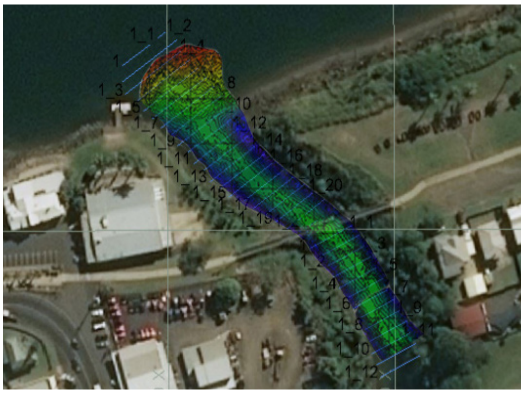
Application Note
March, 2019

Establishment of a Hydrographic Monitoring Site in Australia

A COMPLETE WATER SOLUTION BY XYLEM

I. Introduction

Xylem Water Solutions were appointed by Local Government in Bundaberg to establish hydrographic monitoring site in Bundaberg Creek, just upstream of the confluence with the Burnett River. The monitoring objectives at the hydrographic monitoring site consisted of surface water level and flow measurement in real-time available through cloud based hydrological information management system (HIMS). Part of the initial site establishment consisted of performing detailed bathymetric survey of the Bundaberg Creek from upstream the Quay St Footbridge up to the confluence of the Burnett River for hydraulic analysis of the channel.



II. Establish Hydrographic Monitoring Site

The monitoring objectives consisted of number of measurement components and it was essential that all hydrographic facets were well defined and integrated. The implementation process of the measurement components were systematic during the initial deployment phase to ensure accurate and reliable data record.

A. Survey Marker

One of the key requirements of a new monitoring site is the establishment of a survey marker to reference all reduce levels associated with measurement components. With the current GPS technology that are available for survey grade applications it is essential that the Latitude, Longitude and Elevation in AHD is determined at a minimum.

The coordinates and elevation of the survey marker was determined using Hemisphere S321 GNSS Smart Antenna shown in Figure 1 and Static Survey technique. Raw GPS data was collected over a period of 2 hours. The raw data was converted to RINEX format and uploaded to AUSPOS, service provided by Geoscience Australia. The processing report supplied by AUSPOS provided Latitude and Longitude in GDA94 and Elevation in AHD of the survey marker.

Fig. 1. Hemisphere S321

B. Stage Measurement

Stage measurement is a critical measurement component to any hydrographic monitoring site and it is essential that this is referenced to either a local or geodetic datum. Stage or water level measurements at the monitoring site was accomplished by using the [SonTek SL1500-3G Acoustic Doppler Velocity Meter.]

Fig. 2. SonTek SL1500-3G

The SL500-3G shown in Figure 2 primary stage measurement is performed using the vertical beam. The instrument also has a non vented pressure sensor that is used as a secondary stage measurement in the event the vertical is affected by vegetation.

The SL1500-3G was installed on the right bank of the Bundaberg Creek, upstream of the walk bridge.

Special designed sliding rail with mount was mounted on the right bank shown in Figure 3 for the SL1500-3G. The sliding rail allows the operator to set the instrument elevation to the optimum measurement position for Index Velocity application based on the measurement site conditions and hydraulic properties of the channel.

The sliding rail also provides the operator access to the instrument when routine maintenance is required on the instrument. A locking mechanism was incorporated on the sliding rail to ensure that the instrument is returned to the same elevation after maintenance is completed. This will ensure that Index Velocity model developed for the monitoring site is not affected by change in instrument elevation.

The tide and stage measurements during the initial deployment phase of the monitoring site at Bundaberg Creek is depicted in Figure 4.

Tide levels were requested of Bundaberg Port tide station from Department Environment, Land and Water in Queensland. The tide levels were supplied in Lowest Astronomical Tide datum. An offset was applied to the SonTek SL1500-3G stage measurements to output the stage in AHD level.

C. Index Velocity Measurement

The SL1500-3G was installed relative low to traditional installations for Index velocity application. It is recommended that the instrument elevation should be in the vicinity of the mean channel velocity for best results.

The monitoring objectives required the measurement of full range of flow during tidal changes. The development of the Index Velocity rating is still ongoing and further discharge measurements need to be performed to refine the model.

D. Real-Time Telemetry

The real-time telemetry component was the final stage of the deployment phase and consisted of Campbell CR300 data logger, modem, power supply and wiring from SL1500-3G instrument shown in Figure 6.

