NSW GOVERNMENT

Manly Hydraulics Laboratory

NSW TIDAL PLANES ANALYSIS
2001-2020 HARMONIC ANALYSIS

Report MHL2786
April 2023

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Foreword

NSW Government through the Department of Planning and Environment (DPE) monitors tides along the NSW coast through an extensive data network. Manly Hydraulics Laboratory (MHL) is a business unit within the Water Infrastructure NSW division of DPE. MHL was commissioned by the Biodiversity and Conservation Division (BCD) of DPE to prepare a report on the tidal plane and phase analysis for 247 monitoring stations comprising the NSW coastal data network. Of these stations, 194 are suitable for the tidal analysis presented in this report.

The NSW coastal monitoring database has been developed to support the department's programs associated with coastal, floodplain and estuary management. MHL operates and maintains the coastal data network with an annual service level agreement to BCD.

The report was prepared by MHL and overseen by David Hanslow and Martin Fitzhenry from BCD. The highest and lowest astronomical tide (HAT/LAT) uncertainty calculation method independent review was provided by Dr Peter Tate (Director, WQ Data Pty Ltd).

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Executive summary

This report presents tidal plane analysis including highest and lowest astronomical tides (HAT/LAT) calculated using data collected by Manly Hydraulics Laboratory (MHL) on behalf of the Biodiversity and Conservation Division (BCD) from automatic water level monitoring stations along the coast of NSW. Tidal planes, tidal ranges, primary harmonic constituent's amplitude and phases, and HAT/LAT values are presented for a period of 19 individual years from 1 July 2001 to 30 June 2020 inclusive.

This report updates the twenty years of analysis from 1 July 1990 to 30 June 2010 presented in MHL2053 OEH NSW Tidal Planes Analysis 1990-2010 Harmonic Analysis (MHL, 2012) and includes a number of new monitoring stations commissioned since the earlier report.

The tidal behaviour of an estuary is not static and can be expected to shift under the influence of various dynamic factors over time. The tidal planes presented in this report are based on only one period of data for each monitoring location, and hence may not be representative of all future conditions due to factors such as changing hydrodynamic conditions in the estuary (e.g. entrance conditions and freshwater inflow).

The tide data presented in this report forms part of the database at MHL and can be accessed via MHL's public website at www.mhl.nsw.gov.au or by contacting MHL directly.

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1 Introduction

Since the 1940s MHL has collected tidal data in many estuaries and coastal locations along the NSW coast. This extensive dataset can be used to calculate the tidal planes for most river basins and ocean locations where data is available. The network of water level monitoring stations currently comprises 249 water level stations as listed in Appendix A. These have been sorted into 36 coastal basin groups for ease of reference. A summary of the physical characteristics for the estuaries of NSW is available from the Department of Planning and Environment at https://www.environment.nsw.gov.au/topics/water/estuaries/estuaries-of-nsw.

This report presents the recorded tidal variations along the NSW coastline and provides a compilation of historical tidal planes for the 19-year period between 1 July 2001 and 30 June 2020. In addition, this report presents the highest and lowest predicted astronomical tide (HAT/LAT) during this period. The tidal planes and predictions are calculated from the tidal harmonic constituents determined for each station using the Foreman tidal height analysis and prediction programs (Foreman, 1977; Forman & Neufeld, 1991). The tidal planes and HAT/LAT values are presented in tabular and graphical form for each station in each estuary. Tidal ranges and tidal constituents are presented in tabular form only.

The tidal range and behaviour recorded at each station may be influenced by local bathymetry, meteorological effects of atmospheric pressure, wind, temperature and rainfall, the hydrological effect of floodwater runoff, and oceanographic effects of waves, currents, salinity and water temperature. The tide levels in estuaries can also be affected by river geomorphological changes due to sedimentation and erosion.

The network of tidal stations along the NSW coast provides valuable knowledge of varying tidal responses. By selecting consistent periods of tidal data from each station and filtering the data to remove any significant non-astronomic components, tidal planes representative of each site can be calculated using harmonic analysis. Seiche effects, measured in harbour locations, have not been filtered from the data set as they are expected to have a negligible impact on the tidal plane results. The tidal planes presented in this report are generally indicative of trends, however, the calculated tidal planes are sensitive to the period of the tidal record used in the analysis and therefore should not be used to make further predictions beyond those presented in this report.

The tidal analyses for monitoring locations where there is a lack of astronomical influence are not presented in this report. These include stations located upstream of the normal tidal limit, as identified in MHL1286 Survey of Tidal Limits and Mangrove Limits in NSW Estuaries 1996 to 2005 (MHL, 2006), or influenced by closed entrance conditions such as intermittently closed or open lakes and lagoons (ICOLLs) where the entrance was not continuously open for at least 180 days in any year. The 194 stations analysed for tidal planes and phases are detailed in Appendix A organised by coastal basins, with associated location maps.

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2 Tidal characteristics and analysis

A general description of the main factors affecting tides and coastal water levels in NSW is provided in section 2.1. The tidal planes and tidal phases presented in this report are calculated from the recorded water levels at each of the 194 tidal stations listed in Appendix A using the Foreman (Foreman, 1977; Forman & Neufeld, 1991) tidal height analysis and prediction programs described below. A glossary of terms used in this report is provided in Appendix D .

The tidal analyses presented in this report are undertaken on a financial year-by-year basis (1 July 2001 to 30 June 2020) after removing hydrological effects by excluding periods influenced by any significant rainfall-runoff (flood effects). Refer to chapter 3 for details of the anomaly removal methodology. Hydrological anomalies must be removed before a period of data can be analysed as flood events obscure the astronomical signal.

Yearly analysis is not presented for monitoring locations where there is a lack of continuous astronomical influence (ICOLLs or stations located upstream of the tidal limit). If more than 180 days of data was missing or was non-tidal, then the data for that year is excluded from analysis. This is because tidal range results vary with the length of record (MHL, 1995) and are therefore not necessarily representative for shorter periods.

2.1 Tidal characteristics

Tides are primarily the result of gravitational and centrifugal forces acting on the earth, caused by movement in the earth-moon-sun system. The moon has a greater effect on the tide due to its close proximity to earth.

Analysis of coastal water level records shows clear patterns over regular periods. The principal cycles of a tidal record are related to the relative positions of the sun, moon and earth, and for NSW include the following:

- twice-daily variations with generally two high and two low tides occurring each day, each different sizes (daily inequality)
- a spring–neap cycle of approximately 27.3 days where the range of the tides goes from being relatively small to significantly larger and back
- annual variation associated with the relative distance between the earth and the sun, which repeats on a 365.25-day cycle
- lunar nodal cycle of 18.6 years associated with the declination of the moon. This is close to the Metonic cycle of 19 years (being a close approximation of the lowest common multiple of lunar months and tropical years in days), and
- 21,000 years associated with mean longitude of the solar perigee (perihelion). This is the time taken between any two repeats of a particular axial tilt of the earth (for example, the summer solstice at a particular place) to coincide with the closet approach of the earth and the sun to repeat. This cycle is not discussed further in this report due to the long period being outside of tidal data records.

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2.1.1 Unequal twice daily tides

At the earth's surface the water particles closest to the moon are influenced by the moon's gravitational force. Hence water on the earth's surface bulges towards the moon creating a high tide. On the opposite side of the earth, the centrifugal force of the earth-moon system is greater in the direction away from the moon, creating another high tide (Figure 2-1(a)).

The two high and two low waters on a given day are typically of different heights, known as the *higher high water* and the *lower high water* for the high tides. The daily inequalities vary with the moon's distance from the equator, being smallest when the moon is over the equator. A graph of the water level at a site with unequal tides is included in Figure 2-1(c). The moon orbits the earth in the same direction as the earth rotates on its own axis, so it takes slightly more than one day, approximately 24 hours and 50 minutes, for the moon to return to the same location in the sky (the lunar day). The moon orbits the earth every 27.3 days, and the earth makes one rotation in 24 hours. The earth-moon system rotates about a centre of mass while the earth rotates on its axis creating the lunar day and tides with a period of approximately 12 hours and 25 minutes (Thurman, 1994).

2.1.2 Spring-neap tidal cycle

In addition to the moon, the sun also exerts force on the earth, resulting in solar tides (Figure 2-1(b)). Due to the distance of the sun from the earth the forces produced are much weaker; approximately 46% of the moon's force (Duxbury & Duxbury, 1984). Solar tides occur twice daily and interact with lunar tides, producing spring and neap tides. When the moon and sun are in phase (full and new moons) their forces act together, producing spring tides, and when the moon and sun are out of phase (perpendicular, first and third quarter moons), neap tides result (Figure 2-1(b)).

2.1.3 Annual variation

The rotations of the earth around the sun and the moon around the earth are elliptical, rather than circular, and vary through time. When the moon is closest to the earth the forces acting to produce tides are up to 40% greater than when it is furthest away. The earth's declination (position of the sun and moon over the earth) is 23.5º to the ecliptic: the plane of the earth's orbital path around the sun. The moon's declination is at 5º to the ecliptic (Thurman, 1994). The declination explains the change in the diurnal inequality of tides as the declination of the earth and the moon varies from north to south. This variation causes tides to oscillate north and south of the equator each year and creates more diurnal solar tides during winter and summer.

2.1.4 Long period variations

In addition to the above tidal variations, there are long period cycles of the tide at 8.9 years and 18.6 years due to the relative orientations of the earth with the moon and the sun. This has a modulating effect on the tides, resulting in differing tidal excursions from year to year within the lunar nodal cycle of 18.6 years (National Tidal Datum Epoch).

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2.1.5 Non-tidal water level variations

Each monitoring location can have complex tidal circulations and storm surge characteristics which depend on factors such as the depth of water, orientation to winds and swell, and connectivity to the ocean (Emery & Aubrey, 1991). This is further complicated by the fact that these features are constantly changing. The following factors influence the variations in the tidal record that are not due to astronomic influences:

- **Shelf waves and seiches** – Standing wave oscillation in an enclosed body that can be set up by local wind forcing or by ocean scale events such as El Niño.
- **Tsunamis** – Long period ocean waves resulting from seismic activity (submarine earthquake or volcanic eruption) and can generate seiches.
- **Barometric effect** – The effect of atmospheric pressure on water level. Low pressure cells cause a rise in water level, whereas high pressure causes a drop in water level. Rapid changes in barometric pressure can produce meteotsunamis.
- **Wind stress** – Waves created by the action of the wind on the sea surface. Currents result in a raised water level downwind and a reduced water level upwind. When combined with barometric effect it is called **Storm Surge**.
- **Wave setup** – The result of 'sets' of waves transporting water shoreward and raising the sea level (up to 1.5 m on the NSW open coast).
- **Hydrologic input** – Heavy localised rainfall resulting in raised water levels. Effect is greater in rivers or contained water bodies (these have been removed from the records analysed for this report).
- **Ocean currents** – Ocean currents are capable of raising the water level for extended periods by transporting large quantities of water in, for example, eddies down a coastline.
- **Steric effect** – Changes in water level resulting from density changes (temperature and salinity). Changes are most pronounced in shallow waters.
- **Coastal trapped waves** – Long period waves generated by atmospheric disturbances off the south-western coast of Australia, that travel along the continental shelf resulting in water level changes of up to 0.5 m along the NSW coast.
- **Vertical land motion** - All processes that impact the elevation at a given location (e.g. tectonic movements, subsidence, and settlement due to altered drainage or ground water extraction), causing land to move up or down. Any significant vertical land motion at a station can usually be detected through review of the tidal trace or during station height surveys. Adjustments to water level data and the station's height are made through survey to controlled survey marks of the required vertical class.

In estuaries and embayments the tide is modified by the bathymetry of the estuary. Anthropological effects such as dredging and channelisation may therefore modify the tidal response of an estuary or embayment. Effects of bathymetry include shallow water effects friction, reflection, lake gradient effects, or a combination of these. A fortnightly signal is present in some estuaries and tidal lakes due to 'pumping' up or down during spring/neap tidal cycles. A full description of these effects is given in MHL report 1098 (MHL, 2003).

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2.1.6 Long-term sea level trends

The scenario of a changing sea level associated with the warming of the earth's atmosphere may result in changes to coastal processes, affecting foreshore areas. These changes may affect foreshore alignment and stability, siltation and shoal formation and directly impact on foreshore inundation levels. Further information on past and future sea level trends can be found at the following CSIRO web site https://research.csiro.au/slrwavescoast/sea-level/.

Monitoring station-based sea level trends are incorporated into the analysis by using observed data over the period 2001 to 2020. The constituents for calculation of the prediction and resulting HAT/LAT values are taken from the 19-year epoch and the mean sea level is calculated as the mean over the last five years of observed data. Future sea level trend impact assessment has not been undertaken in the analysis in this report, to find more information about this topic refer to the Intergovernmental Panel on Climate Change (IPCC, 2021).

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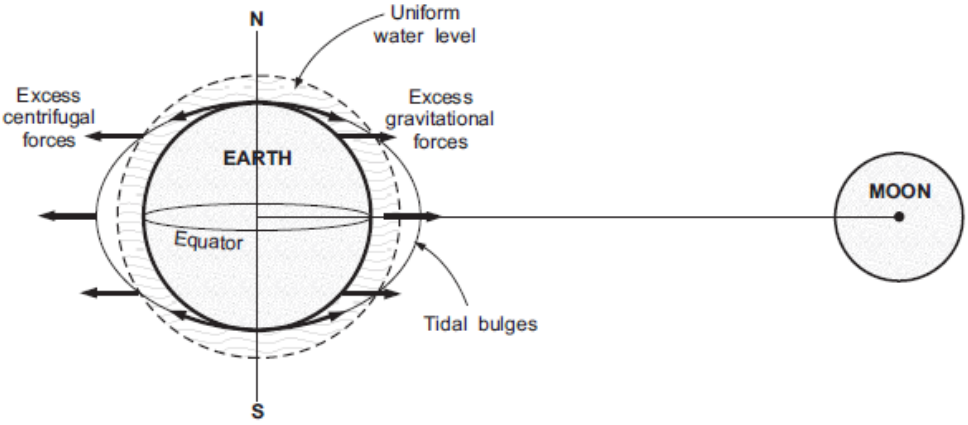
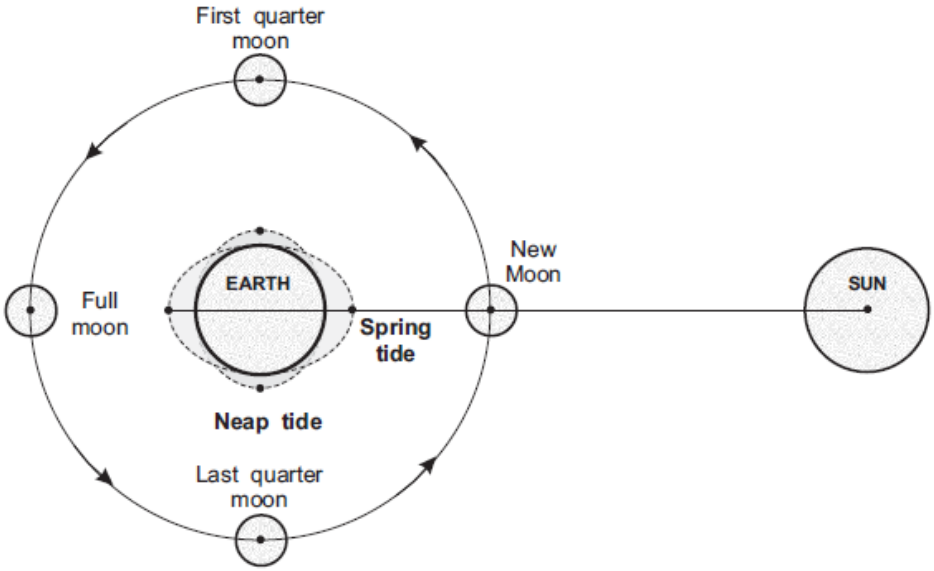
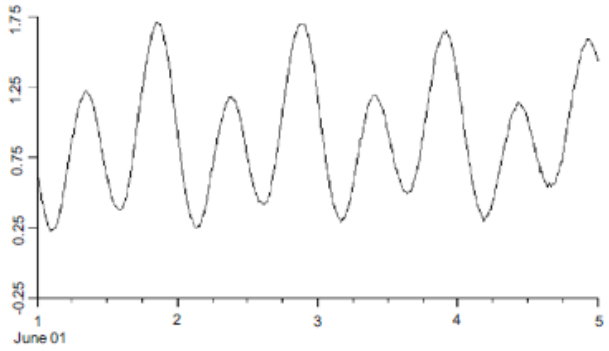


(a) EARTH - MOON SYSTEM



(b) EARTH - MOON - SUN SYSTEM



(c) SEMI - DIURNAL TIDAL PATTERN

Source: Duxbury and Duxbury, 1987

NSW GOVERNMENT	LUNAR AND SOLAR TIDES	Manly Hydraulics Laboratory Report MHL2786 Figure 2-1 Figure2-1.pptx

3 Flood removal methodology

In order to perform the harmonic analysis described in the previous section, each station's data must be processed to remove the influence of hydrological effects which may bias the results. Previously this processing was performed manually by experienced professionals at MHL and was a considerable undertaking given the 19-year period and 194 stations to be analysed. Recent technological improvements have facilitated the partial automation of timeseries processing and harmonic analysis and opportunities were identified to investigate the removal of catchment flooding programmatically.

The following methods were selected to be investigated:

- manual flood removal (control)
- flood removal based on thresholds and/or rate-of-rise
- flood removal based on rainfall totals
- flood removal based on residuals from harmonic analysis
- a combination of the above methods.

In order to assess each of the above methods, five sites were selected with different tidal and catchment behaviour. Analysis was performed for the 19-year period between July 2001 and June 2020 for each method at each site. Results were compared to the control data to observe the difference between the resulting harmonic constituents, tidal planes, accuracy of hindcast, and quantity of data removed. Then a forecast timeseries was produced for each removal method to understand the variation in predicted HAT and LAT values between techniques.

3.1 Thresholds and rate-of-rise

Flood removal based on water level thresholds is a simple way to highlight data which is obviously impacted by catchment flooding. In the majority of cases, this method will remove all flood data which is greater than a particular intensity, while leaving intact some smaller events. In general, the greater the ratio of catchment volume to estuary size, the better the performance of the threshold removal method. The threshold chosen for each site was the predicted HAT based on the control dataset. It was found that this provided a good compromise between the quantity of data removed and the number of floods still present in the data.

Using rate-of-rise thresholds to identify floods may be done using catchment characteristics or observed data. Several methods were tested as a part of this analysis and it was observed that, while the beginning of a flood could be identified with reasonable precision using this method, it was very difficult to identify when a flood had ended. Therefore, no rate-of-rise methods were directly compared to the other flood removal methods, but instead were highlighted for possible inclusion in a combined procedure at a later stage.

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3.2 Rainfall totals

Data removal based on daily rainfall totals is highly dependent on catchment size, river chainage at the site, catchment morphology and antecedent conditions. After selecting several different rainfall totals for analysis, a standard 10mm/day total was selected as a first pass filter. Any day where this threshold was exceeded was removed from the dataset as well as the following day. Ideally, flood removal based on rainfall would be performed based on hydrological routing, however setup of models to perform this routing is time consuming and potentially cost prohibitive.

3.3 Hindcast residuals

Flood removal based on harmonic analysis may be performed by creating a hindcast of the 19-years of recorded data based on the calculated harmonic constituents. This hindcast can then be subtracted from the control data to produce a timeseries of residual values (or anomalies). Floods may be identified by periods where residual values exceed a given threshold. Thresholds of 0.3m, 0.2m, and 0.1m were selected for analysis in this report.

3.4 Sensitivity analysis results

Refer to Appendix B for detailed sensitivity results for the techniques of manual flood removal (control), thresholds and rate of rise, rainfall totals and hindcast production with a threshold of 0.3m, 0.2m and 0.1m residual for removal.

3.5 Flood removal technique selected

Based on the sensitivity analysis results, the hindcast 0.2m threshold was selected as the optimum flood removal technique. This technique provides sufficient removal of non-astronomical influences on the water level, whilst preserving the most data to maintain the integrity of the tidal planes' analysis.

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4 Foreman analysis

The Foreman tidal height analysis and prediction programs were used to analyse the astronomic tide data from each station. The programs produce the amplitudes and phases of a series of harmonic constituents, which are then used to calculate predictions of tides. The Foreman program used in this component of the study divides the tide into 45 astronomical constituents and 24 shallow water constituents for a 366-day tidal record. Large peaks emergent from this spectral information are the dominant harmonic constituents M_2, S_2 (semi-diurnal), K_1 and O_1 (diurnal). The fortnightly constituent M_{sf} (lunisolar synodic) is also presented in relation to shallow water effects present in some NSW estuaries and tidal lakes.

The mean sea level component of water level (Z_0) is approximately the average of all filtered data points. It is also included in the analysis along with the constituents, so the mean sea level (over the period of analysis) is reported by the package even with some data loss and can be subtly different from the average of all samples with anomalies removed (MHL, 2012).

Combinations of the amplitudes of the dominant harmonic constituents are used to calculate the tidal planes and ranges at each station. The major constituents used, and the equations of the tidal planes are given in Table 4-1 to Table 4-3. The periods and angular speeds of the constituents are constant while the phases vary for different locations. In these equations the amplitude of the constituents defines the tidal heights.

Table 4-1 Major constituents used in tidal plane calculations

Constituent	Origin	Period (hours)	Angular speed (minutes/degrees)
M_2 (semi-diurnal)	Principal lunar	12.42	2.07
S_2 (semi-diurnal)	Principal solar	12.00	2.00
K_1 (diurnal)	P. lunar/P. solar	23.93	3.99
O_1 (diurnal)	Principal lunar	25.82	4.30

Table 4-2 Calculation of tidal planes

Tidal plane	Abbreviation	Equation
High High Water Solstices Springs	**HHWSS**	$= Z_0 + M_2 + S_2 + 1.4\ (K_1 + O_1)$
Mean High Water Springs	**MHWS**	$= Z_0 + (M_2 + S_2)$
Mean High Water	**MHW**	$= Z_0 + M_2$
Mean High Water Neaps	**MHWN**	$= Z_0 + (M_2 - S_2)$
Mean Sea Level	**MSL**	$= Z_0$
Mean Low Water Neaps	**MLWN**	$= Z_0 - (M_2 - S_2)$
Mean Low Water	**MLW**	$= Z_0 - M_2$
Mean Low Water Springs	**MLWS**	$= Z_0 - (M_2 + S_2)$
Indian Spring Low Water	**ISLW**	$= Z_0 - (M_2 + S_2 + K_1 + O_1)$

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Table 4-3 Calculation of tidal ranges

Tidal plane range		Equation
Mean Neap Range	**MNR**	= MHWN-MLWN
Mean Range	**MR**	= MHW-MLW
Mean Spring Range	**MSR**	= MHWS-MLWS
Range	**R**	= HHWSS-ISLW

4.1 Residual error

To determine whether a predicted tide provides a good representation of the observed water level record, the difference between the two, or the tidal residual, is calculated. The residual error is expressed in terms of the Root Mean Square (RMS) of the 15-minute difference between the observed and predicted tides (tidal residual) and is calculated as follows:

$$x_{RMS} = \sqrt{\left(\frac{\sum x_i^2}{n}\right)}$$

where xi = difference between observed tide and predicted tide at time i
n = number of tidal records

The RMS error is a measure of how accurately the harmonic analysis models the measured tide (MHL, 1995). This should not be confused with the uncertainty of the measurement which includes gauge and datum errors. The annual RMS errors are provided to show variation of model fit over the period of analysis. For stations with a much smaller mean range than ocean tides, non-astronomical water level variations account for a significantly greater proportion of the variability in the observed water level, resulting in potentially larger RMS residual errors in comparison with sites with mean ocean range (MHL, 2003). Caution should be exercised in the end use and interpretation of the tidal planes data in such circumstances.

4.2 Forecasting method

The method of forecasting to determine constituents consists of calculating constituents over an entire 19 year period (where available). The mean sea level (Z_0) is determined separately by averaging its value over the last 5 years (2015-2020) of the 19-year epoch. The 2012 tidal methodologies investigation (MHL, 2012) showed that there is improved accuracy in the forecast through the use of averaging or trending of the mean sea level over a period of 3-5 years and applying an average of the constituents over 10-20 years. The value of this improvement is variable depending on the site, with stable stations such as Fort Denison allowing a modest improvement to forecasting, but other locations behaving differently.

MHL has incorporated the Foreman Versatile Tide method into its standard analysis routines. This method is an improved version of the original method completed by Foreman in 2007. Improvements include the possibility to analyse records over the full epoch and better handling of missing data allowing the analysis of sparsely sampled data. It also includes a

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more accurate nodal correction, inference and astronomical argument adjustments due to the incorporation of the least square analysis instead of post analysis (MHL, 2012).

The Foreman harmonic analysis technique is best suited to open ocean conditions where tides are symmetrical around MSL. For monitoring locations in river and estuary locations where low water levels are truncated and the symmetry around mean sea level is not maintained, the harmonic model can struggle to fit the observed data and limit its ability to predict tidal behaviour. In some such cases, predicted LAT values can be higher than the ISLW.

The previous epoch (1995-2014) prediction method for ocean tide stations averaged the annual Foreman harmonic analysis and was therefore unable to accurately represent longer period constituents which span over multiple years.

4.3 Highest and lowest astronomical tide

The highest and lowest astronomical tide (HAT/LAT) are the highest and lowest level that can be predicted to occur in the prediction period (1 July 2001 to 30 June 2020) and under any combination of astronomical conditions this level will not be reached every year.

Appendix A provides the HAT/LAT values and the date and time from the prediction that the values occur, as well as the average number of days per year that HAT was exceeded during the 2001-2020 monitoring period. HAT can be exceeded multiple times a year due to non-astronomical influences, refer to 6.1 for further discussion of these influences.

The methodology for calculating the uncertainty at the 95% confidence interval associated with the HAT/LAT values is provided in Appendix C .

4.4 Water as a boundary – tidal plane data

The Surveyor-General's Direction No. 6 reference tidal plane statistical data, which may be provided by MHL as an element to assist define property boundaries (Surveyor General of NSW, 2021).

There are multiple valid and historically adopted methods to calculate Mean High Water Level (MHWL). This has been highlighted in a study by MHL for Transport for NSW *MHL Report 2699 Fort Denison mean high water mark review* (MHL, 2019). MHWL can be calculated from times series water level data using several different methods and data currency, resulting in different MHWL values and measurement uncertainty ranges.

Two common methods for MHWL calculation, include the average of the high tides method and the Foreman harmonic analysis tidal planes method. Both methods use floods' removed time series data.

Users of this document should be aware that the mean high water values presented in this report are calculated using the Foreman method calculated harmonic constituents $Z_0 + M_2$, as show in Table 4-2. The user needs to decide if this method is appropriate for the desired application.

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5 Tidal plane analysis results

Results of the tidal plane analyses are presented from north to south in Appendix A , with the ocean tide stations (those with long period analysis) presented first. The results of the tidal planes analysis include:

- the tidal planes and tidal ranges
- the amplitudes and phases of the major tidal constituents
- the residual error in the calculations between the actual data and model fit
- the percentage of the yearly data analysed
- the mean (annual average) of the analysis results
- the standard deviation of the annual tidal planes results
- uncertainty of the values, including the measurement uncertainty
- the period of record where levels are above the HAT
- any comments specifically related to that data set and analysis.

Figure 5-1 to Figure 5-16 provides the 19-year average tidal plane value and the HAT/LAT value for each monitoring station on the major tidal rivers in NSW. The longitudinal plotting demonstrates the changes in tidal planes values from left to right moving downstream towards the ocean. Tables A2 to A232 show the annual tidal planes for all stations grouped in coastal regions. Where a station was not established for the entire period, data was analysed for the operating period of the site.

The physical characteristics of each river basin were assembled in DECCW Tidal Data Compilation (MHL, 2010) and are presented at https://www.environment.nsw.gov.au/topics/water/estuaries/estuaries-of-nsw/search-nsw-estuary-profiles. A range of physical characteristics is given for each estuary listed, including their location and size. Many estuaries have also been subject to tidal surveys and/ or hydrographic surveys that may cover all or part of an estuary and may assist in interpreting the data in this report.

The tidal planes for each station are presented in Australian Height Datum (AHD) where possible. To understand the datum relationship for each station to the local datum, the adjustment is presented in Table 5-1. Results and limitations of the tidal planes analysis are discussed in section 6.

The quantity of data used for each year's analysis is presented as a percentage of the maximum capture rate over the period of deployment. Therefore, where the instrument was deployed for less than a year, the value will be higher than an annual capture rate. For example, if the site was deployed on 1 January without any data loss the data capture will be 100 percent, not 50 percent. This capture value, however, also includes any flood removal, so years which experienced more frequent flooding events will have a lower capture percentage reflected.

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Table 5-1 Summary of adjustment from AHD to local datum

River/Estuary	Station	Adjustment to local datum	Local datum*
Cobaki Broadwater	Cobaki	+0.863	TRHD
Terranora Creek	Dry Dock	+0.875	TRHD
Terranora Broadwater	Terranora	+0.853	TRHD
Tweed River	Tweed Heads	+0.893	TRHD
Tweed River	Letitia 2A	+0.886	TRHD
Tweed River	Barneys Point	+0.883	TRHD
Tweed River	Tumbulgum	+0.893	TRHD
Tweed River	North Murwillumbah	+0.909	TRHD
Tweed River	Murwillumbah Bridge	+0.909	TRHD
Rous River	Kynnumboon	+0.926	TRHD
Brunswick River	Brunswick Heads	+0.046	BRFMD
Cudgen Creek	Kingscliff	+0.066	BRFMD
Marshalls Creek	Orana Bridge	+0.024	BRFMD
Marshalls Creek	Billinudgel	+0.019	BRFMD
Brunswick River	Mullumbimby	+0.010	BRFMD
Richmond River	Ballina	+0.860	RRVD
Richmond River	Missingham Bridge	+0.860	RRVD
Richmond River	Byrnes Point	+0.857	RRVD
Richmond River	Wardell	+0.824	RRVD
Richmond River	Woodburn	+0.815	RRVD
Evans River	Evans River Fishing Co-op	+0.809	RRVD
Evans River	Iron Gates	+0.819	RRVD
Tucombil Canal	Tucombil Highway Bridge	+0.815	RRVD
Tucombil Canal	Tucombil Floodgate	+0.815	RRVD
Rocky Mouth Creek	Rocky Mouth Creek	+0.815	RRVD
Richmond River	Bungawalbin	+0.809	RRVD
Bungawalbin Creek	Bungawalbin Creek	+0.891	RRVD
Richmond River	Coraki	+0.815	RRVD
Wilsons River	East Gundurimba	+0.831	RRVD
Leycester Creek	Tuncester	+0.855	RRVD
Wilsons River	Woodlawn College	+0.826	RRVD
Clarence River	Yamba	+0.895	IPD
Tasman Sea	Coffs Harbour	+0.882	CHPD
Tasman Sea	Crowdy Head Harbour	+0.911	CHD
Wallis Lake Entrance	Forster	+1.061	FHD
Port Stephens	Mallabula Point	+0.959	PSHD
Port Stephens	Tomaree	+0.944	PSHD
Port Jackson	Sydney Port Jackson at HMAS Penguin	+0.925	ZFD
Port Hacking	Bundeena	+0.925	ZFD
Jervis Bay	HMAS Creswell	+1.070	CD
Bermagui	Bermagui Harbour	+0.714	BLHD
Tasman Sea	Eden Boat Harbour	+0.924	TBHD

*TRHD - Tweed River Hydro Datum, BRFMD - Brunswick River Flood Mitigation Datum, RRVD - Richmond River Valley Datum, IPD - Iluka Port Datum, CHPD - Coffs Harbour Port Datum, CHD - Crowdy Head Datum, FHD - Forster Hydro Datum, PSHD - Port Stephens Hydro Datum, ZFD – Zero Fort Denison, CD – Chart Datum, BLHD - Bermagui Local Hydro Datum, TBHD - Twofold Bay Hydro Datum.

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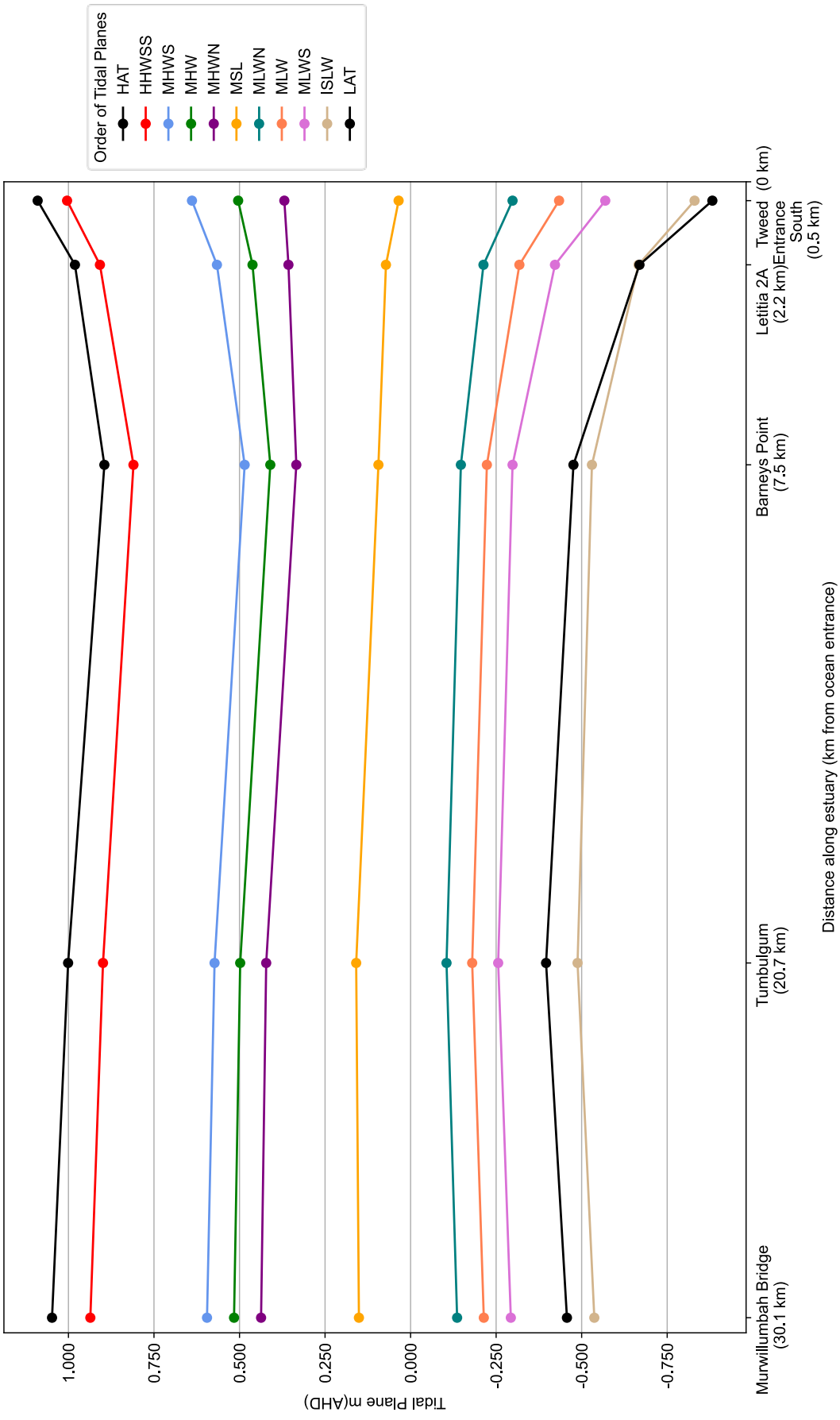

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TWEED RIVER
LONGITUDINAL TIDAL PLANE RESULTS

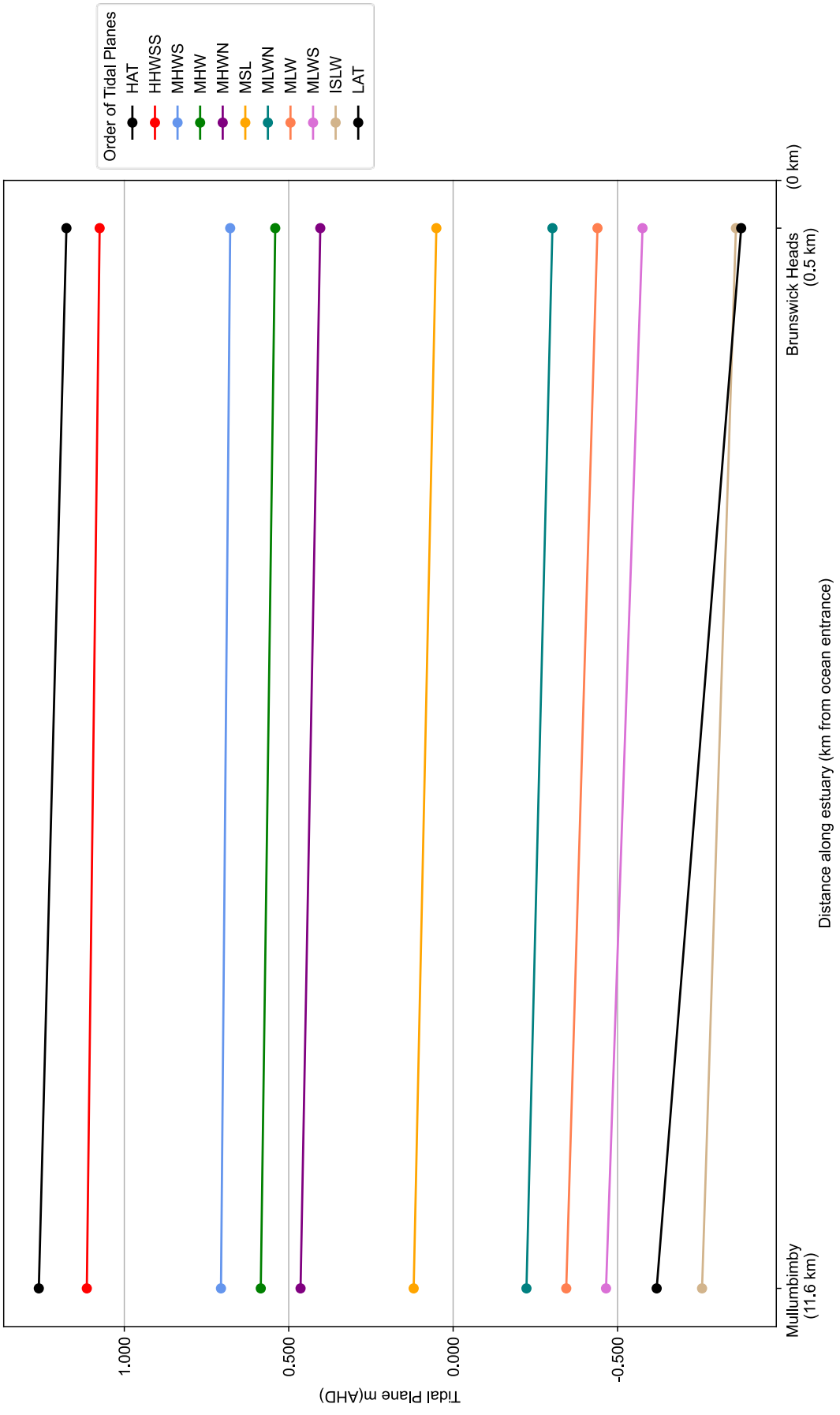
Manly Hydraulics Laboratory

Report MHL2786

Figure

5-1

5_01_Tweed.pptx



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BRUNSWICK RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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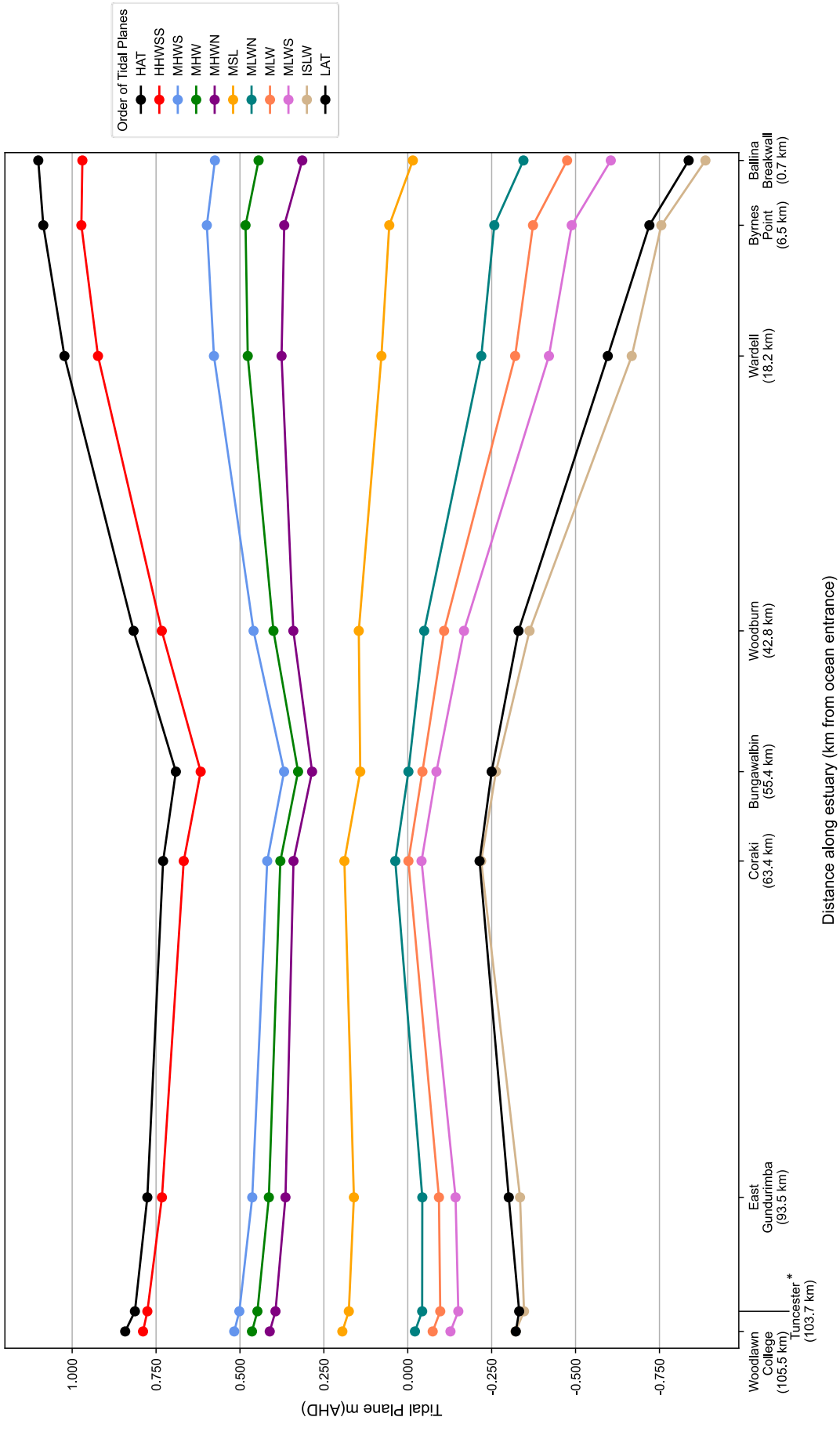
Figure

5-2

5_02_Bruns.pptx



* Tuncester monitoring station is located on Leycester Creek, a tributary of the Wilsons River.

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WILSONS AND RICHMOND RIVER LONGITUDINAL TIDAL PLANE RESULTS

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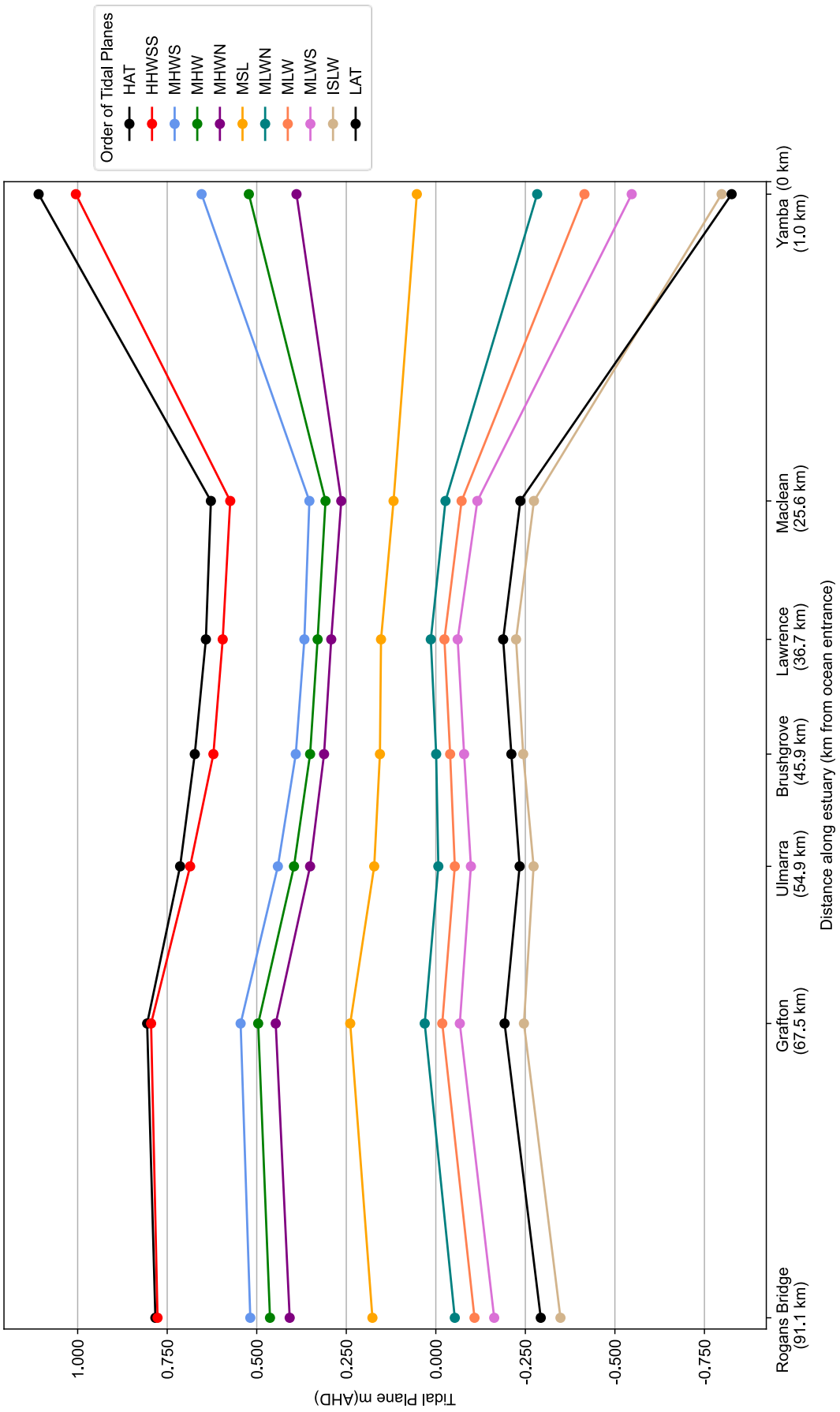
Figure 5-3

5_03_Rich.pptx



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CLARENCE RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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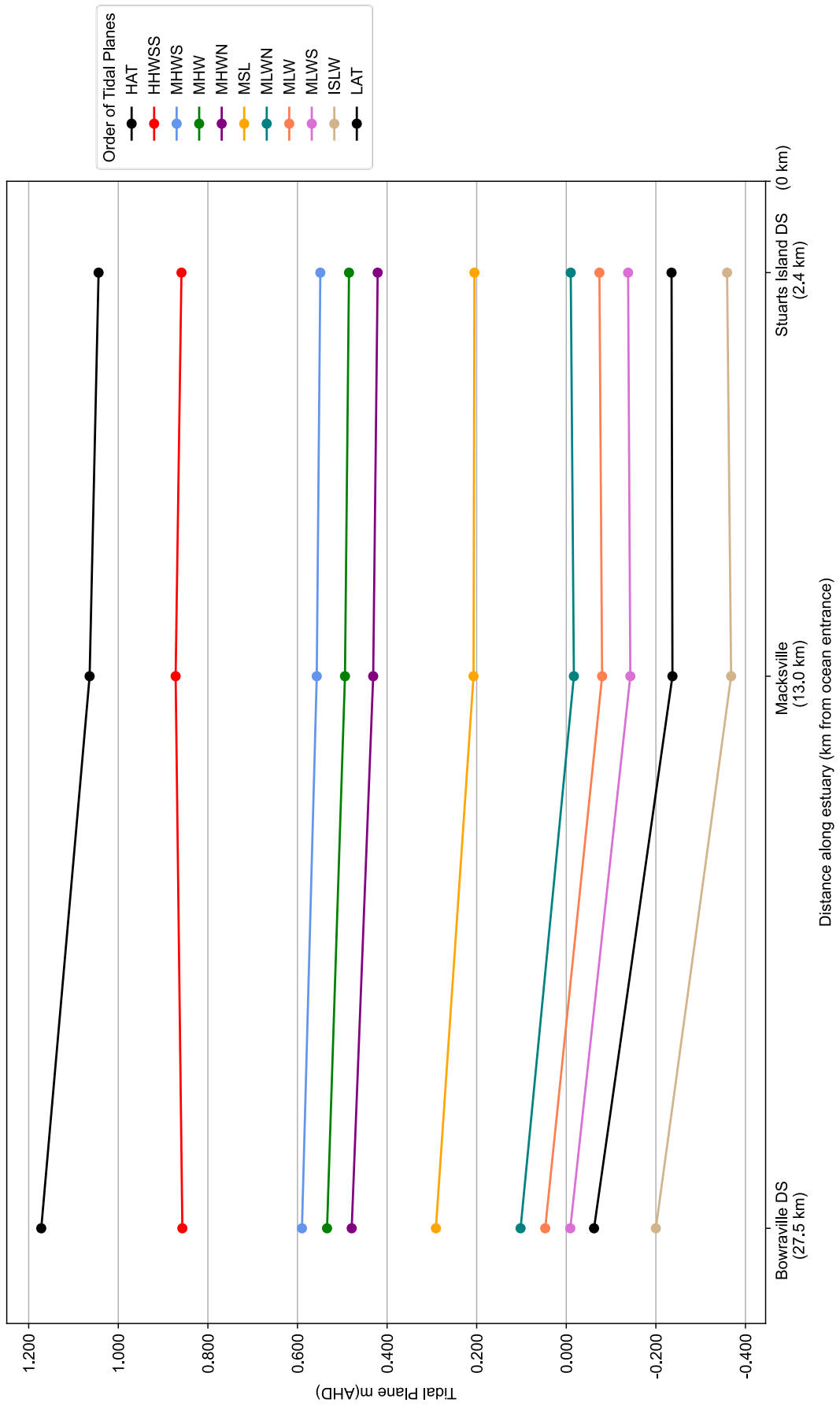
Figure

5-4

5_04_Clare.pptx



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NAMBUCCA RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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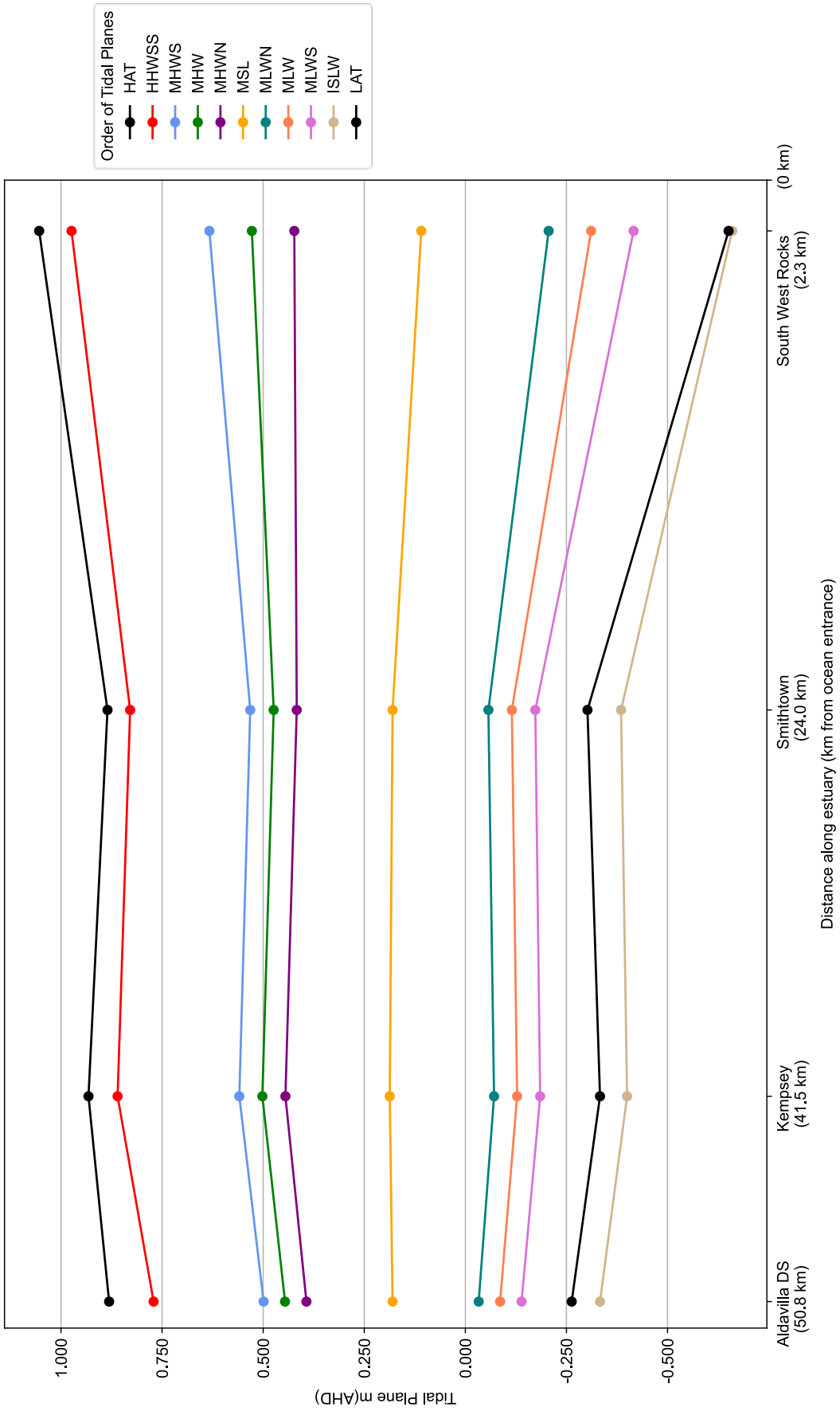
Figure

5-5

5_05_Namb.pptx



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MACLEAY RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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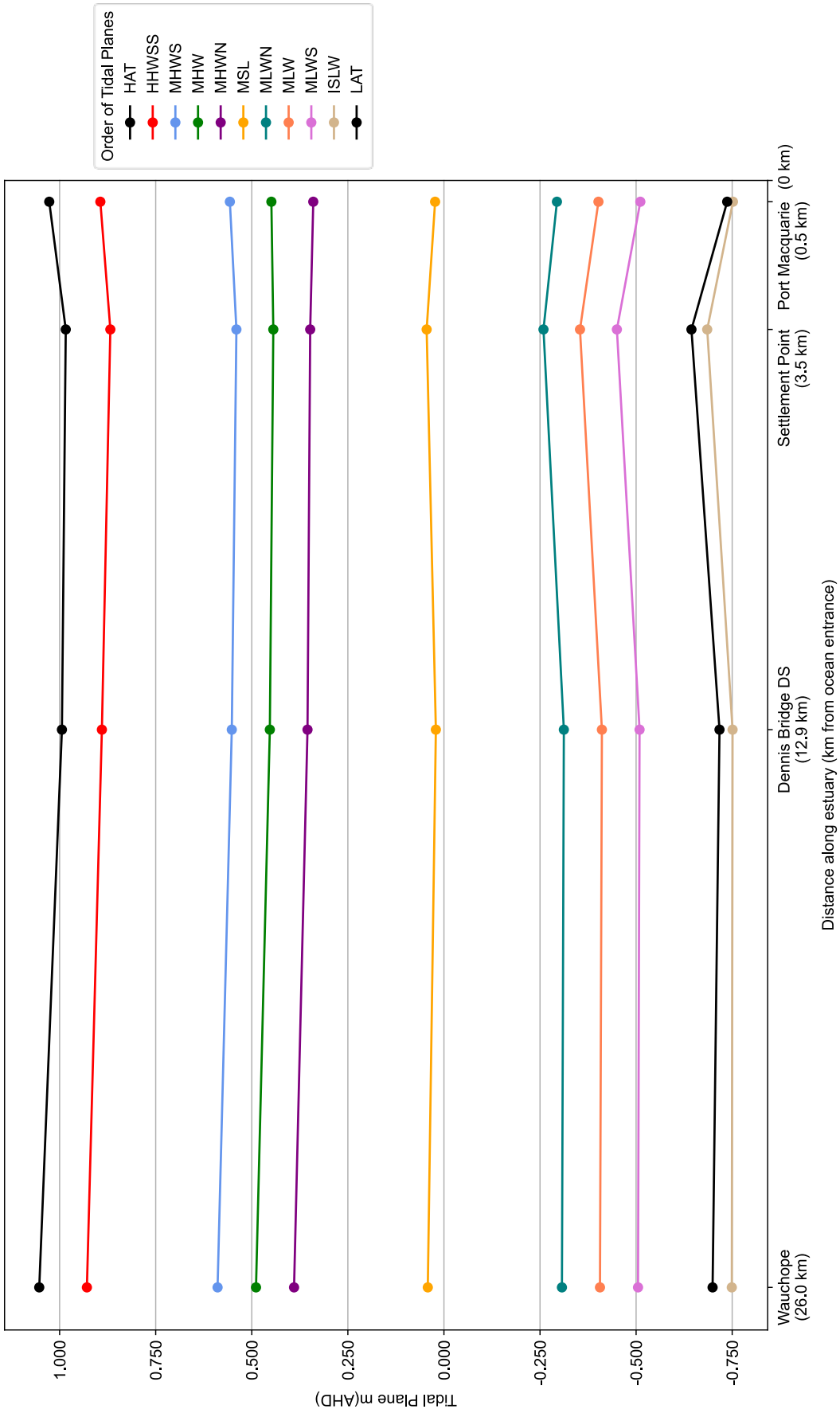
Figure
5-6

5_06_Macl.pptx



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HASTINGS RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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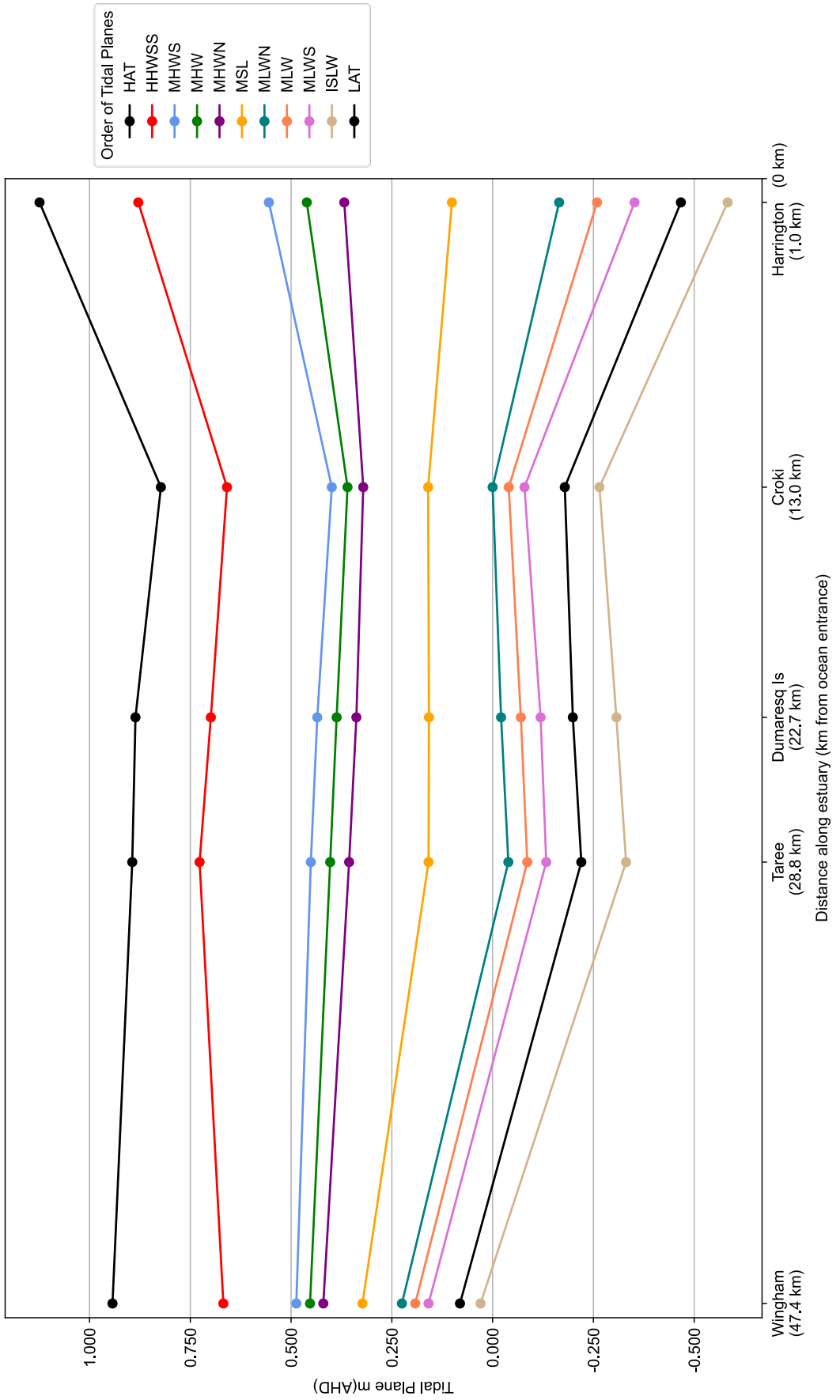
Figure

5-7

5_07_Hast.pptx



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MANNING RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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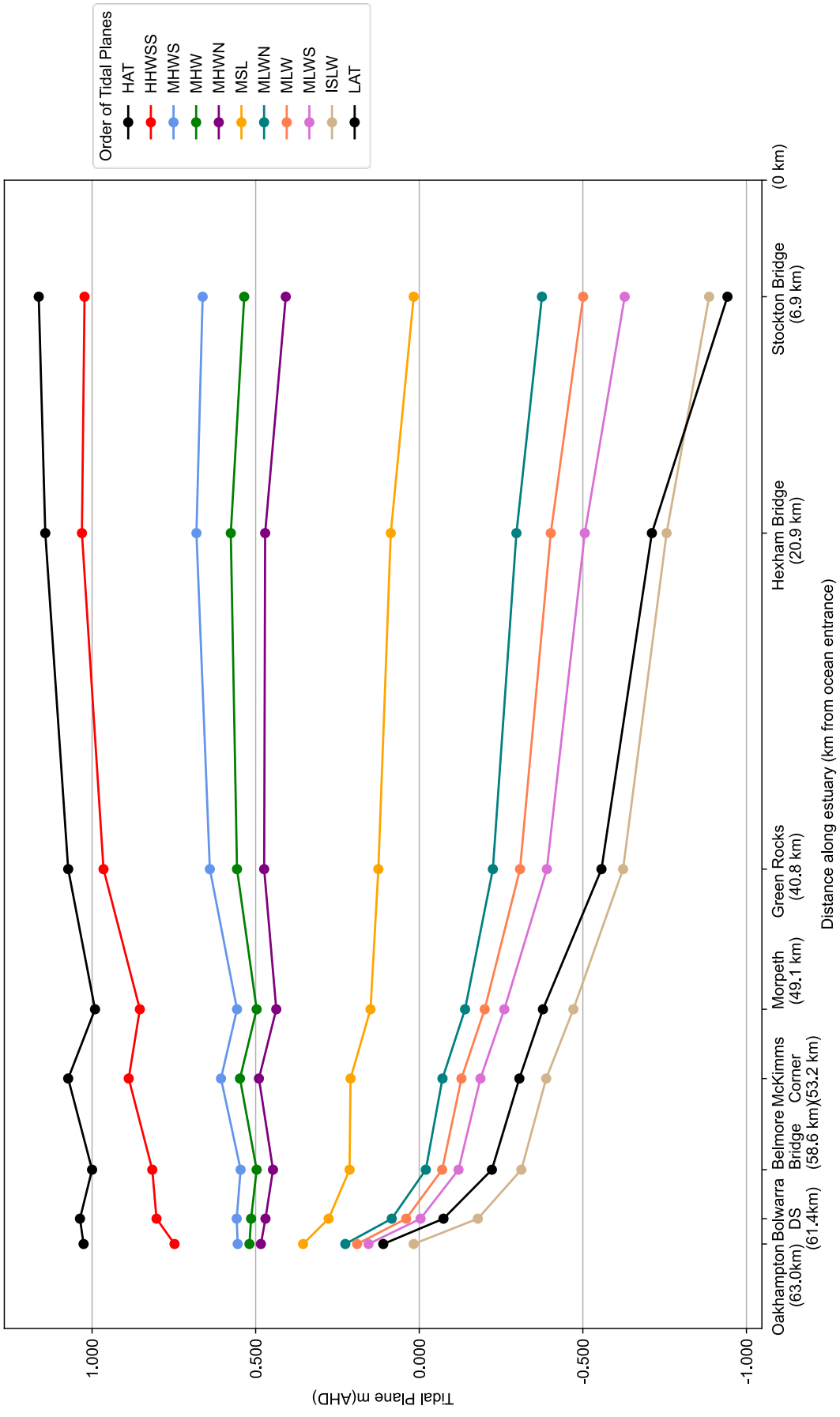
Figure
5-8

5_08_Mann.pptx



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HUNTER RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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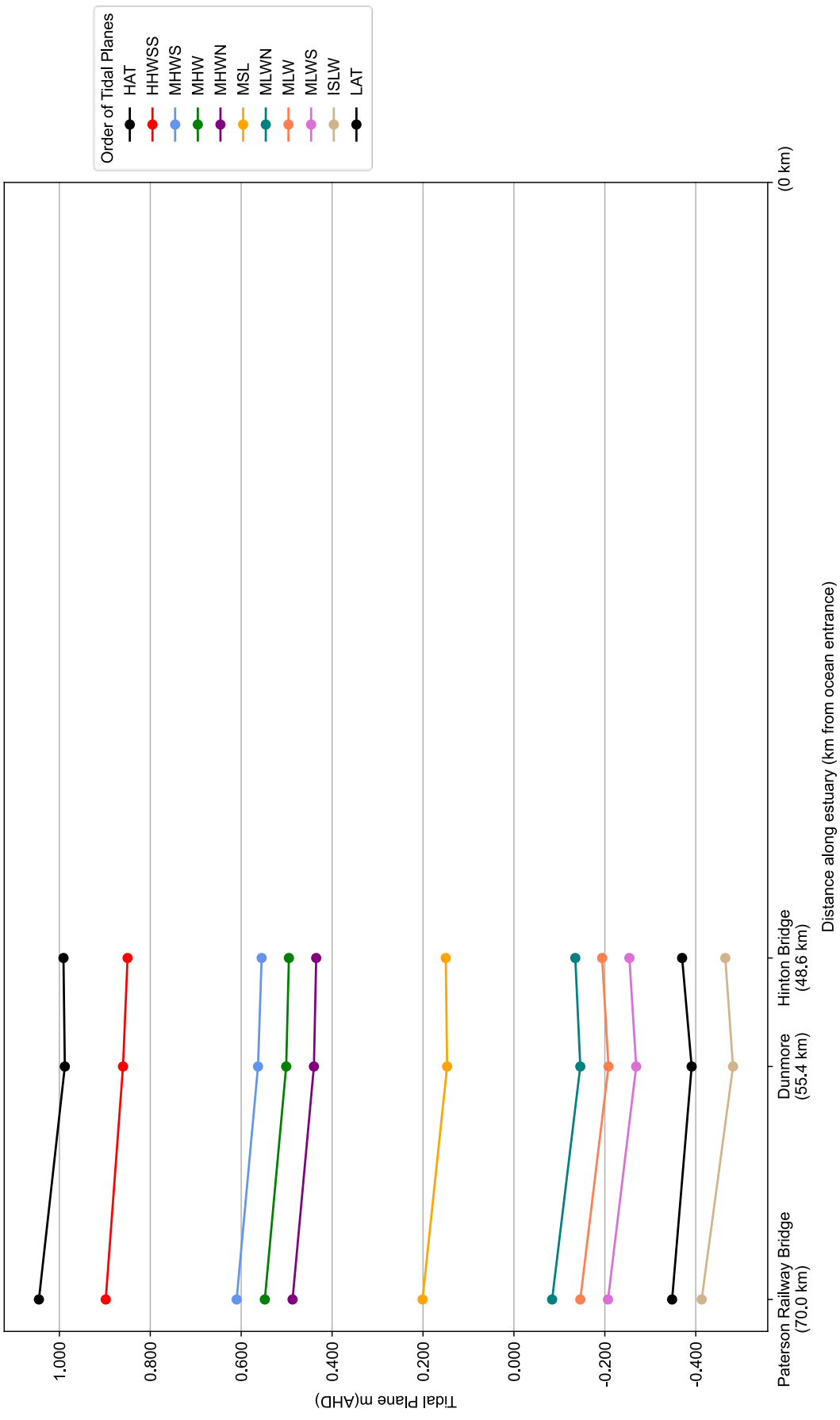
Figure

5-9

5_09_Tweed.pptx



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PATERSON RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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Figure
5-10

5_10_Pater.pptx

* Distance from the ocean entrance where Swansea Channel opens to the lake, no monitoring station, tidal planes results are assumed.

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LAKE MACQUARIE
LONGITUDINAL TIDAL PLANE RESULTS

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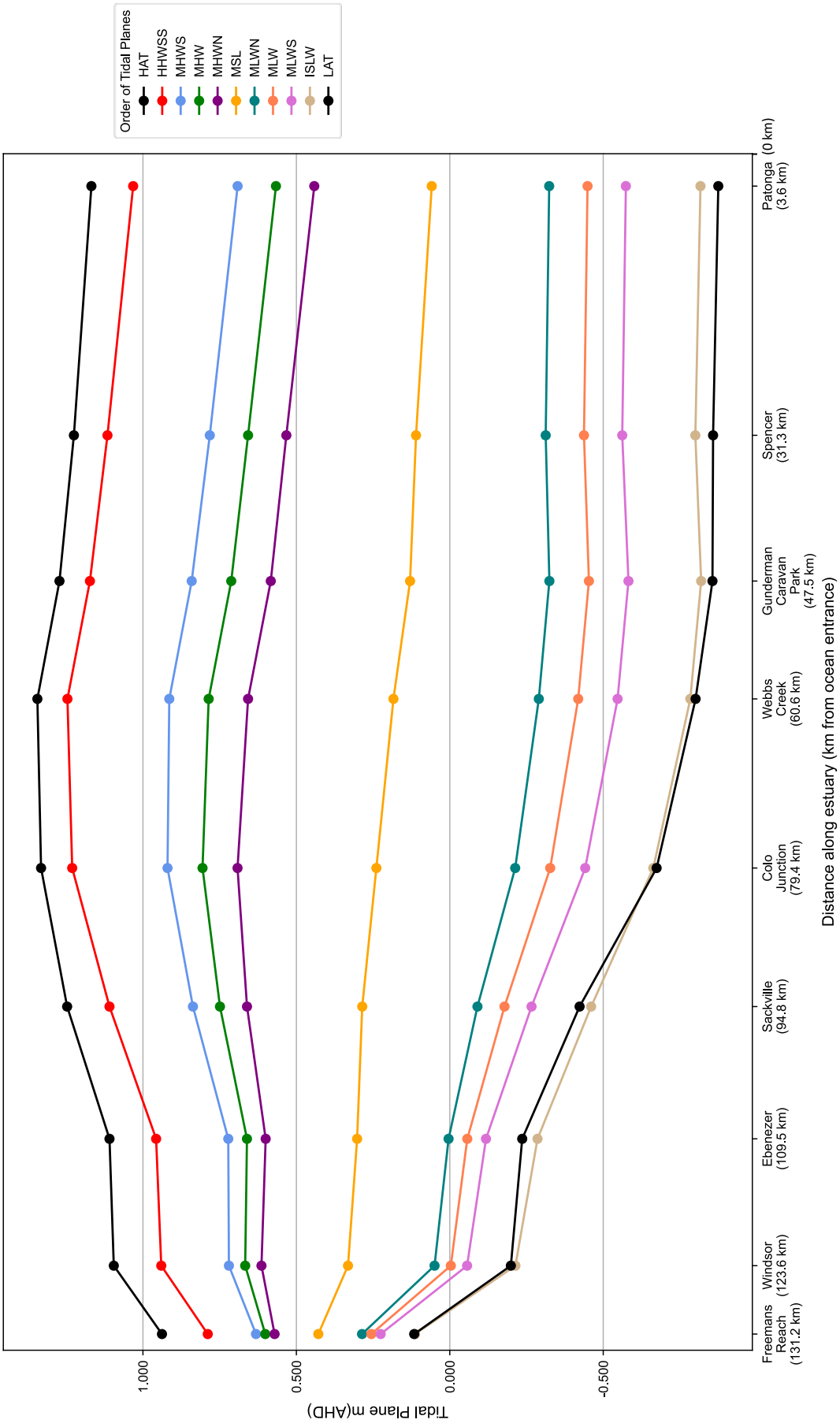
Figure
5-11

5_11_LakeM.pptx



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HAWKESBURY RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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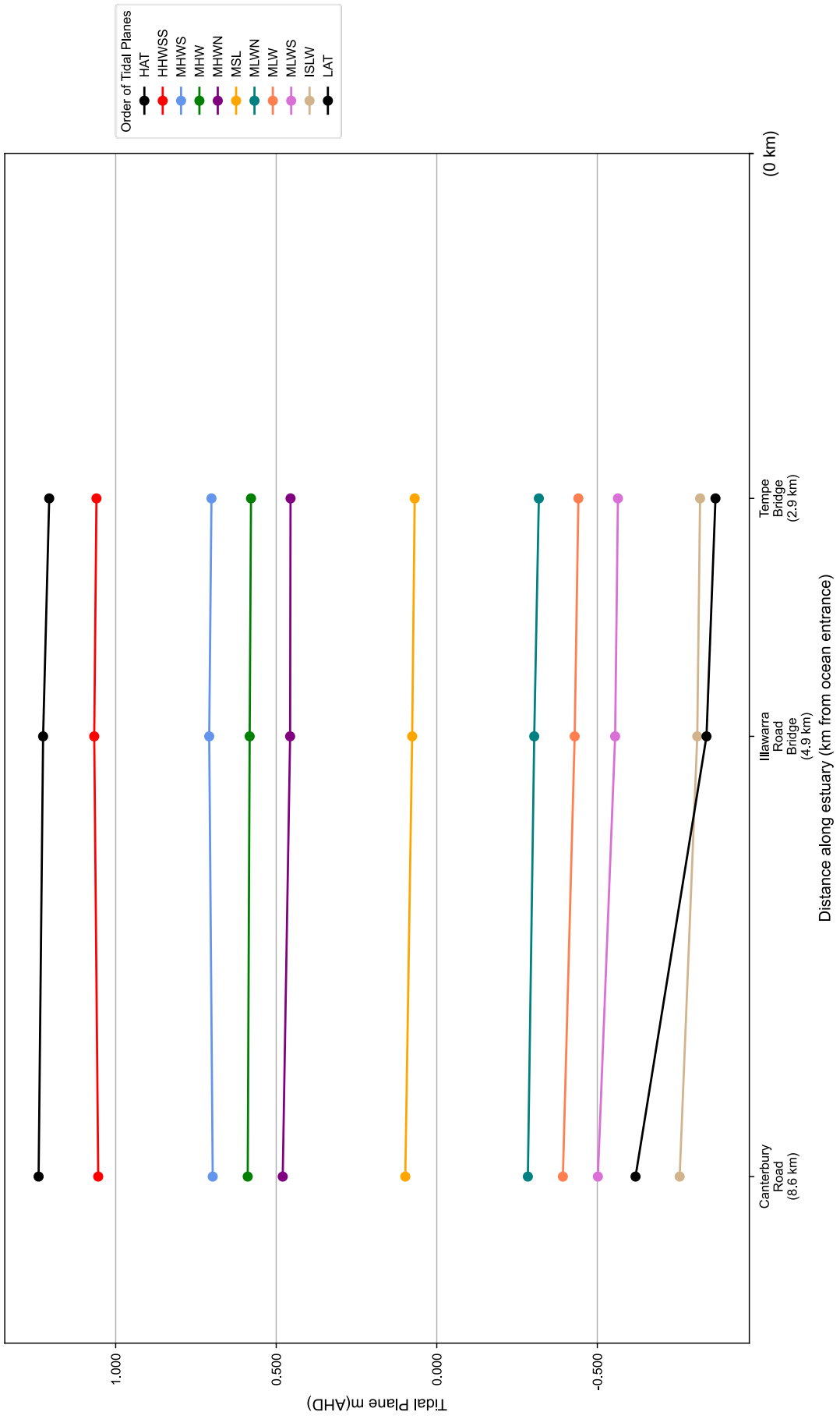
Report MHL2786
Figure
5-12

5_12_Hawke.pptx



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COOKS RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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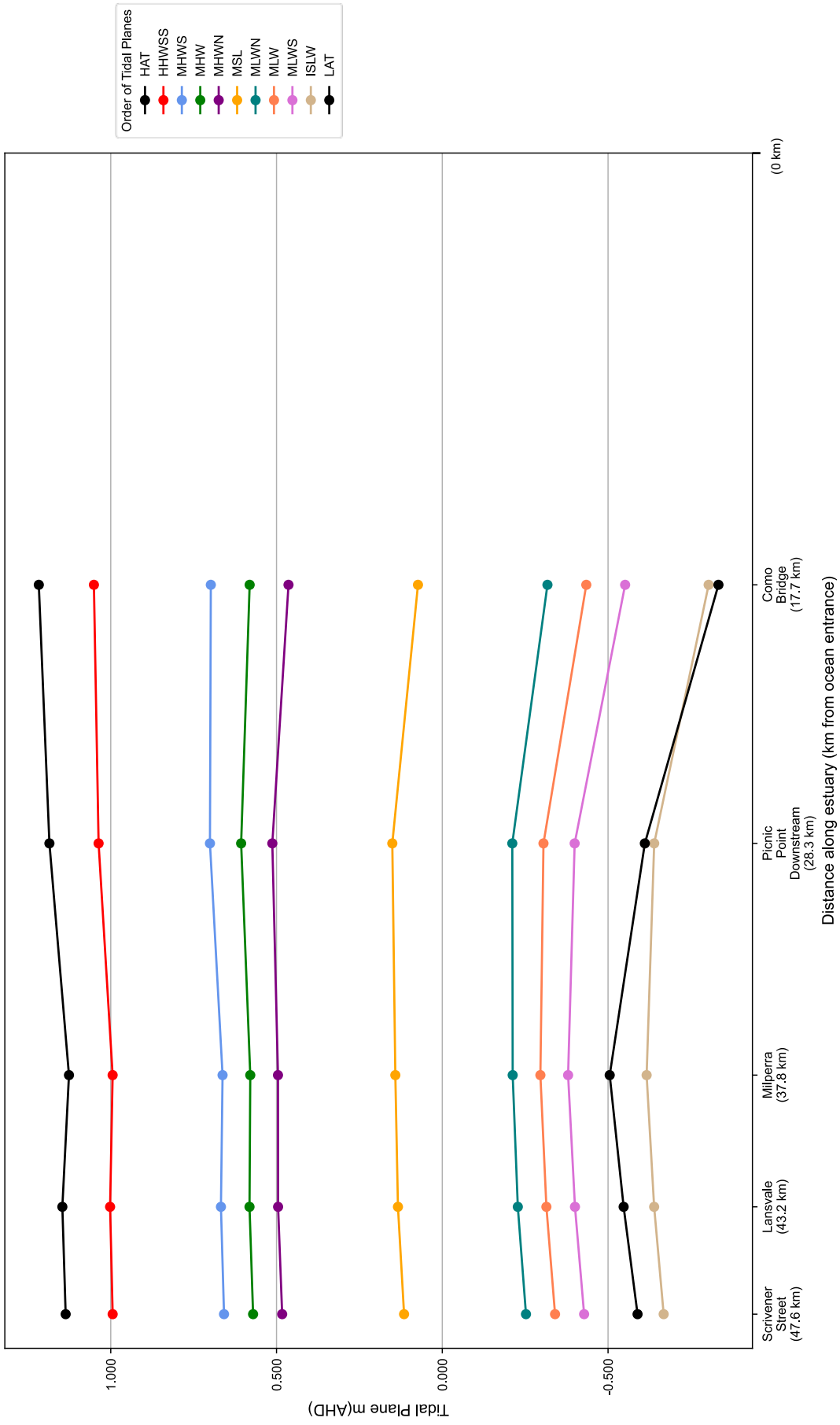
Figure

5-13

5_13_Cooks.pptx



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GEORGES RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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Figure

5-14

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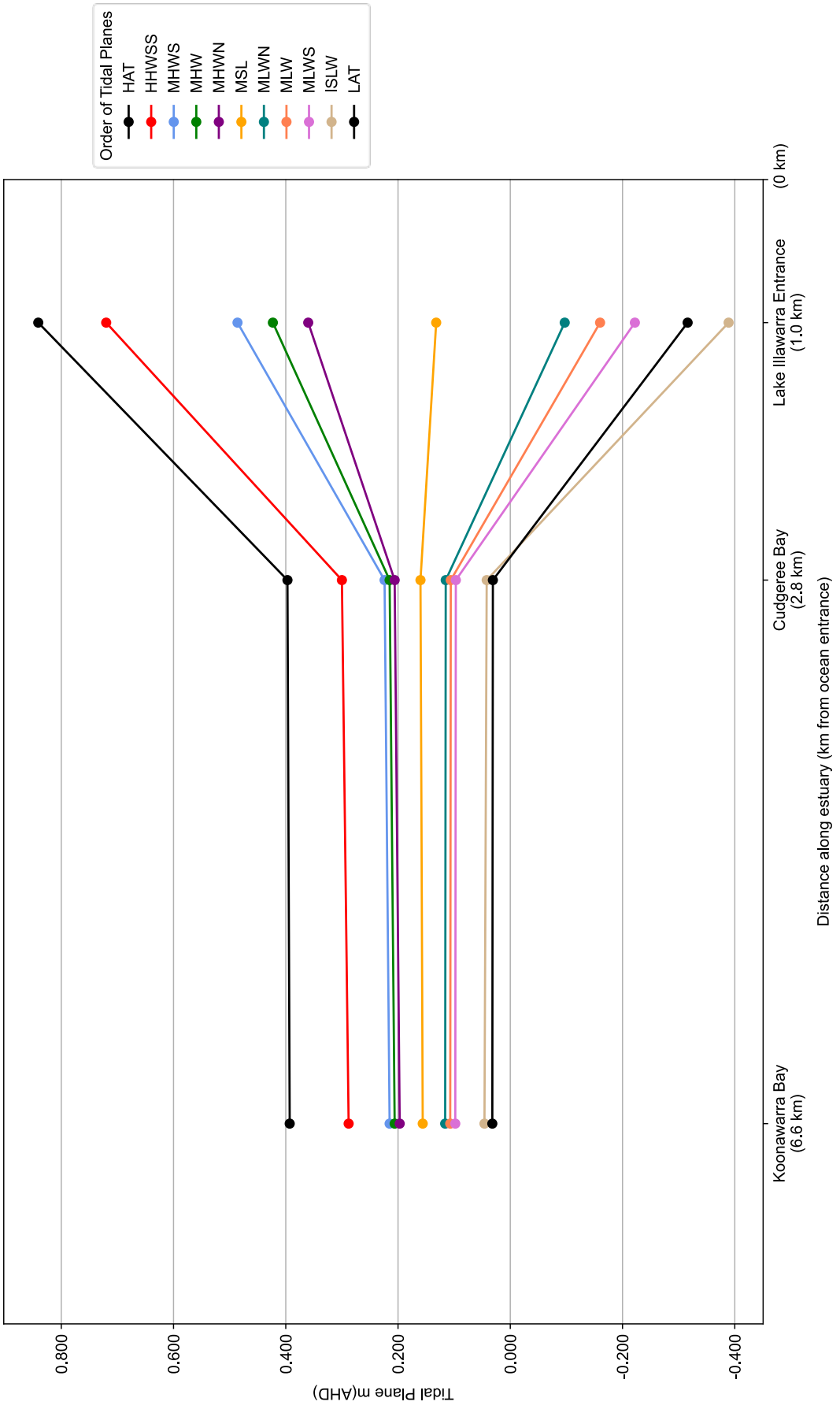

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LAKE ILLAWARRA
LONGITUDINAL TIDAL PLANE RESULTS

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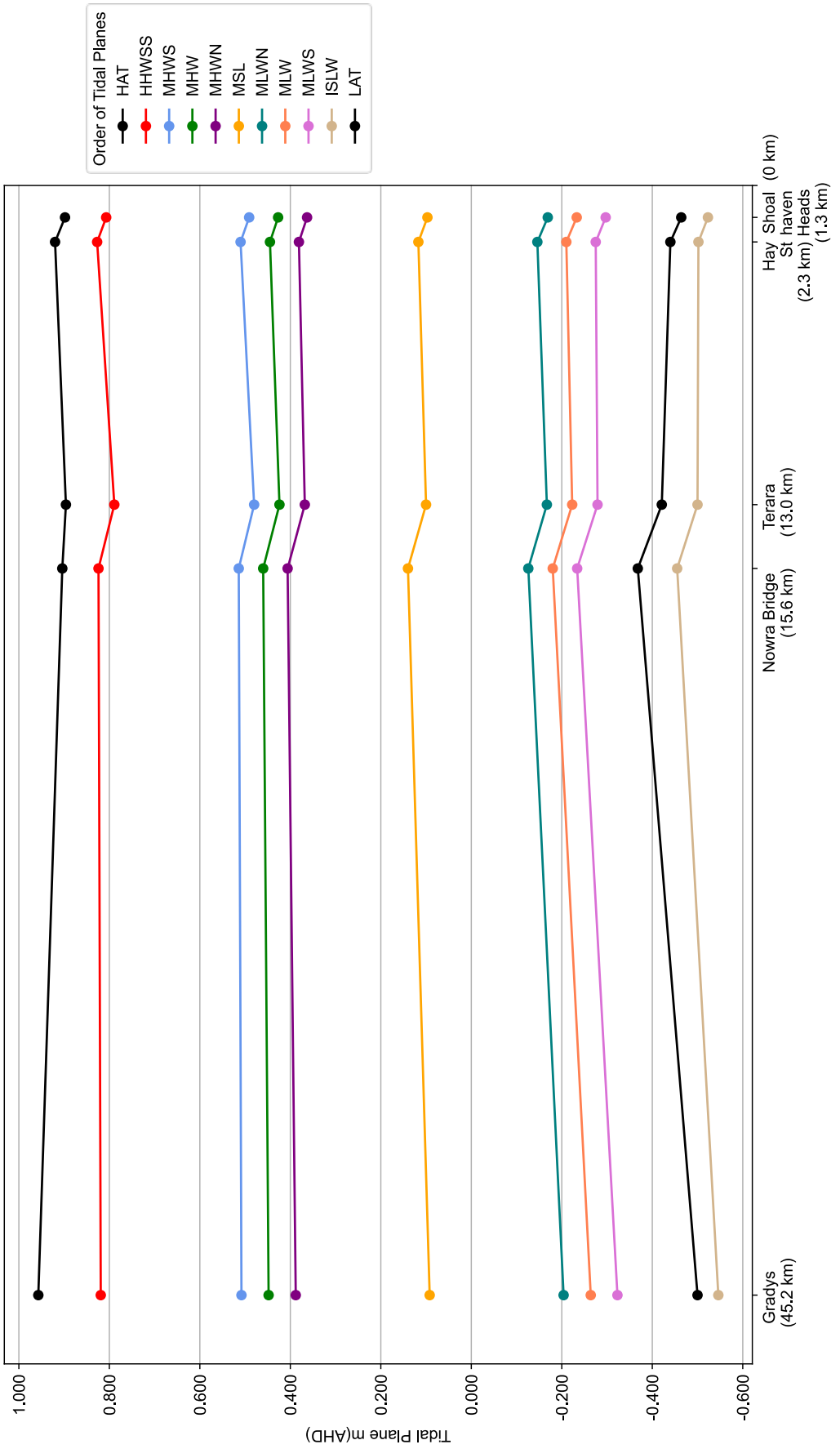
Figure

5-15

5_15_LakeIll.pptx



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SHOALHAVEN RIVER
LONGITUDINAL TIDAL PLANE RESULTS

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Report MHL2786
Figure
5-16

5_16_Shoalh.pptx

6 Discussion and limitation of results

As described in the Australian Tides Manual (TSLWG, 2021), the purpose of tidal analysis is to represent water level time series by a set of harmonics, or sine waves, each of them having a specific amplitude and phase. The set of amplitudes and phases is known as the tidal constants (or constituents). The National Tide Centre of the Bureau of Meteorology (NTC), which publishes the Australian National Tide Tables, undertakes analysis based on the method outlined in (Murray, 1964). It is noted that the harmonic analysis adopted by MHL after (Foreman, 1977) differs from the NTC method by the definitions of harmonic constants, which limits direct comparison with the constants published by NTC. Irrespective of the harmonic method adopted, the four major constituents shown in Table 4-1 can be used to classify the tidal character of a station.

