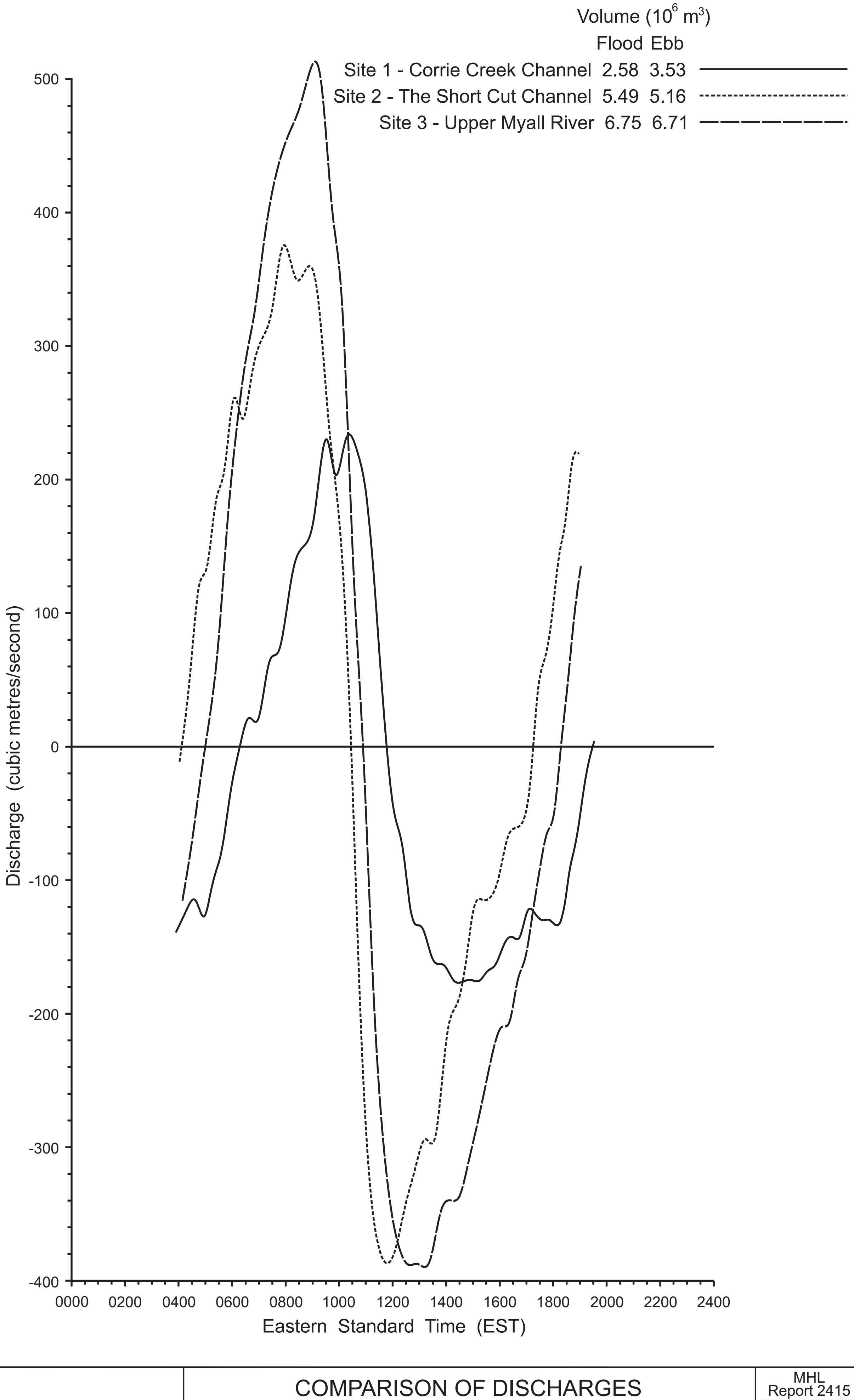

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COMPARISON OF DISCHARGES
SITES 1, 2 AND 3
29 OCTOBER 2015