Fig. 3. Sliding Rail and Mount

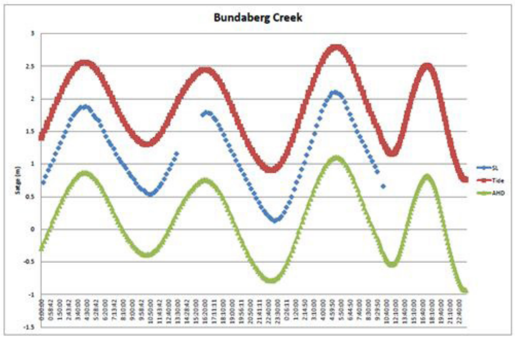


Fig. 4. Stage Measurements

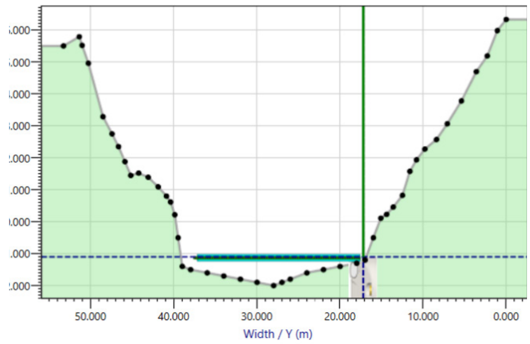


Fig. 5. SonTek SL1500-3G Index Velocity

Fig. 6. Telemetry Instrumentation

The SL1500-3G data is transmitted to the Campbell CR300 data logger through SDI12. The sampling interval of the data logger and SL1500-3G was set to 15 minutes and an averaging interval of 12 minutes.

The data is transmitted via GSM modem to eagle.io, cloud based hydrological information management system.

Power supply consisted of 20W solar panel, 38ah battery and regulator.

The telemetry instrumentation is housed in a stainless steel instrument box mounted on a 3.4m mast shown in Figure 7. Access to the instrument box is only achievable via external ladder for security reasons.

Fig. 7. Instrumentation Shelter

III. Detailed Bathymetry Survey

Detailed bathymetric survey of the Bundaberg Creek from upstream the Quay St Footbridge up to the confluence of the Burnett River was required for hydraulic analysis of the channel.

A. Survey Control

The Horizontal and Vertical survey control for the bathymetry survey was based on Network RTK. A single survey marker was established on the right bank to verify the Network RTK accuracy shown in Figure 8.

Fig. 8. Location of Survey Marker

The calculated coordinates of survey marker is based on GRS80 Ellipsoid, GDA 94 summarized in Table 1.

Table 1: Calculated Coordinates Survey Markers

Survey Marker	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height (m)	Derived AHD (m)
BUN	-24 51 45.09234	152 21 26.99802	55.009	7.307

B. Bathymetry Survey

rQPOD remote control platform shown in Figure 9 was used with HydroSurveyor, Hemisphere S321 and Hypack to perform the bathymetry survey.

The autonomous feature greatly enhanced the survey efficiency at Bundaberg especially due to the narrow line spacing that was used.

Figure 9: rQPOD Platform

The bathymetry survey area was defined by a boundary based on actual measurements performed. A line plan was developed based on the boundary and survey requirements shown in Figure 10.

The line plan was designed such that the individual lines were perpendicular to the channel direction. The spacing of the individual lines was calculated to ensure maximum coverage during the bathymetry survey of the survey area.

Figure 10: Line Plan of Survey Area

The tide data received from the Bundaberg tide station and the stage measurements from the SL1500-3G in conjunction with the survey marker AHD level was critical for applying tide correction shown in Figure 11 to the changing water elevation during the bathymetry survey.

This was even more pertinent due to the fact that the survey was performed over two days, resulting in large changes in water elevation due to tidal influence.

C. Survey Results

A 3D Contour model shown in Figure 12 was generated in Hypack based on the TIN model. The contour model can be used to development of longitudinal and cross sectional profiles, etc.

IV. Conclusion

The product line that is supported by Xylem gives the user a wide range application and this was evident form the Bundaberg project. The integration of the different hardware and software solutions from the Hemisphere products to the cloud based hydrological information management system highlights the complete water solution that is provided by Xylem Water Solutions Australia.

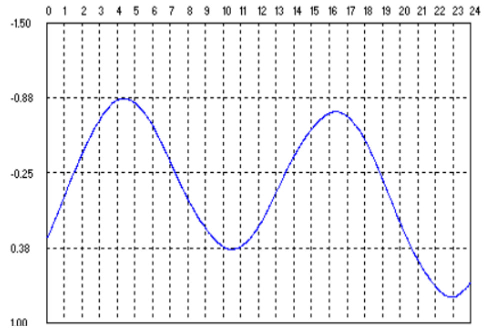


Figure 11: Tide Correction

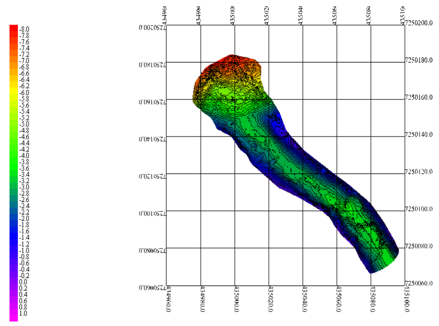


Figure 12: 3D Contour Model

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