6.1 Non-astronomical influences

Key physical and hydrodynamic factors which can influence coastal water levels are numbered below for discussion.

1. Shelf waves and seiches
2. Steric effects
3. Coastal trapped waves
4. Barometric (baroclinic) effects
5. Wind stress
6. Wave setup
7. Ocean currents
8. Tsunamis
9. Bathymetric effects in estuaries and embayments
10. Hydrologic input
11. Long-term sea level changes
12. Geomorphic changes

As these factors are not constant over time and have varying periods, coastal water levels will respond differently to these non-astronomical forces during progressive tidal cycles. The significant hydrologic inputs (10) are predominantly excluded from the analysis by removing them from the data sets, refer to section 3. Any sea level changes (11) that occurred in the 2001 – 2020 recorded water level will be incorporated in the harmonic analysis prediction, though projected sea level changes that have varying rates of rise/fall beyond 2020 are not reflected in the HAT and LAT result. The uncertainty associated with removal of hydrologic inputs is discussed in Appendix C .

The harmonic analysis methods adopted in this report are effective in filtering out influences that do not behave in a periodic or harmonic manner. However, some non-astronomic factors

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may be characterised by cyclic systems (items 1-8 above) that may affect the derivation of tidal constituents. The presence of such non-astronomical influences can have a corrupting effect on the results of tidal harmonic analysis. For example, some of the non-tidal ocean dynamics are often associated with turbulence and are not strictly periodic, but can represent spectral power at tidal frequencies, persist for long periods and impact the apparent mean sea level as described by Taylor et al (Taylor, 2010). Most of these effects are difficult to estimate and hence correct or exclude from the observations. Fortunately, these effects typically represent a relatively small contribution to the total water level variability since the tidal signal is usually dominant.

Bathymetric effects (9) are problematic, as changes to entrance conditions in coastal estuaries and embayments can significantly affect the magnitude and phasing of tidal signals. Where such changes have occurred in periods shorter than one year, the reported annual tidal planes represent an average only of the changing tidal conditions in these systems. Tidal lagoons and lakes, for example, may experience vastly different tidal influence before and after an entrance scouring flood event. Similarly, anthropogenic influences such as river or entrance bar dredging and increased hydrologic inputs from urbanisation during the analysis period would be expected to influence the resulting tidal planes.

The annual tidal analysis results for stations characterised by unstable entrance conditions (particularly ICOLLs) should be treated as representative of average conditions for a particular year. Large changes in tidal plane results from year-to-year are further indicative of unstable hydrodynamic conditions. For these stations, it may be more representative to derive the major tidal constituents on a month-by-month rather than year-by-year basis.

The lunisolar synodic tidal constituent (M_{sf}) becomes important in coastal lakes and lagoons characterised by shallow entrance conditions where frictional resistance during inflowing flood tides is less than during neap tides, resulting in a fortnightly setup/setdown (‘pumping’) in mean water levels. This effect may be confounded by dynamic or unstable entrance conditions and hence may not necessarily follow a regular cycle. This makes the characterisation of tidal planes difficult and misleading when using standard methods. A plot of the major constituents and M_{sf} (see Figure 6-1) for a range of sites progressing upstream at Lake Illawarra shows that the M_{sf} constituent plays an increasing role in water levels upstream.

The above discussion highlights some of the limitations of the traditional harmonic approach to decompose water level observations into tidal and non-tidal components. While some further refinement and alternative methodologies may be employed in future harmonic analysis to add greater insights and application to the tidal analysis results, it is important to note that accurate prediction of total water levels (including non-tidal components) will remain a limitation until analytical numerical prediction models are vastly improved. It is encouraging that recent ocean prediction systems founded on numerical ocean general circulation models and data assimilation include a broader spectrum of ocean processes and driving forces than previously possible, including baroclinic phenomena, coastally impinging boundary currents and eddies, and seasonal and interannual variations of heat and salinity (Taylor, 2010).

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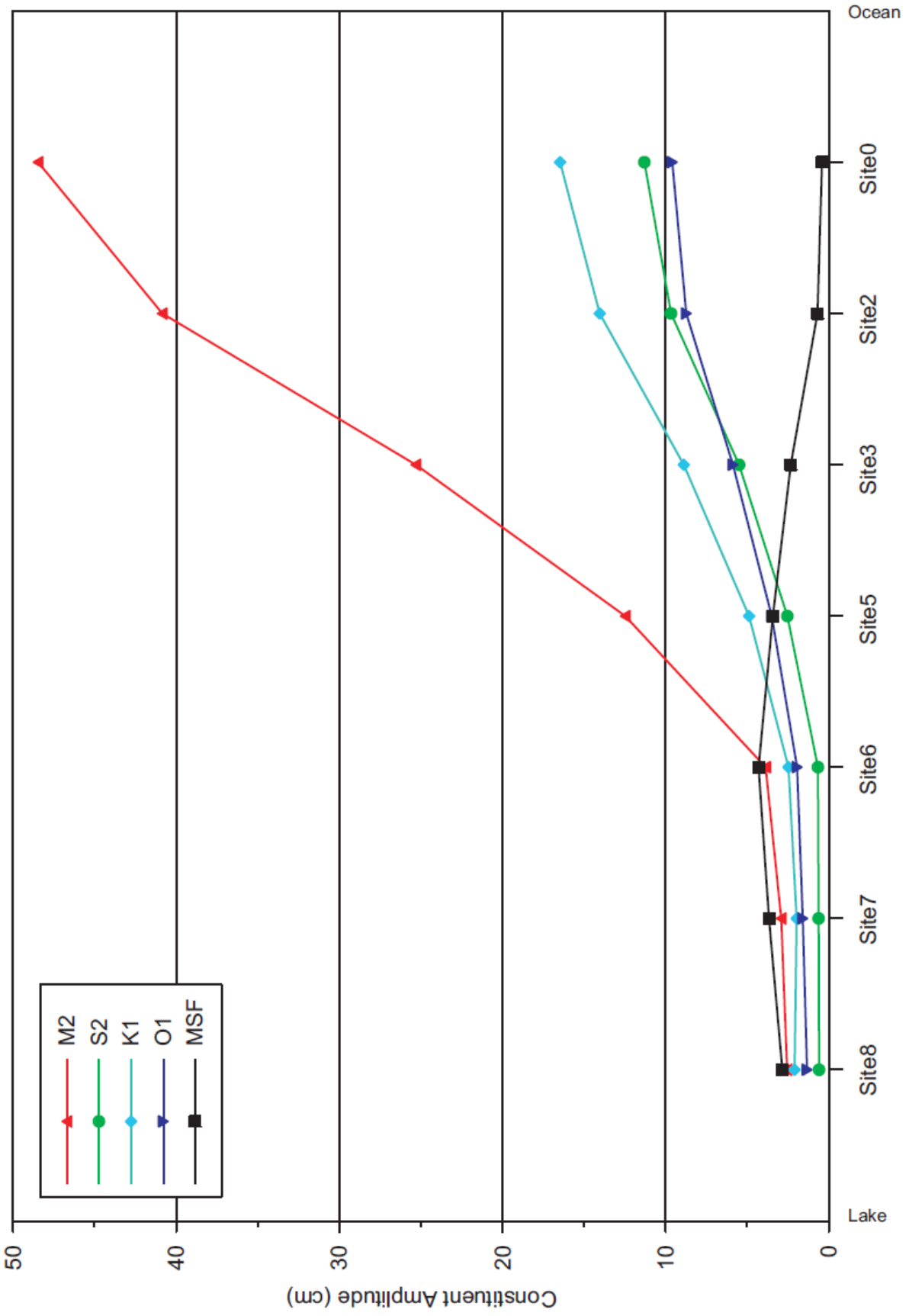

Source: MHL Report 1826, 2009

NSW GOVERNMENT

PLOT OF MAJOR TIDAL CONSTITUENTS AND M_{SF}
LAKE ILLAWARRA

Manly Hydraulics Laboratory

Report MHL2786
Figure
6-1

Figure6-1.pptx

7 Conclusions and recommendations

This report, commissioned by BCD, presents tidal plane analyses and highest and lowest astronomical tides (HAT/LAT) calculated from data collected by MHL from automatic water level monitoring stations along the coast of NSW. Tidal planes, tidal ranges, constituent amplitudes and phases and HAT/LAT values are presented for a period of 19 financial years nominally from 1 July 2001 to 30 June 2020 inclusive.

This report updates and extends the 20-year analysis of tidal planes undertaken from 1 July 1990 to 30 June 2010 (MHL, 2012) and includes a number of new monitoring stations commissioned since the earlier report.

The tidal behaviour of river and estuary locations is constantly changing and is affected by a number of dynamic influences. Hence the tidal planes presented in this report may vary with time as a result of changing hydrodynamic and meteorological conditions.

The annual analysis method is used for upstream river and estuary, harbour entrance and offshore stations. Where the entrance conditions are strongly dynamic such as for ICOLLs the annual harmonic analysis results may not be representative of the range of tidal conditions experienced throughout the year, but rather represent an average of those conditions for a particular year. For these locations it is recommended that harmonic analysis be performed over shorter periods, three months or one month for example, and the variability of the main tidal constituents be investigated.

Sensitivity analysis of the tidal planes and HAT/LAT values derived after removal of non-tidal water level variations from the tidal observations has been undertaken to assess the most appropriate automated removal technique. It is recommended that the selected removal technique (hindcast residual with a 0.2m threshold) is used to prepare water level data for future tidal planes analysis. This method allows a consistent and repeatable approach to the removal of non-tidal water level variations.

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Appendix A Tidal plane analysis results

Results of the tidal plane and HAT/LAT analyses are presented from north to south in Tables A2 to A232.

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Station	Table/figure no.
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Bellambi Lake at Bellambi	*
Towradgi Creek at Towradgi Creek Upstream	*
Towradgi Creek at Towradgi Creek Downstream	*
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Fairy Creek at Fairy Creek Upstream	*
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Byarong Creek at Byarong Creek	*
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Wonboyn Lake at Wonboyn Lake	A232

*Stations excluded from analysis due to insufficient tidal influence.

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OCEAN TIDE GAUGE NETWORK

Manly Hydraulics Laboratory

Report MHL2786

Figure A1

DRAWING A1.PDF

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NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed Heads Offshore

RECORDING STATION: **Tweed Heads Offshore (Tasman Sea)**
DATUM: APPROXIMATE MEAN SEA LEVEL
AWRC #: 201450

ZONE: 56
EASTING: 558309
NORTHING: 6882591

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.069	1.069	1.076	1.077	1.096	1.074	1.128	1.129	1.143	1.140	1.112	1.076	1.062	1.056	1.028	1.043	1.043	1.044	1.043	1.079	0.036
MHWS	0.709	0.696	0.689	0.676	0.679	0.639	0.672	0.661	0.669	0.676	0.661	0.658	0.674	0.692	0.683	0.704	0.704	0.700	0.694	0.681	0.018
MHW	0.554	0.542	0.532	0.520	0.524	0.485	0.518	0.505	0.513	0.522	0.506	0.501	0.520	0.538	0.530	0.550	0.551	0.546	0.542	0.526	0.019
MHWN	0.399	0.388	0.375	0.364	0.369	0.330	0.363	0.349	0.357	0.367	0.351	0.344	0.367	0.384	0.378	0.396	0.397	0.392	0.389	0.371	0.020
MSL	0.003	-0.007	-0.006	-0.009	0.006	-0.029	0.007	-0.003	0.000	0.002	-0.011	-0.019	-0.011	-0.001	-0.018	0.004	-0.006	-0.008	-0.009	-0.006	0.009
MLWN	-0.393	-0.402	-0.386	-0.382	-0.356	-0.388	-0.349	-0.355	-0.356	-0.362	-0.373	-0.383	-0.389	-0.386	-0.413	-0.388	-0.409	-0.408	-0.407	-0.383	0.020
MLW	-0.548	-0.556	-0.544	-0.538	-0.511	-0.542	-0.503	-0.511	-0.512	-0.517	-0.528	-0.540	-0.543	-0.541	-0.565	-0.542	-0.563	-0.562	-0.560	-0.538	0.019
MLWS	-0.703	-0.710	-0.701	-0.694	-0.666	-0.697	-0.658	-0.667	-0.668	-0.672	-0.683	-0.697	-0.697	-0.695	-0.718	-0.696	-0.716	-0.716	-0.713	-0.693	0.019
ISLW	-0.960	-0.977	-0.977	-0.981	-0.964	-1.007	-0.984	-1.001	-1.007	-1.003	-1.005	-0.995	-0.974	-0.955	-0.964	-0.938	-0.958	-0.961	-0.962	-0.978	0.021
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.792	0.790	0.761	0.747	0.726	0.718	0.712	0.704	0.713	0.729	0.724	0.727	0.756	0.770	0.790	0.784	0.805	0.800	0.796	0.755	0.035
MR	1.103	1.098	1.075	1.059	1.035	1.027	1.021	1.016	1.025	1.038	1.034	1.041	1.064	1.078	1.096	1.092	1.113	1.108	1.102	1.064	0.034
MSR	1.413	1.406	1.390	1.370	1.345	1.336	1.330	1.327	1.337	1.348	1.344	1.355	1.371	1.387	1.402	1.400	1.421	1.416	1.408	1.374	0.032
R	2.029	2.046	2.054	2.058	2.059	2.081	2.112	2.130	2.150	2.143	2.117	2.071	2.036	2.011	1.992	1.981	2.001	2.005	2.005	2.057	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.551	0.549	0.538	0.529	0.518	0.513	0.510	0.508	0.512	0.519	0.517	0.520	0.532	0.539	0.548	0.546	0.557	0.554	0.551	0.532	0.017
S2	0.155	0.154	0.157	0.156	0.155	0.155	0.155	0.156	0.156	0.155	0.155	0.157	0.154	0.154	0.153	0.154	0.154	0.154	0.153	0.155	0.001
K1	0.168	0.172	0.179	0.184	0.190	0.194	0.202	0.208	0.210	0.206	0.201	0.190	0.179	0.170	0.162	0.159	0.160	0.160	0.162	0.182	0.018
O1	0.089	0.094	0.097	0.102	0.108	0.117	0.124	0.126	0.129	0.125	0.121	0.108	0.098	0.090	0.085	0.083	0.082	0.086	0.087	0.103	0.017
MSF	0.012	0.007	0.016	0.012	0.019	0.015	0.010	0.019	0.010	0.012	0.014	0.015	0.005	0.015	0.007	0.008	0.009	0.007	0.002	0.011	0.005
z0	0.003	-0.007	-0.006	-0.009	0.006	-0.029	0.007	-0.003	0.000	0.002	-0.011	-0.019	-0.011	-0.001	-0.018	0.004	-0.006	-0.008	-0.009	-0.006	0.009
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	343.941	344.312	344.741	345.373	345.341	344.426	343.844	342.251	341.557	340.762	339.967	339.665	339.758	339.907	340.365	341.337	342.353	342.912	343.318	342.428	1.994
S2	249.689	248.878	249.349	249.353	249.398	249.607	250.042	249.079	249.619	250.125	249.259	249.306	249.342	249.200	250.014	249.025	249.669	249.081	249.315	249.439	0.352
K1	147.224	148.972	149.963	148.847	148.319	147.190	144.813	141.441	138.342	134.568	131.625	130.027	128.503	130.346	132.474	136.596	139.911	142.630	146.434	140.433	7.441
O1	205.525	203.522	203.431	202.805	203.745	204.846	206.656	209.507	214.130	220.525	225.861	228.220	229.007	225.897	221.257	216.994	211.837	208.378	204.955	213.005	9.413
MSF	300.349	262.566	11.064	322.065	53.853	123.582	250.179	124.529	286.716	188.854	228.449	70.960	331.372	34.806	35.476	2.800	56.865	305.897	89.742	162.112	118.365
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.095	0.071	0.079	0.075	0.090	0.060	0.074	0.076	0.083	0.068	0.092	0.076	0.087	0.071	0.073	0.067	0.077	0.073		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.0	89.6	98.3	95.5	95.5	97.1	94.6	96.3	97.3	96.4	98.5	94.0	98.2	95.1	98.6	97.7	97.5	96.9	98.5		

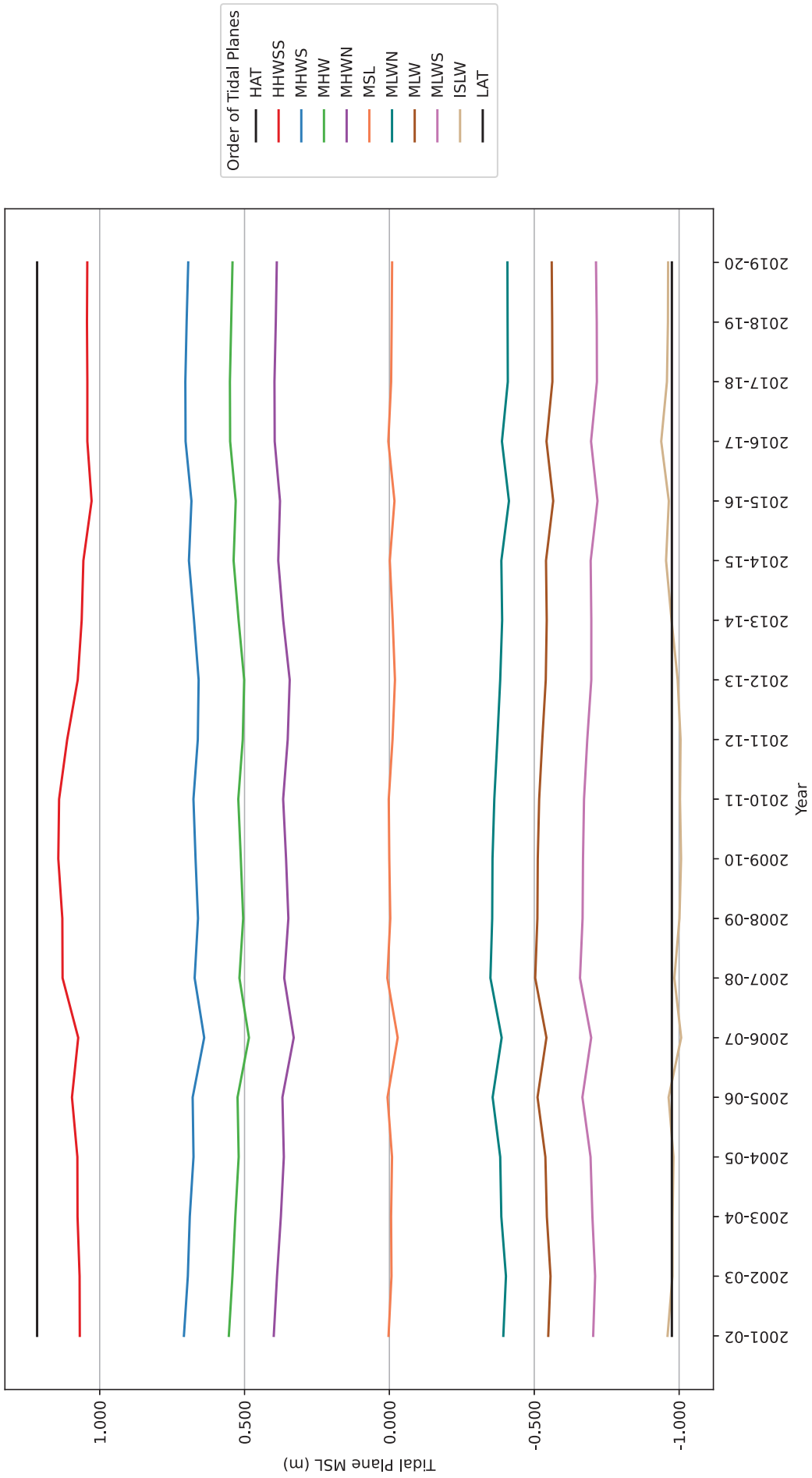
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.22	03/07/2004 21:00	±0.30	3.5
Lowest Astronomical Tide (LAT)	-0.97	28/10/2015 02:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A2

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed Heads Offshore

MHL2786

Figure A2

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tweed River at Tweed Entrance South

RECORDING STATION: **Tweed River at Tweed Entrance South**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201472

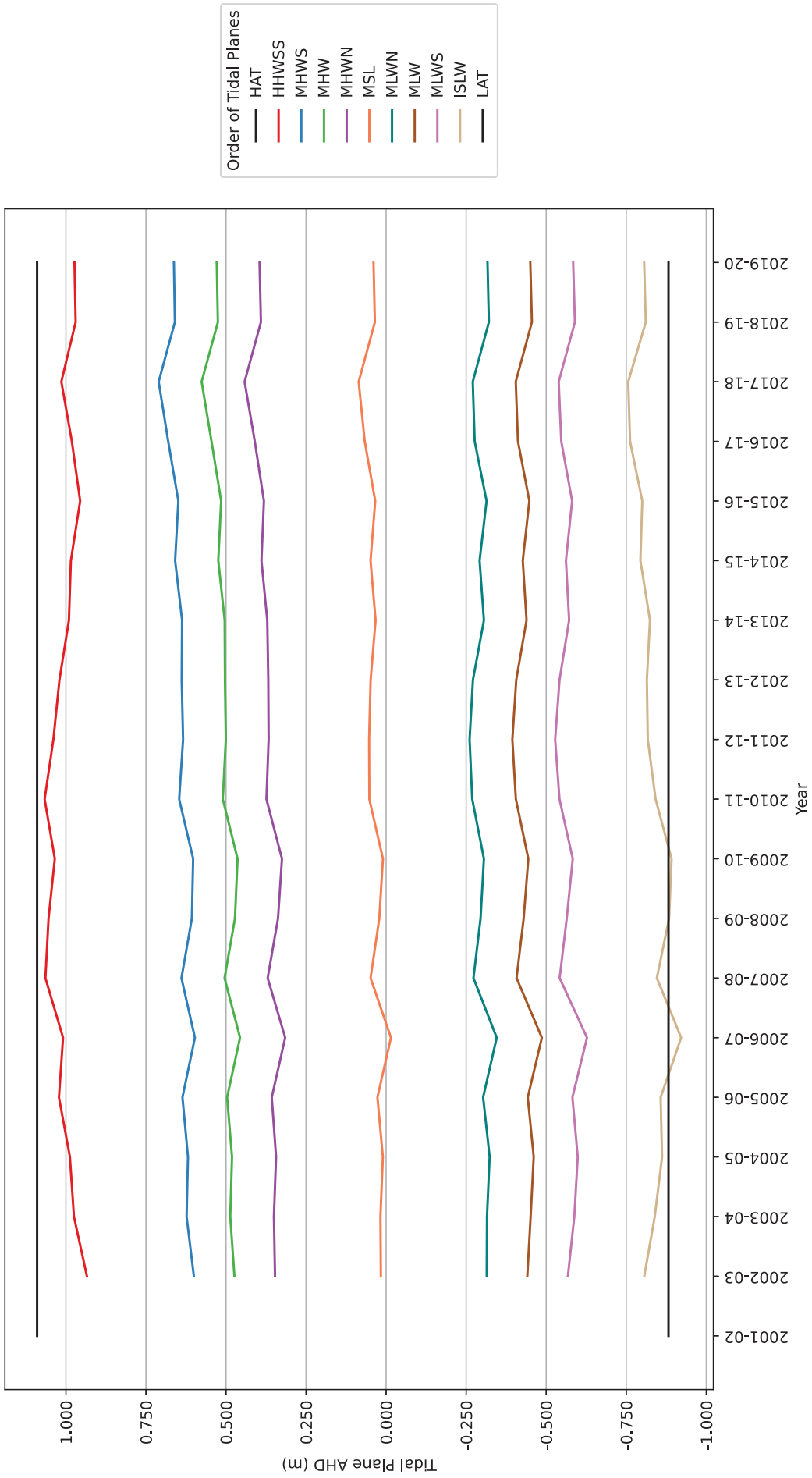
ZONE: 56
EASTING: 554109
NORTHING: 6883772

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.934	0.975	0.988	1.022	1.009	1.064	1.054	1.035	1.067	1.039	1.020	0.991	0.985	0.956	0.982	1.014	0.970	0.973	1.004	0.038
MHWS		0.600	0.623	0.619	0.636	0.597	0.639	0.607	0.603	0.646	0.634	0.638	0.637	0.659	0.649	0.681	0.710	0.660	0.663	0.639	0.029
MHW		0.474	0.487	0.481	0.497	0.456	0.505	0.472	0.464	0.510	0.501	0.503	0.504	0.524	0.515	0.545	0.576	0.525	0.529	0.504	0.030
MHWN		0.347	0.350	0.344	0.357	0.315	0.370	0.338	0.325	0.374	0.367	0.368	0.371	0.389	0.382	0.410	0.442	0.391	0.395	0.369	0.031
MSL		0.016	0.018	0.010	0.027	-0.015	0.049	0.021	0.010	0.052	0.053	0.048	0.033	0.049	0.034	0.067	0.086	0.035	0.039	0.035	0.024
MLWN		-0.314	-0.315	-0.323	-0.303	-0.345	-0.273	-0.295	-0.305	-0.269	-0.261	-0.271	-0.306	-0.292	-0.314	-0.277	-0.271	-0.321	-0.317	-0.298	0.024
MLW		-0.441	-0.451	-0.461	-0.442	-0.486	-0.407	-0.430	-0.444	-0.405	-0.394	-0.406	-0.439	-0.427	-0.447	-0.412	-0.405	-0.455	-0.450	-0.434	0.024
MLWS		-0.568	-0.588	-0.599	-0.582	-0.627	-0.542	-0.564	-0.583	-0.542	-0.528	-0.542	-0.572	-0.562	-0.581	-0.547	-0.539	-0.590	-0.584	-0.569	0.026
ISLW		-0.806	-0.839	-0.862	-0.857	-0.922	-0.846	-0.884	-0.892	-0.842	-0.817	-0.814	-0.824	-0.794	-0.800	-0.762	-0.756	-0.811	-0.806	-0.830	0.043
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.661	0.665	0.667	0.660	0.661	0.643	0.633	0.631	0.643	0.628	0.639	0.677	0.681	0.695	0.687	0.713	0.712	0.712	0.667	0.028
MR		0.915	0.938	0.942	0.939	0.943	0.912	0.902	0.908	0.915	0.895	0.910	0.943	0.951	0.963	0.957	0.981	0.981	0.979	0.937	0.028
MSR		1.168	1.211	1.217	1.218	1.225	1.181	1.171	1.186	1.188	1.162	1.180	1.209	1.221	1.230	1.228	1.249	1.249	1.247	1.208	0.029
R		1.741	1.814	1.849	1.879	1.931	1.910	1.938	1.926	1.908	1.856	1.835	1.815	1.779	1.756	1.744	1.770	1.781	1.779	1.834	0.068
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.457	0.469	0.471	0.470	0.471	0.456	0.451	0.454	0.458	0.447	0.455	0.471	0.475	0.481	0.479	0.491	0.490	0.490	0.469	0.014
S2		0.127	0.136	0.138	0.139	0.141	0.135	0.135	0.139	0.136	0.134	0.135	0.133	0.135	0.134	0.135	0.134	0.134	0.134	0.135	0.003
K1		0.153	0.163	0.170	0.178	0.185	0.189	0.203	0.192	0.188	0.180	0.174	0.164	0.154	0.145	0.143	0.145	0.145	0.147	0.168	0.019
O1		0.085	0.088	0.094	0.098	0.109	0.115	0.117	0.117	0.112	0.109	0.099	0.088	0.079	0.074	0.072	0.072	0.076	0.075	0.093	0.017
MSF		0.009	0.019	0.005	0.021	0.019	0.014	0.021	0.006	0.011	0.011	0.017	0.004	0.020	0.013	0.011	0.015	0.007	0.007	0.013	0.006
z0		0.016	0.018	0.010	0.027	-0.015	0.049	0.021	0.010	0.052	0.053	0.048	0.033	0.049	0.034	0.067	0.086	0.035	0.039	0.035	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		357.597	350.422	350.737	350.458	349.530	349.097	348.597	346.692	346.113	346.014	345.903	345.578	345.281	346.034	346.946	347.470	348.413	348.595	348.304	2.934
S2		258.974	253.961	254.090	253.490	253.944	256.183	254.318	254.022	255.039	254.841	254.696	254.713	253.962	254.653	254.638	254.197	254.425	254.206	254.686	1.219
K1		158.268	155.481	154.128	153.508	152.731	149.534	146.794	144.010	139.872	137.449	134.850	134.086	135.304	137.949	142.173	145.002	147.942	151.146	145.568	7.761
O1		213.656	210.912	209.247	209.979	211.496	212.946	216.939	220.870	226.826	230.850	234.307	236.210	233.032	227.971	222.934	216.890	214.651	211.010	220.040	9.280
MSF		114.725	15.279	302.329	62.669	124.790	244.190	138.586	352.337	176.876	230.731	64.322	280.392	38.035	48.871	33.000	71.323	19.529	54.212	131.789	107.171
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.088	0.068	0.083	0.086	0.089	0.060	0.090	0.094	0.089	0.068	0.096	0.077	0.092	0.070	0.076	0.076	0.081	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		78.0	98.5	95.6	93.1	99.1	89.0	62.8	92.5	87.4	92.2	92.3	97.7	92.7	97.6	94.1	91.1	96.4	96.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.09	04/06/2008 20:45	±0.18	4.2
Lowest Astronomical Tide (LAT)	-0.88	27/10/2011 01:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from the northern side of the entrance (AWRC: 201431) to the southern side of Tweed River entrance in May 2014.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at Tweed Entrance South

MHL2786

Figure A3

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Brunswick River at Brunswick Heads

RECORDING STATION: **Brunswick River at Brunswick Heads**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 202403

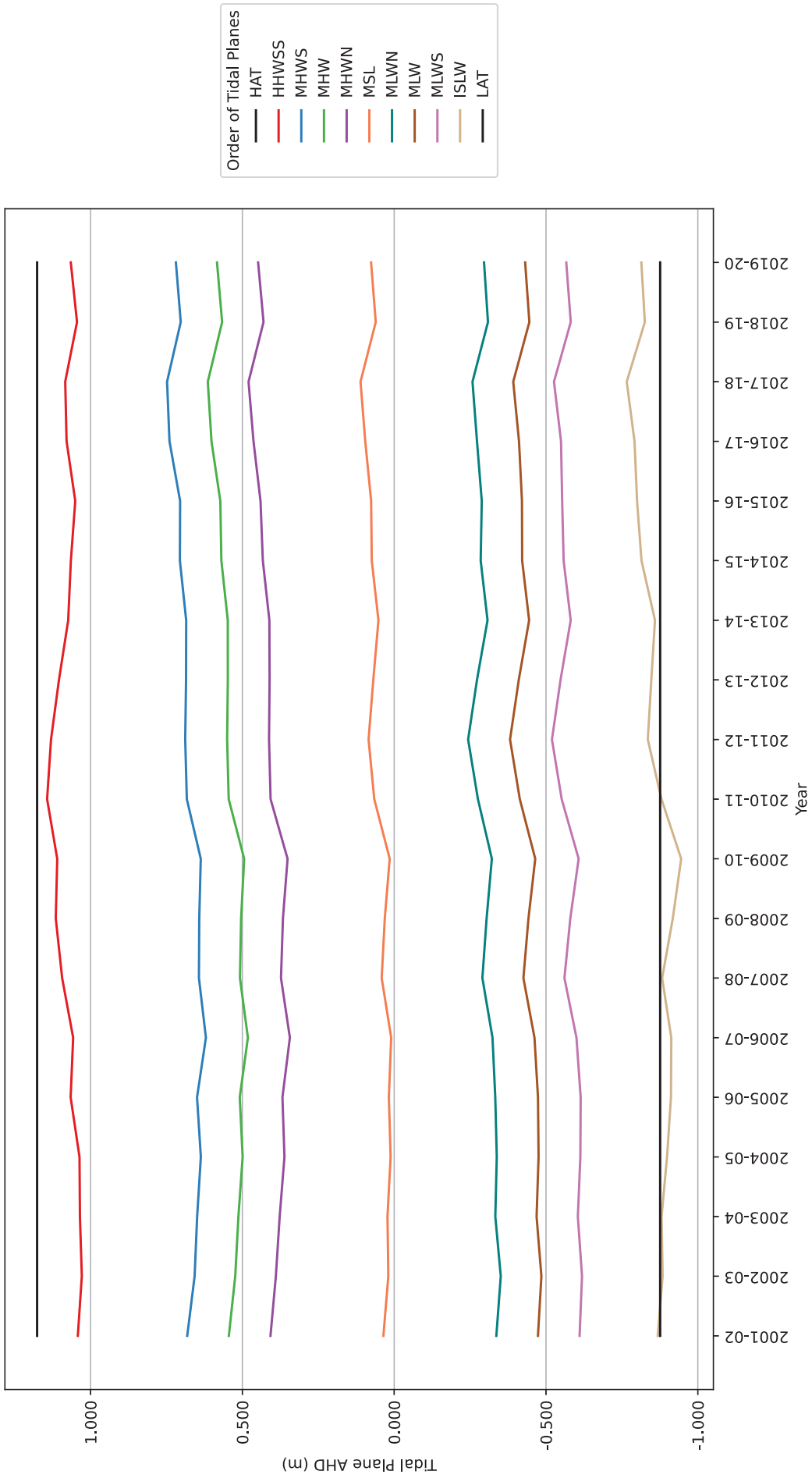
ZONE: 56
EASTING: 554078
NORTHING: 6843182

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.042	1.029	1.035	1.036	1.066	1.057	1.094	1.115	1.110	1.143	1.130	1.104	1.074	1.065	1.050	1.079	1.083	1.045	1.065	1.075	0.033
MHWS	0.682	0.657	0.649	0.637	0.649	0.620	0.643	0.642	0.637	0.683	0.688	0.685	0.685	0.706	0.705	0.740	0.748	0.703	0.719	0.678	0.037
MHW	0.544	0.523	0.513	0.499	0.509	0.482	0.508	0.504	0.494	0.545	0.550	0.548	0.548	0.569	0.573	0.602	0.614	0.567	0.583	0.541	0.038
MHWN	0.407	0.390	0.377	0.361	0.368	0.344	0.373	0.366	0.351	0.407	0.412	0.410	0.411	0.433	0.440	0.463	0.480	0.430	0.448	0.404	0.039
MSL	0.035	0.019	0.022	0.012	0.018	0.010	0.041	0.031	0.015	0.066	0.084	0.069	0.052	0.074	0.076	0.095	0.111	0.061	0.076	0.051	0.031
MLWN	-0.336	-0.351	-0.333	-0.338	-0.333	-0.324	-0.290	-0.304	-0.322	-0.276	-0.244	-0.273	-0.307	-0.285	-0.288	-0.273	-0.258	-0.309	-0.296	-0.302	0.030
MLW	-0.474	-0.485	-0.469	-0.476	-0.474	-0.462	-0.426	-0.442	-0.465	-0.414	-0.382	-0.410	-0.444	-0.421	-0.421	-0.411	-0.392	-0.445	-0.431	-0.439	0.030
MLWS	-0.611	-0.619	-0.605	-0.613	-0.614	-0.600	-0.561	-0.580	-0.608	-0.552	-0.520	-0.548	-0.581	-0.558	-0.553	-0.549	-0.526	-0.582	-0.567	-0.576	0.031
ISLW	-0.868	-0.884	-0.881	-0.899	-0.912	-0.913	-0.883	-0.918	-0.945	-0.880	-0.835	-0.847	-0.859	-0.815	-0.800	-0.792	-0.766	-0.826	-0.814	-0.860	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.744	0.741	0.710	0.699	0.701	0.667	0.663	0.671	0.673	0.683	0.656	0.683	0.719	0.717	0.729	0.736	0.738	0.739	0.744	0.706	0.031
MR	1.018	1.008	0.982	0.975	0.982	0.944	0.934	0.946	0.959	0.959	0.932	0.958	0.992	0.991	0.993	1.013	1.006	1.012	1.015	0.980	0.029
MSR	1.292	1.276	1.254	1.250	1.263	1.220	1.204	1.222	1.245	1.235	1.208	1.233	1.266	1.264	1.258	1.289	1.274	1.285	1.286	1.254	0.027
R	1.910	1.913	1.916	1.935	1.977	1.970	1.976	2.032	2.055	2.023	1.965	1.951	1.932	1.879	1.850	1.870	1.849	1.870	1.879	1.934	0.062
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.509	0.504	0.491	0.487	0.491	0.472	0.467	0.473	0.479	0.479	0.466	0.479	0.496	0.495	0.497	0.506	0.503	0.506	0.507	0.490	0.014
S2	0.137	0.134	0.136	0.138	0.141	0.138	0.135	0.138	0.143	0.138	0.138	0.138	0.137	0.137	0.132	0.138	0.134	0.136	0.135	0.137	0.002
K1	0.167	0.172	0.178	0.182	0.190	0.194	0.199	0.208	0.208	0.204	0.196	0.189	0.179	0.167	0.161	0.159	0.158	0.158	0.161	0.180	0.018
O1	0.091	0.094	0.098	0.104	0.108	0.118	0.123	0.129	0.129	0.125	0.120	0.109	0.099	0.090	0.086	0.083	0.082	0.086	0.086	0.103	0.017
MSF	0.016	0.008	0.011	0.009	0.024	0.021	0.014	0.015	0.007	0.013	0.015	0.011	0.007	0.016	0.008	0.008	0.003	0.004	0.007	0.011	0.006
z0	0.035	0.019	0.022	0.012	0.018	0.010	0.041	0.031	0.015	0.066	0.084	0.069	0.052	0.074	0.076	0.095	0.111	0.061	0.076	0.051	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	352.466	354.222	354.323	353.507	351.643	352.860	352.270	350.838	349.022	348.971	349.867	348.604	347.427	348.278	349.768	349.286	351.898	352.445	352.177	351.046	2.099
S2	260.749	261.835	261.961	260.525	255.867	260.667	262.078	260.931	259.669	261.986	262.379	260.496	260.160	260.225	261.658	259.542	262.945	261.826	260.472	260.840	1.538
K1	154.085	156.528	157.313	155.329	153.630	154.205	151.718	147.668	144.364	140.947	139.274	136.524	135.276	136.865	140.053	142.758	147.712	150.880	153.439	147.293	7.491
O1	214.563	212.336	213.268	211.257	210.839	213.298	215.479	217.920	223.536	228.804	234.478	237.670	237.954	233.788	232.334	225.117	222.557	219.120	215.859	222.115	9.445
MSF	309.506	307.411	356.732	330.420	63.086	140.683	249.996	130.394	354.160	199.799	244.208	68.364	267.256	26.199	4.287	342.944	28.515	301.272	321.010	212.960	125.242
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.098	0.070	0.080	0.071	0.090	0.066	0.104	0.104	0.087	0.065	0.092	0.077	0.088	0.070	0.075	0.074	0.082	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	94.3	82.6	97.3	97.0	77.9	89.3	95.0	78.0	86.5	88.2	89.9	92.0	97.8	92.4	94.3	93.3	89.4	95.2	95.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.18	04/06/2008 21:00	±0.19	3.3
Lowest Astronomical Tide (LAT)	-0.88	27/10/2011 01:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Brunswick River at Brunswick Heads

MHL2786

Figure A4

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Ballina Breakwall

RECORDING STATION: **Richmond River at Ballina Breakwall**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203425

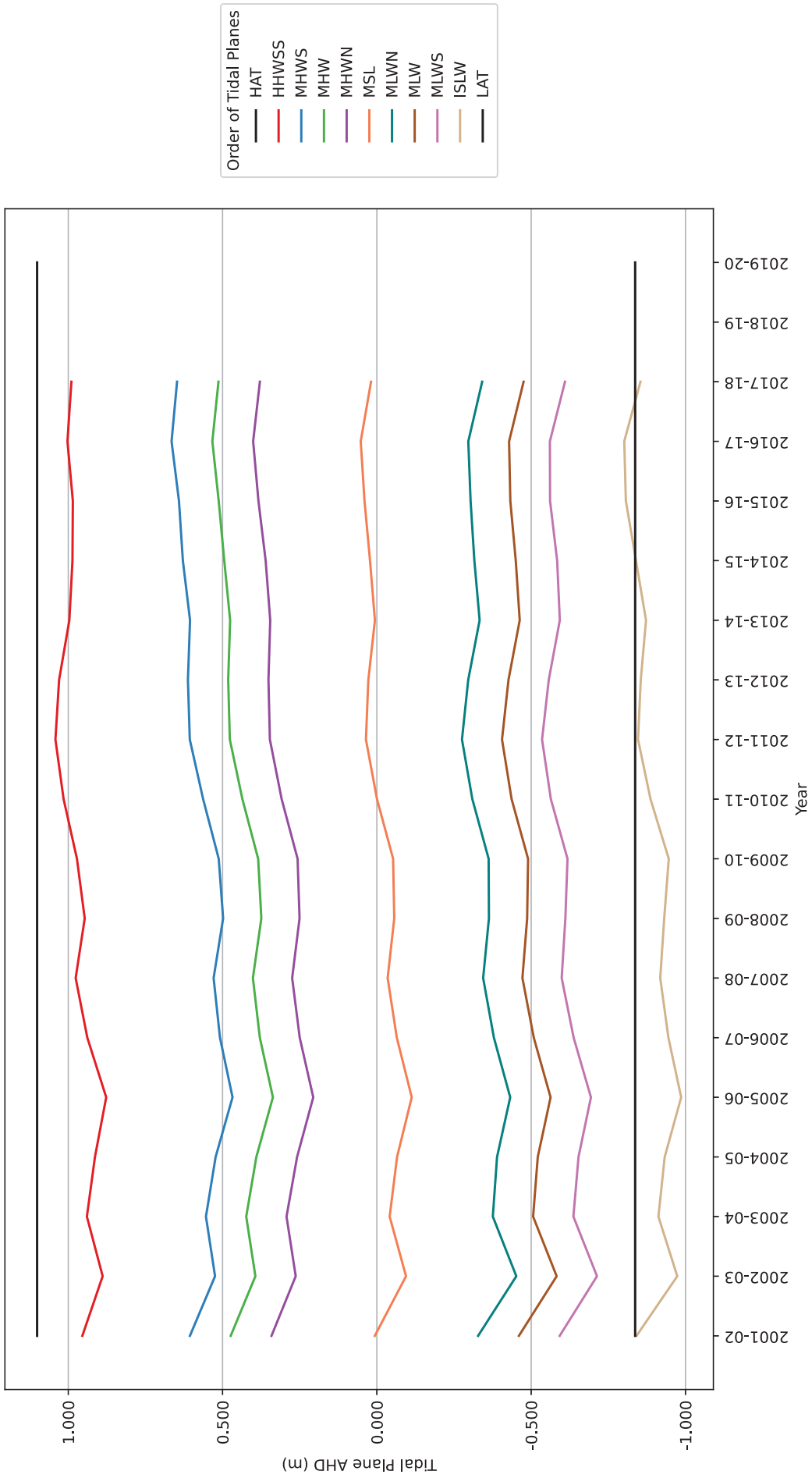
ZONE: 56
EASTING: 556992
NORTHING: 6805681

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.954	0.889	0.940	0.914	0.877	0.938	0.976	0.947	0.972	1.015	1.042	1.030	0.996	0.986	0.985	1.003	0.990		0.999	0.970	0.046
MHWS	0.606	0.524	0.554	0.522	0.468	0.508	0.529	0.498	0.512	0.563	0.606	0.612	0.605	0.629	0.641	0.665	0.647		0.652	0.575	0.062
MHW	0.474	0.394	0.423	0.390	0.337	0.379	0.402	0.374	0.385	0.436	0.476	0.482	0.475	0.495	0.512	0.533	0.513		0.521	0.445	0.060
MHWN	0.341	0.263	0.293	0.258	0.206	0.250	0.274	0.251	0.257	0.308	0.347	0.351	0.346	0.360	0.384	0.401	0.379		0.389	0.314	0.059
MSL	0.007	-0.095	-0.041	-0.065	-0.113	-0.065	-0.035	-0.056	-0.053	-0.000	0.035	0.028	0.006	0.022	0.040	0.052	0.019		0.041	-0.015	0.051
MLWN	-0.328	-0.452	-0.376	-0.389	-0.432	-0.379	-0.344	-0.363	-0.362	-0.309	-0.276	-0.296	-0.333	-0.316	-0.304	-0.296	-0.341		-0.306	-0.345	0.048
MLW	-0.460	-0.583	-0.506	-0.521	-0.563	-0.508	-0.472	-0.487	-0.490	-0.437	-0.406	-0.427	-0.463	-0.450	-0.433	-0.428	-0.475		-0.438	-0.475	0.048
MLWS	-0.592	-0.713	-0.637	-0.653	-0.694	-0.638	-0.599	-0.611	-0.618	-0.564	-0.535	-0.557	-0.593	-0.584	-0.561	-0.561	-0.610		-0.570	-0.605	0.048
ISLW	-0.841	-0.973	-0.912	-0.933	-0.986	-0.945	-0.918	-0.931	-0.946	-0.887	-0.846	-0.855	-0.872	-0.840	-0.807	-0.802	-0.854		-0.817	-0.887	0.058
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.669	0.715	0.669	0.648	0.638	0.629	0.619	0.614	0.619	0.618	0.622	0.647	0.679	0.676	0.687	0.697	0.720		0.695	0.659	0.035
MR	0.934	0.976	0.930	0.912	0.900	0.888	0.873	0.861	0.875	0.872	0.882	0.908	0.938	0.945	0.945	0.962	0.989		0.958	0.919	0.039
MSR	1.198	1.238	1.191	1.176	1.161	1.146	1.128	1.109	1.130	1.127	1.142	1.169	1.198	1.213	1.203	1.226	1.257		1.222	1.180	0.043
R	1.796	1.862	1.852	1.846	1.863	1.883	1.894	1.878	1.918	1.902	1.888	1.885	1.869	1.826	1.792	1.804	1.844		1.816	1.857	0.037
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.467	0.488	0.465	0.456	0.450	0.444	0.437	0.431	0.437	0.436	0.441	0.454	0.469	0.472	0.472	0.481	0.494		0.479	0.460	0.020
S2	0.132	0.131	0.131	0.132	0.131	0.129	0.127	0.124	0.128	0.127	0.130	0.130	0.130	0.134	0.129	0.132	0.134		0.132	0.130	0.003
K1	0.159	0.163	0.173	0.174	0.181	0.189	0.193	0.193	0.198	0.197	0.190	0.186	0.177	0.164	0.159	0.156	0.158		0.158	0.176	0.015
O1	0.090	0.097	0.102	0.105	0.112	0.118	0.126	0.128	0.130	0.126	0.121	0.113	0.102	0.092	0.086	0.085	0.086		0.090	0.106	0.016
MSF	0.015	0.007	0.013	0.013	0.014	0.016	0.011	0.017	0.011	0.012	0.016	0.009	0.006	0.017	0.011	0.009	0.014		0.007	0.012	0.003
z0	0.007	-0.095	-0.041	-0.065	-0.113	-0.065	-0.035	-0.056	-0.053	-0.000	0.035	0.028	0.006	0.022	0.040	0.052	0.019		0.041	-0.015	0.051
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	352.998	353.297	354.035	354.779	354.941	354.393	353.155	352.317	351.964	351.477	348.592	347.909	347.349	348.466	349.097	349.678	349.691		351.531	351.426	2.503
S2	262.971	260.208	262.314	261.726	261.292	262.770	262.513	263.681	263.495	264.155	260.656	259.815	260.049	259.764	258.817	259.481	259.254		260.651	261.312	1.682
K1	145.106	149.812	150.633	150.444	150.572	149.452	147.237	143.967	139.905	136.741	132.825	129.361	129.820	131.477	134.257	136.764	139.175		145.734	141.293	7.716
O1	209.944	209.004	208.684	207.321	207.476	208.349	211.723	215.192	219.865	224.018	227.913	232.380	230.014	229.967	224.238	220.743	216.735		212.734	217.572	8.753
MSF	308.165	325.447	338.210	332.869	0.590	140.128	255.911	108.696	311.650	240.088	265.652	22.151	258.889	11.911	2.818	332.465	356.105		341.994	219.652	133.256
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.084	0.105	0.084	0.079	0.086	0.105	0.082	0.104	0.091	0.095	0.063	0.091	0.082	0.092	0.070	0.072	0.061		0.066		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.3	86.4	91.8	94.4	76.1	96.8	96.4	95.8	99.0	84.4	83.0	85.7	92.7	86.5	85.7	86.8	68.8	48.4	85.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.10	04/06/2004 21:30	±0.19	2.1
Lowest Astronomical Tide (LAT)	-0.84	27/10/2011 02:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Ballina (AWRC: 203421) in May 2011.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Ballina Breakwall

MHL2786

Figure
A5

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Norfolk Island

RECORDING STATION: **Norfolk Island (North Tasman Sea)**
DATUM: LOWEST ASTRONOMICAL TIDE
AWRC #: 240401

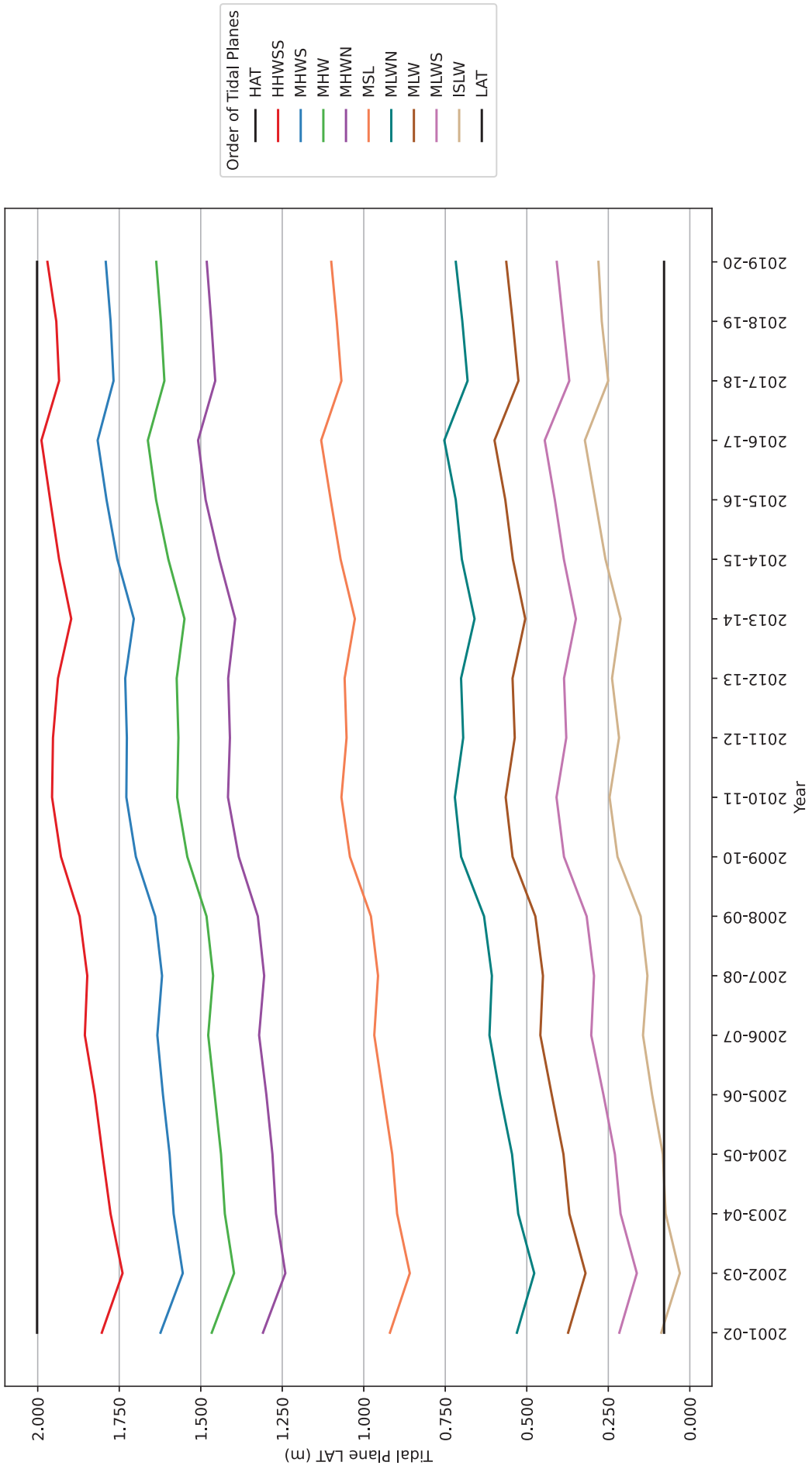
ZONE: 58
EASTING: 787557
NORTHING: 6781940

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.803	1.740	1.777	1.801	1.825	1.855	1.848	1.871	1.929	1.956	1.953	1.938	1.897	1.934	1.962	1.989	1.934	1.943	1.970	1.891	0.074
MHWS	1.623	1.555	1.583	1.595	1.616	1.633	1.619	1.640	1.699	1.728	1.727	1.732	1.705	1.756	1.789	1.816	1.767	1.776	1.791	1.692	0.081
MHW	1.466	1.398	1.426	1.438	1.457	1.477	1.462	1.482	1.541	1.572	1.569	1.574	1.550	1.599	1.637	1.662	1.611	1.622	1.636	1.536	0.082
MHWN	1.309	1.240	1.269	1.280	1.299	1.321	1.305	1.325	1.383	1.416	1.410	1.416	1.394	1.443	1.485	1.508	1.455	1.468	1.482	1.379	0.083
MSL	0.920	0.859	0.898	0.913	0.940	0.968	0.956	0.978	1.042	1.069	1.053	1.059	1.027	1.071	1.101	1.131	1.069	1.083	1.100	1.012	0.080
MLWN	0.530	0.477	0.526	0.545	0.582	0.615	0.607	0.631	0.701	0.721	0.695	0.702	0.660	0.699	0.718	0.753	0.682	0.698	0.718	0.645	0.080
MLW	0.373	0.320	0.369	0.388	0.423	0.458	0.450	0.474	0.544	0.565	0.537	0.544	0.505	0.543	0.566	0.599	0.526	0.543	0.563	0.489	0.081
MLWS	0.216	0.163	0.212	0.230	0.265	0.302	0.294	0.316	0.386	0.409	0.379	0.386	0.349	0.386	0.414	0.445	0.370	0.389	0.408	0.333	0.082
ISLW	0.088	0.031	0.074	0.083	0.116	0.144	0.130	0.151	0.222	0.246	0.217	0.239	0.212	0.259	0.290	0.322	0.250	0.270	0.280	0.191	0.086
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.779	0.763	0.743	0.735	0.717	0.706	0.698	0.694	0.682	0.696	0.715	0.714	0.734	0.744	0.767	0.755	0.774	0.770	0.764	0.734	0.031
MR	1.093	1.078	1.057	1.050	1.034	1.019	1.012	1.008	0.998	1.008	1.032	1.030	1.045	1.057	1.071	1.063	1.086	1.079	1.073	1.047	0.029
MSR	1.407	1.393	1.371	1.366	1.351	1.331	1.325	1.323	1.313	1.319	1.348	1.346	1.356	1.370	1.375	1.371	1.398	1.387	1.383	1.360	0.028
R	1.716	1.709	1.702	1.719	1.709	1.712	1.718	1.721	1.707	1.710	1.736	1.699	1.685	1.676	1.671	1.667	1.684	1.673	1.690	1.700	0.020
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.546	0.539	0.528	0.525	0.517	0.509	0.506	0.504	0.499	0.504	0.516	0.515	0.523	0.528	0.536	0.532	0.543	0.539	0.537	0.523	0.015
S2	0.157	0.157	0.157	0.158	0.159	0.156	0.157	0.157	0.158	0.156	0.158	0.158	0.155	0.156	0.152	0.154	0.156	0.154	0.155	0.156	0.002
K1	0.092	0.096	0.099	0.105	0.105	0.112	0.113	0.115	0.115	0.113	0.111	0.105	0.099	0.093	0.090	0.090	0.087	0.087	0.092	0.101	0.010
O1	0.037	0.036	0.039	0.042	0.044	0.046	0.051	0.051	0.049	0.050	0.051	0.043	0.038	0.035	0.034	0.033	0.032	0.032	0.035	0.041	0.007
MSF	0.019	0.013	0.009	0.003	0.012	0.011	0.007	0.011	0.005	0.011	0.003	0.013	0.004	0.010	0.015	0.010	0.008	0.005	0.007	0.009	0.004
z0	0.920	0.859	0.898	0.913	0.940	0.968	0.956	0.978	1.042	1.069	1.053	1.059	1.027	1.071	1.101	1.131	1.069	1.083	1.100	1.012	0.080
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	309.476	311.737	312.862	310.878	310.825	310.234	308.875	307.769	307.073	307.142	305.428	305.334	306.291	307.323	305.392	306.287	306.749	307.626	308.229	308.186	2.253
S2	248.542	250.297	249.365	246.818	247.360	248.205	247.138	248.093	247.253	248.570	247.685	247.567	249.024	248.188	247.271	246.298	246.640	246.413	246.581	247.753	1.078
K1	169.562	171.571	173.200	170.060	171.666	167.087	166.142	163.095	161.474	156.686	153.397	151.922	151.782	152.454	153.942	158.152	161.223	165.382	166.482	162.383	7.400
O1	221.089	218.109	220.659	218.356	220.240	220.080	223.343	226.406	229.722	233.493	239.962	242.692	245.253	243.224	234.647	230.771	223.929	224.056	223.441	228.393	9.016
MSF	232.463	327.294	346.989	237.464	48.914	136.338	232.669	139.780	67.955	99.618	297.059	95.911	4.875	64.035	2.778	136.631	289.809	50.808	184.036	157.654	109.440
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.116	0.086	0.119	0.064	0.096	0.059	0.079	0.078	0.070	0.055	0.075	0.073	0.095	0.048	0.071	0.055	0.074	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.5	89.3	97.8	90.3	94.1	92.9	99.8	95.3	88.7	87.0	88.6	90.0	99.3	88.4	66.2	64.7	88.0	87.3	72.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	2.00	01/02/2010 08:30	±0.22	5.3
Lowest Astronomical Tide (LAT)	0.08	28/10/2007 01:45		

COMMENTS Station decommissioned in Sep 2015.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Norfolk Island

MHL2786

Figure A6

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Yamba

RECORDING STATION:	**Clarence River at Yamba**	ZONE:	56
DATUM:	AUSTRALIAN HEIGHT DATUM	EASTING:	535118
AWRC #:	204454	NORTHING:	6744433

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.022	0.974	0.964	0.998	1.039	0.995	1.011	1.015	1.034	1.050	1.027	1.023	1.007	1.001	0.977	1.006	1.001	0.971	0.984	1.005	0.024
MHWS	0.699	0.640	0.625	0.639	0.668	0.601	0.613	0.607	0.618	0.647	0.632	0.653	0.660	0.686	0.674	0.709	0.705	0.667	0.675	0.654	0.033
MHW	0.567	0.507	0.491	0.502	0.525	0.466	0.482	0.477	0.486	0.520	0.502	0.524	0.527	0.553	0.544	0.579	0.574	0.537	0.546	0.522	0.034
MHWN	0.435	0.373	0.356	0.364	0.382	0.330	0.351	0.348	0.354	0.393	0.373	0.395	0.395	0.421	0.414	0.449	0.443	0.406	0.417	0.389	0.035
MSL	0.083	0.015	0.008	0.023	0.042	0.006	0.038	0.038	0.040	0.081	0.061	0.073	0.056	0.079	0.063	0.100	0.093	0.048	0.061	0.053	0.028
MLWN	-0.269	-0.343	-0.341	-0.319	-0.297	-0.317	-0.275	-0.272	-0.274	-0.230	-0.251	-0.249	-0.282	-0.263	-0.287	-0.250	-0.258	-0.309	-0.295	-0.283	0.032
MLW	-0.401	-0.477	-0.475	-0.456	-0.441	-0.453	-0.407	-0.401	-0.406	-0.357	-0.380	-0.378	-0.414	-0.395	-0.417	-0.380	-0.389	-0.440	-0.424	-0.415	0.034
MLWS	-0.533	-0.610	-0.610	-0.593	-0.584	-0.588	-0.538	-0.530	-0.538	-0.485	-0.510	-0.507	-0.547	-0.528	-0.547	-0.509	-0.519	-0.571	-0.553	-0.547	0.036
ISLW	-0.763	-0.848	-0.852	-0.850	-0.848	-0.869	-0.822	-0.822	-0.835	-0.772	-0.792	-0.770	-0.795	-0.753	-0.763	-0.722	-0.731	-0.787	-0.773	-0.798	0.044
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.704	0.716	0.696	0.683	0.680	0.648	0.626	0.620	0.628	0.623	0.624	0.644	0.677	0.684	0.701	0.700	0.701	0.715	0.712	0.673	0.035
MR	0.967	0.983	0.966	0.958	0.966	0.918	0.888	0.878	0.892	0.877	0.883	0.902	0.942	0.949	0.961	0.959	0.963	0.976	0.970	0.937	0.038
MSR	1.231	1.250	1.235	1.232	1.252	1.189	1.151	1.137	1.157	1.132	1.141	1.160	1.207	1.214	1.221	1.218	1.225	1.238	1.229	1.201	0.041
R	1.785	1.822	1.816	1.849	1.887	1.864	1.833	1.837	1.869	1.822	1.818	1.793	1.802	1.753	1.740	1.728	1.731	1.758	1.757	1.803	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.484	0.492	0.483	0.479	0.483	0.459	0.444	0.439	0.446	0.439	0.441	0.451	0.471	0.474	0.481	0.479	0.481	0.488	0.485	0.468	0.019
S2	0.132	0.134	0.135	0.137	0.143	0.135	0.131	0.129	0.132	0.127	0.129	0.129	0.133	0.132	0.130	0.130	0.131	0.131	0.129	0.132	0.004
K1	0.147	0.150	0.152	0.160	0.165	0.172	0.173	0.175	0.176	0.173	0.170	0.163	0.158	0.144	0.139	0.137	0.135	0.138	0.139	0.156	0.015
O1	0.084	0.088	0.090	0.097	0.099	0.109	0.111	0.116	0.120	0.114	0.112	0.101	0.090	0.081	0.078	0.076	0.076	0.078	0.081	0.095	0.015
MSF	0.023	0.011	0.030	0.008	0.023	0.033	0.002	0.021	0.003	0.006	0.011	0.006	0.002	0.023	0.012	0.011	0.013	0.008	0.002	0.013	0.010
z0	0.083	0.015	0.008	0.023	0.042	0.006	0.038	0.038	0.040	0.081	0.061	0.073	0.056	0.079	0.063	0.100	0.093	0.048	0.061	0.053	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	349.057	349.426	349.561	349.902	349.435	349.072	348.670	347.412	346.343	346.226	345.130	345.723	345.365	344.982	345.865	346.556	346.824	348.077	348.577	347.484	1.698
S2	257.981	256.658	256.189	255.987	254.354	259.313	256.949	259.397	257.180	258.107	257.849	257.614	258.214	256.639	257.703	257.687	256.861	257.326	257.565	257.346	1.154
K1	144.330	146.459	146.630	145.615	144.883	142.667	142.008	141.596	135.718	132.231	129.061	126.972	126.107	128.229	129.055	134.476	137.619	140.173	143.124	137.734	7.232
O1	201.001	199.405	198.040	199.146	199.232	201.987	203.411	206.701	210.242	215.731	221.470	225.365	224.913	221.927	218.660	213.373	208.166	205.410	202.324	209.290	9.469
MSF	303.658	36.020	30.357	348.791	45.871	109.841	282.168	86.919	157.566	173.220	290.212	36.398	273.238	20.904	5.642	359.752	40.431	298.339	218.971	164.121	126.747
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.067	0.096	0.071	0.083	0.068	0.101	0.069	0.098	0.085	0.090	0.069	0.095	0.080	0.090	0.075	0.075	0.078	0.089	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	64.2	92.9	59.7	98.7	57.8	65.7	96.6	92.6	97.2	82.1	92.2	86.0	97.1	89.9	96.0	91.0	94.2	98.0	93.3		

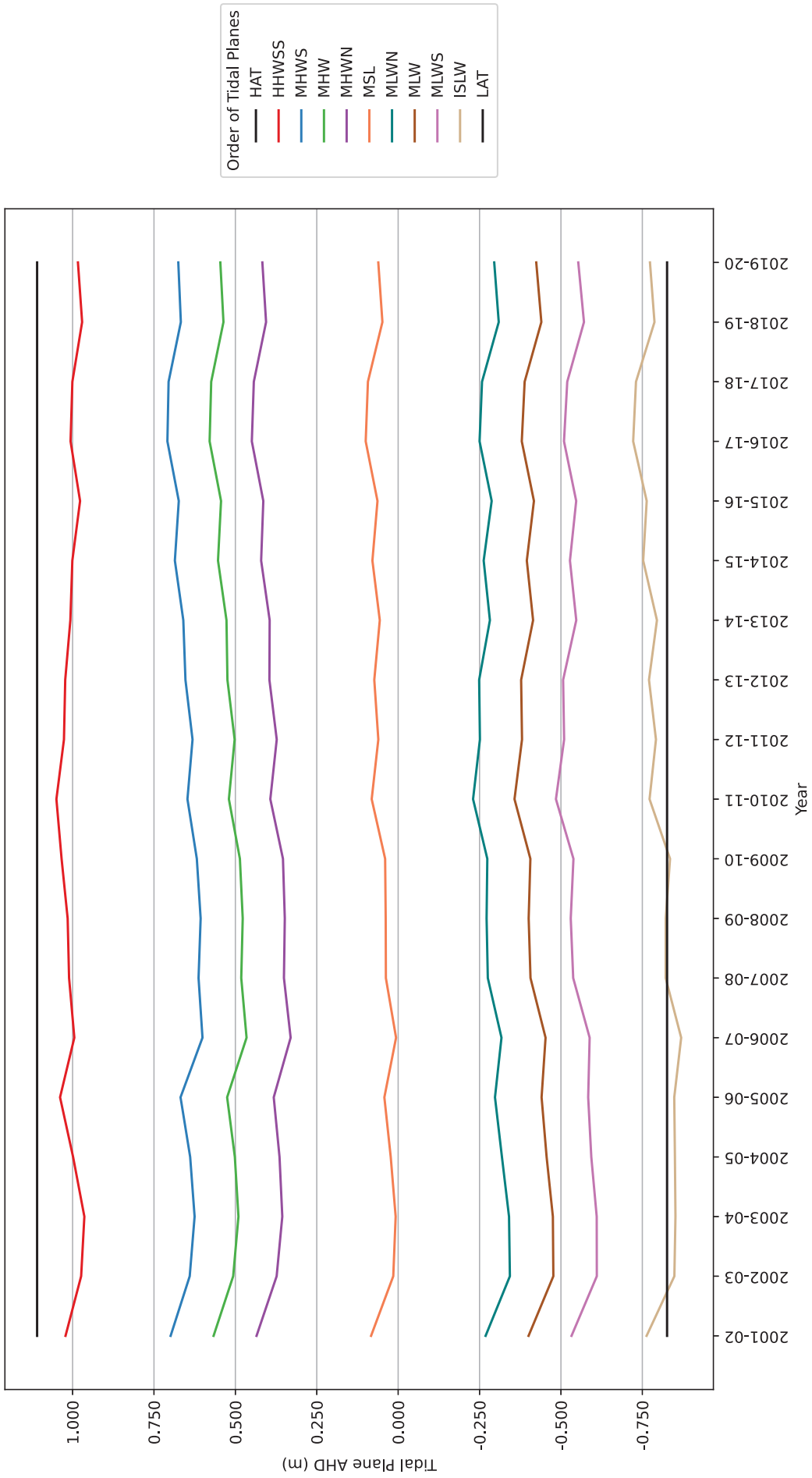
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.11	03/07/2004 21:15	±0.18	3.6
Lowest Astronomical Tide (LAT)	-0.83	29/09/2015 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A7

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Yamba

MHL2786

Figure A7

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tasman Sea at Coffs Harbour

RECORDING STATION: **Tasman Sea at Coffs Harbour**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205470

ZONE: 56
EASTING: 514052
NORTHING: 6647645

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07*	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.027	1.032	1.052	1.041	1.070			1.150	1.111	1.137	1.106	1.113	1.093	1.087	1.071	1.101	1.099	1.067	1.087	1.085	0.035
MHWS	0.681	0.667	0.669	0.643	0.660			0.693	0.653	0.692	0.674	0.706	0.718	0.736	0.734	0.771	0.769	0.732	0.746	0.703	0.040
MHW	0.536	0.522	0.522	0.494	0.513			0.545	0.506	0.548	0.528	0.559	0.574	0.591	0.591	0.627	0.624	0.588	0.602	0.557	0.041
MHWN	0.390	0.378	0.375	0.346	0.366			0.398	0.359	0.405	0.382	0.412	0.430	0.445	0.448	0.483	0.480	0.444	0.459	0.412	0.043
MSL	-0.012	-0.023	-0.012	-0.036	-0.005			0.024	-0.006	0.038	0.016	0.042	0.049	0.057	0.050	0.083	0.077	0.038	0.055	0.026	0.036
MLWN	-0.413	-0.424	-0.399	-0.419	-0.375			-0.350	-0.370	-0.328	-0.349	-0.328	-0.333	-0.331	-0.348	-0.317	-0.327	-0.368	-0.349	-0.360	0.035
MLW	-0.559	-0.569	-0.546	-0.567	-0.522			-0.497	-0.517	-0.472	-0.495	-0.475	-0.477	-0.477	-0.491	-0.461	-0.471	-0.512	-0.493	-0.506	0.035
MLWS	-0.704	-0.713	-0.693	-0.715	-0.669			-0.644	-0.664	-0.615	-0.641	-0.622	-0.621	-0.622	-0.634	-0.605	-0.616	-0.656	-0.636	-0.651	0.036
ISLW	-0.951	-0.974	-0.966	-1.000	-0.962			-0.971	-0.991	-0.933	-0.950	-0.913	-0.889	-0.873	-0.874	-0.841	-0.851	-0.895	-0.880	-0.924	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.804	0.802	0.774	0.765	0.741			0.748	0.729	0.733	0.731	0.740	0.763	0.777	0.796	0.800	0.806	0.811	0.808	0.772	0.031
MR	1.095	1.091	1.068	1.061	1.035			1.042	1.023	1.020	1.023	1.034	1.051	1.068	1.082	1.088	1.095	1.100	1.095	1.063	0.029
MSR	1.386	1.380	1.362	1.358	1.329			1.337	1.317	1.307	1.315	1.328	1.339	1.359	1.369	1.376	1.385	1.389	1.382	1.354	0.028
R	1.978	2.006	2.019	2.042	2.033			2.120	2.102	2.071	2.056	2.026	1.982	1.960	1.945	1.942	1.950	1.962	1.966	2.009	0.056
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.547	0.545	0.534	0.531	0.518			0.521	0.511	0.510	0.511	0.517	0.525	0.534	0.541	0.544	0.548	0.550	0.548	0.532	0.015
S2	0.146	0.144	0.147	0.148	0.147			0.147	0.147	0.144	0.146	0.147	0.144	0.146	0.143	0.144	0.145	0.144	0.143	0.145	0.002
K1	0.162	0.171	0.178	0.184	0.189			0.206	0.205	0.200	0.196	0.189	0.175	0.167	0.160	0.156	0.157	0.158	0.161	0.177	0.017
O1	0.084	0.090	0.095	0.101	0.104			0.120	0.123	0.118	0.113	0.102	0.093	0.083	0.080	0.079	0.078	0.081	0.082	0.096	0.015
MSF	0.019	0.014	0.013	0.015	0.015			0.025	0.004	0.003	0.010	0.008	0.001	0.011	0.013	0.013	0.007	0.014	0.004	0.011	0.006
z0	-0.012	-0.023	-0.012	-0.036	-0.005			0.024	-0.006	0.038	0.016	0.042	0.049	0.057	0.050	0.083	0.077	0.038	0.055	0.026	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	345.819	347.049	347.295	347.546	347.267			344.828	343.755	343.091	342.519	342.493	342.299	342.737	343.091	343.739	344.535	345.385	345.750	344.659	1.871
S2	254.274	254.201	254.575	254.009	253.830			254.617	254.928	254.987	254.434	253.785	254.481	254.740	254.576	253.982	253.842	253.553	254.838	254.332	0.439
K1	138.826	140.817	141.365	141.461	139.406			132.708	130.227	126.551	123.059	121.165	121.077	122.173	124.951	127.678	131.388	134.635	136.500	131.411	7.471
O1	194.754	193.206	192.629	191.883	193.591			200.017	203.513	209.500	214.776	216.707	217.063	214.918	209.547	205.969	201.104	198.624	196.520	203.195	9.073
MSF	313.162	42.826	344.764	288.641	34.158			95.901	312.522	173.936	282.439	53.003	134.431	24.010	327.255	336.789	343.848	318.339	172.257	211.664	124.935
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.088	0.100	0.081	0.083	0.083			0.085	0.088	0.095	0.073	0.090	0.079	0.085	0.072	0.071	0.075	0.088	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.9	96.2	98.0	94.2	88.3	6.3	11.0	92.7	93.2	85.7	97.0	87.4	91.4	86.4	91.0	86.6	83.7	91.8	92.0		

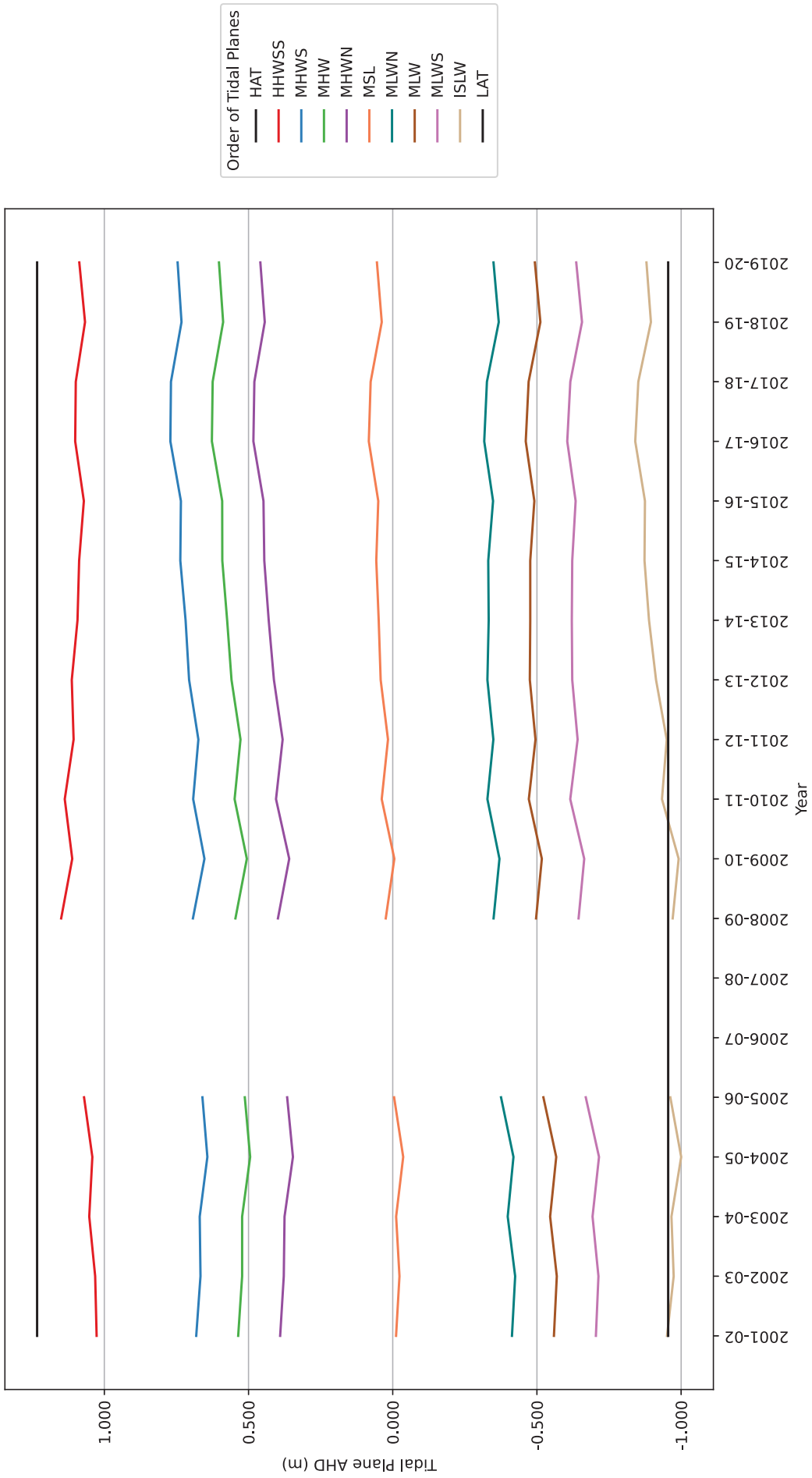
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.23	04/06/2008 20:30	±0.18	2.9
Lowest Astronomical Tide (LAT)	-0.95	29/09/2015 02:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A8

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tasman Sea at Coffs Harbour

MHL2786

Figure A8

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tasman Sea at Lord Howe Island

RECORDING STATION: **Tasman Sea at Lord Howe Island**
DATUM: LORD HOWE ISLAND TIDAL DATUM
AWRC #: 240402

ZONE: 57
EASTING: 505521
NORTHING: 6512362

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	2.098	2.150	2.107	2.155	2.212	2.156	2.162	2.133	2.069	2.150	2.098	2.146	2.113	2.101	2.119	2.159	2.056	2.127	2.179	2.131	0.038
MHWS	1.827	1.866	1.823	1.855	1.894	1.827	1.828	1.780	1.724	1.814	1.771	1.837	1.819	1.825	1.854	1.902	1.797	1.858	1.910	1.832	0.046
MHW	1.651	1.688	1.645	1.676	1.716	1.649	1.651	1.603	1.548	1.637	1.597	1.661	1.645	1.645	1.683	1.729	1.622	1.682	1.734	1.656	0.046
MHWN	1.475	1.510	1.468	1.498	1.538	1.470	1.473	1.426	1.371	1.459	1.424	1.485	1.471	1.465	1.511	1.555	1.447	1.505	1.559	1.479	0.046
MSL	1.031	1.075	1.043	1.081	1.133	1.065	1.075	1.030	0.973	1.055	1.014	1.072	1.051	1.047	1.069	1.118	1.001	1.058	1.119	1.059	0.040
MLWN	0.588	0.641	0.619	0.663	0.729	0.659	0.678	0.634	0.574	0.652	0.605	0.660	0.632	0.630	0.627	0.681	0.556	0.611	0.680	0.638	0.042
MLW	0.412	0.462	0.441	0.485	0.550	0.480	0.500	0.457	0.398	0.474	0.431	0.484	0.457	0.450	0.455	0.508	0.381	0.434	0.504	0.461	0.041
MLWS	0.236	0.284	0.263	0.307	0.372	0.302	0.323	0.281	0.221	0.297	0.257	0.308	0.283	0.270	0.283	0.334	0.206	0.257	0.329	0.285	0.041
ISLW	0.042	0.081	0.060	0.092	0.145	0.067	0.084	0.028	-0.025	0.057	0.024	0.087	0.073	0.073	0.095	0.151	0.020	0.065	0.137	0.071	0.044
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.887	0.869	0.849	0.835	0.809	0.812	0.795	0.793	0.798	0.808	0.819	0.825	0.839	0.836	0.885	0.874	0.891	0.894	0.878	0.842	0.036
MR	1.239	1.226	1.205	1.192	1.166	1.168	1.150	1.146	1.150	1.162	1.167	1.178	1.187	1.195	1.228	1.221	1.241	1.248	1.230	1.195	0.034
MSR	1.591	1.582	1.560	1.548	1.522	1.525	1.505	1.499	1.503	1.517	1.514	1.530	1.536	1.555	1.571	1.568	1.591	1.601	1.582	1.547	0.033
R	2.056	2.069	2.047	2.062	2.067	2.089	2.078	2.104	2.095	2.093	2.074	2.059	2.040	2.028	2.024	2.007	2.035	2.062	2.043	2.060	0.026
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.620	0.613	0.602	0.596	0.583	0.584	0.575	0.573	0.575	0.581	0.583	0.589	0.594	0.598	0.614	0.610	0.620	0.624	0.615	0.597	0.017
S2	0.176	0.178	0.178	0.178	0.178	0.178	0.177	0.177	0.176	0.177	0.174	0.176	0.174	0.180	0.172	0.174	0.175	0.177	0.176	0.176	0.002
K1	0.126	0.133	0.134	0.139	0.145	0.148	0.150	0.155	0.155	0.155	0.145	0.141	0.139	0.131	0.126	0.120	0.123	0.123	0.127	0.138	0.012
O1	0.067	0.070	0.068	0.075	0.082	0.088	0.089	0.097	0.091	0.085	0.088	0.079	0.072	0.066	0.062	0.063	0.062	0.069	0.065	0.076	0.011
MSF	0.012	0.006	0.006	0.016	0.008	0.015	0.025	0.016	0.010	0.027	0.018	0.024	0.011	0.029	0.028	0.008	0.015	0.015	0.013	0.016	0.007
z0	1.031	1.075	1.043	1.081	1.133	1.065	1.075	1.030	0.973	1.055	1.014	1.072	1.051	1.047	1.069	1.118	1.001	1.058	1.119	1.059	0.040
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	345.816	345.986	346.450	346.515	346.347	346.192	345.061	344.074	343.250	342.966	342.020	341.544	341.971	341.833	342.108	342.966	343.890	343.958	344.790	344.091	1.772
S2	258.941	258.422	259.497	259.360	259.757	258.653	258.905	259.774	258.005	258.624	259.350	258.979	258.459	257.410	258.952	259.200	260.088	258.423	259.575	258.967	0.665
K1	149.560	149.009	149.581	150.213	150.697	148.676	145.791	143.085	141.022	137.368	131.481	131.984	131.488	132.754	135.926	138.773	140.765	142.656	146.363	141.957	6.931
O1	202.310	203.767	202.888	202.081	200.904	202.663	203.789	208.115	211.490	221.991	224.441	225.879	224.333	218.306	217.306	212.918	208.720	208.339	203.673	210.732	8.715
MSF	220.267	179.080	38.228	210.881	13.713	56.956	260.060	73.200	129.082	49.035	260.781	32.414	280.516	115.538	310.934	341.627	252.233	167.354	162.129	166.002	102.965
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.109	0.152	0.127	0.125	0.091	0.136	0.089	0.120	0.152	0.176	0.131	0.133	0.122	0.169	0.109	0.110	0.111	0.143	0.086		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.2	85.9	74.4	64.8	78.1	85.2	50.7	93.9	77.0	63.0	84.5	88.4	94.1	78.0	90.5	73.7	71.9	64.0	84.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	2.32	31/01/2010 08:45	±0.19	13.6
Lowest Astronomical Tide (LAT)	-0.07	29/09/2015 02:30		