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Figure 4.2

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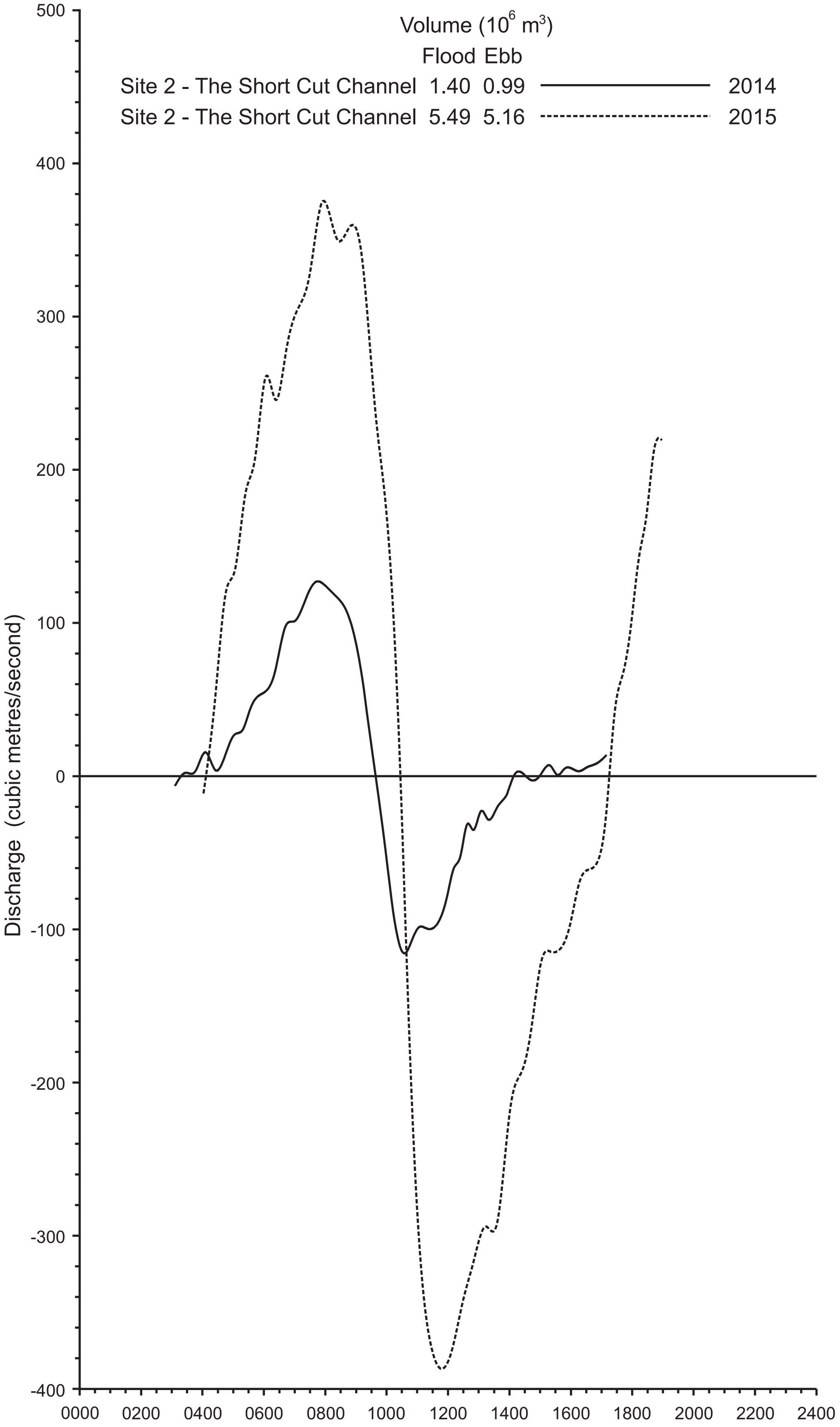

