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Experience With Radar Sensor Equipped Tide Gauges in Queensland

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Outline

- **What is a tidal station**
- **The equipment presently deployed**
- **Radar sensors are sensitive to wave action**
- **Calibrations**
- **Some general comments**
- **Any questions**

There are REALLY BIG ships out there

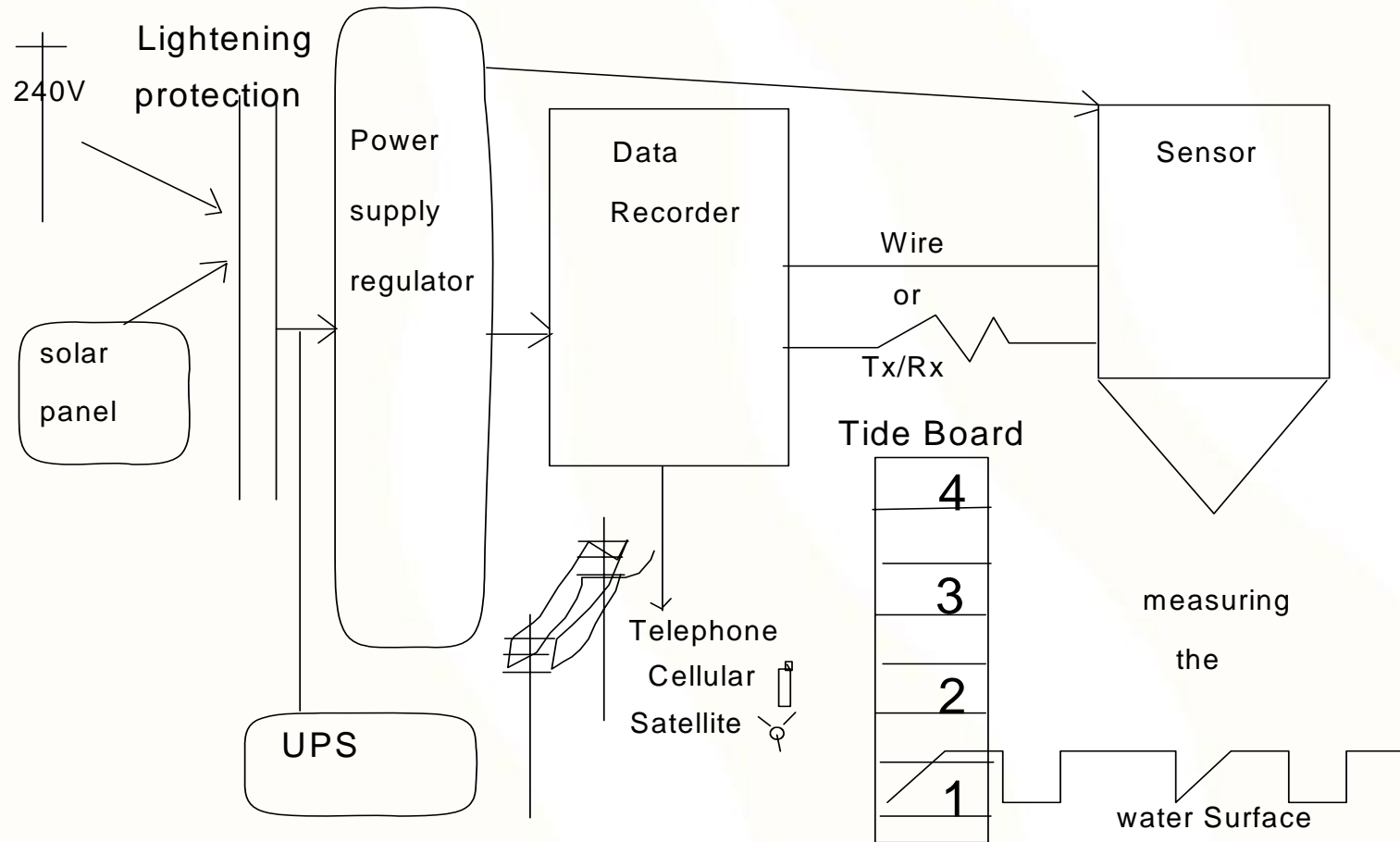


And we do want to be doing this for real

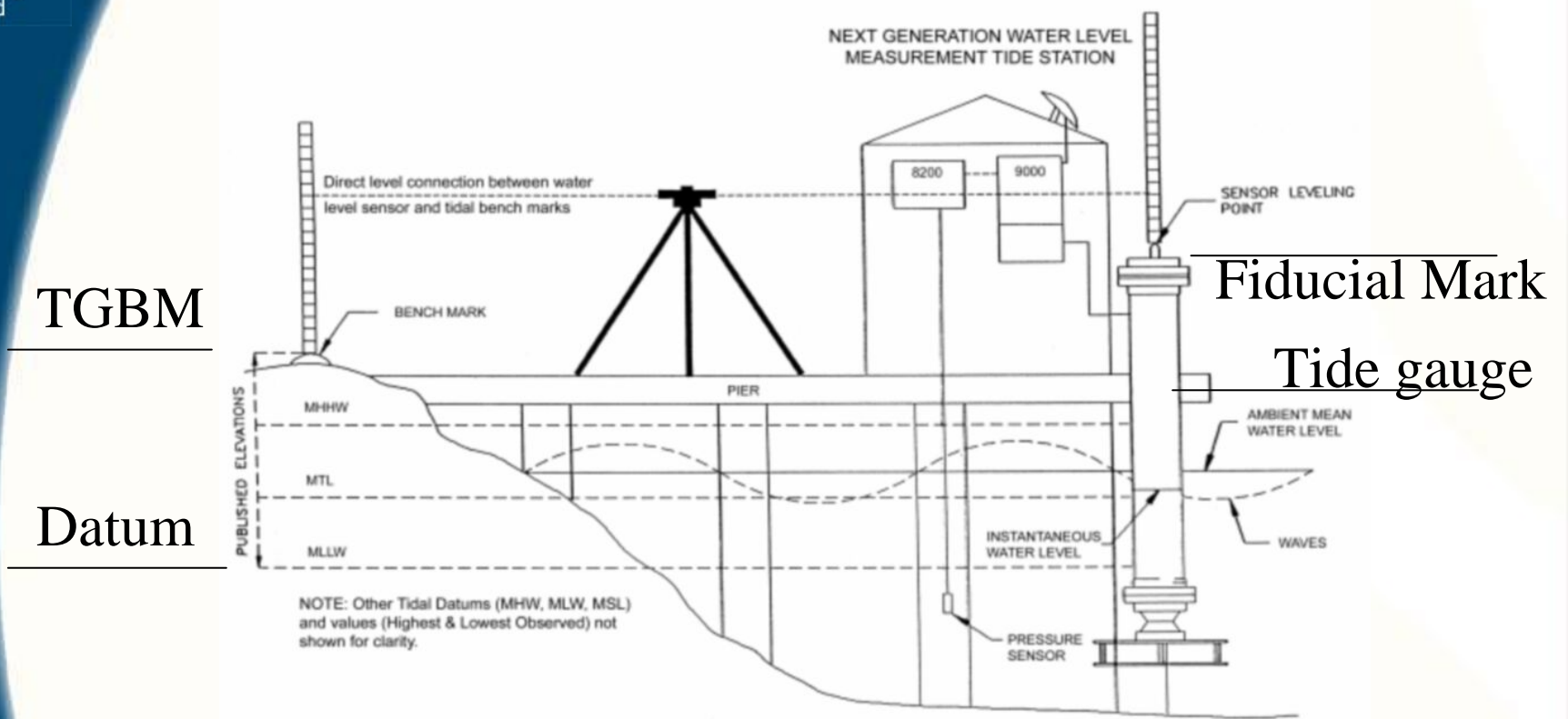
Simulated Oil Recovery



Tidal Station Components



Tidal Station Height Reference

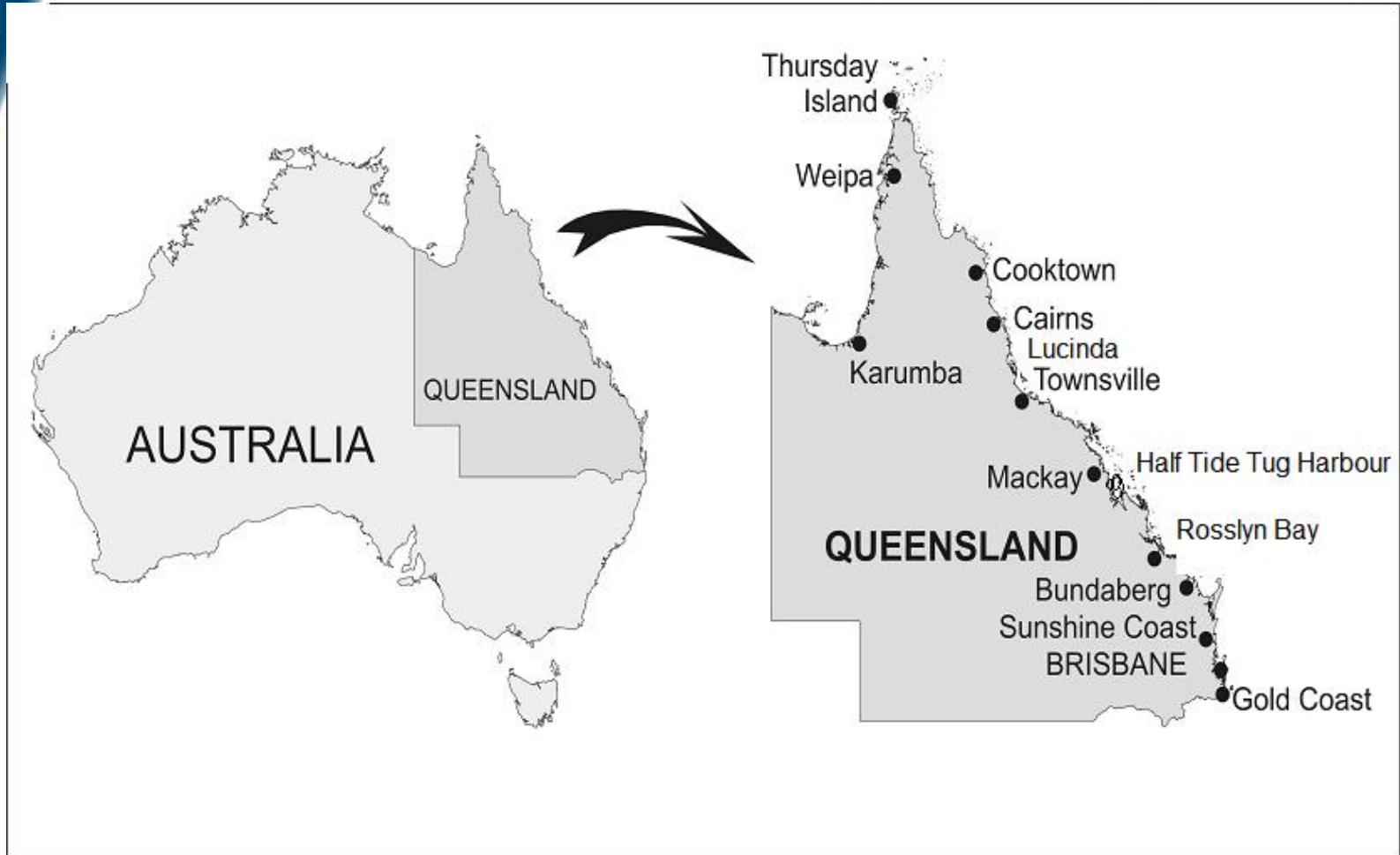


Tidal heights are measured relative to a datum level which is a fixed distance below the Tide Gauge Bench Mark