COMMENTS

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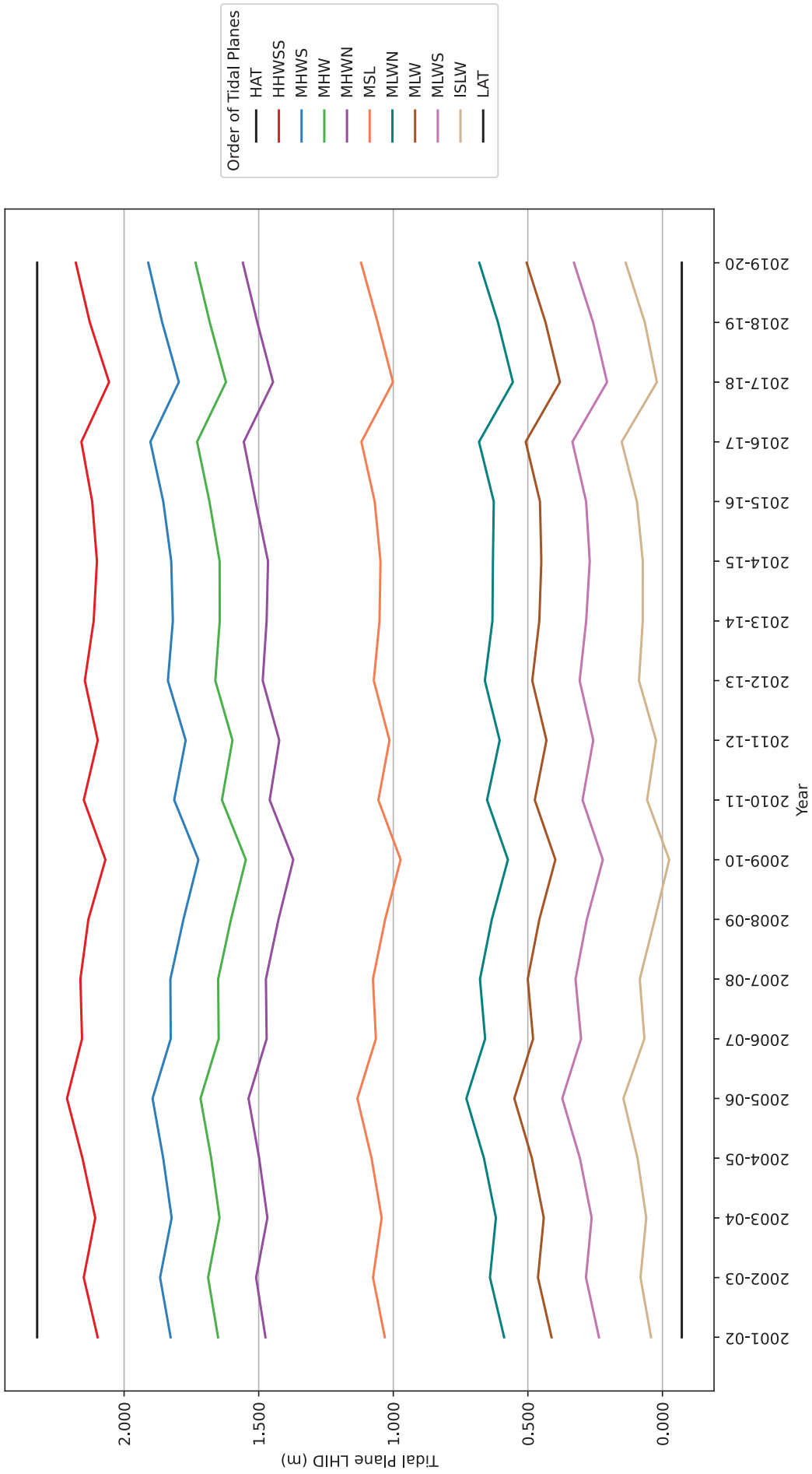
Table A9

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tasman Sea at Lord Howe Island

MHL2786

Figure A9

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Port Macquarie Offshore

RECORDING STATION: **Port Macquarie Offshore (Tasman Sea)**
DATUM: APPROXIMATE MEAN SEA LEVEL
AWRC #: 207450

ZONE: 56
EASTING: 494823
NORTHING: 6520319

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.012	1.001	1.031	1.022	1.037	1.025	1.065	1.059	1.073	1.089	1.031	1.023	1.014	1.007	0.989	0.980	0.982	0.982	0.920	1.018	0.039
MHWS	0.670	0.650	0.666	0.644	0.646	0.611	0.634	0.616	0.632	0.650	0.608	0.622	0.642	0.663	0.661	0.660	0.662	0.657	0.590	0.641	0.023
MHW	0.530	0.509	0.526	0.503	0.504	0.472	0.494	0.475	0.492	0.511	0.468	0.483	0.504	0.521	0.522	0.524	0.523	0.519	0.451	0.502	0.023
MHWN	0.391	0.368	0.385	0.362	0.363	0.333	0.354	0.335	0.352	0.372	0.328	0.345	0.366	0.380	0.383	0.387	0.384	0.382	0.313	0.362	0.023
MSL	-0.000	-0.021	0.004	-0.012	0.001	-0.030	-0.001	-0.018	-0.004	0.011	-0.033	-0.024	-0.012	-0.004	-0.009	-0.011	-0.016	-0.020	-0.092	-0.015	0.022
MLWN	-0.391	-0.411	-0.378	-0.386	-0.361	-0.393	-0.356	-0.370	-0.361	-0.349	-0.393	-0.392	-0.390	-0.388	-0.401	-0.409	-0.416	-0.422	-0.497	-0.393	0.033
MLW	-0.531	-0.552	-0.519	-0.527	-0.502	-0.533	-0.496	-0.511	-0.501	-0.488	-0.534	-0.531	-0.528	-0.530	-0.540	-0.545	-0.555	-0.560	-0.635	-0.532	0.032
MLWS	-0.670	-0.693	-0.659	-0.668	-0.643	-0.672	-0.636	-0.651	-0.641	-0.627	-0.674	-0.670	-0.666	-0.672	-0.678	-0.682	-0.694	-0.697	-0.773	-0.672	0.031
ISLW	-0.915	-0.943	-0.920	-0.938	-0.923	-0.967	-0.944	-0.968	-0.956	-0.940	-0.976	-0.956	-0.932	-0.917	-0.913	-0.910	-0.923	-0.929	-1.009	-0.941	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.781	0.779	0.763	0.747	0.724	0.726	0.710	0.704	0.714	0.720	0.721	0.737	0.756	0.768	0.785	0.796	0.799	0.804	0.811	0.755	0.035
MR	1.061	1.061	1.045	1.029	1.007	1.005	0.990	0.986	0.993	0.999	1.001	1.014	1.032	1.051	1.062	1.069	1.078	1.079	1.087	1.034	0.034
MSR	1.340	1.343	1.326	1.312	1.289	1.283	1.270	1.268	1.273	1.278	1.282	1.292	1.308	1.335	1.339	1.342	1.356	1.354	1.363	1.313	0.033
R	1.927	1.943	1.951	1.960	1.961	1.992	2.010	2.026	2.029	2.029	2.007	1.979	1.946	1.925	1.901	1.890	1.905	1.911	1.930	1.959	0.046
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.530	0.530	0.522	0.515	0.503	0.502	0.495	0.493	0.497	0.499	0.501	0.507	0.516	0.526	0.531	0.534	0.539	0.540	0.543	0.517	0.017
S2	0.140	0.141	0.141	0.141	0.141	0.139	0.140	0.141	0.140	0.139	0.140	0.139	0.138	0.142	0.139	0.136	0.139	0.138	0.138	0.140	0.001
K1	0.155	0.158	0.165	0.168	0.173	0.181	0.187	0.188	0.189	0.191	0.183	0.176	0.167	0.156	0.149	0.146	0.145	0.148	0.149	0.167	0.016
O1	0.090	0.092	0.095	0.102	0.107	0.114	0.121	0.128	0.125	0.122	0.119	0.111	0.099	0.090	0.085	0.082	0.084	0.084	0.087	0.102	0.016
MSF	0.021	0.013	0.021	0.007	0.018	0.013	0.010	0.020	0.002	0.012	0.015	0.016	0.003	0.024	0.005	0.015	0.016	0.011	0.013	0.013	0.006
z0	-0.000	-0.021	0.004	-0.012	0.001	-0.030	-0.001	-0.018	-0.004	0.011	-0.033	-0.024	-0.012	-0.004	-0.009	-0.011	-0.016	-0.020	-0.092	-0.015	0.022
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	347.411	347.477	347.608	347.839	347.392	347.139	346.406	346.136	344.438	344.234	343.610	342.629	342.698	342.590	343.803	344.844	346.156	346.208	346.708	345.544	1.848
S2	257.464	255.445	255.226	255.212	254.956	255.080	255.437	256.462	255.900	256.180	256.565	255.141	255.627	254.390	256.174	254.999	256.849	255.875	254.644	255.665	0.797
K1	133.975	134.555	134.155	134.920	133.637	132.866	131.053	128.191	124.860	121.266	117.758	116.995	115.356	116.870	118.396	123.586	126.640	129.985	133.031	126.742	7.098
O1	197.361	194.239	193.979	192.843	194.636	193.979	197.304	199.905	205.235	210.789	215.165	216.868	216.699	217.559	211.937	207.299	203.045	199.063	196.832	203.407	8.947
MSF	296.820	62.487	296.572	272.485	11.181	105.003	276.307	71.967	332.381	136.172	259.394	73.001	315.303	70.339	3.197	332.305	334.677	359.910	143.665	197.535	125.636
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079	0.091	0.079	0.079	0.080	0.090	0.074	0.069	0.080	0.081	0.078	0.090	0.091	0.080	0.087	0.079	0.080	0.092	0.098		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	73.9	97.1	83.5	94.6	91.5	96.5	98.3	95.3	97.0	95.9	97.6	91.5	97.3	60.1	89.5	97.5	93.9	94.7	58.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.17	03/07/2004 21:00	±0.30	4.1
Lowest Astronomical Tide (LAT)	-0.94	31/01/2014 15:00		

COMMENTS

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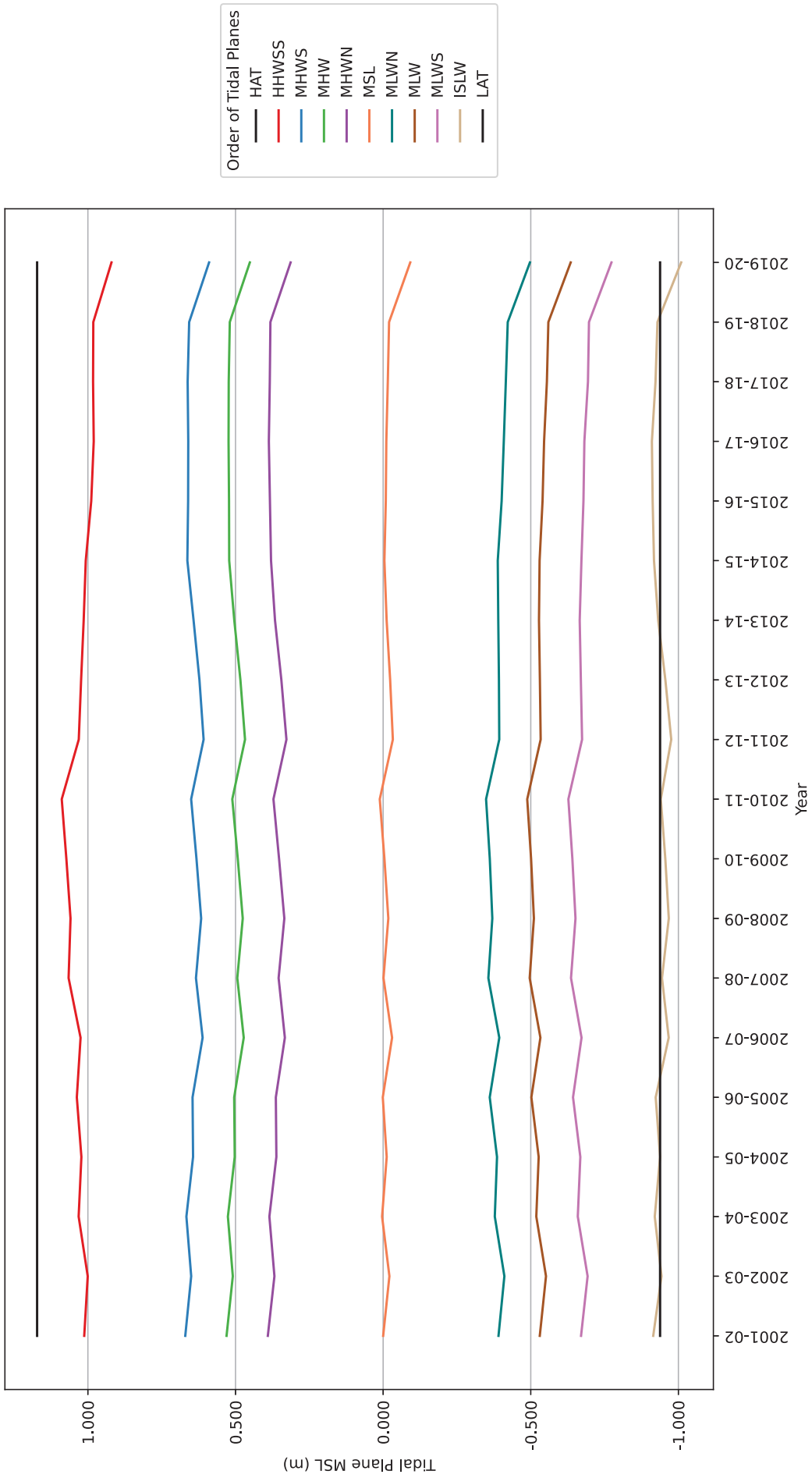


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Port Macquarie Offshore

MHL2786

Figure A10

RECORDING STATION: **Hastings River at Port Macquarie**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207420

ZONE: 56
EASTING: 491554
NORTHING: 6523090

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.895	0.865	0.888	0.869	0.887	0.870	0.892	0.938	0.956	0.946	0.941	0.919	0.896	0.871	0.858	0.891	0.881	0.854	0.876	0.894	0.031
MHWS	0.589	0.552	0.558	0.533	0.535	0.501	0.509	0.543	0.556	0.552	0.561	0.562	0.560	0.568	0.566	0.605	0.593	0.564	0.579	0.557	0.026
MHW	0.481	0.443	0.449	0.423	0.426	0.394	0.401	0.434	0.445	0.443	0.451	0.454	0.450	0.461	0.460	0.498	0.484	0.455	0.472	0.449	0.026
MHWN	0.372	0.334	0.340	0.313	0.317	0.288	0.294	0.325	0.333	0.335	0.342	0.345	0.340	0.355	0.353	0.391	0.375	0.346	0.365	0.340	0.026
MSL	0.039	0.009	0.017	0.001	0.013	-0.015	0.000	0.031	0.031	0.036	0.039	0.030	0.018	0.033	0.022	0.059	0.039	0.005	0.028	0.023	0.018
MLWN	-0.293	-0.316	-0.305	-0.311	-0.290	-0.318	-0.293	-0.263	-0.271	-0.262	-0.264	-0.284	-0.304	-0.288	-0.310	-0.272	-0.296	-0.335	-0.309	-0.294	0.021
MLW	-0.402	-0.425	-0.414	-0.421	-0.399	-0.424	-0.401	-0.372	-0.382	-0.371	-0.374	-0.393	-0.414	-0.395	-0.417	-0.379	-0.405	-0.444	-0.416	-0.402	0.021
MLWS	-0.510	-0.534	-0.523	-0.531	-0.508	-0.531	-0.508	-0.481	-0.493	-0.479	-0.483	-0.501	-0.523	-0.501	-0.523	-0.486	-0.514	-0.553	-0.523	-0.511	0.020
ISLW	-0.729	-0.758	-0.759	-0.771	-0.760	-0.795	-0.782	-0.763	-0.779	-0.761	-0.755	-0.756	-0.764	-0.718	-0.731	-0.691	-0.720	-0.760	-0.735	-0.752	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.665	0.651	0.644	0.624	0.607	0.605	0.587	0.588	0.604	0.597	0.606	0.629	0.644	0.643	0.663	0.664	0.671	0.681	0.673	0.634	0.031
MR	0.883	0.868	0.863	0.844	0.825	0.819	0.802	0.806	0.827	0.814	0.825	0.846	0.864	0.856	0.876	0.877	0.889	0.899	0.887	0.851	0.031
MSR	1.100	1.085	1.081	1.064	1.042	1.032	1.017	1.025	1.049	1.031	1.044	1.064	1.083	1.069	1.089	1.091	1.107	1.117	1.102	1.068	0.030
R	1.623	1.623	1.646	1.640	1.647	1.665	1.674	1.701	1.735	1.707	1.696	1.676	1.659	1.589	1.589	1.582	1.601	1.614	1.611	1.646	0.044
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.441	0.434	0.431	0.422	0.412	0.409	0.401	0.403	0.413	0.407	0.412	0.423	0.432	0.428	0.438	0.439	0.445	0.449	0.444	0.426	0.015
S2	0.109	0.109	0.109	0.110	0.109	0.107	0.108	0.109	0.111	0.109	0.110	0.109	0.110	0.106	0.107	0.107	0.109	0.109	0.107	0.108	0.001
K1	0.137	0.141	0.149	0.148	0.154	0.162	0.165	0.168	0.170	0.170	0.163	0.156	0.151	0.136	0.132	0.131	0.130	0.131	0.133	0.149	0.015
O1	0.081	0.083	0.087	0.091	0.097	0.102	0.109	0.114	0.116	0.112	0.108	0.099	0.090	0.081	0.076	0.074	0.076	0.077	0.079	0.092	0.014
MSF	0.022	0.009	0.023	0.008	0.019	0.009	0.015	0.015	0.009	0.006	0.019	0.012	0.007	0.022	0.012	0.017	0.017	0.008	0.011	0.014	0.006
z0	0.039	0.009	0.017	0.001	0.013	-0.015	0.000	0.031	0.031	0.036	0.039	0.030	0.018	0.033	0.022	0.059	0.039	0.005	0.028	0.023	0.018
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	0.407	0.811	1.448	1.537	1.317	1.306	0.692	359.497	357.130	357.975	356.622	355.959	355.876	356.847	357.206	358.384	358.259	358.779	359.723	226.304	176.739
S2	269.751	269.523	269.584	269.616	269.545	269.622	271.172	270.409	269.508	271.379	270.734	268.363	270.192	269.980	269.938	269.335	269.766	269.194	268.982	269.821	0.726
K1	145.461	145.612	146.465	146.693	145.655	144.739	143.229	138.471	135.114	132.705	128.843	127.422	126.023	128.886	129.715	135.155	137.076	140.512	144.343	138.006	7.360
O1	209.132	207.203	206.226	205.134	206.702	206.394	210.398	212.448	216.195	222.608	226.479	229.659	229.823	230.388	224.921	219.009	215.261	210.384	209.253	215.664	9.016
MSF	314.583	87.689	297.389	339.120	6.048	58.148	274.233	73.906	309.763	166.164	269.811	81.217	303.920	5.493	306.444	329.190	328.633	350.176	229.364	217.436	123.995
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.100	0.080	0.088	0.082	0.093	0.079	0.079	0.088	0.091	0.074	0.092	0.088	0.090	0.075	0.073	0.078	0.094	0.079		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	77.5	94.5	91.8	90.0	90.5	86.3	97.0	91.0	91.5	93.8	94.4	90.4	97.3	91.9	98.1	94.4	93.1	97.7	96.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.03	04/06/2004 21:45	±0.20	6.4
Lowest Astronomical Tide (LAT)	-0.74	29/09/2015 03:00		

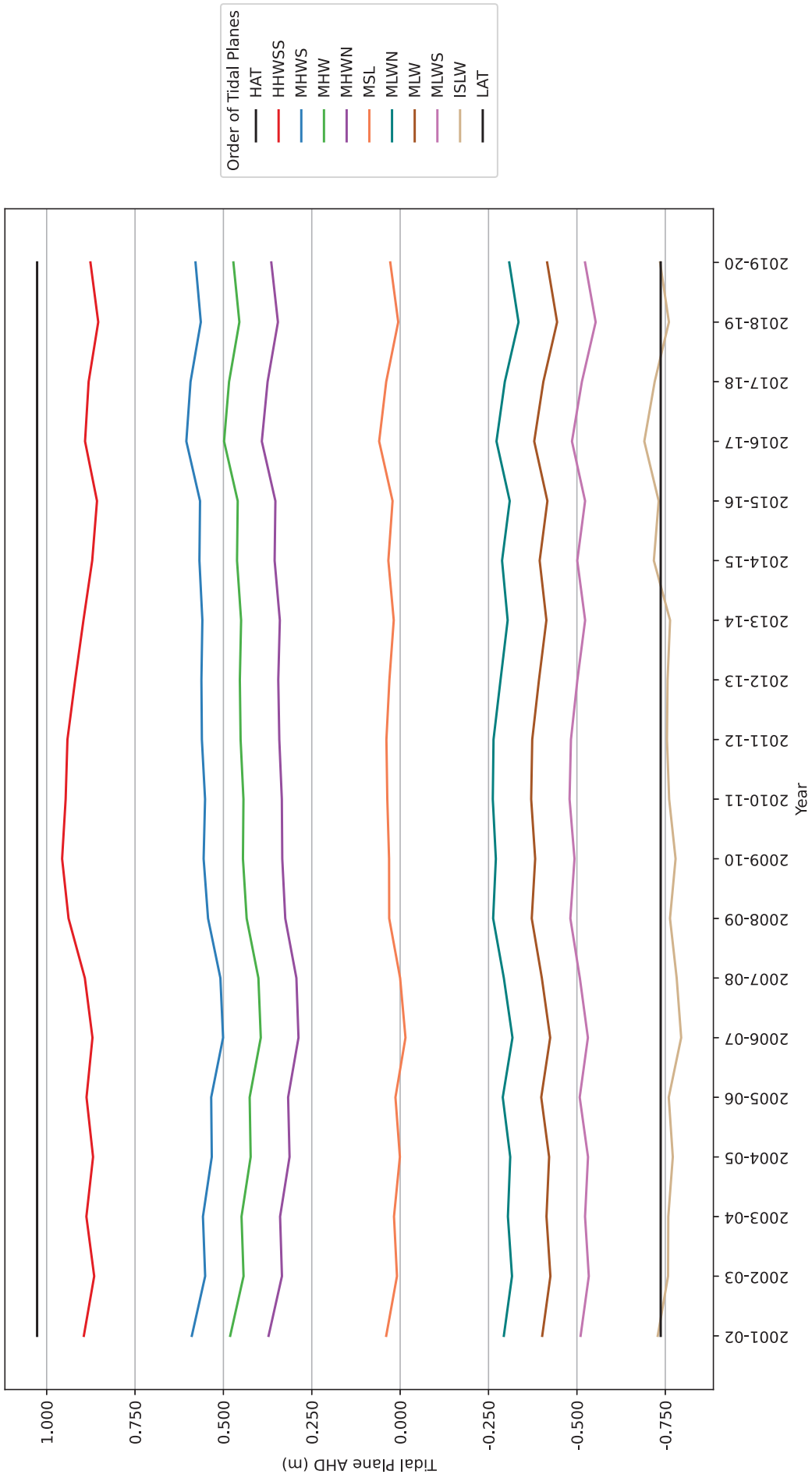
COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Port Macquarie at Port Macquarie

Table A11

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Port Macquarie at Port Macquarie

MHL2786

Figure A11

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tasman Sea at Crowdy Head Boat Harbour

RECORDING STATION: **Tasman Sea at Crowdy Head Boat Harbour**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208471

ZONE: 56
EASTING: 476346
NORTHING: 6477415

YEAR	2001-02*	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			0.954	0.992	1.035	1.037	1.052	1.080	1.090	1.102	1.097	1.044	1.032	1.017	0.999	1.040	1.020	0.990	1.020	1.035	0.041
MHWS			0.572	0.593	0.619	0.597	0.596	0.618	0.626	0.645	0.647	0.632	0.649	0.662	0.655	0.697	0.685	0.652	0.670	0.636	0.034
MHW			0.434	0.452	0.477	0.450	0.457	0.478	0.488	0.506	0.507	0.496	0.513	0.526	0.520	0.562	0.549	0.517	0.534	0.498	0.036
MHWN			0.295	0.310	0.335	0.303	0.318	0.339	0.349	0.367	0.366	0.359	0.377	0.389	0.384	0.428	0.412	0.381	0.397	0.359	0.039
MSL			-0.093	-0.076	-0.039	-0.080	-0.043	-0.023	-0.017	0.001	-0.014	-0.014	-0.005	0.000	-0.012	0.027	0.007	-0.028	-0.006	-0.024	0.033
MLWN			-0.481	-0.463	-0.414	-0.463	-0.405	-0.385	-0.383	-0.365	-0.395	-0.388	-0.386	-0.389	-0.408	-0.373	-0.398	-0.438	-0.410	-0.408	0.034
MLW			-0.620	-0.604	-0.556	-0.609	-0.544	-0.524	-0.522	-0.504	-0.535	-0.524	-0.522	-0.525	-0.544	-0.508	-0.534	-0.574	-0.546	-0.547	0.035
MLWS			-0.758	-0.746	-0.698	-0.756	-0.683	-0.663	-0.661	-0.643	-0.676	-0.661	-0.659	-0.662	-0.679	-0.642	-0.670	-0.709	-0.682	-0.685	0.037
ISLW			-1.031	-1.030	-0.995	-1.071	-1.008	-0.994	-0.992	-0.970	-0.997	-0.955	-0.932	-0.915	-0.925	-0.887	-0.909	-0.950	-0.932	-0.970	0.050
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.776	0.773	0.749	0.766	0.723	0.724	0.732	0.732	0.761	0.747	0.763	0.778	0.792	0.801	0.810	0.819	0.807	0.768	0.031
MR			1.054	1.056	1.033	1.059	1.001	1.002	1.010	1.010	1.042	1.020	1.035	1.051	1.064	1.070	1.083	1.090	1.080	1.045	0.029
MSR			1.331	1.339	1.317	1.353	1.279	1.281	1.287	1.288	1.322	1.293	1.307	1.324	1.335	1.339	1.356	1.362	1.352	1.321	0.028
R			1.985	2.022	2.031	2.108	2.060	2.074	2.082	2.072	2.094	1.999	1.964	1.932	1.923	1.927	1.929	1.940	1.952	2.006	0.066
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.527	0.528	0.516	0.530	0.500	0.501	0.505	0.505	0.521	0.510	0.518	0.526	0.532	0.535	0.541	0.545	0.540	0.522	0.014
S2			0.139	0.141	0.142	0.147	0.139	0.139	0.139	0.139	0.140	0.136	0.136	0.136	0.136	0.134	0.136	0.136	0.136	0.138	0.003
K1			0.168	0.173	0.181	0.190	0.194	0.195	0.195	0.195	0.191	0.180	0.170	0.157	0.152	0.153	0.149	0.151	0.156	0.174	0.018
O1			0.105	0.112	0.117	0.125	0.132	0.136	0.136	0.132	0.131	0.115	0.103	0.096	0.093	0.092	0.090	0.090	0.094	0.112	0.018
MSF			0.017	0.004	0.020	0.023	0.009	0.022	0.003	0.006	0.017	0.009	0.005	0.015	0.009	0.012	0.013	0.007	0.011	0.012	0.006
z0			-0.093	-0.076	-0.039	-0.080	-0.043	-0.023	-0.017	0.001	-0.014	-0.014	-0.005	0.000	-0.012	0.027	0.007	-0.028	-0.006	-0.024	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			348.681	348.947	348.507	347.861	347.381	346.374	345.200	344.709	344.221	343.817	343.555	344.082	344.154	345.406	345.755	346.460	346.864	345.998	1.809
S2			256.260	256.141	256.279	257.586	256.555	256.837	256.259	257.425	256.762	256.634	257.117	256.651	256.470	256.508	256.807	256.659	256.997	256.703	0.403
K1			136.679	136.775	134.618	133.275	131.493	129.536	126.219	122.464	119.330	118.024	116.887	118.745	119.473	124.574	126.798	131.007	133.842	127.044	6.936
O1			188.345	189.078	189.719	190.602	192.652	196.076	200.541	206.971	210.030	212.926	213.044	211.926	209.020	202.811	197.039	194.378	192.568	199.866	9.124
MSF			310.600	269.335	356.517	119.950	293.950	77.914	350.555	103.416	296.580	72.799	101.937	37.966	274.339	308.704	315.159	1.117	202.354	205.482	121.116
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.091	0.086	0.091	0.102	0.072	0.081	0.088	0.094	0.073	0.088	0.087	0.082	0.071	0.071	0.073	0.095	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	42.6	3.0	92.5	98.6	86.0	92.7	89.7	95.5	93.4	87.9	91.2	89.0	91.7	89.5	94.5	87.5	88.6	93.0	91.5		

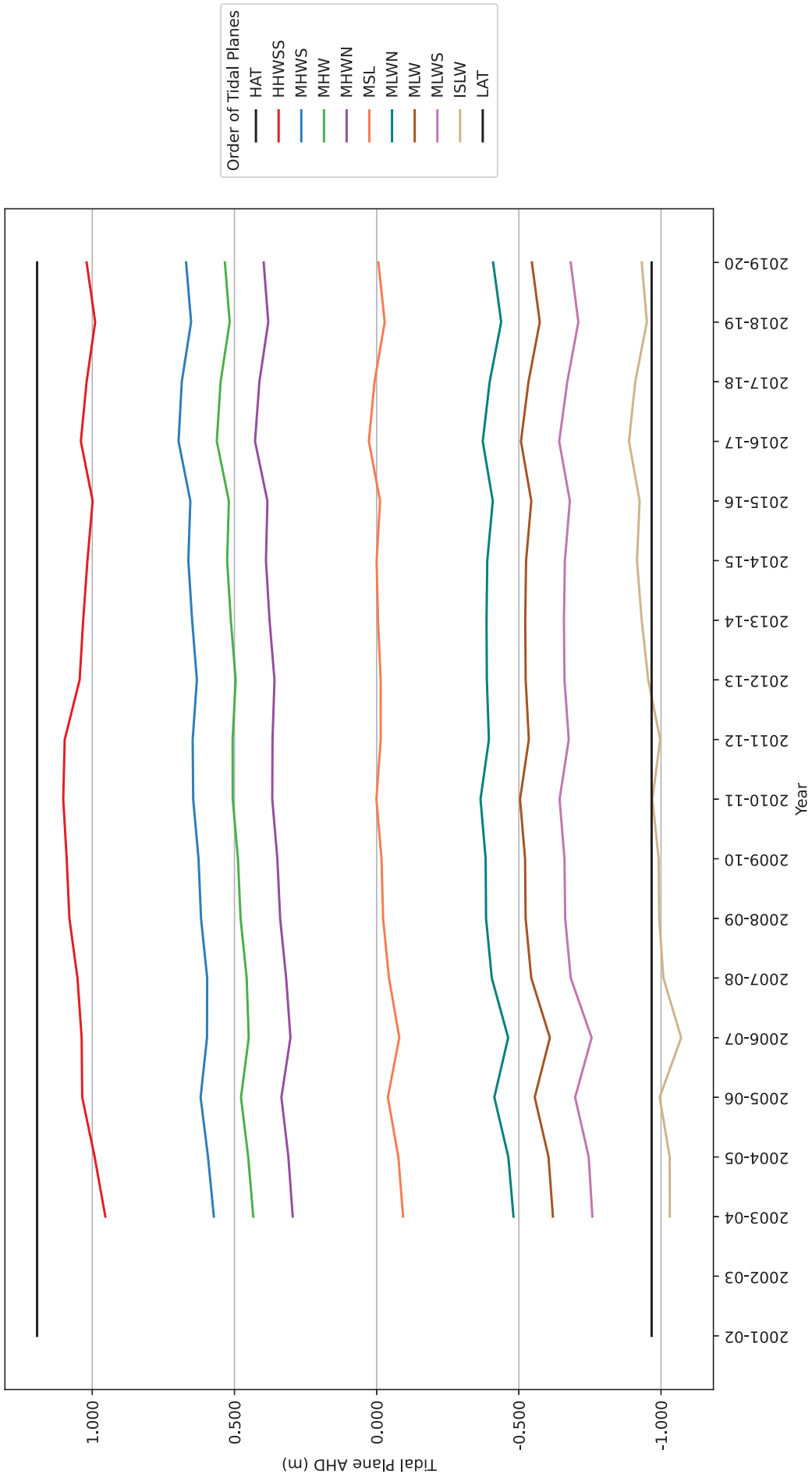
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.19	04/06/2008 20:30	±0.18	4.2
Lowest Astronomical Tide (LAT)	-0.97	29/09/2015 02:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A12

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tasman Sea at Crowdy Head Boat Harbour

MHL2786

Figure A12

RECORDING STATION: **Wallis Lake Entrance at Forster**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209402

ZONE: 56
EASTING: 453635
NORTHING: 6440173

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Wallis Lake Entrance at Forster

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.787	0.766	0.789	0.810	0.837	0.852	0.849	0.877	0.873	0.890	0.844	0.830	0.820	0.832	0.799	0.844	0.847	0.822	0.841	0.832	0.032
MHWS	0.506	0.474	0.485	0.493	0.504	0.496	0.485	0.505	0.507	0.526	0.511	0.511	0.522	0.554	0.536	0.580	0.584	0.550	0.563	0.521	0.032
MHW	0.393	0.357	0.370	0.377	0.387	0.379	0.369	0.385	0.393	0.412	0.403	0.403	0.414	0.444	0.429	0.471	0.472	0.439	0.451	0.408	0.035
MHWN	0.279	0.239	0.255	0.260	0.270	0.263	0.254	0.266	0.279	0.298	0.295	0.294	0.306	0.335	0.323	0.362	0.361	0.327	0.339	0.295	0.037
MSL	-0.063	-0.110	-0.078	-0.070	-0.053	-0.063	-0.063	-0.050	-0.031	-0.017	-0.009	-0.014	-0.011	0.006	-0.008	0.031	0.018	-0.018	0.000	-0.032	0.037
MLWN	-0.406	-0.458	-0.411	-0.401	-0.376	-0.388	-0.380	-0.367	-0.341	-0.332	-0.314	-0.323	-0.329	-0.323	-0.338	-0.301	-0.324	-0.363	-0.338	-0.359	0.041
MLW	-0.519	-0.576	-0.526	-0.517	-0.493	-0.505	-0.496	-0.486	-0.455	-0.446	-0.422	-0.431	-0.437	-0.433	-0.445	-0.410	-0.435	-0.474	-0.450	-0.471	0.044
MLWS	-0.633	-0.693	-0.641	-0.634	-0.609	-0.621	-0.611	-0.605	-0.569	-0.561	-0.530	-0.539	-0.544	-0.542	-0.552	-0.519	-0.547	-0.586	-0.562	-0.584	0.047
ISLW	-0.833	-0.902	-0.858	-0.860	-0.848	-0.876	-0.871	-0.871	-0.831	-0.820	-0.768	-0.767	-0.757	-0.741	-0.740	-0.708	-0.735	-0.780	-0.761	-0.807	0.059
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.685	0.698	0.666	0.661	0.646	0.651	0.635	0.633	0.620	0.630	0.609	0.617	0.635	0.658	0.661	0.663	0.684	0.690	0.677	0.654	0.026
MR	0.912	0.933	0.896	0.894	0.880	0.884	0.865	0.872	0.848	0.858	0.825	0.834	0.851	0.877	0.875	0.881	0.907	0.913	0.901	0.879	0.028
MSR	1.139	1.168	1.126	1.128	1.113	1.117	1.095	1.110	1.077	1.087	1.042	1.050	1.066	1.096	1.089	1.099	1.130	1.136	1.124	1.105	0.032
R	1.620	1.668	1.647	1.670	1.685	1.728	1.720	1.749	1.704	1.710	1.611	1.598	1.577	1.573	1.539	1.552	1.583	1.603	1.602	1.639	0.064
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.456	0.466	0.448	0.447	0.440	0.442	0.433	0.436	0.424	0.429	0.413	0.417	0.425	0.438	0.437	0.441	0.454	0.457	0.450	0.440	0.014
S2	0.113	0.118	0.115	0.117	0.117	0.116	0.115	0.119	0.114	0.114	0.108	0.108	0.108	0.109	0.107	0.109	0.111	0.112	0.112	0.113	0.004
K1	0.130	0.134	0.138	0.142	0.151	0.161	0.162	0.165	0.160	0.161	0.149	0.148	0.138	0.130	0.123	0.124	0.123	0.126	0.129	0.142	0.015
O1	0.071	0.074	0.079	0.084	0.088	0.094	0.099	0.101	0.102	0.099	0.088	0.080	0.075	0.069	0.065	0.065	0.065	0.068	0.070	0.081	0.013
MSF	0.009	0.012	0.013	0.005	0.022	0.012	0.009	0.016	0.007	0.016	0.009	0.019	0.008	0.021	0.002	0.013	0.012	0.011	0.007	0.012	0.005
z0	-0.063	-0.110	-0.078	-0.070	-0.053	-0.063	-0.063	-0.050	-0.031	-0.017	-0.009	-0.014	-0.011	0.006	-0.008	0.031	0.018	-0.018	0.000	-0.032	0.037
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	349.335	349.715	350.605	350.868	350.552	349.875	349.498	348.090	347.120	346.293	346.185	345.922	345.512	346.157	346.164	347.472	348.167	348.804	349.017	348.176	1.790
S2	260.680	258.947	258.503	257.833	258.250	259.356	259.117	259.067	259.309	259.974	259.466	259.167	259.886	259.124	259.422	259.516	259.546	259.401	259.424	259.262	0.624
K1	132.932	136.324	135.579	136.531	134.977	132.851	130.838	129.944	125.530	121.954	118.611	118.154	116.664	118.483	119.653	124.415	127.306	131.030	133.151	127.628	6.955
O1	182.985	183.110	183.071	184.065	183.860	185.077	186.493	190.906	196.158	201.955	207.058	209.474	209.962	207.961	203.889	196.909	191.469	190.327	186.570	193.753	10.039
MSF	325.144	59.390	352.238	42.467	60.674	327.506	349.109	95.827	61.839	107.893	319.953	76.182	84.800	49.423	311.470	350.478	347.358	32.123	148.163	184.318	135.071
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.086	0.082	0.081	0.075	0.085	0.082	0.068	0.072	0.081	0.084	0.066	0.076	0.082	0.075	0.066	0.062	0.067	0.089	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	68.9	89.2	98.4	82.2	96.8	64.5	74.9	75.2	97.2	89.5	93.5	88.8	94.5	91.4	95.4	83.5	86.7	94.5	93.6		

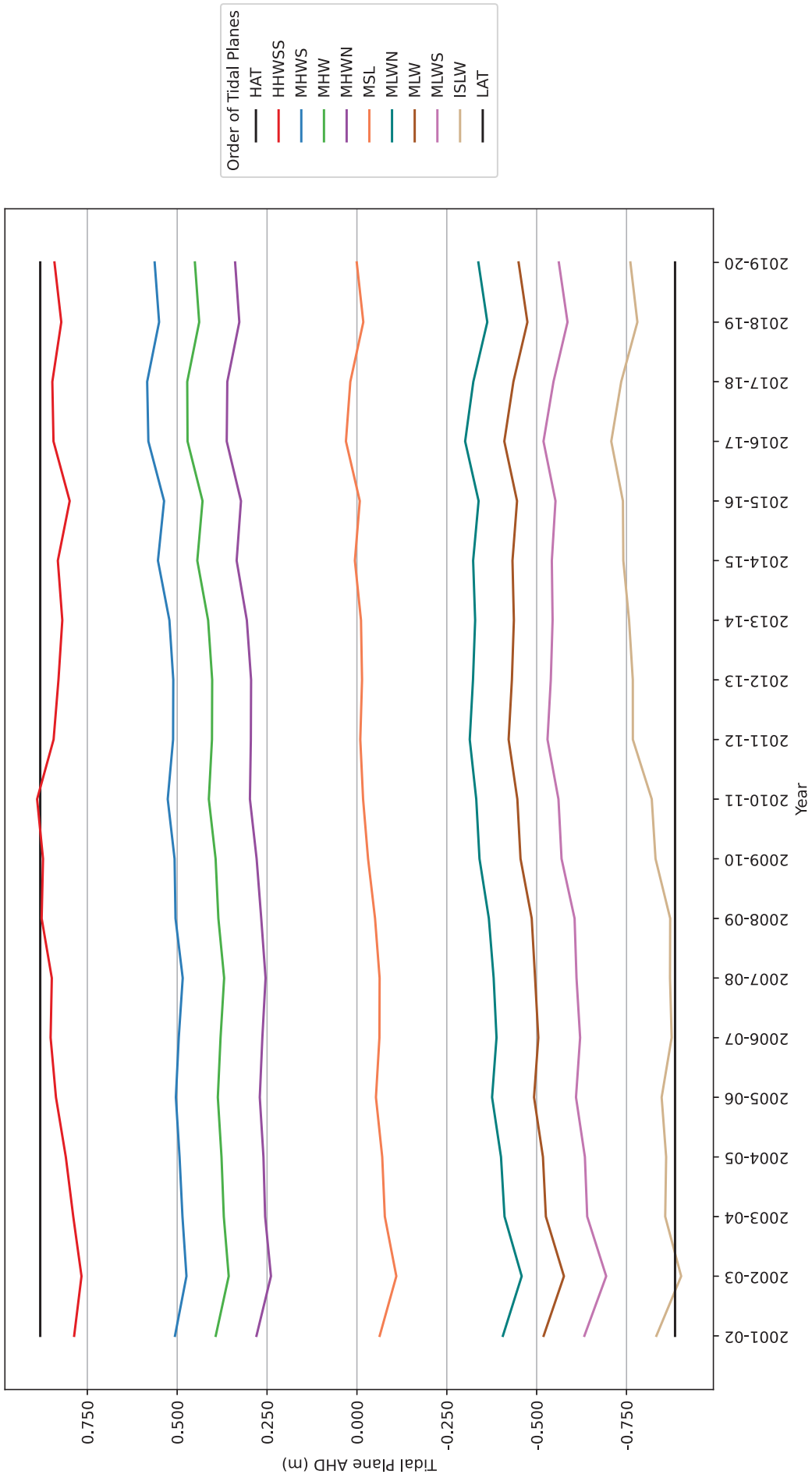
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.88	03/07/2004 21:15	±0.18	1.9
Lowest Astronomical Tide (LAT)	-0.89	29/09/2015 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A13

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallis Lake Entrance at Forster

MHL2786

Figure
A13

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Port Stephens at Shoal Bay

RECORDING STATION: **Port Stephens at Shoal Bay**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209474

ZONE: 56
EASTING: 422749
NORTHING: 6379489

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.006	0.966	0.974	0.969	1.011	1.003	1.031	1.043	1.044	1.080	1.073	1.053	1.036	1.023	0.993	1.037	1.018	0.995	1.022	1.020	0.032
MHWS	0.660	0.610	0.605	0.584	0.612	0.583	0.599	0.600	0.598	0.636	0.646	0.650	0.664	0.677	0.664	0.711	0.695	0.665	0.685	0.639	0.039
MHW	0.534	0.483	0.478	0.455	0.483	0.454	0.471	0.473	0.473	0.510	0.519	0.522	0.538	0.550	0.539	0.585	0.569	0.538	0.558	0.512	0.040
MHWN	0.408	0.356	0.350	0.327	0.353	0.324	0.343	0.345	0.348	0.384	0.392	0.394	0.412	0.423	0.414	0.460	0.443	0.411	0.432	0.385	0.041
MSL	0.011	-0.042	-0.039	-0.055	-0.018	-0.042	-0.021	-0.016	-0.012	0.017	0.020	0.020	0.033	0.034	0.016	0.062	0.035	0.006	0.027	0.002	0.032
MLWN	-0.387	-0.439	-0.428	-0.436	-0.388	-0.408	-0.385	-0.376	-0.373	-0.350	-0.351	-0.353	-0.347	-0.355	-0.382	-0.336	-0.372	-0.400	-0.377	-0.381	0.030
MLW	-0.513	-0.566	-0.555	-0.564	-0.518	-0.538	-0.513	-0.504	-0.498	-0.476	-0.478	-0.481	-0.473	-0.482	-0.507	-0.461	-0.498	-0.526	-0.504	-0.508	0.031
MLWS	-0.639	-0.694	-0.683	-0.693	-0.647	-0.667	-0.641	-0.631	-0.623	-0.601	-0.605	-0.610	-0.598	-0.608	-0.632	-0.587	-0.624	-0.653	-0.630	-0.635	0.032
ISLW	-0.886	-0.947	-0.946	-0.968	-0.932	-0.967	-0.950	-0.948	-0.941	-0.919	-0.911	-0.897	-0.864	-0.856	-0.867	-0.820	-0.854	-0.889	-0.871	-0.907	0.044
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.795	0.795	0.778	0.763	0.742	0.732	0.728	0.722	0.721	0.734	0.743	0.747	0.759	0.778	0.796	0.795	0.815	0.811	0.809	0.766	0.033
MR	1.047	1.050	1.033	1.020	1.000	0.991	0.984	0.976	0.971	0.986	0.997	1.003	1.010	1.031	1.046	1.047	1.067	1.064	1.062	1.020	0.032
MSR	1.299	1.304	1.288	1.276	1.258	1.251	1.240	1.231	1.221	1.237	1.251	1.260	1.262	1.285	1.296	1.298	1.319	1.318	1.315	1.274	0.031
R	1.892	1.913	1.920	1.936	1.942	1.971	1.981	1.990	1.986	1.999	1.984	1.950	1.900	1.879	1.860	1.857	1.872	1.884	1.893	1.927	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.523	0.525	0.516	0.510	0.500	0.496	0.492	0.488	0.485	0.493	0.499	0.502	0.505	0.516	0.523	0.523	0.534	0.532	0.531	0.510	0.016
S2	0.126	0.127	0.127	0.128	0.129	0.130	0.128	0.127	0.125	0.126	0.127	0.128	0.126	0.127	0.125	0.126	0.126	0.127	0.127	0.127	0.001
K1	0.162	0.166	0.171	0.177	0.182	0.189	0.194	0.197	0.198	0.198	0.193	0.185	0.174	0.163	0.155	0.154	0.152	0.155	0.159	0.175	0.017
O1	0.085	0.088	0.093	0.098	0.103	0.111	0.115	0.119	0.120	0.119	0.112	0.102	0.092	0.084	0.080	0.079	0.078	0.081	0.082	0.097	0.015
MSF	0.009	0.007	0.018	0.003	0.013	0.010	0.006	0.020	0.002	0.010	0.017	0.013	0.002	0.014	0.009	0.013	0.013	0.009	0.011	0.010	0.005
z0	0.011	-0.042	-0.039	-0.055	-0.018	-0.042	-0.021	-0.016	-0.012	0.017	0.020	0.020	0.033	0.034	0.016	0.062	0.035	0.006	0.027	0.002	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	353.719	353.734	354.059	354.686	354.820	354.109	353.310	352.254	351.045	350.519	350.061	350.426	350.274	350.627	351.458	352.186	352.587	353.001	353.663	352.449	1.606
S2	265.474	265.097	264.523	263.815	264.612	264.891	265.089	265.550	265.341	266.449	265.709	265.471	266.122	266.241	266.708	266.071	266.127	266.128	266.165	265.557	0.751
K1	127.130	130.045	129.479	129.647	128.430	127.866	124.737	121.299	118.930	114.808	112.216	110.724	110.158	111.013	113.065	117.676	120.405	123.852	126.697	120.957	7.227
O1	184.140	181.880	181.230	181.011	182.845	183.469	185.729	189.268	192.625	198.680	204.170	204.795	205.679	202.971	201.650	195.878	191.778	186.813	185.728	191.597	8.944
MSF	291.382	349.211	310.616	125.102	25.907	130.078	318.837	66.595	1.797	122.863	289.074	72.810	157.404	38.267	257.618	306.955	310.111	6.297	185.383	177.174	121.932
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.085	0.076	0.080	0.084	0.090	0.072	0.077	0.082	0.095	0.070	0.083	0.083	0.077	0.067	0.063	0.071	0.093	0.066		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.6	99.5	97.4	98.6	94.2	97.0	99.5	98.2	97.5	97.1	96.5	91.3	92.8	91.5	94.4	87.3	91.2	95.9	92.5		

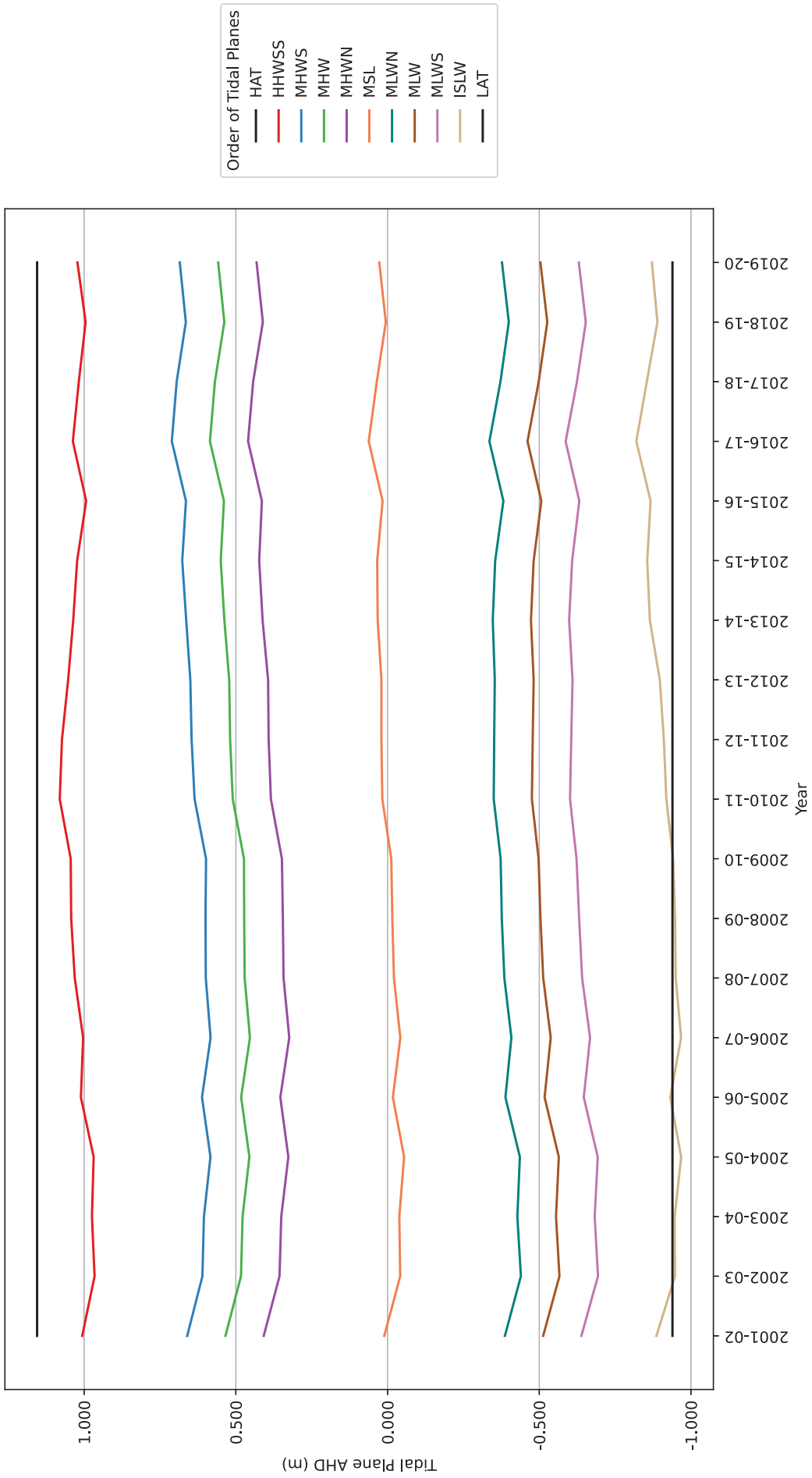
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.16	04/06/2008 20:45	±0.21	3.5
Lowest Astronomical Tide (LAT)	-0.94	28/09/2015 02:15		

COMMENTS Station relocated from Tomaree (AWRC: 209474) in Apr 2014.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A14

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Port Stephens at Shoal Bay

MHL2786

Figure A14

RECORDING STATION: **Hawkesbury River at Patonga**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212440

ZONE: 56
EASTING: 339822
NORTHING: 6286295

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hawkesbury River at Patonga

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.060	0.994	1.003	0.993	1.035	1.015	1.038	1.009	1.041	1.084	1.067	1.052	1.046	1.030	1.008	1.057	1.033	1.007	1.035	1.032	0.026
MHWS	0.754	0.676	0.673	0.649	0.675	0.641	0.649	0.611	0.637	0.684	0.684	0.694	0.713	0.726	0.715	0.767	0.743	0.716	0.732	0.691	0.043
MHW	0.629	0.551	0.547	0.523	0.549	0.515	0.523	0.485	0.511	0.559	0.559	0.570	0.589	0.602	0.592	0.643	0.618	0.591	0.609	0.567	0.044
MHWN	0.504	0.426	0.421	0.396	0.423	0.389	0.397	0.360	0.386	0.433	0.434	0.446	0.464	0.477	0.469	0.519	0.494	0.466	0.486	0.442	0.044
MSL	0.105	0.028	0.034	0.015	0.052	0.021	0.036	0.002	0.021	0.067	0.068	0.072	0.085	0.089	0.070	0.120	0.086	0.061	0.085	0.059	0.033
MLWN	-0.293	-0.370	-0.353	-0.366	-0.320	-0.346	-0.325	-0.356	-0.343	-0.299	-0.297	-0.302	-0.295	-0.300	-0.328	-0.279	-0.321	-0.344	-0.317	-0.324	0.027
MLW	-0.418	-0.496	-0.479	-0.493	-0.446	-0.472	-0.450	-0.482	-0.468	-0.424	-0.422	-0.426	-0.419	-0.424	-0.451	-0.403	-0.446	-0.469	-0.440	-0.449	0.028
MLWS	-0.543	-0.621	-0.605	-0.619	-0.572	-0.598	-0.576	-0.608	-0.594	-0.550	-0.547	-0.550	-0.544	-0.549	-0.574	-0.527	-0.570	-0.594	-0.563	-0.574	0.028
ISLW	-0.761	-0.848	-0.841	-0.865	-0.829	-0.865	-0.854	-0.891	-0.883	-0.835	-0.820	-0.805	-0.781	-0.766	-0.783	-0.734	-0.778	-0.803	-0.780	-0.817	0.045
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.797	0.796	0.773	0.763	0.743	0.736	0.722	0.715	0.728	0.732	0.731	0.748	0.759	0.777	0.797	0.798	0.815	0.810	0.804	0.766	0.033
MR	1.047	1.046	1.026	1.016	0.995	0.987	0.973	0.967	0.979	0.983	0.981	0.996	1.008	1.026	1.043	1.046	1.064	1.060	1.050	1.015	0.032
MSR	1.297	1.296	1.279	1.269	1.246	1.238	1.225	1.219	1.230	1.234	1.230	1.244	1.257	1.274	1.288	1.294	1.313	1.310	1.295	1.265	0.031
R	1.821	1.842	1.844	1.857	1.863	1.880	1.893	1.900	1.924	1.919	1.887	1.857	1.827	1.796	1.791	1.791	1.811	1.810	1.815	1.849	0.043
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.524	0.523	0.513	0.508	0.497	0.494	0.487	0.484	0.490	0.492	0.490	0.498	0.504	0.513	0.521	0.523	0.532	0.530	0.525	0.508	0.016
S2	0.125	0.125	0.126	0.127	0.126	0.126	0.126	0.126	0.125	0.126	0.125	0.124	0.125	0.124	0.123	0.124	0.124	0.125	0.123	0.125	0.001
K1	0.136	0.141	0.146	0.150	0.156	0.161	0.165	0.167	0.170	0.169	0.164	0.156	0.147	0.137	0.132	0.130	0.129	0.131	0.135	0.149	0.015
O1	0.082	0.086	0.090	0.096	0.101	0.106	0.113	0.117	0.119	0.116	0.110	0.100	0.090	0.081	0.077	0.077	0.078	0.077	0.081	0.095	0.015
MSF	0.005	0.006	0.022	0.005	0.015	0.011	0.008	0.018	0.006	0.009	0.014	0.016	0.003	0.012	0.008	0.011	0.013	0.011	0.007	0.011	0.005
z0	0.105	0.028	0.034	0.015	0.052	0.021	0.036	0.002	0.021	0.067	0.068	0.072	0.085	0.089	0.070	0.120	0.086	0.061	0.085	0.059	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	353.166	353.782	354.150	354.468	354.107	353.175	352.594	351.912	350.650	349.837	349.928	349.765	349.793	350.181	350.320	351.362	351.788	352.091	352.959	351.896	1.657
S2	263.329	263.434	262.651	261.945	262.454	263.076	263.323	264.129	262.950	263.677	263.889	263.015	263.974	263.151	263.925	263.267	263.507	262.632	263.486	263.253	0.566
K1	124.212	126.557	126.355	126.180	125.186	124.382	122.710	119.585	115.945	112.056	109.135	108.650	106.577	108.165	109.651	114.781	118.040	120.414	123.554	118.007	7.130
O1	186.864	183.832	182.978	183.514	184.493	185.272	187.786	190.215	194.340	200.954	205.694	206.708	205.863	206.927	203.859	198.789	192.996	188.518	187.943	193.555	8.956
MSF	303.355	293.921	295.896	131.386	15.255	113.931	313.930	72.656	260.479	93.598	258.593	67.225	125.142	34.098	238.753	317.893	296.781	28.828	207.103	182.570	110.969
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.062	0.081	0.073	0.075	0.084	0.086	0.071	0.089	0.078	0.081	0.067	0.083	0.075	0.075	0.068	0.059	0.067	0.090	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	77.4	98.7	96.7	98.3	92.9	97.2	98.8	97.7	93.2	97.3	92.4	92.3	91.1	92.2	95.4	87.8	93.3	96.5	93.1		

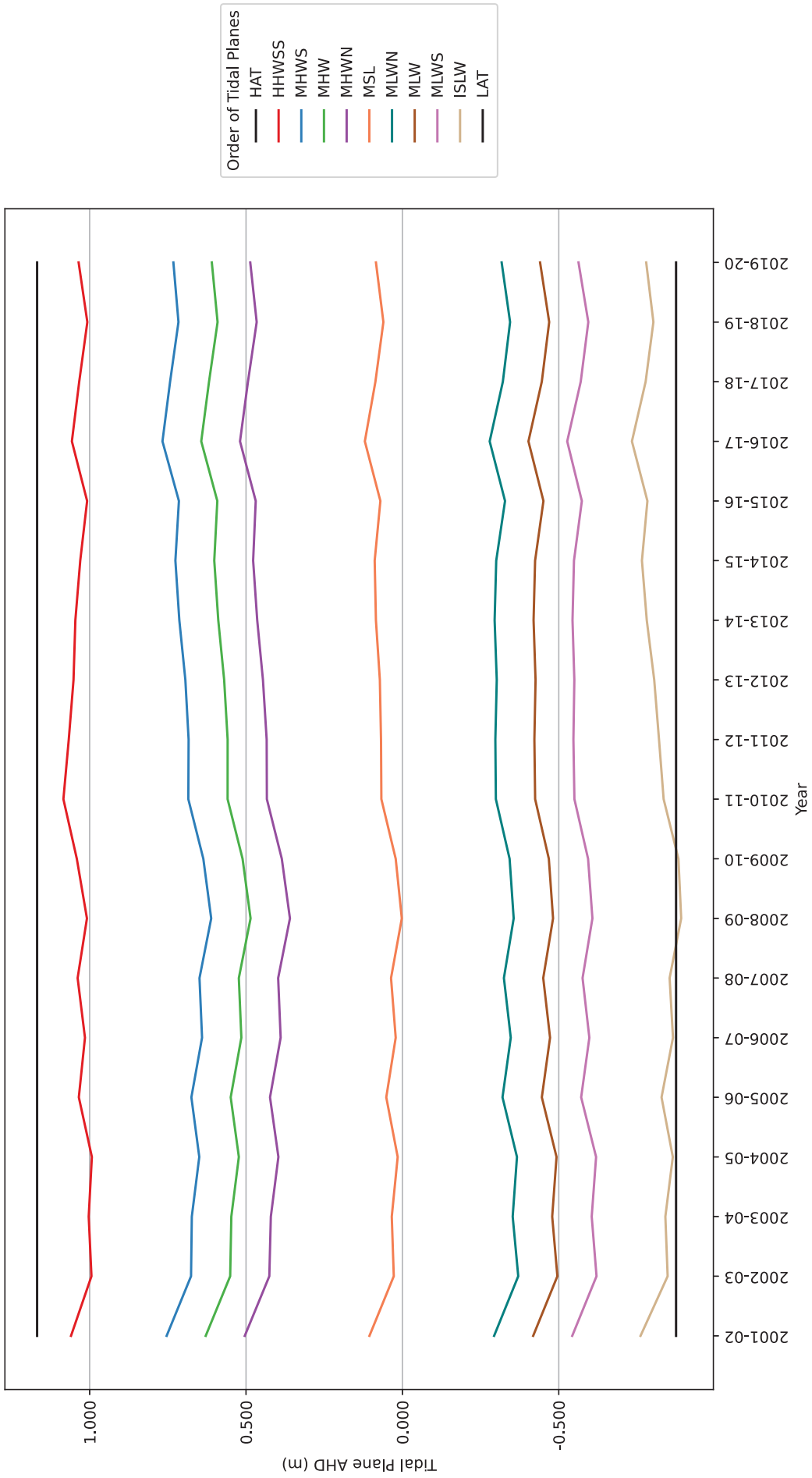
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.17	04/06/2008 20:45	±0.18	4.2
Lowest Astronomical Tide (LAT)	-0.88	09/09/2014 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A15

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Patonga

MHL2786

Figure A15

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Port Jackson at Sydney

RECORDING STATION: **Port Jackson at Sydney**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213470

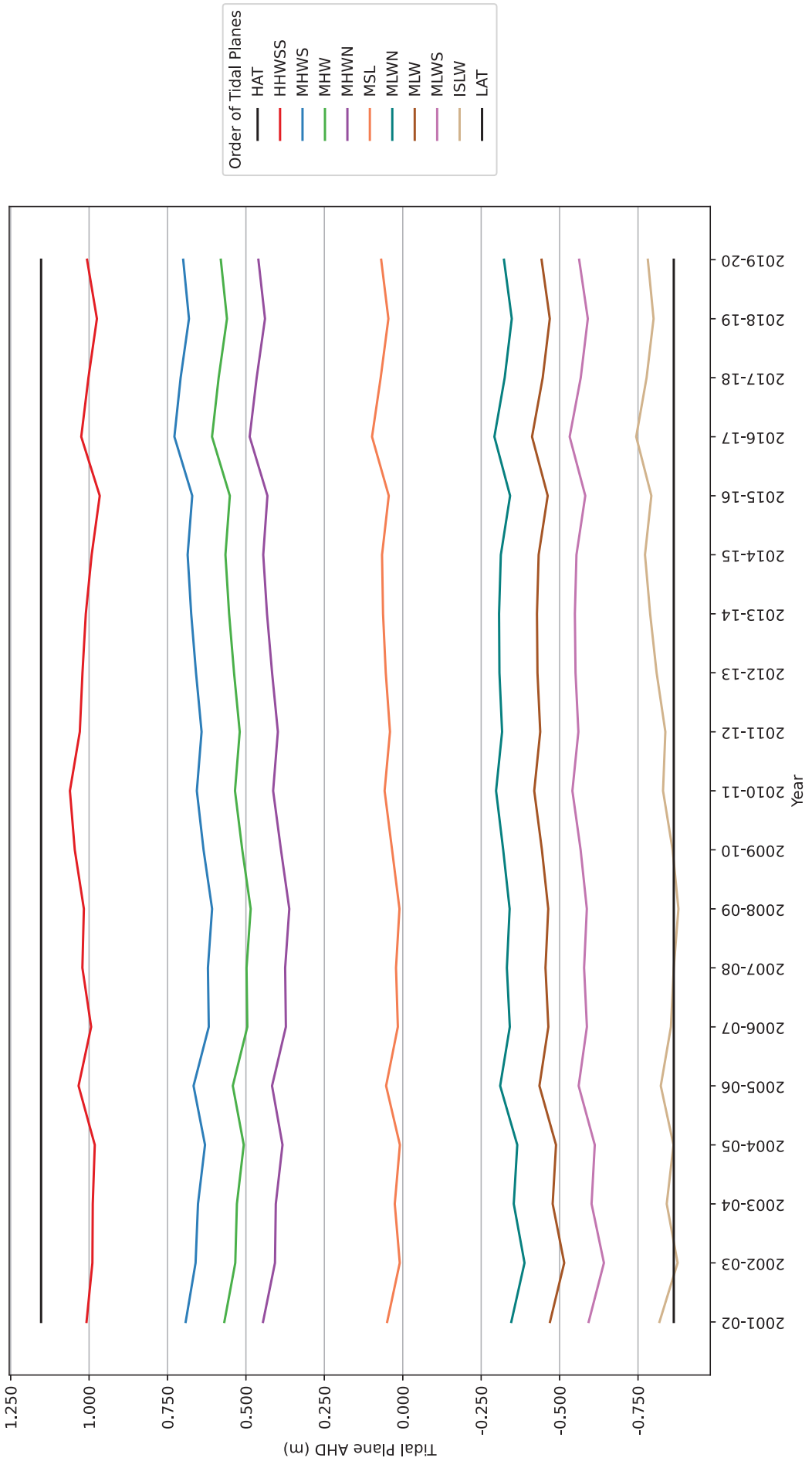
ZONE: 56
EASTING: 338842
NORTHING: 6255833

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.008	0.989	0.988	0.982	1.034	0.993	1.021	1.017	1.046	1.061	1.030	1.021	1.010	0.992	0.966	1.025	1.002	0.975	1.006	1.009	0.025
MHWS	0.692	0.660	0.653	0.630	0.667	0.618	0.621	0.608	0.635	0.656	0.641	0.659	0.674	0.686	0.671	0.728	0.708	0.682	0.700	0.663	0.032
MHW	0.569	0.534	0.529	0.507	0.542	0.495	0.498	0.485	0.512	0.535	0.520	0.538	0.554	0.565	0.551	0.608	0.587	0.560	0.580	0.540	0.033
MHWN	0.445	0.407	0.405	0.383	0.417	0.373	0.375	0.362	0.388	0.413	0.398	0.417	0.433	0.445	0.431	0.488	0.466	0.439	0.460	0.418	0.034
MSL	0.050	0.010	0.025	0.009	0.053	0.016	0.022	0.010	0.034	0.058	0.041	0.054	0.063	0.066	0.045	0.098	0.070	0.046	0.069	0.044	0.024
MLWN	-0.346	-0.388	-0.354	-0.365	-0.311	-0.341	-0.332	-0.341	-0.320	-0.297	-0.317	-0.308	-0.307	-0.313	-0.342	-0.292	-0.325	-0.348	-0.323	-0.330	0.024
MLW	-0.469	-0.515	-0.478	-0.489	-0.436	-0.464	-0.455	-0.464	-0.444	-0.419	-0.438	-0.429	-0.428	-0.433	-0.462	-0.412	-0.446	-0.469	-0.443	-0.452	0.025
MLWS	-0.593	-0.641	-0.602	-0.612	-0.561	-0.587	-0.578	-0.587	-0.567	-0.541	-0.560	-0.551	-0.549	-0.554	-0.582	-0.532	-0.567	-0.590	-0.562	-0.575	0.027
ISLW	-0.818	-0.876	-0.842	-0.863	-0.823	-0.855	-0.864	-0.879	-0.860	-0.830	-0.837	-0.809	-0.789	-0.772	-0.793	-0.744	-0.777	-0.800	-0.781	-0.822	0.039
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.792	0.796	0.759	0.748	0.727	0.714	0.707	0.702	0.708	0.711	0.715	0.725	0.740	0.757	0.774	0.780	0.791	0.787	0.783	0.748	0.034
MR	1.038	1.049	1.007	0.995	0.977	0.960	0.953	0.949	0.955	0.954	0.958	0.967	0.981	0.998	1.013	1.020	1.033	1.029	1.023	0.993	0.033
MSR	1.285	1.302	1.255	1.243	1.228	1.205	1.199	1.195	1.202	1.197	1.201	1.210	1.223	1.240	1.253	1.260	1.276	1.272	1.262	1.237	0.034
R	1.827	1.866	1.830	1.845	1.856	1.848	1.885	1.895	1.906	1.891	1.867	1.830	1.799	1.764	1.759	1.769	1.779	1.775	1.788	1.830	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.519	0.524	0.503	0.498	0.489	0.480	0.477	0.474	0.478	0.477	0.479	0.484	0.491	0.499	0.507	0.510	0.517	0.515	0.511	0.496	0.017
S2	0.123	0.127	0.124	0.124	0.125	0.123	0.123	0.123	0.123	0.122	0.122	0.121	0.121	0.121	0.120	0.120	0.121	0.121	0.120	0.122	0.002
K1	0.140	0.145	0.147	0.152	0.156	0.160	0.170	0.170	0.171	0.171	0.164	0.156	0.147	0.136	0.132	0.132	0.130	0.131	0.135	0.150	0.015
O1	0.086	0.090	0.093	0.099	0.106	0.108	0.116	0.122	0.122	0.118	0.113	0.103	0.093	0.083	0.079	0.080	0.080	0.079	0.083	0.098	0.016
MSF	0.010	0.006	0.019	0.004	0.013	0.006	0.017	0.019	0.003	0.011	0.017	0.018	0.003	0.011	0.007	0.011	0.014	0.010	0.007	0.011	0.005
z0	0.050	0.010	0.025	0.009	0.053	0.016	0.022	0.010	0.034	0.058	0.041	0.054	0.063	0.066	0.045	0.098	0.070	0.046	0.069	0.044	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	350.069	350.783	351.152	351.600	351.223	350.469	349.998	349.239	347.934	347.453	347.197	346.969	346.998	347.269	347.460	348.467	349.035	349.426	350.372	349.111	1.603
S2	259.619	259.369	259.406	258.732	259.121	259.658	259.692	260.862	259.664	260.760	260.623	259.529	260.493	259.907	260.574	260.021	259.997	259.307	260.456	259.884	0.603
K1	125.413	126.423	126.543	127.531	125.881	124.784	123.950	120.567	116.691	112.932	109.917	108.838	107.122	108.635	110.332	115.233	118.776	121.075	123.880	118.659	7.170
O1	186.066	181.579	181.958	183.211	184.012	184.654	187.704	188.720	194.152	199.750	204.131	206.428	205.772	205.741	203.031	197.997	191.519	188.168	186.424	192.685	9.013
MSF	304.615	312.778	291.665	238.692	21.177	113.733	299.415	67.000	261.787	84.941	280.961	65.986	158.151	38.443	235.892	297.385	293.840	26.024	215.286	189.883	110.079
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.083	0.075	0.079	0.082	0.086	0.072	0.070	0.080	0.086	0.070	0.082	0.078	0.076	0.070	0.062	0.070	0.091	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.9	98.8	96.0	96.3	92.0	97.5	90.5	99.6	97.3	97.8	98.1	94.0	92.6	93.8	96.7	90.6	93.9	96.3	94.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.15	04/06/2008 20:30	±0.18	3.6
Lowest Astronomical Tide (LAT)	-0.86	31/01/2014 15:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Port Jackson at Sydney

MHL2786

Figure A16

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Port Hacking at Bundeena

RECORDING STATION: **Port Hacking at Bundeena**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214452

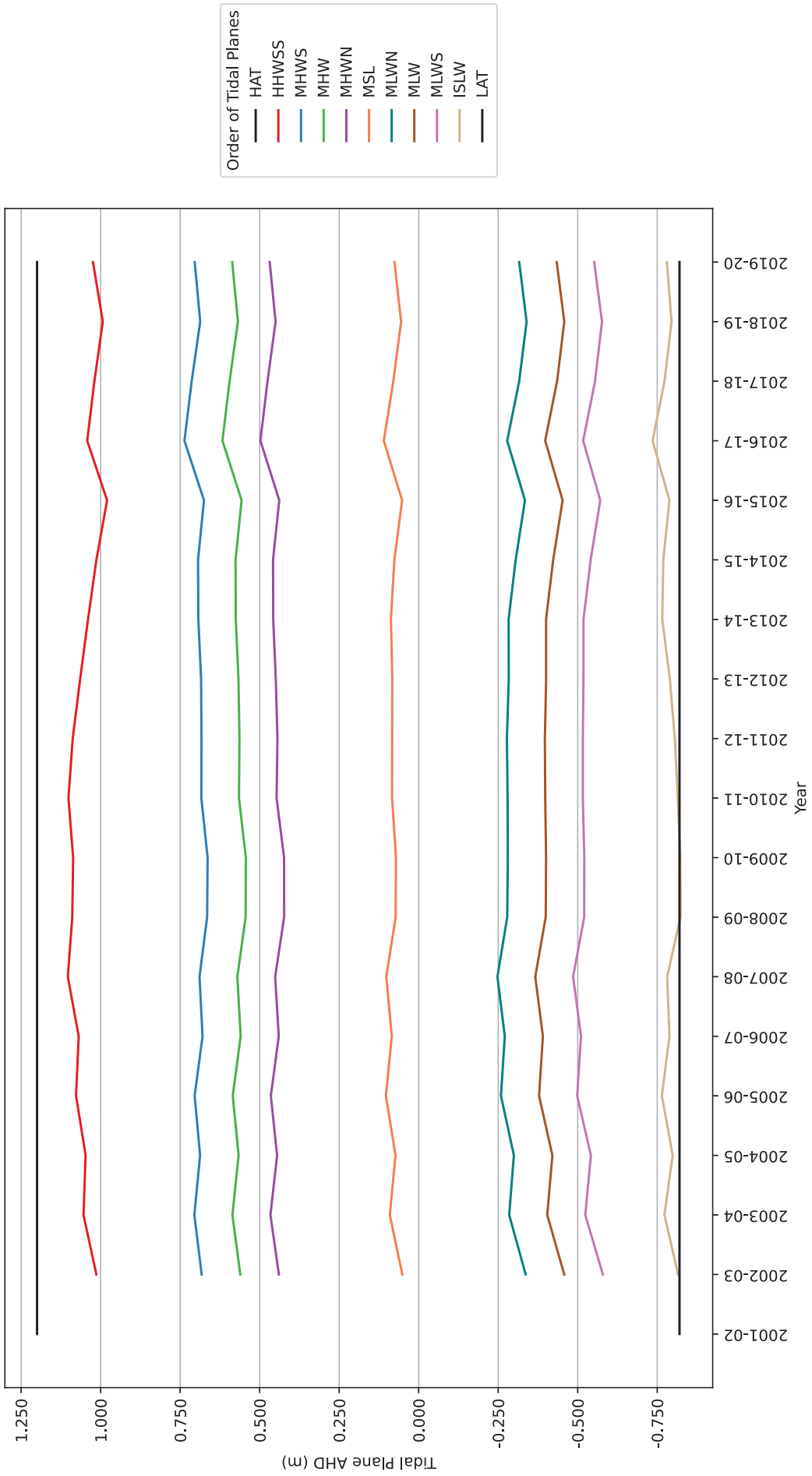
ZONE: 56
EASTING: 329394
NORTHING: 6227133

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		1.014	1.054	1.047	1.077	1.069	1.103	1.089	1.087	1.101	1.088	1.065	1.040	1.013	0.980	1.042	1.020	0.993	1.024	1.050	0.037
MHWS		0.682	0.705	0.687	0.705	0.680	0.689	0.665	0.664	0.683	0.683	0.684	0.693	0.694	0.675	0.737	0.714	0.687	0.704	0.691	0.018
MHW		0.561	0.586	0.566	0.585	0.560	0.570	0.544	0.544	0.565	0.564	0.567	0.575	0.576	0.557	0.617	0.595	0.568	0.586	0.571	0.018
MHWN		0.440	0.466	0.445	0.465	0.440	0.451	0.423	0.423	0.447	0.444	0.449	0.457	0.458	0.438	0.498	0.475	0.450	0.469	0.452	0.018
MSL		0.052	0.091	0.073	0.103	0.085	0.102	0.072	0.072	0.084	0.083	0.083	0.087	0.077	0.052	0.110	0.080	0.055	0.076	0.080	0.016
MLWN		-0.336	-0.285	-0.299	-0.259	-0.271	-0.248	-0.278	-0.280	-0.279	-0.277	-0.283	-0.283	-0.305	-0.334	-0.278	-0.316	-0.339	-0.316	-0.293	0.027
MLW		-0.458	-0.404	-0.420	-0.378	-0.390	-0.366	-0.399	-0.400	-0.398	-0.397	-0.401	-0.400	-0.423	-0.452	-0.398	-0.435	-0.458	-0.434	-0.412	0.027
MLWS		-0.579	-0.524	-0.541	-0.498	-0.510	-0.485	-0.520	-0.521	-0.516	-0.516	-0.518	-0.518	-0.541	-0.571	-0.517	-0.554	-0.576	-0.552	-0.531	0.027
ISLW		-0.816	-0.773	-0.799	-0.765	-0.788	-0.781	-0.823	-0.823	-0.815	-0.805	-0.790	-0.766	-0.769	-0.788	-0.735	-0.773	-0.795	-0.780	-0.788	0.023
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.776	0.751	0.744	0.724	0.711	0.699	0.701	0.704	0.726	0.721	0.733	0.740	0.763	0.773	0.776	0.791	0.789	0.785	0.745	0.032
MR		1.019	0.990	0.987	0.963	0.950	0.937	0.944	0.944	0.963	0.960	0.967	0.976	0.999	1.009	1.015	1.030	1.026	1.020	0.983	0.031
MSR		1.262	1.229	1.229	1.203	1.190	1.175	1.186	1.184	1.200	1.199	1.202	1.211	1.235	1.246	1.254	1.268	1.263	1.256	1.222	0.031
R		1.829	1.827	1.846	1.842	1.857	1.884	1.913	1.909	1.916	1.893	1.854	1.806	1.783	1.768	1.778	1.793	1.788	1.804	1.838	0.049
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.509	0.495	0.493	0.482	0.475	0.468	0.472	0.472	0.481	0.480	0.484	0.488	0.499	0.505	0.507	0.515	0.513	0.510	0.492	0.016
S2		0.121	0.120	0.121	0.120	0.120	0.119	0.121	0.120	0.118	0.119	0.117	0.118	0.118	0.118	0.119	0.119	0.119	0.118	0.119	0.001
K1		0.145	0.153	0.156	0.160	0.165	0.173	0.178	0.176	0.177	0.171	0.163	0.153	0.142	0.136	0.136	0.136	0.136	0.141	0.155	0.016
O1		0.091	0.096	0.101	0.107	0.113	0.122	0.125	0.126	0.121	0.118	0.109	0.095	0.086	0.082	0.083	0.082	0.083	0.088	0.102	0.016
MSF		0.006	0.015	0.005	0.015	0.006	0.012	0.016	0.002	0.022	0.018	0.020	0.000	0.011	0.004	0.016	0.015	0.010	0.007	0.011	0.006
z0		0.052	0.091	0.073	0.103	0.085	0.102	0.072	0.072	0.084	0.083	0.083	0.087	0.077	0.052	0.110	0.080	0.055	0.076	0.080	0.016
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		351.380	352.240	351.923	352.506	351.101	350.870	349.733	348.639	347.917	347.515	347.390	347.317	347.617	347.757	348.488	349.417	349.919	350.814	349.586	1.819
S2		260.007	260.250	259.211	260.862	260.563	261.100	261.277	260.306	258.808	260.377	259.831	261.021	260.202	260.802	261.734	260.295	259.916	260.768	260.407	0.716
K1		128.517	127.993	127.908	127.841	126.446	124.444	121.652	118.492	115.750	112.032	109.721	108.671	109.998	112.174	116.322	119.784	122.952	125.241	119.774	7.081
O1		182.133	180.366	180.906	183.373	184.286	186.068	187.175	192.543	197.681	203.650	205.966	204.132	204.999	202.318	195.034	189.810	186.386	184.494	191.740	9.187
MSF		228.316	303.263	128.227	350.666	77.511	305.375	55.121	224.786	68.462	294.085	64.962	53.759	48.413	198.735	320.492	299.614	44.449	191.984	181.012	113.240
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.070	0.068	0.074	0.078	0.088	0.066	0.065	0.081	0.074	0.070	0.080	0.079	0.078	0.069	0.066	0.074	0.095	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		77.9	69.6	98.1	84.0	86.9	76.3	96.7	97.9	56.1	88.8	94.1	90.0	94.8	88.9	65.8	96.8	98.1	95.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.20	04/06/2004 21:15	±0.18	4.1
Lowest Astronomical Tide (LAT)	-0.82	09/09/2014 02:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Port Hacking (AWRC: 214451) in Dec 2014.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Port Hacking at Bundeena

MHL2786

Figure A17

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven Offshore

RECORDING STATION: **Shoalhaven Offshore (Tasman Sea)**
DATUM: APPROXIMATE MEAN SEA LEVEL
AWRC #: 215450

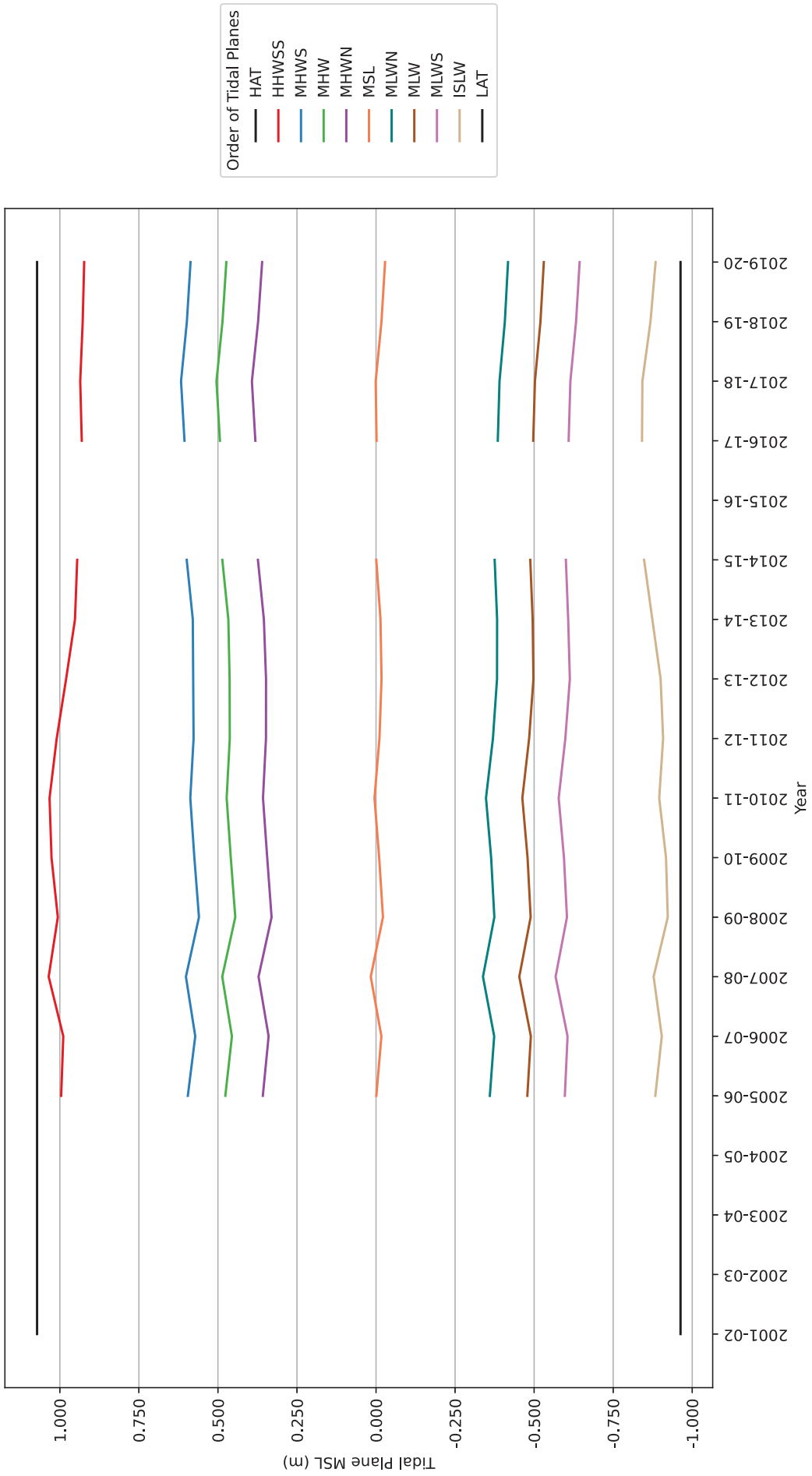
ZONE: 56
EASTING: 297771
NORTHING: 6133980