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COMPARISON OF DISCHARGES
SITE 2 - THE SHORT CUT CHANNEL
31 MARCH 2014 AND 29 OCTOBER 2015

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Figure 4.3

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5. Discussion

The aim of the 2014 and 2015 pre and post dredging tidal gaugings was to assist in quantifying the impact of the dredging that occurred during 2015. Table 5.1 shows the maximum velocities, peak flows and tidal prisms on the flood and ebb tides for the 2014 and 2015 gauging. The gauging dates were planned to correspond with similar tidal ranges (within the constraints of the project and available timeframes). It should be noted that at the time of the 2015 gauging the ocean tidal range was slightly greater than at the time of the 2014 gauging. However, the increase in peak flows and volumes following the dredging is still significantly larger than the increase the tidal range would provide.

Looking at the results of the 2014 and 2015 pre and post dredging tidal gaugings shown in Tables 5.1 and 5.2 it is clear that a larger volume of water is coming in and out the Short Cut Channel on the flood and ebb tides since the dredging took place. This is a direct result of the increase in channel depth and width in the Short Cut Channel and the resulting reduced resistance to flow due to the dredging. The volume of tidal water in the Short Cut Channel is approximately 3.9 times greater on the flood tide and approximately 5.2 times greater on the ebb tide post dredging.

While the maximum velocities for Site 1 and 3 remained similar for both the 2014 and 2015 gaugings, the maximum velocities for Site 2 (The Short Cut Channel) have doubled since the dredging has been completed.

Table 5.1 Summary of Velocity and Discharge Data - 2014 - 2015

Site	Max. Velocity (m/s)				Peak Flow (m^3/s)				Tidal Prisms ($10^6 \times m^3$)			
	Flood		Ebb		Flood		Ebb		Flood		Ebb	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Corrie Creek Channel	0.96	0.81	0.94	0.91	232	233	204	176	3.33	2.58	3.59	3.53
The Short Cut Channel	0.51	0.97	0.42	0.81	126	375	116	386	1.40	5.49	0.99	5.16
Upper Myall River	1.05	1.02	0.78	0.97	330	512	249	389	4.13	6.75	4.13	6.71

Note 2014 Port Stephens flood tidal range was 1.42m and ebb tidal range was 1.49m.
2015 Port Stephens flood tidal range was 1.70m and ebb tidal range was 1.84m.
2014 values for Site 3 are an average of Site 3a and 3b data.

Table 5.2 shows the ratio of tidal prism in the Short Cut Channel to Corrie Creek Channel in 2009, 2014 and 2015. Although the flow distribution is quite complex this shows a significant increase in the relative flow of the Short Cut Channel in 2015 as a result of the dredging. It is worth noting that the similar tidal gauging that took place in 2009 (MHL2009) showed the tidal prisms in Corrie Creek Channel and the Short Cut Channel were approximately equal.

Detailed hydrodynamic modelling was undertaken by BMT WBM (2014) to design an optimal channel configuration that would simulate the 2001 flow conditions. The 2001 entrance condition was used as the benchmark for assessment because it was considered to be most adequate by the community. Therefore, the adopted dredge channel design recreated the approximate location of the 2001 entrance channel by bisecting the existing Winda Woppa sand spit. As there was no tidal gauging carried out in 2001, the modelling results had to be used to compare 2001 flow conditions with the 2015 results.

Based on the 2001 hydrosurvey, the modelling estimated the flow split (tidal prism) between the Corrie Creek Channel and the Short Cut Channel to be a flow ratio of approximately 1:4 (Corrie:Short Cut). The 2015 tidal gauging measured a flow split ratio of 1:2.1 for the flood tide and 1:1.5 for the ebb tide (Corrie:Short Cut), well short of the 1:4 flow split ratio predicted by the modelling.

There are three possible reasons for this discrepancy. Firstly, it could be that the model did not accurately replicate the 2001 flow conditions. Secondly, using the flow split ratio of the two channels may not be an appropriate performance indicator. Or thirdly, the design dredge channel was not actually achieved. Most likely it will be some combination of all three.