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The Equipment Presently Deployed



**Typical Radar Sensor Mounting
Environmental Protection
Agency**



**Lucinda Storm Tide Station
Environmental Protection
Agency**



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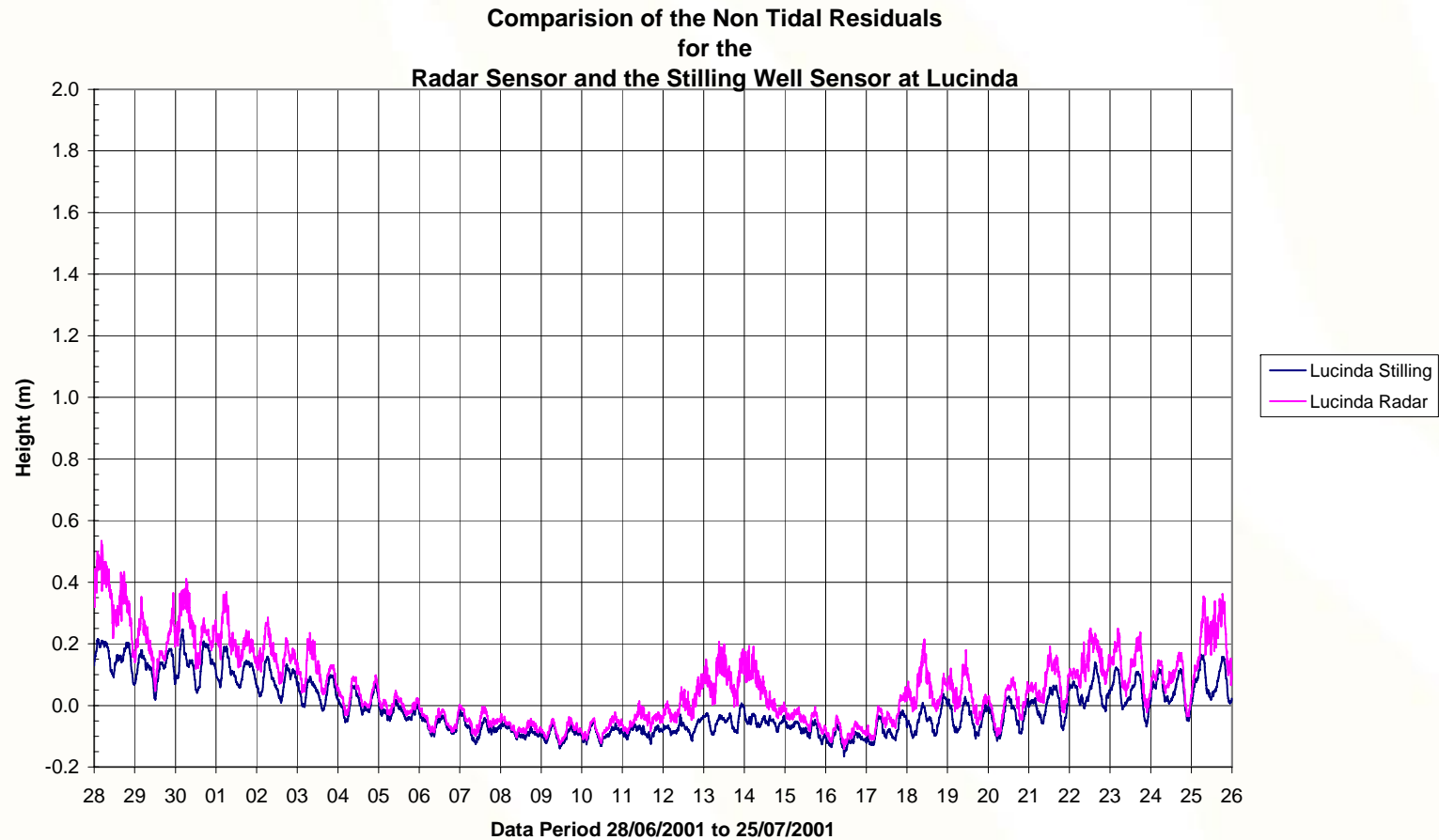
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Half Tide Tug Harbour