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16*	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS					0.996	0.989	1.035	1.006	1.026	1.033	1.010	0.980	0.952	0.945		0.931	0.936	0.928	0.923	0.978	0.041
MHWS					0.595	0.572	0.601	0.560	0.575	0.587	0.577	0.578	0.579	0.599		0.606	0.617	0.598	0.587	0.588	0.015
MHW					0.477	0.456	0.486	0.445	0.459	0.472	0.463	0.463	0.467	0.486		0.494	0.505	0.486	0.473	0.474	0.016
MHWN					0.358	0.340	0.372	0.330	0.344	0.357	0.348	0.348	0.355	0.374		0.382	0.393	0.373	0.360	0.359	0.017
MSL					-0.001	-0.017	0.017	-0.022	-0.010	0.005	-0.011	-0.017	-0.014	-0.001		-0.002	0.001	-0.017	-0.029	-0.008	0.012
MLWN					-0.360	-0.374	-0.338	-0.374	-0.364	-0.348	-0.370	-0.383	-0.383	-0.375		-0.385	-0.391	-0.407	-0.417	-0.376	0.021
MLW					-0.479	-0.490	-0.453	-0.489	-0.479	-0.463	-0.484	-0.498	-0.495	-0.488		-0.497	-0.503	-0.520	-0.531	-0.491	0.020
MLWS					-0.597	-0.606	-0.568	-0.604	-0.594	-0.578	-0.599	-0.613	-0.608	-0.600		-0.609	-0.615	-0.633	-0.644	-0.605	0.019
ISLW					-0.883	-0.904	-0.878	-0.923	-0.917	-0.896	-0.908	-0.900	-0.874	-0.848		-0.841	-0.842	-0.868	-0.884	-0.883	0.027
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR					0.718	0.713	0.710	0.705	0.708	0.705	0.718	0.731	0.738	0.749		0.767	0.783	0.780	0.778	0.736	0.030
MR					0.955	0.945	0.939	0.934	0.939	0.935	0.947	0.961	0.962	0.974		0.991	1.007	1.006	1.004	0.964	0.027
MSR					1.192	1.177	1.169	1.164	1.169	1.165	1.176	1.191	1.187	1.199		1.215	1.231	1.231	1.230	1.193	0.025
R					1.879	1.893	1.913	1.929	1.943	1.928	1.918	1.880	1.826	1.793		1.772	1.778	1.796	1.807	1.861	0.063
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2					0.478	0.473	0.470	0.467	0.469	0.468	0.473	0.480	0.481	0.487		0.495	0.504	0.503	0.502	0.482	0.014
S2					0.119	0.116	0.115	0.115	0.115	0.115	0.114	0.115	0.112	0.113		0.112	0.112	0.113	0.113	0.114	0.002
K1					0.177	0.183	0.190	0.195	0.195	0.192	0.190	0.180	0.169	0.159		0.149	0.146	0.151	0.154	0.174	0.018
O1					0.109	0.115	0.121	0.124	0.128	0.126	0.120	0.107	0.098	0.088		0.083	0.081	0.084	0.087	0.105	0.018
MSF					0.007	0.010	0.009	0.012	0.004	0.011	0.017	0.022	0.005	0.011		0.014	0.022	0.012	0.005	0.011	0.006
z0					-0.001	-0.017	0.017	-0.022	-0.010	0.005	-0.011	-0.017	-0.014	-0.001		-0.002	0.001	-0.017	-0.029	-0.008	0.012
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2					351.592	350.818	349.889	349.170	347.714	346.642	346.778	346.246	346.232	346.362		347.602	350.196	348.631	349.755	348.402	1.846
S2					259.659	259.131	259.696	260.053	260.086	261.465	259.459	258.382	259.475	259.355		259.055	262.803	259.286	259.781	259.835	1.097
K1					121.106	119.782	116.569	113.203	111.588	105.738	103.418	101.631	101.323	102.350		108.615	112.679	115.146	117.875	110.787	6.957
O1					172.356	174.954	176.520	178.030	182.936	189.441	192.898	194.592	195.749	194.131		184.937	180.314	176.335	174.279	183.391	8.478
MSF					10.182	86.426	317.846	52.844	229.274	85.922	276.202	58.002	264.150	37.925		329.576	269.169	72.331	127.037	158.349	115.561
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
					0.082	0.088	0.072	0.070	0.084	0.080	0.073	0.083	0.088	0.081		0.070	0.077	0.088	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
					75.8	96.5	94.8	98.1	94.3	71.7	98.1	96.5	97.0	95.3	25.1	93.7	70.7	97.5	95.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.07	24/06/2013 21:00	±0.30	2.7
Lowest Astronomical Tide (LAT)	-0.96	31/01/2014 15:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven Offshore

MHL2786

Figure A18

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Crookhaven River at Crookhaven Heads

RECORDING STATION: **Crookhaven River at Crookhaven Heads**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215408

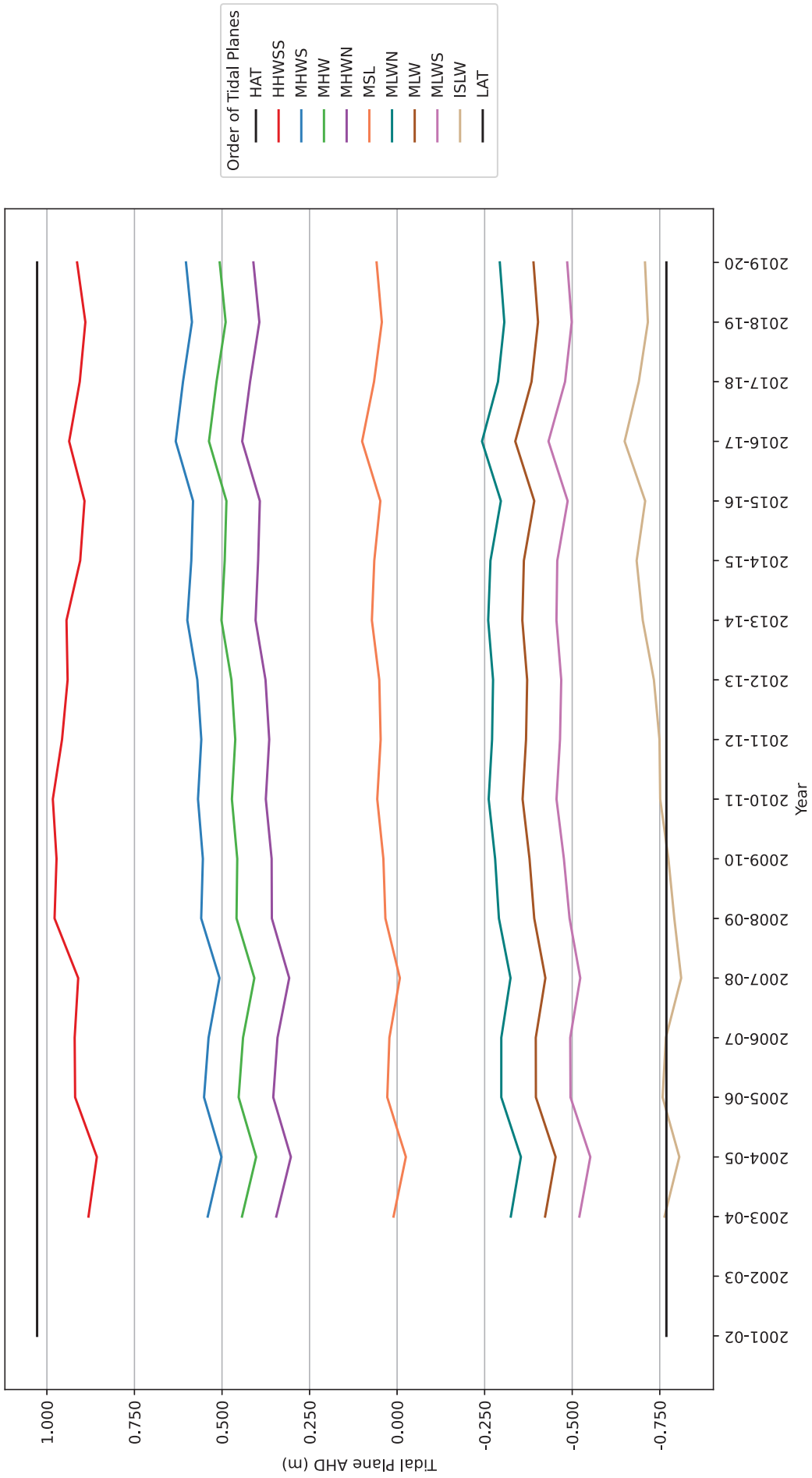
ZONE: 56
EASTING: 295288
NORTHING: 6135163

YEAR	2001-02*	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			0.881	0.857	0.919	0.921	0.911	0.978	0.973	0.983	0.957	0.941	0.944	0.905	0.893	0.937	0.906	0.890	0.914	0.924	0.035
MHWS			0.541	0.502	0.551	0.538	0.507	0.559	0.555	0.569	0.559	0.570	0.599	0.588	0.583	0.632	0.611	0.586	0.603	0.568	0.035
MHW			0.443	0.402	0.452	0.440	0.408	0.459	0.456	0.472	0.462	0.473	0.502	0.492	0.487	0.537	0.516	0.490	0.507	0.470	0.036
MHWN			0.345	0.303	0.354	0.342	0.308	0.358	0.358	0.375	0.365	0.376	0.404	0.397	0.392	0.442	0.420	0.393	0.410	0.373	0.037
MSL			0.010	-0.025	0.028	0.022	-0.008	0.033	0.039	0.057	0.047	0.051	0.072	0.065	0.048	0.100	0.066	0.044	0.059	0.042	0.030
MLWN			-0.325	-0.354	-0.298	-0.298	-0.324	-0.291	-0.280	-0.261	-0.271	-0.274	-0.260	-0.267	-0.296	-0.242	-0.288	-0.306	-0.293	-0.290	0.027
MLW			-0.423	-0.453	-0.396	-0.396	-0.423	-0.392	-0.378	-0.358	-0.368	-0.371	-0.358	-0.362	-0.392	-0.337	-0.384	-0.402	-0.390	-0.387	0.028
MLWS			-0.520	-0.552	-0.495	-0.494	-0.523	-0.492	-0.476	-0.455	-0.465	-0.469	-0.455	-0.457	-0.487	-0.432	-0.480	-0.499	-0.486	-0.485	0.029
ISLW			-0.764	-0.806	-0.758	-0.768	-0.811	-0.792	-0.775	-0.751	-0.749	-0.733	-0.701	-0.684	-0.708	-0.650	-0.690	-0.716	-0.708	-0.739	0.045
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.670	0.657	0.651	0.639	0.632	0.648	0.638	0.636	0.636	0.650	0.664	0.663	0.688	0.685	0.708	0.699	0.704	0.663	0.025
MR			0.865	0.855	0.849	0.836	0.831	0.850	0.835	0.830	0.830	0.844	0.859	0.854	0.879	0.875	0.899	0.892	0.896	0.858	0.023
MSR			1.061	1.053	1.046	1.033	1.030	1.052	1.031	1.024	1.024	1.039	1.054	1.045	1.070	1.064	1.091	1.085	1.089	1.052	0.022
R			1.645	1.663	1.678	1.688	1.722	1.770	1.747	1.734	1.706	1.674	1.646	1.589	1.601	1.586	1.596	1.606	1.622	1.663	0.059
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.433	0.428	0.424	0.418	0.416	0.425	0.417	0.415	0.415	0.422	0.430	0.427	0.440	0.437	0.450	0.446	0.448	0.429	0.012
S2			0.098	0.099	0.099	0.098	0.100	0.101	0.098	0.097	0.097	0.097	0.097	0.095	0.095	0.095	0.096	0.096	0.096	0.097	0.002
K1			0.153	0.158	0.163	0.168	0.174	0.182	0.180	0.178	0.173	0.164	0.155	0.145	0.142	0.139	0.136	0.139	0.141	0.158	0.016
O1			0.090	0.097	0.100	0.105	0.114	0.117	0.119	0.118	0.111	0.100	0.091	0.081	0.080	0.078	0.075	0.078	0.081	0.096	0.016
MSF			0.022	0.008	0.018	0.007	0.009	0.008	0.005	0.014	0.023	0.017	0.009	0.007	0.014	0.013	0.020	0.006	0.011	0.012	0.006
z0			0.010	-0.025	0.028	0.022	-0.008	0.033	0.039	0.057	0.047	0.051	0.072	0.065	0.048	0.100	0.066	0.044	0.059	0.042	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			358.856	358.845	358.946	357.754	357.021	356.033	355.021	354.219	354.367	354.499	354.106	354.354	354.951	355.846	356.259	356.643	357.887	356.212	1.746
S2			266.762	265.848	265.751	266.316	266.183	267.024	267.515	268.370	267.535	266.656	268.011	267.188	267.151	267.002	267.529	266.825	268.291	267.056	0.776
K1			130.464	130.128	128.982	127.880	124.450	121.057	119.148	115.086	111.751	110.286	110.823	111.243	113.701	117.369	119.305	124.115	126.635	120.143	7.210
O1			180.512	181.264	181.442	184.052	185.088	186.985	192.110	198.375	202.852	205.270	204.489	205.504	201.181	194.220	189.841	186.455	183.758	191.965	9.220
MSF			283.432	188.268	1.341	90.862	297.900	34.090	280.029	47.120	283.404	45.788	247.908	1.392	266.540	313.427	291.530	21.298	271.079	174.436	124.847
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.073	0.081	0.098	0.087	0.071	0.067	0.083	0.083	0.068	0.085	0.079	0.080	0.069	0.063	0.072	0.092	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	16.0	0.0	93.2	99.9	86.1	93.6	93.3	98.1	96.7	97.6	97.6	95.9	92.1	93.6	93.4	92.8	96.0	97.3	91.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.03	04/06/2008 21:00	±0.19	3.4
Lowest Astronomical Tide (LAT)	-0.77	09/09/2014 02:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Crookhaven River at Crookhaven Heads

MHL2786

Figure A19

RECORDING STATION: **Jervis Bay at Jervis Bay**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216470

ZONE: 56
EASTING: 291092
NORTHING: 6111027

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Jervis Bay at Jervis Bay

YEAR	2001-02	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.040		0.991	1.004	1.057	0.967	1.030	1.054	1.084	1.086	1.062	1.035	1.036	1.018	0.962	1.032	1.009	0.997	1.013	1.027	0.035
MHWS	0.691		0.631	0.623	0.660	0.560	0.610	0.627	0.647	0.657	0.649	0.649	0.674	0.684	0.643	0.719	0.701	0.679	0.689	0.655	0.038
MHW	0.574		0.517	0.508	0.541	0.446	0.497	0.514	0.534	0.545	0.536	0.537	0.564	0.573	0.535	0.608	0.590	0.569	0.578	0.543	0.038
MHWN	0.457		0.404	0.393	0.422	0.332	0.385	0.401	0.421	0.433	0.423	0.426	0.455	0.461	0.427	0.497	0.478	0.458	0.467	0.430	0.039
MSL	0.053		0.028	0.022	0.050	-0.022	0.033	0.049	0.064	0.083	0.068	0.066	0.089	0.089	0.046	0.116	0.090	0.069	0.083	0.060	0.032
MLWN	-0.351		-0.347	-0.350	-0.322	-0.376	-0.319	-0.302	-0.293	-0.267	-0.286	-0.293	-0.277	-0.282	-0.336	-0.265	-0.299	-0.319	-0.302	-0.310	0.032
MLW	-0.468		-0.461	-0.465	-0.441	-0.491	-0.431	-0.416	-0.406	-0.379	-0.399	-0.405	-0.387	-0.394	-0.444	-0.375	-0.410	-0.430	-0.413	-0.423	0.033
MLWS	-0.585		-0.574	-0.580	-0.560	-0.605	-0.543	-0.529	-0.519	-0.491	-0.512	-0.516	-0.497	-0.506	-0.552	-0.486	-0.521	-0.540	-0.524	-0.536	0.034
ISLW	-0.835		-0.832	-0.852	-0.844	-0.896	-0.844	-0.834	-0.832	-0.798	-0.807	-0.793	-0.755	-0.744	-0.780	-0.710	-0.742	-0.767	-0.755	-0.801	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.809		0.751	0.743	0.744	0.708	0.704	0.703	0.714	0.700	0.709	0.719	0.732	0.743	0.762	0.762	0.777	0.777	0.768	0.740	0.031
MR	1.043		0.978	0.972	0.983	0.937	0.928	0.929	0.940	0.924	0.935	0.942	0.951	0.967	0.979	0.983	1.000	0.998	0.990	0.966	0.032
MSR	1.277		1.205	1.202	1.221	1.165	1.153	1.156	1.166	1.148	1.161	1.165	1.171	1.190	1.196	1.205	1.222	1.220	1.213	1.191	0.033
R	1.875		1.823	1.856	1.902	1.863	1.874	1.888	1.916	1.884	1.869	1.828	1.791	1.763	1.742	1.741	1.751	1.764	1.769	1.828	0.060
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.521		0.489	0.486	0.491	0.468	0.464	0.465	0.470	0.462	0.468	0.471	0.476	0.483	0.489	0.492	0.500	0.499	0.495	0.483	0.016
S2	0.117		0.114	0.115	0.119	0.114	0.112	0.113	0.113	0.112	0.113	0.112	0.110	0.112	0.108	0.111	0.111	0.111	0.111	0.113	0.003
K1	0.161		0.164	0.172	0.179	0.180	0.185	0.187	0.191	0.189	0.183	0.173	0.165	0.155	0.149	0.145	0.144	0.147	0.150	0.168	0.017
O1	0.088		0.093	0.101	0.105	0.111	0.115	0.118	0.121	0.118	0.112	0.103	0.093	0.084	0.079	0.079	0.077	0.079	0.082	0.098	0.016
MSF	0.010		0.019	0.007	0.010	0.011	0.011	0.009	0.003	0.022	0.017	0.019	0.005	0.008	0.008	0.013	0.018	0.008	0.007	0.011	0.005
z0	0.053		0.028	0.022	0.050	-0.022	0.033	0.049	0.064	0.083	0.068	0.066	0.089	0.089	0.046	0.116	0.090	0.069	0.083	0.060	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	350.162		351.398	351.560	351.711	351.037	349.892	348.879	347.675	347.245	347.030	346.411	347.213	347.970	347.711	349.507	349.050	349.686	350.063	349.122	1.696
S2	261.456		259.634	259.804	259.900	260.481	259.545	260.338	260.527	261.345	260.679	260.091	261.565	261.070	261.517	263.152	260.650	260.313	261.448	260.751	0.898
K1	115.148		118.245	117.866	117.568	116.154	113.340	109.797	107.297	103.208	100.044	98.297	99.702	99.184	100.822	105.979	108.190	111.786	114.248	108.715	7.156
O1	172.140		170.080	170.421	170.046	172.652	173.929	177.001	180.889	186.431	191.523	192.256	192.418	192.359	191.361	182.363	179.014	174.890	173.275	180.169	8.709
MSF	274.880		263.699	154.159	358.642	123.296	332.227	39.517	172.431	69.502	283.607	55.993	233.501	51.497	251.605	336.145	300.943	39.103	250.923	199.537	112.358
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078		0.075	0.083	0.090	0.103	0.076	0.073	0.083	0.080	0.069	0.080	0.080	0.080	0.066	0.064	0.077	0.089	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	77.0	29.6	96.5	96.6	83.2	91.1	99.6	95.5	95.8	95.3	96.3	94.2	89.5	92.2	84.3	60.7	95.6	95.5	90.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.14	04/06/2008 20:30	±0.18	3.4
Lowest Astronomical Tide (LAT)	-0.88	09/09/2014 02:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

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Table A20

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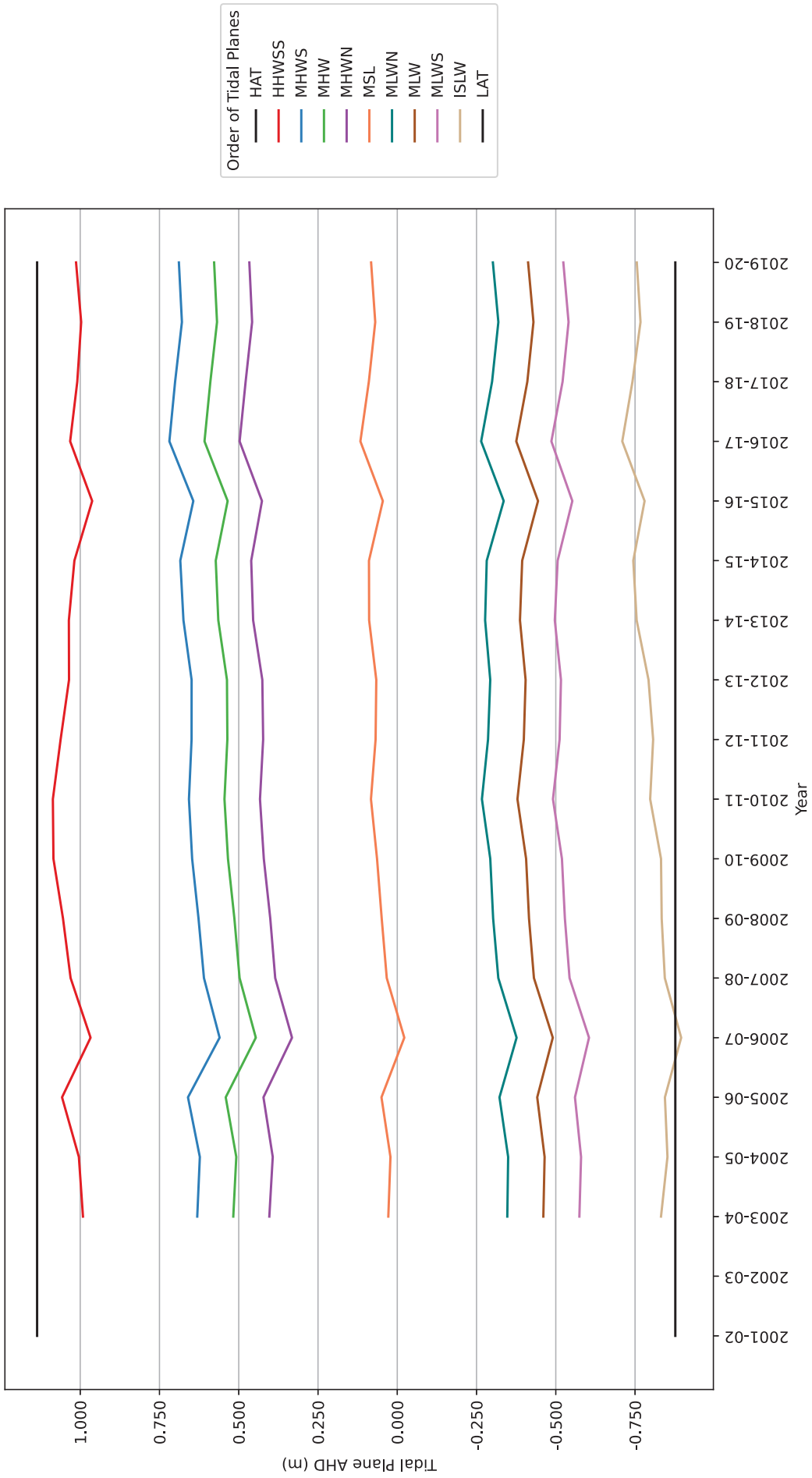


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Jervis Bay at Jervis Bay

MHL2786

Figure A20

RECORDING STATION: **Tasman Sea at Ulladulla Boat Harbour**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216471

ZONE: 56
EASTING: 270711
NORTHING: 6084368

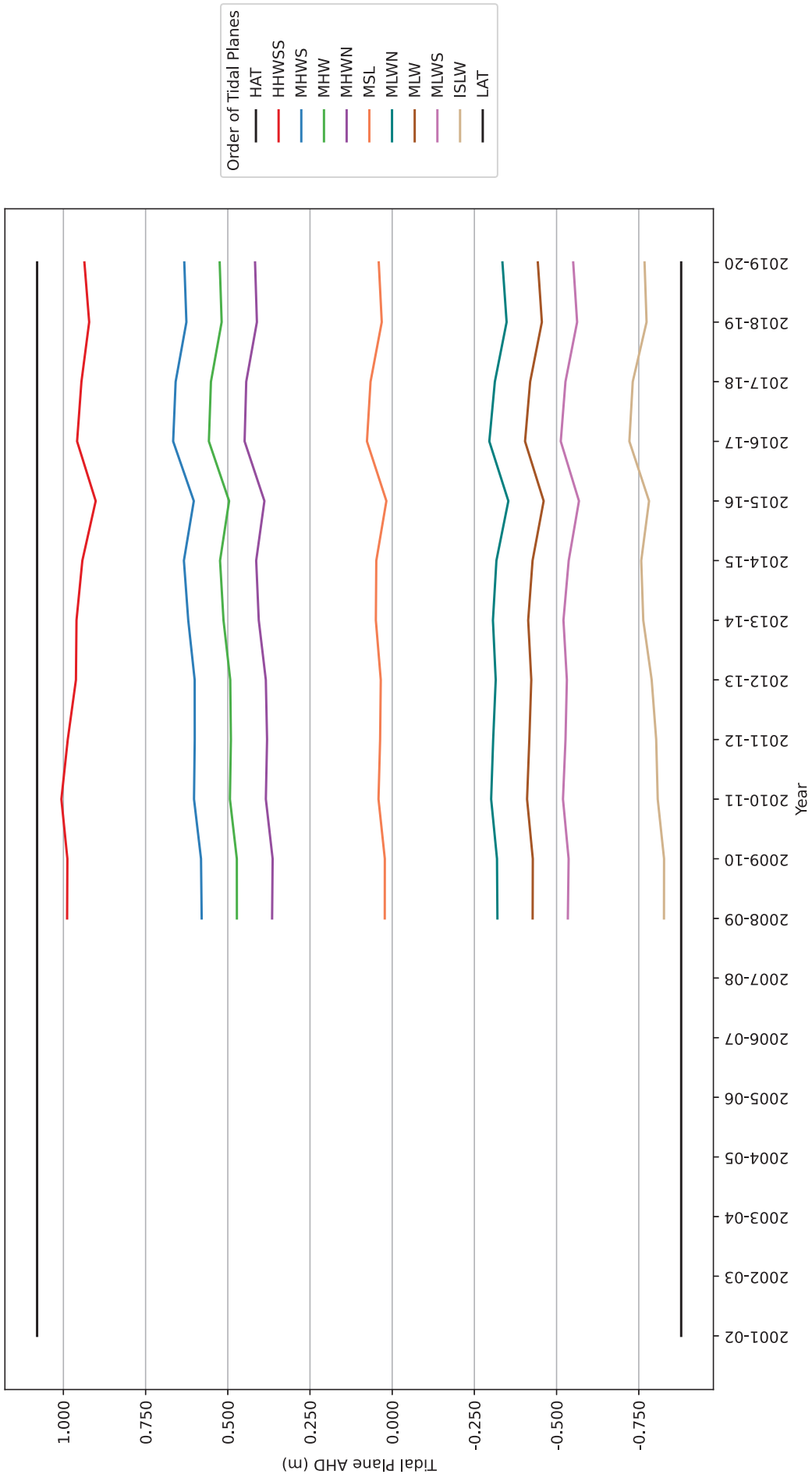
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tasman Sea at Ulladulla Boat Harbour

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS								0.989	0.988	1.006	0.987	0.962	0.960	0.942	0.902	0.958	0.945	0.922	0.936	0.958	0.031
MHWS								0.579	0.581	0.603	0.601	0.601	0.620	0.634	0.603	0.666	0.659	0.626	0.632	0.617	0.028
MHW								0.472	0.473	0.494	0.491	0.493	0.513	0.524	0.496	0.558	0.551	0.519	0.525	0.509	0.028
MHWN								0.365	0.364	0.384	0.381	0.384	0.406	0.414	0.389	0.449	0.444	0.411	0.417	0.401	0.028
MSL								0.023	0.022	0.042	0.037	0.035	0.050	0.048	0.018	0.077	0.066	0.032	0.041	0.041	0.018
MLWN								-0.320	-0.319	-0.301	-0.307	-0.315	-0.306	-0.317	-0.353	-0.295	-0.312	-0.348	-0.335	-0.319	0.018
MLW								-0.427	-0.428	-0.410	-0.417	-0.423	-0.414	-0.427	-0.461	-0.404	-0.420	-0.455	-0.443	-0.427	0.017
MLWS								-0.534	-0.537	-0.519	-0.527	-0.531	-0.521	-0.537	-0.568	-0.513	-0.527	-0.562	-0.551	-0.536	0.017
ISLW								-0.827	-0.827	-0.808	-0.803	-0.789	-0.764	-0.758	-0.781	-0.721	-0.732	-0.774	-0.768	-0.779	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR								0.685	0.682	0.685	0.688	0.699	0.712	0.731	0.742	0.744	0.756	0.760	0.752	0.720	0.031
MR								0.900	0.900	0.904	0.908	0.916	0.927	0.951	0.957	0.962	0.971	0.974	0.968	0.936	0.030
MSR								1.114	1.118	1.122	1.128	1.132	1.141	1.170	1.171	1.179	1.186	1.188	1.183	1.153	0.029
R								1.815	1.815	1.814	1.790	1.751	1.724	1.700	1.683	1.680	1.677	1.695	1.704	1.737	0.057
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2								0.450	0.450	0.452	0.454	0.458	0.463	0.475	0.478	0.481	0.485	0.487	0.484	0.468	0.015
S2								0.107	0.109	0.109	0.110	0.108	0.107	0.110	0.107	0.109	0.107	0.107	0.108	0.108	0.001
K1								0.180	0.178	0.177	0.170	0.160	0.154	0.142	0.138	0.135	0.132	0.136	0.140	0.153	0.018
O1								0.112	0.113	0.112	0.106	0.098	0.089	0.079	0.075	0.073	0.072	0.075	0.077	0.090	0.017
MSF								0.010	0.001	0.022	0.018	0.019	0.003	0.009	0.009	0.006	0.015	0.008	0.005	0.011	0.007
z0								0.023	0.022	0.042	0.037	0.035	0.050	0.048	0.018	0.077	0.066	0.032	0.041	0.041	0.018
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2								349.732	348.260	347.817	347.527	347.561	347.849	348.467	348.674	349.792	349.913	350.183	351.025	348.900	1.179
S2								262.287	261.350	261.882	261.002	261.035	261.857	261.349	261.926	261.419	261.073	261.438	263.328	261.662	0.661
K1								109.339	104.597	100.057	97.480	95.845	96.415	95.875	98.379	102.798	106.221	109.326	111.462	102.316	5.760
O1								177.124	181.585	187.574	191.971	193.185	193.301	193.698	190.308	185.031	180.893	176.097	174.648	185.451	7.195
MSF								43.828	168.531	60.957	295.331	61.969	220.348	47.712	301.402	341.972	312.219	42.582	263.436	180.024	121.919
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
								0.070	0.084	0.087	0.071	0.086	0.081	0.083	0.075	0.067	0.076	0.090	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
								96.8	96.4	95.4	95.4	93.6	89.3	91.7	93.2	88.8	92.4	94.7	90.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.08	04/06/2008 20:30	±0.18	4.4
Lowest Astronomical Tide (LAT)	-0.88	31/01/2014 15:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Gauge established in August 2007

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tasman Sea at Ulladulla Boat Harbour

MHL2786

Figure A21

RECORDING STATION: **Batemans Bay Offshore (Tasman Sea)**
DATUM: APPROXIMATE MEAN SEA LEVEL
AWRC #: 216450

ZONE: 56
EASTING: 251726
NORTHING: 6037036

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16*	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.892	0.857	0.870	0.888	0.893	0.899	0.918	0.928	0.922	0.937	0.900	0.885	0.876	0.863		0.852	0.872	0.850	0.861	0.887	0.027
MHWS	0.599	0.557	0.560	0.565	0.557	0.544	0.551	0.553	0.544	0.561	0.541	0.549	0.559	0.575		0.581	0.601	0.572	0.579	0.564	0.018
MHW	0.493	0.448	0.452	0.456	0.449	0.436	0.444	0.445	0.437	0.455	0.434	0.443	0.453	0.468		0.476	0.489	0.467	0.472	0.457	0.017
MHWN	0.387	0.340	0.345	0.347	0.341	0.329	0.337	0.337	0.330	0.349	0.326	0.338	0.347	0.362		0.370	0.377	0.362	0.365	0.349	0.017
MSL	0.012	-0.027	-0.014	-0.005	-0.004	-0.014	-0.001	-0.001	-0.009	0.008	-0.017	-0.014	-0.008	-0.003		-0.005	0.002	-0.017	-0.011	-0.007	0.010
MLWN	-0.362	-0.395	-0.373	-0.357	-0.348	-0.357	-0.338	-0.339	-0.347	-0.332	-0.361	-0.366	-0.363	-0.368		-0.380	-0.373	-0.395	-0.388	-0.363	0.019
MLW	-0.469	-0.503	-0.480	-0.466	-0.456	-0.465	-0.445	-0.447	-0.454	-0.438	-0.468	-0.471	-0.469	-0.474		-0.485	-0.485	-0.500	-0.494	-0.471	0.019
MLWS	-0.575	-0.611	-0.588	-0.575	-0.564	-0.572	-0.552	-0.556	-0.561	-0.544	-0.575	-0.577	-0.575	-0.581		-0.591	-0.597	-0.606	-0.601	-0.578	0.019
ISLW	-0.784	-0.826	-0.809	-0.805	-0.804	-0.826	-0.814	-0.823	-0.831	-0.813	-0.832	-0.817	-0.801	-0.787		-0.784	-0.791	-0.804	-0.803	-0.809	0.016
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.749	0.735	0.718	0.704	0.689	0.686	0.675	0.676	0.676	0.681	0.687	0.704	0.710	0.729		0.750	0.750	0.757	0.753	0.713	0.030
MR	0.962	0.951	0.933	0.922	0.905	0.901	0.889	0.893	0.891	0.893	0.901	0.915	0.922	0.943		0.961	0.974	0.967	0.966	0.927	0.030
MSR	1.174	1.168	1.147	1.139	1.121	1.116	1.103	1.109	1.105	1.105	1.116	1.125	1.135	1.156		1.173	1.199	1.178	1.180	1.142	0.031
R	1.676	1.683	1.679	1.693	1.698	1.725	1.732	1.751	1.753	1.750	1.733	1.703	1.677	1.650		1.636	1.663	1.655	1.664	1.696	0.037
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.481	0.476	0.466	0.461	0.453	0.450	0.445	0.446	0.445	0.446	0.451	0.457	0.461	0.471		0.481	0.487	0.484	0.483	0.464	0.015
S2	0.106	0.108	0.107	0.109	0.108	0.108	0.107	0.108	0.107	0.106	0.107	0.105	0.106	0.107		0.106	0.112	0.105	0.107	0.107	0.002
K1	0.131	0.134	0.139	0.142	0.146	0.153	0.157	0.158	0.160	0.161	0.155	0.147	0.141	0.129		0.122	0.122	0.126	0.127	0.142	0.014
O1	0.078	0.080	0.083	0.089	0.094	0.101	0.105	0.109	0.109	0.108	0.102	0.094	0.085	0.077		0.071	0.072	0.073	0.075	0.089	0.014
MSF	0.023	0.012	0.022	0.013	0.014	0.006	0.013	0.009	0.005	0.024	0.019	0.019	0.010	0.010		0.013	0.020	0.011	0.004	0.014	0.006
z0	0.012	-0.027	-0.014	-0.005	-0.004	-0.014	-0.001	-0.001	-0.009	0.008	-0.017	-0.014	-0.008	-0.003		-0.005	0.002	-0.017	-0.011	-0.007	0.010
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	352.206	352.838	352.739	353.357	353.333	352.375	351.089	350.522	349.441	348.771	348.792	348.034	348.488	348.982		350.490	352.527	351.693	352.018	350.983	1.824
S2	261.144	261.830	261.756	261.397	261.402	261.642	260.991	262.214	261.837	262.251	262.843	261.366	262.200	261.373		261.531	263.587	263.701	264.064	262.063	0.914
K1	114.832	116.829	116.738	116.674	116.883	115.044	112.273	109.659	106.600	102.759	99.999	97.935	96.971	98.567		105.314	109.622	111.811	114.141	109.036	7.170
O1	176.206	174.631	173.009	172.773	174.394	175.211	177.840	180.699	184.797	190.075	195.081	197.075	196.350	196.795		187.421	184.807	177.814	176.486	182.859	8.894
MSF	235.275	289.496	240.632	131.756	24.327	26.392	326.294	7.299	159.015	64.539	286.859	45.403	222.206	61.206		334.884	282.494	66.658	203.152	167.105	114.837
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.088	0.075	0.083	0.086	0.083	0.080	0.074	0.088	0.084	0.074	0.081	0.090	0.082		0.074	0.084	0.093	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	84.7	96.4	95.9	97.1	94.4	96.6	97.8	96.8	97.2	96.4	95.9	96.6	96.0	94.2	39.4	93.4	95.7	97.0	93.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.01	24/06/2013 21:00	±0.30	5.2
Lowest Astronomical Tide (LAT)	-0.92	31/01/2014 15:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Batemans Bay Offshore

Table A22

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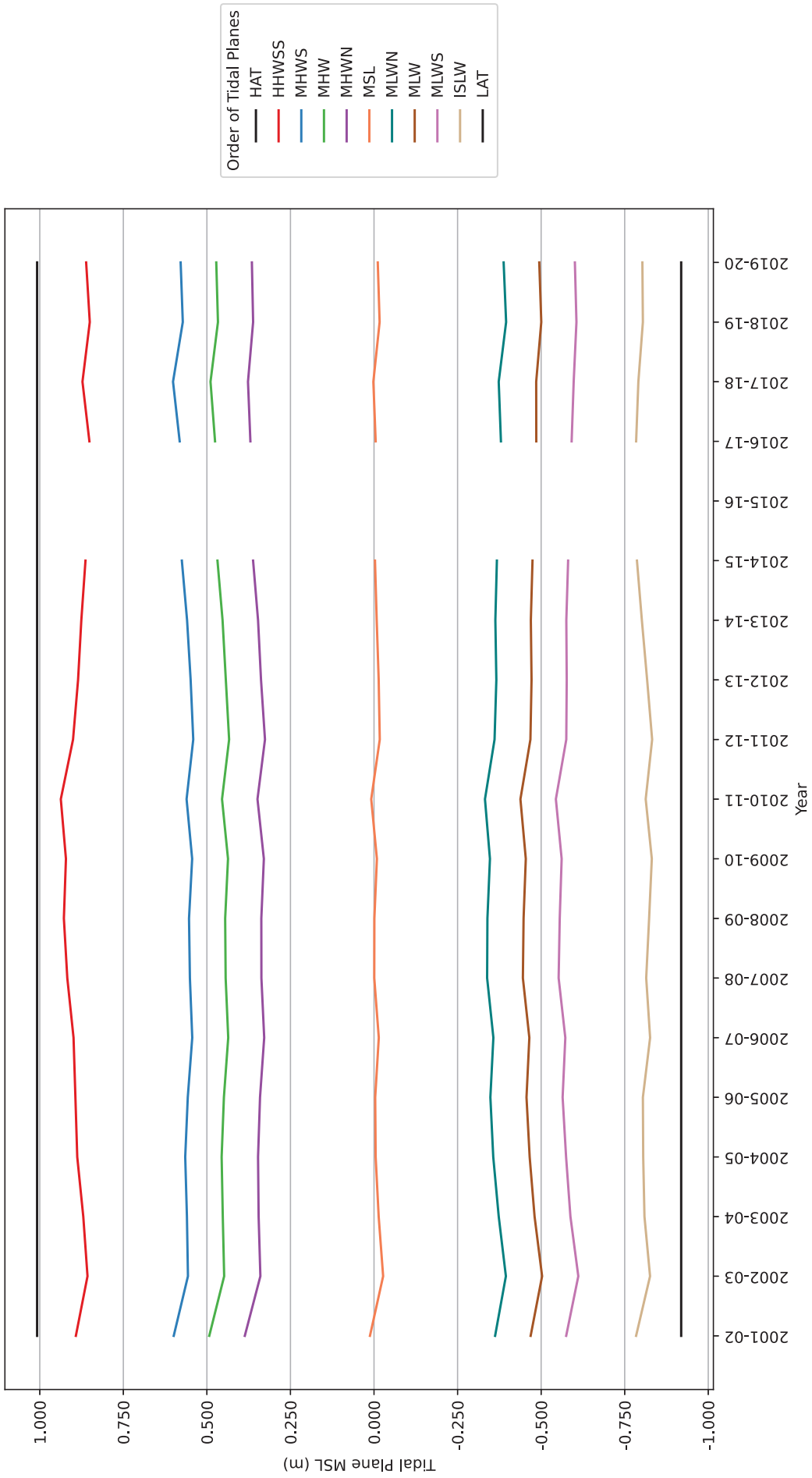

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NSW TIDAL PLANE ANALYSIS
Batemans Bay Offshore

MHL2786

Figure A22

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clyde River at Princess Jetty

RECORDING STATION: **Clyde River at Princess Jetty**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216410

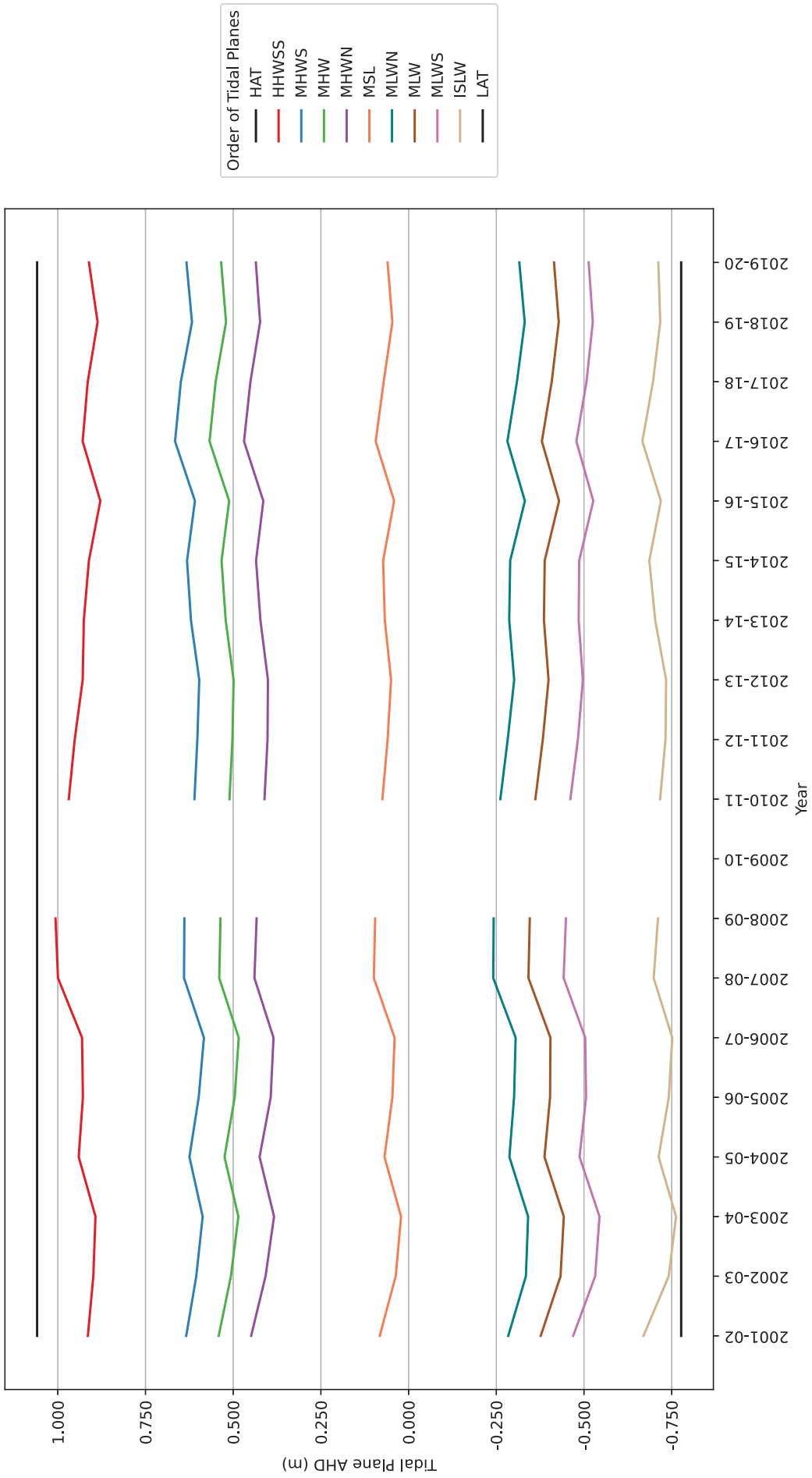
ZONE: 56
EASTING: 244664
NORTHING: 6045231

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.914	0.899	0.893	0.940	0.928	0.931	0.999	1.007		0.969	0.952	0.929	0.926	0.911	0.879	0.929	0.915	0.887	0.911	0.929	0.035
MHWS	0.634	0.605	0.587	0.625	0.598	0.583	0.640	0.639		0.610	0.602	0.597	0.620	0.632	0.609	0.666	0.649	0.617	0.633	0.619	0.022
MHW	0.541	0.507	0.485	0.525	0.496	0.484	0.540	0.536		0.511	0.502	0.499	0.521	0.533	0.512	0.567	0.550	0.520	0.534	0.520	0.023
MHWN	0.449	0.408	0.384	0.425	0.393	0.385	0.439	0.433		0.411	0.402	0.401	0.422	0.435	0.414	0.469	0.451	0.423	0.435	0.421	0.024
MSL	0.082	0.037	0.021	0.069	0.046	0.040	0.099	0.095		0.075	0.060	0.050	0.068	0.073	0.041	0.094	0.071	0.046	0.060	0.063	0.022
MLWN	-0.284	-0.334	-0.341	-0.287	-0.301	-0.305	-0.241	-0.242		-0.261	-0.283	-0.301	-0.287	-0.290	-0.331	-0.282	-0.309	-0.331	-0.316	-0.296	0.029
MLW	-0.377	-0.433	-0.442	-0.387	-0.403	-0.404	-0.342	-0.345		-0.361	-0.383	-0.399	-0.386	-0.388	-0.429	-0.380	-0.408	-0.428	-0.414	-0.395	0.029
MLWS	-0.469	-0.532	-0.544	-0.487	-0.506	-0.503	-0.442	-0.448		-0.461	-0.483	-0.497	-0.485	-0.486	-0.526	-0.478	-0.507	-0.525	-0.513	-0.494	0.028
ISLW	-0.669	-0.741	-0.762	-0.713	-0.742	-0.752	-0.699	-0.711		-0.717	-0.732	-0.734	-0.703	-0.686	-0.719	-0.666	-0.697	-0.717	-0.712	-0.715	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.733	0.742	0.724	0.712	0.694	0.690	0.681	0.676		0.672	0.685	0.702	0.709	0.724	0.746	0.751	0.760	0.754	0.751	0.717	0.030
MR	0.918	0.940	0.928	0.912	0.899	0.889	0.881	0.882		0.872	0.885	0.898	0.907	0.921	0.941	0.947	0.958	0.948	0.949	0.915	0.028
MSR	1.103	1.137	1.131	1.112	1.104	1.087	1.082	1.088		1.072	1.085	1.094	1.105	1.118	1.136	1.144	1.156	1.143	1.147	1.113	0.026
R	1.584	1.640	1.655	1.653	1.670	1.682	1.698	1.717		1.686	1.684	1.663	1.629	1.597	1.598	1.596	1.611	1.604	1.623	1.644	0.041
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.459	0.470	0.464	0.456	0.449	0.444	0.441	0.441		0.436	0.442	0.449	0.454	0.461	0.470	0.474	0.479	0.474	0.474	0.458	0.014
S2	0.093	0.099	0.102	0.100	0.103	0.099	0.100	0.103		0.100	0.100	0.098	0.099	0.098	0.097	0.098	0.099	0.097	0.099	0.099	0.002
K1	0.125	0.131	0.136	0.138	0.142	0.150	0.154	0.157		0.152	0.150	0.144	0.135	0.125	0.122	0.119	0.119	0.121	0.124	0.136	0.013
O1	0.076	0.079	0.082	0.087	0.094	0.098	0.102	0.105		0.104	0.100	0.094	0.083	0.075	0.071	0.069	0.071	0.072	0.074	0.085	0.013
MSF	0.019	0.016	0.021	0.008	0.012	0.007	0.010	0.004		0.013	0.018	0.019	0.008	0.009	0.012	0.007	0.022	0.006	0.006	0.012	0.006
z0	0.082	0.037	0.021	0.069	0.046	0.040	0.099	0.095		0.075	0.060	0.050	0.068	0.073	0.041	0.094	0.071	0.046	0.060	0.063	0.022
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	0.905	0.837	0.779	1.672	0.804	0.089	359.728	359.134		359.001	357.188	356.819	357.412	358.260	357.905	359.343	0.358	0.569	1.131	179.552	183.942
S2	271.025	272.582	272.527	272.091	272.249	273.074	273.046	273.475		277.695	274.508	273.391	273.812	273.601	274.022	272.860	274.668	274.607	273.671	273.495	1.412
K1	118.616	122.261	121.980	121.502	121.454	120.765	118.095	116.448		107.810	105.694	103.721	103.342	104.670	105.920	110.857	115.117	116.993	119.856	114.172	7.139
O1	182.666	179.854	177.865	179.077	180.197	181.231	184.022	186.555		196.102	200.188	203.738	203.095	203.211	199.107	192.907	190.816	184.441	182.392	189.304	9.368
MSF	257.056	304.935	267.836	123.623	17.929	90.850	306.177	38.328		75.114	294.008	39.718	228.226	40.728	287.417	333.852	288.033	22.820	258.468	181.951	120.225
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.085	0.084	0.082	0.092	0.100	0.074	0.064		0.088	0.072	0.078	0.082	0.079	0.072	0.067	0.079	0.093	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	80.3	95.9	95.6	82.1	94.2	93.8	90.4	69.1	0.0	62.8	95.8	90.7	94.1	92.9	93.9	94.1	97.2	96.6	92.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.06	04/06/2008 21:00	±0.19	9.1
Lowest Astronomical Tide (LAT)	-0.78	12/08/2014 03:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clyde River at Princess Jetty

MHL2786

Figure A23

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Bermagui Harbour at Bermagui

RECORDING STATION: **Bermagui Harbour at Bermagui**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 219470

ZONE: 56
EASTING: 237453
NORTHING: 5964777

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.852	0.829	0.861	0.855	0.893	0.872	0.878	0.910	0.911	0.928	0.926	0.906	0.889	0.873	0.838	0.891	0.884	0.857	0.872	0.880	0.028
MHWS	0.551	0.513	0.531	0.512	0.535	0.503	0.491	0.515	0.512	0.530	0.545	0.545	0.556	0.569	0.545	0.597	0.589	0.563	0.572	0.541	0.029
MHW	0.447	0.409	0.427	0.405	0.428	0.397	0.389	0.411	0.409	0.427	0.442	0.442	0.454	0.465	0.441	0.496	0.488	0.460	0.468	0.437	0.030
MHWN	0.344	0.305	0.324	0.299	0.322	0.291	0.286	0.307	0.306	0.323	0.339	0.338	0.351	0.362	0.337	0.394	0.387	0.357	0.364	0.334	0.031
MSL	-0.018	-0.054	-0.030	-0.046	-0.013	-0.047	-0.047	-0.023	-0.022	-0.012	-0.001	-0.003	0.003	0.003	-0.022	0.030	0.017	-0.012	-0.003	-0.016	0.023
MLWN	-0.379	-0.413	-0.385	-0.391	-0.347	-0.385	-0.380	-0.353	-0.349	-0.347	-0.341	-0.343	-0.345	-0.356	-0.380	-0.334	-0.353	-0.381	-0.370	-0.365	0.022
MLW	-0.483	-0.517	-0.488	-0.497	-0.454	-0.491	-0.483	-0.457	-0.452	-0.450	-0.444	-0.447	-0.447	-0.459	-0.484	-0.436	-0.454	-0.484	-0.474	-0.468	0.022
MLWS	-0.586	-0.621	-0.592	-0.604	-0.560	-0.597	-0.585	-0.561	-0.555	-0.554	-0.547	-0.550	-0.550	-0.563	-0.588	-0.537	-0.555	-0.587	-0.578	-0.572	0.023
ISLW	-0.802	-0.846	-0.827	-0.849	-0.816	-0.860	-0.861	-0.843	-0.841	-0.838	-0.819	-0.808	-0.787	-0.780	-0.797	-0.746	-0.765	-0.797	-0.792	-0.815	0.032
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.724	0.717	0.709	0.690	0.669	0.676	0.667	0.659	0.655	0.670	0.680	0.682	0.696	0.717	0.717	0.729	0.740	0.739	0.734	0.698	0.028
MR	0.930	0.925	0.916	0.903	0.882	0.888	0.872	0.868	0.861	0.877	0.886	0.888	0.901	0.925	0.925	0.931	0.942	0.944	0.942	0.906	0.028
MSR	1.137	1.133	1.123	1.115	1.095	1.100	1.076	1.076	1.067	1.084	1.092	1.094	1.106	1.132	1.133	1.134	1.144	1.150	1.150	1.113	0.027
R	1.654	1.675	1.688	1.704	1.709	1.732	1.739	1.754	1.752	1.766	1.746	1.713	1.676	1.653	1.635	1.637	1.649	1.654	1.664	1.695	0.044
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.465	0.463	0.458	0.451	0.441	0.444	0.436	0.434	0.431	0.438	0.443	0.444	0.450	0.462	0.462	0.466	0.471	0.472	0.471	0.453	0.014
S2	0.103	0.104	0.104	0.106	0.106	0.106	0.102	0.104	0.103	0.103	0.103	0.103	0.103	0.104	0.104	0.101	0.101	0.103	0.104	0.104	0.001
K1	0.133	0.138	0.143	0.148	0.152	0.156	0.161	0.165	0.165	0.166	0.160	0.155	0.147	0.134	0.130	0.129	0.130	0.130	0.131	0.146	0.014
O1	0.083	0.088	0.093	0.097	0.103	0.107	0.115	0.117	0.120	0.118	0.112	0.103	0.091	0.083	0.079	0.080	0.080	0.080	0.083	0.096	0.015
MSF	0.022	0.019	0.021	0.016	0.013	0.015	0.013	0.010	0.006	0.023	0.019	0.019	0.003	0.014	0.007	0.012	0.022	0.009	0.005	0.014	0.006
z0	-0.018	-0.054	-0.030	-0.046	-0.013	-0.047	-0.047	-0.023	-0.022	-0.012	-0.001	-0.003	0.003	0.003	-0.022	0.030	0.017	-0.012	-0.003	-0.016	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	354.849	355.719	354.163	355.014	354.872	354.608	353.711	352.558	352.035	350.694	350.039	350.766	351.184	351.034	351.471	351.845	352.257	352.672	353.774	352.803	1.738
S2	263.565	263.865	262.631	262.008	262.285	262.789	262.461	264.383	263.794	263.412	263.239	263.582	264.001	262.136	263.168	262.356	262.989	262.260	262.991	263.048	0.701
K1	124.791	126.207	125.437	125.252	125.144	123.617	121.307	119.256	116.631	112.080	108.738	107.239	106.884	108.676	110.365	114.187	117.256	119.990	122.213	117.646	6.905
O1	182.120	179.312	178.496	178.409	179.538	180.195	183.394	185.696	190.222	195.110	200.526	200.207	201.138	200.966	199.038	191.998	186.895	185.246	181.795	188.437	8.612
MSF	244.642	276.131	239.085	115.811	14.436	3.172	341.685	358.093	197.700	53.053	286.013	42.523	291.386	55.941	331.767	319.832	288.728	349.188	288.951	215.691	125.307
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078	0.092	0.085	0.088	0.088	0.089	0.087	0.079	0.096	0.093	0.074	0.087	0.090	0.083	0.077	0.070	0.085	0.096	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.1	96.8	95.3	93.1	90.6	95.4	98.2	95.6	93.7	93.5	93.1	94.0	89.9	91.8	91.8	92.1	93.6	93.0	89.5		

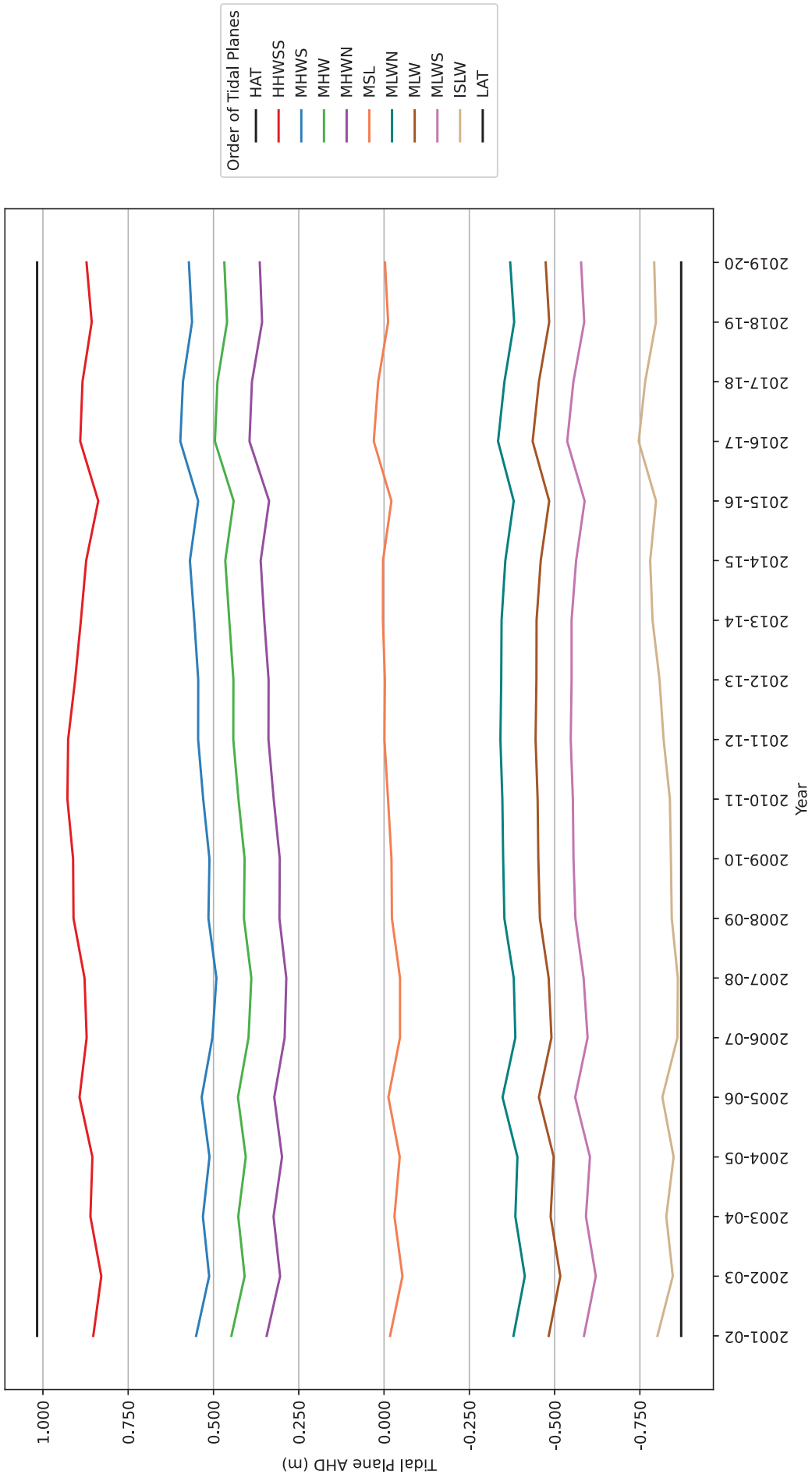
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.02	04/06/2004 21:15	±0.18	5.8
Lowest Astronomical Tide (LAT)	-0.87	31/01/2014 15:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A24

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Bermagui Harbour at Bermagui

MHL2786

Figure A24

RECORDING STATION: **Tasman Sea at Eden Boat Harbour**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220470

ZONE: 55
EASTING: 758557
NORTHING: 5893267

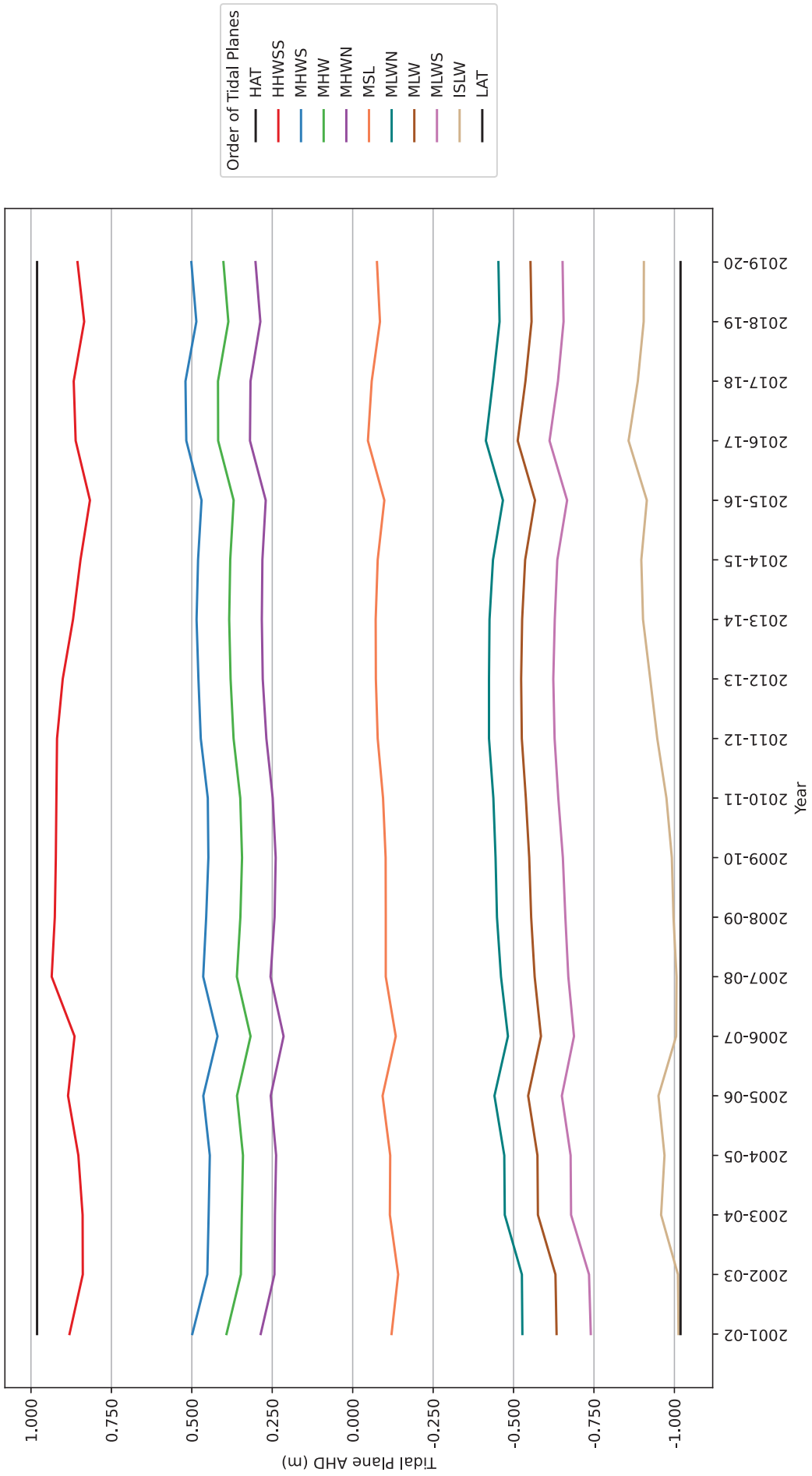
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tasman Sea at Eden Boat Harbour

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.880	0.839	0.839	0.853	0.885	0.865	0.936	0.926	0.923	0.921	0.919	0.901	0.869	0.846	0.817	0.861	0.867	0.835	0.855	0.876	0.036
MHWS	0.499	0.452	0.448	0.444	0.464	0.420	0.465	0.455	0.449	0.450	0.472	0.479	0.485	0.481	0.470	0.517	0.520	0.486	0.501	0.471	0.026
MHW	0.392	0.348	0.345	0.341	0.360	0.317	0.360	0.349	0.344	0.349	0.370	0.380	0.384	0.381	0.370	0.418	0.419	0.386	0.402	0.369	0.027
MHWN	0.286	0.243	0.242	0.238	0.255	0.215	0.255	0.243	0.239	0.249	0.268	0.280	0.282	0.281	0.270	0.319	0.318	0.287	0.302	0.267	0.029
MSL	-0.121	-0.141	-0.116	-0.117	-0.093	-0.134	-0.103	-0.103	-0.102	-0.094	-0.078	-0.072	-0.071	-0.078	-0.098	-0.047	-0.059	-0.085	-0.075	-0.094	0.025
MLWN	-0.527	-0.526	-0.473	-0.471	-0.441	-0.483	-0.461	-0.448	-0.444	-0.437	-0.424	-0.424	-0.425	-0.436	-0.467	-0.414	-0.436	-0.457	-0.453	-0.455	0.031
MLW	-0.634	-0.630	-0.576	-0.574	-0.545	-0.585	-0.566	-0.555	-0.549	-0.538	-0.526	-0.524	-0.527	-0.536	-0.567	-0.513	-0.537	-0.556	-0.553	-0.557	0.033
MLWS	-0.740	-0.735	-0.679	-0.677	-0.650	-0.688	-0.670	-0.661	-0.653	-0.639	-0.628	-0.624	-0.628	-0.636	-0.666	-0.612	-0.638	-0.655	-0.652	-0.660	0.034
ISLW	-1.013	-1.011	-0.959	-0.969	-0.950	-1.005	-1.007	-0.997	-0.992	-0.975	-0.947	-0.925	-0.902	-0.897	-0.914	-0.857	-0.886	-0.904	-0.905	-0.948	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.813	0.769	0.714	0.709	0.695	0.697	0.716	0.691	0.683	0.686	0.692	0.703	0.708	0.717	0.737	0.733	0.754	0.744	0.755	0.722	0.034
MR	1.026	0.978	0.920	0.915	0.905	0.903	0.926	0.904	0.893	0.888	0.896	0.903	0.911	0.917	0.937	0.931	0.956	0.942	0.954	0.926	0.034
MSR	1.239	1.186	1.127	1.121	1.114	1.108	1.135	1.116	1.102	1.090	1.100	1.103	1.113	1.117	1.136	1.129	1.158	1.141	1.154	1.131	0.035
R	1.893	1.850	1.798	1.822	1.835	1.870	1.942	1.923	1.915	1.896	1.866	1.826	1.772	1.743	1.731	1.719	1.753	1.739	1.760	1.824	0.072
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.513	0.489	0.460	0.458	0.452	0.451	0.463	0.452	0.446	0.444	0.448	0.452	0.455	0.458	0.468	0.466	0.478	0.471	0.477	0.463	0.017
S2	0.106	0.104	0.103	0.103	0.105	0.103	0.105	0.106	0.105	0.101	0.102	0.100	0.101	0.100	0.100	0.099	0.101	0.099	0.100	0.102	0.002
K1	0.171	0.173	0.174	0.179	0.185	0.193	0.202	0.203	0.203	0.202	0.194	0.185	0.173	0.166	0.158	0.155	0.157	0.157	0.159	0.178	0.017
O1	0.102	0.104	0.106	0.112	0.116	0.125	0.134	0.133	0.135	0.134	0.125	0.116	0.101	0.095	0.090	0.090	0.091	0.092	0.094	0.110	0.017
MSF	0.023	0.025	0.022	0.012	0.007	0.016	0.010	0.009	0.007	0.023	0.015	0.018	0.002	0.014	0.005	0.011	0.022	0.011	0.001	0.013	0.007
z0	-0.121	-0.141	-0.116	-0.117	-0.093	-0.134	-0.103	-0.103	-0.102	-0.094	-0.078	-0.072	-0.071	-0.078	-0.098	-0.047	-0.059	-0.085	-0.075	-0.094	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	352.646	352.080	353.282	353.588	353.520	351.815	351.690	351.045	350.099	349.262	348.591	348.458	348.995	349.259	349.217	350.616	350.712	351.062	351.615	350.924	1.668
S2	260.165	260.140	260.083	260.087	260.381	260.418	261.170	262.268	261.456	262.064	261.129	261.346	262.182	261.003	260.183	260.719	261.756	261.646	260.687	260.994	0.752
K1	116.819	118.420	118.508	118.608	117.734	116.977	114.468	110.739	108.641	104.537	102.013	99.629	99.682	101.152	103.856	106.765	109.901	112.449	115.735	110.349	6.934
O1	172.848	169.763	169.352	169.766	170.637	171.742	173.002	177.066	181.390	187.008	191.622	191.111	191.970	190.533	189.427	182.887	178.170	176.081	173.858	179.381	8.491
MSF	231.617	272.412	217.106	127.071	13.210	24.726	297.578	324.400	205.428	50.211	287.829	42.026	21.825	41.112	350.629	302.226	286.497	322.444	13.081	180.601	128.667
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.087	0.095	0.087	0.093	0.088	0.097	0.091	0.090	0.099	0.096	0.079	0.089	0.088	0.085	0.079	0.072	0.090	0.097	0.080		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	83.9	86.9	94.8	96.0	86.3	94.1	75.1	88.8	92.3	91.0	91.1	90.8	83.5	87.3	89.0	86.5	89.5	88.8	87.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.98	04/06/2004 21:00	±0.18	6.8
Lowest Astronomical Tide (LAT)	-1.02	11/01/2005 15:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

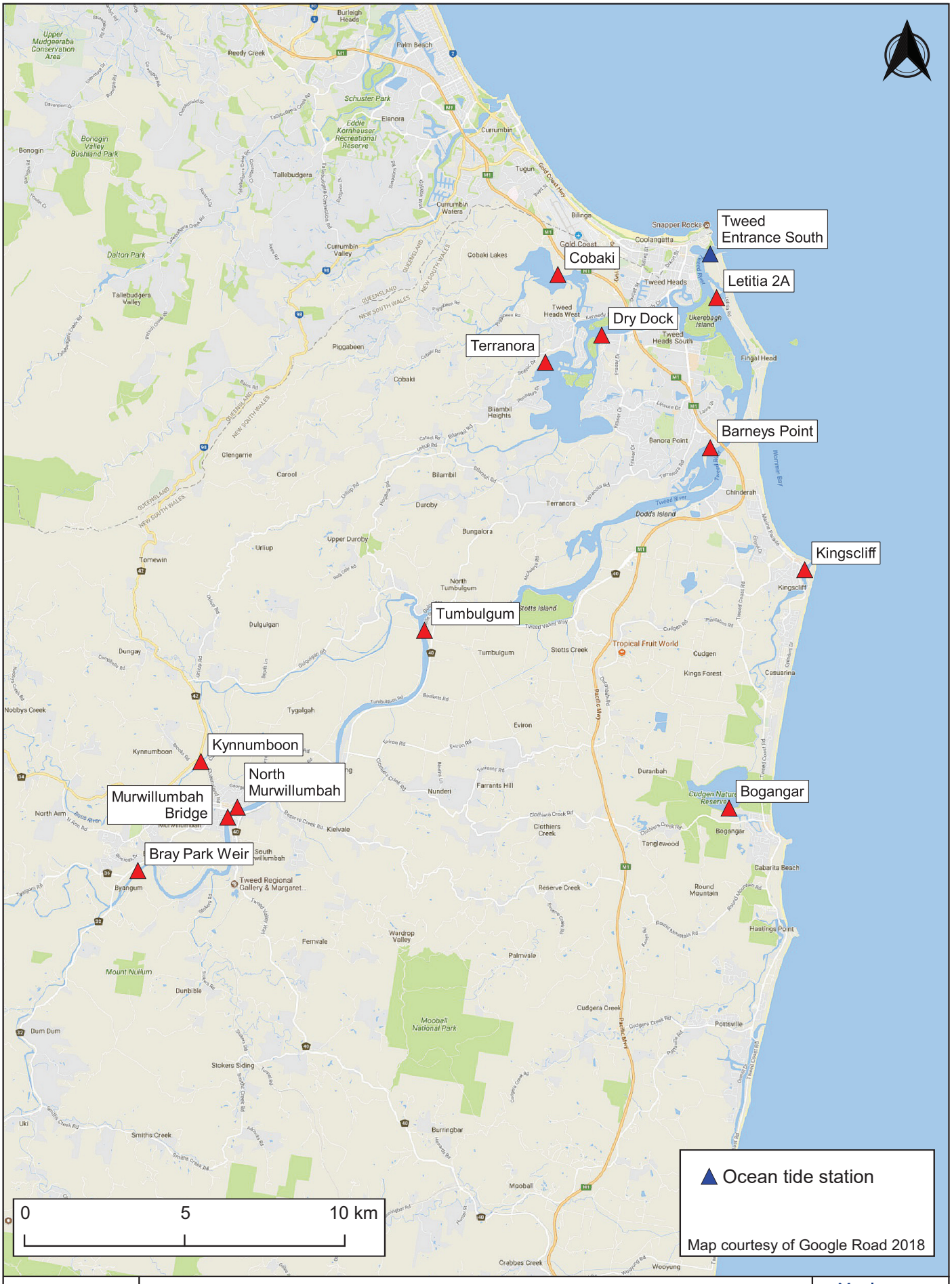


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tasman Sea at Eden Boat Harbour

MHL2786

Figure A25



NSW GOVERNMENT

STATION LOCATIONS
TWEED RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A26

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Broadwater at Cobaki

RECORDING STATION: **Cobaki Broadwater at Cobaki**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201448

ZONE: 56
EASTING: 549344
NORTHING: 6883128

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.702	0.705	0.713	0.715	0.753	0.738	0.796	0.800	0.786	0.816	0.812	0.786	0.749	0.767	0.746	0.772	0.798	0.758	0.780	0.763	0.036
MHWS	0.418	0.406	0.404	0.391	0.414	0.381	0.425	0.423	0.408	0.451	0.453	0.451	0.442	0.475	0.466	0.496	0.520	0.472	0.491	0.441	0.038
MHW	0.353	0.342	0.337	0.324	0.345	0.312	0.357	0.354	0.340	0.384	0.386	0.383	0.376	0.409	0.398	0.427	0.451	0.401	0.421	0.374	0.038
MHWN	0.288	0.278	0.271	0.257	0.276	0.242	0.289	0.285	0.272	0.317	0.318	0.315	0.310	0.342	0.331	0.358	0.381	0.330	0.350	0.306	0.037
MSL	0.059	0.047	0.046	0.034	0.058	0.026	0.073	0.072	0.059	0.101	0.101	0.097	0.082	0.110	0.088	0.115	0.127	0.075	0.095	0.077	0.028
MLWN	-0.169	-0.184	-0.179	-0.189	-0.160	-0.189	-0.142	-0.141	-0.154	-0.115	-0.116	-0.122	-0.145	-0.123	-0.154	-0.128	-0.128	-0.180	-0.161	-0.152	0.025
MLW	-0.234	-0.249	-0.245	-0.257	-0.229	-0.259	-0.210	-0.210	-0.222	-0.182	-0.183	-0.190	-0.211	-0.189	-0.222	-0.197	-0.197	-0.251	-0.231	-0.219	0.025
MLWS	-0.299	-0.313	-0.312	-0.324	-0.298	-0.329	-0.278	-0.279	-0.290	-0.249	-0.250	-0.257	-0.277	-0.256	-0.289	-0.266	-0.267	-0.322	-0.302	-0.287	0.026
ISLW	-0.502	-0.526	-0.533	-0.555	-0.540	-0.583	-0.543	-0.548	-0.560	-0.509	-0.507	-0.497	-0.497	-0.465	-0.490	-0.463	-0.466	-0.526	-0.508	-0.517	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.457	0.462	0.449	0.446	0.436	0.432	0.432	0.426	0.426	0.432	0.434	0.437	0.455	0.465	0.485	0.486	0.509	0.510	0.511	0.457	0.029
MR	0.587	0.591	0.582	0.581	0.574	0.571	0.567	0.564	0.562	0.566	0.568	0.572	0.587	0.598	0.620	0.624	0.648	0.652	0.652	0.593	0.031
MSR	0.716	0.719	0.716	0.715	0.712	0.710	0.703	0.702	0.697	0.700	0.703	0.708	0.720	0.731	0.755	0.762	0.787	0.794	0.793	0.729	0.033
R	1.204	1.231	1.246	1.270	1.292	1.322	1.339	1.348	1.346	1.325	1.318	1.283	1.246	1.232	1.236	1.235	1.264	1.284	1.287	1.279	0.044
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.293	0.295	0.291	0.290	0.287	0.285	0.284	0.282	0.281	0.283	0.284	0.286	0.294	0.299	0.310	0.312	0.324	0.326	0.326	0.296	0.015
S2	0.065	0.064	0.067	0.067	0.069	0.070	0.068	0.069	0.068	0.067	0.067	0.068	0.066	0.066	0.068	0.069	0.070	0.071	0.071	0.068	0.002
K1	0.124	0.128	0.134	0.138	0.144	0.148	0.153	0.157	0.156	0.151	0.149	0.143	0.132	0.127	0.123	0.122	0.123	0.125	0.126	0.137	0.012
O1	0.079	0.085	0.087	0.093	0.098	0.106	0.112	0.113	0.115	0.110	0.107	0.097	0.087	0.082	0.078	0.075	0.075	0.079	0.079	0.092	0.014
MSF	0.037	0.025	0.027	0.028	0.009	0.017	0.038	0.017	0.024	0.037	0.040	0.015	0.030	0.023	0.022	0.024	0.018	0.028	0.024	0.025	0.008
z0	0.059	0.047	0.046	0.034	0.058	0.026	0.073	0.072	0.059	0.101	0.101	0.097	0.082	0.110	0.088	0.115	0.127	0.075	0.095	0.077	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	49.762	49.505	49.298	48.932	48.654	47.107	47.193	45.930	44.370	44.069	43.693	43.444	43.562	44.069	44.133	44.656	44.553	44.482	44.950	45.914	2.287
S2	323.508	322.111	320.586	320.676	319.537	319.388	321.506	320.376	320.541	322.290	322.115	322.115	321.712	321.801	322.371	321.060	320.323	319.478	318.989	321.078	1.231
K1	198.074	198.651	199.359	197.987	196.746	195.023	192.677	189.109	185.958	182.489	179.475	177.750	176.675	178.686	180.549	184.462	186.811	188.762	192.046	188.489	7.824
O1	254.255	252.410	251.482	251.247	250.511	251.025	252.475	256.638	260.449	265.573	270.967	272.613	276.107	272.398	268.135	262.635	257.258	254.148	250.710	259.528	8.816
MSF	286.520	281.719	312.891	286.971	303.710	235.091	263.665	229.621	291.453	249.279	260.697	296.655	272.204	314.923	290.975	291.776	290.331	280.057	286.067	280.242	23.531
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.103	0.066	0.075	0.085	0.091	0.066	0.095	0.094	0.096	0.070	0.106	0.074	0.091	0.069	0.075	0.074	0.086	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	98.4	97.9	98.6	95.3	97.0	99.6	96.6	94.3	92.4	89.2	95.8	91.4	98.2	91.6	97.0	94.5	92.6	96.8	95.6		

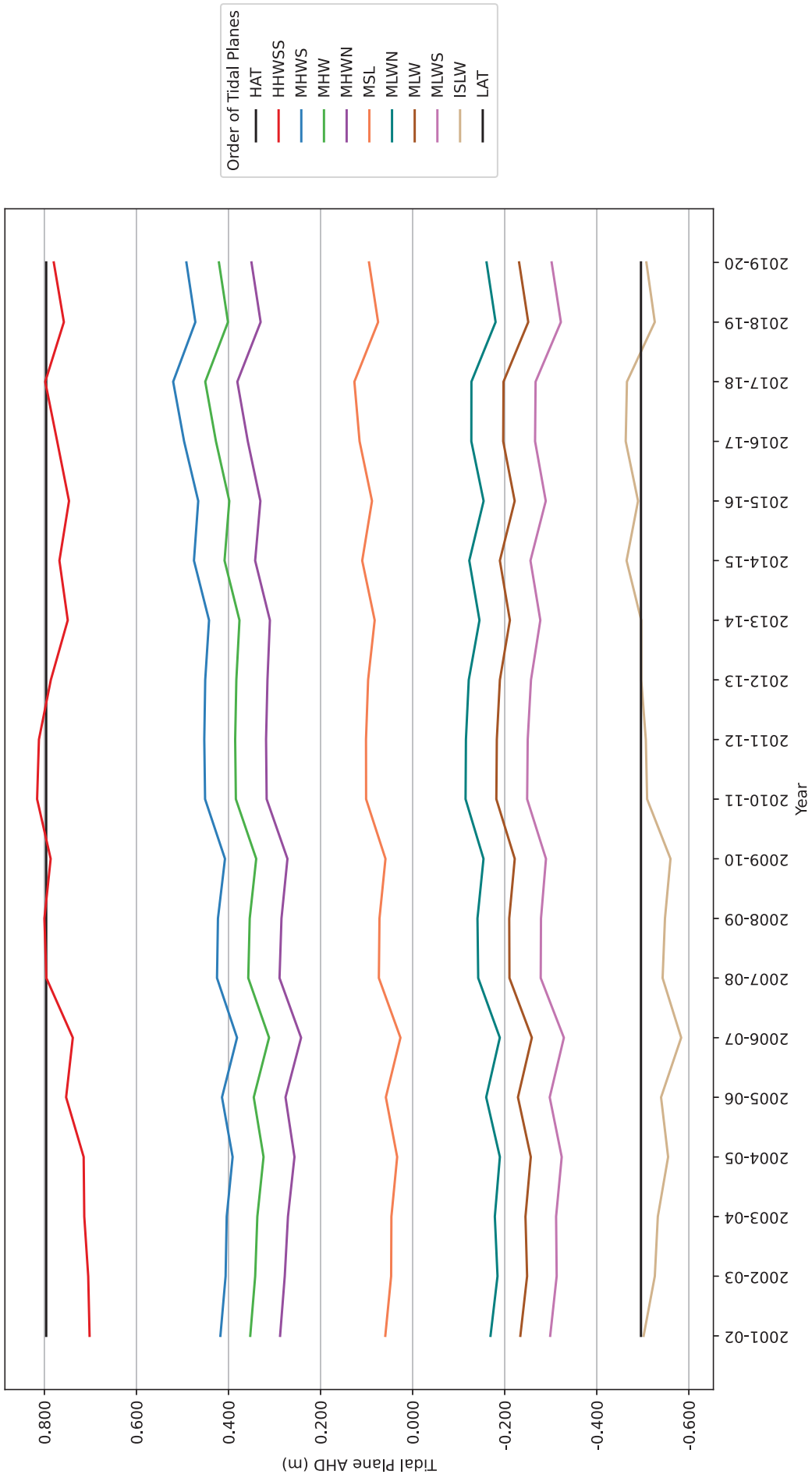
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.80	04/06/2004 23:30	±0.16	10.5
Lowest Astronomical Tide (LAT)	-0.50	25/11/2007 03:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A27

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Broadwater at Cobaki

MHL2786

Figure A27

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Terranora Inlet at Dry Dock

RECORDING STATION: **Terranora Inlet at Dry Dock**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201428

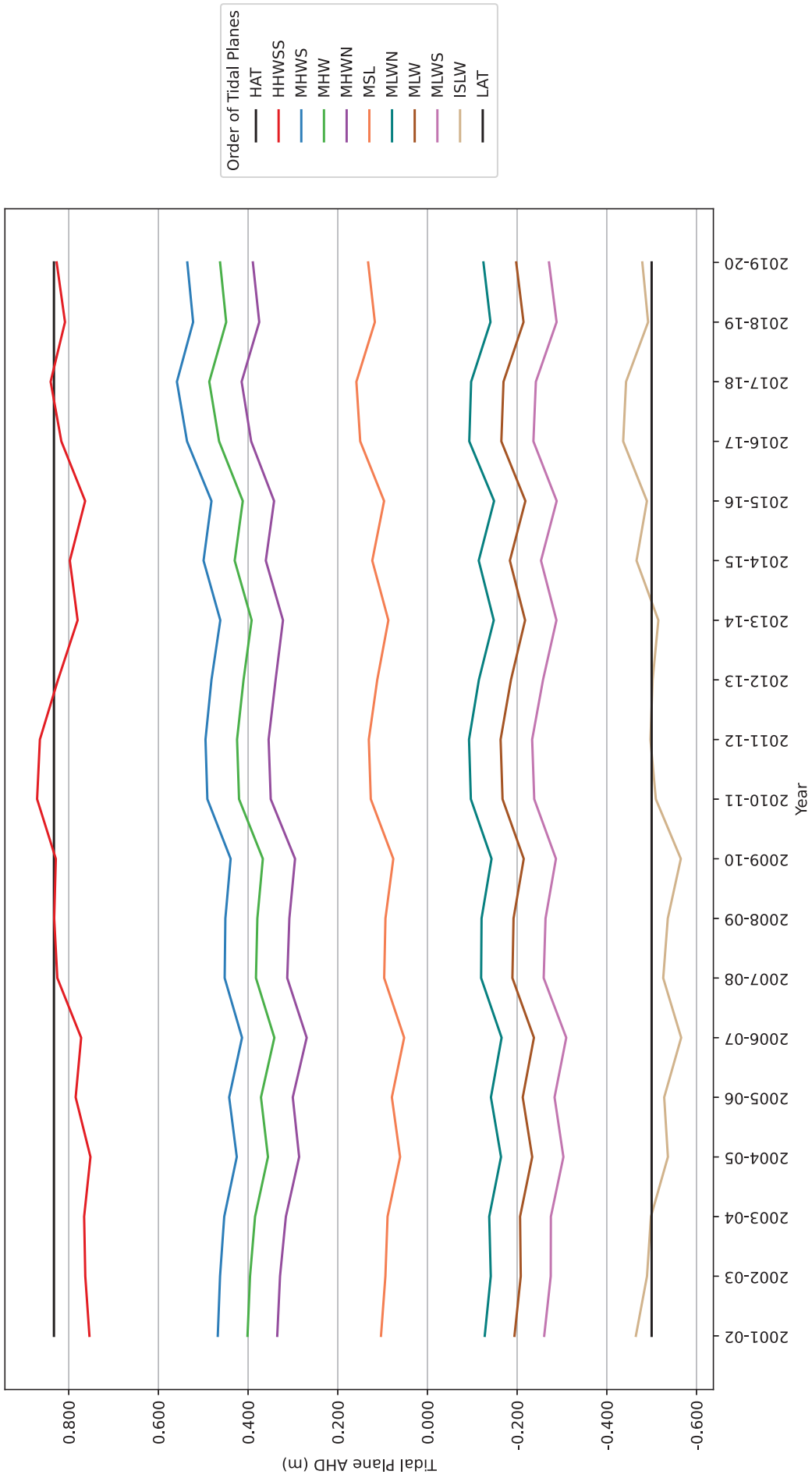
ZONE: 56
EASTING: 550715
NORTHING: 6881235