Table 5.2 Ratio of Tidal Prism in the Corrie Creek Channel:Short Cut Channel

Year	Flood Tide	Ebb Tide
2009	1:0.9	1:0.9
2014	1:0.4	1:0.3
2015	1:2.1	1:1.5

An examination of the three discharge curves in Figure 4.2 shows the following tidal flow patterns. At 0400 hours (EST) the flood flow starts entering the Short Cut Channel. At 0500 hours (EST) all the flood flow coming in the Short Cut Channel is going back out Corrie Creek Channel with no flow entering the Upper Myall River. Then by 0600 hours (EST) all the flow coming in the Short Cut Channel is entering the Upper Myall River with Corrie Creek Channel at low water slack. At 1100 hours (EST) the water flooding in the Corrie Creek Channel is going straight out the Short Cut Channel and not entering the Myall River which is at high water slack. Then at 1700 hours (EST) the Short Cut Channel is at low water slack and the ebb tide flowing out of the Myall River is all going out through Corrie Creek Channel.

A comparison was also made of the time for each channel to reach peak flow after the previous tidal level change as shown in Table 5.3. This shows that for both the flood and ebb tide the Upper Myall River did not change significantly between 2014 and 2015. However, due to the increased capacity since dredging, the Short Cut Channel reached peak flow on both the flood and ebb tide significantly quicker in 2015 and Corrie Creek Channel was significantly slower, particularly on the ebb tide.

Table 5.3 Time to Peak Flow After Low/High Water (hours:minutes)

Site	Flood Tide		Ebb Tide	
	2014	2015	2014	2015
Corrie Creek Channel	6:00	7:45	2:00	4:45
The Short Cut Channel	5:00	3:15	4:30	1:30
Upper Myall River	6:00	6:15	3:30	3:15

Note Time of flood tide is time since low water and time of ebb tide is time since high water.

The impact of the dredging of the Short Cut Channel on the duration of the flood and ebb tides is shown in Tables 5.4 and 5.5. This data shows that the duration of the flood tide in all three channels has remained almost unchanged by the dredging. However, the duration of the ebb tide has increased in all channels: only slightly in the Upper Myall River, more significantly in Corrie Creek Channel and quite significantly in the Short Cut Channel.

There is little change in the time for the Myall River to reach peak flow as it is offset by the longer period for Corrie Creek to reach peak. Also the tidal signal and volume capacity in the Upper Myall River controls the amount of flow that can penetrate up the Myall River and its timing.

Table 5.4 Duration of Flood/Ebb Tide 2014 (hours:minutes)

Site	Flood Tide			Ebb Tide		
	Start	End	Duration	Start	End	Duration
Corrie Creek Channel	0445	1045	6:00	1045	1700	6:15
The Short Cut Channel	0300	0930	6:30	0930	1400	4:30
Upper Myall River	0445	1015	5:30	1015	1700	6:45

Table 5.5 Duration of Flood/Ebb Tide 2015 (hours:minutes)

Site	Flood Tide			Ebb Tide		
	Start	End	Duration	Start	End	Duration
Corrie Creek Channel	0615	1145	5:30	1145	1930	7:45
The Short Cut Channel	0400	1030	6:30	1030	1715	6:45
Upper Myall River	0500	1100	6:00	1100	1815	7:15