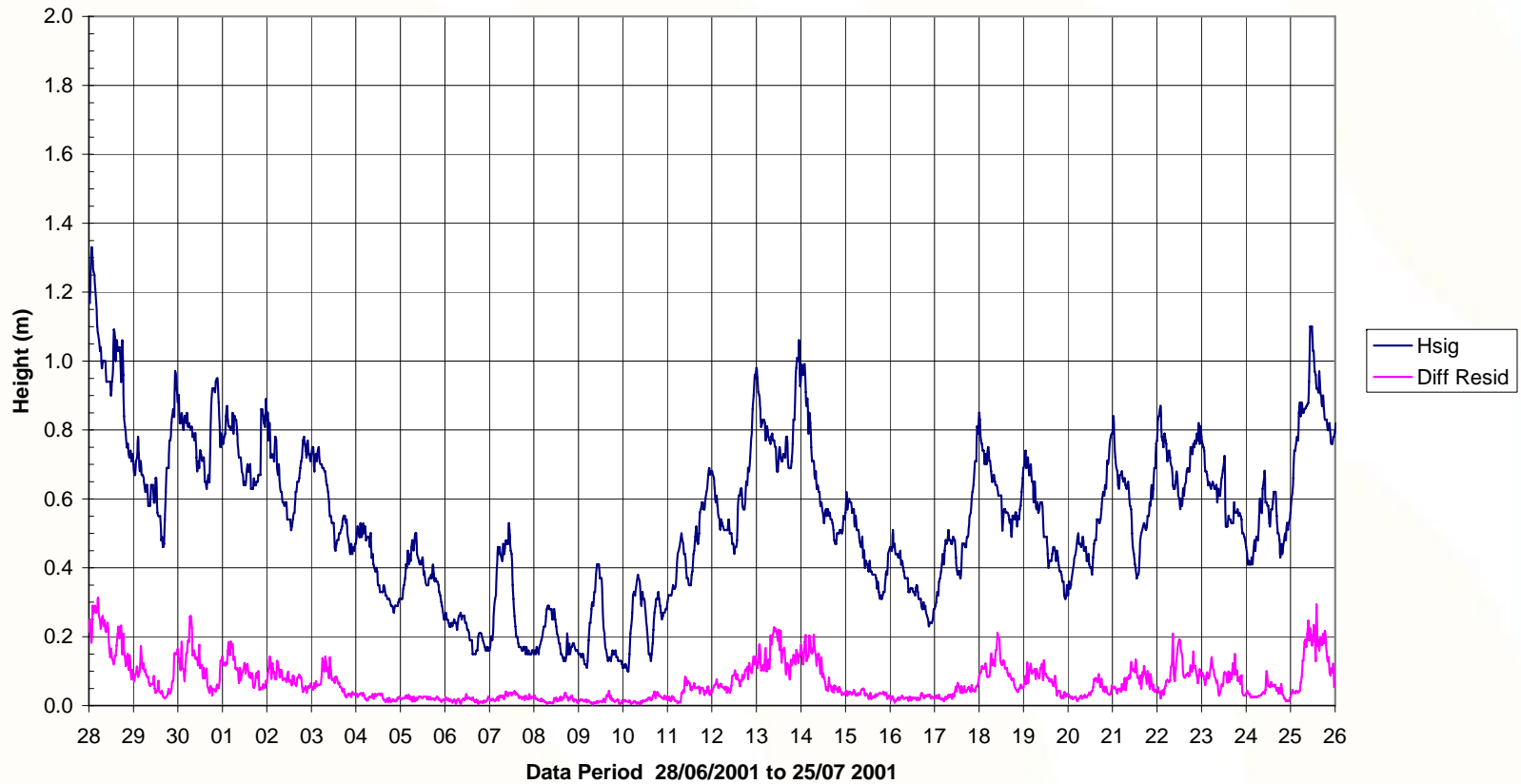
Rosslyn Bay SEAFRAME Station National Tidal Centre

Comparison of the Non Tidal Residuals for the Radar Sensor and Stilling Well System at the Lucinda Station



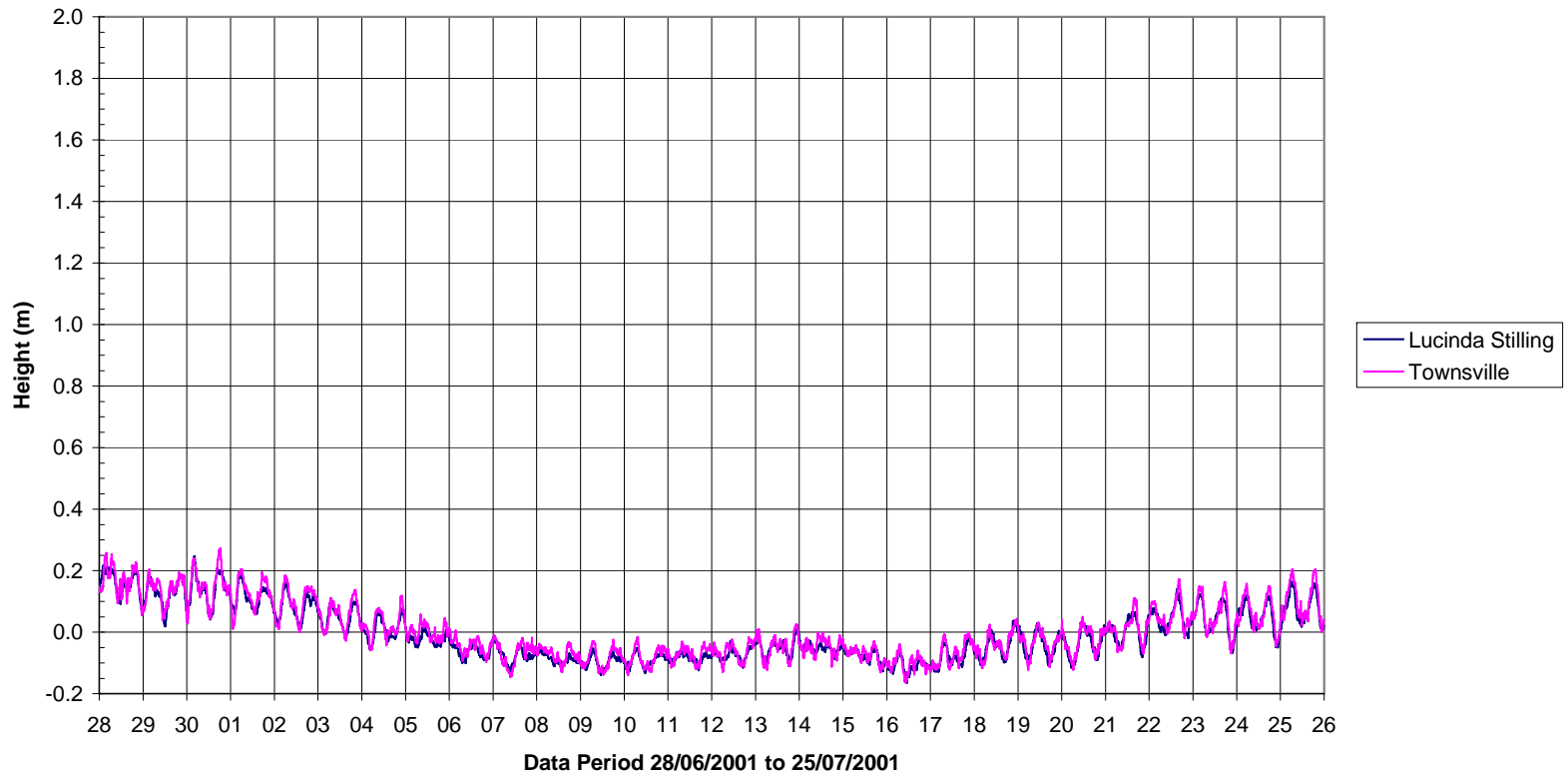
Wave Heights vs Difference in Non Tidal Residuals for the Radar Sensor and Stilling Well System at the Lucinda Station