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.754	0.763	0.766	0.752	0.785	0.772	0.825	0.832	0.829	0.871	0.864	0.824	0.780	0.798	0.763	0.816	0.840	0.808	0.827	0.804	0.037
MHWS	0.468	0.463	0.453	0.425	0.442	0.413	0.452	0.451	0.439	0.491	0.495	0.482	0.462	0.499	0.482	0.536	0.559	0.523	0.536	0.477	0.040
MHW	0.401	0.396	0.384	0.356	0.371	0.341	0.382	0.379	0.367	0.420	0.425	0.410	0.392	0.430	0.412	0.465	0.487	0.449	0.462	0.407	0.039
MHWN	0.335	0.329	0.316	0.286	0.300	0.269	0.313	0.308	0.295	0.350	0.354	0.339	0.322	0.360	0.342	0.393	0.414	0.375	0.389	0.336	0.039
MSL	0.104	0.094	0.089	0.061	0.079	0.052	0.096	0.094	0.076	0.126	0.131	0.112	0.087	0.123	0.097	0.150	0.158	0.117	0.132	0.104	0.028
MLWN	-0.128	-0.141	-0.138	-0.164	-0.142	-0.165	-0.120	-0.121	-0.143	-0.097	-0.093	-0.115	-0.148	-0.114	-0.149	-0.093	-0.097	-0.141	-0.125	-0.128	0.023
MLW	-0.194	-0.208	-0.207	-0.234	-0.213	-0.237	-0.189	-0.192	-0.215	-0.167	-0.163	-0.186	-0.218	-0.184	-0.218	-0.165	-0.170	-0.214	-0.198	-0.199	0.022
MLWS	-0.260	-0.275	-0.275	-0.303	-0.283	-0.310	-0.259	-0.263	-0.287	-0.238	-0.234	-0.258	-0.288	-0.253	-0.288	-0.236	-0.242	-0.288	-0.271	-0.269	0.022
ISLW	-0.465	-0.490	-0.498	-0.536	-0.528	-0.566	-0.526	-0.536	-0.565	-0.509	-0.497	-0.502	-0.515	-0.466	-0.490	-0.437	-0.443	-0.492	-0.479	-0.502	0.036
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.463	0.470	0.453	0.450	0.442	0.435	0.432	0.429	0.438	0.446	0.447	0.453	0.470	0.475	0.491	0.486	0.512	0.516	0.514	0.464	0.028
MR	0.595	0.604	0.591	0.589	0.584	0.579	0.572	0.571	0.582	0.588	0.588	0.596	0.610	0.614	0.630	0.629	0.656	0.663	0.660	0.605	0.029
MSR	0.728	0.738	0.728	0.728	0.726	0.723	0.711	0.714	0.726	0.729	0.729	0.739	0.750	0.753	0.770	0.772	0.801	0.811	0.807	0.746	0.031
R	1.219	1.253	1.264	1.288	1.313	1.338	1.351	1.368	1.394	1.380	1.362	1.326	1.295	1.264	1.253	1.253	1.283	1.300	1.306	1.306	0.050
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.298	0.302	0.295	0.295	0.292	0.289	0.286	0.286	0.291	0.294	0.294	0.298	0.305	0.307	0.315	0.315	0.328	0.332	0.330	0.303	0.015
S2	0.066	0.067	0.069	0.070	0.071	0.072	0.070	0.071	0.072	0.071	0.070	0.072	0.070	0.069	0.070	0.072	0.072	0.074	0.073	0.071	0.002
K1	0.125	0.130	0.136	0.140	0.147	0.150	0.155	0.160	0.162	0.157	0.154	0.146	0.137	0.130	0.124	0.124	0.125	0.126	0.129	0.140	0.013
O1	0.079	0.085	0.087	0.093	0.098	0.106	0.111	0.113	0.117	0.114	0.110	0.099	0.090	0.083	0.077	0.076	0.076	0.078	0.080	0.093	0.015
MSF	0.038	0.029	0.026	0.036	0.012	0.020	0.040	0.017	0.025	0.032	0.038	0.007	0.029	0.020	0.021	0.023	0.015	0.023	0.023	0.025	0.009
z0	0.104	0.094	0.089	0.061	0.079	0.052	0.096	0.094	0.076	0.126	0.131	0.112	0.087	0.123	0.097	0.150	0.158	0.117	0.132	0.104	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	33.944	33.410	33.673	33.313	32.942	31.337	31.777	30.380	28.363	28.429	28.435	27.655	27.441	28.249	28.022	28.872	28.719	28.597	29.222	30.146	2.323
S2	301.788	301.165	299.944	300.096	298.885	298.951	301.486	300.043	300.197	302.618	302.320	300.640	300.961	300.866	300.763	300.564	299.221	299.147	298.135	300.410	1.202
K1	188.296	188.516	189.715	188.006	187.142	185.463	182.863	180.164	176.405	172.835	170.023	167.711	166.434	169.466	170.605	174.702	176.916	179.193	182.383	178.781	7.827
O1	246.605	243.842	243.923	242.997	242.686	242.879	244.943	248.014	252.683	257.660	262.919	265.910	268.372	263.751	260.616	254.892	249.066	246.057	242.940	251.619	8.928
MSF	282.985	281.612	307.005	283.679	293.673	233.096	253.862	228.651	288.643	243.018	261.951	268.481	270.660	319.157	291.817	293.968	280.209	278.776	283.994	276.065	23.618
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.095	0.066	0.089	0.087	0.090	0.068	0.095	0.092	0.089	0.069	0.096	0.079	0.092	0.071	0.078	0.074	0.083	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.6	96.5	98.4	93.9	97.2	99.3	94.0	94.7	98.7	87.0	94.7	94.2	98.9	93.7	98.6	94.7	89.2	83.6	94.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.83	04/06/2004 23:00	±0.18	8.7
Lowest Astronomical Tide (LAT)	-0.50	25/11/2007 03:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Terranora Inlet at Dry Dock

MHL2786

Figure
A28

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Terranora Inlet at Terranora

RECORDING STATION: **Terranora Inlet at Terranora**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201447

ZONE: 56
EASTING: 548955
NORTHING: 6880384

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.745	0.743	0.730	0.736	0.776	0.754	0.825	0.824	0.808	0.837	0.844	0.822	0.787	0.790	0.763	0.797	0.823	0.777	0.804	0.789	0.036
MHWS	0.468	0.453	0.430	0.422	0.446	0.409	0.467	0.460	0.443	0.482	0.499	0.495	0.481	0.506	0.491	0.529	0.551	0.502	0.523	0.477	0.038
MHW	0.408	0.394	0.368	0.360	0.384	0.346	0.405	0.398	0.382	0.421	0.438	0.432	0.420	0.444	0.430	0.465	0.487	0.437	0.459	0.415	0.037
MHWN	0.348	0.335	0.307	0.298	0.322	0.284	0.342	0.337	0.321	0.361	0.377	0.370	0.359	0.383	0.369	0.402	0.423	0.372	0.395	0.353	0.037
MSL	0.132	0.117	0.096	0.089	0.115	0.081	0.140	0.136	0.121	0.156	0.172	0.162	0.141	0.162	0.141	0.172	0.183	0.133	0.154	0.137	0.029
MLWN	-0.084	-0.101	-0.116	-0.120	-0.093	-0.121	-0.063	-0.064	-0.079	-0.049	-0.032	-0.045	-0.078	-0.060	-0.086	-0.058	-0.057	-0.107	-0.088	-0.079	0.026
MLW	-0.144	-0.160	-0.177	-0.181	-0.155	-0.184	-0.126	-0.125	-0.140	-0.110	-0.094	-0.107	-0.139	-0.121	-0.147	-0.121	-0.121	-0.171	-0.152	-0.141	0.026
MLWS	-0.203	-0.219	-0.239	-0.243	-0.217	-0.246	-0.188	-0.187	-0.201	-0.170	-0.155	-0.170	-0.200	-0.183	-0.209	-0.185	-0.184	-0.236	-0.216	-0.203	0.026
ISLW	-0.401	-0.426	-0.453	-0.467	-0.453	-0.493	-0.444	-0.447	-0.462	-0.424	-0.401	-0.403	-0.418	-0.386	-0.402	-0.376	-0.378	-0.432	-0.416	-0.425	0.032
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.432	0.436	0.423	0.418	0.414	0.405	0.406	0.400	0.399	0.410	0.409	0.415	0.436	0.443	0.455	0.460	0.481	0.479	0.483	0.432	0.028
MR	0.552	0.554	0.545	0.541	0.539	0.530	0.530	0.524	0.522	0.531	0.532	0.540	0.559	0.566	0.578	0.587	0.608	0.608	0.611	0.556	0.029
MSR	0.671	0.672	0.668	0.665	0.664	0.655	0.655	0.647	0.644	0.653	0.654	0.665	0.682	0.688	0.700	0.713	0.735	0.737	0.739	0.679	0.031
R	1.146	1.168	1.183	1.203	1.229	1.247	1.269	1.271	1.270	1.261	1.245	1.225	1.205	1.176	1.165	1.173	1.201	1.209	1.221	1.214	0.039
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.276	0.277	0.273	0.271	0.270	0.265	0.265	0.262	0.261	0.266	0.266	0.270	0.280	0.283	0.289	0.293	0.304	0.304	0.305	0.278	0.015
S2	0.060	0.059	0.061	0.062	0.062	0.062	0.062	0.062	0.061	0.061	0.061	0.062	0.061	0.061	0.061	0.063	0.064	0.065	0.064	0.062	0.001
K1	0.120	0.124	0.129	0.133	0.139	0.143	0.147	0.151	0.150	0.146	0.143	0.138	0.131	0.124	0.118	0.118	0.120	0.120	0.122	0.132	0.012
O1	0.078	0.083	0.085	0.091	0.097	0.104	0.109	0.109	0.111	0.108	0.104	0.095	0.087	0.079	0.076	0.073	0.074	0.077	0.079	0.090	0.014
MSF	0.039	0.029	0.029	0.032	0.014	0.021	0.040	0.019	0.035	0.039	0.044	0.017	0.034	0.025	0.026	0.028	0.021	0.030	0.027	0.029	0.008
z0	0.132	0.117	0.096	0.089	0.115	0.081	0.140	0.136	0.121	0.156	0.172	0.162	0.141	0.162	0.141	0.172	0.183	0.133	0.154	0.137	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	56.649	56.487	56.615	56.854	56.177	55.101	54.684	53.687	52.207	51.439	51.564	50.940	51.179	51.091	51.570	51.864	51.591	51.801	52.103	53.347	2.271
S2	330.470	328.826	329.194	329.397	328.541	328.155	329.451	329.310	330.133	329.413	329.432	330.682	329.603	329.772	330.989	328.815	328.244	327.707	327.495	329.244	0.955
K1	201.226	202.110	203.101	201.872	200.818	198.974	196.176	193.129	189.519	185.760	183.276	181.325	180.179	182.300	184.013	187.763	190.001	192.438	195.570	192.082	7.890
O1	256.116	254.145	253.612	253.647	252.352	253.752	255.014	259.069	263.186	269.128	273.529	274.686	278.094	273.808	270.312	264.645	258.904	255.883	252.496	261.704	8.855
MSF	284.844	278.911	307.491	283.242	297.405	244.056	265.558	235.907	288.564	247.635	263.904	271.525	272.120	310.861	286.771	288.233	286.748	278.506	279.436	277.459	19.782
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.094	0.064	0.080	0.081	0.083	0.064	0.087	0.085	0.081	0.067	0.090	0.073	0.085	0.068	0.072	0.071	0.080	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	98.3	97.6	97.2	99.1	97.0	99.4	96.7	94.4	94.0	92.5	93.2	92.4	98.5	92.2	97.9	94.5	93.3	96.3	95.2		

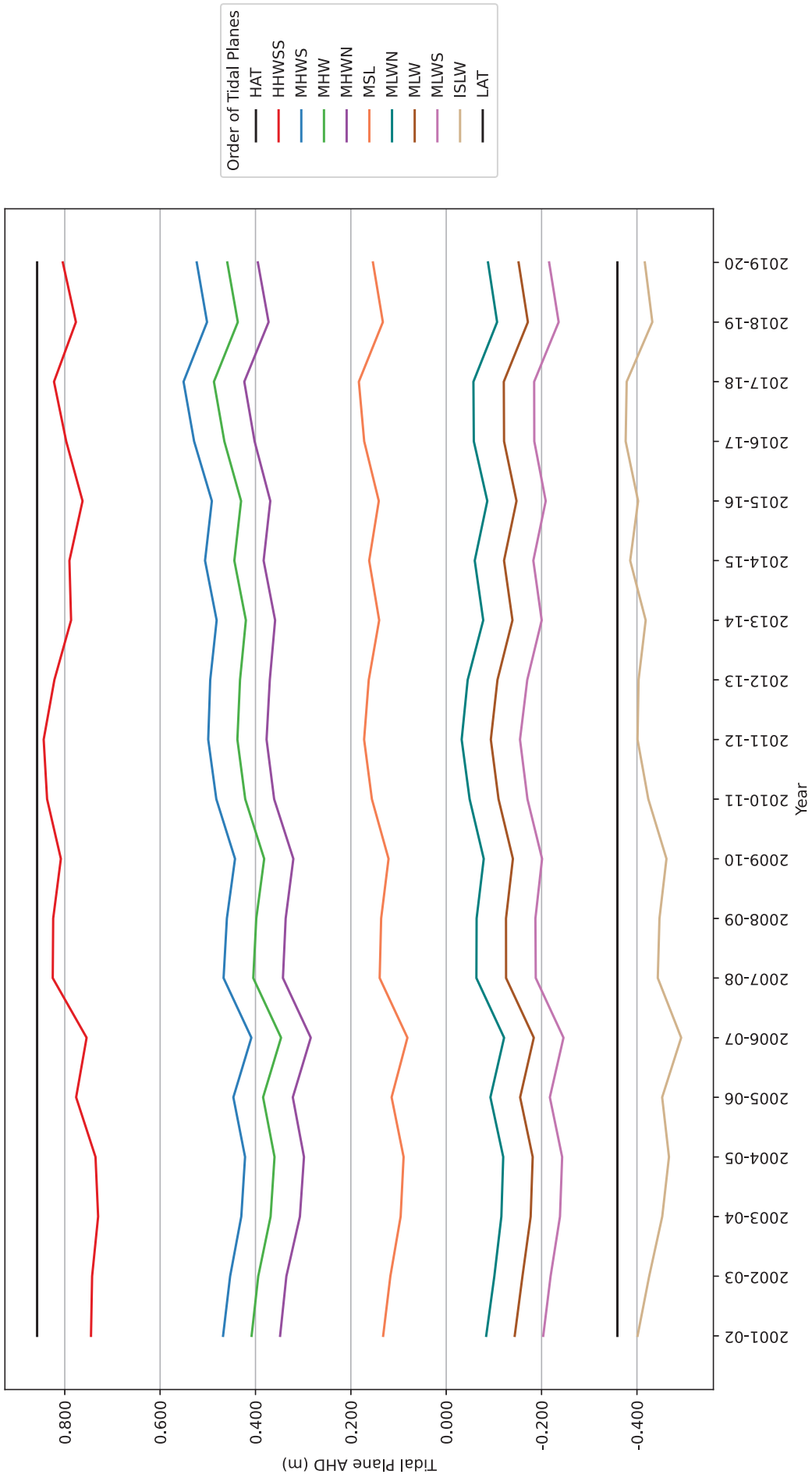
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.86	04/06/2004 23:45	±0.16	10.2
Lowest Astronomical Tide (LAT)	-0.36	13/12/2008 04:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A29

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Terranora Inlet at Terranora

MHL2786

Figure
A29

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed River at Letitia 2A

RECORDING STATION: **Tweed River at Letitia 2A**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201429

ZONE: 56
EASTING: 554309
NORTHING: 6882407

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13*	2013-14*	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.849	0.881	0.867	0.850	0.923	0.909	0.952	0.942	0.935	0.958				0.899	0.873	0.900	0.956	0.901	0.929	0.908	0.037
MHWS	0.539	0.556	0.532	0.502	0.560	0.529	0.556	0.544	0.533	0.572				0.588	0.571	0.604	0.657	0.597	0.618	0.566	0.039
MHW	0.436	0.452	0.427	0.396	0.455	0.422	0.454	0.442	0.432	0.475				0.487	0.467	0.497	0.547	0.488	0.510	0.462	0.038
MHWN	0.332	0.347	0.321	0.290	0.351	0.315	0.351	0.340	0.331	0.377				0.386	0.364	0.391	0.437	0.379	0.402	0.357	0.037
MSL	0.042	0.055	0.040	0.014	0.079	0.049	0.087	0.081	0.076	0.114				0.094	0.062	0.090	0.117	0.065	0.086	0.072	0.028
MLWN	-0.248	-0.238	-0.240	-0.261	-0.193	-0.217	-0.176	-0.177	-0.179	-0.148				-0.198	-0.239	-0.211	-0.203	-0.249	-0.230	-0.213	0.033
MLW	-0.352	-0.342	-0.346	-0.367	-0.298	-0.324	-0.279	-0.279	-0.281	-0.246				-0.299	-0.343	-0.318	-0.312	-0.358	-0.338	-0.318	0.035
MLWS	-0.456	-0.447	-0.452	-0.473	-0.403	-0.431	-0.381	-0.382	-0.382	-0.344				-0.400	-0.447	-0.424	-0.422	-0.467	-0.446	-0.422	0.037
ISLW	-0.677	-0.679	-0.691	-0.722	-0.662	-0.702	-0.664	-0.666	-0.668	-0.619				-0.622	-0.662	-0.636	-0.636	-0.683	-0.669	-0.666	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.580	0.585	0.561	0.552	0.544	0.532	0.527	0.517	0.511	0.525				0.584	0.603	0.602	0.640	0.628	0.632	0.570	0.043
MR	0.787	0.794	0.772	0.763	0.753	0.746	0.732	0.722	0.713	0.721				0.786	0.811	0.815	0.860	0.846	0.848	0.779	0.047
MSR	0.995	1.003	0.984	0.975	0.962	0.960	0.938	0.926	0.915	0.916				0.988	1.018	1.028	1.079	1.064	1.064	0.989	0.052
R	1.525	1.560	1.558	1.572	1.585	1.610	1.617	1.608	1.603	1.578				1.521	1.535	1.536	1.591	1.584	1.598	1.574	0.031
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.394	0.397	0.386	0.382	0.377	0.373	0.366	0.361	0.356	0.360				0.393	0.405	0.408	0.430	0.423	0.424	0.390	0.024
S2	0.104	0.105	0.106	0.106	0.105	0.107	0.103	0.102	0.101	0.098				0.101	0.104	0.106	0.110	0.109	0.108	0.105	0.003
K1	0.140	0.145	0.151	0.154	0.161	0.165	0.171	0.172	0.172	0.165				0.141	0.138	0.137	0.139	0.139	0.142	0.152	0.013
O1	0.081	0.087	0.089	0.094	0.099	0.106	0.112	0.112	0.114	0.111				0.081	0.077	0.075	0.075	0.078	0.080	0.092	0.015
MSF	0.025	0.013	0.021	0.018	0.010	0.016	0.023	0.008	0.012	0.013				0.022	0.012	0.018	0.010	0.013	0.011	0.015	0.005
z0	0.042	0.055	0.040	0.014	0.079	0.049	0.087	0.081	0.076	0.114				0.094	0.062	0.090	0.117	0.065	0.086	0.072	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	4.280	6.010	7.327	8.057	9.146	9.064	11.341	14.415	16.802	13.452				0.851	359.731	0.508	359.764	0.758	1.335	51.428	120.461
S2	268.709	269.716	270.293	270.465	271.775	273.748	278.093	282.338	287.057	285.012				269.237	267.619	266.863	266.670	266.163	266.617	272.524	6.855
K1	166.250	167.921	169.847	169.068	169.222	168.330	166.967	166.980	166.364	160.707				148.744	149.720	153.332	155.174	158.576	161.920	162.445	7.229
O1	225.369	223.365	224.737	224.374	224.232	226.859	229.720	233.727	241.904	245.332				245.961	241.199	234.684	227.206	224.886	222.402	230.997	8.313
MSF	292.350	283.238	334.941	305.541	2.680	195.416	264.252	135.871	287.663	241.882				318.576	308.311	329.832	43.314	311.408	316.334	248.226	102.428
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.110	0.067	0.085	0.081	0.086	0.062	0.088	0.089	0.079				0.091	0.068	0.063	0.067	0.085	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.5	97.0	98.1	97.6	91.3	95.1	94.0	87.8	93.3	78.0	13.3	0.0	0.0	64.6	97.8	92.6	81.8	95.1	94.3		

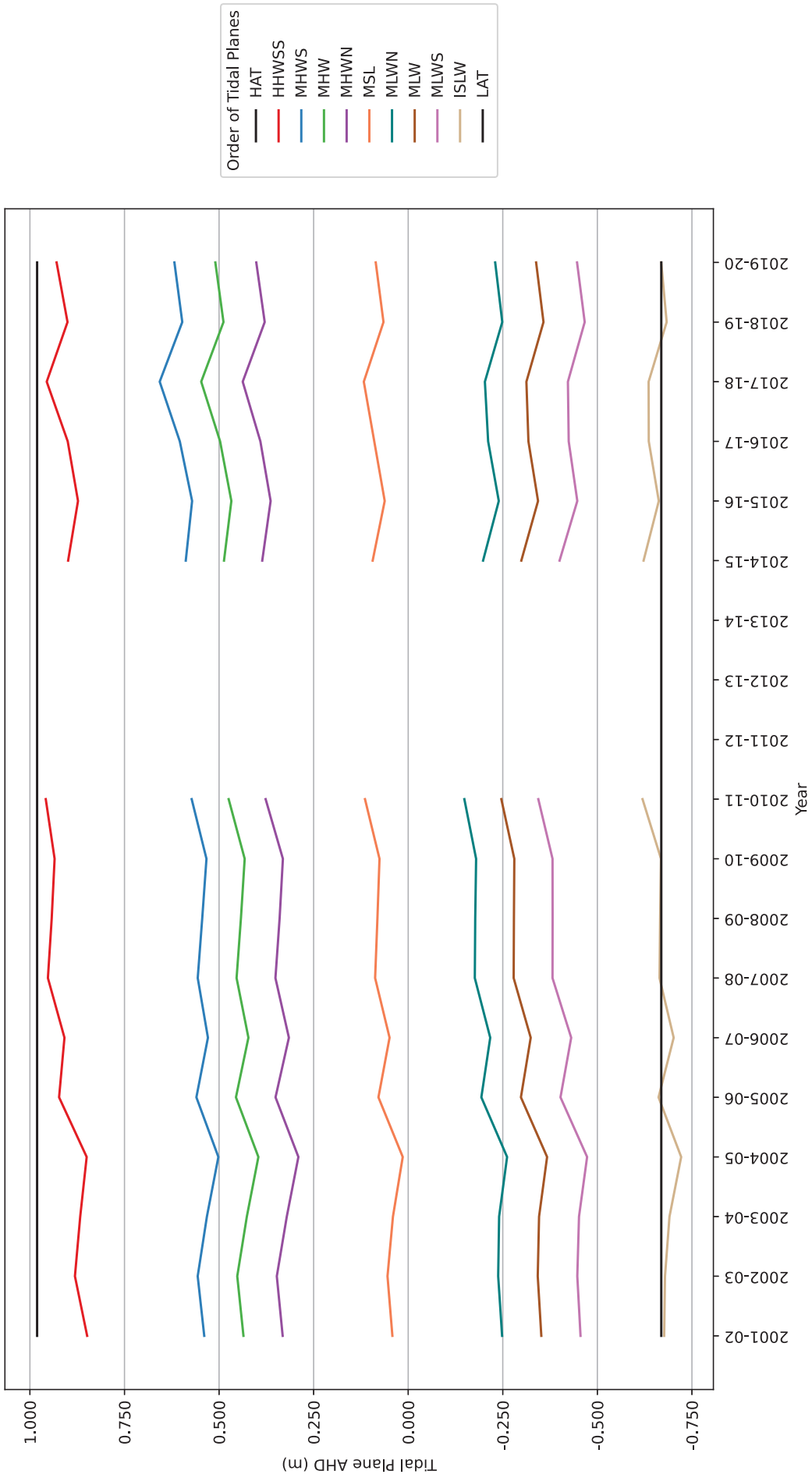
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.98	04/06/2004 22:00	±0.20	8.4
Lowest Astronomical Tide (LAT)	-0.67	15/11/2016 02:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A30

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at Letitia 2A

MHL2786

Figure
A30

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed River at Barneys Point

RECORDING STATION:	**Tweed River at Barneys Point**	ZONE:	56
DATUM:	AUSTRALIAN HEIGHT DATUM	EASTING:	554110
AWRC #:	201426	NORTHING:	6877710

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07*	2007-08	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.746	0.762	0.755	0.742	0.763		0.836		0.834	0.848	0.880	0.854	0.826	0.825	0.784	0.826	0.854	0.800	0.832	0.810	0.043
MHWS	0.452	0.456	0.436	0.411	0.417		0.456		0.437	0.468	0.513	0.510	0.506	0.526	0.500	0.544	0.571	0.513	0.538	0.485	0.047
MHW	0.378	0.381	0.360	0.335	0.341		0.381		0.362	0.396	0.438	0.434	0.431	0.451	0.426	0.467	0.493	0.436	0.459	0.410	0.047
MHWN	0.304	0.307	0.283	0.260	0.265		0.305		0.287	0.323	0.363	0.357	0.357	0.376	0.352	0.390	0.415	0.358	0.380	0.334	0.046
MSL	0.063	0.066	0.048	0.030	0.036		0.083		0.060	0.091	0.133	0.126	0.117	0.132	0.104	0.135	0.150	0.099	0.117	0.094	0.037
MLWN	-0.178	-0.175	-0.187	-0.199	-0.192		-0.138		-0.167	-0.140	-0.097	-0.105	-0.123	-0.113	-0.144	-0.120	-0.116	-0.161	-0.145	-0.147	0.032
MLW	-0.252	-0.249	-0.263	-0.275	-0.268		-0.214		-0.242	-0.213	-0.172	-0.181	-0.197	-0.188	-0.217	-0.196	-0.194	-0.238	-0.224	-0.223	0.032
MLWS	-0.326	-0.323	-0.339	-0.350	-0.344		-0.290		-0.317	-0.286	-0.247	-0.258	-0.272	-0.263	-0.291	-0.273	-0.272	-0.316	-0.303	-0.298	0.032
ISLW	-0.536	-0.542	-0.568	-0.587	-0.591		-0.561		-0.601	-0.558	-0.509	-0.503	-0.500	-0.477	-0.494	-0.475	-0.474	-0.520	-0.513	-0.530	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.481	0.481	0.471	0.459	0.457		0.443		0.453	0.463	0.460	0.462	0.480	0.490	0.496	0.510	0.531	0.519	0.525	0.481	0.027
MR	0.630	0.630	0.623	0.610	0.609		0.594		0.604	0.609	0.609	0.615	0.629	0.639	0.643	0.663	0.687	0.674	0.683	0.632	0.029
MSR	0.778	0.779	0.775	0.760	0.761		0.746		0.754	0.755	0.759	0.768	0.777	0.788	0.790	0.817	0.843	0.829	0.841	0.784	0.031
R	1.282	1.304	1.323	1.329	1.354		1.397		1.435	1.406	1.389	1.358	1.326	1.302	1.278	1.301	1.327	1.320	1.345	1.340	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.315	0.315	0.311	0.305	0.304		0.297		0.302	0.304	0.305	0.308	0.314	0.320	0.322	0.332	0.343	0.337	0.341	0.316	0.014
S2	0.074	0.074	0.076	0.075	0.076		0.076		0.075	0.073	0.075	0.076	0.074	0.075	0.074	0.077	0.078	0.078	0.079	0.076	0.002
K1	0.129	0.133	0.138	0.142	0.146		0.158		0.164	0.159	0.153	0.148	0.139	0.131	0.125	0.126	0.126	0.126	0.130	0.140	0.013
O1	0.081	0.086	0.090	0.095	0.101		0.113		0.119	0.113	0.109	0.098	0.090	0.083	0.078	0.075	0.076	0.078	0.081	0.092	0.014
MSF	0.036	0.034	0.029	0.035	0.017		0.045		0.028	0.032	0.044	0.021	0.033	0.029	0.027	0.037	0.020	0.028	0.022	0.030	0.008
z0	0.063	0.066	0.048	0.030	0.036		0.083		0.060	0.091	0.133	0.126	0.117	0.132	0.104	0.135	0.150	0.099	0.117	0.094	0.037
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	28.435	29.098	29.466	30.647	30.254		29.034		27.045	26.424	25.955	25.955	26.292	26.004	27.428	26.602	27.169	29.331	28.460	27.859	1.581
S2	294.947	294.477	294.960	295.949	294.645		297.179		297.535	298.087	298.997	297.990	298.536	298.717	300.701	297.780	299.297	298.686	297.255	297.396	1.820
K1	183.145	184.336	184.929	184.052	184.163		179.175		173.132	169.384	166.869	165.020	163.440	165.681	167.422	171.455	173.413	177.319	179.664	174.859	7.730
O1	239.424	238.016	237.195	237.403	235.895		239.834		247.985	253.525	257.585	261.076	262.473	258.086	254.880	248.706	242.542	241.249	237.996	246.698	9.403
MSF	285.429	272.271	300.930	282.824	295.893		267.370		298.806	243.863	262.065	292.616	278.516	308.427	292.451	293.445	293.022	282.096	283.104	284.302	16.013
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.093	0.069	0.090	0.076		0.066		0.084	0.092	0.067	0.091	0.074	0.084	0.069	0.064	0.073	0.084	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.3	97.5	97.9	98.7	76.7	37.7	89.6	3.5	93.0	66.2	92.7	89.8	97.2	89.9	97.8	91.1	83.3	96.1	94.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.90	04/06/2004 22:30	±0.19	9.9
Lowest Astronomical Tide (LAT)	-0.48	13/12/2012 02:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

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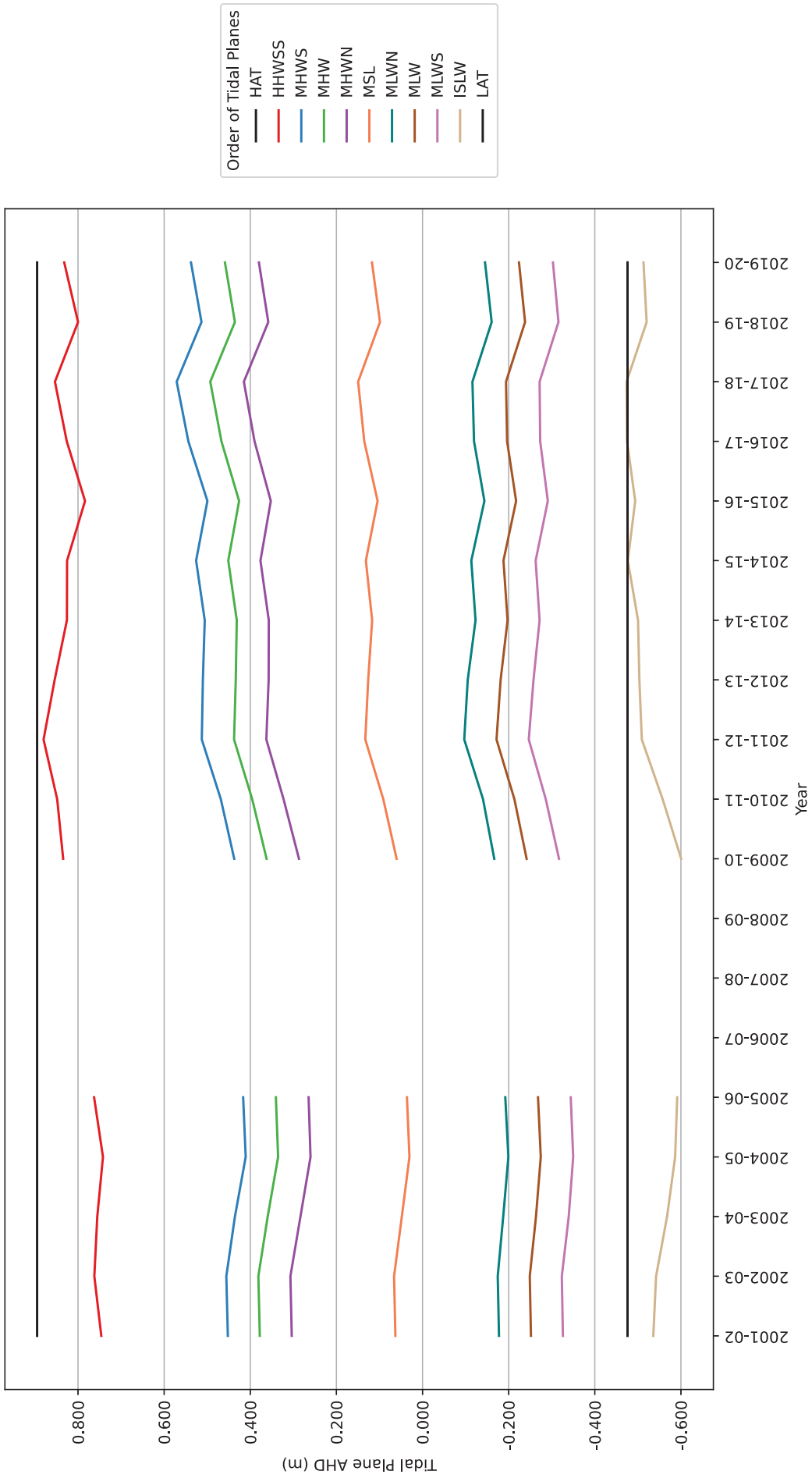

NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at Barneys Point

MHL2786

Figure
A31

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed River at Tumbulgum

RECORDING STATION:	**Tweed River at Tumbulgum**	ZONE:	56
DATUM:	AUSTRALIAN HEIGHT DATUM	EASTING:	545172
AWRC #:	201432	NORTHING:	6871999

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.801	0.809	0.840	0.834	0.884	0.821		0.949	0.940	0.983	0.988	0.946	0.904	0.905	0.879	0.928	0.959	0.888	0.918	0.899	0.059
MHWS	0.517	0.513	0.528	0.510	0.538	0.471		0.572	0.550	0.599	0.627	0.594	0.578	0.602	0.590	0.640	0.671	0.595	0.616	0.573	0.052
MHW	0.446	0.445	0.456	0.438	0.466	0.404		0.500	0.476	0.524	0.548	0.516	0.502	0.525	0.513	0.560	0.589	0.514	0.535	0.498	0.048
MHWN	0.375	0.377	0.384	0.366	0.394	0.337		0.427	0.403	0.449	0.469	0.439	0.426	0.449	0.437	0.480	0.508	0.432	0.453	0.422	0.044
MSL	0.124	0.125	0.131	0.120	0.147	0.103		0.180	0.156	0.198	0.216	0.178	0.155	0.173	0.155	0.193	0.205	0.139	0.157	0.159	0.032
MLWN	-0.127	-0.128	-0.121	-0.127	-0.101	-0.132		-0.066	-0.091	-0.054	-0.037	-0.083	-0.116	-0.103	-0.126	-0.095	-0.097	-0.154	-0.138	-0.105	0.031
MLW	-0.198	-0.195	-0.193	-0.198	-0.173	-0.199		-0.139	-0.165	-0.129	-0.116	-0.161	-0.192	-0.179	-0.203	-0.174	-0.179	-0.235	-0.220	-0.180	0.031
MLWS	-0.269	-0.263	-0.266	-0.270	-0.245	-0.266		-0.212	-0.238	-0.204	-0.195	-0.238	-0.268	-0.256	-0.279	-0.254	-0.261	-0.316	-0.302	-0.256	0.031
ISLW	-0.471	-0.475	-0.488	-0.502	-0.493	-0.516		-0.481	-0.517	-0.478	-0.452	-0.489	-0.500	-0.473	-0.486	-0.460	-0.466	-0.526	-0.517	-0.488	0.021
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.502	0.505	0.504	0.492	0.494	0.470		0.493	0.494	0.503	0.506	0.522	0.542	0.552	0.563	0.575	0.605	0.586	0.592	0.528	0.041
MR	0.644	0.640	0.649	0.636	0.639	0.604		0.639	0.641	0.653	0.664	0.677	0.694	0.704	0.716	0.735	0.768	0.749	0.755	0.678	0.049
MSR	0.786	0.776	0.794	0.780	0.784	0.738		0.784	0.788	0.803	0.821	0.832	0.846	0.857	0.868	0.894	0.932	0.911	0.918	0.829	0.057
R	1.272	1.284	1.328	1.336	1.377	1.337		1.429	1.457	1.461	1.440	1.435	1.404	1.378	1.365	1.388	1.425	1.414	1.434	1.387	0.057
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.322	0.320	0.325	0.318	0.320	0.302		0.319	0.320	0.327	0.332	0.338	0.347	0.352	0.358	0.367	0.384	0.374	0.377	0.339	0.024
S2	0.071	0.068	0.072	0.072	0.072	0.067		0.073	0.074	0.075	0.079	0.078	0.076	0.076	0.076	0.080	0.082	0.081	0.082	0.075	0.004
K1	0.123	0.128	0.135	0.138	0.147	0.148		0.158	0.161	0.156	0.148	0.153	0.142	0.134	0.129	0.129	0.129	0.130	0.133	0.140	0.012
O1	0.079	0.084	0.088	0.093	0.100	0.101		0.110	0.118	0.118	0.109	0.099	0.090	0.083	0.078	0.077	0.076	0.080	0.082	0.093	0.014
MSF	0.041	0.030	0.029	0.037	0.014	0.035		0.035	0.032	0.045	0.047	0.018	0.035	0.031	0.027	0.037	0.019	0.028	0.025	0.032	0.009
z0	0.124	0.125	0.131	0.120	0.147	0.103		0.180	0.156	0.198	0.216	0.178	0.155	0.173	0.155	0.193	0.205	0.139	0.157	0.159	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	60.463	61.088	60.085	60.997	60.189	64.891		55.635	54.858	58.190	54.677	52.126	51.894	51.506	52.010	51.216	50.139	52.872	52.691	55.863	4.457
S2	338.498	335.465	335.042	335.295	335.073	339.484		331.867	333.490	335.290	333.327	331.926	331.720	332.099	332.479	329.087	329.687	329.464	329.200	333.250	3.019
K1	200.456	201.476	200.915	199.598	198.702	200.782		189.413	186.853	184.038	180.960	179.211	177.269	178.582	180.704	183.906	185.769	190.055	192.813	189.528	8.832
O1	253.077	251.186	250.149	249.884	249.692	250.718		253.728	258.649	265.550	266.889	273.774	274.511	270.750	266.663	260.553	253.089	252.321	248.406	258.310	9.033
MSF	292.892	278.420	306.618	273.138	275.432	267.641		258.403	285.631	275.026	254.832	286.081	277.289	311.824	288.901	289.010	284.557	288.240	286.607	282.252	14.375
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.097	0.065	0.076	0.085	0.069		0.086	0.088	0.085	0.071	0.102	0.076	0.088	0.070	0.079	0.070	0.085	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	59.1	95.7	93.3	95.3	94.4	51.6	8.1	82.4	92.6	77.8	68.3	83.4	97.3	89.1	97.0	81.7	85.4	96.5	93.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.00	04/06/2004 23:30	±0.19	15.7
Lowest Astronomical Tide (LAT)	-0.40	13/12/2012 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

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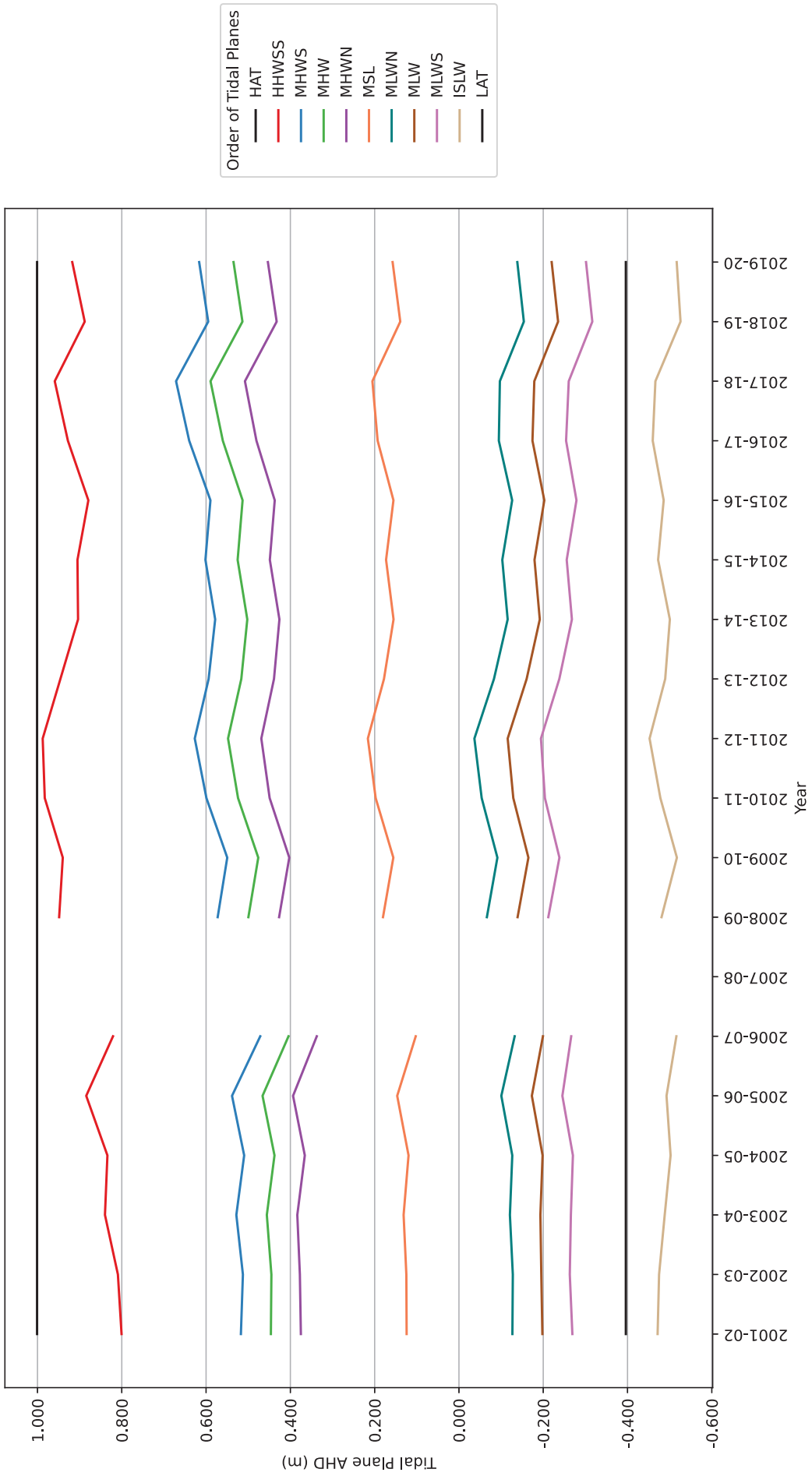
Table A32

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at Tumbulgum

MHL2786

Figure
A32

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed River at North Murwillumbah

RECORDING STATION: **Tweed River at North Murwillumbah**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201420

ZONE: 56
EASTING: 539329
NORTHING: 6866467

YEAR	2001-02	2002-03	2003-04*	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.864	0.823		0.859	0.903	0.871	0.958	0.962	0.967	0.984	1.001	0.990	0.910	0.919	0.887	0.933	0.942	0.897	0.928	0.922	0.050
MHWS	0.560	0.508		0.520	0.546	0.501	0.569	0.563	0.555	0.582	0.621	0.631	0.578	0.607	0.595	0.640	0.647	0.599	0.623	0.580	0.044
MHW	0.480	0.431		0.440	0.466	0.423	0.488	0.483	0.472	0.501	0.538	0.546	0.496	0.525	0.513	0.555	0.562	0.512	0.536	0.498	0.042
MHWN	0.401	0.354		0.361	0.386	0.345	0.408	0.403	0.389	0.420	0.455	0.461	0.414	0.444	0.432	0.470	0.476	0.426	0.448	0.416	0.039
MSL	0.116	0.076		0.089	0.116	0.084	0.143	0.134	0.119	0.141	0.177	0.179	0.123	0.148	0.128	0.161	0.151	0.110	0.131	0.129	0.029
MLWN	-0.168	-0.202		-0.183	-0.154	-0.178	-0.121	-0.134	-0.152	-0.138	-0.102	-0.102	-0.168	-0.147	-0.176	-0.147	-0.174	-0.206	-0.186	-0.158	0.030
MLW	-0.248	-0.279		-0.262	-0.234	-0.256	-0.202	-0.214	-0.235	-0.219	-0.185	-0.187	-0.250	-0.229	-0.258	-0.232	-0.259	-0.292	-0.274	-0.240	0.030
MLWS	-0.327	-0.356		-0.342	-0.314	-0.333	-0.283	-0.295	-0.318	-0.300	-0.267	-0.272	-0.332	-0.311	-0.339	-0.318	-0.345	-0.379	-0.361	-0.322	0.030
ISLW	-0.545	-0.581		-0.584	-0.569	-0.598	-0.560	-0.579	-0.612	-0.588	-0.538	-0.529	-0.569	-0.533	-0.548	-0.527	-0.555	-0.592	-0.578	-0.566	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.569	0.555		0.544	0.539	0.523	0.529	0.537	0.542	0.558	0.557	0.563	0.583	0.590	0.608	0.617	0.650	0.632	0.635	0.574	0.039
MR	0.728	0.710		0.703	0.700	0.679	0.690	0.698	0.707	0.720	0.723	0.733	0.746	0.754	0.771	0.787	0.821	0.805	0.809	0.738	0.044
MSR	0.887	0.865		0.861	0.860	0.834	0.852	0.858	0.873	0.882	0.888	0.904	0.910	0.918	0.934	0.958	0.992	0.977	0.983	0.902	0.049
R	1.409	1.403		1.442	1.472	1.468	1.518	1.541	1.578	1.572	1.539	1.519	1.480	1.452	1.435	1.460	1.497	1.489	1.506	1.488	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.364	0.355		0.351	0.350	0.339	0.345	0.349	0.354	0.360	0.361	0.367	0.373	0.377	0.386	0.394	0.410	0.402	0.405	0.369	0.022
S2	0.079	0.077		0.079	0.080	0.078	0.081	0.080	0.083	0.081	0.083	0.085	0.082	0.082	0.081	0.085	0.086	0.086	0.087	0.082	0.003
K1	0.134	0.137		0.146	0.153	0.155	0.163	0.169	0.172	0.168	0.161	0.155	0.146	0.138	0.130	0.132	0.133	0.133	0.136	0.148	0.014
O1	0.083	0.087		0.096	0.102	0.109	0.114	0.116	0.123	0.120	0.110	0.101	0.092	0.085	0.079	0.078	0.077	0.080	0.082	0.096	0.016
MSF	0.038	0.028		0.035	0.015	0.021	0.041	0.026	0.031	0.047	0.040	0.022	0.035	0.028	0.029	0.033	0.023	0.029	0.024	0.030	0.008
z0	0.116	0.076		0.089	0.116	0.084	0.143	0.134	0.119	0.141	0.177	0.179	0.123	0.148	0.128	0.161	0.151	0.110	0.131	0.129	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	63.708	65.960		64.459	62.775	63.769	60.955	59.262	58.080	57.350	56.010	54.858	55.865	55.645	55.912	55.242	54.826	57.013	56.986	58.815	3.761
S2	340.871	343.430		341.000	339.595	340.094	338.669	337.805	339.101	337.768	337.089	339.095	338.325	339.330	338.549	335.948	335.771	336.258	336.643	338.630	1.978
K1	202.278	205.064		202.349	200.369	200.206	195.576	192.129	189.691	186.166	181.891	179.871	179.255	179.963	182.797	186.546	187.737	191.993	195.218	191.061	8.598
O1	256.619	254.238		252.789	252.908	254.018	253.903	257.870	263.231	267.303	272.171	273.886	277.181	273.311	268.114	262.758	254.607	254.043	250.609	261.087	8.767
MSF	287.651	281.041		272.047	281.329	257.834	275.307	256.556	275.295	255.593	275.459	294.178	277.435	308.146	293.287	290.170	284.888	293.529	287.637	280.410	14.076
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.089		0.082	0.092	0.101	0.069	0.094	0.085	0.084	0.068	0.083	0.076	0.091	0.073	0.074	0.068	0.086	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.3	73.9	28.8	98.3	94.9	98.4	92.2	89.0	93.9	66.3	78.9	68.6	97.3	88.4	96.2	90.8	69.1	95.8	93.2		

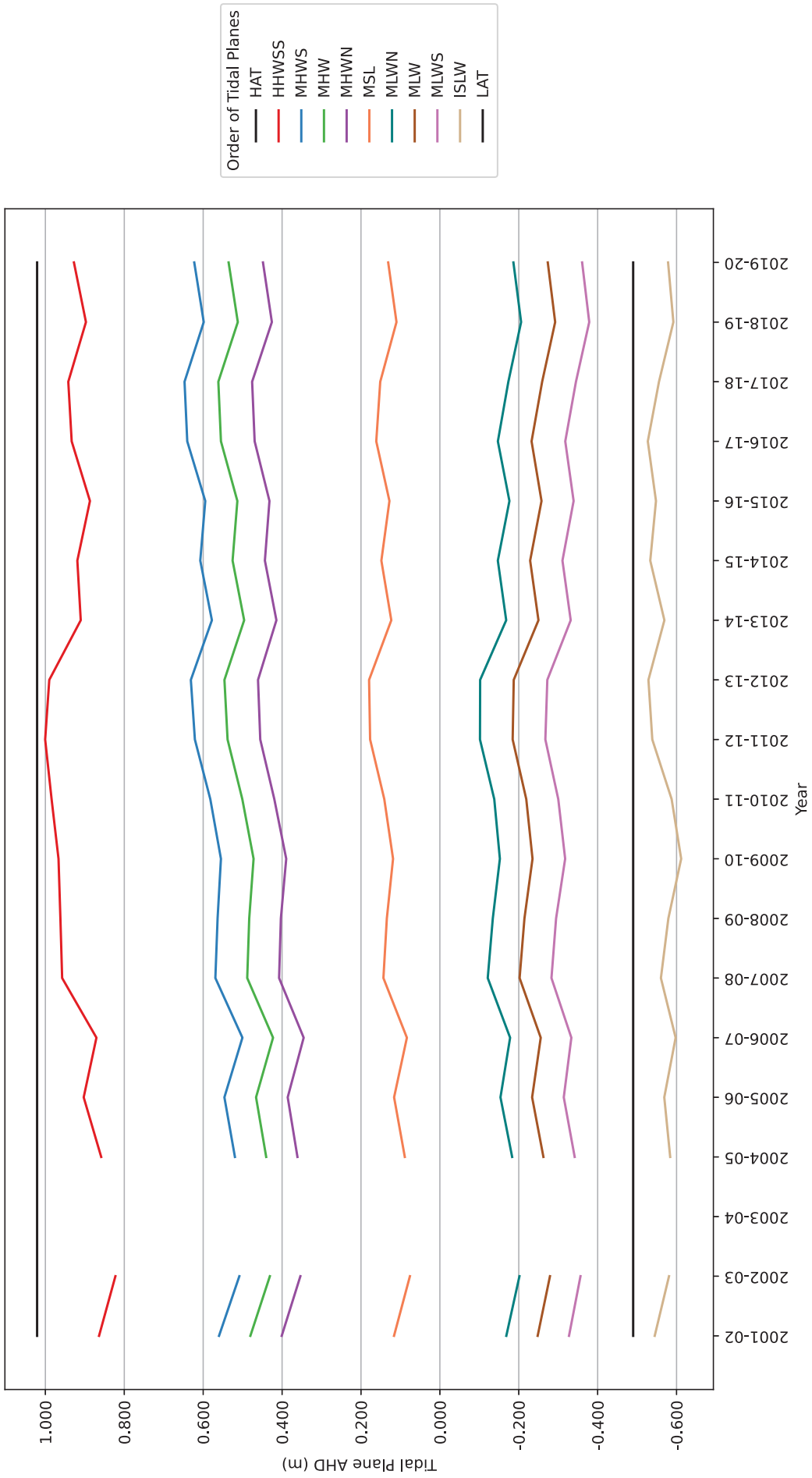
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.02	04/06/2004 23:45	±0.19	16.1
Lowest Astronomical Tide (LAT)	-0.49	25/11/2011 04:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A33

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at North Murwillumbah

MHL2786

Figure
A33

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tweed River at Murwillumbah Bridge

RECORDING STATION: **Tweed River at Murwillumbah Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201465

ZONE: 56
EASTING: 539219
NORTHING: 6866353

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.900	0.893	0.884	0.938	0.923	0.972	0.993	0.988	1.006	1.011	0.954	0.878	0.918	0.891	0.933	0.957	0.894	0.922	0.936	0.044
MHWS		0.588	0.569	0.546	0.580	0.553	0.580	0.590	0.585	0.609	0.635	0.599	0.548	0.607	0.599	0.639	0.665	0.600	0.619	0.595	0.032
MHW		0.518	0.493	0.471	0.504	0.480	0.504	0.514	0.510	0.534	0.556	0.519	0.472	0.526	0.517	0.553	0.577	0.513	0.532	0.516	0.028
MHWN		0.448	0.417	0.397	0.429	0.406	0.428	0.438	0.434	0.459	0.477	0.439	0.396	0.444	0.435	0.467	0.489	0.427	0.444	0.437	0.025
MSL		0.166	0.139	0.123	0.156	0.142	0.160	0.166	0.164	0.181	0.202	0.162	0.106	0.150	0.132	0.160	0.165	0.113	0.130	0.151	0.024
MLWN		-0.115	-0.139	-0.151	-0.117	-0.123	-0.108	-0.107	-0.106	-0.098	-0.073	-0.115	-0.183	-0.145	-0.171	-0.146	-0.158	-0.200	-0.184	-0.136	0.034
MLW		-0.186	-0.215	-0.225	-0.192	-0.197	-0.184	-0.183	-0.181	-0.173	-0.152	-0.195	-0.259	-0.226	-0.253	-0.232	-0.246	-0.287	-0.271	-0.214	0.038
MLWS		-0.256	-0.290	-0.300	-0.268	-0.270	-0.261	-0.259	-0.256	-0.248	-0.231	-0.275	-0.336	-0.308	-0.334	-0.318	-0.334	-0.373	-0.359	-0.293	0.041
ISLW		-0.479	-0.522	-0.541	-0.524	-0.534	-0.541	-0.547	-0.544	-0.532	-0.500	-0.529	-0.571	-0.529	-0.543	-0.528	-0.542	-0.584	-0.575	-0.537	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.563	0.556	0.548	0.546	0.530	0.536	0.546	0.540	0.557	0.550	0.553	0.579	0.589	0.606	0.613	0.646	0.627	0.628	0.573	0.036
MR		0.704	0.708	0.696	0.697	0.676	0.688	0.698	0.691	0.707	0.708	0.713	0.731	0.752	0.770	0.785	0.823	0.800	0.803	0.731	0.046
MSR		0.844	0.859	0.845	0.847	0.823	0.841	0.850	0.841	0.857	0.866	0.873	0.884	0.915	0.933	0.957	0.999	0.973	0.978	0.888	0.056
R		1.379	1.415	1.425	1.462	1.458	1.513	1.540	1.532	1.538	1.512	1.483	1.449	1.447	1.435	1.460	1.499	1.478	1.496	1.473	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.352	0.354	0.348	0.348	0.338	0.344	0.349	0.345	0.353	0.354	0.357	0.366	0.376	0.385	0.393	0.411	0.400	0.402	0.365	0.023
S2		0.070	0.076	0.074	0.075	0.073	0.076	0.076	0.075	0.075	0.079	0.080	0.076	0.081	0.082	0.086	0.088	0.087	0.087	0.079	0.005
K1		0.135	0.143	0.146	0.155	0.157	0.166	0.169	0.171	0.169	0.160	0.155	0.145	0.139	0.130	0.132	0.132	0.131	0.135	0.148	0.015
O1		0.088	0.089	0.095	0.101	0.107	0.114	0.118	0.117	0.115	0.109	0.099	0.090	0.083	0.079	0.077	0.077	0.080	0.081	0.096	0.015
MSF		0.027	0.033	0.034	0.015	0.019	0.040	0.023	0.030	0.045	0.040	0.011	0.031	0.026	0.025	0.030	0.023	0.031	0.024	0.028	0.009
z0		0.166	0.139	0.123	0.156	0.142	0.160	0.166	0.164	0.181	0.202	0.162	0.106	0.150	0.132	0.160	0.165	0.113	0.130	0.151	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		63.647	63.250	64.043	62.471	62.927	60.679	59.288	57.876	56.332	55.952	55.508	55.645	55.304	55.649	55.139	54.233	56.755	56.746	58.414	3.456
S2		338.730	334.415	336.265	334.269	335.330	333.566	332.795	333.749	332.703	332.020	333.874	333.723	336.922	337.712	335.133	334.548	335.017	335.361	334.785	1.759
K1		198.955	202.716	202.180	200.887	200.458	195.423	193.037	190.783	186.303	183.956	181.572	179.812	182.052	182.343	186.182	187.662	191.860	194.658	191.158	7.766
O1		252.528	252.621	252.684	251.764	253.576	254.277	257.569	263.488	268.152	272.374	275.537	277.484	272.181	268.888	262.210	254.759	253.987	250.911	260.833	9.256
MSF		259.870	302.996	273.343	275.186	256.960	274.557	258.504	278.880	256.623	271.072	294.148	277.308	311.780	287.501	287.286	287.918	286.949	287.567	279.358	15.604
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.096	0.070	0.082	0.088	0.088	0.068	0.102	0.087	0.088	0.090	0.100	0.081	0.096	0.072	0.074	0.075	0.089	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		61.3	96.5	97.7	94.8	98.4	91.9	87.5	96.4	85.3	82.6	91.0	98.1	91.6	97.4	83.5	91.6	98.2	95.7		

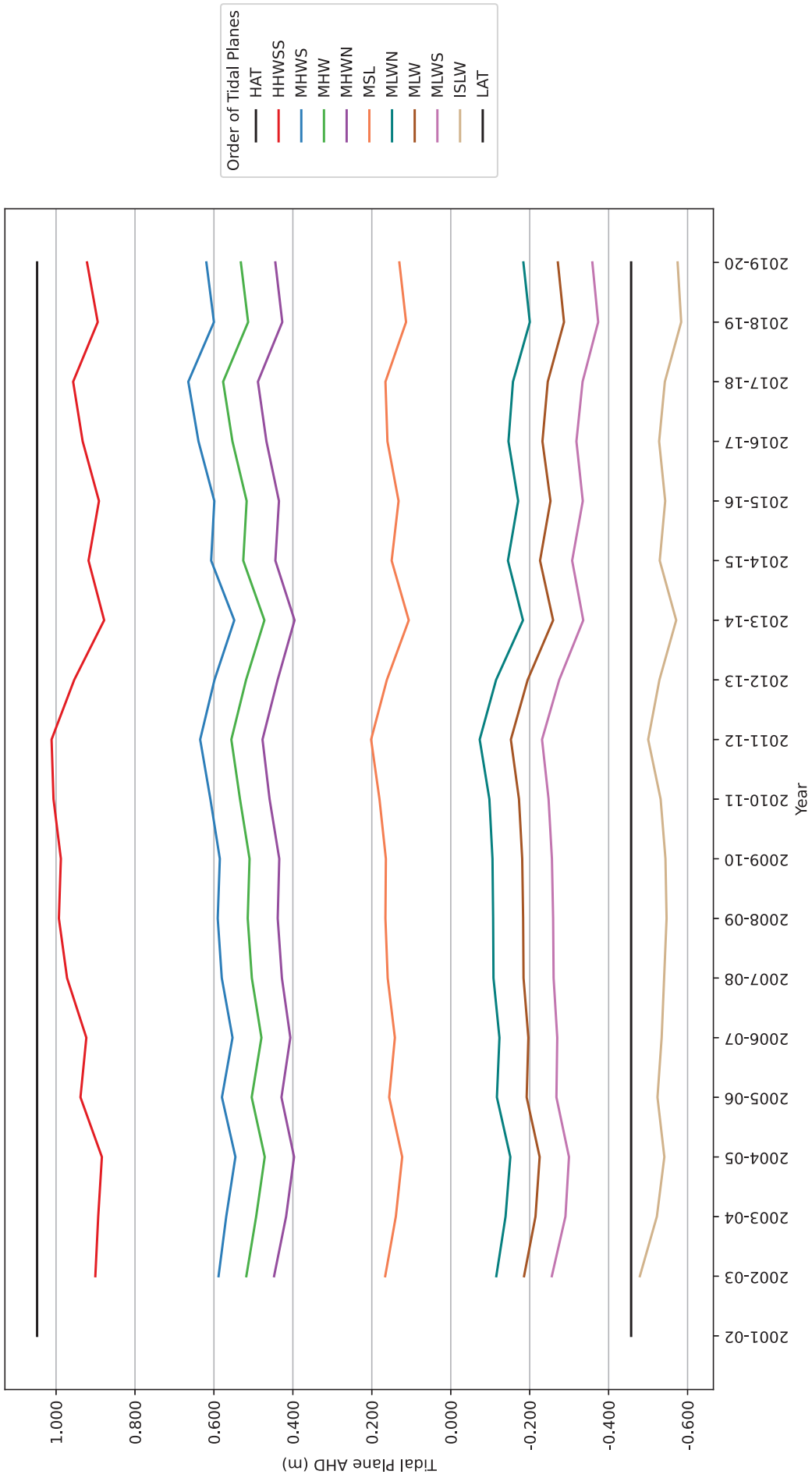
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.05	04/06/2004 23:45	±0.18	17.7
Lowest Astronomical Tide (LAT)	-0.46	25/11/2011 04:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A34

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tweed River at Murwillumbah Bridge

MHL2786

Figure A34

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Rous River at Kynnumboon

RECORDING STATION: **Rous River at Kynnumboon**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 201422

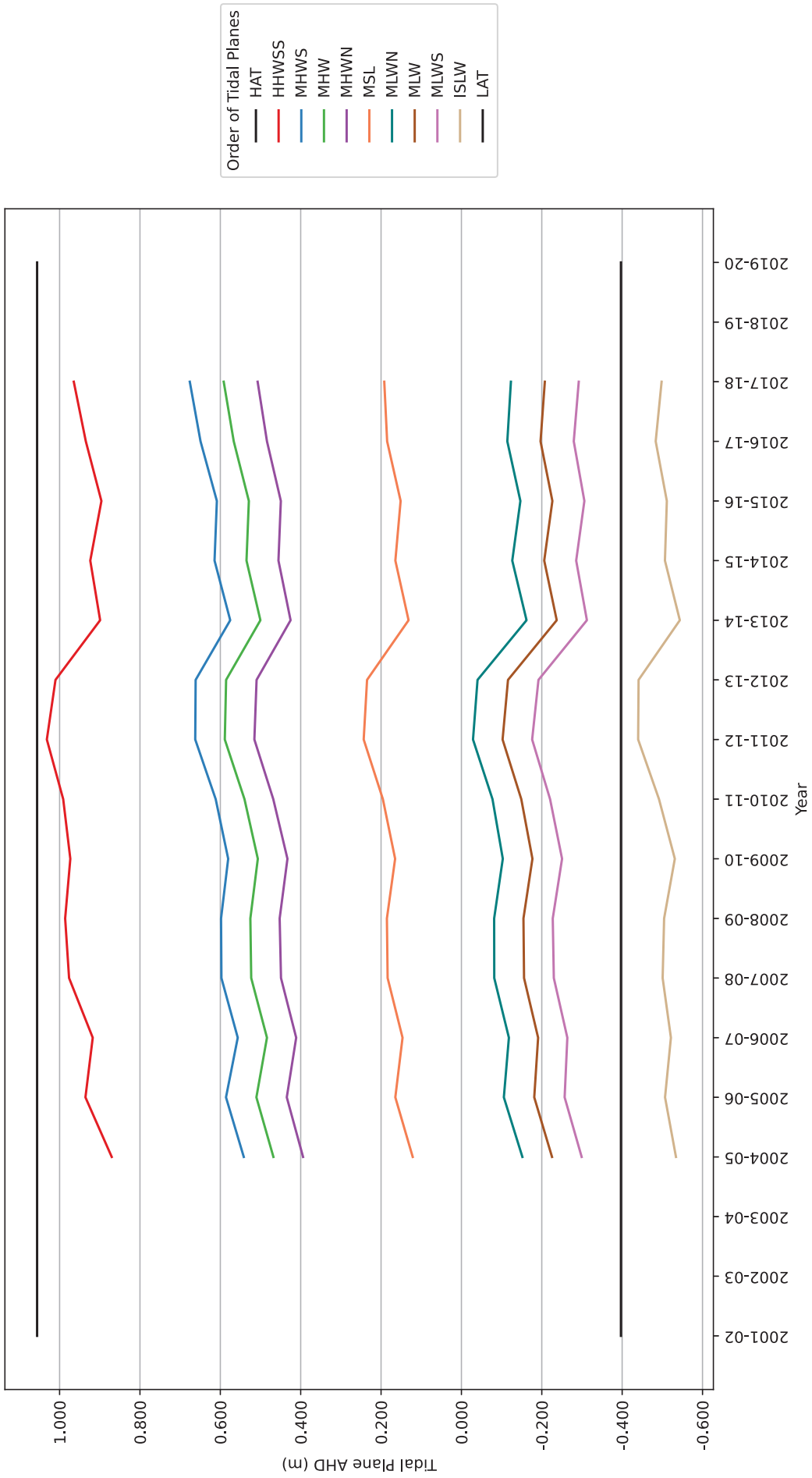
ZONE: 56
EASTING: 538179
NORTHING: 6867895

YEAR	2001-02	2002-03*	2003-04*	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.846			0.870	0.936	0.918	0.976	0.986	0.973	0.991	1.032	1.010	0.899	0.924	0.896	0.935	0.965		0.914	0.942	0.052
MHWS	0.553			0.542	0.586	0.557	0.597	0.598	0.580	0.612	0.662	0.661	0.575	0.614	0.609	0.649	0.676		0.618	0.606	0.041
MHW	0.476			0.468	0.510	0.484	0.523	0.525	0.507	0.540	0.589	0.586	0.500	0.535	0.529	0.567	0.592		0.535	0.529	0.039
MHWN	0.400			0.394	0.435	0.411	0.449	0.452	0.433	0.468	0.515	0.510	0.425	0.455	0.449	0.484	0.507		0.451	0.452	0.037
MSL	0.120			0.121	0.165	0.147	0.184	0.185	0.165	0.195	0.243	0.235	0.132	0.164	0.151	0.185	0.192		0.141	0.170	0.036
MLWN	-0.159			-0.152	-0.106	-0.118	-0.082	-0.081	-0.103	-0.077	-0.029	-0.040	-0.162	-0.127	-0.147	-0.114	-0.123		-0.168	-0.112	0.042
MLW	-0.236			-0.226	-0.181	-0.191	-0.156	-0.154	-0.177	-0.149	-0.102	-0.116	-0.237	-0.206	-0.226	-0.197	-0.208		-0.252	-0.188	0.044
MLWS	-0.313			-0.299	-0.257	-0.264	-0.230	-0.227	-0.250	-0.221	-0.176	-0.192	-0.312	-0.286	-0.306	-0.280	-0.292		-0.336	-0.265	0.046
ISLW	-0.522			-0.534	-0.507	-0.521	-0.501	-0.504	-0.531	-0.492	-0.440	-0.441	-0.544	-0.507	-0.511	-0.484	-0.498		-0.547	-0.505	0.031
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.559			0.546	0.540	0.529	0.531	0.534	0.536	0.546	0.544	0.550	0.587	0.582	0.596	0.598	0.630		0.620	0.564	0.033
MR	0.712			0.693	0.691	0.675	0.679	0.680	0.683	0.689	0.691	0.702	0.737	0.741	0.755	0.764	0.799		0.787	0.717	0.041
MSR	0.866			0.841	0.843	0.820	0.827	0.826	0.831	0.832	0.838	0.853	0.888	0.900	0.915	0.929	0.968		0.954	0.871	0.049
R	1.369			1.404	1.442	1.439	1.477	1.491	1.504	1.483	1.472	1.451	1.443	1.430	1.407	1.418	1.463		1.461	1.447	0.036
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.356			0.347	0.346	0.337	0.339	0.340	0.342	0.344	0.346	0.351	0.369	0.370	0.378	0.382	0.400		0.393	0.359	0.020
S2	0.077			0.074	0.076	0.073	0.074	0.073	0.074	0.072	0.074	0.076	0.075	0.080	0.080	0.083	0.084		0.084	0.077	0.004
K1	0.130			0.141	0.149	0.151	0.158	0.161	0.163	0.159	0.154	0.150	0.142	0.138	0.128	0.128	0.130		0.131	0.145	0.013
O1	0.080			0.094	0.101	0.107	0.113	0.116	0.118	0.112	0.110	0.099	0.089	0.082	0.078	0.076	0.076		0.080	0.096	0.016
MSF	0.036			0.041	0.017	0.017	0.040	0.028	0.032	0.050	0.044	0.032	0.036	0.024	0.028	0.033	0.024		0.025	0.032	0.009
z0	0.120			0.121	0.165	0.147	0.184	0.185	0.165	0.195	0.243	0.235	0.132	0.164	0.151	0.185	0.192		0.141	0.170	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	81.039			82.462	80.768	80.782	79.042	78.933	78.777	77.861	77.580	76.201	74.618	74.091	74.406	74.801	74.041		76.000	77.588	2.797
S2	3.018			359.123	357.455	357.663	355.586	355.759	358.680	358.573	358.133	357.991	356.769	359.809	1.437	359.725	359.610		2.068	291.337	143.471
K1	212.566			214.307	211.763	211.288	207.215	204.616	202.625	198.095	197.091	194.765	191.385	192.887	193.368	197.338	198.933		206.225	202.154	7.701
O1	265.298			262.668	261.371	263.299	262.892	266.592	272.464	278.349	280.793	284.545	286.382	281.813	278.318	272.157	265.991		259.223	271.385	9.108
MSF	288.132			282.745	280.387	254.330	277.062	255.946	281.056	263.038	271.189	289.768	275.760	308.634	291.052	282.795	281.625		291.587	279.694	13.869
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080			0.081	0.098	0.088	0.071	0.104	0.100	0.102	0.096	0.090	0.078	0.103	0.073	0.080	0.078		0.086		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.0	12.7	17.4	92.5	96.1	99.2	91.5	85.5	96.0	82.7	80.9	78.9	97.7	91.9	96.7	90.9	85.4	32.0	64.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.06	05/06/2004 00:15	±0.20	23.4
Lowest Astronomical Tide (LAT)	-0.40	25/11/2011 05:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Rous River at Kynnumboon

MHL2786

Figure
A35

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cudgen Creek at Kingscliff

RECORDING STATION: **Cudgen Creek at Kingscliff**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 202418

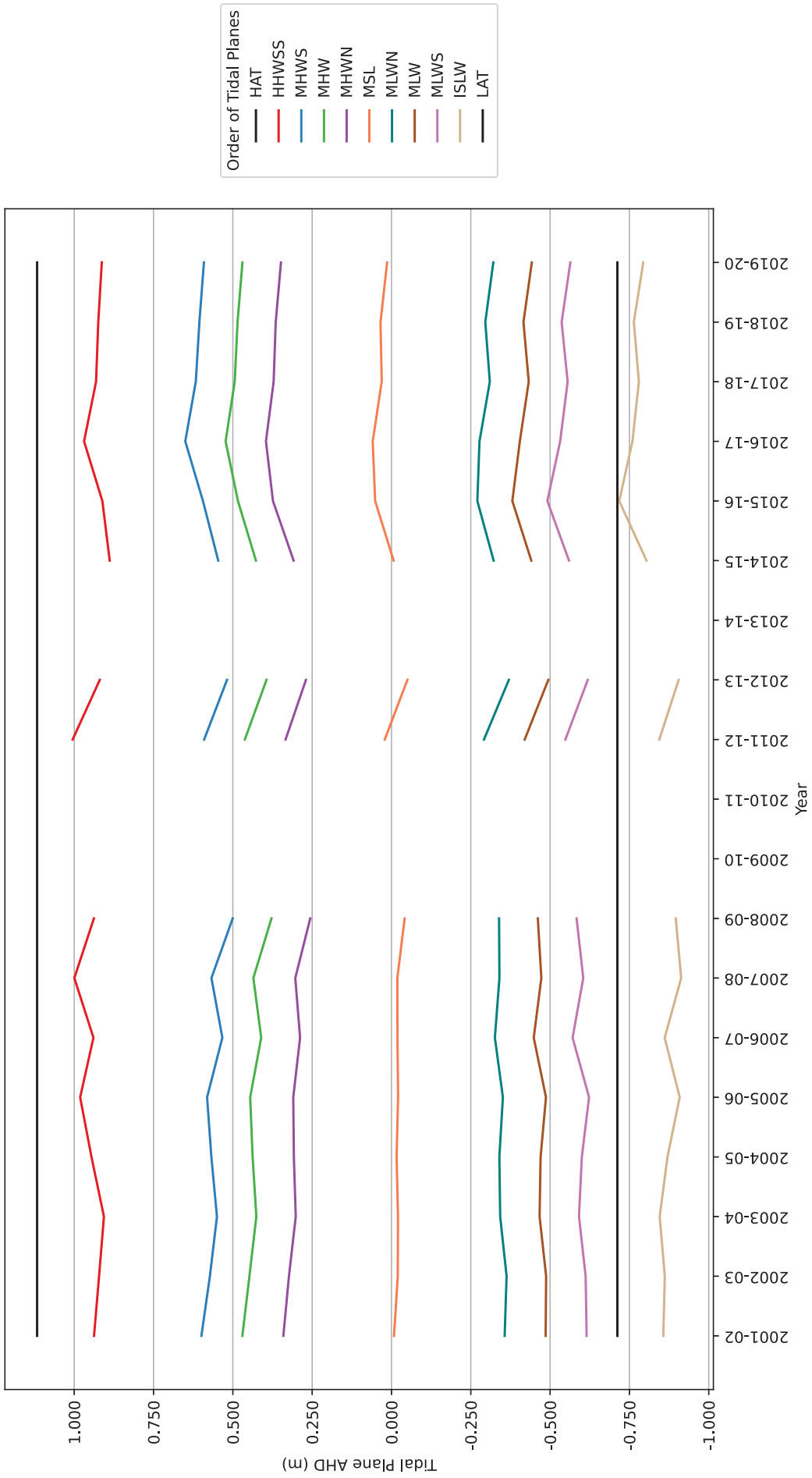
ZONE: 56
EASTING: 557064
NORTHING: 6873896

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10*	2010-11*	2011-12	2012-13	2013-14*	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.938	0.922	0.906	0.946	0.981	0.939	1.000	0.938			1.005	0.919		0.888	0.911	0.969	0.931	0.924	0.913	0.939	0.033
MHWS	0.599	0.572	0.550	0.568	0.581	0.533	0.567	0.500			0.591	0.518		0.546	0.594	0.650	0.617	0.606	0.591	0.574	0.038
MHW	0.470	0.448	0.426	0.438	0.445	0.411	0.435	0.378			0.462	0.394		0.427	0.484	0.523	0.494	0.485	0.470	0.449	0.038
MHWN	0.341	0.323	0.302	0.308	0.310	0.288	0.303	0.256			0.334	0.270		0.308	0.374	0.396	0.371	0.365	0.348	0.325	0.039
MSL	-0.008	-0.020	-0.020	-0.016	-0.021	-0.019	-0.019	-0.042			0.021	-0.050		-0.007	0.051	0.059	0.031	0.035	0.014	-0.001	0.032
MLWN	-0.357	-0.363	-0.343	-0.340	-0.351	-0.326	-0.340	-0.339			-0.292	-0.370		-0.322	-0.271	-0.277	-0.310	-0.296	-0.321	-0.326	0.030
MLW	-0.486	-0.487	-0.467	-0.470	-0.487	-0.448	-0.472	-0.461			-0.420	-0.494		-0.441	-0.381	-0.405	-0.433	-0.416	-0.442	-0.451	0.033
MLWS	-0.615	-0.612	-0.591	-0.600	-0.623	-0.571	-0.604	-0.583			-0.548	-0.619		-0.560	-0.491	-0.532	-0.555	-0.536	-0.564	-0.575	0.037
ISLW	-0.857	-0.862	-0.845	-0.870	-0.909	-0.861	-0.913	-0.896			-0.844	-0.905		-0.804	-0.718	-0.760	-0.780	-0.764	-0.794	-0.836	0.060
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.698	0.686	0.644	0.648	0.661	0.614	0.643	0.595			0.625	0.640		0.630	0.644	0.673	0.681	0.661	0.669	0.651	0.027
MR	0.956	0.935	0.893	0.908	0.932	0.859	0.908	0.840			0.882	0.888		0.868	0.865	0.927	0.927	0.901	0.912	0.900	0.032
MSR	1.214	1.184	1.141	1.168	1.204	1.104	1.172	1.084			1.139	1.137		1.106	1.086	1.182	1.172	1.142	1.155	1.149	0.040
R	1.794	1.783	1.752	1.816	1.890	1.800	1.913	1.834			1.849	1.825		1.692	1.629	1.728	1.711	1.688	1.707	1.776	0.079
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.478	0.468	0.446	0.454	0.466	0.429	0.454	0.420			0.441	0.444		0.434	0.432	0.464	0.463	0.451	0.456	0.450	0.016
S2	0.129	0.125	0.124	0.130	0.136	0.122	0.132	0.122			0.128	0.124		0.119	0.110	0.127	0.123	0.120	0.121	0.125	0.006
K1	0.152	0.156	0.158	0.165	0.177	0.174	0.187	0.189			0.179	0.175		0.154	0.139	0.144	0.143	0.142	0.135	0.161	0.018
O1	0.089	0.094	0.097	0.105	0.109	0.116	0.121	0.123			0.117	0.111		0.090	0.088	0.084	0.082	0.086	0.095	0.100	0.014
MSF	0.029	0.020	0.015	0.022	0.012	0.020	0.022	0.023			0.031	0.013		0.006	0.027	0.017	0.013	0.026	0.015	0.019	0.007
z0	-0.008	-0.020	-0.020	-0.016	-0.021	-0.019	-0.019	-0.042			0.021	-0.050		-0.007	0.051	0.059	0.031	0.035	0.014	-0.001	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	353.197	354.094	355.395	354.326	352.510	355.567	351.578	356.591			351.170	354.508		352.074	354.801	352.100	353.932	356.761	356.590	354.075	1.834
S2	261.337	260.690	262.827	260.560	257.819	264.006	260.155	267.602			264.188	264.152		265.737	268.379	263.330	267.375	267.852	261.245	263.579	3.172
K1	154.648	156.036	158.168	155.539	154.660	155.574	150.891	150.778			140.666	138.111		138.715	142.742	144.593	148.255	152.239	151.535	149.572	6.607
O1	211.576	208.651	210.158	208.264	208.763	211.832	211.668	216.915			229.750	231.990		226.767	227.380	222.674	217.925	215.169	212.664	217.009	8.127
MSF	278.861	276.492	282.596	262.066	49.249	228.690	260.989	209.378			247.465	285.141		209.841	267.364	278.336	264.187	264.203	262.546	245.463	57.421
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.096	0.074	0.078	0.081	0.088	0.067	0.095			0.067	0.072		0.110	0.063	0.064	0.073	0.072	0.099		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.0	88.5	90.8	89.2	94.4	93.0	76.2	89.9	3.0	8.5	84.7	60.3	0.0	87.8	88.8	87.4	90.5	86.7	76.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2008 20:45	±0.19	4.1
Lowest Astronomical Tide (LAT)	-0.71	28/10/2015 03:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

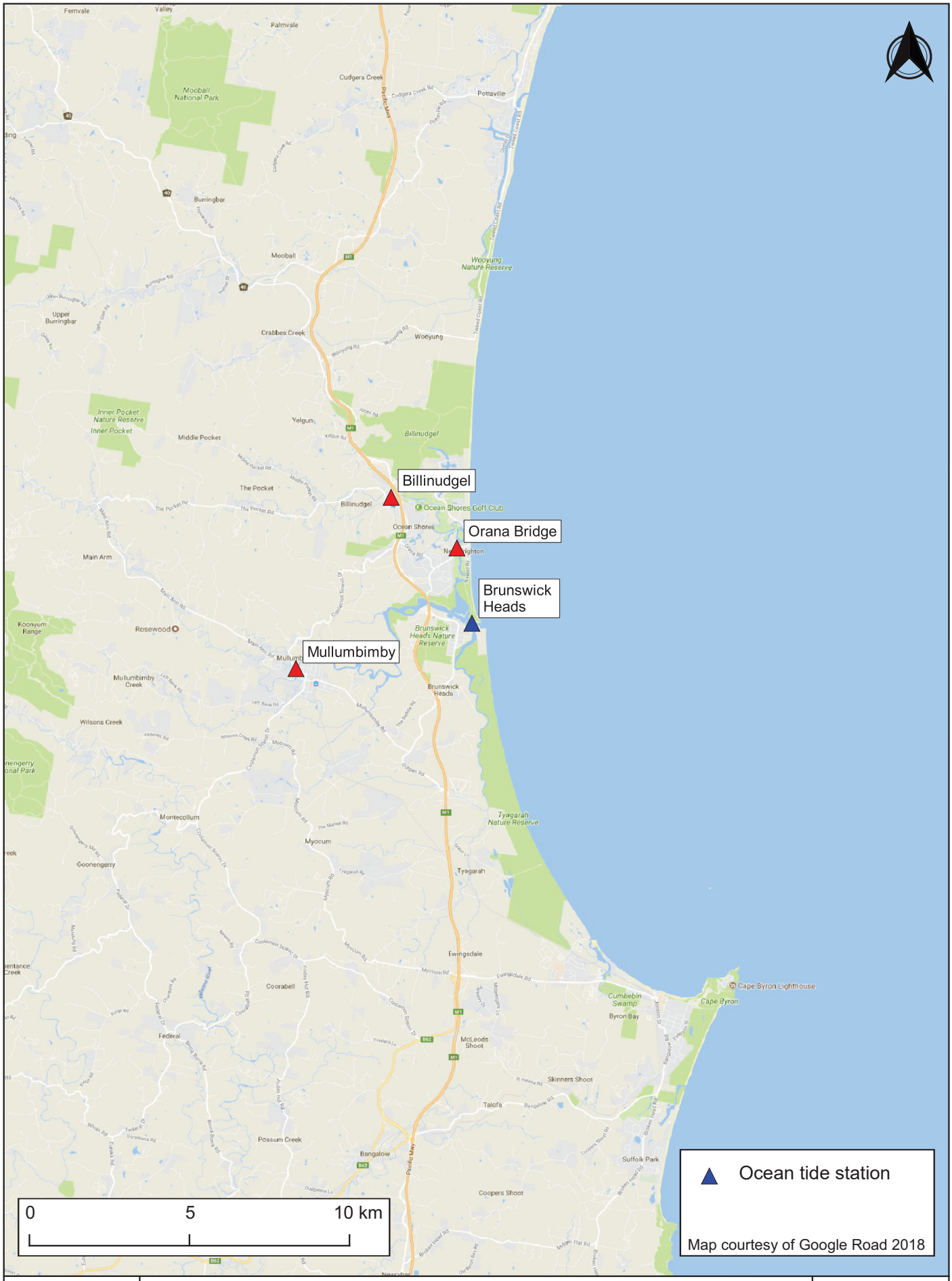


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cudgen Creek at Kingscliff

MHL2786

Figure
A36



NSW GOVERNMENT

STATION LOCATIONS
BRUNSWICK RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A37

DRAWING A37.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Marshalls Creek at Orana Bridge

RECORDING STATION:	**Marshalls Creek at Orana Bridge**	ZONE:	56
DATUM:	AUSTRALIAN HEIGHT DATUM	EASTING:	553611
AWRC #:	202475	NORTHING:	6845534