6. References

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Appendix A

ADCP Transect Filenames

Table A1 ADCP Filenames - Site 1 - 31 March 2014

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall1_	data_000	0101
2	myall1_	data_002	0102
3	myall1_	data_005	0103
4	myall1_	data_007	0104
5	myall1_	data_009	0105
6	myall1_	data_011	0106
7	myall1_	data_013	0107
8	myall1_	data_015	0108
9	myall1_	data_017	0109
10	myall1_	data_019	0110
11	myall1_	data_021	0111
12	myall1_	data_023	0112
13	myall1_	data_025	0113
14	myall1_	data_027	0114
15	myall1_	data_030	0115
16	myall1_	data_032	0116
17	myall1_	data_034	0117
18	myall1_	data_036	0118
19	myall1_	data_038	0119
20	myall1_	data_040	0120
21	myall1_	data_042	0121
22	myall1_	data_044	0122
23	myall1_	data_046	0123
24	myall1_	data_049	0124
25	myall1_	data_052	0125
26	myall1_	data_054	0126
27	myall1_	data_056	0127
28	myall1_	data_058	0128
29	myall1_	data_060	0129
30	myall1_	data_062	0130
31	myall1_	data_064	0131
32	myall1_	data_066	0132
33	myall1_	data_068	0133
34	myall1_	data_070	0134
35	myall1_	data_072	0135
36	myall1_	data_074	0136
37	myall1_	data_076	0137
38	myall1_	data_078	0138
39	myall1_	data_080	0139
40	myall1_	data_082	0140
41	myall1_	data_084	0141
42	myall1_	data_086	0142
43	myall1_	data_088	0143
44	myall1_	data_091	0144
45	myall1_	data_092	0145

Table A2 ADCP Filenames - Site 2 - 31 March 2014

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall1_	data_001	0201
2	myall1_	data_003	0202
3	myall1_	data_005	0203
4	myall1_	data_007	0204
5	myall1_	data_009	0205
6	myall1_	data_011	0206
7	myall1_	data_013	0207
8	myall1_	data_015	0208
9	myall1_	data_017	0209
10	myall1_	data_019	0210
11	myall1_	data_021	0211
12	myall1_	data_023	0212
13	myall1_	data_025	0213
14	myall1_	data_027	0214
15	myall1_	data_029	0215
16	myall1_	data_031	0216
17	myall1_	data_033	0217
18	myall1_	data_035	0218
19	myall1_	data_037	0219
20	myall1_	data_039	0220
21	myall1_	data_041	0221
22	myall1_	data_043	0222
23	myall1_	data_045	0223
24	myall1_	data_047	0224
25	myall1_	data_049	0225
26	myall1_	data_051	0226
27	myall1_	data_053	0227
28	myall1_	data_055	0228
29	myall1_	data_057	0229
30	myall1_	data_059	0230
31	myall1_	data_061	0231
32	myall1_	data_063	0232
33	myall1_	data_065	0233
34	myall1_	data_067	0234
35	myall1_	data_069	0235
36	myall1_	data_071	0236
37	myall1_	data_073	0237
38	myall1_	data_075	0238
39	myall1_	data_077	0239
40	myall1_	data_079	0240
41	myall1_	data_081	0241
42	myall1_	data_083	0242
43	myall1_	data_085	0243
44	myall1_	data_087	0244
45	myall1_	data_090	0245
46	myall1_	data_092	0246

Table A3 ADCP Filenames - Site 3a - 31 March 2014

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall1_	data_000	03a01
2	myall1_	data_002	03a02
3	myall1_	data_004	03a03
4	myall1_	data_006	03a04
5	myall1_	data_008	03a05
6	myall1_	data_010	03a06
7	myall1_	data_012	03a07
8	myall1_	data_014	03a08
9	myall1_	data_016	03a09
10	myall1_	data_018	03a10
11	myall1_	data_020	03a11
12	myall1_	data_022	03a12
13	myall1_	data_024	03a13
14	myall1_	data_026	03a14
15	myall1_	data_028	03a15
16	myall1_	data_030	03a16
17	myall1_	data_032	03a17
18	myall1_	data_034	03a18
19	myall1_	data_036	03a19
20	myall1_	data_038	03a20
21	myall1_	data_040	03a21
22	myall1_	data_042	03a22
23	myall1_	data_044	03a23
24	myall1_	data_046	03a24
25	myall1_	data_048	03a25
26	myall1_	data_050	03a26
27	myall1_	data_052	03a27
28	myall1_	data_054	03a28
29	myall1_	data_056	03a29
30	myall1_	data_058	03a30
31	myall1_	data_060	03a31
32	myall1_	data_062	03a32
33	myall1_	data_064	03a33
34	myall1_	data_066	03a34
35	myall1_	data_068	03a35
36	myall1_	data_070	03a36
37	myall1_	data_072	03a37
38	myall1_	data_074	03a38
39	myall1_	data_076	03a39
40	myall1_	data_078	03a40
41	myall1_	data_080	03a41
42	myall1_	data_082	03a42
43	myall1_	data_084	03a43
44	myall1_	data_086	03a44
45	myall1_	data_089	03a45
46	myall1_	data_091	03a46
47	myall1_	data_093	03a47