Wave Height vs Difference in Non Tidal Residuals for the Radar Sensor Readings and the Stilling Well Readings at Lucinda



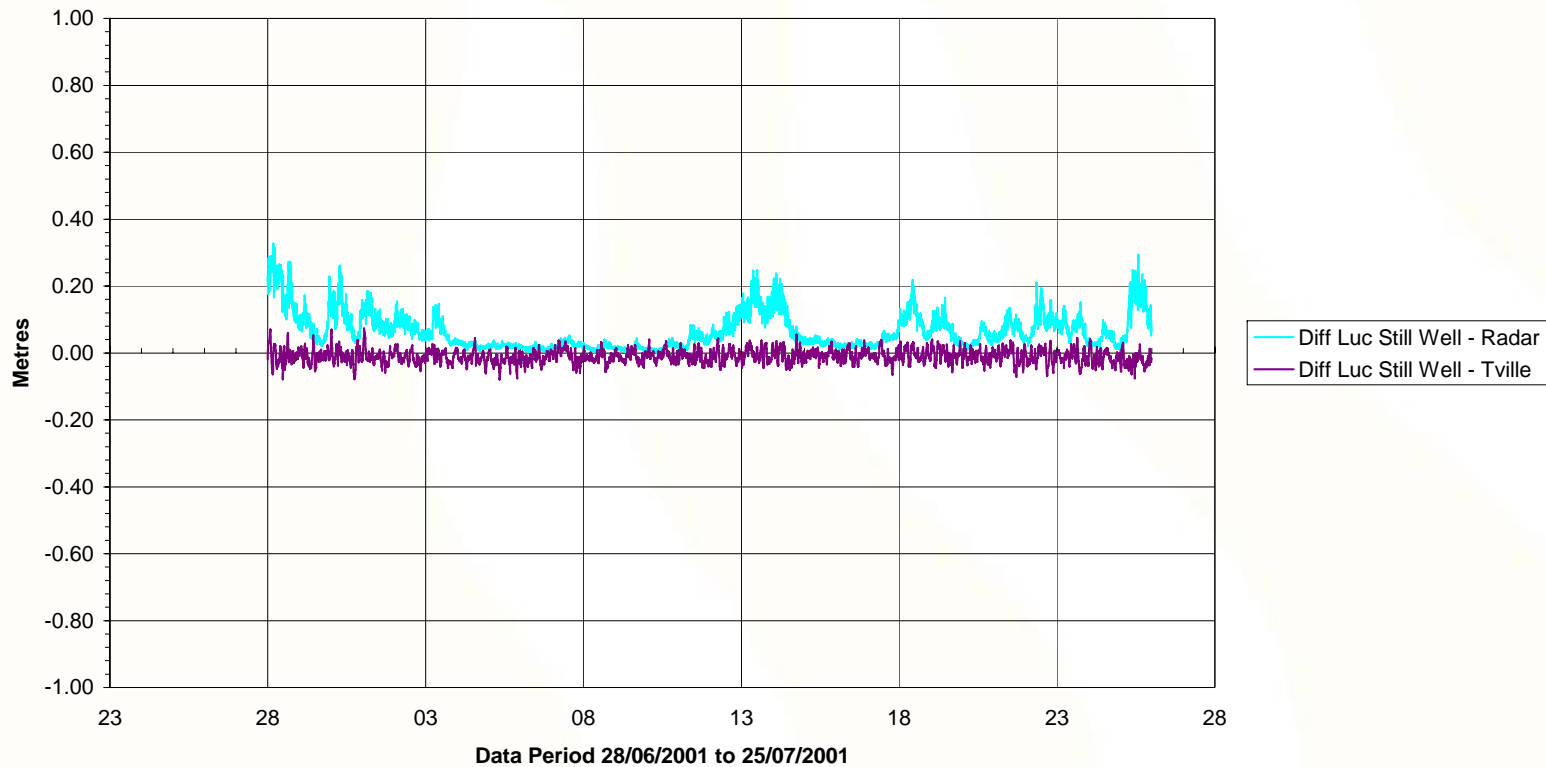
Comparison of the Non Tidal Residuals for the Lucinda Station and Townsville Tidal Stations

Comparison of the Non Tidal Residuals
for the
Lucinda Stilling Readings and the Townsville Readings



Difference in the Non Tidal Residuals Lucinda Stilling Well v Lucinda Radar Lucinda Stilling Well v Townsville

Difference between the Non Tidal Residuals
1 Lucinda Stilling Well minus Lucinda Radar
2 Lucinda Stilling Well minus Townsville