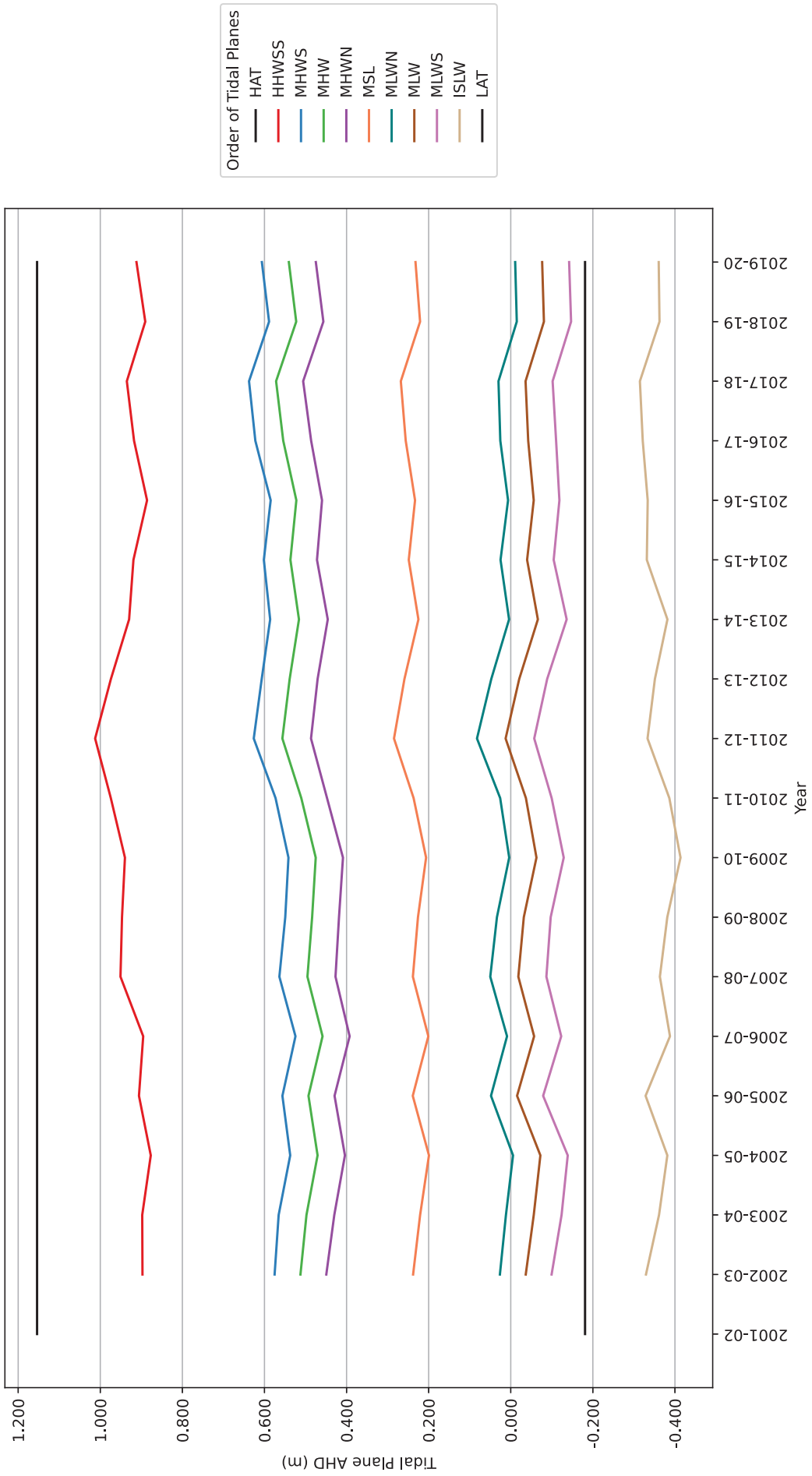
YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.897	0.898	0.877	0.906	0.895	0.951	0.947	0.940	0.974	1.013	0.974	0.930	0.919	0.886	0.918	0.935	0.890	0.912	0.926	0.036
MHWS		0.575	0.565	0.537	0.556	0.524	0.564	0.549	0.542	0.573	0.626	0.607	0.586	0.602	0.585	0.622	0.638	0.589	0.606	0.580	0.032
MHW		0.512	0.498	0.471	0.493	0.458	0.495	0.484	0.475	0.510	0.556	0.539	0.516	0.537	0.522	0.554	0.572	0.523	0.541	0.514	0.032
MHWN		0.449	0.430	0.404	0.429	0.393	0.427	0.418	0.409	0.448	0.487	0.471	0.446	0.472	0.460	0.486	0.506	0.457	0.475	0.448	0.032
MSL		0.238	0.221	0.199	0.239	0.201	0.238	0.226	0.206	0.237	0.284	0.259	0.225	0.248	0.233	0.256	0.268	0.221	0.232	0.235	0.023
MLWN		0.026	0.012	-0.006	0.048	0.009	0.050	0.034	0.004	0.026	0.082	0.047	0.004	0.025	0.007	0.025	0.030	-0.015	-0.011	0.022	0.025
MLW		-0.037	-0.056	-0.072	-0.015	-0.057	-0.018	-0.032	-0.063	-0.037	0.013	-0.021	-0.066	-0.040	-0.056	-0.043	-0.036	-0.081	-0.076	-0.044	0.024
MLWS		-0.100	-0.124	-0.139	-0.079	-0.123	-0.087	-0.097	-0.129	-0.100	-0.057	-0.089	-0.136	-0.105	-0.119	-0.110	-0.102	-0.147	-0.142	-0.110	0.024
ISLW		-0.329	-0.361	-0.381	-0.329	-0.388	-0.363	-0.381	-0.414	-0.386	-0.333	-0.351	-0.382	-0.331	-0.334	-0.322	-0.315	-0.362	-0.360	-0.357	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.423	0.418	0.410	0.381	0.383	0.377	0.385	0.405	0.422	0.404	0.423	0.442	0.447	0.453	0.461	0.476	0.471	0.486	0.426	0.034
MR		0.549	0.554	0.543	0.508	0.515	0.514	0.516	0.538	0.547	0.544	0.559	0.582	0.577	0.578	0.597	0.608	0.603	0.617	0.558	0.034
MSR		0.675	0.689	0.676	0.635	0.647	0.650	0.647	0.671	0.673	0.683	0.695	0.722	0.706	0.703	0.733	0.740	0.736	0.749	0.691	0.035
R		1.227	1.259	1.258	1.234	1.283	1.314	1.328	1.354	1.361	1.346	1.325	1.311	1.251	1.220	1.239	1.250	1.253	1.272	1.283	0.046
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.274	0.277	0.271	0.254	0.258	0.257	0.258	0.269	0.274	0.272	0.280	0.291	0.288	0.289	0.298	0.304	0.302	0.309	0.279	0.017
S2		0.063	0.068	0.067	0.064	0.066	0.068	0.065	0.066	0.063	0.070	0.068	0.070	0.065	0.063	0.068	0.066	0.066	0.066	0.066	0.002
K1		0.130	0.133	0.135	0.138	0.144	0.148	0.151	0.149	0.153	0.148	0.142	0.135	0.126	0.121	0.120	0.122	0.122	0.124	0.136	0.011
O1		0.100	0.104	0.108	0.112	0.121	0.129	0.133	0.136	0.133	0.128	0.120	0.110	0.101	0.094	0.092	0.091	0.093	0.094	0.111	0.016
MSF		0.069	0.072	0.074	0.055	0.056	0.078	0.053	0.071	0.076	0.073	0.058	0.073	0.061	0.064	0.063	0.058	0.069	0.067	0.066	0.008
z0		0.238	0.221	0.199	0.239	0.201	0.238	0.226	0.206	0.237	0.284	0.259	0.225	0.248	0.233	0.256	0.268	0.221	0.232	0.235	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		19.890	20.493	20.688	17.431	18.362	17.701	16.754	14.842	14.307	15.053	13.369	12.363	12.974	14.427	13.595	15.547	16.161	15.871	16.102	2.557
S2		291.091	289.452	288.383	288.314	284.041	286.263	287.518	288.340	291.238	289.281	287.417	285.988	291.776	292.495	289.189	293.489	291.041	290.715	289.224	2.463
K1		178.289	181.454	180.469	175.678	176.753	175.873	171.660	166.681	163.284	162.161	159.459	157.152	160.181	162.026	164.623	168.725	172.512	174.813	169.544	7.801
O1		232.874	232.505	232.219	230.385	231.108	232.757	236.239	239.752	245.575	250.790	253.621	254.150	252.039	250.261	244.440	241.316	238.042	234.522	240.700	8.526
MSF		273.683	283.525	276.628	271.849	268.823	275.605	263.232	278.032	264.111	270.877	276.426	271.357	283.840	281.011	277.123	274.070	273.877	276.804	274.493	5.655
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.098	0.063	0.069	0.083	0.078	0.066	0.088	0.083	0.082	0.061	0.089	0.073	0.085	0.066	0.073	0.070	0.078	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		58.6	97.9	96.0	89.8	98.5	92.7	87.9	98.8	91.8	88.4	90.3	97.8	92.8	97.7	93.8	93.7	98.3	95.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.15	04/06/2004 22:00	±0.17	5.9
Lowest Astronomical Tide (LAT)	-0.18	31/08/2005 12:45		

COMMENTS

*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Marshalls Creek at Orana Bridge

MHL2786

Figure
A38

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Marshalls Creek at Billinudgel

RECORDING STATION: **Marshalls Creek at Billinudgel**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 202400

ZONE: 56
EASTING: 551554
NORTHING: 6847116

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.615	0.573	0.584	0.575	0.650	0.606	0.696	0.678	0.679	0.738	0.748	0.706	0.664	0.685	0.656	0.663	0.705	0.647	0.658	0.659	0.051
MHWS	0.416	0.381	0.382	0.369	0.427	0.372	0.435	0.421	0.414	0.477	0.488	0.465	0.440	0.473	0.456	0.462	0.496	0.440	0.448	0.435	0.039
MHW	0.388	0.356	0.356	0.342	0.403	0.347	0.405	0.394	0.386	0.450	0.458	0.437	0.409	0.444	0.426	0.431	0.465	0.408	0.418	0.407	0.037
MHWN	0.360	0.331	0.330	0.315	0.380	0.321	0.375	0.368	0.358	0.423	0.428	0.409	0.379	0.415	0.397	0.400	0.434	0.376	0.387	0.378	0.036
MSL	0.282	0.261	0.261	0.249	0.309	0.250	0.302	0.294	0.283	0.343	0.349	0.328	0.293	0.325	0.308	0.307	0.332	0.280	0.291	0.297	0.030
MLWN	0.203	0.190	0.192	0.183	0.238	0.178	0.230	0.220	0.209	0.263	0.269	0.246	0.207	0.235	0.219	0.213	0.230	0.183	0.195	0.216	0.027
MLW	0.175	0.165	0.166	0.156	0.215	0.152	0.200	0.193	0.181	0.236	0.239	0.219	0.177	0.206	0.190	0.182	0.199	0.151	0.164	0.188	0.027
MLWS	0.147	0.140	0.139	0.129	0.191	0.127	0.170	0.167	0.153	0.209	0.209	0.191	0.147	0.178	0.160	0.151	0.167	0.119	0.134	0.159	0.027
ISLW	0.005	0.003	-0.004	-0.018	0.032	-0.040	-0.017	-0.017	-0.037	0.022	0.024	0.019	-0.013	0.026	0.017	0.008	0.018	-0.029	-0.016	-0.001	0.022
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.157	0.141	0.138	0.132	0.141	0.144	0.145	0.148	0.149	0.160	0.158	0.163	0.172	0.180	0.178	0.187	0.204	0.193	0.192	0.162	0.021
MR	0.213	0.191	0.191	0.186	0.188	0.194	0.205	0.201	0.205	0.214	0.219	0.218	0.232	0.238	0.236	0.249	0.266	0.257	0.253	0.219	0.025
MSR	0.270	0.241	0.243	0.239	0.236	0.245	0.266	0.255	0.261	0.268	0.279	0.274	0.293	0.295	0.295	0.312	0.329	0.321	0.314	0.275	0.030
R	0.610	0.569	0.588	0.593	0.619	0.647	0.713	0.696	0.716	0.715	0.724	0.687	0.677	0.658	0.639	0.655	0.687	0.676	0.674	0.660	0.047
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.107	0.095	0.095	0.093	0.094	0.097	0.103	0.101	0.103	0.107	0.109	0.109	0.116	0.119	0.118	0.125	0.133	0.129	0.127	0.109	0.013
S2	0.028	0.025	0.026	0.027	0.024	0.025	0.030	0.027	0.028	0.027	0.030	0.028	0.030	0.029	0.029	0.031	0.031	0.032	0.030	0.028	0.002
K1	0.076	0.074	0.076	0.078	0.084	0.087	0.096	0.096	0.096	0.095	0.095	0.089	0.084	0.080	0.077	0.078	0.081	0.080	0.081	0.084	0.008
O1	0.066	0.063	0.067	0.069	0.075	0.081	0.091	0.088	0.094	0.091	0.091	0.083	0.076	0.071	0.066	0.065	0.068	0.068	0.069	0.076	0.011
MSF	0.071	0.070	0.073	0.076	0.063	0.057	0.076	0.062	0.070	0.083	0.077	0.063	0.078	0.057	0.062	0.074	0.067	0.074	0.070	0.070	0.007
z0	0.282	0.261	0.261	0.249	0.309	0.250	0.302	0.294	0.283	0.343	0.349	0.328	0.293	0.325	0.308	0.307	0.332	0.280	0.291	0.297	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	93.336	96.531	94.506	97.417	94.267	92.803	84.675	82.799	80.635	80.250	80.187	77.763	77.128	77.129	81.079	76.464	77.172	79.621	80.600	84.440	7.571
S2	7.330	9.390	8.620	6.671	5.339	3.280	355.699	357.156	355.398	355.020	355.990	357.015	353.247	0.074	2.461	353.223	356.184	356.891	357.421	208.232	177.734
K1	227.251	231.192	230.236	231.172	226.684	225.059	218.639	215.962	209.988	206.253	203.752	201.388	198.780	202.204	206.254	207.491	210.711	214.953	218.875	215.097	10.965
O1	279.595	278.523	278.288	278.421	277.223	277.047	273.189	277.602	279.625	286.091	287.892	291.473	291.656	289.788	290.326	283.134	278.493	275.659	274.470	281.500	6.076
MSF	282.689	291.289	291.190	280.553	270.989	273.551	283.790	270.850	277.868	276.519	276.521	270.081	277.782	284.163	285.567	272.398	275.625	275.622	280.942	278.842	6.381
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.071	0.102	0.059	0.065	0.080	0.076	0.070	0.097	0.093	0.082	0.088	0.104	0.069	0.092	0.062	0.076	0.073	0.073	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.4	93.9	98.4	94.8	91.0	96.6	88.2	84.8	97.2	82.7	87.2	85.2	97.2	89.4	96.2	92.4	93.7	98.0	95.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.86	05/06/2004 00:15	±0.16	21.0
Lowest Astronomical Tide (LAT)	0.00	07/10/2004 11:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A39

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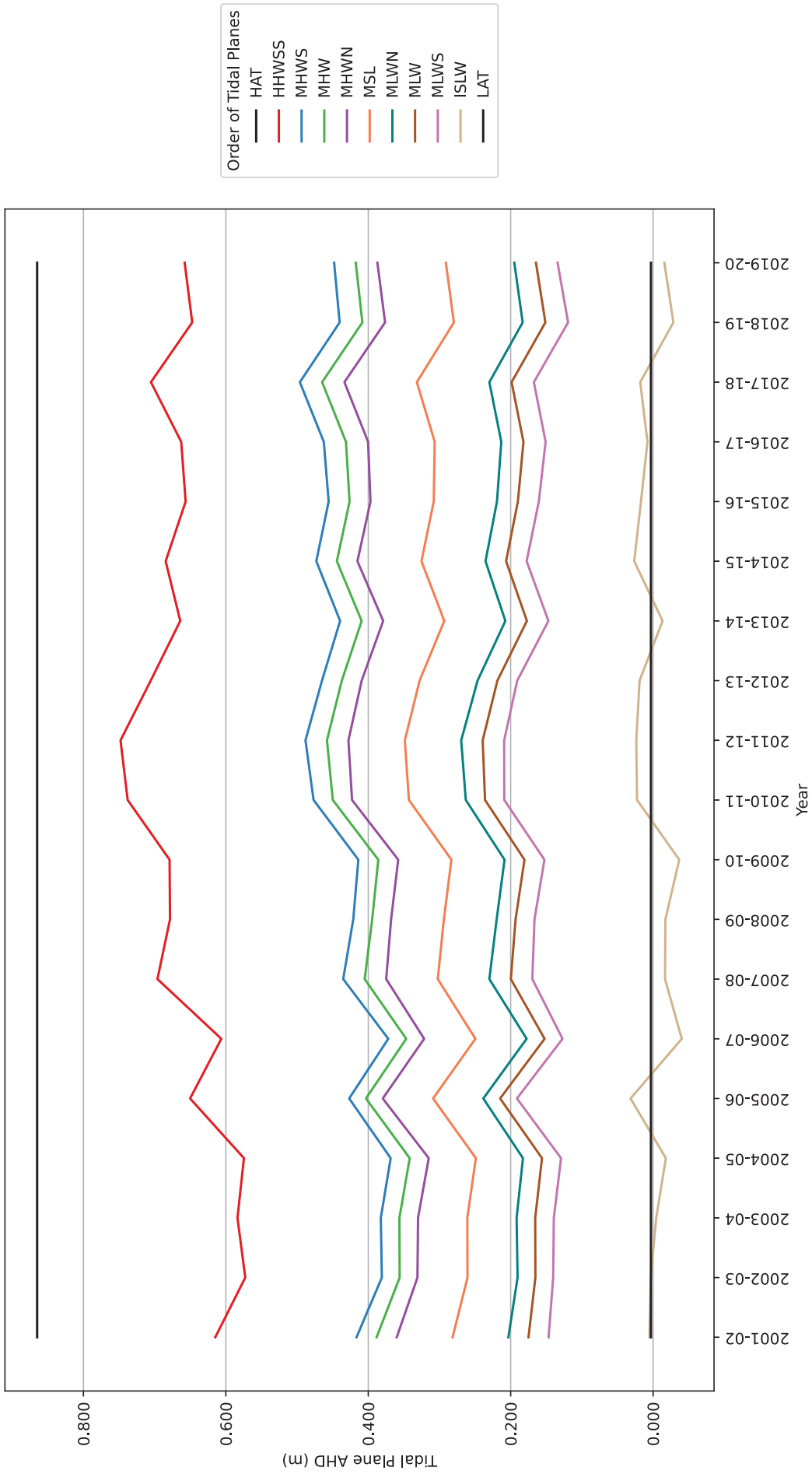


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Marshalls Creek at Billinudgel

MHL2786

Figure A39

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Brunswick River at Mullumbimby

RECORDING STATION: **Brunswick River at Mullumbimby**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 202402

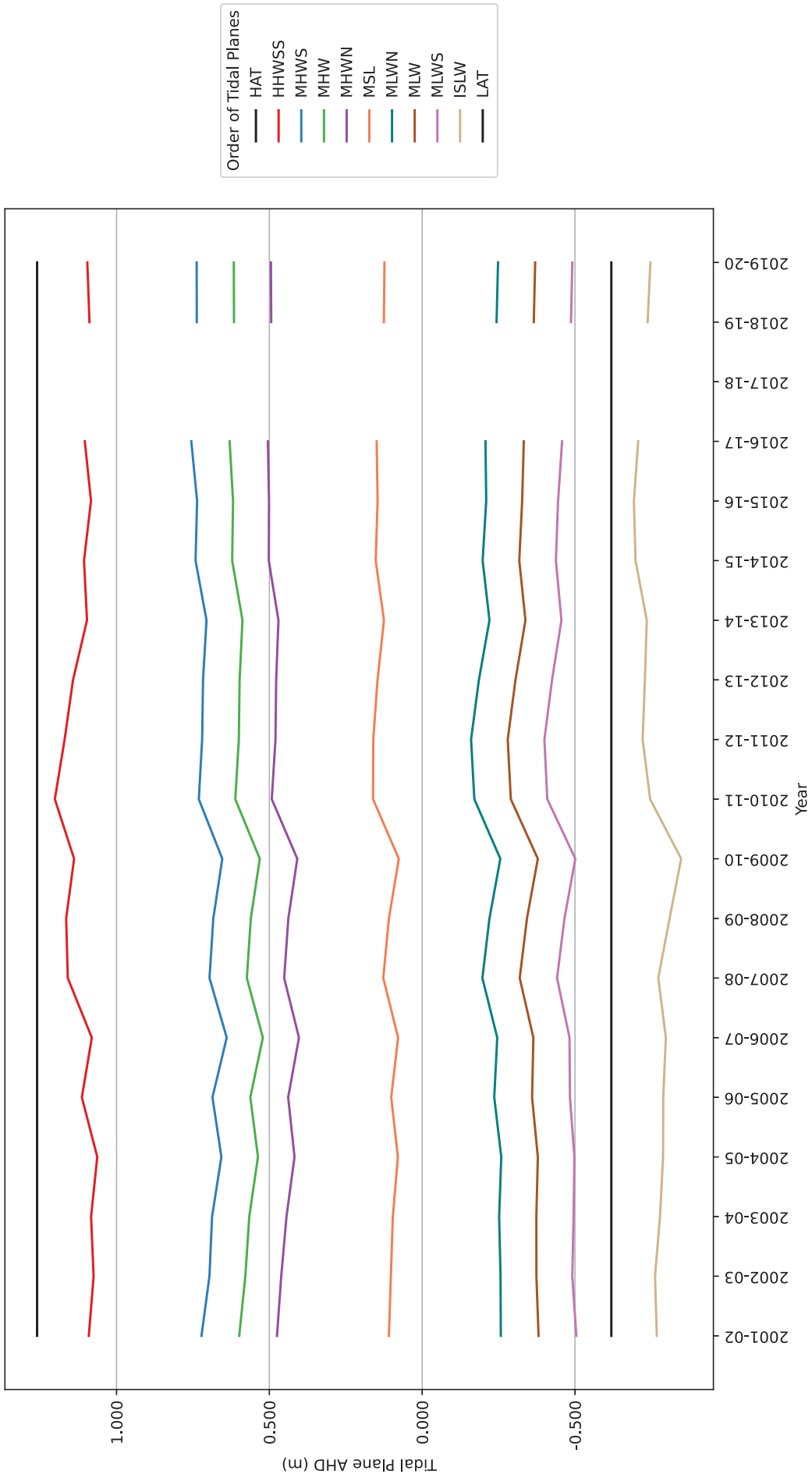
ZONE: 56
EASTING: 548580
NORTHING: 6841766

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.091	1.075	1.083	1.063	1.114	1.081	1.160	1.165	1.139	1.202	1.170	1.142	1.097	1.106	1.084	1.104		1.089	1.096	1.114	0.039
MHWS	0.722	0.696	0.687	0.657	0.686	0.640	0.696	0.683	0.654	0.731	0.720	0.717	0.706	0.742	0.736	0.755		0.738	0.738	0.706	0.033
MHW	0.599	0.579	0.566	0.537	0.562	0.521	0.574	0.561	0.531	0.612	0.600	0.597	0.588	0.622	0.619	0.630		0.616	0.616	0.585	0.033
MHWN	0.475	0.461	0.444	0.418	0.438	0.403	0.452	0.438	0.409	0.492	0.480	0.478	0.470	0.502	0.501	0.505		0.494	0.495	0.464	0.033
MSL	0.109	0.102	0.096	0.079	0.101	0.079	0.127	0.109	0.076	0.161	0.160	0.146	0.125	0.152	0.146	0.149		0.125	0.123	0.120	0.028
MLWN	-0.257	-0.256	-0.252	-0.259	-0.236	-0.246	-0.197	-0.220	-0.256	-0.171	-0.160	-0.186	-0.220	-0.198	-0.210	-0.207		-0.243	-0.248	-0.223	0.032
MLW	-0.381	-0.374	-0.374	-0.379	-0.360	-0.364	-0.319	-0.343	-0.378	-0.290	-0.280	-0.305	-0.338	-0.318	-0.327	-0.333		-0.365	-0.370	-0.344	0.032
MLWS	-0.504	-0.491	-0.495	-0.498	-0.484	-0.482	-0.441	-0.466	-0.501	-0.409	-0.400	-0.425	-0.456	-0.438	-0.445	-0.458		-0.487	-0.491	-0.465	0.033
ISLW	-0.768	-0.762	-0.778	-0.788	-0.789	-0.797	-0.773	-0.810	-0.848	-0.746	-0.721	-0.729	-0.735	-0.698	-0.693	-0.707		-0.738	-0.747	-0.757	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.732	0.718	0.696	0.677	0.674	0.649	0.649	0.658	0.664	0.663	0.640	0.663	0.690	0.700	0.711	0.712		0.737	0.743	0.688	0.033
MR	0.979	0.952	0.939	0.916	0.922	0.885	0.893	0.904	0.910	0.902	0.880	0.903	0.926	0.939	0.946	0.963		0.981	0.986	0.929	0.033
MSR	1.227	1.187	1.183	1.155	1.170	1.122	1.137	1.149	1.155	1.140	1.120	1.142	1.161	1.179	1.181	1.213		1.224	1.229	1.171	0.035
R	1.859	1.837	1.862	1.851	1.902	1.878	1.932	1.975	1.986	1.948	1.891	1.871	1.832	1.805	1.776	1.811		1.826	1.843	1.871	0.059
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.490	0.476	0.470	0.458	0.461	0.443	0.446	0.452	0.455	0.451	0.440	0.451	0.463	0.470	0.473	0.481		0.490	0.493	0.465	0.017
S2	0.124	0.117	0.122	0.120	0.124	0.118	0.122	0.123	0.123	0.119	0.120	0.120	0.118	0.120	0.118	0.125		0.122	0.121	0.121	0.002
K1	0.164	0.168	0.175	0.177	0.186	0.189	0.197	0.205	0.206	0.200	0.191	0.186	0.172	0.164	0.157	0.160		0.157	0.160	0.179	0.017
O1	0.100	0.103	0.108	0.114	0.119	0.127	0.134	0.139	0.141	0.137	0.130	0.118	0.107	0.097	0.091	0.089		0.094	0.095	0.113	0.018
MSF	0.036	0.031	0.029	0.033	0.007	0.018	0.038	0.022	0.028	0.035	0.037	0.017	0.034	0.020	0.025	0.027		0.026	0.027	0.027	0.008
z0	0.109	0.102	0.096	0.079	0.101	0.079	0.127	0.109	0.076	0.161	0.160	0.146	0.125	0.152	0.146	0.149		0.125	0.123	0.120	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	18.882	21.101	20.997	21.391	19.047	20.419	18.532	17.019	16.003	14.766	15.547	15.027	15.807	14.728	15.342	16.021		18.048	17.846	17.585	2.324
S2	298.246	298.848	299.642	300.186	297.759	299.332	297.721	297.432	298.257	297.776	297.751	298.441	300.614	299.132	299.326	298.680		298.914	298.096	298.675	0.902
K1	171.065	172.989	174.071	172.740	170.257	170.950	168.255	164.295	161.191	157.223	155.679	153.389	153.160	153.358	156.335	160.686		167.007	169.680	164.018	7.638
O1	227.228	225.712	225.213	223.900	224.113	224.905	227.371	230.802	235.592	240.938	246.302	249.788	251.028	247.642	244.362	237.122		231.803	228.573	234.577	9.705
MSF	287.667	287.724	294.549	276.851	270.464	233.610	271.416	245.130	269.410	256.483	259.211	283.699	269.063	309.000	295.304	276.599		278.829	281.953	274.831	18.334
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.110	0.068	0.077	0.090	0.089	0.068	0.098	0.104	0.079	0.065	0.095	0.077	0.088	0.071	0.067		0.086	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.7	92.2	97.1	95.5	95.1	98.7	92.2	86.5	94.2	82.1	88.0	87.8	97.2	85.8	94.8	65.2	46.2	96.3	95.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.26	04/06/2004 22:15	±0.18	5.8
Lowest Astronomical Tide (LAT)	-0.62	28/10/2015 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

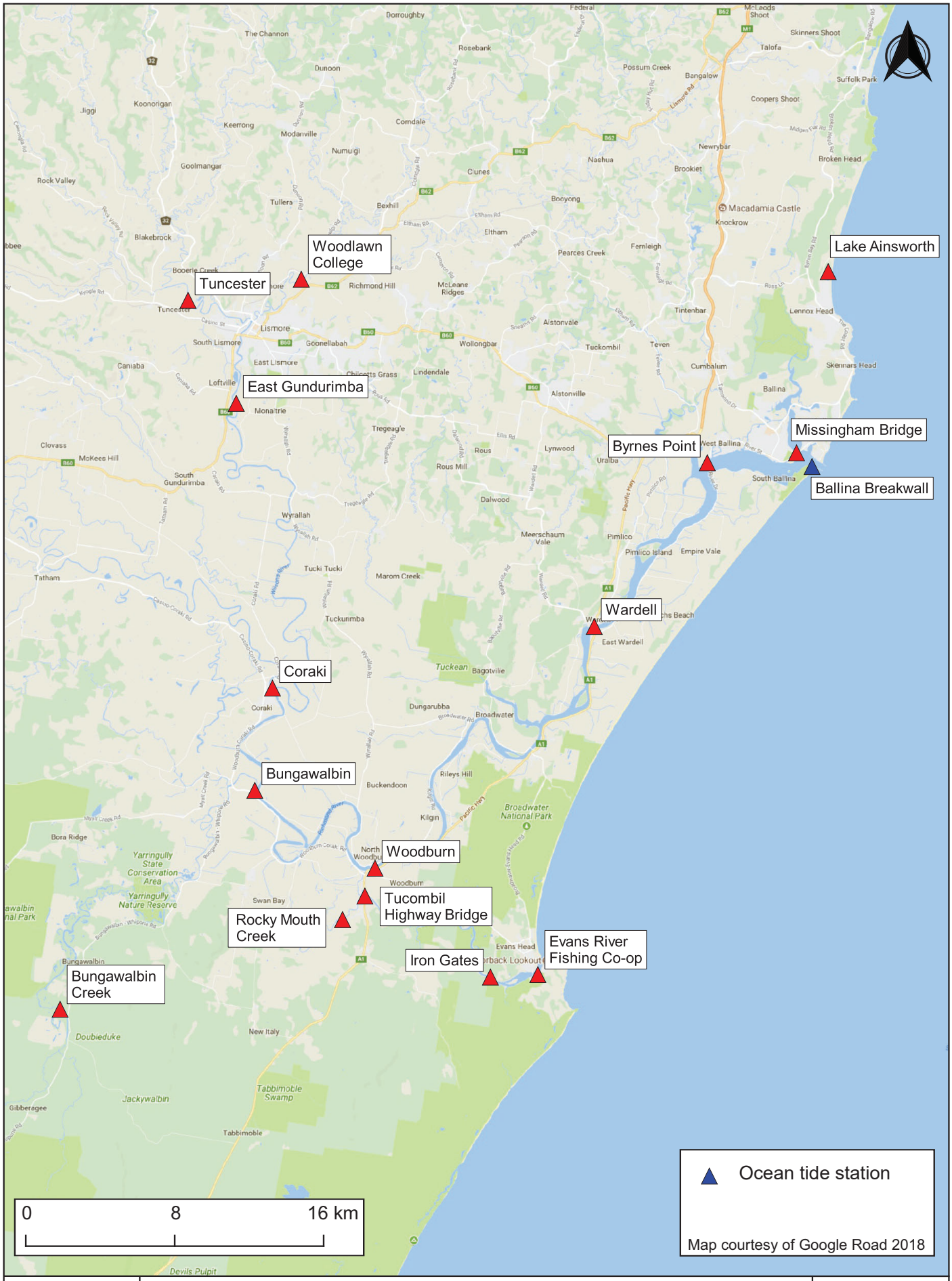


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Brunswick River at Mullumbimby

MHL2786

Figure
A40



NSW GOVERNMENT

STATION LOCATIONS
RICHMOND RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A41

DRAWING A41.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Richmond River at Missingham Bridge

RECORDING STATION: **Richmond River at Missingham Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203465

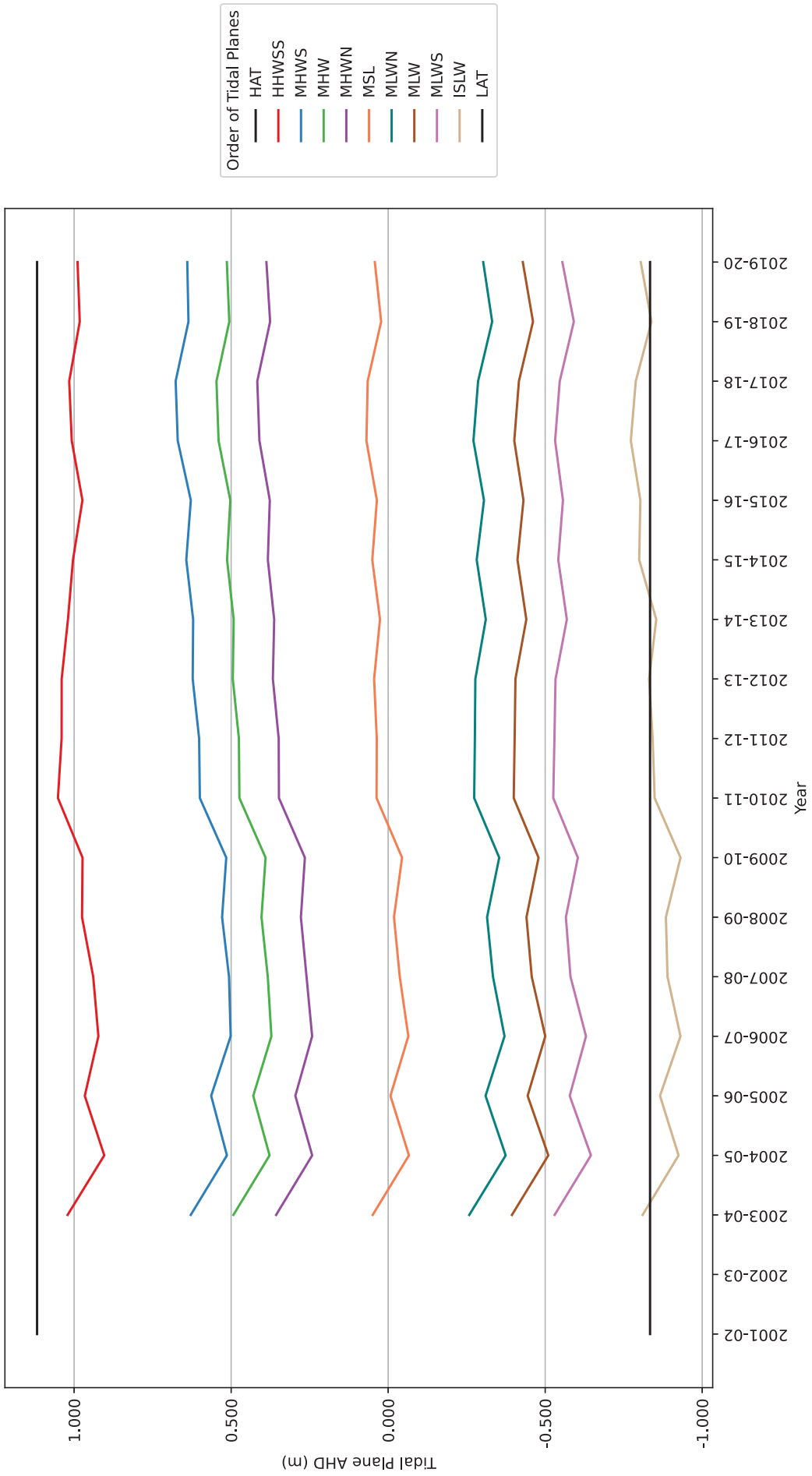
ZONE: 56
EASTING: 556161
NORTHING: 6806420

YEAR	2001-02*	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			1.021	0.904	0.966	0.923	0.939	0.975	0.973	1.052	1.040	1.040	1.020	1.004	0.974	1.008	1.016	0.982	0.989	0.990	0.042
MHWS			0.629	0.513	0.564	0.502	0.507	0.529	0.516	0.600	0.602	0.622	0.621	0.643	0.628	0.670	0.677	0.636	0.640	0.594	0.060
MHW			0.493	0.378	0.430	0.372	0.383	0.403	0.390	0.474	0.475	0.495	0.492	0.513	0.503	0.540	0.547	0.506	0.514	0.465	0.059
MHWN			0.357	0.242	0.296	0.242	0.260	0.278	0.265	0.348	0.349	0.367	0.363	0.383	0.377	0.410	0.417	0.376	0.388	0.336	0.059
MSL			0.049	-0.066	-0.007	-0.064	-0.037	-0.019	-0.044	0.037	0.036	0.045	0.026	0.051	0.036	0.069	0.065	0.022	0.042	0.014	0.045
MLWN			-0.258	-0.374	-0.310	-0.371	-0.334	-0.315	-0.354	-0.274	-0.276	-0.278	-0.311	-0.282	-0.305	-0.272	-0.286	-0.331	-0.303	-0.308	0.035
MLW			-0.394	-0.510	-0.444	-0.500	-0.457	-0.440	-0.479	-0.400	-0.403	-0.405	-0.440	-0.412	-0.431	-0.402	-0.416	-0.461	-0.429	-0.437	0.035
MLWS			-0.530	-0.646	-0.578	-0.630	-0.581	-0.566	-0.604	-0.526	-0.529	-0.533	-0.569	-0.542	-0.557	-0.532	-0.546	-0.591	-0.555	-0.566	0.036
ISLW			-0.810	-0.925	-0.866	-0.931	-0.890	-0.885	-0.931	-0.849	-0.842	-0.831	-0.854	-0.799	-0.803	-0.773	-0.788	-0.839	-0.804	-0.848	0.050
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.615	0.616	0.606	0.613	0.594	0.593	0.619	0.622	0.625	0.645	0.674	0.665	0.682	0.682	0.703	0.707	0.690	0.644	0.039
MR			0.887	0.888	0.874	0.872	0.841	0.844	0.869	0.874	0.878	0.900	0.932	0.925	0.934	0.942	0.963	0.967	0.942	0.902	0.040
MSR			1.159	1.159	1.142	1.132	1.087	1.095	1.120	1.125	1.131	1.155	1.190	1.185	1.185	1.202	1.223	1.227	1.194	1.159	0.042
R			1.831	1.829	1.832	1.854	1.829	1.859	1.904	1.900	1.882	1.871	1.873	1.803	1.777	1.780	1.804	1.821	1.793	1.838	0.040
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.443	0.444	0.437	0.436	0.420	0.422	0.435	0.437	0.439	0.450	0.466	0.462	0.467	0.471	0.482	0.484	0.471	0.451	0.020
S2			0.136	0.136	0.134	0.130	0.123	0.125	0.125	0.126	0.127	0.128	0.129	0.130	0.126	0.130	0.130	0.130	0.126	0.129	0.004
K1			0.180	0.173	0.176	0.181	0.189	0.192	0.197	0.198	0.190	0.186	0.179	0.162	0.159	0.155	0.155	0.157	0.157	0.176	0.015
O1			0.100	0.106	0.112	0.120	0.119	0.127	0.130	0.125	0.122	0.112	0.106	0.095	0.087	0.086	0.087	0.090	0.092	0.107	0.015
MSF			0.010	0.011	0.014	0.019	0.021	0.017	0.010	0.011	0.014	0.010	0.008	0.018	0.012	0.010	0.010	0.015	0.011	0.013	0.004
z0			0.049	-0.066	-0.007	-0.064	-0.037	-0.019	-0.044	0.037	0.036	0.045	0.026	0.051	0.036	0.069	0.065	0.022	0.042	0.014	0.045
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			356.728	357.154	357.595	356.630	356.299	354.768	354.228	354.752	353.909	352.650	351.579	351.499	352.423	352.813	352.750	353.530	354.865	354.363	1.966
S2			266.431	263.413	263.163	264.223	266.889	266.815	266.124	268.056	267.254	265.999	264.730	264.509	264.110	264.085	264.561	263.395	264.653	265.201	1.505
K1			150.554	152.378	152.379	150.969	149.503	144.910	141.972	139.158	135.918	133.550	132.823	133.109	135.899	139.214	141.871	145.358	148.885	142.850	7.093
O1			210.819	210.136	211.778	210.675	214.472	216.816	222.542	225.334	232.277	234.159	234.460	233.416	229.467	223.594	218.553	215.412	215.261	221.128	8.939
MSF			337.429	291.239	52.400	112.084	285.499	104.366	294.600	228.229	268.578	342.181	262.091	13.384	349.690	325.222	357.844	293.476	286.765	247.358	108.302
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.074	0.094	0.091	0.111	0.077	0.104	0.112	0.094	0.072	0.100	0.084	0.097	0.078	0.084	0.079	0.091	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
			50.2	95.6	85.2	91.8	94.2	90.5	96.7	83.4	89.1	83.5	94.3	83.1	95.2	88.8	88.5	95.9	93.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 21:30	±0.20	3.7
Lowest Astronomical Tide (LAT)	-0.83	27/10/2011 02:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2003.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Missingham Bridge

MHL2786

Figure A42

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Byrnes Point

RECORDING STATION: **Richmond River at Byrnes Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203461

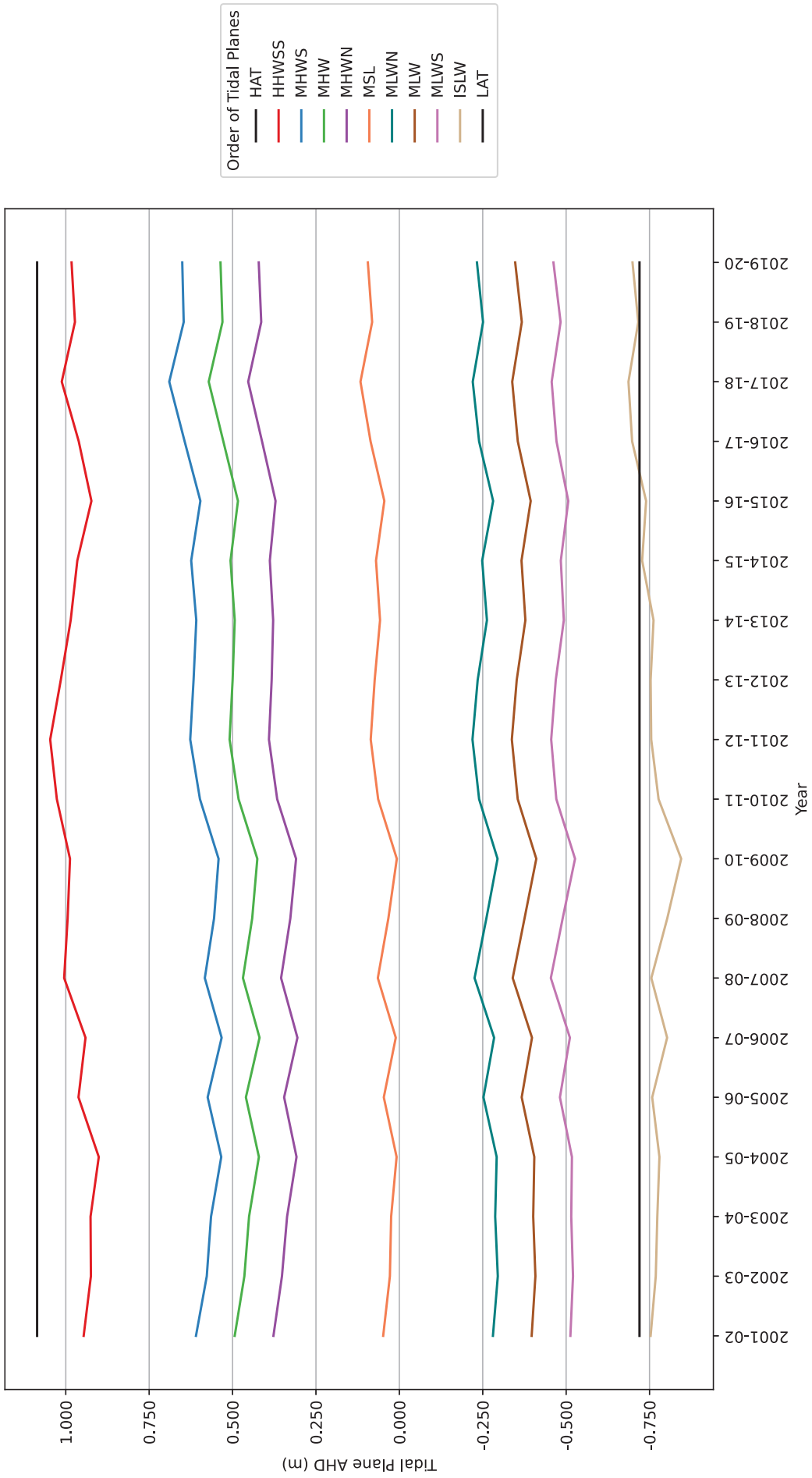
ZONE: 56
EASTING: 551362
NORTHING: 6805886

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.946	0.925	0.926	0.901	0.962	0.941	1.005	0.995	0.987	1.027	1.047	1.015	0.985	0.965	0.923	0.961	1.012	0.973	0.983	0.973	0.039
MHWS	0.610	0.577	0.565	0.534	0.575	0.533	0.583	0.556	0.542	0.598	0.627	0.617	0.609	0.624	0.596	0.644	0.690	0.646	0.651	0.599	0.043
MHW	0.494	0.465	0.451	0.421	0.460	0.419	0.469	0.441	0.426	0.482	0.509	0.500	0.494	0.506	0.484	0.528	0.571	0.530	0.536	0.483	0.042
MHWN	0.377	0.352	0.337	0.308	0.345	0.306	0.355	0.327	0.310	0.366	0.391	0.383	0.378	0.388	0.371	0.412	0.453	0.414	0.422	0.368	0.041
MSL	0.048	0.028	0.025	0.008	0.047	0.011	0.064	0.033	0.008	0.064	0.086	0.074	0.058	0.070	0.045	0.086	0.117	0.082	0.094	0.055	0.031
MLWN	-0.281	-0.295	-0.287	-0.292	-0.252	-0.284	-0.226	-0.261	-0.294	-0.239	-0.219	-0.235	-0.263	-0.248	-0.281	-0.239	-0.220	-0.251	-0.233	-0.258	0.026
MLW	-0.397	-0.408	-0.401	-0.405	-0.367	-0.398	-0.340	-0.375	-0.411	-0.355	-0.337	-0.352	-0.378	-0.366	-0.394	-0.355	-0.338	-0.367	-0.347	-0.373	0.025
MLWS	-0.513	-0.521	-0.515	-0.517	-0.481	-0.511	-0.454	-0.490	-0.527	-0.471	-0.455	-0.469	-0.493	-0.484	-0.506	-0.471	-0.457	-0.483	-0.462	-0.488	0.024
ISLW	-0.753	-0.769	-0.773	-0.780	-0.758	-0.803	-0.755	-0.803	-0.845	-0.777	-0.755	-0.753	-0.762	-0.728	-0.740	-0.698	-0.687	-0.716	-0.699	-0.756	0.039
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.658	0.647	0.624	0.600	0.598	0.590	0.580	0.588	0.604	0.605	0.610	0.618	0.641	0.637	0.652	0.651	0.673	0.665	0.654	0.626	0.029
MR	0.890	0.873	0.852	0.826	0.827	0.817	0.809	0.816	0.836	0.837	0.846	0.852	0.871	0.872	0.878	0.883	0.910	0.897	0.883	0.857	0.030
MSR	1.123	1.098	1.080	1.051	1.056	1.044	1.037	1.045	1.069	1.068	1.082	1.086	1.102	1.108	1.103	1.115	1.147	1.130	1.113	1.087	0.032
R	1.700	1.693	1.699	1.681	1.720	1.744	1.760	1.798	1.832	1.804	1.802	1.768	1.747	1.693	1.663	1.659	1.699	1.689	1.682	1.728	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.445	0.436	0.426	0.413	0.413	0.408	0.404	0.408	0.418	0.418	0.423	0.426	0.436	0.436	0.439	0.441	0.455	0.449	0.442	0.428	0.015
S2	0.116	0.113	0.114	0.113	0.115	0.114	0.114	0.114	0.116	0.116	0.118	0.117	0.115	0.118	0.113	0.116	0.118	0.116	0.115	0.115	0.002
K1	0.151	0.156	0.161	0.162	0.169	0.177	0.181	0.188	0.191	0.186	0.181	0.175	0.168	0.153	0.149	0.144	0.146	0.147	0.149	0.165	0.016
O1	0.090	0.092	0.097	0.100	0.108	0.115	0.120	0.126	0.127	0.120	0.118	0.110	0.101	0.091	0.084	0.083	0.084	0.086	0.088	0.102	0.015
MSF	0.031	0.009	0.022	0.019	0.010	0.014	0.020	0.005	0.013	0.021	0.022	0.012	0.018	0.019	0.017	0.019	0.012	0.022	0.018	0.017	0.006
z0	0.048	0.028	0.025	0.008	0.047	0.011	0.064	0.033	0.008	0.064	0.086	0.074	0.058	0.070	0.045	0.086	0.117	0.082	0.094	0.055	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	4.261	5.853	6.149	6.958	7.021	6.353	5.624	4.367	2.901	1.407	1.531	0.810	0.120	1.110	2.192	2.688	2.340	3.419	4.205	3.648	2.207
S2	274.899	275.188	276.400	276.192	276.137	276.851	277.273	277.755	276.672	277.689	276.187	275.273	275.895	275.431	275.981	275.512	275.614	274.785	276.024	276.093	0.863
K1	157.995	159.859	160.679	160.764	159.299	159.309	156.789	152.811	149.018	145.491	142.564	139.798	139.738	140.425	143.507	147.047	149.523	153.451	156.406	151.288	7.704
O1	219.096	218.065	218.222	217.763	217.238	218.245	220.880	224.198	228.571	231.742	238.414	241.940	241.096	240.302	237.231	231.583	225.755	222.580	221.953	227.099	8.969
MSF	298.214	294.276	319.724	299.405	41.815	141.136	299.627	128.376	294.364	262.121	264.594	346.890	269.365	352.067	318.796	282.027	305.943	284.352	284.048	267.744	78.806
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.102	0.076	0.084	0.083	0.095	0.072	0.099	0.100	0.103	0.073	0.108	0.081	0.095	0.081	0.088	0.077	0.085	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.5	96.9	98.4	98.7	93.1	98.4	91.8	90.9	97.8	83.3	90.1	85.8	96.8	90.0	98.0	89.8	84.0	93.9	92.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.09	04/06/2004 22:00	±0.19	4.5
Lowest Astronomical Tide (LAT)	-0.72	27/10/2011 02:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Byrnes Point

MHL2786

Figure A43

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Wardell

RECORDING STATION: **Richmond River at Wardell**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203468

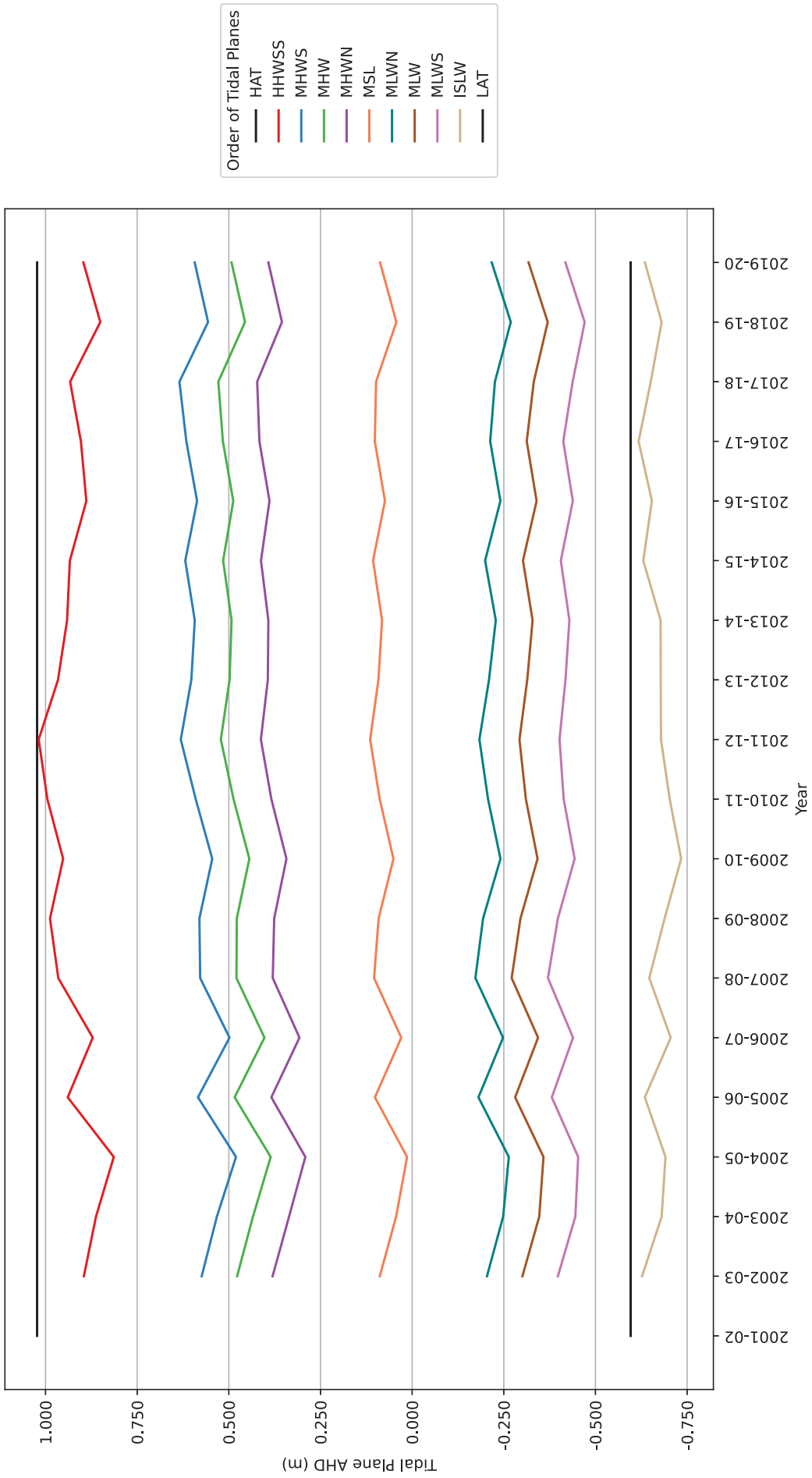
ZONE: 56
EASTING: 545282
NORTHING: 6797087

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.896	0.862	0.814	0.939	0.871	0.965	0.988	0.952	0.995	1.019	0.966	0.941	0.934	0.889	0.904	0.933	0.851	0.897	0.923	0.054
MHWS		0.574	0.533	0.480	0.584	0.498	0.578	0.580	0.545	0.590	0.631	0.602	0.593	0.619	0.587	0.616	0.635	0.557	0.593	0.578	0.042
MHW		0.477	0.434	0.386	0.484	0.403	0.479	0.478	0.444	0.487	0.522	0.498	0.493	0.516	0.488	0.516	0.529	0.456	0.493	0.477	0.039
MHWN		0.381	0.336	0.291	0.384	0.307	0.380	0.376	0.343	0.384	0.413	0.394	0.392	0.412	0.389	0.417	0.423	0.355	0.392	0.376	0.037
MSL		0.088	0.044	0.014	0.102	0.030	0.104	0.091	0.051	0.088	0.115	0.092	0.082	0.107	0.074	0.102	0.098	0.043	0.088	0.078	0.029
MLWN		-0.204	-0.248	-0.264	-0.181	-0.248	-0.172	-0.193	-0.241	-0.207	-0.183	-0.210	-0.228	-0.199	-0.241	-0.213	-0.226	-0.269	-0.217	-0.219	0.028
MLW		-0.301	-0.347	-0.358	-0.281	-0.343	-0.271	-0.295	-0.342	-0.310	-0.293	-0.314	-0.329	-0.302	-0.339	-0.313	-0.332	-0.370	-0.318	-0.320	0.027
MLWS		-0.398	-0.445	-0.453	-0.381	-0.439	-0.370	-0.397	-0.443	-0.413	-0.402	-0.418	-0.429	-0.406	-0.438	-0.412	-0.438	-0.471	-0.418	-0.421	0.026
ISLW		-0.627	-0.681	-0.691	-0.635	-0.705	-0.647	-0.689	-0.734	-0.702	-0.679	-0.678	-0.678	-0.630	-0.654	-0.618	-0.651	-0.681	-0.635	-0.667	0.032
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.585	0.584	0.555	0.565	0.555	0.553	0.570	0.584	0.591	0.596	0.603	0.620	0.611	0.630	0.629	0.648	0.624	0.609	0.595	0.029
MR		0.778	0.781	0.744	0.765	0.746	0.751	0.774	0.786	0.797	0.815	0.812	0.821	0.818	0.827	0.829	0.861	0.826	0.810	0.797	0.033
MSR		0.972	0.978	0.933	0.965	0.937	0.949	0.978	0.988	1.004	1.033	1.021	1.022	1.024	1.025	1.028	1.073	1.027	1.011	0.998	0.038
R		1.523	1.543	1.505	1.574	1.576	1.612	1.676	1.686	1.698	1.697	1.644	1.619	1.564	1.543	1.521	1.584	1.531	1.532	1.590	0.066
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.389	0.390	0.372	0.383	0.373	0.375	0.387	0.393	0.399	0.407	0.406	0.411	0.409	0.414	0.414	0.430	0.413	0.405	0.398	0.016
S2		0.097	0.098	0.095	0.100	0.095	0.099	0.102	0.101	0.103	0.109	0.104	0.100	0.103	0.099	0.100	0.106	0.101	0.101	0.101	0.004
K1		0.142	0.145	0.145	0.154	0.159	0.165	0.172	0.172	0.174	0.167	0.157	0.152	0.139	0.137	0.129	0.135	0.130	0.134	0.150	0.015
O1		0.088	0.091	0.094	0.100	0.108	0.111	0.119	0.118	0.116	0.109	0.103	0.096	0.086	0.079	0.077	0.078	0.080	0.083	0.096	0.015
MSF		0.008	0.026	0.022	0.008	0.010	0.028	0.010	0.022	0.033	0.034	0.016	0.026	0.016	0.021	0.034	0.017	0.024	0.029	0.021	0.009
z0		0.088	0.044	0.014	0.102	0.030	0.104	0.091	0.051	0.088	0.115	0.092	0.082	0.107	0.074	0.102	0.098	0.043	0.088	0.078	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		22.731	22.519	23.687	23.403	22.867	21.616	20.112	19.083	17.503	17.587	16.832	16.507	17.731	18.838	19.089	18.677	20.090	20.871	19.986	2.361
S2		293.585	293.035	292.801	293.357	293.031	292.758	294.047	292.773	291.485	292.068	290.779	291.725	292.512	292.665	292.363	293.025	292.961	293.283	292.681	0.784
K1		169.851	173.698	174.467	172.457	172.684	169.724	164.431	161.922	157.421	151.634	154.002	152.515	154.058	155.859	160.359	161.042	166.471	169.684	163.460	7.935
O1		230.557	230.100	230.946	229.553	230.486	232.584	236.060	240.351	243.446	249.951	253.397	253.432	250.475	248.705	243.555	237.103	233.994	231.447	239.230	8.796
MSF		256.176	303.168	289.684	333.345	171.417	293.063	228.994	284.751	274.800	258.880	309.625	277.544	324.676	304.869	289.152	305.287	292.144	300.088	283.204	37.330
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.102	0.073	0.082	0.083	0.099	0.069	0.100	0.101	0.108	0.091	0.117	0.083	0.091	0.082	0.079	0.081	0.092	0.079		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		59.1	96.2	98.6	87.3	98.4	85.7	82.7	97.1	80.2	75.5	85.7	96.7	83.4	94.9	85.2	95.0	99.4	165.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.02	04/06/2004 22:30	±0.20	12.8
Lowest Astronomical Tide (LAT)	-0.60	27/10/2015 03:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Wardell

MHL2786

Figure A44

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Woodburn

RECORDING STATION: **Richmond River at Woodburn**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203412

ZONE: 56
EASTING: 533281
NORTHING: 6784097

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.686	0.662	0.690	0.665	0.706	0.675	0.748	0.736	0.747	0.810	0.804	0.775	0.749	0.764	0.757	0.765	0.749	0.717	0.719	0.733	0.044
MHWS	0.438	0.404	0.418	0.386	0.421	0.372	0.433	0.417	0.422	0.498	0.500	0.492	0.482	0.512	0.513	0.533	0.524	0.484	0.481	0.460	0.050
MHW	0.379	0.348	0.358	0.326	0.364	0.313	0.374	0.359	0.364	0.439	0.442	0.434	0.424	0.449	0.450	0.471	0.466	0.423	0.422	0.400	0.049
MHWN	0.319	0.291	0.298	0.267	0.306	0.253	0.315	0.301	0.306	0.380	0.383	0.375	0.366	0.386	0.388	0.410	0.408	0.363	0.362	0.341	0.048
MSL	0.115	0.092	0.104	0.076	0.122	0.068	0.136	0.123	0.124	0.195	0.199	0.184	0.164	0.179	0.175	0.203	0.208	0.150	0.157	0.146	0.044
MLWN	-0.089	-0.107	-0.090	-0.116	-0.063	-0.118	-0.044	-0.055	-0.058	0.011	0.015	-0.007	-0.038	-0.028	-0.038	-0.004	0.008	-0.063	-0.049	-0.049	0.042
MLW	-0.148	-0.163	-0.150	-0.175	-0.120	-0.177	-0.102	-0.113	-0.117	-0.048	-0.044	-0.065	-0.096	-0.091	-0.101	-0.065	-0.050	-0.123	-0.108	-0.108	0.042
MLWS	-0.208	-0.220	-0.210	-0.235	-0.178	-0.237	-0.161	-0.171	-0.175	-0.108	-0.103	-0.123	-0.154	-0.154	-0.164	-0.127	-0.107	-0.183	-0.167	-0.168	0.042
ISLW	-0.385	-0.403	-0.405	-0.434	-0.381	-0.453	-0.386	-0.398	-0.407	-0.331	-0.320	-0.325	-0.344	-0.333	-0.338	-0.293	-0.268	-0.350	-0.338	-0.363	0.048
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.407	0.398	0.389	0.383	0.369	0.371	0.359	0.355	0.364	0.369	0.368	0.382	0.404	0.413	0.426	0.414	0.400	0.426	0.412	0.390	0.023
MR	0.527	0.511	0.509	0.502	0.484	0.490	0.477	0.472	0.480	0.488	0.486	0.498	0.520	0.540	0.551	0.537	0.515	0.546	0.530	0.508	0.025
MSR	0.647	0.624	0.629	0.621	0.599	0.609	0.594	0.588	0.597	0.606	0.603	0.615	0.636	0.666	0.677	0.659	0.631	0.667	0.648	0.627	0.027
R	1.071	1.065	1.095	1.100	1.087	1.128	1.135	1.134	1.155	1.141	1.124	1.100	1.094	1.097	1.096	1.058	1.017	1.066	1.057	1.096	0.035
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.264	0.255	0.254	0.251	0.242	0.245	0.238	0.236	0.240	0.244	0.243	0.249	0.260	0.270	0.276	0.268	0.258	0.273	0.265	0.254	0.012
S2	0.060	0.057	0.060	0.059	0.058	0.059	0.059	0.058	0.058	0.059	0.059	0.058	0.058	0.063	0.063	0.061	0.058	0.060	0.059	0.059	0.002
K1	0.105	0.110	0.116	0.118	0.118	0.125	0.129	0.130	0.132	0.128	0.124	0.116	0.112	0.107	0.106	0.102	0.097	0.100	0.102	0.115	0.011
O1	0.072	0.074	0.078	0.082	0.085	0.091	0.097	0.098	0.100	0.095	0.093	0.086	0.078	0.073	0.068	0.064	0.064	0.067	0.068	0.081	0.012
MSF	0.038	0.022	0.033	0.030	0.017	0.010	0.037	0.020	0.029	0.041	0.050	0.039	0.035	0.024	0.024	0.038	0.024	0.032	0.037	0.030	0.010
z0	0.115	0.092	0.104	0.076	0.122	0.068	0.136	0.123	0.124	0.195	0.199	0.184	0.164	0.179	0.175	0.203	0.208	0.150	0.157	0.146	0.044
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	59.315	62.416	62.711	63.313	62.916	61.287	61.567	59.265	57.611	58.090	57.059	55.252	54.517	55.190	56.319	57.144	57.925	57.466	58.688	58.845	2.792
S2	331.264	331.948	332.335	331.796	333.042	331.400	331.558	331.442	331.829	330.865	330.275	329.264	329.827	330.222	329.281	328.940	328.880	328.661	329.222	330.634	1.338
K1	203.094	206.493	205.988	205.500	205.050	204.035	201.450	197.600	193.682	189.625	187.857	185.211	183.876	185.181	185.576	192.400	195.674	197.923	201.113	196.175	8.072
O1	262.037	261.875	261.028	260.943	261.040	260.303	263.773	267.683	272.027	276.946	280.473	283.291	284.210	281.504	277.827	273.197	270.757	263.304	263.259	269.762	8.643
MSF	295.754	282.655	305.655	283.638	279.703	212.738	282.026	248.471	281.897	288.066	275.756	296.264	286.752	309.710	307.926	296.281	290.264	292.424	290.900	284.573	22.054
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.084	0.115	0.077	0.080	0.102	0.085	0.086	0.117	0.108	0.099	0.102	0.125	0.083	0.097	0.080	0.078	0.083	0.093	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.4	98.5	94.3	99.5	93.6	98.1	88.3	84.5	97.4	75.5	84.2	78.9	93.5	86.5	93.9	79.1	92.0	106.8	94.4		

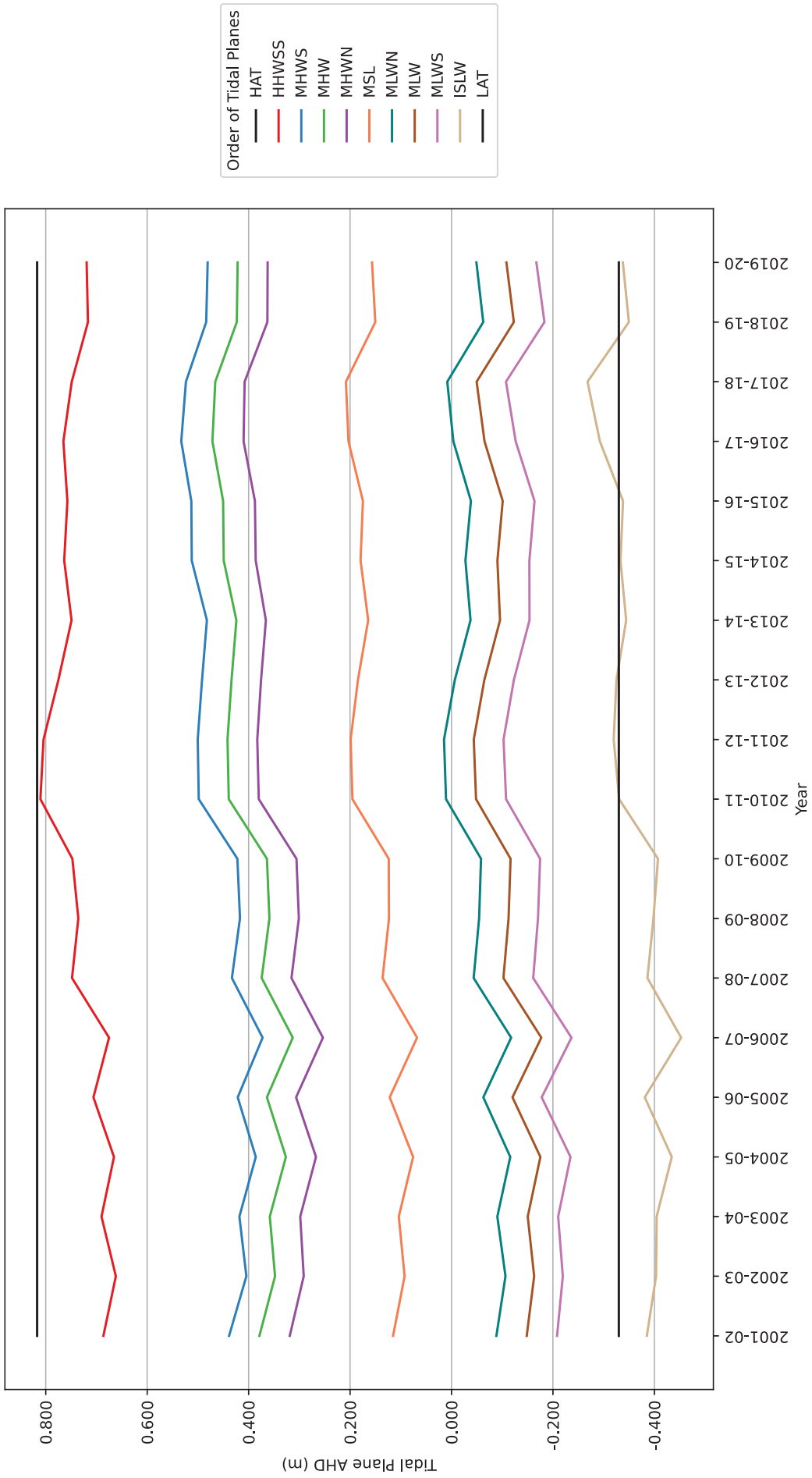
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.82	05/06/2004 00:00	±0.20	28.1
Lowest Astronomical Tide (LAT)	-0.33	25/11/2011 04:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A45

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Woodburn

MHL2786

Figure
A45

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Evans River at Evans River Fishing Co-op

RECORDING STATION: **Evans River at Evans River Fishing Co-op**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203462

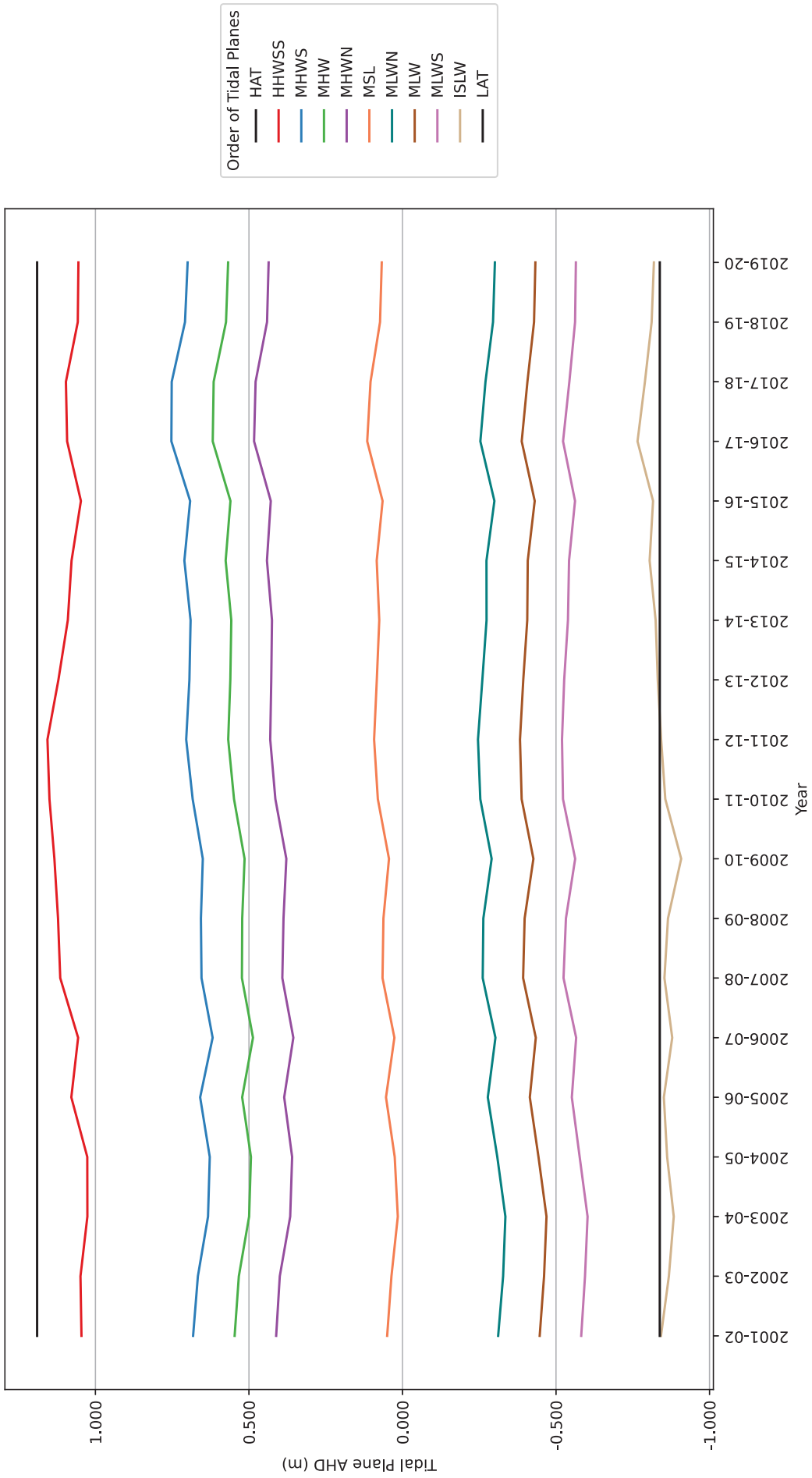
ZONE: 56
EASTING: 542250
NORTHING: 6778375

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.046	1.049	1.026	1.027	1.079	1.056	1.115	1.122	1.134	1.150	1.156	1.121	1.090	1.078	1.047	1.092	1.096	1.058	1.055	1.084	0.040
MHWS	0.682	0.666	0.633	0.628	0.659	0.618	0.655	0.656	0.650	0.683	0.704	0.694	0.690	0.710	0.692	0.753	0.752	0.708	0.700	0.681	0.037
MHW	0.547	0.533	0.499	0.494	0.522	0.487	0.523	0.522	0.514	0.549	0.568	0.561	0.558	0.576	0.560	0.618	0.615	0.575	0.568	0.547	0.037
MHWN	0.411	0.400	0.366	0.359	0.385	0.355	0.391	0.387	0.378	0.414	0.431	0.427	0.425	0.441	0.429	0.483	0.478	0.441	0.436	0.413	0.036
MSL	0.050	0.036	0.015	0.025	0.054	0.026	0.065	0.062	0.044	0.080	0.092	0.084	0.076	0.084	0.065	0.115	0.104	0.073	0.067	0.064	0.027
MLWN	-0.312	-0.328	-0.335	-0.309	-0.278	-0.303	-0.261	-0.263	-0.290	-0.253	-0.246	-0.260	-0.274	-0.274	-0.299	-0.254	-0.270	-0.295	-0.301	-0.284	0.026
MLW	-0.447	-0.461	-0.469	-0.443	-0.415	-0.434	-0.393	-0.398	-0.426	-0.388	-0.383	-0.393	-0.406	-0.408	-0.431	-0.388	-0.407	-0.428	-0.433	-0.419	0.026
MLWS	-0.582	-0.594	-0.603	-0.577	-0.552	-0.566	-0.525	-0.532	-0.562	-0.523	-0.520	-0.527	-0.539	-0.542	-0.562	-0.523	-0.544	-0.562	-0.565	-0.553	0.025
ISLW	-0.842	-0.868	-0.883	-0.862	-0.851	-0.879	-0.853	-0.865	-0.908	-0.856	-0.842	-0.831	-0.825	-0.805	-0.816	-0.765	-0.790	-0.812	-0.819	-0.841	0.035
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.723	0.727	0.701	0.668	0.663	0.658	0.653	0.651	0.669	0.667	0.677	0.687	0.699	0.715	0.728	0.737	0.749	0.736	0.737	0.697	0.033
MR	0.994	0.994	0.969	0.936	0.937	0.921	0.916	0.920	0.941	0.937	0.950	0.954	0.964	0.984	0.991	1.006	1.022	1.003	1.001	0.965	0.033
MSR	1.264	1.261	1.236	1.205	1.211	1.184	1.179	1.189	1.213	1.206	1.224	1.221	1.229	1.253	1.254	1.276	1.295	1.270	1.264	1.233	0.034
R	1.887	1.916	1.910	1.889	1.930	1.935	1.968	1.987	2.041	2.006	1.999	1.952	1.915	1.883	1.863	1.858	1.886	1.869	1.874	1.925	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.497	0.497	0.484	0.468	0.468	0.461	0.458	0.460	0.470	0.468	0.475	0.477	0.482	0.492	0.495	0.503	0.511	0.502	0.500	0.483	0.017
S2	0.135	0.133	0.134	0.134	0.137	0.131	0.132	0.134	0.136	0.135	0.137	0.133	0.133	0.134	0.131	0.135	0.137	0.134	0.132	0.134	0.002
K1	0.163	0.171	0.174	0.174	0.183	0.189	0.197	0.199	0.204	0.200	0.194	0.186	0.178	0.164	0.161	0.152	0.155	0.157	0.159	0.177	0.017
O1	0.097	0.102	0.107	0.111	0.117	0.124	0.131	0.133	0.141	0.133	0.129	0.119	0.107	0.099	0.093	0.091	0.091	0.093	0.095	0.111	0.017
MSF	0.021	0.013	0.034	0.028	0.016	0.013	0.016	0.013	0.011	0.016	0.024	0.011	0.013	0.019	0.014	0.013	0.007	0.017	0.014	0.016	0.006
z0	0.050	0.036	0.015	0.025	0.054	0.026	0.065	0.062	0.044	0.080	0.092	0.084	0.076	0.084	0.065	0.115	0.104	0.073	0.067	0.064	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	353.378	354.864	355.282	356.299	355.671	355.011	354.106	352.382	351.054	351.335	350.372	349.904	350.390	350.569	351.505	351.070	351.171	352.954	353.802	352.691	2.060
S2	261.686	262.005	263.274	263.091	262.893	263.825	263.546	263.039	261.311	263.680	263.926	261.125	263.706	262.632	262.968	262.821	261.507	262.300	261.808	262.692	0.897
K1	148.938	150.210	150.960	150.380	150.123	149.315	147.076	143.481	139.431	136.828	133.438	131.113	130.986	133.035	133.780	138.216	140.767	144.555	148.232	142.151	7.336
O1	208.599	209.358	207.843	209.045	208.041	209.398	211.472	215.091	218.427	223.545	229.143	233.868	232.075	229.884	228.331	219.880	215.664	213.311	211.440	217.601	9.112
MSF	304.464	323.556	294.190	304.136	24.951	157.237	281.475	123.422	285.390	235.712	246.273	350.755	260.765	350.439	312.208	295.622	334.853	288.493	286.473	266.338	82.409
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.098	0.081	0.086	0.068	0.097	0.067	0.098	0.087	0.091	0.069	0.096	0.079	0.090	0.095	0.077	0.077	0.087	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.9	91.8	90.7	93.3	72.6	98.1	95.3	79.7	97.2	87.2	84.1	88.1	92.6	89.9	89.9	68.6	90.7	95.8	95.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.19	04/06/2004 21:30	±0.18	5.5
Lowest Astronomical Tide (LAT)	-0.84	27/10/2011 02:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Evans River at Evans River Fishing Co-op

MHL2786

Figure A46

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Evans River at Iron Gates

RECORDING STATION: **Evans River at Iron Gates**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203475

ZONE: 56
EASTING: 539700
NORTHING: 6778241

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.974	0.951	0.976	0.977	1.001	0.965	1.028	1.018	1.055	1.087	1.059	1.024	0.995	0.984	0.966	1.003	1.004	0.962	0.974	1.000	0.037
MHWS	0.625	0.577	0.590	0.586	0.594	0.546	0.588	0.563	0.593	0.633	0.611	0.612	0.606	0.628	0.624	0.671	0.673	0.626	0.632	0.609	0.033
MHW	0.519	0.476	0.485	0.482	0.490	0.449	0.489	0.464	0.493	0.533	0.508	0.511	0.506	0.526	0.526	0.570	0.569	0.525	0.531	0.508	0.032
MHWN	0.412	0.376	0.381	0.378	0.386	0.352	0.391	0.364	0.392	0.432	0.405	0.409	0.406	0.423	0.427	0.470	0.465	0.424	0.431	0.407	0.031
MSL	0.092	0.061	0.072	0.083	0.091	0.072	0.112	0.078	0.101	0.139	0.111	0.112	0.103	0.115	0.114	0.149	0.139	0.108	0.112	0.103	0.024
MLWN	-0.227	-0.254	-0.237	-0.212	-0.204	-0.207	-0.167	-0.207	-0.190	-0.155	-0.183	-0.185	-0.200	-0.194	-0.199	-0.172	-0.187	-0.208	-0.207	-0.200	0.024
MLW	-0.334	-0.355	-0.342	-0.315	-0.308	-0.304	-0.266	-0.307	-0.290	-0.255	-0.286	-0.287	-0.300	-0.296	-0.298	-0.272	-0.291	-0.308	-0.307	-0.301	0.025
MLWS	-0.440	-0.456	-0.447	-0.419	-0.411	-0.401	-0.365	-0.406	-0.391	-0.356	-0.390	-0.388	-0.400	-0.398	-0.396	-0.373	-0.395	-0.409	-0.407	-0.402	0.026
ISLW	-0.690	-0.723	-0.722	-0.698	-0.703	-0.701	-0.678	-0.731	-0.721	-0.680	-0.709	-0.683	-0.678	-0.653	-0.640	-0.610	-0.632	-0.649	-0.652	-0.682	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.639	0.630	0.618	0.590	0.590	0.559	0.558	0.571	0.582	0.587	0.588	0.595	0.606	0.617	0.627	0.641	0.652	0.632	0.638	0.606	0.029
MR	0.852	0.832	0.827	0.797	0.797	0.753	0.755	0.770	0.783	0.788	0.794	0.797	0.806	0.821	0.823	0.843	0.860	0.834	0.838	0.809	0.031
MSR	1.066	1.033	1.036	1.005	1.005	0.947	0.953	0.969	0.984	0.989	1.001	1.000	1.006	1.026	1.020	1.044	1.068	1.035	1.039	1.012	0.034
R	1.664	1.674	1.698	1.675	1.704	1.666	1.706	1.749	1.777	1.767	1.768	1.707	1.672	1.637	1.606	1.614	1.636	1.612	1.626	1.682	0.055
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.426	0.416	0.414	0.399	0.399	0.376	0.378	0.385	0.392	0.394	0.397	0.399	0.403	0.411	0.412	0.421	0.430	0.417	0.419	0.405	0.016
S2	0.107	0.101	0.105	0.104	0.104	0.097	0.099	0.099	0.101	0.100	0.103	0.101	0.100	0.102	0.098	0.101	0.104	0.101	0.100	0.101	0.002
K1	0.150	0.159	0.164	0.165	0.170	0.174	0.181	0.185	0.185	0.185	0.182	0.172	0.164	0.152	0.148	0.144	0.143	0.144	0.147	0.164	0.015
O1	0.100	0.108	0.112	0.114	0.121	0.126	0.133	0.140	0.145	0.139	0.137	0.123	0.113	0.103	0.096	0.093	0.093	0.096	0.097	0.115	0.018
MSF	0.043	0.026	0.037	0.038	0.024	0.023	0.038	0.020	0.038	0.041	0.045	0.021	0.039	0.031	0.033	0.037	0.027	0.041	0.038	0.034	0.008
z0	0.092	0.061	0.072	0.083	0.091	0.072	0.112	0.078	0.101	0.139	0.111	0.112	0.103	0.115	0.114	0.149	0.139	0.108	0.112	0.103	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	8.082	5.395	10.247	11.224	10.620	10.690	14.249	8.326	5.498	6.350	5.273	5.110	5.245	5.393	6.812	6.494	6.140	8.514	9.033	7.826	2.609
S2	279.486	275.819	281.092	280.255	280.002	281.471	287.548	283.497	278.535	280.987	281.713	278.906	281.175	280.929	281.637	279.891	279.909	280.733	279.912	280.710	2.279
K1	161.100	162.038	164.428	163.987	163.027	162.848	162.546	156.008	154.058	150.169	146.321	144.429	143.973	145.786	147.367	151.497	154.011	158.156	161.463	155.432	7.371
O1	220.793	219.648	219.997	220.954	221.170	221.950	226.044	227.504	231.323	237.412	241.722	245.922	245.160	243.332	240.886	233.905	229.122	226.814	224.245	230.416	9.334
MSF	289.955	284.417	289.225	272.453	303.555	250.667	274.204	254.115	276.535	242.544	266.280	296.753	271.584	307.656	285.578	283.416	287.339	279.804	277.923	278.632	16.939
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.089	0.072	0.075	0.074	0.090	0.063	0.092	0.077	0.080	0.070	0.094	0.076	0.086	0.075	0.069	0.073	0.085	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	91.6	80.3	98.4	95.0	84.6	98.9	94.8	94.0	89.1	70.4	93.8	87.8	97.8	92.5	92.5	90.1	92.7	97.2	96.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 21:45	±0.19	6.3
Lowest Astronomical Tide (LAT)	-0.56	25/11/2011 02:15		

COMMENTS

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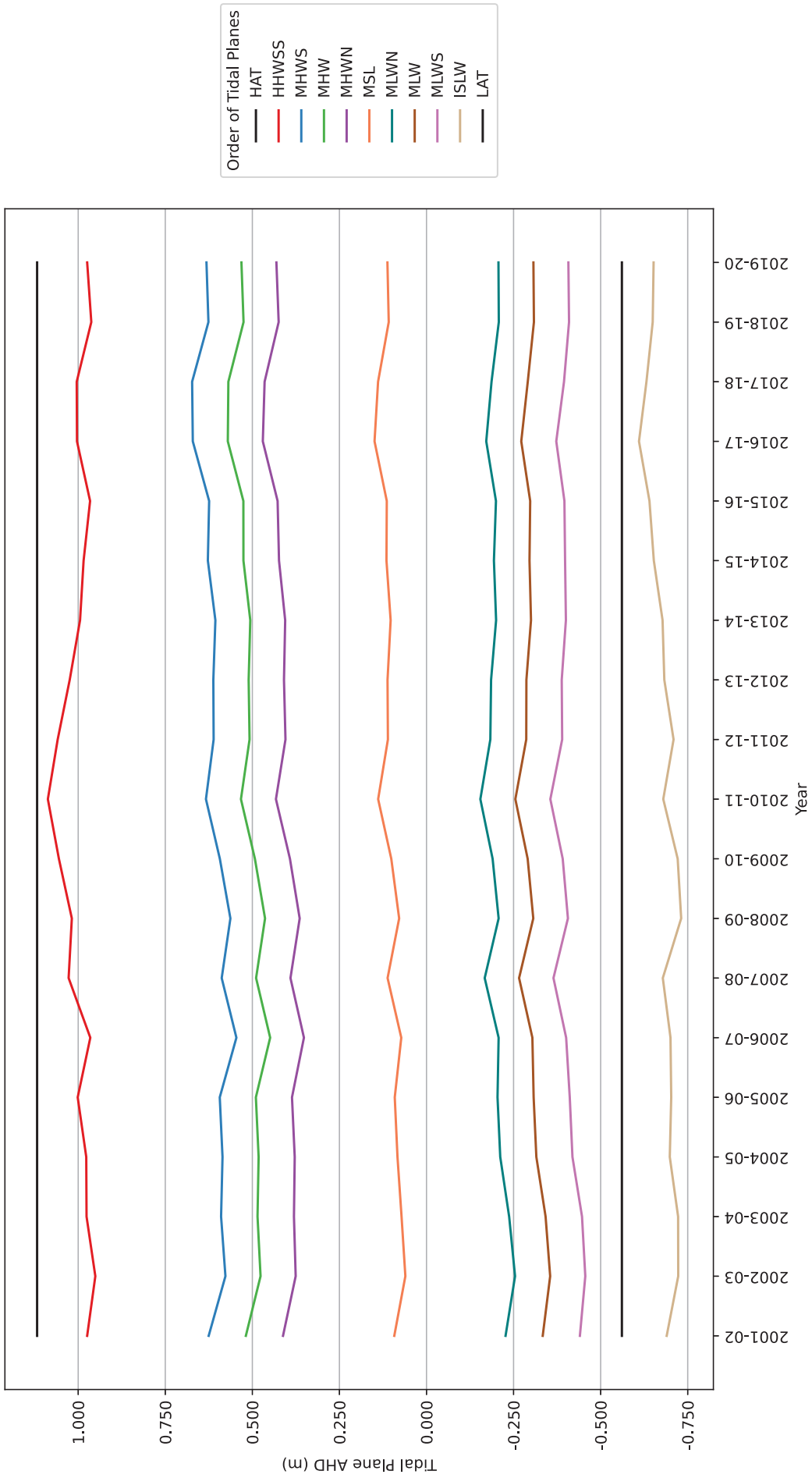
Table A47