Table A4 ADCP Filenames - Site 3b - 31 March 2014

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall1_	data_001	03b01
2	myall1_	data_003	03b02
3	myall1_	data_006	03b03
4	myall1_	data_008	03b04
5	myall1_	data_010	03b05
6	myall1_	data_012	03b06
7	myall1_	data_014	03b07
8	myall1_	data_016	03b08
9	myall1_	data_018	03b09
10	myall1_	data_020	03b10
11	myall1_	data_022	03b11
12	myall1_	data_024	03b12
13	myall1_	data_026	03b13
14	myall1_	data_028	03b14
15	myall1_	data_031	03b15
16	myall1_	data_033	03b16
17	myall1_	data_035	03b17
18	myall1_	data_037	03b18
19	myall1_	data_039	03b19
20	myall1_	data_041	03b20
21	myall1_	data_043	03b21
22	myall1_	data_045	03b22
23	myall1_	data_048	03b23
24	myall1_	data_051	03b24
25	myall1_	data_053	03b25
26	myall1_	data_055	03b26
27	myall1_	data_057	03b27
28	myall1_	data_059	03b28
29	myall1_	data_061	03b29
30	myall1_	data_063	03b30
31	myall1_	data_065	03b31
32	myall1_	data_067	03b32
33	myall1_	data_069	03b33
34	myall1_	data_071	03b34
35	myall1_	data_073	03b35
36	myall1_	data_075	03b36
37	myall1_	data_077	03b37
38	myall1_	data_079	03b38
39	myall1_	data_081	03b39
40	myall1_	data_083	03b40
41	myall1_	data_085	03b41
42	myall1_	data_087	03b42
43	myall1_	data_089	03b43
44	myall1_	data_093	03b44

Table A5 ADCP Filenames - Site 1 - 29 October 2015

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall2_	myall_2000	0101
2	myall2_	myall_2003	0102
3	myall2_	myall_2006	0103
4	myall2_	myall_2009	0104
5	myall2_	myall_2012	0105
6	myall2_	myall_2015	0106
7	myall2_	myall_2018	0107
8	myall2_	myall_2021	0108
9	myall2_	myall_2024	0109
10	myall2_	myall_2027	0110
11	myall2_	myall_2030	0111
12	myall2_	myall_2033	0112
13	myall2_	myall_2036	0113
14	myall2_	myall_2039	0114
15	myall2_	myall_2044	0115
16	myall2_	myall_2047	0116
17	myall2_	myall_2050	0117
18	myall2_	myall_2053	0118
19	myall2_	myall_2056	0119
20	myall2_	myall_2059	0120
21	myall2_	myall_2062	0121
22	myall2_	myall_2065	0122
23	myall2_	myall_2068	0123
24	myall2_	myall_2071	0124
25	myall2_	myall_2074	0125
26	myall2_	myall_2077	0126
27	myall2_	myall_2080	0127
28	myall2_	myall_2083	0128
29	myall2_	myall_2086	0129
30	myall2_	myall_2089	0130
31	myall2_	myall_2092	0131
32	myall2_	myall_2095	0132
33	myall2_	myall_2098	0133
34	myall2_	myall_2103	0134
35	myall2_	myall_2106	0135
36	myall2_	myall_2109	0136
37	myall2_	myall_2112	0137
38	myall2_	myall_2115	0138
39	myall2_	myall_2118	0139
40	myall2_	myall_2121	0140
41	myall2_	myall_2129	0141
42	myall2_	myall_2132	0142
43	myall2_	myall_2135	0143
44	myall2_	myall_2138	0144
45	myall2_	myall_2139	0145