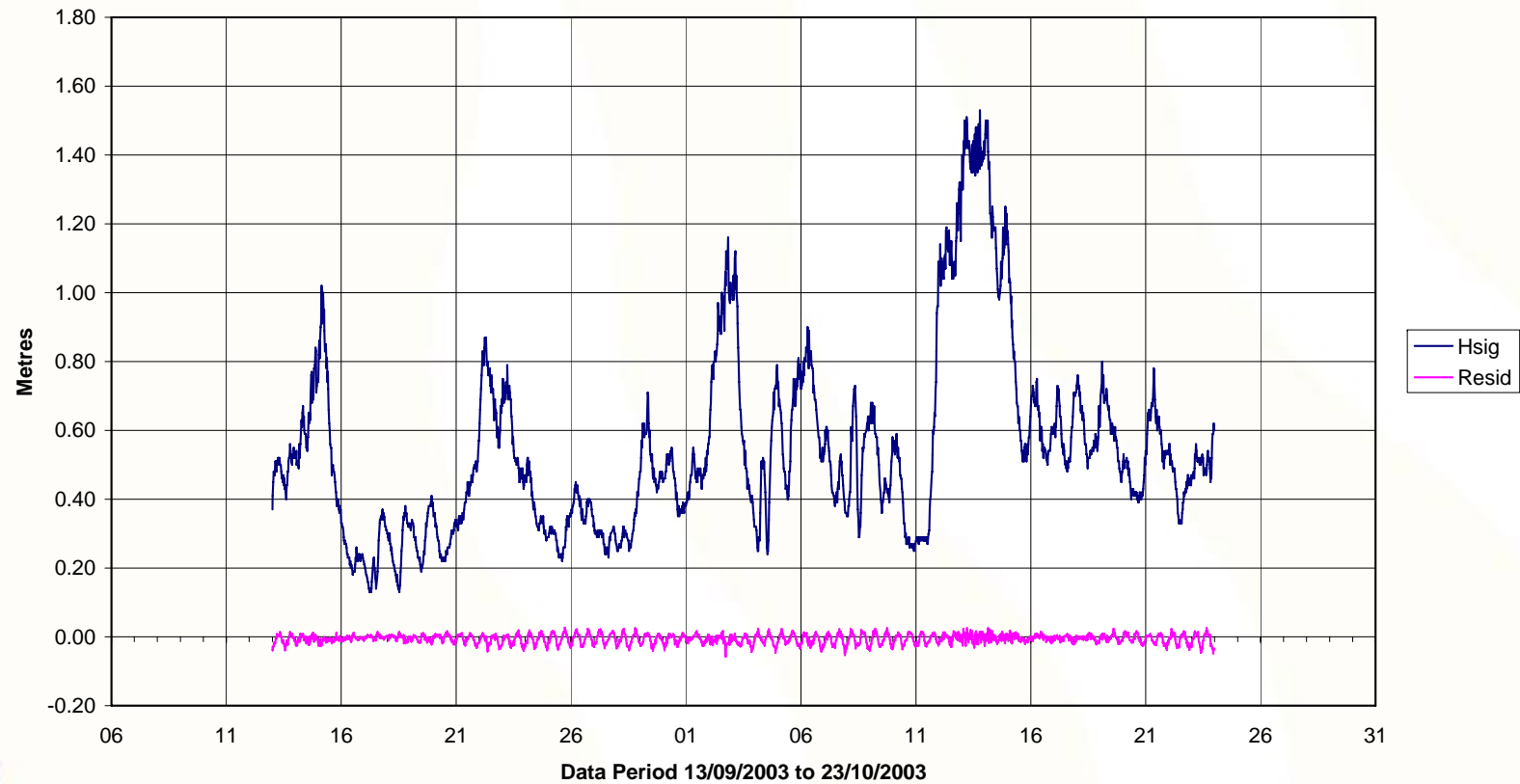


On advice from the manufacturers of the radar sensor:-

- 1. the Vega Puls 42 sensor (24 giga hertz and small radar footprint) initially installed was replaced by a**
- 2. Vega Puls 54 unit (3 giga hertz and larger radar footprint) which was**
- 3. "tuned" by extending the data integrating span out to two minutes.**

Wave Height vs Difference in Non Tidal Residuals After "Tuning" the Sensor

Wave Height Vs Difference in the Non Tidal Residuals for the Radar Sensor Readings and the Stilling Well readings at Lucinda After "Tuning" the Sensor.

