LICENCE CONDITIONS

QUALITY CODE DESCRIPTIONS

Quality Code		Water Level*	Rainfall	Barometric Pressure*	Temperature*	Conductivity*^
5 (Very Good)	Records processed to	±5mm	±3% of calibration	±0.5mbar	±0.5ºC	±2mS/m
6 (Good)	Records processed to	±10mm		±1mbar	±1.0ºC	±2mS/m
55 (Fair)	Records processed to	±20mm	±5% of calibration	±2mbar	±2.0ºC	±5mS/m
100 (Leost Code)	Data from previous MHL database, processed to	±20mm	±3% of calibration	±1mbar		
105 (Poor)	Records processed to	±50mm	±10% of calibration	±5mbar	±5.0ºC	±10mS/m
208 (Very Poor)	Records processed to greater than	±50mm	±10% of calibration	±5mbar	±5.0ºC	±10mS/m
41 (Fitted Data)	Fitted data	Uncertainty is not defined for fitted data				
150 (Un-coded)	Un-coded – data not yet quality controlled	Raw data from the instrument with only preliminary quality checks performed				
1, 161, 204, 205, 206, 207, 250, 255 (Sensor is dry or data loss or missing data)	Data loss					

* A quality code is assigned under the conditions that at least 95% of the data meets the quality code requirements, based on single point calibration

^ Conductivity quality code descriptions are only relevant for freshwater environments.

GAPS AND MISSING DATA

Gaps in the data record can be caused for many reasons and few data stations have a complete unbroken record of data. Gaps may be due to equipment damage, telemetry or logger problems or other site issues.

TIME

All times are Australian Eastern Standard Time (EST) accurate to ±2 minutes unless otherwise specified. Allowance for daylight saving time needs to be made by the user of the data if required.

ACCURACY AND RESOLUTION The resolution of data is usually higher than the accuracy. A sensor may record data to 3 decimal places but the data value may only be accurate to 2 decimal places due to systematic and random uncertainties involved in the collection of the data.

DATA FIT FOR PURPOSE

General Guidelines

Tidal data is subject to a range of influences that may be desirable for the end user, or considered as noise. Seiching for example may be the subject of study for one user, but unwanted noise for another. Some processes (wind waves for example) are filtered out by measurement and sampling technique. Similarly flood events have not been removed from river entrance datasets. It is MHL policy to leave recorded data as untouched as possible allowing the record available for many different purposes.

The end user of the data needs to determine the suitability of the data record for the research question being considered and its fitness in terms of quality. The user will need to analyse the extent to which these datasets match or miss the suitability and fitness expected. Depending on the suitability of the dataset and its quality the user may have to reformulate or relax the research question and make a final decision to accept or reject the outcome of the analysis after consideration of qualitative and quantitative measure of the data.

The following paragraphs outline some of the main points to consider when determining if the data is fit for purpose.

Correction with Validation Readings - the raw data from the instrument is quality controlled using observer readings from visits to the site. The data is adjusted, if required, using the observer readings of the actual water level against a known datum. Further checks are made against the backup sensor at the site, the predicted and residual data and nearby sites if necessary. Floods are not removed from the river entrance site datasets.

Missing data - if there is missing data in the gauge record, where possible it is recovered and filled from the backup sensor at the site. If only a single point is missing then the data is interpolated linearly between the adjacent points. Other than these two cases missing ocean tide data is not in-filled or reconstructed.

Systematic Issues – some instrumentation has been known to over or under range data particularly on the low or high points of the tide. This is generally identified by comparison with prediction. The over-ranging values have been removed but the correct data has been left in the record. This may mean there are periods of data where there are a significant number of high or low points in the tide missing. This is problematic for means and median analysis and sea level trends.

Quality Coding –Data is quality coded as part of the quality assurance procedure. The codes are shown on the previous page. Data coded100 Leost Code or 55 Fair or better is generally issued but data of poorer quality may be available on request. Data coded poor or very poor usually indicates unresolvable issues such as possible datum offsets, unquantified instrument issues or systematic issues as described above. Any data coded poor or very poor should be carefully considered before it is used in analyses.

Datums - many ocean tide level gauges are recorded in the local port datum which generally equates to Indian springs low water (ISLW). An indicative adjustment of each station datum level to the local Australian Height Datum (AHD) is shown in the accompanying table. These adjustments were calculated circa 1990 for MHL by NSW Public Works Survey, using range ratio method and tidal harmonic analysis over varying time periods. These values should be used with caution, as AHD levels are revised from time to time and improvements to GPS surveying techniques may provide additional refinement. Some ocean tide stations have been updated based on the 2010/11 LPI levelling and ellipsoidal height determination. Offshore sites are not related to a datum, but provide valuable astronomical constituent information and anomalies. Norfolk Island and Lord Howe Island are recent installations that were not included in the original datum adjustment review.

Tides are not stationary – it is prudent to keep in mind during analysis of tidal records that tides are not stationary. The major constituents are not constant nor is the mean sea level (Zo). Variations in these components can have significant impact when research involves comparing long term trends or analyses between different time periods of data.