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Evans River at Iron Gates

MHL2786

Figure A47

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tucombil Canal at Tucombil Highway Bridge

RECORDING STATION: **Tucombil Canal at Tucombil Highway Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203480

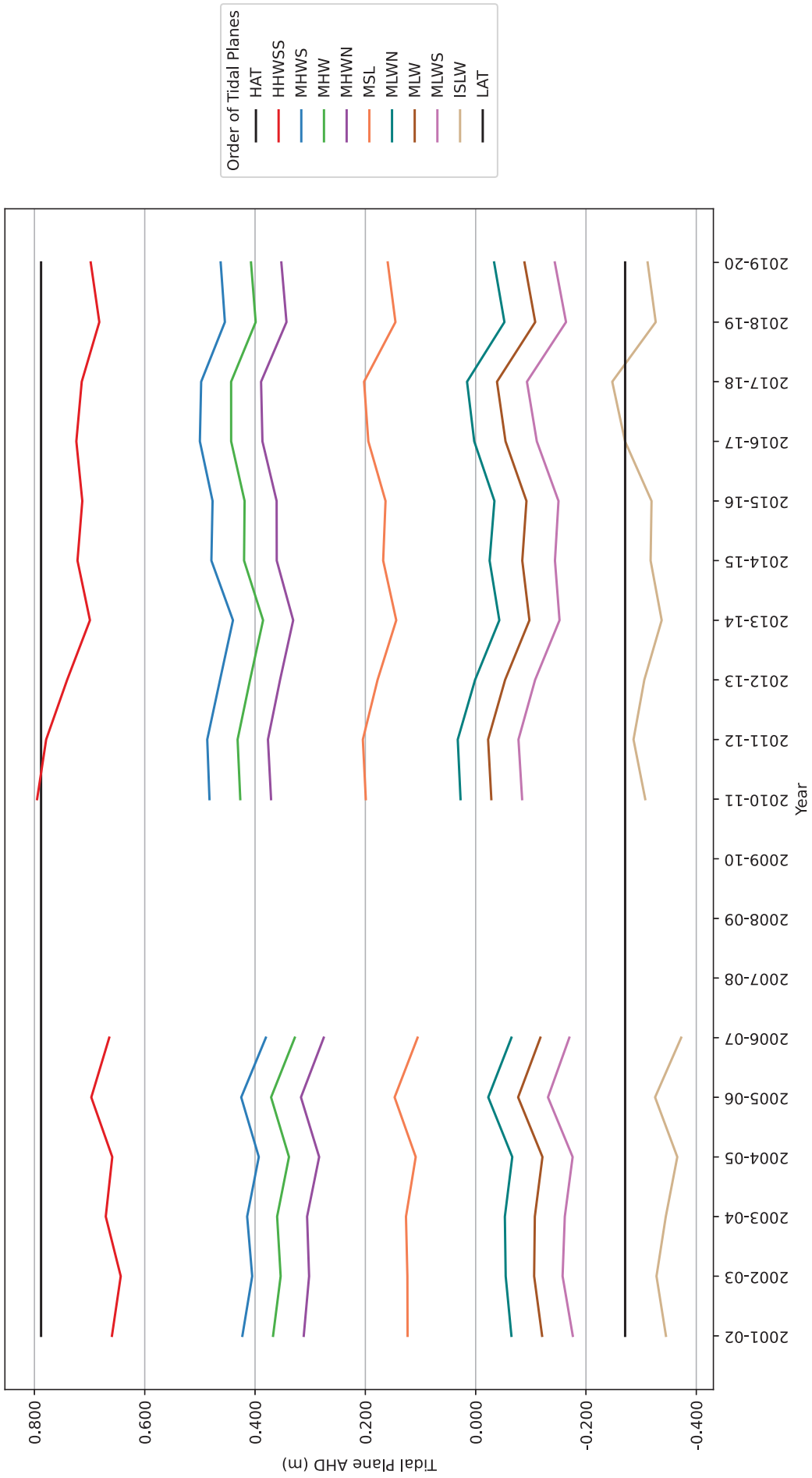
ZONE: 56
EASTING: 532949
NORTHING: 6782596

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08*	2008-09*	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.659	0.644	0.671	0.659	0.697	0.664				0.795	0.779	0.741	0.699	0.722	0.713	0.724	0.714	0.682	0.698	0.704	0.042
MHWS	0.423	0.405	0.414	0.393	0.425	0.380				0.483	0.487	0.464	0.440	0.479	0.477	0.500	0.498	0.455	0.462	0.449	0.038
MHW	0.367	0.354	0.360	0.338	0.371	0.328				0.427	0.432	0.409	0.385	0.420	0.419	0.443	0.443	0.399	0.407	0.394	0.037
MHWN	0.312	0.302	0.306	0.284	0.317	0.275				0.371	0.377	0.355	0.331	0.361	0.361	0.387	0.389	0.343	0.352	0.339	0.036
MSL	0.123	0.124	0.126	0.109	0.147	0.105				0.199	0.205	0.178	0.144	0.168	0.163	0.195	0.202	0.145	0.159	0.156	0.033
MLWN	-0.065	-0.054	-0.053	-0.066	-0.023	-0.065				0.027	0.032	0.001	-0.043	-0.025	-0.034	0.003	0.016	-0.052	-0.033	-0.027	0.033
MLW	-0.120	-0.106	-0.107	-0.121	-0.077	-0.117				-0.028	-0.023	-0.053	-0.097	-0.085	-0.092	-0.054	-0.039	-0.108	-0.088	-0.082	0.033
MLWS	-0.176	-0.158	-0.162	-0.176	-0.131	-0.170				-0.084	-0.078	-0.108	-0.152	-0.144	-0.150	-0.111	-0.093	-0.164	-0.144	-0.137	0.033
ISLW	-0.345	-0.328	-0.345	-0.366	-0.325	-0.373				-0.307	-0.286	-0.306	-0.337	-0.317	-0.319	-0.271	-0.248	-0.326	-0.312	-0.319	0.032
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.377	0.356	0.359	0.350	0.340	0.340				0.344	0.344	0.354	0.374	0.386	0.395	0.384	0.373	0.395	0.386	0.366	0.020
MR	0.488	0.460	0.467	0.460	0.448	0.445				0.455	0.454	0.462	0.483	0.504	0.511	0.497	0.482	0.507	0.496	0.476	0.022
MSR	0.599	0.563	0.576	0.569	0.556	0.550				0.567	0.564	0.571	0.592	0.623	0.627	0.611	0.591	0.619	0.606	0.586	0.025
R	1.005	0.971	1.015	1.024	1.022	1.037				1.103	1.065	1.047	1.037	1.039	1.032	0.995	0.962	1.009	1.010	1.023	0.034
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.244	0.230	0.234	0.230	0.224	0.223				0.228	0.227	0.231	0.241	0.252	0.256	0.249	0.241	0.253	0.248	0.238	0.011
S2	0.056	0.052	0.054	0.055	0.054	0.052				0.056	0.055	0.054	0.055	0.059	0.058	0.057	0.054	0.056	0.055	0.055	0.002
K1	0.099	0.100	0.109	0.111	0.113	0.117				0.126	0.119	0.115	0.109	0.103	0.103	0.097	0.093	0.097	0.101	0.107	0.009
O1	0.070	0.070	0.074	0.079	0.081	0.086				0.098	0.090	0.083	0.077	0.071	0.066	0.063	0.061	0.065	0.067	0.075	0.010
MSF	0.040	0.023	0.031	0.033	0.016	0.013				0.037	0.044	0.020	0.040	0.023	0.024	0.038	0.024	0.032	0.035	0.030	0.009
z0	0.123	0.124	0.126	0.109	0.147	0.105				0.199	0.205	0.178	0.144	0.168	0.163	0.195	0.202	0.145	0.159	0.156	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	63.531	69.118	69.374	69.641	70.329	66.748				64.328	63.450	62.640	61.541	61.992	63.509	63.728	64.600	64.465	65.214	65.263	2.874
S2	334.646	339.927	340.029	340.275	341.981	336.682				338.780	338.020	339.569	339.081	338.576	338.283	337.582	338.805	338.959	338.119	338.707	1.638
K1	204.993	208.226	209.342	207.578	208.862	205.467				194.175	193.323	189.182	189.112	190.300	191.720	197.031	201.195	203.596	206.666	200.048	7.703
O1	261.076	259.722	264.429	262.893	265.203	261.239				282.281	285.323	289.611	288.679	285.535	283.636	277.333	274.819	268.128	267.906	273.613	10.921
MSF	292.273	276.982	306.537	275.117	265.291	236.752				282.511	279.763	297.526	283.802	308.198	303.806	296.912	287.278	290.291	287.619	285.666	17.614
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.108	0.075	0.079	0.089	0.084				0.096	0.097	0.117	0.079	0.098	0.082	0.073	0.083	0.091	0.081		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.4	92.5	92.8	94.5	83.4	91.9	39.5	2.5	47.2	74.5	81.1	83.9	96.8	87.4	95.2	80.8	92.7	98.4	94.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.79	05/06/2004 00:15	±0.18	26.4
Lowest Astronomical Tide (LAT)	-0.27	25/11/2011 04:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tucombil Canal at Tucombil Highway Bridge

MHL2786

Figure A48

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Tucombil Floodgate

RECORDING STATION: **Richmond River at Tucombil Floodgate**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203434

ZONE: 56
EASTING: 534031
NORTHING: 6781670

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16*	2016-17*	2017-18*	2018-19*	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.798	0.810	0.833	0.828	0.868	0.836	0.902	0.900	0.891	0.922	0.948	0.911	0.870	0.856						0.870	0.045
MHWS	0.499	0.479	0.490	0.480	0.500	0.456	0.497	0.491	0.477	0.520	0.566	0.542	0.524	0.542						0.505	0.031
MHW	0.431	0.411	0.419	0.411	0.432	0.392	0.427	0.425	0.410	0.452	0.493	0.473	0.458	0.471						0.436	0.029
MHWN	0.362	0.343	0.347	0.341	0.364	0.329	0.357	0.358	0.343	0.385	0.420	0.404	0.392	0.400						0.368	0.028
MSL	0.128	0.094	0.105	0.108	0.130	0.103	0.133	0.129	0.117	0.157	0.189	0.174	0.153	0.163						0.135	0.029
MLWN	-0.107	-0.155	-0.136	-0.125	-0.104	-0.122	-0.092	-0.100	-0.109	-0.071	-0.041	-0.056	-0.087	-0.074						-0.099	0.031
MLW	-0.175	-0.223	-0.208	-0.195	-0.172	-0.185	-0.162	-0.167	-0.176	-0.138	-0.114	-0.125	-0.153	-0.145						-0.167	0.031
MLWS	-0.243	-0.291	-0.280	-0.264	-0.240	-0.249	-0.232	-0.234	-0.243	-0.206	-0.187	-0.194	-0.219	-0.216						-0.236	0.030
ISLW	-0.457	-0.527	-0.524	-0.513	-0.503	-0.521	-0.521	-0.526	-0.539	-0.493	-0.460	-0.458	-0.466	-0.440						-0.496	0.033
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.469	0.499	0.483	0.467	0.468	0.450	0.449	0.458	0.452	0.455	0.462	0.460	0.479	0.475						0.466	0.014
MR	0.606	0.634	0.626	0.606	0.604	0.578	0.589	0.592	0.586	0.591	0.608	0.598	0.611	0.617						0.603	0.016
MSR	0.742	0.769	0.770	0.745	0.740	0.705	0.729	0.725	0.720	0.726	0.754	0.737	0.743	0.758						0.740	0.019
R	1.255	1.338	1.357	1.341	1.371	1.357	1.422	1.425	1.431	1.415	1.408	1.369	1.335	1.296						1.366	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.303	0.317	0.313	0.303	0.302	0.289	0.294	0.296	0.293	0.295	0.304	0.299	0.306	0.308						0.302	0.008
S2	0.068	0.068	0.072	0.070	0.068	0.064	0.070	0.067	0.067	0.068	0.073	0.069	0.066	0.071						0.069	0.002
K1	0.125	0.138	0.141	0.142	0.148	0.153	0.161	0.162	0.162	0.158	0.152	0.150	0.143	0.131						0.148	0.011
O1	0.089	0.098	0.103	0.106	0.115	0.119	0.128	0.130	0.134	0.130	0.121	0.114	0.104	0.092						0.113	0.015
MSF	0.053	0.046	0.055	0.051	0.034	0.038	0.054	0.039	0.054	0.054	0.059	0.055	0.049	0.053						0.050	0.007
z0	0.128	0.094	0.105	0.108	0.130	0.103	0.133	0.129	0.117	0.157	0.189	0.174	0.153	0.163						0.135	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	56.327	58.375	58.089	60.044	58.507	60.152	57.434	55.651	55.806	56.568	51.542	52.817	53.206	53.313						56.274	2.725
S2	335.343	340.155	338.251	338.918	341.674	340.796	339.414	340.824	337.886	338.539	338.206	337.459	337.872	342.141						339.105	1.852
K1	193.930	194.650	194.558	195.264	193.326	194.283	190.465	186.781	184.204	180.593	175.465	175.103	174.980	176.857						186.461	8.338
O1	248.751	246.623	246.239	246.874	246.583	248.822	249.500	252.544	257.540	262.355	266.373	269.697	269.827	268.181						255.708	9.567
MSF	282.569	272.415	280.492	273.465	282.076	257.291	266.022	257.889	276.055	270.178	270.200	280.824	272.536	300.464						274.462	10.973
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.090	0.066	0.076	0.081	0.081	0.068	0.089	0.083	0.085	0.075	0.088	0.078	0.090							
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.6	98.8	97.0	98.9	84.9	98.1	93.9	91.2	96.7	80.4	63.1	80.9	92.3	84.4							

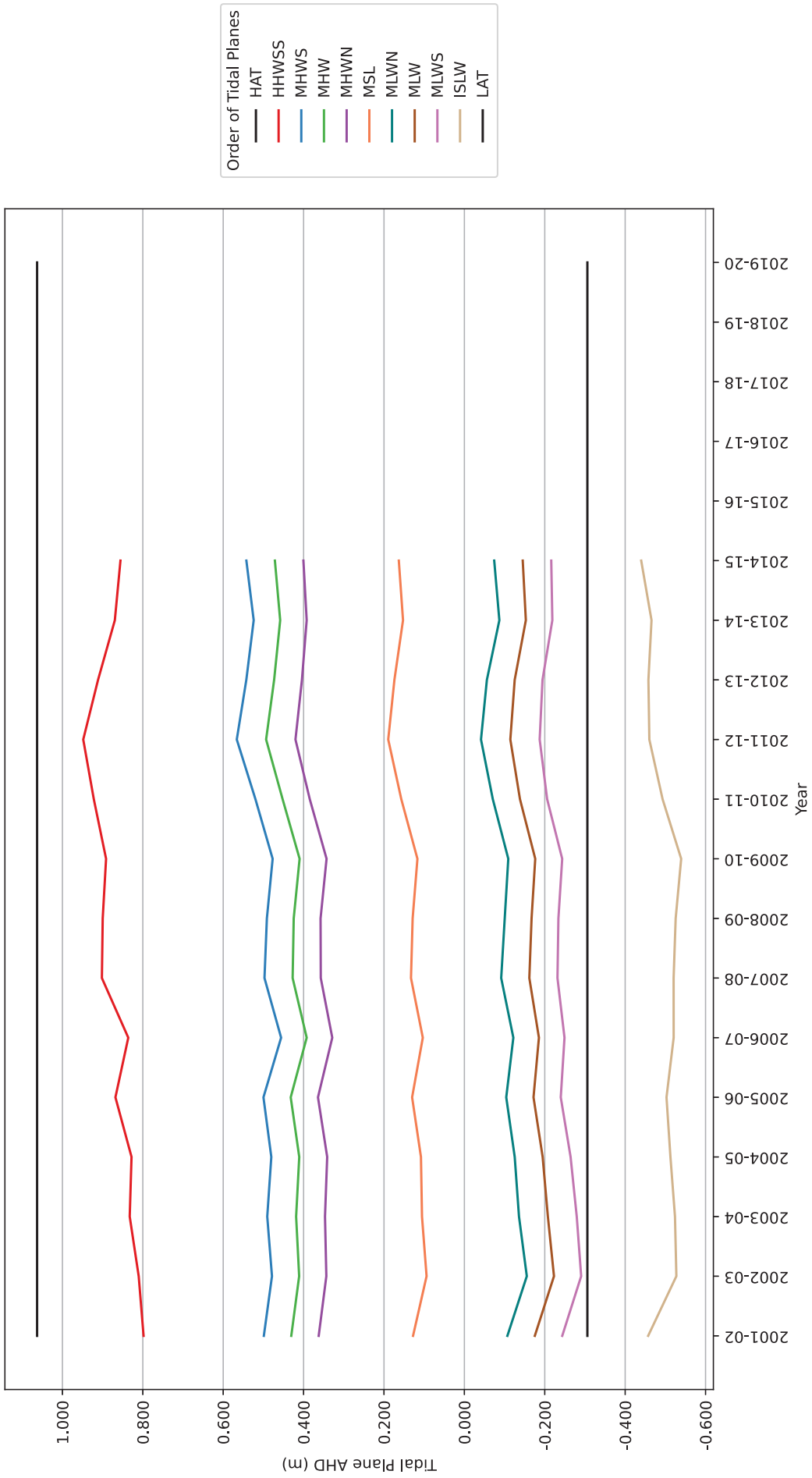
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.06	04/06/2004 23:15	±0.20	9.5
Lowest Astronomical Tide (LAT)	-0.31	24/12/2011 04:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station decommissioned in Jul 2015.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A49

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Tucombil Floodgate

MHL2786

Figure
A49

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Rocky Mouth Creek at Rocky Mouth Creek

RECORDING STATION: **Rocky Mouth Creek at Rocky Mouth Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203432

ZONE: 56
EASTING: 531748
NORTHING: 6781331

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.677	0.664	0.671	0.662	0.713	0.696	0.769	0.736	0.745	0.808	0.801	0.770	0.727	0.754	0.737	0.759	0.766	0.703	0.724	0.731	0.044
MHWS	0.440	0.413	0.409	0.387	0.436	0.399	0.463	0.429	0.428	0.497	0.507	0.492	0.467	0.509	0.500	0.533	0.549	0.477	0.489	0.464	0.047
MHW	0.383	0.358	0.351	0.331	0.381	0.340	0.407	0.374	0.373	0.442	0.451	0.437	0.412	0.449	0.441	0.475	0.493	0.419	0.433	0.408	0.047
MHWN	0.325	0.304	0.293	0.274	0.326	0.281	0.350	0.318	0.318	0.387	0.394	0.382	0.356	0.390	0.382	0.416	0.437	0.362	0.378	0.351	0.047
MSL	0.134	0.114	0.109	0.091	0.152	0.108	0.178	0.150	0.146	0.212	0.220	0.202	0.165	0.192	0.180	0.219	0.249	0.162	0.183	0.167	0.043
MLWN	-0.058	-0.075	-0.074	-0.092	-0.022	-0.065	0.006	-0.019	-0.027	0.037	0.046	0.021	-0.026	-0.006	-0.021	0.022	0.060	-0.037	-0.013	-0.018	0.043
MLW	-0.115	-0.130	-0.132	-0.149	-0.077	-0.124	-0.050	-0.074	-0.082	-0.018	-0.010	-0.034	-0.081	-0.065	-0.080	-0.037	0.004	-0.095	-0.068	-0.075	0.043
MLWS	-0.172	-0.184	-0.190	-0.205	-0.132	-0.184	-0.107	-0.129	-0.137	-0.073	-0.066	-0.089	-0.136	-0.124	-0.139	-0.095	-0.051	-0.152	-0.124	-0.131	0.044
ISLW	-0.341	-0.364	-0.377	-0.402	-0.330	-0.395	-0.326	-0.349	-0.363	-0.296	-0.276	-0.287	-0.322	-0.299	-0.309	-0.256	-0.207	-0.314	-0.292	-0.321	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.383	0.379	0.367	0.366	0.347	0.345	0.345	0.337	0.345	0.350	0.348	0.362	0.382	0.396	0.403	0.394	0.377	0.400	0.390	0.369	0.022
MR	0.497	0.488	0.483	0.479	0.457	0.464	0.457	0.448	0.455	0.460	0.461	0.471	0.493	0.514	0.521	0.511	0.489	0.514	0.502	0.482	0.023
MSR	0.612	0.596	0.598	0.593	0.568	0.583	0.570	0.558	0.565	0.570	0.573	0.581	0.603	0.633	0.639	0.628	0.600	0.628	0.613	0.595	0.025
R	1.018	1.028	1.048	1.064	1.043	1.091	1.095	1.085	1.108	1.104	1.077	1.057	1.050	1.053	1.046	1.015	0.973	1.017	1.017	1.052	0.036
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.249	0.244	0.241	0.240	0.229	0.232	0.229	0.224	0.227	0.230	0.230	0.236	0.246	0.257	0.260	0.256	0.244	0.257	0.251	0.241	0.012
S2	0.057	0.054	0.058	0.057	0.055	0.059	0.056	0.055	0.055	0.055	0.056	0.055	0.055	0.059	0.059	0.058	0.056	0.057	0.056	0.057	0.002
K1	0.100	0.107	0.110	0.116	0.115	0.123	0.126	0.125	0.128	0.126	0.119	0.115	0.109	0.103	0.103	0.099	0.094	0.098	0.101	0.111	0.011
O1	0.069	0.073	0.077	0.081	0.083	0.089	0.093	0.094	0.098	0.097	0.091	0.083	0.077	0.072	0.067	0.062	0.061	0.065	0.067	0.079	0.012
MSF	0.042	0.025	0.029	0.030	0.019	0.010	0.034	0.022	0.029	0.037	0.050	0.023	0.040	0.023	0.024	0.037	0.024	0.032	0.036	0.030	0.009
z0	0.134	0.114	0.109	0.091	0.152	0.108	0.178	0.150	0.146	0.212	0.220	0.202	0.165	0.192	0.180	0.219	0.249	0.162	0.183	0.167	0.043
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	69.680	71.576	71.801	72.330	71.901	69.723	70.947	68.900	66.394	67.341	66.320	65.770	64.596	64.987	66.547	67.132	67.198	67.271	67.948	68.335	2.471
S2	344.662	342.790	343.874	342.955	346.586	343.339	342.674	343.588	343.116	341.237	341.475	343.098	342.583	342.077	342.028	341.520	341.917	342.353	340.776	342.771	1.337
K1	209.305	212.994	213.387	211.946	211.112	211.603	207.808	205.304	200.331	195.812	194.622	191.711	190.933	191.474	193.269	199.126	202.082	205.249	208.077	202.955	8.069
O1	267.360	267.809	267.082	267.044	268.492	265.145	269.759	273.846	277.692	285.014	286.509	291.679	290.457	288.595	284.807	279.824	275.621	270.057	269.589	276.125	9.116
MSF	309.597	280.444	309.718	284.931	290.380	242.553	285.029	252.087	280.835	283.617	275.518	298.713	285.873	307.924	304.169	294.223	290.615	291.582	290.447	287.277	17.373
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.117	0.076	0.083	0.104	0.087	0.084	0.109	0.111	0.101	0.105	0.122	0.083	0.098	0.083	0.076	0.079	0.095	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	58.6	94.8	93.6	99.5	90.2	70.7	80.5	80.6	93.8	75.8	77.1	82.9	96.3	86.7	95.0	80.1	88.1	98.6	94.0		

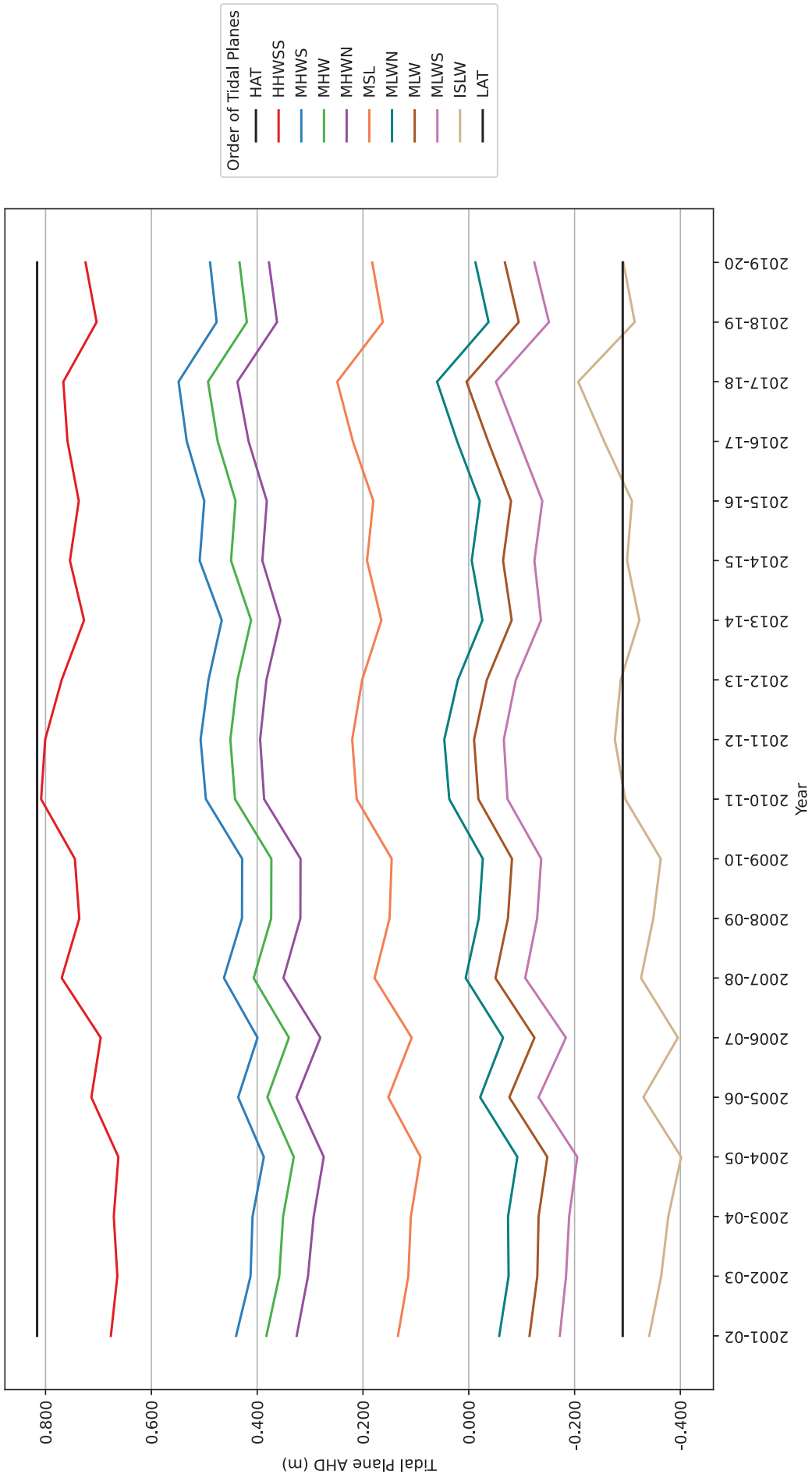
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.82	05/06/2004 00:15	±0.20	28.6
Lowest Astronomical Tide (LAT)	-0.29	25/11/2011 05:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A50

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Rocky Mouth Creek at Rocky Mouth Creek

MHL2786

Figure
A50

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Bungawalbin

RECORDING STATION: **Richmond River at Bungawalbin**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203450

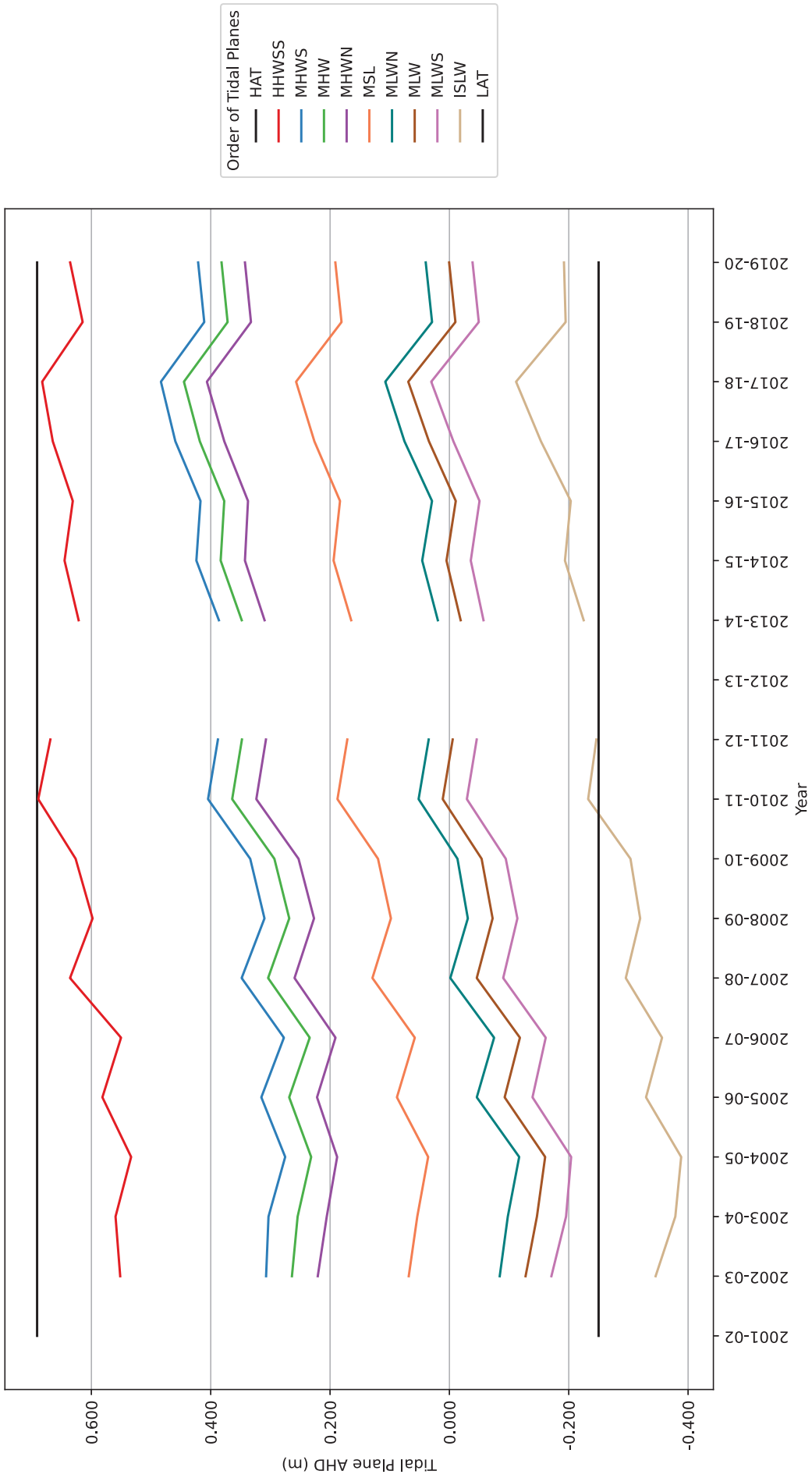
ZONE: 56
EASTING: 527031
NORTHING: 6788276

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.552	0.560	0.533	0.582	0.550	0.636	0.598	0.626	0.689	0.669		0.621	0.645	0.631	0.665	0.682	0.615	0.636	0.617	0.048
MHWS		0.307	0.303	0.275	0.315	0.277	0.348	0.310	0.334	0.405	0.388		0.386	0.424	0.417	0.459	0.484	0.411	0.421	0.369	0.064
MHW		0.264	0.254	0.232	0.269	0.234	0.304	0.268	0.293	0.364	0.348		0.348	0.383	0.377	0.418	0.445	0.372	0.382	0.327	0.066
MHWN		0.221	0.206	0.188	0.222	0.191	0.260	0.227	0.253	0.324	0.307		0.310	0.343	0.338	0.377	0.406	0.333	0.343	0.285	0.069
MSL		0.068	0.054	0.036	0.088	0.058	0.129	0.098	0.120	0.188	0.171		0.165	0.194	0.183	0.226	0.257	0.181	0.191	0.142	0.066
MLWN		-0.084	-0.098	-0.117	-0.046	-0.075	-0.001	-0.031	-0.013	0.052	0.035		0.019	0.046	0.029	0.075	0.108	0.029	0.040	-0.002	0.064
MLW		-0.128	-0.147	-0.160	-0.093	-0.118	-0.046	-0.072	-0.054	0.011	-0.005		-0.019	0.005	-0.011	0.034	0.069	-0.010	0.000	-0.044	0.066
MLWS		-0.171	-0.195	-0.204	-0.139	-0.161	-0.090	-0.114	-0.094	-0.029	-0.046		-0.057	-0.036	-0.050	-0.007	0.030	-0.049	-0.039	-0.085	0.069
ISLW		-0.346	-0.379	-0.388	-0.329	-0.356	-0.296	-0.320	-0.303	-0.232	-0.246		-0.225	-0.194	-0.203	-0.153	-0.112	-0.195	-0.192	-0.263	0.083
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.305	0.303	0.305	0.268	0.266	0.261	0.258	0.266	0.272	0.273		0.290	0.297	0.308	0.302	0.299	0.303	0.303	0.287	0.019
MR		0.392	0.401	0.392	0.361	0.352	0.350	0.341	0.347	0.353	0.353		0.367	0.378	0.388	0.384	0.376	0.382	0.381	0.370	0.019
MSR		0.478	0.499	0.479	0.454	0.439	0.438	0.424	0.428	0.434	0.434		0.443	0.460	0.468	0.466	0.453	0.460	0.460	0.454	0.020
R		0.897	0.938	0.922	0.911	0.907	0.931	0.918	0.930	0.922	0.915		0.846	0.839	0.835	0.818	0.794	0.809	0.828	0.880	0.050
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.196	0.201	0.196	0.181	0.176	0.175	0.170	0.174	0.176	0.177		0.183	0.189	0.194	0.192	0.188	0.191	0.191	0.185	0.009
S2		0.043	0.049	0.044	0.047	0.043	0.044	0.042	0.040	0.040	0.040		0.038	0.041	0.040	0.041	0.039	0.039	0.039	0.042	0.003
K1		0.105	0.108	0.107	0.110	0.112	0.116	0.117	0.116	0.114	0.114		0.098	0.093	0.092	0.089	0.085	0.087	0.092	0.103	0.011
O1		0.070	0.075	0.077	0.080	0.083	0.089	0.089	0.093	0.089	0.087		0.070	0.065	0.061	0.058	0.057	0.058	0.061	0.074	0.013
MSF		0.018	0.036	0.031	0.020	0.012	0.041	0.024	0.039	0.052	0.061		0.042	0.023	0.028	0.039	0.024	0.035	0.039	0.033	0.013
z0		0.068	0.054	0.036	0.088	0.058	0.129	0.098	0.120	0.188	0.171		0.165	0.194	0.183	0.226	0.257	0.181	0.191	0.142	0.066
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		97.691	96.467	97.286	96.249	96.382	95.985	94.615	93.025	92.417	91.895		90.267	91.009	91.973	92.426	93.343	93.534	94.624	94.070	2.289
S2		10.557	8.016	6.202	13.250	9.933	8.532	7.851	6.888	4.337	5.335		6.639	6.807	6.266	5.026	6.605	7.237	6.363	7.403	2.199
K1		231.205	226.613	224.089	226.614	226.167	223.628	219.140	212.574	211.979	210.981		207.955	209.426	209.869	215.803	218.022	221.866	224.528	218.851	7.353
O1		281.730	280.317	279.707	280.601	281.228	282.998	288.821	292.942	296.910	300.970		304.840	302.242	299.843	294.912	289.890	285.410	284.653	289.883	8.664
MSF		232.670	301.339	279.992	299.850	229.484	279.164	257.526	279.203	290.055	289.128		288.056	305.465	304.047	295.360	288.260	295.005	289.795	282.612	22.546
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.123	0.086	0.091	0.113	0.091	0.088	0.124	0.104	0.109	0.104		0.083	0.103	0.083	0.084	0.086	0.089	0.084		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		75.3	96.6	97.7	84.2	85.3	87.8	84.2	80.5	76.8	64.2	49.2	95.4	86.8	93.7	77.6	87.4	96.6	93.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.69	05/06/2004 01:00	±0.20	33.6
Lowest Astronomical Tide (LAT)	-0.25	14/12/2016 05:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Sep 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Bungawalbin

MHL2786

Figure A51

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Bungawalbin Creek at Bungawalbin Creek

RECORDING STATION: **Bungawalbin Creek at Bungawalbin Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 2034133

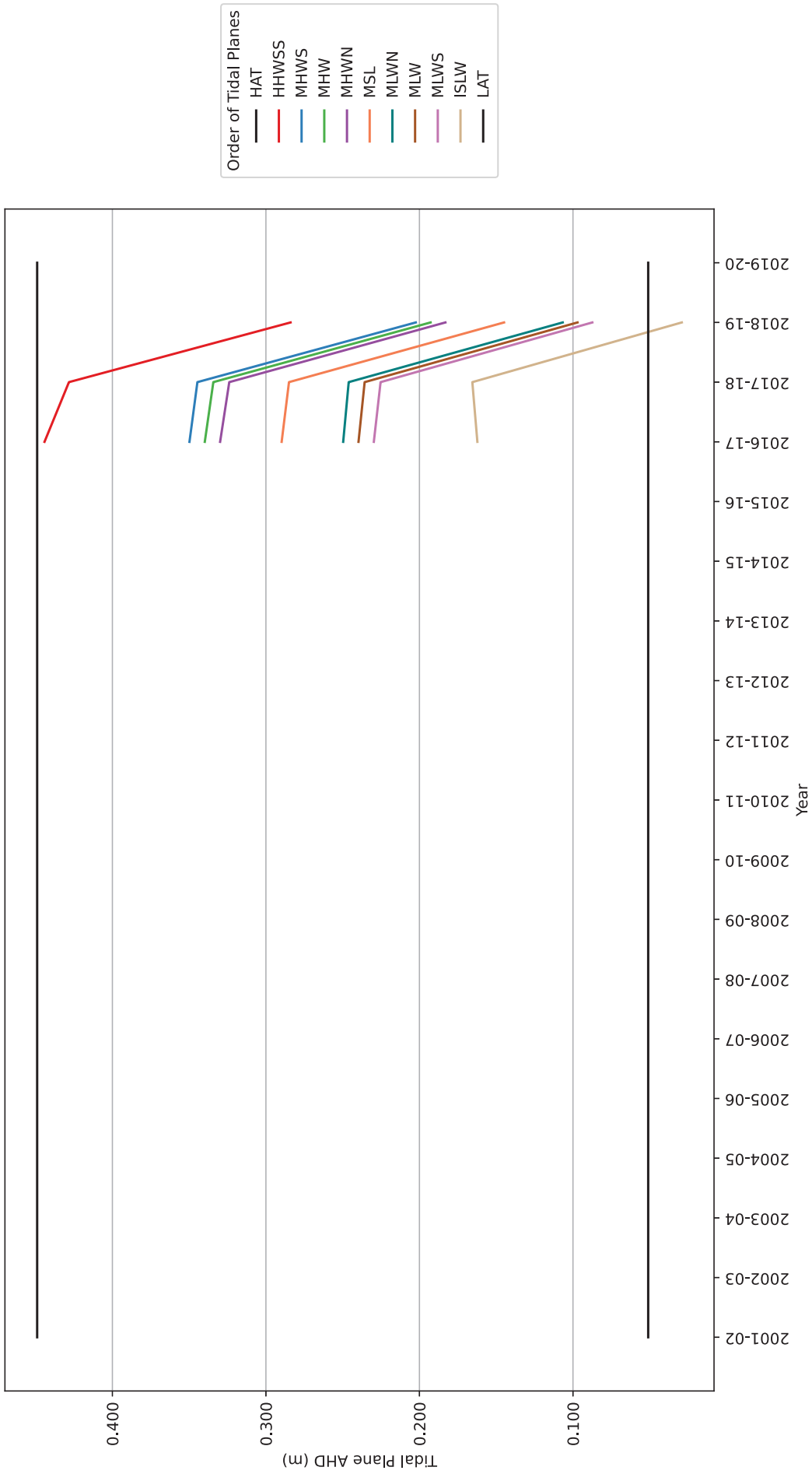
ZONE: 56
EASTING: 516561
NORTHING: 6776508

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11*	2011-12*	2012-13*	2013-14*	2014-15*	2015-16*	2016-17	2017-18	2018-19	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS																0.444	0.428	0.284		0.385	0.088
MHWS																0.350	0.345	0.202		0.299	0.084
MHW																0.340	0.334	0.193		0.289	0.083
MHWN																0.330	0.324	0.183		0.279	0.083
MSL																0.290	0.285	0.145		0.240	0.082
MLWN																0.250	0.246	0.107		0.201	0.082
MLW																0.240	0.236	0.097		0.191	0.081
MLWS																0.230	0.225	0.087		0.181	0.081
ISLW																0.162	0.166	0.029		0.119	0.078
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR																0.080	0.078	0.076		0.078	0.002
MR																0.100	0.099	0.096		0.098	0.002
MSR																0.120	0.119	0.115		0.118	0.003
R																0.282	0.263	0.255		0.267	0.014
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2																0.050	0.049	0.048		0.049	0.001
S2																0.010	0.010	0.010		0.010	0.000
K1																0.041	0.034	0.033		0.036	0.004
O1																0.027	0.025	0.025		0.026	0.001
MSF																0.020	0.023	0.033		0.026	0.007
z0																0.290	0.285	0.145		0.240	0.082
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2																225.599	223.848	231.864		227.104	4.215
S2																144.154	152.833	151.044		149.344	4.582
K1																301.191	308.309	320.774		310.091	9.913
O1																14.351	8.616	16.392		13.120	4.031
MSF																289.087	273.796	307.579		290.154	16.917
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
																0.151	0.104	0.090			
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
																74.8	83.8	93.6	0.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.45	27/04/2017 04:15	±0.26	17.9
Lowest Astronomical Tide (LAT)	0.05	18/12/2016 13:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Feb 2016.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Bungawalbin Creek at Bungawalbin Creek

MHL2786

Figure
A52

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Richmond River at Coraki

RECORDING STATION: **Richmond River at Coraki**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203403

ZONE: 56
EASTING: 527981
NORTHING: 6793775

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.624	0.629	0.653	0.643	0.660	0.637	0.698	0.660	0.681	0.765	0.750	0.692	0.641	0.672	0.648	0.674	0.687	0.621	0.649	0.668	0.039
MHWS	0.395	0.391	0.399	0.381	0.395	0.358	0.414	0.371	0.389	0.470	0.471	0.442	0.404	0.449	0.433	0.466	0.483	0.415	0.432	0.419	0.037
MHW	0.355	0.353	0.357	0.341	0.357	0.321	0.374	0.335	0.352	0.429	0.432	0.403	0.365	0.408	0.393	0.425	0.444	0.375	0.393	0.380	0.036
MHWN	0.314	0.315	0.315	0.301	0.320	0.284	0.335	0.298	0.315	0.388	0.392	0.364	0.327	0.368	0.354	0.385	0.405	0.336	0.354	0.340	0.035
MSL	0.150	0.151	0.153	0.142	0.173	0.138	0.197	0.157	0.173	0.247	0.249	0.222	0.176	0.214	0.196	0.227	0.250	0.177	0.196	0.189	0.037
MLWN	-0.014	-0.013	-0.008	-0.018	0.027	-0.007	0.059	0.016	0.031	0.105	0.106	0.080	0.026	0.061	0.037	0.070	0.095	0.018	0.039	0.037	0.041
MLW	-0.055	-0.052	-0.050	-0.058	-0.011	-0.044	0.020	-0.021	-0.006	0.064	0.066	0.041	-0.012	0.020	-0.002	0.029	0.056	-0.022	-0.000	-0.002	0.041
MLWS	-0.096	-0.090	-0.093	-0.098	-0.048	-0.082	-0.020	-0.058	-0.043	0.023	0.027	0.002	-0.051	-0.020	-0.042	-0.011	0.017	-0.061	-0.039	-0.041	0.040
ISLW	-0.259	-0.260	-0.274	-0.285	-0.237	-0.281	-0.223	-0.264	-0.251	-0.188	-0.172	-0.176	-0.220	-0.180	-0.195	-0.160	-0.129	-0.209	-0.194	-0.219	0.046
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.329	0.328	0.323	0.319	0.293	0.291	0.277	0.282	0.284	0.282	0.287	0.284	0.301	0.307	0.317	0.316	0.310	0.318	0.315	0.303	0.017
MR	0.410	0.405	0.407	0.399	0.368	0.365	0.355	0.356	0.358	0.364	0.365	0.362	0.378	0.388	0.396	0.396	0.388	0.397	0.393	0.382	0.019
MSR	0.491	0.482	0.492	0.479	0.443	0.440	0.433	0.429	0.432	0.447	0.444	0.440	0.454	0.469	0.474	0.477	0.466	0.476	0.471	0.460	0.021
R	0.882	0.889	0.928	0.928	0.897	0.918	0.920	0.924	0.932	0.953	0.922	0.868	0.861	0.851	0.843	0.834	0.816	0.830	0.843	0.886	0.042
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.205	0.202	0.204	0.200	0.184	0.183	0.177	0.178	0.179	0.182	0.183	0.181	0.189	0.194	0.198	0.198	0.194	0.199	0.197	0.191	0.010
S2	0.041	0.038	0.042	0.040	0.037	0.037	0.039	0.037	0.037	0.041	0.039	0.039	0.038	0.040	0.039	0.040	0.039	0.040	0.039	0.039	0.001
K1	0.096	0.102	0.107	0.110	0.110	0.114	0.115	0.118	0.117	0.119	0.112	0.103	0.099	0.094	0.093	0.090	0.087	0.088	0.093	0.103	0.011
O1	0.067	0.068	0.075	0.078	0.079	0.085	0.088	0.088	0.092	0.092	0.088	0.075	0.070	0.065	0.061	0.059	0.059	0.059	0.062	0.074	0.012
MSF	0.040	0.020	0.034	0.034	0.026	0.013	0.036	0.031	0.035	0.042	0.051	0.022	0.042	0.023	0.025	0.036	0.022	0.035	0.040	0.032	0.010
z0	0.150	0.151	0.153	0.142	0.173	0.138	0.197	0.157	0.173	0.247	0.249	0.222	0.176	0.214	0.196	0.227	0.250	0.177	0.196	0.189	0.037
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	108.398	110.788	110.406	111.397	111.988	111.841	112.304	109.282	106.841	106.197	105.332	104.944	103.705	104.468	105.679	106.254	106.380	107.281	108.573	108.003	2.788
S2	22.070	23.007	22.650	22.606	22.807	24.400	24.061	21.729	22.479	20.247	19.641	20.850	21.124	21.640	21.829	19.333	21.467	22.222	21.977	21.902	1.311
K1	231.999	234.780	233.294	232.536	232.937	233.242	231.468	227.844	223.127	218.884	216.244	213.610	213.526	215.749	215.914	221.661	224.335	227.872	230.562	225.241	7.630
O1	287.420	287.128	286.254	286.190	287.444	287.754	289.347	294.272	298.411	302.341	307.714	313.789	310.678	308.321	305.665	300.604	295.879	291.002	290.090	296.332	9.343
MSF	300.408	284.356	305.232	288.052	297.262	232.076	288.186	273.550	281.359	287.843	282.047	301.607	285.218	303.906	305.602	291.585	289.754	290.214	291.729	288.420	16.250
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.094	0.114	0.082	0.085	0.100	0.097	0.089	0.107	0.118	0.108	0.110	0.128	0.082	0.102	0.087	0.082	0.085	0.093	0.087		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.9	97.8	95.7	98.5	73.7	89.9	81.0	73.2	90.0	68.9	77.8	79.5	96.7	87.3	94.5	81.8	89.5	98.3	95.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.73	05/06/2004 01:30	±0.20	43.4
Lowest Astronomical Tide (LAT)	-0.21	13/12/2012 05:45		

COMMENTS

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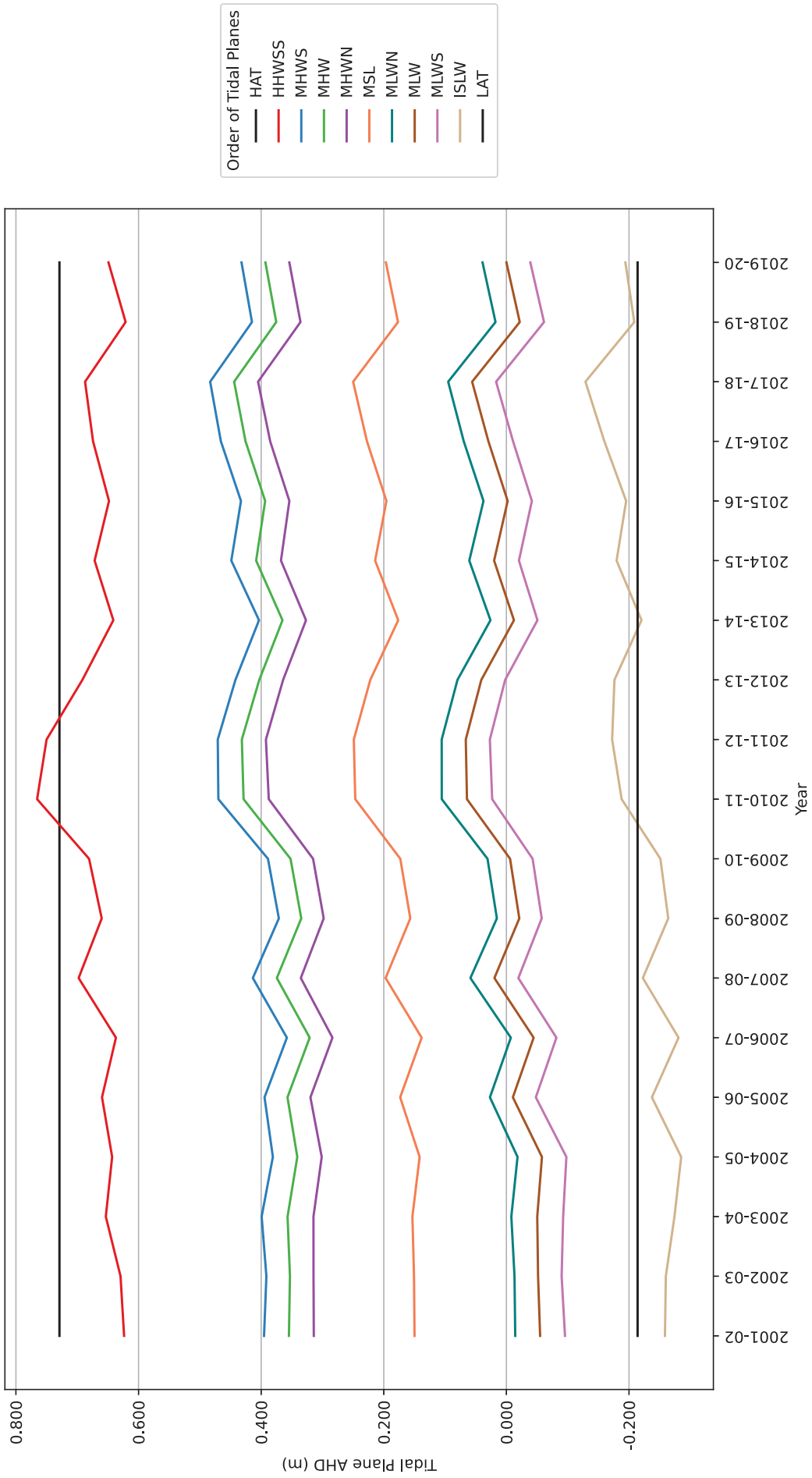


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Richmond River at Coraki

MHL2786

Figure A53

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wilsons River at East Gundurimba

RECORDING STATION: **Wilsons River at East Gundurimba**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203427

ZONE: 56
EASTING: 526034
NORTHING: 6809079

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.722	0.715	0.721	0.695	0.718	0.672	0.775	0.766	0.760	0.847	0.841	0.776	0.681	0.708	0.688	0.719	0.742	0.669	0.702	0.732	0.051
MHWS	0.479	0.462	0.447	0.413	0.429	0.372	0.462	0.443	0.440	0.530	0.535	0.497	0.427	0.470	0.459	0.496	0.527	0.448	0.470	0.463	0.041
MHW	0.427	0.413	0.394	0.360	0.380	0.321	0.410	0.395	0.391	0.481	0.484	0.449	0.380	0.422	0.411	0.447	0.478	0.398	0.420	0.414	0.042
MHWN	0.375	0.364	0.342	0.308	0.332	0.269	0.359	0.347	0.342	0.432	0.434	0.401	0.333	0.374	0.363	0.399	0.429	0.349	0.371	0.364	0.042
MSL	0.152	0.145	0.129	0.091	0.134	0.068	0.164	0.152	0.151	0.243	0.245	0.210	0.132	0.171	0.155	0.190	0.226	0.131	0.158	0.161	0.047
MLWN	-0.070	-0.073	-0.084	-0.126	-0.063	-0.133	-0.030	-0.043	-0.040	0.055	0.057	0.018	-0.068	-0.031	-0.053	-0.018	0.023	-0.087	-0.056	-0.043	0.053
MLW	-0.123	-0.122	-0.137	-0.178	-0.112	-0.185	-0.082	-0.091	-0.089	0.006	0.006	-0.029	-0.115	-0.079	-0.101	-0.067	-0.026	-0.136	-0.105	-0.093	0.054
MLWS	-0.175	-0.171	-0.190	-0.231	-0.160	-0.236	-0.133	-0.139	-0.138	-0.043	-0.044	-0.077	-0.162	-0.127	-0.149	-0.115	-0.074	-0.186	-0.154	-0.142	0.054
ISLW	-0.349	-0.352	-0.385	-0.433	-0.367	-0.450	-0.357	-0.370	-0.366	-0.270	-0.263	-0.277	-0.343	-0.297	-0.313	-0.274	-0.228	-0.344	-0.321	-0.335	0.058
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.445	0.437	0.426	0.433	0.394	0.403	0.389	0.391	0.382	0.377	0.377	0.383	0.401	0.406	0.416	0.418	0.406	0.436	0.427	0.408	0.022
MR	0.550	0.535	0.531	0.539	0.492	0.506	0.492	0.486	0.480	0.475	0.478	0.478	0.495	0.502	0.512	0.514	0.504	0.535	0.525	0.507	0.023
MSR	0.654	0.633	0.637	0.644	0.590	0.609	0.595	0.582	0.578	0.574	0.579	0.574	0.589	0.598	0.608	0.611	0.601	0.634	0.624	0.606	0.025
R	1.071	1.067	1.105	1.128	1.085	1.122	1.133	1.136	1.126	1.117	1.104	1.053	1.024	1.005	1.001	0.993	0.969	1.012	1.023	1.067	0.055
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.275	0.268	0.266	0.269	0.246	0.253	0.246	0.243	0.240	0.238	0.239	0.239	0.247	0.251	0.256	0.257	0.252	0.267	0.263	0.253	0.012
S2	0.052	0.049	0.053	0.053	0.049	0.051	0.051	0.048	0.049	0.049	0.050	0.048	0.047	0.048	0.048	0.048	0.049	0.049	0.049	0.050	0.002
K1	0.103	0.108	0.115	0.118	0.119	0.122	0.128	0.129	0.128	0.127	0.121	0.114	0.107	0.104	0.098	0.096	0.092	0.095	0.099	0.112	0.012
O1	0.071	0.073	0.081	0.084	0.088	0.092	0.097	0.102	0.100	0.100	0.097	0.086	0.074	0.066	0.065	0.063	0.061	0.063	0.067	0.080	0.014
MSF	0.038	0.031	0.036	0.036	0.026	0.013	0.040	0.042	0.035	0.056	0.065	0.025	0.043	0.025	0.030	0.039	0.027	0.037	0.045	0.036	0.012
z0	0.152	0.145	0.129	0.091	0.134	0.068	0.164	0.152	0.151	0.243	0.245	0.210	0.132	0.171	0.155	0.190	0.226	0.131	0.158	0.161	0.047
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	153.153	155.945	156.483	155.845	156.019	154.705	153.484	152.250	151.543	151.049	149.839	149.995	149.979	150.432	151.310	151.103	150.887	151.568	152.633	152.538	2.254
S2	74.211	76.390	74.805	73.367	76.345	74.629	72.413	75.678	75.557	70.114	71.304	73.450	74.964	74.311	75.029	70.645	72.264	72.913	72.996	73.757	1.834
K1	251.627	254.298	253.899	252.424	252.832	251.751	248.474	244.539	241.938	237.836	234.312	234.790	234.988	236.629	237.334	242.867	244.916	247.825	250.999	244.962	7.229
O1	306.791	305.116	304.575	304.245	305.391	304.064	306.045	311.475	317.171	321.061	325.064	329.221	331.005	328.156	324.092	320.537	313.532	309.675	308.645	314.519	9.568
MSF	295.806	283.082	308.146	284.978	276.173	231.592	292.302	253.467	284.048	288.677	281.869	298.501	290.169	295.838	306.765	293.603	292.863	291.104	296.430	286.601	17.816
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.088	0.130	0.086	0.086	0.121	0.089	0.100	0.126	0.127	0.122	0.127	0.154	0.093	0.122	0.095	0.099	0.101	0.094	0.094		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.2	96.9	96.4	98.4	92.7	97.2	82.2	77.5	95.2	68.4	78.9	82.2	96.4	88.0	94.2	80.7	90.1	97.1	91.7		

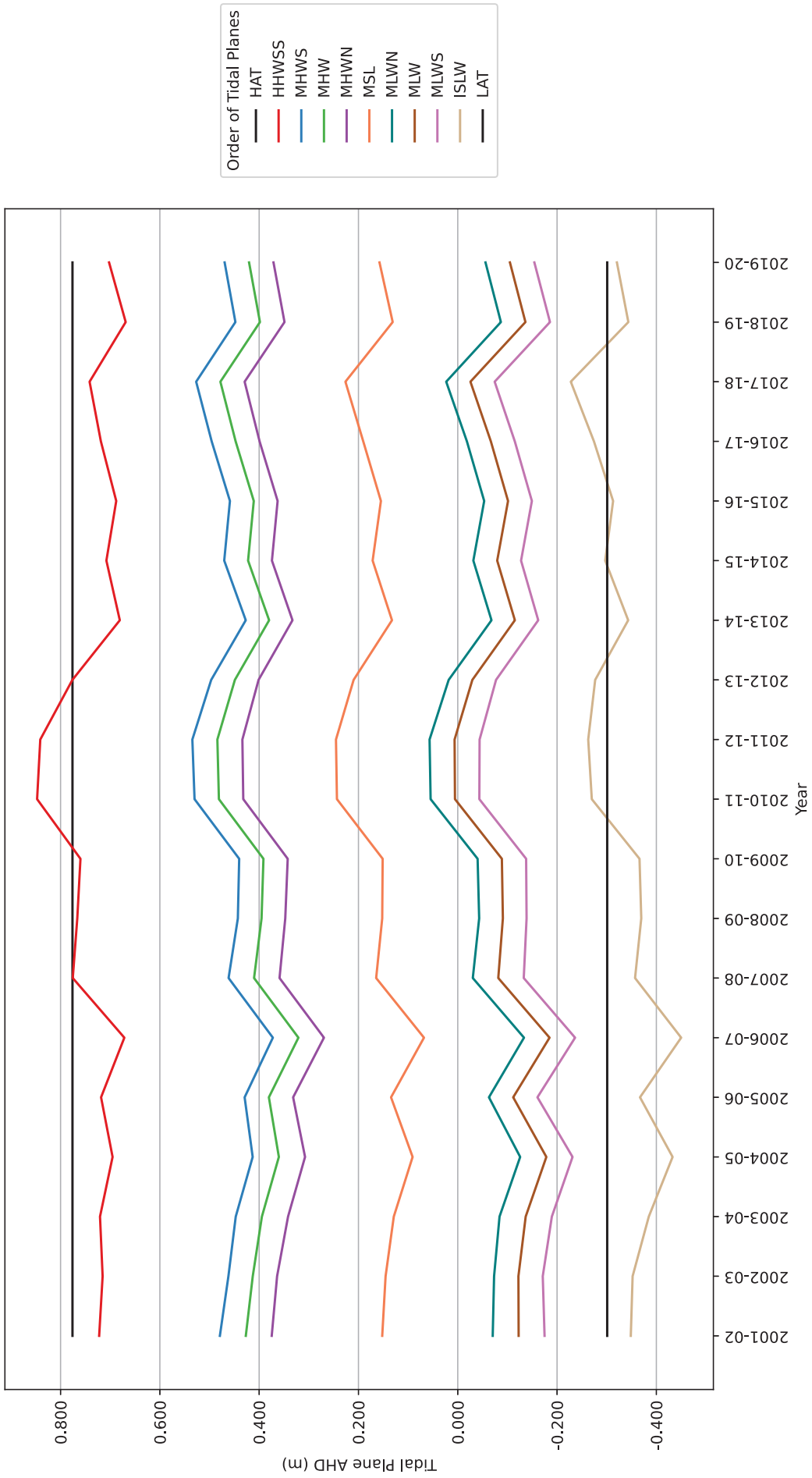
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.78	18/05/2003 03:00	±0.22	56.5
Lowest Astronomical Tide (LAT)	-0.30	02/11/2004 10:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A54

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wilsons River at East Gundurimba

MHL2786

Figure A54

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Leycester Creek at Tuncester

RECORDING STATION: **Leycester Creek at Tuncester**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203443

ZONE: 56
EASTING: 523441
NORTHING: 6814619

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.792	0.780	0.784	0.729	0.780	0.712	0.834	0.815	0.811	0.880	0.871	0.788	0.711	0.748	0.740	0.752	0.779	0.706	0.730	0.776	0.051
MHWS	0.544	0.520	0.506	0.443	0.483	0.406	0.505	0.490	0.484	0.561	0.558	0.515	0.455	0.508	0.504	0.525	0.558	0.480	0.493	0.502	0.040
MHW	0.486	0.465	0.448	0.386	0.430	0.349	0.450	0.437	0.431	0.509	0.504	0.463	0.403	0.455	0.450	0.472	0.505	0.426	0.440	0.448	0.041
MHWN	0.428	0.410	0.390	0.328	0.378	0.293	0.395	0.385	0.379	0.458	0.451	0.412	0.352	0.403	0.397	0.419	0.453	0.371	0.387	0.394	0.041
MSL	0.191	0.176	0.162	0.096	0.166	0.077	0.194	0.174	0.175	0.256	0.247	0.206	0.136	0.185	0.174	0.195	0.234	0.137	0.155	0.176	0.045
MLWN	-0.047	-0.059	-0.066	-0.136	-0.046	-0.138	-0.008	-0.036	-0.030	0.054	0.043	0.001	-0.080	-0.033	-0.048	-0.029	0.015	-0.098	-0.077	-0.043	0.052
MLW	-0.105	-0.114	-0.124	-0.194	-0.099	-0.194	-0.062	-0.089	-0.082	0.003	-0.010	-0.050	-0.131	-0.085	-0.102	-0.082	-0.037	-0.152	-0.130	-0.097	0.053
MLWS	-0.162	-0.168	-0.182	-0.251	-0.151	-0.251	-0.117	-0.141	-0.135	-0.049	-0.063	-0.102	-0.182	-0.138	-0.155	-0.134	-0.090	-0.206	-0.183	-0.151	0.054
ISLW	-0.339	-0.355	-0.380	-0.455	-0.363	-0.469	-0.353	-0.374	-0.369	-0.277	-0.287	-0.297	-0.366	-0.309	-0.324	-0.297	-0.248	-0.368	-0.353	-0.346	0.055
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.475	0.470	0.457	0.465	0.423	0.430	0.403	0.421	0.408	0.403	0.408	0.410	0.432	0.436	0.445	0.448	0.437	0.469	0.463	0.437	0.024
MR	0.591	0.579	0.572	0.580	0.529	0.543	0.512	0.526	0.514	0.507	0.514	0.513	0.534	0.540	0.552	0.554	0.542	0.578	0.570	0.545	0.027
MSR	0.707	0.688	0.687	0.695	0.635	0.656	0.622	0.631	0.619	0.610	0.621	0.616	0.637	0.645	0.659	0.659	0.648	0.686	0.677	0.652	0.030
R	1.131	1.135	1.163	1.184	1.143	1.181	1.187	1.189	1.180	1.157	1.159	1.086	1.077	1.057	1.063	1.049	1.027	1.073	1.083	1.122	0.055
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.295	0.289	0.286	0.290	0.265	0.272	0.256	0.263	0.257	0.253	0.257	0.257	0.267	0.270	0.276	0.277	0.271	0.289	0.285	0.272	0.014
S2	0.058	0.055	0.058	0.057	0.053	0.057	0.055	0.052	0.053	0.052	0.053	0.052	0.051	0.052	0.053	0.053	0.053	0.054	0.053	0.054	0.002
K1	0.105	0.112	0.117	0.119	0.122	0.126	0.132	0.130	0.132	0.128	0.123	0.112	0.109	0.104	0.100	0.098	0.095	0.097	0.101	0.114	0.013
O1	0.072	0.075	0.082	0.085	0.089	0.092	0.104	0.102	0.102	0.100	0.101	0.083	0.075	0.067	0.068	0.064	0.063	0.064	0.068	0.082	0.015
MSF	0.038	0.029	0.037	0.036	0.028	0.013	0.056	0.039	0.036	0.054	0.059	0.024	0.046	0.025	0.031	0.039	0.026	0.038	0.042	0.037	0.012
z0	0.191	0.176	0.162	0.096	0.166	0.077	0.194	0.174	0.175	0.256	0.247	0.206	0.136	0.185	0.174	0.195	0.234	0.137	0.155	0.176	0.045
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	158.481	161.044	162.297	161.173	161.508	159.545	160.540	157.190	156.882	156.959	154.591	154.605	155.158	156.205	157.323	157.551	157.493	157.853	159.135	158.186	2.335
S2	80.269	82.242	81.765	79.209	81.885	79.198	79.322	80.752	83.151	77.537	77.641	77.237	81.244	79.982	81.083	77.882	80.308	80.452	79.623	80.041	1.681
K1	254.901	257.660	256.626	255.234	255.134	255.468	251.005	245.944	244.748	240.982	237.556	237.073	237.112	239.220	240.069	245.537	248.365	251.090	253.930	247.771	7.395
O1	309.363	308.037	307.714	306.795	307.551	306.675	309.897	312.781	319.427	323.323	327.673	332.163	333.504	332.261	326.807	323.186	316.817	312.402	311.335	317.248	9.646
MSF	294.217	290.031	306.060	287.057	271.738	214.154	296.639	256.959	284.371	280.723	283.755	319.395	288.390	298.539	308.844	296.604	291.904	289.930	295.757	287.109	22.210
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.132	0.093	0.090	0.127	0.089	0.105	0.130	0.134	0.118	0.136	0.160	0.092	0.127	0.097	0.101	0.109	0.096	0.103		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.9	95.3	95.9	97.8	90.6	95.8	63.6	72.8	93.6	58.9	75.8	77.0	96.7	88.1	92.3	80.3	89.9	93.9	95.4		

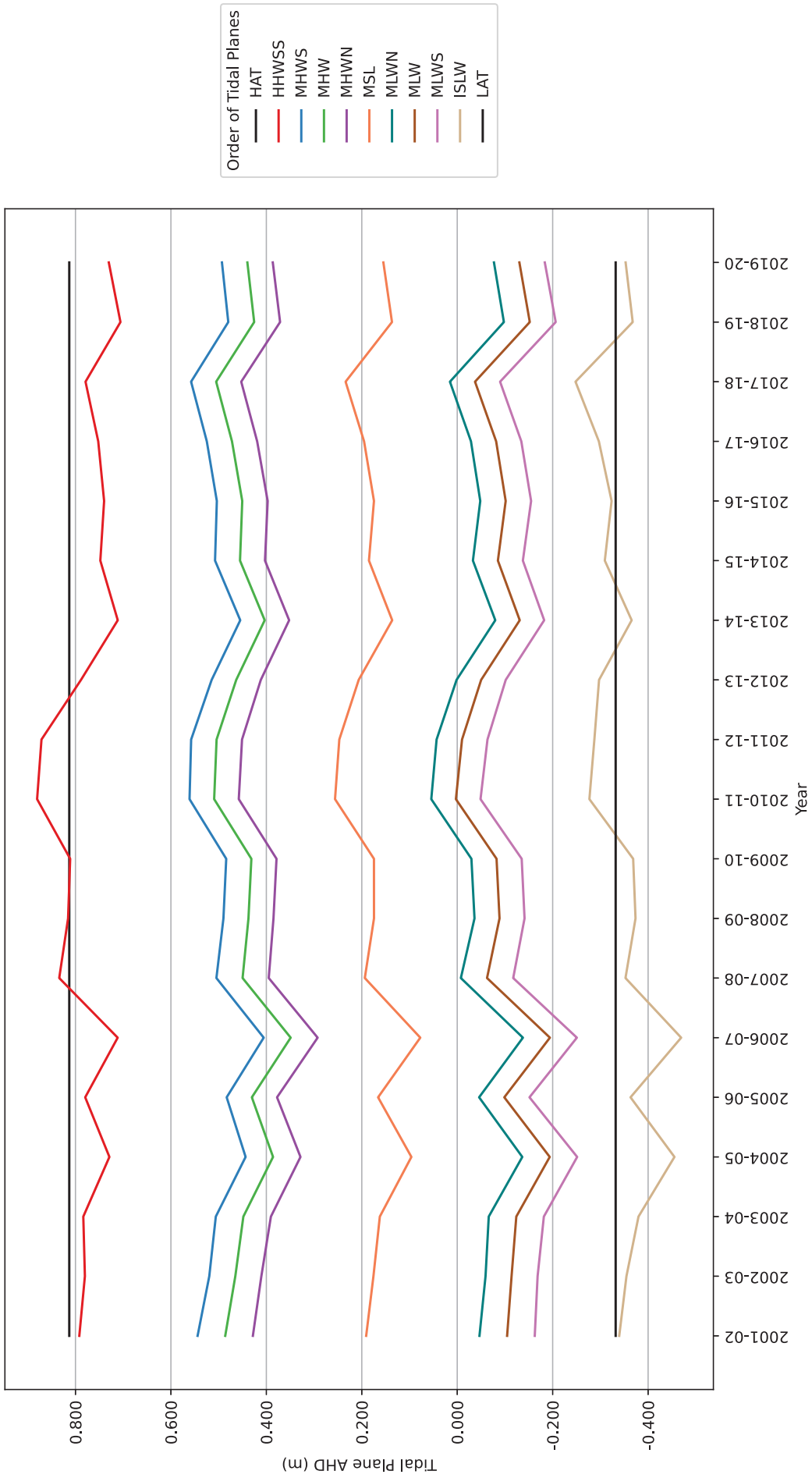
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.81	18/05/2003 03:15	±0.24	58.4
Lowest Astronomical Tide (LAT)	-0.33	04/12/2010 06:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A55

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Leycester Creek at Tuncester

MHL2786

Figure A55

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wilsons River at Woodlawn College

RECORDING STATION: **Wilsons River at Woodlawn College**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 203402

ZONE: 56
EASTING: 529528
NORTHING: 6815751

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.740	0.727	0.750	0.731	0.780	0.741	0.846	0.835	0.839	0.925	0.915	0.837	0.734	0.773	0.754	0.774	0.827	0.724	0.736	0.789	0.063
MHWS	0.492	0.471	0.475	0.450	0.489	0.442	0.531	0.509	0.514	0.604	0.609	0.556	0.478	0.534	0.517	0.550	0.606	0.499	0.501	0.517	0.050
MHW	0.435	0.420	0.419	0.395	0.438	0.387	0.475	0.455	0.461	0.554	0.557	0.506	0.427	0.483	0.465	0.498	0.553	0.445	0.449	0.464	0.051
MHWN	0.378	0.369	0.364	0.340	0.386	0.332	0.420	0.401	0.407	0.504	0.505	0.455	0.376	0.432	0.414	0.445	0.500	0.391	0.396	0.411	0.051
MSL	0.141	0.140	0.140	0.112	0.177	0.117	0.219	0.194	0.205	0.307	0.304	0.251	0.160	0.215	0.191	0.222	0.290	0.155	0.166	0.195	0.060
MLWN	-0.096	-0.089	-0.084	-0.116	-0.032	-0.099	0.017	-0.013	0.003	0.110	0.103	0.048	-0.056	-0.002	-0.033	-0.001	0.080	-0.081	-0.065	-0.021	0.069
MLW	-0.153	-0.140	-0.139	-0.171	-0.084	-0.154	-0.038	-0.066	-0.050	0.060	0.051	-0.003	-0.108	-0.053	-0.084	-0.053	0.026	-0.135	-0.117	-0.074	0.070
MLWS	-0.210	-0.191	-0.194	-0.226	-0.135	-0.208	-0.094	-0.120	-0.103	0.010	-0.001	-0.054	-0.159	-0.104	-0.135	-0.106	-0.027	-0.189	-0.170	-0.127	0.071
ISLW	-0.387	-0.374	-0.391	-0.427	-0.343	-0.422	-0.319	-0.354	-0.336	-0.220	-0.219	-0.255	-0.342	-0.275	-0.305	-0.265	-0.185	-0.350	-0.337	-0.321	0.069
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.474	0.459	0.448	0.456	0.419	0.431	0.402	0.413	0.405	0.394	0.401	0.407	0.432	0.434	0.447	0.447	0.420	0.472	0.461	0.433	0.025
MR	0.588	0.561	0.558	0.566	0.521	0.541	0.513	0.521	0.511	0.494	0.505	0.509	0.535	0.536	0.549	0.551	0.526	0.580	0.566	0.539	0.027
MSR	0.703	0.663	0.669	0.676	0.624	0.650	0.624	0.629	0.617	0.594	0.609	0.610	0.637	0.638	0.652	0.655	0.633	0.688	0.671	0.644	0.029
R	1.128	1.101	1.141	1.159	1.122	1.163	1.165	1.189	1.174	1.144	1.134	1.092	1.076	1.048	1.059	1.039	1.012	1.074	1.073	1.110	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.294	0.280	0.279	0.283	0.261	0.270	0.257	0.261	0.255	0.247	0.253	0.254	0.267	0.268	0.275	0.276	0.263	0.290	0.283	0.269	0.013
S2	0.057	0.051	0.055	0.055	0.051	0.055	0.056	0.054	0.053	0.050	0.052	0.051	0.051	0.051	0.051	0.052	0.053	0.054	0.052	0.053	0.002
K1	0.105	0.110	0.115	0.117	0.121	0.122	0.128	0.131	0.130	0.127	0.120	0.115	0.108	0.104	0.101	0.096	0.095	0.097	0.100	0.113	0.012
O1	0.072	0.073	0.082	0.084	0.087	0.092	0.097	0.102	0.102	0.102	0.098	0.086	0.075	0.067	0.069	0.063	0.063	0.064	0.068	0.081	0.014
MSF	0.033	0.034	0.036	0.040	0.033	0.014	0.043	0.047	0.031	0.063	0.059	0.017	0.043	0.025	0.032	0.035	0.026	0.038	0.043	0.036	0.012
z0	0.141	0.140	0.140	0.112	0.177	0.117	0.219	0.194	0.205	0.307	0.304	0.251	0.160	0.215	0.191	0.222	0.290	0.155	0.166	0.195	0.060
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	161.187	167.323	166.579	166.355	165.383	162.987	163.514	159.611	160.052	161.396	157.977	157.646	157.381	158.703	159.614	159.263	159.647	159.309	161.154	161.320	3.151
S2	83.394	87.368	85.286	85.219	85.900	82.962	82.638	81.922	84.261	80.839	80.516	81.586	83.110	82.294	84.168	78.808	83.810	81.744	81.130	82.998	2.091
K1	255.633	260.504	258.889	257.560	256.447	256.216	252.048	247.845	245.942	241.544	239.441	238.742	238.359	240.217	241.441	246.748	249.951	251.710	254.928	249.167	7.537
O1	309.637	311.587	308.818	307.969	308.785	308.272	310.855	313.830	320.801	325.116	327.885	334.073	334.791	332.448	327.298	324.010	316.813	313.363	311.719	318.319	9.522
MSF	295.063	298.191	310.319	288.685	277.056	222.256	303.144	261.773	278.144	281.744	277.811	294.556	290.336	295.010	303.610	296.600	266.863	289.686	297.649	285.710	19.875
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.095	0.150	0.094	0.096	0.130	0.085	0.105	0.135	0.140	0.131	0.145	0.161	0.093	0.129	0.099	0.108	0.104	0.097	0.107		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	98.1	93.9	96.8	96.2	89.8	92.3	76.8	75.0	93.0	65.1	71.2	81.3	94.9	87.1	92.7	78.6	56.1	96.1	95.0		

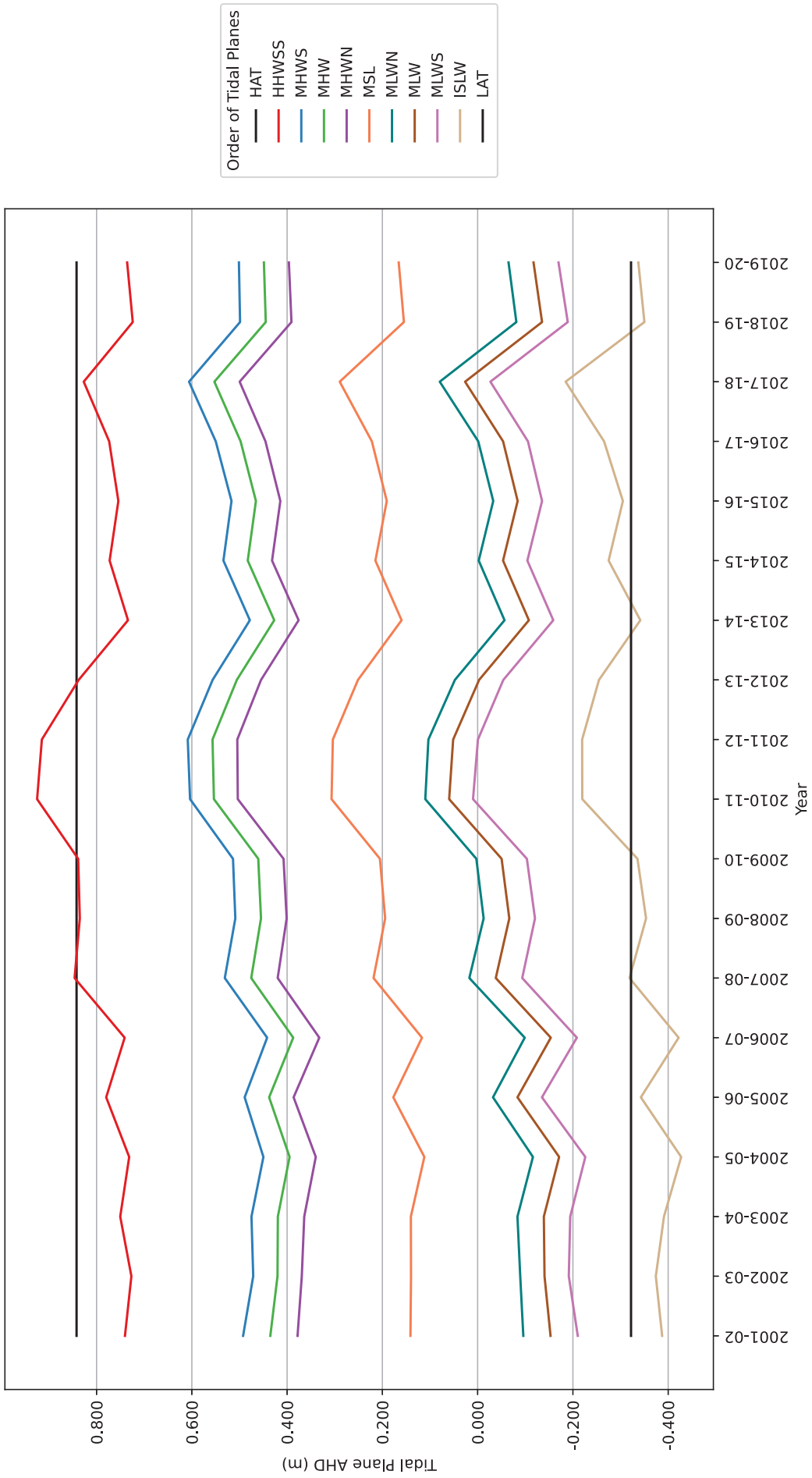
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.84	18/05/2003 03:30	±0.32	57.1
Lowest Astronomical Tide (LAT)	-0.32	04/12/2010 06:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A56

MHL2786

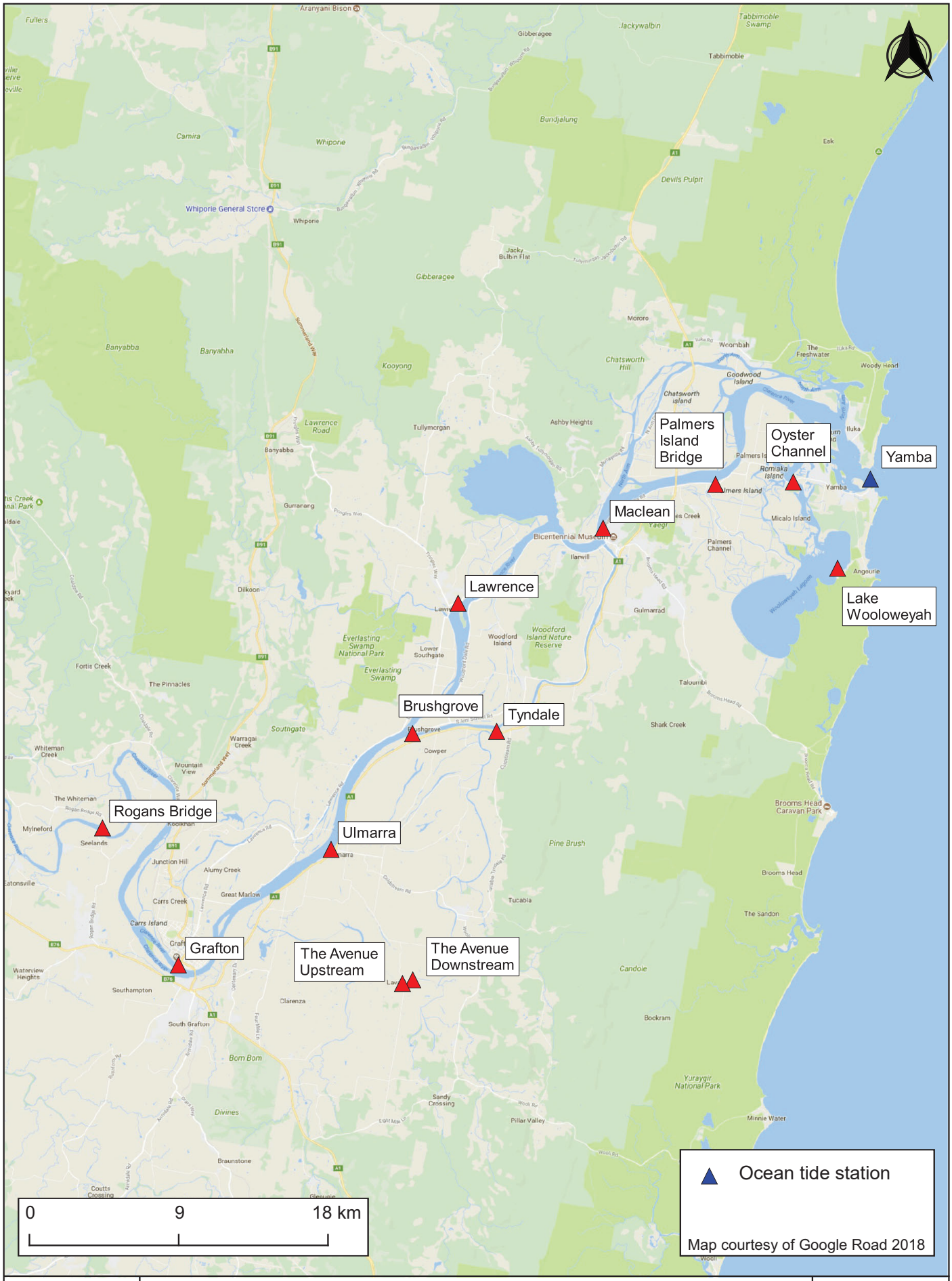


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wilsons River at Woodlawn College

MHL2786

Figure
A56



NSW GOVERNMENT

STATION LOCATIONS
CLARENCE RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A57

DRAWING A57.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Oyster Channel

RECORDING STATION: **Clarence River at Oyster Channel**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204451