Table A6 ADCP Filenames - Site 2 - 29 October 2015

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall2_	myall_2001	0201
2	myall2_	myall_2004	0202
3	myall2_	myall_2007	0203
4	myall2_	myall_2010	0204
5	myall2_	myall_2013	0205
6	myall2_	myall_2016	0206
7	myall2_	myall_2019	0207
8	myall2_	myall_2022	0208
9	myall2_	myall_2025	0209
10	myall2_	myall_2028	0210
11	myall2_	myall_2031	0211
12	myall2_	myall_2034	0212
13	myall2_	myall_2037	0213
14	myall2_	myall_2040	0214
15	myall2_	myall_2045	0215
16	myall2_	myall_2048	0216
17	myall2_	myall_2051	0217
18	myall2_	myall_2054	0218
19	myall2_	myall_2057	0219
20	myall2_	myall_2060	0220
21	myall2_	myall_2063	0221
22	myall2_	myall_2066	0222
23	myall2_	myall_2069	0223
24	myall2_	myall_2072	0224
25	myall2_	myall_2075	0225
26	myall2_	myall_2078	0226
27	myall2_	myall_2081	0227
28	myall2_	myall_2084	0228
29	myall2_	myall_2087	0229
30	myall2_	myall_2090	0230
31	myall2_	myall_2093	0231
32	myall2_	myall_2096	0232
33	myall2_	myall_2099	0233
34	myall2_	myall_2104	0234
35	myall2_	myall_2107	0235
36	myall2_	myall_2110	0236
37	myall2_	myall_2113	0237
38	myall2_	myall_2116	0238
39	myall2_	myall_2119	0239
40	myall2_	myall_2124	0240
41	myall2_	myall_2127	0241
42	myall2_	myall_2130	0242
43	myall2_	myall_2133	0243
44	myall2_	myall_2136	0244

Table A7 ADCP Filenames - Site 3 - 29 October 2015

Transect Number	Configuration Filename (*.WRC)	Raw Data Filename (*R.000)	ASCII Filename (*T.000)
1	myall2_	myall_2002	0301
2	myall2_	myall_2005	0302
3	myall2_	myall_2008	0303
4	myall2_	myall_2011	0304
5	myall2_	myall_2014	0305
6	myall2_	myall_2017	0306
7	myall2_	myall_2020	0307
8	myall2_	myall_2023	0308
9	myall2_	myall_2026	0309
10	myall2_	myall_2029	0310
11	myall2_	myall_2032	0311
12	myall2_	myall_2035	0312
13	myall2_	myall_2038	0313
14	myall2_	myall_2041	0314
15	myall2_	myall_2046	0315
16	myall2_	myall_2049	0316
17	myall2_	myall_2052	0317
18	myall2_	myall_2055	0318
19	myall2_	myall_2058	0319
20	myall2_	myall_2061	0320
21	myall2_	myall_2064	0321
22	myall2_	myall_2067	0322
23	myall2_	myall_2070	0323
24	myall2_	myall_2073	0324
25	myall2_	myall_2076	0325
26	myall2_	myall_2079	0326
27	myall2_	myall_2082	0327
28	myall2_	myall_2085	0328
29	myall2_	myall_2088	0329
30	myall2_	myall_2091	0330
31	myall2_	myall_2094	0331
32	myall2_	myall_2097	0332
33	myall2_	myall_2100	0333
34	myall2_	myall_2105	0334
35	myall2_	myall_2108	0335
36	myall2_	myall_2111	0336
37	myall2_	myall_2114	0337
38	myall2_	myall_2117	0338
39	myall2_	myall_2120	0339
40	myall2_	myall_2125	0340
41	myall2_	myall_2128	0341
42	myall2_	myall_2131	0342
43	myall2_	myall_2134	0343
44	myall2_	myall_2137	0344