Prediction and Anomalies – MHL predictions are calculated using the Foreman versatile method. The prediction method together with the time period used for the analysis can significantly impact on the results. Any anomalies (or residuals) can suffer similar impacts. If there are significant non-astronomical influences in the tidal records then predictions that don't take into account these oceanographic processes can affect the accuracy of the prediction in comparison to actual measured water levels. Similarly, river entrance and upstream morphological changes will impact on the accuracy of any tidal predictions. Predictions conducted during one morphological condition will not be accurate for other morphological conditions in the estuary. Due to these limitations predictions should be considered in the nature of a general guide only and should not be relied upon in any critical situation, nor used for navigation. To the greatest extent permitted by law NSW Public Works excludes all liability for any loss or damage (including damage caused by negligence) incurred by any person/organisation directly or indirectly as a result of usage of this information and usage of the information is done at their own risk.

DATUM ADJUSTMENT

Each ocean tide level gauge is recorded in the local port datum which generally equates to Indian Springs Low Water (ISLW). An indicative adjustment of each station datum level to the local Australian Height Datum (AHD) is shown in the table below. These adjustments were calculated circa 1990 for MHL by NSW Public Works Survey Branch, using tidal harmonic analysis over a tidal epoch. These values should be used with caution, as AHD levels are revised from time to time and improvements to GPS surveying techniques may provide additional refinement. Offshore Aanderaa sites are not related to a datum, but provide valuable astronomical constituent information and anomalies. Norfolk Island and Lord Howe Island are recent installations that were not included in the original datum adjustment review and use local datums.

Summary of Adjustment to AHD

Station	Station Datum (SD)	Adjustment (SD – Adjustment = AHD)
Tweed Entrance South	Tweed River Hydro Datum	0.893
Cobaki	Tweed River Hydro Datum	0.863
Dry Dock	Tweed River Hydro Datum	0.875
Terranora	Tweed River Hydro Datum	0.853
Tweed Heads	Tweed River Hydro Datum	0.893
Letitia 2A	Tweed River Hydro Datum	0.886
Letitia 2B	Tweed River Hydro Datum	0.894
Barney's Point	Tweed River Hydro Datum	0.883
Tumbulgum	Tweed River Hydro Datum	0.893
North Murwillumbah	Tweed River Hydro Datum	0.909
Murwillumbah Bridge	Tweed River Hydro Datum	0.909
Bray Park Weir	Tweed River Hydro Datum	0.934
Kynnumboon	Tweed River Hydro Datum	0.926
Tweed Heads Offshore	Mean Sea Level	NA
Brunswick Heads	Brunswick River Flood Mitigation Datum	0.024
Bogangar	Brunswick River Flood Mitigation Datum	0.051
Kingscliff	Brunswick River Flood Mitigation Datum	0.066
Kingscliff Upstream	Brunswick River Flood Mitigation Datum	0.066
Orana Bridge	Brunswick River Flood Mitigation Datum	0.024
Billinudgel	Brunswick River Flood Mitigation Datum	0.019
Mullumbimby	Brunswick River Flood Mitigation Datum	0.010
Ballina Breakwall	Richmond River Valley Datum	0.860
Missingham Bridge	Richmond River Valley Datum	0.860
Byrnes Point	Richmond River Valley Datum	0.857
Wardell	Richmond River Valley Datum	0.824
Woodburn	Richmond River Valley Datum	0.815
Evans River Fishing Co-op	Richmond River Valley Datum	0.809
Iron Gates	Richmond River Valley Datum	0.819
Tucombil Highway Bridge	Richmond River Valley Datum	0.815
Tucombil Floodgate	Richmond River Valley Datum	0.815
Rocky Mouth Creek	Richmond River Valley Datum	0.815
Bungawalbin	Richmond River Valley Datum	0.809
Bungawalbin Creek	Richmond River Valley Datum	0.891
Coraki	Richmond River Valley Datum	0.815
East Gundurimba	Richmond River Valley Datum	0.831
Tuncester	Richmond River Valley Datum	0.855
Woodlawn	Richmond River Valley Datum	0.826
Goodwood Island	Iluka Port Datum	0.895
Yamba	Iluka Port Datum	0.895
Yamba Offshore	Mean Sea Level	NA
Lord Howe Island	Lord Howe Island Hydro Datum	NA
Norfolk Island	Norfolk Island Tidal Datum	NA
Coffs Harbour	Coffs Port Datum	0.882
Port Macquarie	Australian Height Datum	0.000
Port Macquarie Offshore	Mean Sea Level	NA
Crowdy Head	Crowdy Head Datum	0.911
Forster	Forster Hydro Datum	1.061
Port Stephens	Port Stephens Hydro Datum	0.944

Station	Station Datum (SD)	Adjustment (SD – Adjustment = AHD)
Mallabulla Point	Port Stephens Hydro Datum	0.959
Shoal Bay (Tomaree)	Port Stephens Hydro Datum	0.944
Patonga	Australian Height Datum	0.000
Sydney	Zero Fort Denison	0.925
Fort Denison (Sydney Ports)	Zero Fort Denison	0.925
Silverwater Bridge	Zero Fort Denison	0.925
Liverpool Weir	Weir crest	-2.762
Bundeena (Port Hacking)	Zero Fort Denison	0.925
Shoalhaven Offshore	Mean Sea Level	NA
Crookhaven Heads	Australian Height Datum	0.000
Jervis Bay	Jervis Bay Port Datum	1.070
Ulladulla	Australian Height Datum	0.000
Princess Jetty	Australian Height Datum	0.000
Batemans Bay Offshore	Mean Sea Level	NA
Bermagui	Bermagui Local Hydro Datum	0.714
Eden Boat Harbour	Twofold bay Hydro Datum	0.924