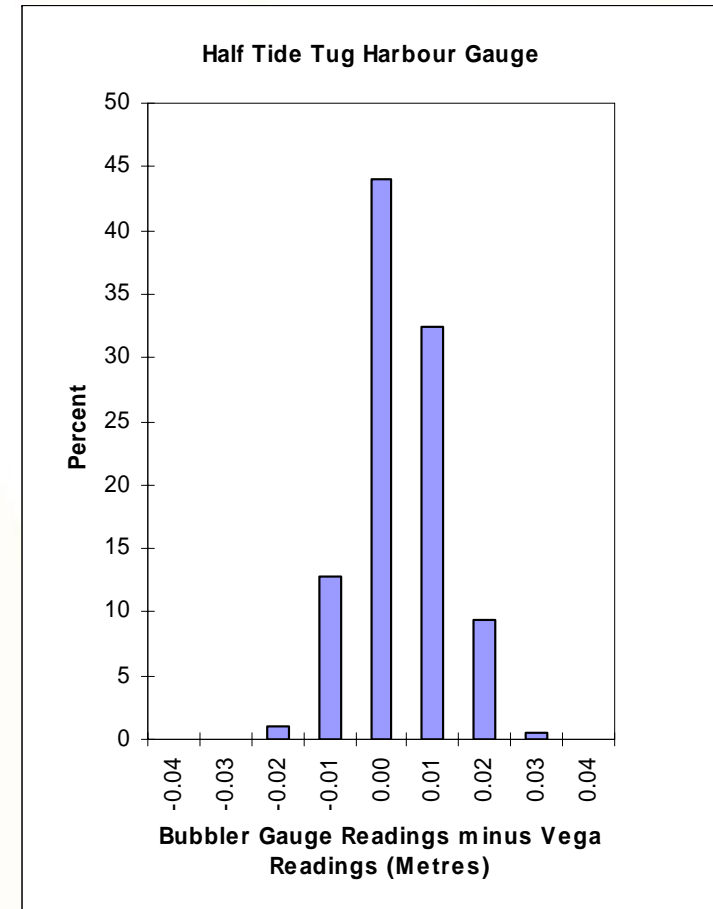
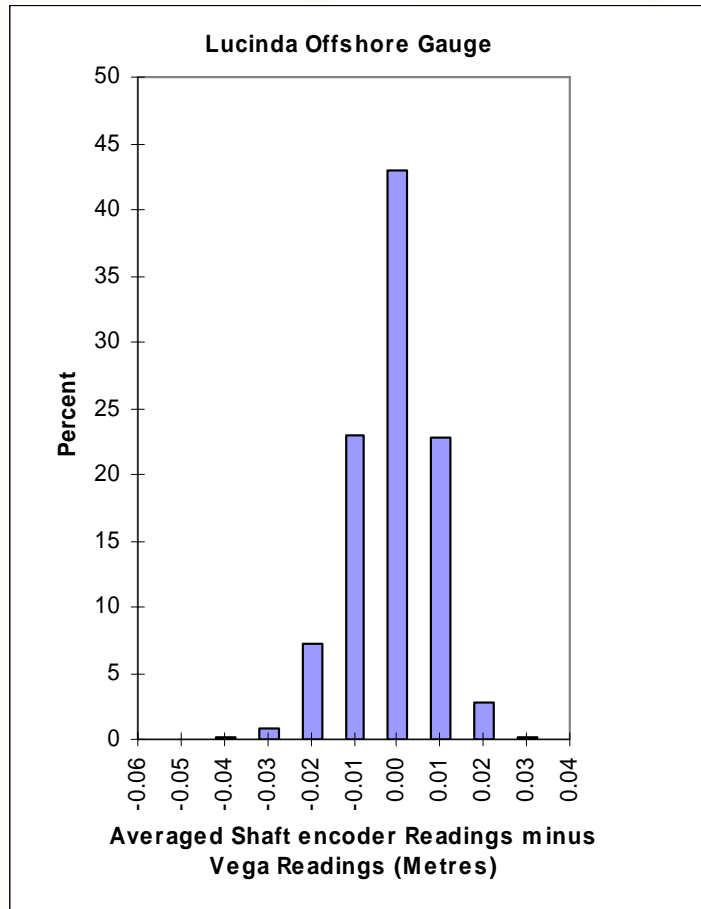




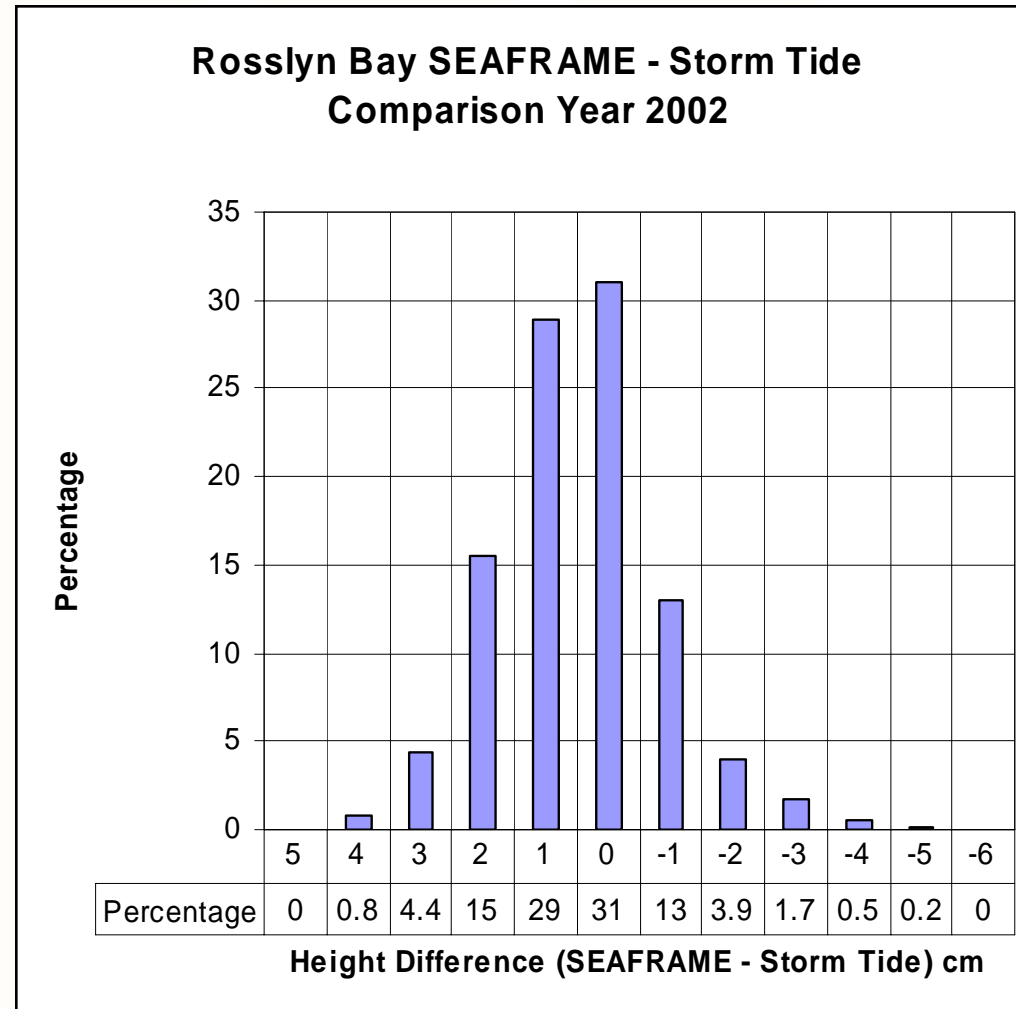
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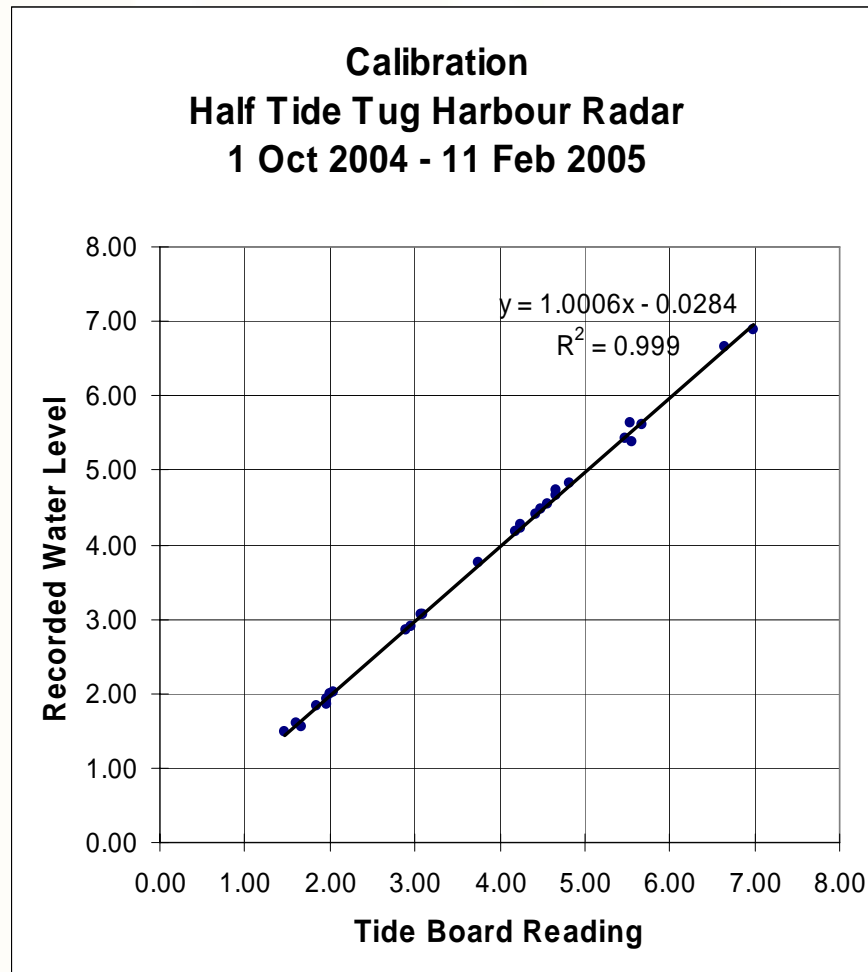
Difference in the Height Measured by:- the Lucinda Stilling Well System & Radar Sensor Half Tide Tug Harbour Gas Purge System & the Radar Sensor



Difference in the Height Measured by:- the Rosslyn Bay Air Acoustic System & the Radar Sensor



Calibration of the Half Tide Tug Harbour Radar Gauge





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In Situ Calibration Half Tide Tug Harbour Radar Sensor

The station was laboratory calibrated prior to deployment on 13 May 2002.

In situ calibrations of this station:-

27 May 2002	Slope = 0.9939 Zero offset 0.028
26 Jun 2002	Slope = 1.0020 Zero offset 0.008
17 Feb 2003	Slope = 0.9939 Zero offset 0.022
	Slope = 1.0000 Zero offset 0.000
31 Dec 2003	Slope = 0.9982 Zero offset 0.014
11 Feb 2005	Slope = 1.0006 Zero offset -0.028

The slope should be 1.000 and the Zero offset 0.000

The gauge calibration settings have not been changed since 17 Feb 2003



Water Level Check Summary

Water Level Checks Since 01 Oct 2004		
Nominally three checks per week – 28 in total.		
	Board minus Half Tide gas purge gauge	Board minus Half Tide radar gauge
Mean	-0.015	-0.018
Std Dev	0.053	0.053
Max	0.11	0.11 Attributed to poor water level checks
Min	-0.16	-0.17 Attributed to poor water level checks



Concluding Comments

- **To date the radar sensors have been reliable.**
- **The radar sensor is easily mounted over the side of a wharf or on any permanent structure that gives a clear view of the water.**
- **The use of downward looking radar sensors has removed the need to construct a stilling well and the use of divers to clear the inlet holes of stilling wells of marine fouling or replace under water sensors.**
- **The ongoing expense of employing divers is avoided.**



Concluding Comments Cont

- **The data recorder and the radar sensor unit must be calibrated as a single unit.**

It is not acceptable to calibrate the sensor and analogue to digital converter individually.

- **The author's preference is to calibrate the tide gauge as a single system, in situ.**
- **The calibration at the Half Tide Tug Harbour radar gauge has remained stable since its installation on 13 May 2002.**



Concluding Comments Cont

- **As with all tidal stations, positioning is critical to successful and precise measurement by the radar sensors.**

Sites which suffer heavy wave action should be avoided.

- **The contamination of the tidal recording by waves can be avoided by the selection of an appropriate measuring unit and data integrating time span.**
- **The precision of the radar measurements is high.**



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Concluding Comments Cont

- **Maritime Safety Queensland is no longer dependant on deploying a stilling well or other sensor system in the water.**
- **The radar sensor has become an important element of the tidal equipment operated in Queensland.**



Acknowledgements

- **The tidal authorities of Australia work cooperatively in undertaking our observations.**

The readings from the SEAFRAME station at Rosslyn Bay were provided by the National Tidal Centre.

The readings from the Rosslyn Bay and Lucinda Offshore storm tide stations, and the Townsville wave recordings were provided by the Queensland Environment Protection Agency.

The work of the Environmental Protection Agency, Coastal Services Unit, who commenced experimenting with radar units in May 1999 and have pioneered and engineered the establishment of radar sensors at Qld tidal stations is acknowledged.



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