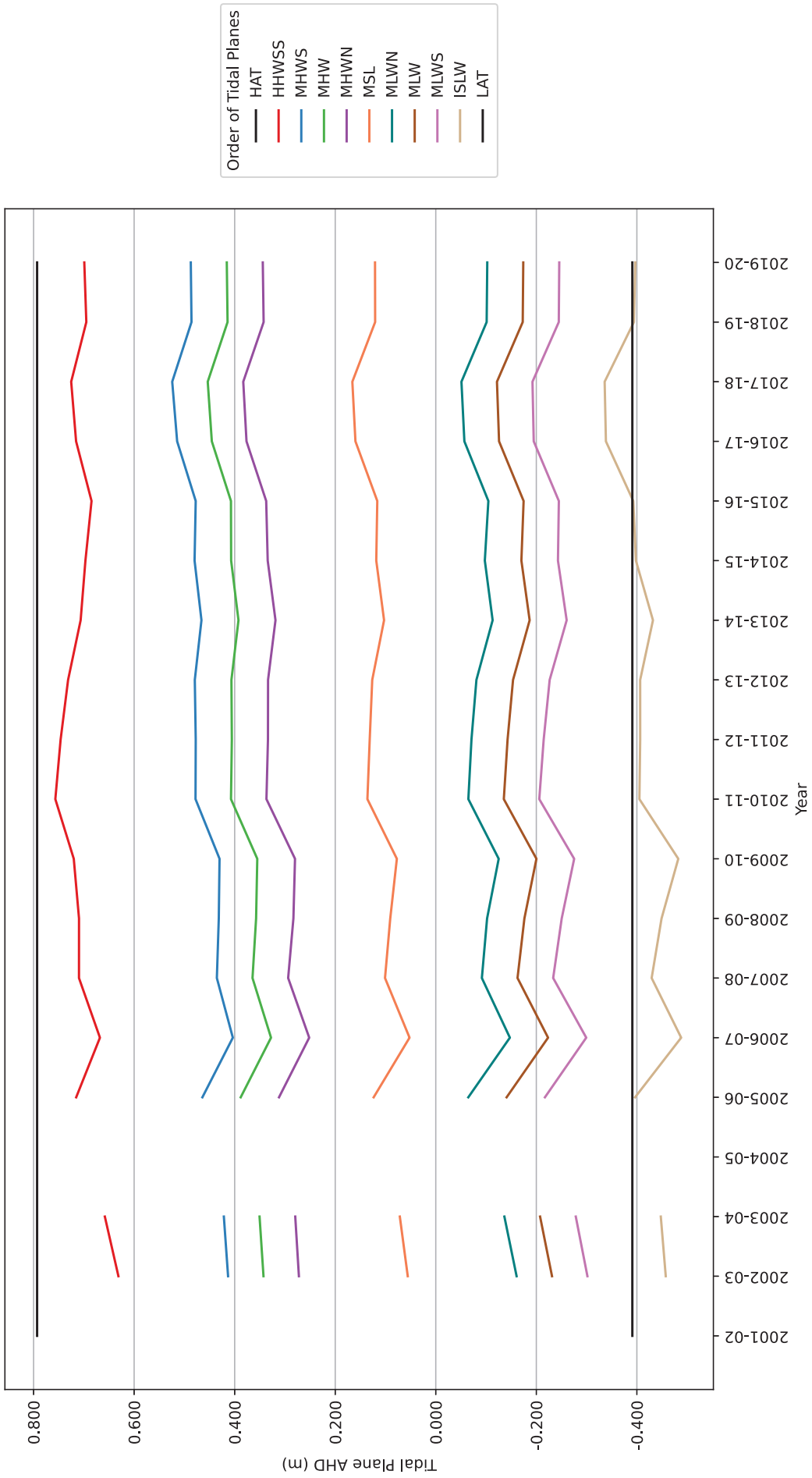
ZONE: 56
EASTING: 530468
NORTHING: 6744254

YEAR	2001-02*	2002-03	2003-04	2004-05*	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.631	0.658		0.715	0.668	0.710	0.710	0.720	0.757	0.746	0.731	0.706	0.697	0.685	0.715	0.725	0.695	0.699	0.704	0.031
MHWS		0.413	0.422		0.464	0.404	0.435	0.432	0.430	0.478	0.477	0.479	0.466	0.480	0.478	0.514	0.524	0.486	0.487	0.463	0.035
MHW		0.343	0.351		0.388	0.328	0.365	0.357	0.355	0.407	0.406	0.406	0.392	0.407	0.407	0.445	0.454	0.414	0.416	0.391	0.036
MHWN		0.272	0.280		0.312	0.252	0.294	0.283	0.280	0.337	0.334	0.334	0.319	0.334	0.337	0.376	0.383	0.342	0.344	0.318	0.037
MSL		0.056	0.072		0.124	0.052	0.101	0.091	0.077	0.136	0.131	0.126	0.103	0.118	0.116	0.160	0.166	0.121	0.121	0.110	0.032
MLWN		-0.161	-0.136		-0.065	-0.147	-0.092	-0.102	-0.125	-0.065	-0.071	-0.081	-0.113	-0.098	-0.105	-0.057	-0.051	-0.101	-0.102	-0.098	0.032
MLW		-0.231	-0.207		-0.141	-0.223	-0.163	-0.176	-0.200	-0.135	-0.143	-0.154	-0.187	-0.170	-0.175	-0.126	-0.122	-0.173	-0.174	-0.171	0.032
MLWS		-0.302	-0.278		-0.217	-0.299	-0.234	-0.251	-0.275	-0.206	-0.215	-0.227	-0.260	-0.243	-0.245	-0.195	-0.192	-0.245	-0.246	-0.243	0.033
ISLW		-0.457	-0.448		-0.396	-0.488	-0.429	-0.449	-0.482	-0.405	-0.407	-0.407	-0.432	-0.398	-0.393	-0.338	-0.336	-0.394	-0.397	-0.415	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.433	0.416		0.377	0.399	0.385	0.385	0.405	0.402	0.405	0.414	0.432	0.432	0.442	0.433	0.434	0.444	0.447	0.417	0.022
MR		0.574	0.558		0.529	0.551	0.527	0.534	0.555	0.543	0.548	0.560	0.579	0.577	0.582	0.571	0.575	0.587	0.590	0.561	0.020
MSR		0.715	0.700		0.681	0.703	0.669	0.682	0.705	0.684	0.692	0.706	0.726	0.723	0.722	0.709	0.717	0.731	0.733	0.706	0.019
R		1.089	1.106		1.112	1.156	1.139	1.159	1.202	1.162	1.153	1.138	1.138	1.095	1.078	1.054	1.061	1.089	1.096	1.119	0.041
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.287	0.279		0.264	0.276	0.264	0.267	0.278	0.271	0.274	0.280	0.290	0.289	0.291	0.286	0.288	0.294	0.295	0.281	0.010
S2		0.070	0.071		0.076	0.076	0.071	0.074	0.075	0.071	0.072	0.073	0.074	0.073	0.070	0.069	0.071	0.072	0.072	0.072	0.002
K1		0.093	0.101		0.106	0.110	0.112	0.112	0.116	0.115	0.108	0.103	0.102	0.091	0.088	0.086	0.085	0.089	0.090	0.100	0.011
O1		0.063	0.068		0.074	0.079	0.084	0.087	0.091	0.084	0.084	0.077	0.070	0.064	0.060	0.058	0.058	0.061	0.062	0.072	0.011
MSF		0.005	0.030		0.012	0.006	0.028	0.010	0.021	0.022	0.029	0.013	0.022	0.029	0.023	0.026	0.015	0.030	0.023	0.020	0.008
z0		0.056	0.072		0.124	0.052	0.101	0.091	0.077	0.136	0.131	0.126	0.103	0.118	0.116	0.160	0.166	0.121	0.121	0.110	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		9.344	9.787		10.021	9.770	9.146	7.860	6.444	6.646	5.922	6.179	5.888	5.875	6.617	7.621	7.805	8.795	9.353	7.828	1.551
S2		280.215	279.024		281.708	279.299	279.365	280.297	278.369	280.461	280.009	278.765	279.855	277.247	279.048	278.851	278.604	278.165	278.332	279.271	1.066
K1		164.549	169.505		167.969	167.149	165.717	163.510	158.018	154.558	153.220	150.876	150.110	151.573	153.853	157.824	162.623	164.067	167.392	160.148	6.720
O1		225.279	225.356		226.653	227.223	229.617	232.890	236.085	240.517	246.050	250.394	251.510	247.583	245.277	239.250	234.858	232.820	228.340	236.453	9.047
MSF		18.552	301.848		87.333	212.450	284.420	187.571	280.521	262.113	286.109	289.294	271.205	341.957	304.162	299.467	300.055	282.514	276.705	252.134	83.524
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.100	0.076		0.066	0.090	0.066	0.097	0.089	0.088	0.071	0.101	0.080	0.095	0.076	0.085	0.076	0.089	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		59.4	98.8	9.5	50.9	99.4	94.5	90.3	98.0	83.2	90.8	88.1	97.8	90.7	96.6	90.8	91.7	97.9	92.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.79	04/06/2004 22:15	±0.18	8.7
Lowest Astronomical Tide (LAT)	-0.39	25/11/2011 02:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Oyster Channel

MHL2786

Figure
A58

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Maclean

RECORDING STATION: **Clarence River at Maclean**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204410

ZONE: 56
EASTING: 518999
NORTHING: 6741473

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.549	0.501	0.519	0.487	0.548	0.524	0.602	0.628	0.614	0.657	0.661	0.635	0.595	0.578	0.564	0.591	0.585	0.519	0.542	0.574	0.052
MHWS	0.352	0.304	0.309	0.275	0.315	0.280	0.339	0.358	0.346	0.393	0.401	0.397	0.376	0.385	0.375	0.406	0.399	0.340	0.354	0.353	0.041
MHW	0.307	0.262	0.266	0.233	0.272	0.235	0.294	0.312	0.299	0.347	0.352	0.349	0.330	0.342	0.330	0.362	0.356	0.298	0.309	0.308	0.040
MHWN	0.263	0.220	0.223	0.192	0.230	0.190	0.249	0.266	0.252	0.302	0.303	0.300	0.283	0.299	0.286	0.317	0.314	0.257	0.265	0.264	0.039
MSL	0.110	0.079	0.085	0.060	0.098	0.055	0.112	0.122	0.108	0.157	0.151	0.150	0.127	0.151	0.127	0.162	0.161	0.113	0.119	0.118	0.033
MLWN	-0.043	-0.062	-0.053	-0.073	-0.035	-0.081	-0.025	-0.022	-0.036	0.012	-0.000	-0.001	-0.028	0.003	-0.031	0.007	0.007	-0.032	-0.026	-0.027	0.027
MLW	-0.087	-0.104	-0.096	-0.114	-0.077	-0.125	-0.070	-0.068	-0.083	-0.033	-0.050	-0.049	-0.075	-0.040	-0.076	-0.038	-0.035	-0.073	-0.071	-0.072	0.027
MLWS	-0.132	-0.146	-0.139	-0.156	-0.119	-0.170	-0.115	-0.114	-0.130	-0.079	-0.099	-0.097	-0.121	-0.082	-0.121	-0.082	-0.078	-0.115	-0.115	-0.116	0.026
ISLW	-0.273	-0.287	-0.289	-0.308	-0.286	-0.344	-0.303	-0.307	-0.322	-0.267	-0.285	-0.268	-0.278	-0.220	-0.256	-0.214	-0.211	-0.243	-0.249	-0.274	0.036
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.305	0.282	0.275	0.264	0.265	0.271	0.274	0.287	0.288	0.289	0.303	0.301	0.311	0.296	0.317	0.310	0.306	0.288	0.291	0.291	0.016
MR	0.395	0.366	0.362	0.348	0.350	0.360	0.364	0.380	0.382	0.380	0.402	0.398	0.404	0.382	0.407	0.399	0.392	0.372	0.380	0.380	0.018
MSR	0.484	0.450	0.448	0.431	0.434	0.450	0.454	0.473	0.477	0.471	0.501	0.494	0.497	0.467	0.496	0.489	0.478	0.455	0.469	0.469	0.021
R	0.821	0.788	0.808	0.795	0.833	0.868	0.905	0.935	0.936	0.924	0.946	0.903	0.873	0.798	0.819	0.805	0.795	0.762	0.791	0.848	0.060
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.197	0.183	0.181	0.174	0.175	0.180	0.182	0.190	0.191	0.190	0.201	0.199	0.202	0.191	0.203	0.200	0.196	0.186	0.190	0.190	0.009
S2	0.045	0.042	0.043	0.042	0.042	0.045	0.045	0.046	0.047	0.045	0.049	0.048	0.046	0.043	0.045	0.045	0.043	0.042	0.044	0.045	0.002
K1	0.083	0.082	0.088	0.088	0.096	0.100	0.106	0.109	0.107	0.106	0.105	0.098	0.093	0.081	0.081	0.078	0.080	0.076	0.079	0.091	0.012
O1	0.057	0.058	0.062	0.064	0.071	0.075	0.082	0.083	0.084	0.083	0.081	0.072	0.063	0.057	0.054	0.053	0.053	0.052	0.056	0.066	0.012
MSF	0.036	0.016	0.028	0.024	0.004	0.003	0.033	0.007	0.019	0.029	0.032	0.026	0.022	0.024	0.023	0.027	0.014	0.027	0.021	0.022	0.009
z0	0.110	0.079	0.085	0.060	0.098	0.055	0.112	0.122	0.108	0.157	0.151	0.150	0.127	0.151	0.127	0.162	0.161	0.113	0.119	0.118	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	42.742	45.203	47.040	47.836	49.451	46.056	46.530	42.666	41.523	42.333	40.214	39.088	38.575	41.545	39.182	43.308	44.575	45.801	46.328	43.684	3.186
S2	307.571	308.832	309.924	308.299	311.224	308.467	310.063	309.492	309.715	308.205	309.995	310.059	308.542	308.589	307.671	309.449	311.980	311.171	309.706	309.419	1.211
K1	196.253	199.853	199.076	200.590	199.424	195.249	193.923	189.816	185.590	181.796	177.458	177.813	175.245	180.365	179.336	185.664	190.913	195.212	197.631	189.537	8.757
O1	252.360	252.623	252.377	253.250	253.181	253.503	254.553	256.927	261.081	266.911	269.047	272.842	275.225	274.943	269.296	263.408	259.815	258.707	254.540	260.768	8.210
MSF	300.615	313.784	305.120	292.335	332.577	222.767	287.573	219.198	283.952	273.143	280.295	293.147	275.959	344.962	313.569	294.552	303.485	281.869	273.686	289.084	30.715
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.099	0.076	0.082	0.083	0.090	0.068	0.098	0.087	0.087	0.071	0.102	0.076	0.093	0.076	0.079	0.075	0.085	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	98.4	97.6	95.4	98.5	96.7	99.6	94.3	87.1	97.5	82.9	91.0	84.2	97.9	89.2	97.5	91.4	95.4	99.1	92.7		

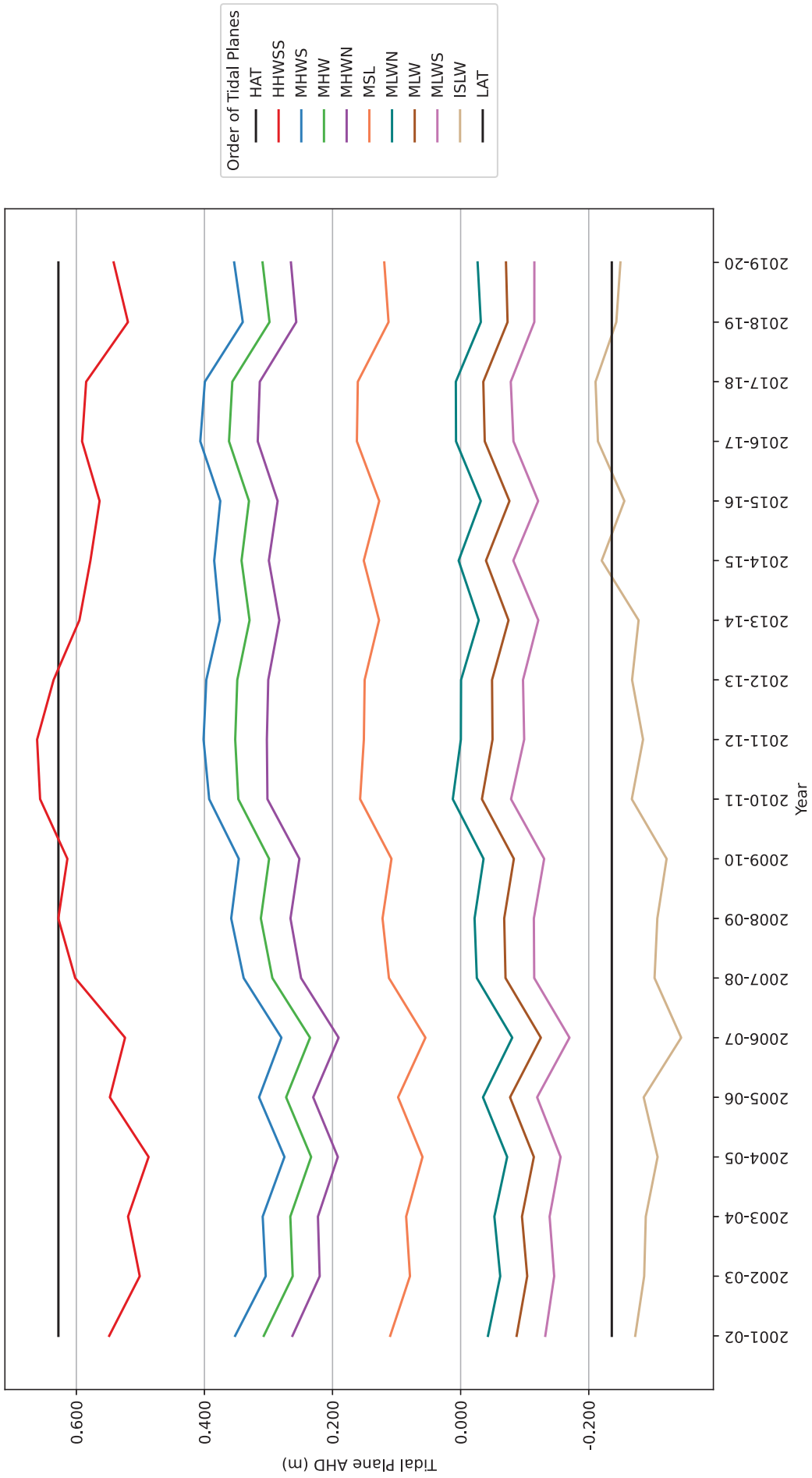
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.63	04/06/2004 23:30	±0.18	29.9
Lowest Astronomical Tide (LAT)	-0.24	13/12/2008 03:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A59

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Maclean

MHL2786

Figure
A59

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Lawrence

RECORDING STATION: **Clarence River at Lawrence**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204453

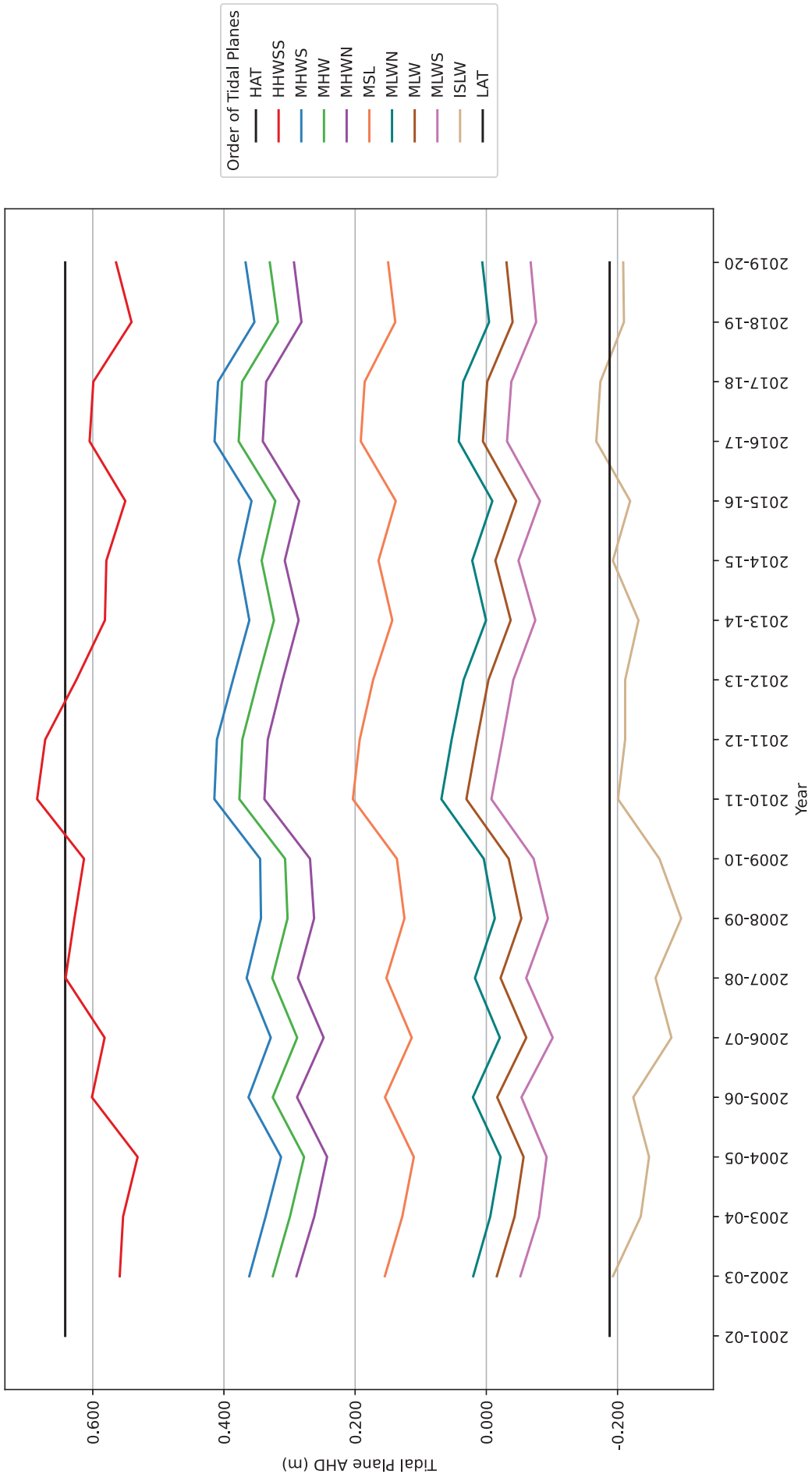
ZONE: 56
EASTING: 510259
NORTHING: 6736948

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.559	0.554	0.532	0.601	0.582	0.641	0.628	0.613	0.685	0.672	0.625	0.581	0.579	0.550	0.605	0.599	0.541	0.564	0.595	0.044
MHWS		0.361	0.336	0.313	0.363	0.329	0.365	0.344	0.345	0.415	0.411	0.386	0.361	0.378	0.358	0.414	0.409	0.353	0.367	0.367	0.030
MHW		0.325	0.299	0.278	0.326	0.288	0.326	0.303	0.307	0.377	0.372	0.348	0.324	0.343	0.322	0.378	0.372	0.318	0.330	0.330	0.030
MHWN		0.289	0.262	0.243	0.289	0.248	0.287	0.263	0.269	0.338	0.333	0.310	0.286	0.307	0.285	0.341	0.336	0.282	0.293	0.292	0.030
MSL		0.155	0.128	0.111	0.155	0.114	0.152	0.125	0.136	0.203	0.193	0.173	0.143	0.164	0.138	0.191	0.185	0.139	0.150	0.153	0.027
MLWN		0.020	-0.006	-0.022	0.020	-0.021	0.017	-0.013	0.004	0.069	0.053	0.035	0.000	0.022	-0.009	0.042	0.035	-0.004	0.006	0.014	0.026
MLW		-0.016	-0.043	-0.057	-0.017	-0.061	-0.022	-0.053	-0.034	0.030	0.014	-0.003	-0.037	-0.014	-0.046	0.005	-0.001	-0.040	-0.031	-0.024	0.026
MLWS		-0.052	-0.080	-0.092	-0.054	-0.101	-0.061	-0.094	-0.072	-0.008	-0.025	-0.041	-0.075	-0.049	-0.082	-0.032	-0.038	-0.076	-0.068	-0.061	0.026
ISLW		-0.193	-0.235	-0.248	-0.224	-0.282	-0.258	-0.297	-0.264	-0.201	-0.212	-0.212	-0.232	-0.193	-0.219	-0.168	-0.174	-0.210	-0.209	-0.224	0.035
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.269	0.268	0.264	0.268	0.269	0.270	0.275	0.265	0.270	0.280	0.276	0.286	0.286	0.295	0.299	0.300	0.286	0.287	0.279	0.012
MR		0.341	0.342	0.335	0.342	0.349	0.348	0.356	0.341	0.346	0.358	0.352	0.361	0.356	0.367	0.372	0.374	0.358	0.361	0.353	0.011
MSR		0.413	0.417	0.405	0.416	0.430	0.426	0.437	0.417	0.422	0.435	0.427	0.436	0.427	0.440	0.446	0.447	0.429	0.435	0.428	0.012
R		0.752	0.789	0.780	0.825	0.864	0.899	0.925	0.877	0.886	0.884	0.837	0.813	0.772	0.770	0.772	0.773	0.751	0.773	0.819	0.057
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.171	0.171	0.167	0.171	0.175	0.174	0.178	0.170	0.173	0.179	0.176	0.180	0.178	0.184	0.186	0.187	0.179	0.180	0.177	0.006
S2		0.036	0.037	0.035	0.037	0.040	0.039	0.040	0.038	0.038	0.039	0.038	0.038	0.035	0.036	0.037	0.037	0.036	0.037	0.037	0.002
K1		0.081	0.090	0.090	0.098	0.103	0.111	0.113	0.107	0.110	0.104	0.099	0.093	0.085	0.082	0.081	0.082	0.079	0.083	0.094	0.012
O1		0.060	0.065	0.066	0.072	0.078	0.087	0.090	0.085	0.083	0.083	0.072	0.065	0.059	0.056	0.055	0.054	0.055	0.058	0.069	0.012
MSF		0.012	0.026	0.026	0.008	0.003	0.038	0.012	0.017	0.021	0.034	0.022	0.024	0.025	0.025	0.023	0.015	0.026	0.017	0.021	0.009
z0		0.155	0.128	0.111	0.155	0.114	0.152	0.125	0.136	0.203	0.193	0.173	0.143	0.164	0.138	0.191	0.185	0.139	0.150	0.153	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		82.129	83.477	84.296	85.203	80.930	81.747	77.026	76.883	77.006	74.771	74.197	73.453	77.555	73.887	78.801	79.982	81.179	81.493	79.112	3.692
S2		349.867	347.688	346.506	348.176	344.596	346.640	344.917	345.658	343.541	345.081	343.914	344.227	346.430	342.907	347.501	347.788	348.444	346.709	346.144	1.912
K1		216.699	216.071	216.685	214.415	210.682	209.635	205.730	203.201	199.833	196.474	195.775	193.361	197.800	197.712	203.469	207.549	211.775	213.610	206.138	7.943
O1		264.942	265.914	267.043	267.240	267.167	268.888	271.172	277.564	281.506	284.077	288.329	290.803	288.366	284.519	278.306	274.685	272.849	268.459	275.657	8.742
MSF		324.301	309.348	290.108	357.051	237.717	296.309	228.116	285.157	260.783	282.679	296.586	277.384	342.937	311.753	296.108	305.740	280.967	279.290	292.352	32.030
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.094	0.076	0.081	0.085	0.088	0.070	0.106	0.088	0.092	0.072	0.107	0.079	0.092	0.080	0.076	0.076	0.084	0.063		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		53.0	98.7	98.7	82.7	99.2	89.1	84.6	86.9	67.0	90.3	85.4	98.7	90.5	98.6	88.6	96.6	99.1	223.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.64	05/06/2004 00:30	±0.18	37.6
Lowest Astronomical Tide (LAT)	-0.19	25/11/2007 05:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Lawrence

MHL2786

Figure A60

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Tyndale

RECORDING STATION: **Clarence River at Tyndale**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204465

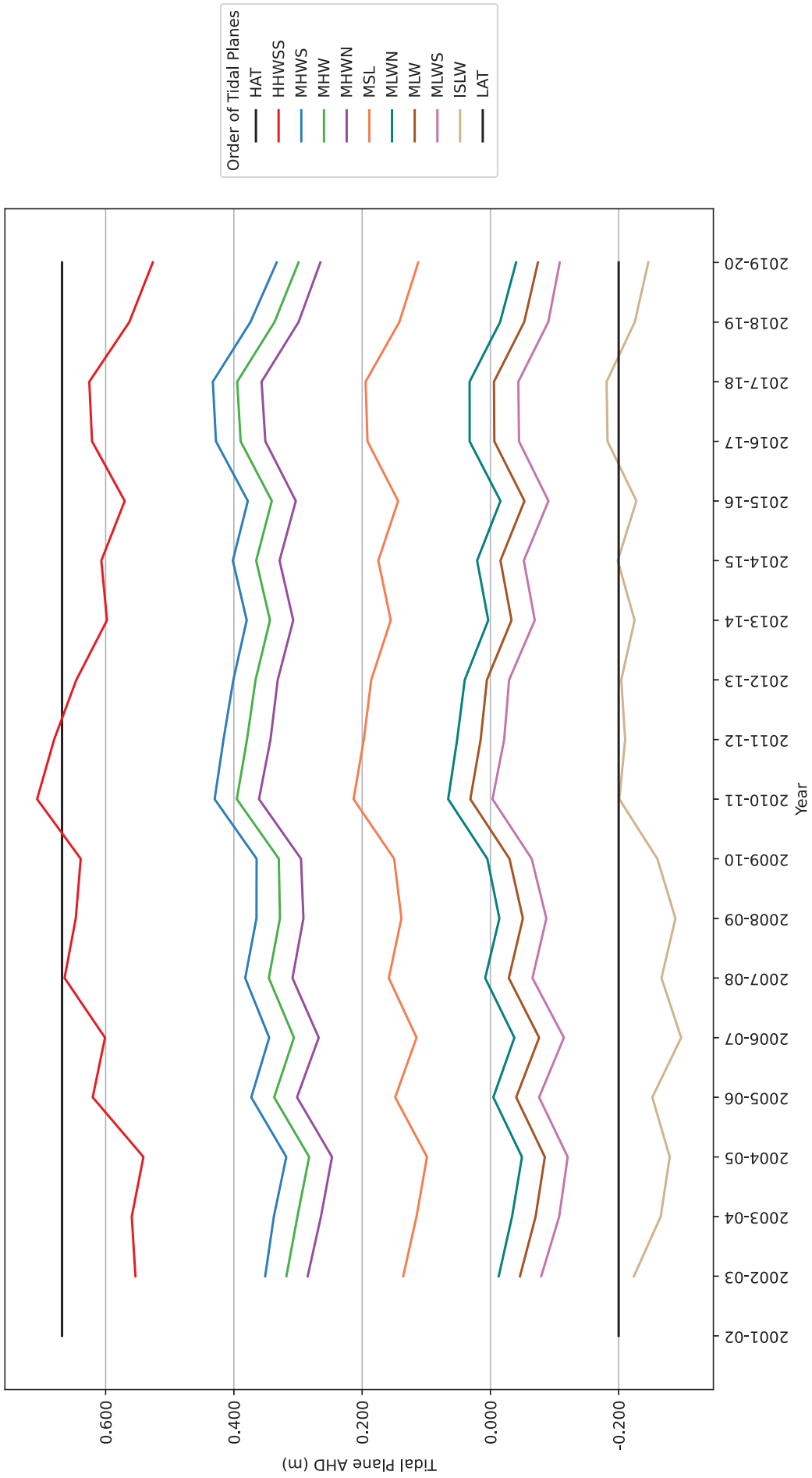
ZONE: 56
EASTING: 512580
NORTHING: 6729227

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.554	0.559	0.541	0.620	0.601	0.664	0.647	0.639	0.707	0.680	0.646	0.598	0.607	0.570	0.621	0.626	0.563	0.526	0.609	0.050
MHWS		0.351	0.338	0.318	0.373	0.345	0.382	0.365	0.365	0.430	0.416	0.401	0.380	0.402	0.378	0.428	0.433	0.374	0.333	0.378	0.034
MHW		0.318	0.301	0.283	0.337	0.306	0.346	0.328	0.330	0.395	0.380	0.366	0.344	0.365	0.341	0.389	0.395	0.337	0.299	0.342	0.034
MHWN		0.285	0.264	0.247	0.302	0.268	0.309	0.292	0.295	0.361	0.343	0.332	0.307	0.329	0.303	0.351	0.357	0.299	0.265	0.306	0.034
MSL		0.136	0.115	0.099	0.149	0.115	0.158	0.139	0.150	0.213	0.197	0.186	0.155	0.175	0.144	0.192	0.195	0.142	0.113	0.154	0.033
MLWN		-0.013	-0.034	-0.049	-0.005	-0.037	0.008	-0.014	0.005	0.066	0.052	0.040	0.003	0.021	-0.016	0.032	0.032	-0.015	-0.040	0.002	0.033
MLW		-0.046	-0.071	-0.085	-0.040	-0.076	-0.029	-0.051	-0.030	0.031	0.015	0.005	-0.033	-0.016	-0.053	-0.006	-0.006	-0.053	-0.074	-0.034	0.033
MLWS		-0.079	-0.107	-0.121	-0.076	-0.115	-0.066	-0.087	-0.064	-0.003	-0.021	-0.029	-0.069	-0.052	-0.091	-0.045	-0.044	-0.090	-0.108	-0.070	0.033
ISLW		-0.224	-0.266	-0.280	-0.253	-0.297	-0.267	-0.289	-0.260	-0.201	-0.210	-0.204	-0.225	-0.199	-0.228	-0.183	-0.181	-0.225	-0.246	-0.235	0.036
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.298	0.298	0.296	0.306	0.305	0.300	0.306	0.291	0.295	0.291	0.292	0.304	0.308	0.319	0.319	0.324	0.314	0.305	0.304	0.010
MR		0.364	0.371	0.367	0.377	0.382	0.374	0.379	0.360	0.364	0.364	0.361	0.377	0.381	0.394	0.396	0.400	0.389	0.373	0.376	0.012
MSR		0.431	0.445	0.439	0.449	0.460	0.448	0.452	0.429	0.433	0.438	0.430	0.449	0.454	0.469	0.473	0.476	0.464	0.441	0.449	0.015
R		0.777	0.825	0.821	0.873	0.898	0.931	0.935	0.899	0.908	0.890	0.850	0.823	0.805	0.798	0.804	0.807	0.788	0.773	0.845	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.182	0.186	0.184	0.189	0.191	0.187	0.189	0.180	0.182	0.182	0.180	0.188	0.190	0.197	0.198	0.200	0.195	0.187	0.188	0.006
S2		0.033	0.037	0.036	0.036	0.039	0.037	0.037	0.035	0.035	0.037	0.035	0.036	0.036	0.037	0.039	0.038	0.038	0.034	0.036	0.002
K1		0.083	0.093	0.092	0.102	0.104	0.113	0.112	0.108	0.111	0.105	0.100	0.092	0.086	0.082	0.083	0.083	0.080	0.082	0.095	0.012
O1		0.062	0.066	0.067	0.075	0.079	0.088	0.089	0.088	0.087	0.083	0.075	0.064	0.061	0.055	0.055	0.055	0.055	0.056	0.070	0.013
MSF		0.006	0.026	0.027	0.006	0.005	0.039	0.011	0.018	0.034	0.035	0.022	0.026	0.025	0.024	0.027	0.015	0.026	0.026	0.022	0.010
z0		0.136	0.115	0.099	0.149	0.115	0.158	0.139	0.150	0.213	0.197	0.186	0.155	0.175	0.144	0.192	0.195	0.142	0.113	0.154	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		98.114	98.941	99.684	100.346	96.526	97.534	93.820	95.115	95.057	93.513	93.119	91.739	93.789	90.330	94.998	95.850	96.388	96.949	95.656	2.704
S2		349.975	348.404	347.075	350.654	346.055	347.462	347.865	342.956	348.360	4.026	3.227	2.710	4.017	0.354	3.529	4.697	4.278	0.414	175.337	177.314
K1		214.659	222.072	222.936	220.881	216.400	216.006	212.393	210.760	206.427	204.354	202.728	200.170	203.708	203.167	208.879	213.162	217.521	222.849	212.171	7.534
O1		271.322	271.316	272.565	271.648	273.149	274.224	278.719	283.825	290.504	291.265	293.199	296.553	294.898	289.666	283.945	279.803	277.926	277.329	281.770	8.891
MSF		304.264	314.382	293.862	337.474	236.580	290.663	227.900	292.717	269.527	282.315	299.975	276.916	341.816	311.679	292.336	306.237	280.067	242.812	288.973	30.931
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.112	0.076	0.082	0.081	0.101	0.073	0.099	0.092	0.090	0.091	0.111	0.079	0.095	0.077	0.083	0.076	0.083	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		61.8	98.2	99.1	96.6	99.4	93.3	86.8	94.1	77.4	89.8	84.8	98.0	90.0	98.0	91.5	95.8	99.1	59.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.67	05/06/2004 01:15	±0.18	35.6
Lowest Astronomical Tide (LAT)	-0.20	18/08/2009 15:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Tyndale

MHL2786

Figure
A61

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Clarence River at The Avenue Downstream

RECORDING STATION: **Clarence River at The Avenue Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204476

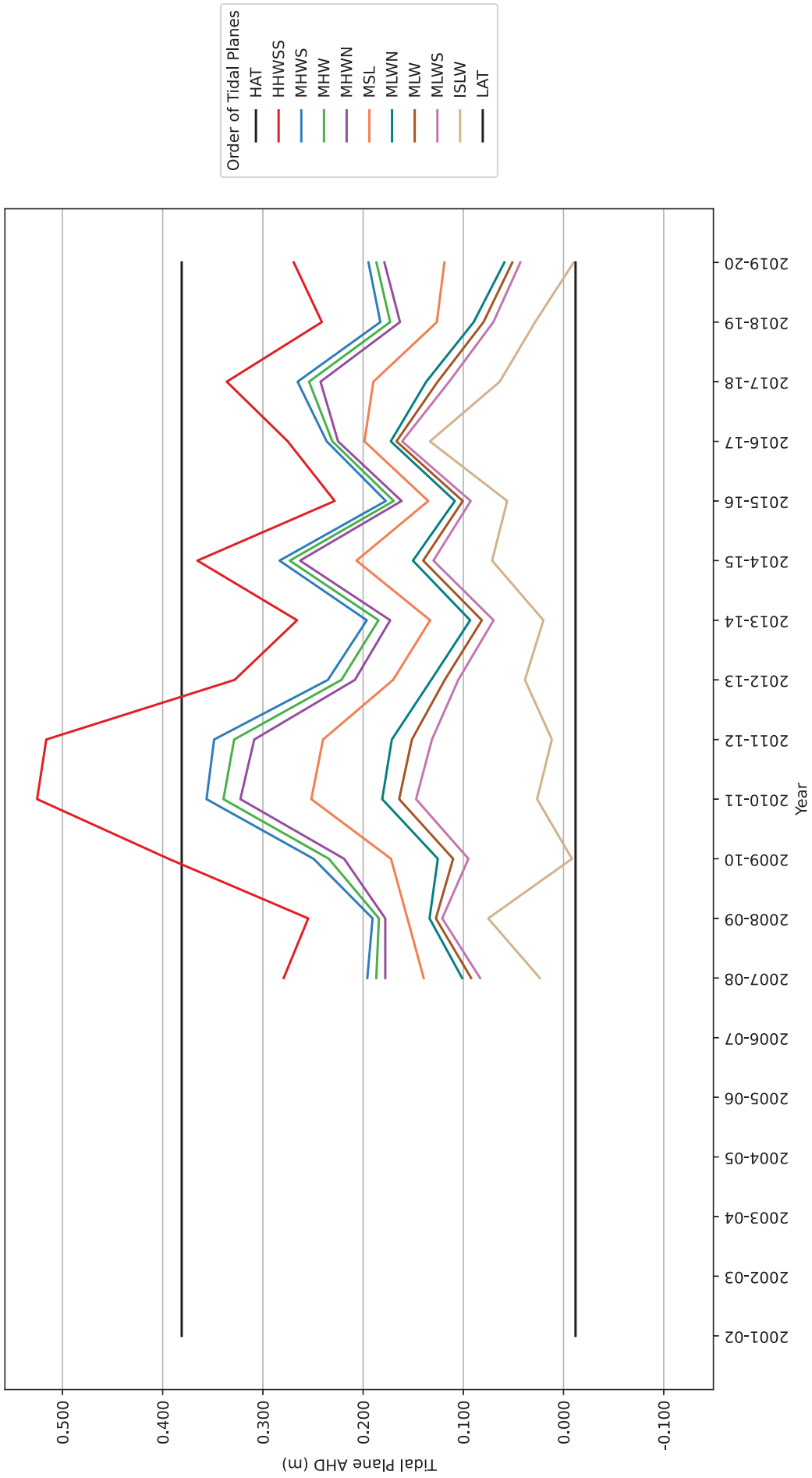
ZONE: 56
EASTING: 507174
NORTHING: 6714140

YEAR	2001-02*	2002-03*	2003-04	2004-05*	2005-06	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			0.228		0.162		0.279	0.255	0.394	0.525	0.516	0.328	0.266	0.365	0.228	0.275	0.336	0.241	0.269	0.311	0.103
MHWS			0.138		0.101		0.196	0.191	0.249	0.356	0.349	0.235	0.196	0.283	0.177	0.236	0.265	0.183	0.195	0.223	0.070
MHW			0.123		0.091		0.187	0.184	0.234	0.339	0.329	0.222	0.185	0.273	0.169	0.231	0.254	0.173	0.187	0.212	0.068
MHWN			0.107		0.081		0.178	0.178	0.219	0.322	0.309	0.208	0.173	0.263	0.162	0.225	0.243	0.163	0.179	0.201	0.066
MSL			0.042		0.044		0.140	0.156	0.172	0.252	0.240	0.170	0.133	0.207	0.135	0.199	0.190	0.126	0.119	0.155	0.060
MLWN			-0.023		0.008		0.101	0.134	0.125	0.181	0.171	0.132	0.093	0.150	0.108	0.172	0.137	0.090	0.059	0.109	0.058
MLW			-0.038		-0.002		0.092	0.127	0.110	0.164	0.151	0.119	0.081	0.140	0.101	0.167	0.126	0.080	0.051	0.098	0.058
MLWS			-0.053		-0.012		0.083	0.121	0.095	0.147	0.131	0.105	0.070	0.130	0.093	0.161	0.114	0.070	0.043	0.086	0.058
ISLW			-0.117		-0.056		0.024	0.075	-0.008	0.026	0.012	0.039	0.020	0.071	0.056	0.133	0.064	0.028	-0.010	0.024	0.059
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.130		0.073		0.077	0.044	0.094	0.142	0.137	0.076	0.080	0.113	0.053	0.053	0.106	0.074	0.120	0.091	0.032
MR			0.161		0.093		0.095	0.057	0.124	0.175	0.177	0.103	0.103	0.133	0.069	0.064	0.128	0.093	0.136	0.114	0.038
MSR			0.191		0.113		0.113	0.069	0.155	0.209	0.217	0.130	0.127	0.154	0.085	0.075	0.151	0.113	0.152	0.137	0.045
R			0.345		0.218		0.256	0.180	0.403	0.499	0.505	0.290	0.246	0.294	0.172	0.142	0.272	0.213	0.279	0.288	0.110
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.080		0.047		0.047	0.028	0.062	0.088	0.089	0.052	0.052	0.067	0.034	0.032	0.064	0.047	0.068	0.057	0.019
S2			0.015		0.010		0.009	0.006	0.015	0.017	0.020	0.013	0.012	0.010	0.008	0.006	0.011	0.010	0.008	0.011	0.004
K1			0.040		0.027		0.033	0.026	0.051	0.065	0.062	0.035	0.030	0.032	0.021	0.016	0.031	0.026	0.034	0.035	0.014
O1			0.024		0.017		0.027	0.020	0.052	0.056	0.057	0.031	0.019	0.027	0.016	0.011	0.019	0.016	0.020	0.028	0.015
MSF			0.022		0.002		0.013	0.019	0.033	0.032	0.031	0.015	0.003	0.018	0.003	0.018	0.006	0.012	0.009	0.016	0.011
z0			0.042		0.044		0.140	0.156	0.172	0.252	0.240	0.170	0.133	0.207	0.135	0.199	0.190	0.126	0.119	0.155	0.060
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			153.604		161.153		173.219	186.980	164.651	142.379	148.634	159.805	169.876	163.759	189.147	178.901	176.028	189.526	156.124	167.586	14.651
S2			52.401		78.799		69.990	83.345	62.268	42.241	64.358	67.200	89.335	69.196	114.485	80.220	98.884	110.519	59.096	76.156	20.563
K1			267.822		268.560		271.412	283.875	248.302	237.735	234.923	247.051	260.848	254.035	269.430	271.950	272.339	289.031	267.793	263.007	15.702
O1			324.555		325.444		328.063	333.672	325.011	312.431	317.823	341.269	357.798	343.583	351.293	358.622	338.774	346.538	330.692	335.704	14.064
MSF			290.804		134.886		317.335	79.493	265.733	261.201	274.123	16.171	330.357	333.945	319.074	303.542	51.574	347.653	284.671	240.704	111.519
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.129		0.116		0.105	0.131	0.127	0.100	0.102	0.149	0.099	0.125	0.065	0.098	0.093	0.074	0.096		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
			73.4	0.0	94.8	0.0	86.1	79.0	69.9	60.2	83.4	81.7	78.3	77.8	94.9	73.1	95.9	92.9	85.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.38	09/05/2004 05:45	±0.24	93.6
Lowest Astronomical Tide (LAT)	-0.01	10/10/2005 12:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at The Avenue Downstream

MHL2786

Figure
A62

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Brushgrove

RECORDING STATION: **Clarence River at Brushgrove**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204406

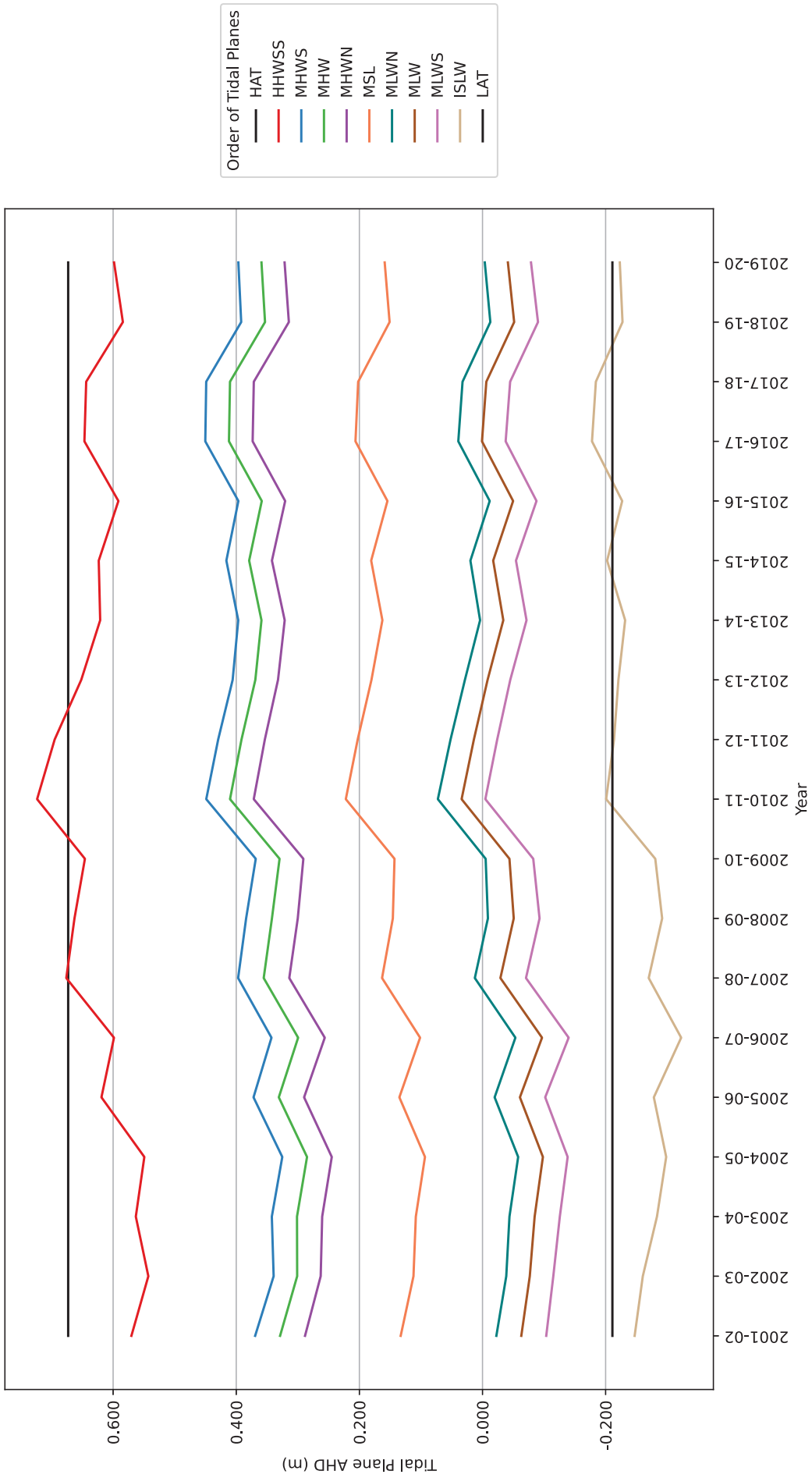
ZONE: 56
EASTING: 507508
NORTHING: 6729089

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.570	0.543	0.563	0.549	0.619	0.599	0.676	0.663	0.646	0.723	0.695	0.652	0.621	0.623	0.591	0.647	0.644	0.584	0.598	0.621	0.049
MHWS	0.369	0.339	0.342	0.325	0.372	0.343	0.397	0.384	0.368	0.449	0.429	0.406	0.397	0.416	0.397	0.450	0.449	0.392	0.397	0.391	0.038
MHW	0.329	0.301	0.301	0.285	0.331	0.299	0.355	0.342	0.330	0.410	0.391	0.369	0.359	0.379	0.359	0.412	0.410	0.353	0.359	0.351	0.039
MHWN	0.288	0.263	0.260	0.245	0.290	0.256	0.314	0.300	0.291	0.372	0.354	0.332	0.321	0.342	0.321	0.373	0.371	0.315	0.321	0.312	0.040
MSL	0.133	0.112	0.108	0.093	0.135	0.101	0.163	0.146	0.143	0.222	0.203	0.180	0.163	0.181	0.154	0.206	0.202	0.151	0.159	0.156	0.037
MLWN	-0.023	-0.039	-0.044	-0.058	-0.020	-0.053	0.012	-0.009	-0.005	0.073	0.052	0.029	0.004	0.020	-0.012	0.039	0.032	-0.013	-0.004	-0.001	0.036
MLW	-0.063	-0.077	-0.085	-0.098	-0.061	-0.097	-0.029	-0.051	-0.044	0.034	0.014	-0.008	-0.034	-0.017	-0.050	0.001	-0.006	-0.051	-0.041	-0.040	0.037
MLWS	-0.104	-0.115	-0.126	-0.138	-0.102	-0.140	-0.071	-0.093	-0.082	-0.005	-0.024	-0.045	-0.072	-0.054	-0.088	-0.038	-0.045	-0.090	-0.079	-0.079	0.038
ISLW	-0.247	-0.260	-0.283	-0.298	-0.278	-0.323	-0.270	-0.292	-0.281	-0.201	-0.214	-0.221	-0.232	-0.202	-0.227	-0.178	-0.184	-0.227	-0.223	-0.244	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.311	0.301	0.304	0.303	0.309	0.310	0.301	0.309	0.296	0.299	0.302	0.304	0.317	0.322	0.332	0.334	0.339	0.327	0.325	0.313	0.013
MR	0.392	0.378	0.386	0.383	0.392	0.396	0.384	0.393	0.373	0.376	0.377	0.377	0.393	0.396	0.408	0.411	0.416	0.405	0.400	0.391	0.013
MSR	0.473	0.454	0.468	0.464	0.474	0.483	0.468	0.477	0.451	0.453	0.453	0.451	0.468	0.470	0.484	0.488	0.494	0.482	0.475	0.470	0.013
R	0.817	0.803	0.847	0.848	0.897	0.921	0.946	0.955	0.926	0.924	0.909	0.873	0.853	0.826	0.818	0.824	0.828	0.812	0.821	0.866	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.196	0.189	0.193	0.192	0.196	0.198	0.192	0.196	0.187	0.188	0.189	0.189	0.196	0.198	0.204	0.205	0.208	0.202	0.200	0.196	0.006
S2	0.041	0.038	0.041	0.040	0.041	0.043	0.042	0.042	0.039	0.039	0.038	0.037	0.038	0.037	0.038	0.038	0.039	0.039	0.038	0.039	0.002
K1	0.085	0.085	0.092	0.093	0.101	0.104	0.112	0.111	0.109	0.110	0.104	0.101	0.095	0.088	0.083	0.085	0.085	0.082	0.085	0.095	0.011
O1	0.059	0.061	0.066	0.067	0.075	0.079	0.088	0.088	0.089	0.086	0.085	0.074	0.065	0.060	0.056	0.056	0.055	0.055	0.059	0.070	0.013
MSF	0.034	0.019	0.025	0.025	0.008	0.004	0.041	0.008	0.019	0.027	0.037	0.020	0.025	0.026	0.025	0.030	0.015	0.026	0.025	0.023	0.009
z0	0.133	0.112	0.108	0.093	0.135	0.101	0.163	0.146	0.143	0.222	0.203	0.180	0.163	0.181	0.154	0.206	0.202	0.151	0.159	0.156	0.037
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	97.088	98.684	100.727	101.001	101.695	97.614	98.731	94.955	96.108	96.058	94.691	94.045	92.863	94.868	91.563	96.152	97.092	97.693	99.085	96.880	2.734
S2	2.317	3.409	5.041	3.916	6.908	2.628	3.490	3.115	4.308	5.067	6.141	6.495	6.174	6.659	3.099	6.958	7.692	7.288	6.949	5.140	1.788
K1	220.478	223.019	221.962	222.754	221.242	216.500	215.367	213.138	210.729	206.305	204.685	203.550	200.648	204.156	203.690	209.743	213.540	217.726	219.470	213.090	7.522
O1	273.219	273.821	271.241	272.674	271.879	272.448	274.516	277.133	283.572	287.690	291.101	294.782	297.904	294.838	290.002	283.928	280.108	277.797	274.825	281.236	8.970
MSF	300.908	317.035	313.761	291.886	319.574	248.060	291.799	268.295	273.566	270.679	277.821	288.548	280.315	338.190	311.154	293.141	302.625	281.911	274.604	291.783	21.851
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.105	0.077	0.086	0.084	0.094	0.071	0.106	0.087	0.082	0.090	0.117	0.079	0.096	0.077	0.078	0.075	0.082	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.4	97.7	98.5	99.7	96.1	99.5	87.7	82.1	96.4	71.5	87.2	83.5	98.8	90.0	98.0	90.1	95.4	98.6	93.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.67	05/06/2004 01:00	±0.18	34.1
Lowest Astronomical Tide (LAT)	-0.21	25/11/2007 05:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Brushgrove

MHL2786

Figure
A63

RECORDING STATION: **Clarence River at Ulmarra**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204480

ZONE: 56
EASTING: 502596
NORTHING: 6722105

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

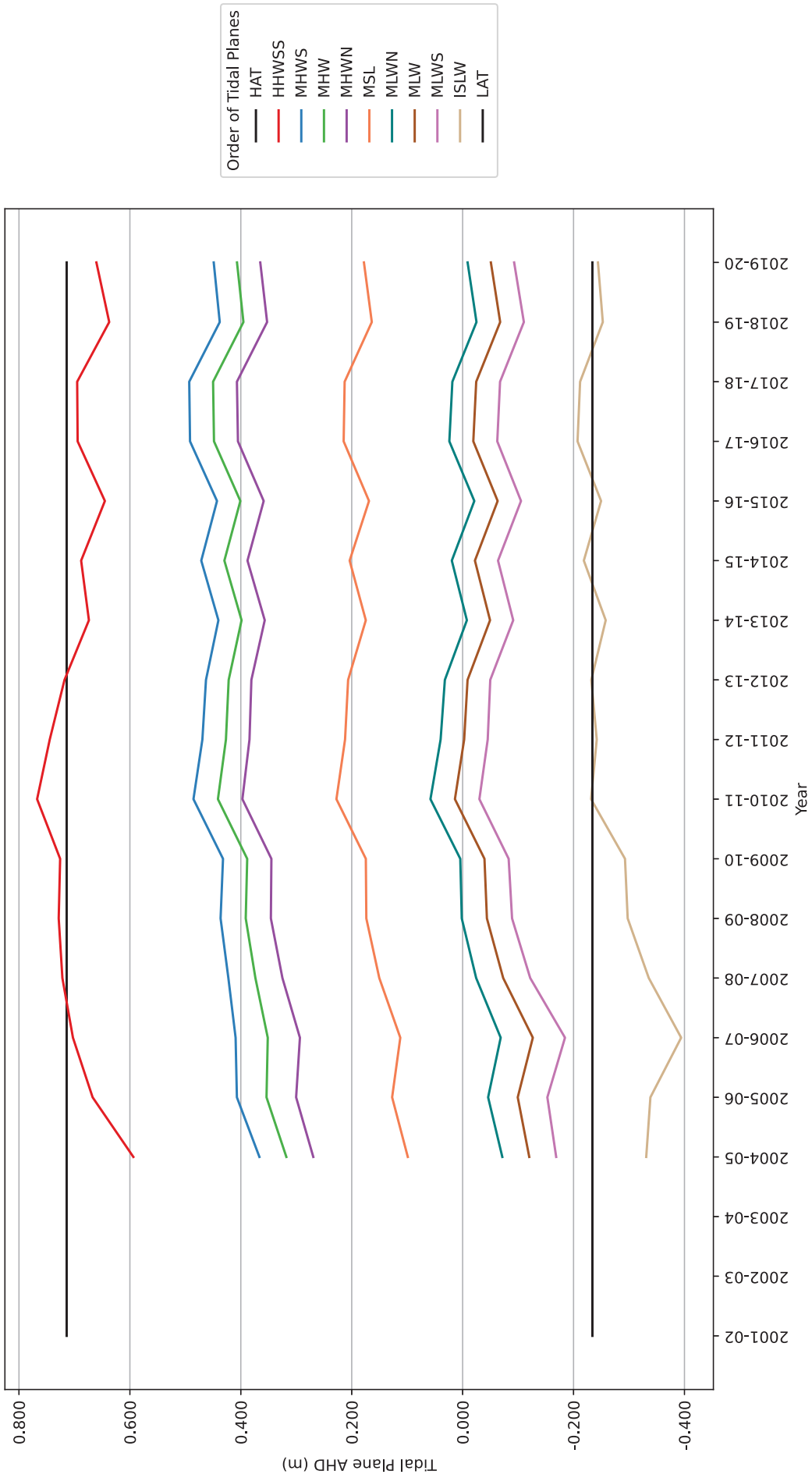
Clarence River at Ulmarra

YEAR	2001-02*	2002-03	2003-04*	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.594		0.594	0.667	0.703	0.722	0.728	0.726	0.767	0.744	0.718	0.674	0.688	0.645	0.694	0.695	0.637	0.660	0.686	0.049
MHWS		0.382		0.366	0.407	0.409	0.422	0.436	0.432	0.485	0.469	0.463	0.440	0.471	0.443	0.492	0.493	0.438	0.449	0.441	0.036
MHW		0.335		0.318	0.354	0.351	0.374	0.391	0.388	0.441	0.427	0.422	0.399	0.430	0.401	0.448	0.450	0.395	0.407	0.396	0.039
MHWN		0.287		0.269	0.300	0.293	0.325	0.346	0.345	0.397	0.384	0.381	0.357	0.388	0.359	0.405	0.407	0.353	0.365	0.351	0.043
MSL		0.118		0.099	0.127	0.112	0.150	0.174	0.175	0.228	0.212	0.206	0.175	0.204	0.169	0.215	0.213	0.164	0.178	0.172	0.039
MLWN		-0.051		-0.072	-0.046	-0.069	-0.024	0.002	0.004	0.058	0.040	0.032	-0.008	0.020	-0.021	0.024	0.019	-0.025	-0.009	-0.007	0.038
MLW		-0.099		-0.120	-0.099	-0.127	-0.073	-0.044	-0.039	0.014	-0.003	-0.009	-0.049	-0.022	-0.063	-0.019	-0.024	-0.068	-0.051	-0.053	0.041
MLWS		-0.147		-0.169	-0.153	-0.185	-0.122	-0.089	-0.083	-0.030	-0.045	-0.050	-0.091	-0.064	-0.105	-0.062	-0.067	-0.110	-0.093	-0.098	0.045
ISLW		-0.298		-0.331	-0.339	-0.394	-0.336	-0.298	-0.293	-0.232	-0.242	-0.232	-0.258	-0.219	-0.250	-0.207	-0.212	-0.253	-0.244	-0.273	0.053
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.338		0.341	0.346	0.362	0.349	0.344	0.341	0.339	0.345	0.349	0.364	0.368	0.380	0.381	0.388	0.378	0.374	0.358	0.017
MR		0.434		0.438	0.453	0.478	0.447	0.435	0.428	0.427	0.430	0.431	0.448	0.452	0.464	0.468	0.474	0.463	0.458	0.449	0.017
MSR		0.529		0.535	0.560	0.594	0.544	0.526	0.515	0.516	0.515	0.513	0.532	0.535	0.548	0.554	0.560	0.548	0.542	0.539	0.021
R		0.891		0.925	1.006	1.097	1.057	1.026	1.019	0.999	0.986	0.950	0.932	0.906	0.895	0.901	0.907	0.890	0.904	0.958	0.065
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.217		0.219	0.227	0.239	0.223	0.217	0.214	0.214	0.215	0.215	0.224	0.226	0.232	0.234	0.237	0.231	0.229	0.224	0.008
S2		0.048		0.049	0.053	0.058	0.049	0.045	0.044	0.044	0.042	0.041	0.042	0.042	0.042	0.043	0.043	0.043	0.042	0.045	0.005
K1		0.087		0.093	0.109	0.123	0.123	0.116	0.117	0.112	0.109	0.104	0.099	0.092	0.087	0.088	0.087	0.085	0.090	0.101	0.014
O1		0.063		0.069	0.077	0.086	0.091	0.093	0.092	0.089	0.088	0.078	0.068	0.063	0.057	0.057	0.057	0.057	0.061	0.073	0.014
MSF		0.015		0.028	0.026	0.016	0.043	0.023	0.021	0.031	0.040	0.020	0.025	0.025	0.024	0.028	0.015	0.025	0.025	0.025	0.008
z0		0.118		0.099	0.127	0.112	0.150	0.174	0.175	0.228	0.212	0.206	0.175	0.204	0.169	0.215	0.213	0.164	0.178	0.172	0.039
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		106.582		107.836	107.814	104.580	105.129	102.805	103.560	103.038	102.455	101.769	100.769	102.543	99.467	103.813	104.542	105.116	106.796	104.036	2.371
S2		24.978		25.516	25.492	19.630	17.791	17.929	18.928	17.359	19.477	17.412	17.552	18.419	14.121	18.242	17.817	17.329	18.285	19.193	3.159
K1		231.640		225.139	213.776	215.910	217.096	213.894	213.007	210.014	206.017	206.543	203.455	206.414	206.644	212.053	216.110	219.885	222.144	214.102	7.569
O1		275.895		274.296	276.166	275.886	276.471	280.283	284.789	291.472	294.417	296.979	300.382	297.934	292.953	287.266	282.513	280.068	277.469	285.014	8.969
MSF		303.107		288.779	331.554	144.571	280.606	202.946	298.225	271.491	280.997	292.315	278.653	340.250	308.762	289.606	302.393	281.579	277.582	280.789	45.522
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.109		0.084	0.071	0.096	0.072	0.101	0.089	0.092	0.097	0.116	0.078	0.095	0.078	0.080	0.077	0.083	0.081		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		78.0	47.8	99.5	63.7	56.7	68.0	69.0	81.3	75.2	87.2	86.3	99.0	89.9	98.3	90.3	94.4	99.0	93.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.71	05/06/2004 01:30	±0.20	35.9
Lowest Astronomical Tide (LAT)	-0.23	13/12/2008 05:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Sep 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Ulmarra

MHL2786

Figure
A64

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Grafton

RECORDING STATION: **Clarence River at Grafton**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204400

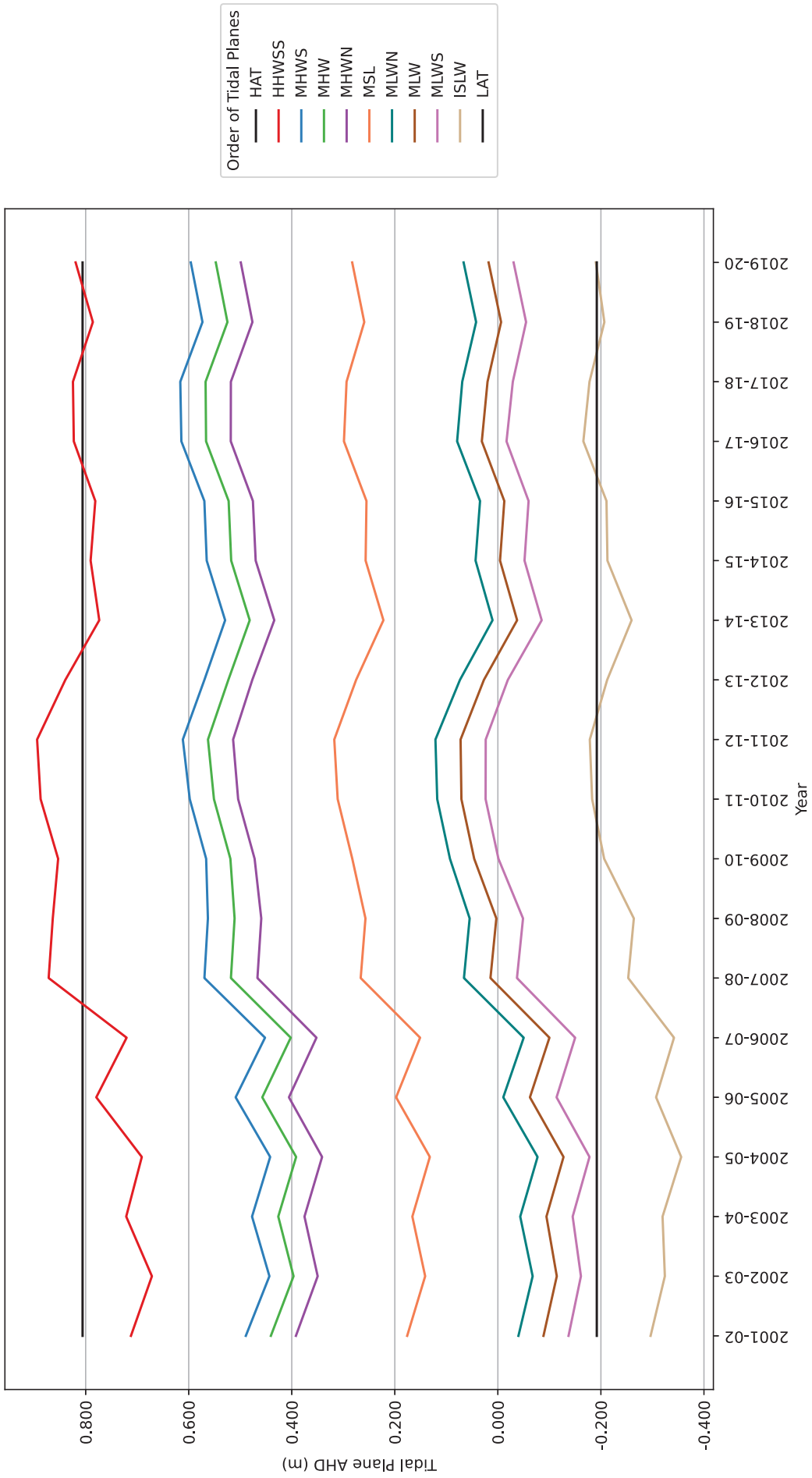
ZONE: 56
EASTING: 493388
NORTHING: 6715141

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.712	0.671	0.721	0.691	0.779	0.721	0.872	0.864	0.853	0.887	0.894	0.839	0.774	0.790	0.781	0.823	0.825	0.786	0.820	0.795	0.067
MHWS	0.489	0.443	0.477	0.442	0.509	0.452	0.570	0.563	0.566	0.598	0.611	0.570	0.529	0.565	0.570	0.614	0.616	0.573	0.596	0.545	0.059
MHW	0.441	0.397	0.426	0.392	0.457	0.402	0.518	0.511	0.519	0.551	0.563	0.523	0.482	0.518	0.523	0.566	0.567	0.525	0.547	0.496	0.059
MHWN	0.392	0.350	0.375	0.341	0.405	0.352	0.467	0.459	0.472	0.504	0.514	0.477	0.434	0.470	0.475	0.518	0.518	0.476	0.499	0.447	0.060
MSL	0.176	0.141	0.166	0.132	0.197	0.151	0.266	0.257	0.283	0.311	0.317	0.275	0.222	0.257	0.255	0.299	0.294	0.259	0.283	0.239	0.060
MLWN	-0.040	-0.068	-0.043	-0.077	-0.010	-0.050	0.066	0.055	0.093	0.118	0.121	0.074	0.010	0.043	0.035	0.079	0.069	0.042	0.066	0.031	0.062
MLW	-0.089	-0.114	-0.094	-0.127	-0.062	-0.100	0.014	0.003	0.046	0.071	0.072	0.027	-0.037	-0.004	-0.013	0.031	0.020	-0.006	0.018	-0.018	0.062
MLWS	-0.137	-0.161	-0.145	-0.178	-0.114	-0.150	-0.037	-0.049	-0.001	0.024	0.024	-0.019	-0.085	-0.052	-0.060	-0.017	-0.029	-0.055	-0.031	-0.067	0.063
ISLW	-0.296	-0.324	-0.320	-0.356	-0.307	-0.342	-0.253	-0.264	-0.206	-0.183	-0.178	-0.212	-0.260	-0.213	-0.211	-0.166	-0.178	-0.207	-0.190	-0.246	0.062
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.432	0.417	0.419	0.418	0.416	0.402	0.401	0.404	0.379	0.386	0.393	0.403	0.424	0.427	0.441	0.439	0.449	0.434	0.432	0.417	0.019
MR	0.529	0.511	0.520	0.519	0.519	0.502	0.504	0.508	0.473	0.480	0.490	0.496	0.519	0.522	0.535	0.535	0.547	0.531	0.529	0.514	0.020
MSR	0.626	0.605	0.622	0.620	0.623	0.602	0.607	0.612	0.567	0.574	0.588	0.589	0.614	0.617	0.629	0.631	0.645	0.628	0.626	0.612	0.020
R	1.009	0.996	1.041	1.047	1.086	1.062	1.125	1.128	1.060	1.070	1.073	1.052	1.033	1.003	0.992	0.989	1.003	0.993	1.010	1.041	0.043
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.265	0.255	0.260	0.259	0.260	0.251	0.252	0.254	0.237	0.240	0.245	0.248	0.260	0.261	0.268	0.268	0.274	0.266	0.265	0.257	0.010
S2	0.049	0.047	0.051	0.050	0.052	0.050	0.051	0.052	0.047	0.047	0.049	0.046	0.048	0.048	0.047	0.048	0.049	0.048	0.049	0.049	0.002
K1	0.095	0.097	0.103	0.105	0.112	0.109	0.122	0.123	0.114	0.117	0.115	0.110	0.104	0.097	0.091	0.091	0.091	0.092	0.097	0.105	0.011
O1	0.064	0.066	0.071	0.073	0.081	0.083	0.094	0.092	0.091	0.089	0.087	0.083	0.070	0.064	0.060	0.058	0.057	0.060	0.063	0.074	0.013
MSF	0.034	0.017	0.026	0.028	0.009	0.008	0.039	0.015	0.020	0.033	0.046	0.020	0.025	0.025	0.031	0.032	0.014	0.017	0.021	0.024	0.010
z0	0.176	0.141	0.166	0.132	0.197	0.151	0.266	0.257	0.283	0.311	0.317	0.275	0.222	0.257	0.255	0.299	0.294	0.259	0.283	0.239	0.060
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	114.844	116.548	117.337	117.237	116.849	113.192	115.400	112.598	116.740	114.062	111.784	111.391	110.558	112.135	109.523	113.704	114.474	114.723	116.655	114.198	2.395
S2	27.783	31.913	29.979	29.149	30.651	26.668	28.349	28.736	36.172	31.357	30.547	32.502	31.186	31.041	27.681	31.545	31.005	29.994	33.016	30.488	2.205
K1	227.703	229.323	228.859	229.223	226.313	221.732	222.497	220.446	219.163	216.540	212.527	210.250	208.110	210.432	211.287	217.173	220.479	221.544	226.084	219.984	6.989
O1	279.480	279.778	276.965	277.889	276.891	274.840	281.004	284.735	291.519	295.992	297.136	300.722	303.805	301.404	297.074	291.307	286.305	284.175	281.705	287.512	9.479
MSF	302.659	297.952	312.875	291.534	292.285	239.756	290.067	269.804	272.867	272.176	288.717	304.224	277.709	340.622	324.705	293.687	286.292	274.969	291.315	290.748	21.940
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.104	0.081	0.090	0.092	0.084	0.070	0.098	0.092	0.087	0.093	0.107	0.081	0.097	0.075	0.077	0.074	0.087	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	99.2	98.2	99.2	99.8	96.6	94.3	87.0	80.4	71.3	59.8	72.3	84.3	99.3	89.7	87.6	86.1	92.5	78.3	79.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.81	06/06/2004 02:45	±0.20	38.1
Lowest Astronomical Tide (LAT)	-0.19	13/12/2008 06:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Grafton

MHL2786

Figure A65

RECORDING STATION: **Clarence River at Rogans Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204414

ZONE: 56
EASTING: 488813
NORTHING: 6723401

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clarence River at Rogans Bridge

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.730	0.702	0.725	0.687	0.773	0.731	0.811	0.821	0.830	0.877	0.873	0.804	0.764	0.786	0.733	0.787	0.802		0.750	0.777	0.054
MHWS	0.500	0.466	0.474	0.432	0.496	0.449	0.506	0.507	0.516	0.588	0.582	0.536	0.513	0.556	0.515	0.572	0.587		0.523	0.518	0.046
MHW	0.445	0.414	0.418	0.376	0.440	0.391	0.450	0.447	0.463	0.535	0.529	0.482	0.459	0.502	0.462	0.518	0.531		0.472	0.463	0.047
MHWN	0.391	0.362	0.363	0.319	0.383	0.332	0.393	0.388	0.409	0.482	0.475	0.429	0.404	0.447	0.410	0.464	0.475		0.420	0.408	0.048
MSL	0.152	0.132	0.132	0.090	0.158	0.107	0.180	0.162	0.195	0.276	0.258	0.205	0.164	0.210	0.159	0.215	0.224		0.174	0.177	0.049
MLWN	-0.086	-0.099	-0.099	-0.140	-0.067	-0.119	-0.032	-0.065	-0.020	0.071	0.042	-0.018	-0.075	-0.028	-0.091	-0.034	-0.027		-0.071	-0.053	0.053
MLW	-0.141	-0.151	-0.155	-0.197	-0.124	-0.177	-0.089	-0.124	-0.073	0.018	-0.012	-0.072	-0.130	-0.083	-0.144	-0.088	-0.083		-0.123	-0.108	0.054
MLWS	-0.196	-0.203	-0.210	-0.253	-0.180	-0.235	-0.145	-0.183	-0.126	-0.035	-0.065	-0.125	-0.184	-0.137	-0.197	-0.143	-0.139		-0.174	-0.163	0.055
ISLW	-0.360	-0.372	-0.389	-0.435	-0.378	-0.437	-0.363	-0.408	-0.350	-0.241	-0.273	-0.317	-0.363	-0.301	-0.352	-0.296	-0.293		-0.336	-0.348	0.054
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.477	0.461	0.462	0.460	0.451	0.451	0.425	0.453	0.429	0.412	0.433	0.447	0.479	0.475	0.501	0.498	0.503		0.491	0.462	0.027
MR	0.586	0.565	0.573	0.573	0.563	0.568	0.538	0.571	0.535	0.517	0.540	0.554	0.588	0.584	0.606	0.607	0.614		0.594	0.571	0.027
MSR	0.696	0.669	0.684	0.686	0.676	0.684	0.651	0.690	0.642	0.623	0.648	0.661	0.698	0.693	0.712	0.715	0.726		0.698	0.681	0.027
R	1.090	1.074	1.115	1.122	1.150	1.167	1.174	1.229	1.180	1.118	1.146	1.120	1.127	1.087	1.085	1.083	1.095		1.086	1.125	0.042
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.293	0.283	0.286	0.286	0.282	0.284	0.269	0.286	0.268	0.259	0.270	0.277	0.294	0.292	0.303	0.303	0.307		0.297	0.286	0.013
S2	0.055	0.052	0.056	0.056	0.056	0.058	0.056	0.059	0.053	0.053	0.054	0.053	0.055	0.055	0.053	0.054	0.056		0.052	0.055	0.002
K1	0.098	0.101	0.106	0.106	0.115	0.116	0.124	0.129	0.126	0.115	0.117	0.113	0.107	0.100	0.093	0.094	0.095		0.099	0.109	0.011
O1	0.067	0.067	0.073	0.075	0.083	0.086	0.094	0.096	0.098	0.091	0.090	0.079	0.072	0.064	0.062	0.059	0.059		0.063	0.077	0.013
MSF	0.040	0.026	0.029	0.032	0.011	0.009	0.039	0.018	0.024	0.032	0.030	0.019	0.029	0.019	0.026	0.032	0.019		0.029	0.026	0.009
z0	0.152	0.132	0.132	0.090	0.158	0.107	0.180	0.162	0.195	0.276	0.258	0.205	0.164	0.210	0.159	0.215	0.224		0.174	0.177	0.049
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	133.497	136.381	134.836	133.072	132.990	129.417	133.672	129.464	133.033	132.427	129.395	128.200	128.231	129.468	128.252	132.195	132.374		134.477	131.743	2.541
S2	50.629	52.955	49.207	46.874	47.631	45.300	50.251	50.037	54.833	53.985	52.815	52.046	52.033	52.471	50.867	52.808	52.131		53.051	51.107	2.536
K1	237.190	239.287	237.445	237.300	235.097	233.038	231.767	229.140	228.803	222.994	221.330	218.613	216.974	219.307	221.019	226.388	228.428		234.680	228.822	7.349
O1	287.372	288.514	284.131	285.878	284.855	285.165	287.939	290.868	298.510	302.907	304.267	307.738	310.976	308.133	304.719	298.899	293.159		287.782	295.101	9.342
MSF	295.888	300.417	313.403	294.922	323.307	263.915	291.559	265.831	280.539	272.267	278.331	334.591	288.766	328.746	319.580	301.311	285.010		262.540	294.496	22.414
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.096	0.088	0.093	0.103	0.097	0.087	0.109	0.095	0.103	0.105	0.131	0.083	0.107	0.075	0.080	0.086		0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.2	97.2	97.6	98.2	94.1	96.8	87.8	79.1	89.2	57.2	72.3	71.2	97.1	88.1	94.3	80.1	96.3	42.8	77.8		

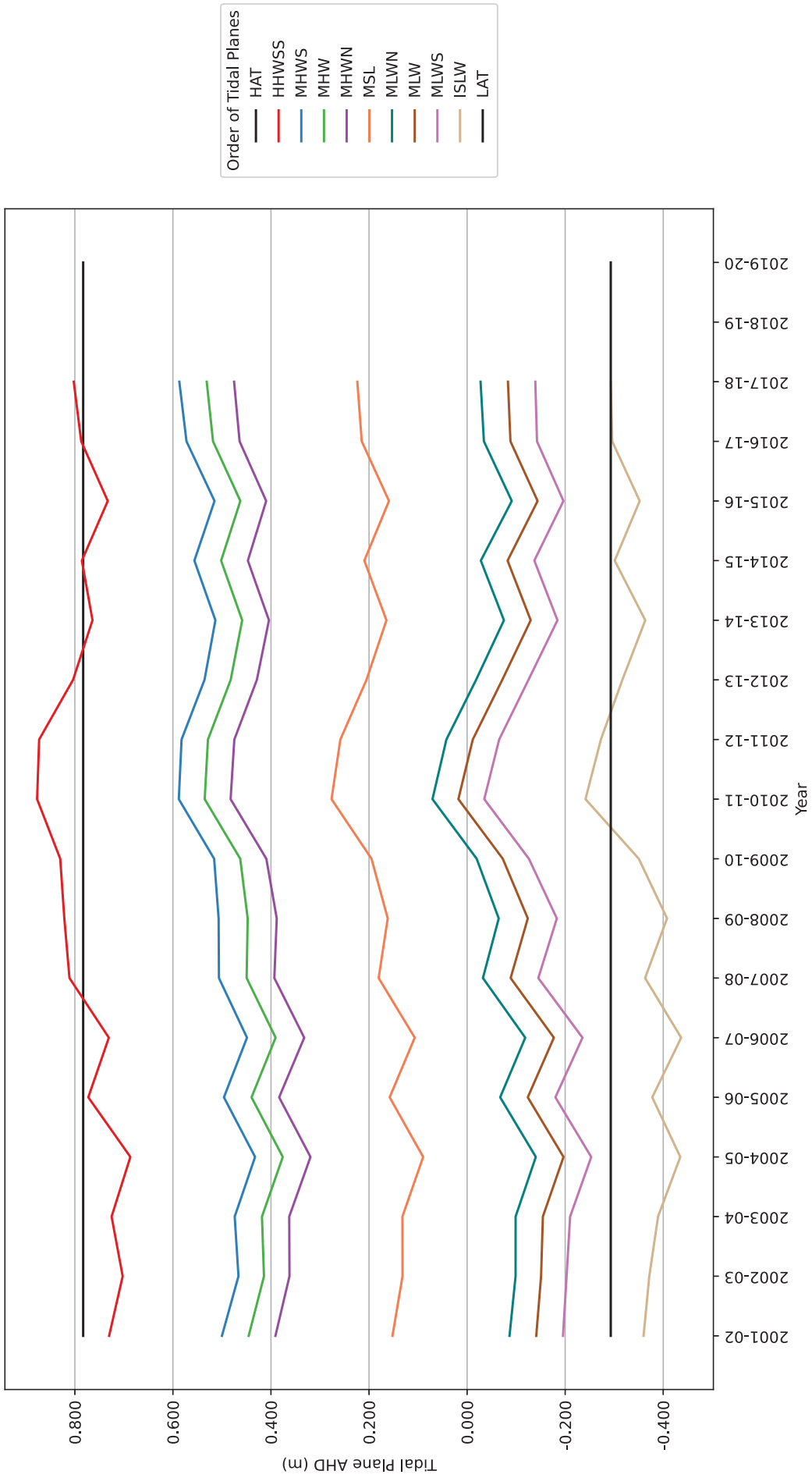
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.78	20/02/2015 14:30	±0.23	49.4
Lowest Astronomical Tide (LAT)	-0.29	25/11/2011 07:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A66

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clarence River at Rogans Bridge

MHL2786

Figure
A66

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Palmers Channel at Palmers Island Bridge

RECORDING STATION: **Palmers Channel at Palmers Island Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204426

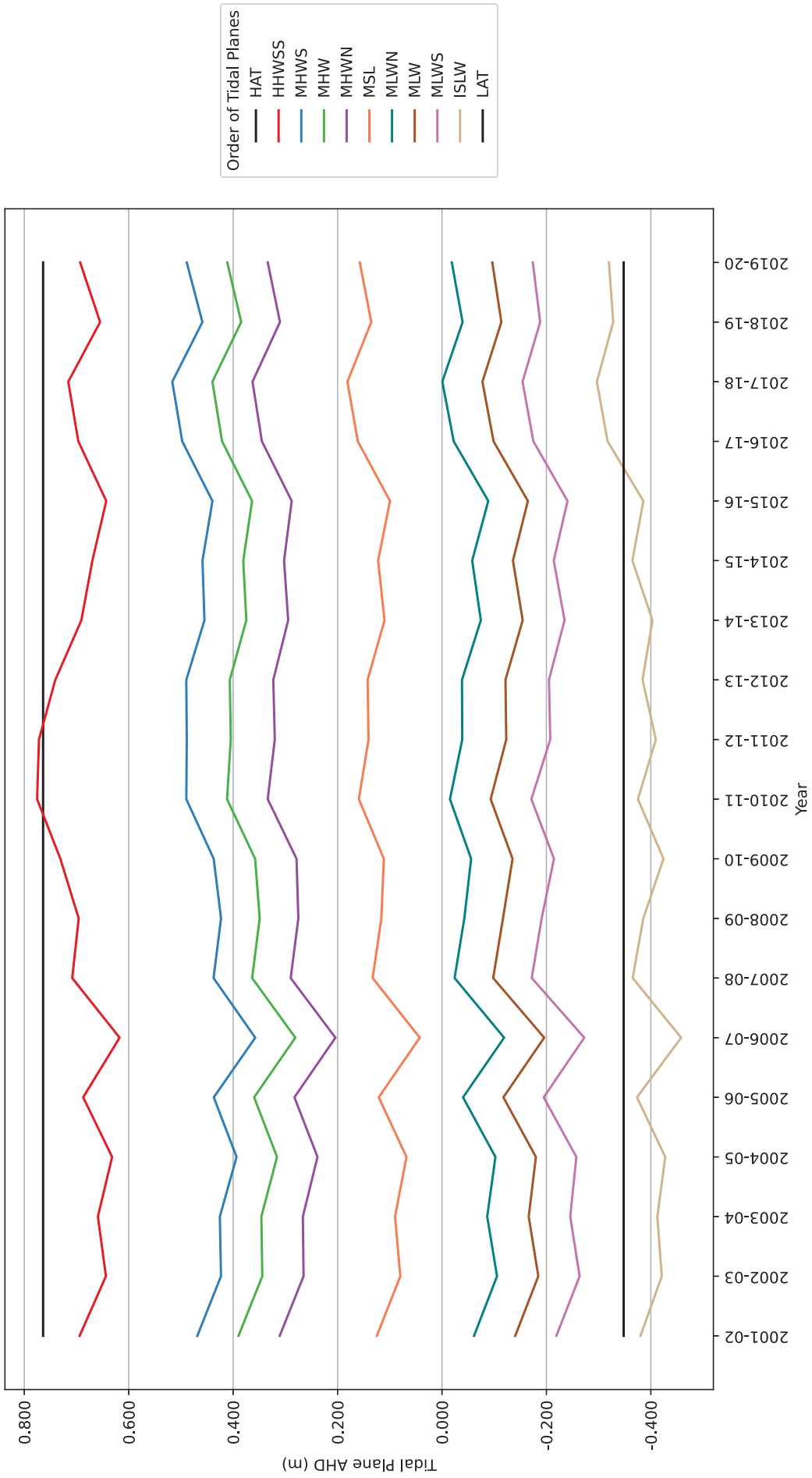
ZONE: 56
EASTING: 525780
NORTHING: 6744108

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.694	0.644	0.659	0.632	0.687	0.617	0.708	0.696	0.731	0.775	0.772	0.741	0.691	0.670	0.643	0.697	0.716	0.655	0.693	0.691	0.044
MHWS	0.469	0.423	0.425	0.393	0.437	0.358	0.438	0.423	0.437	0.490	0.489	0.490	0.455	0.459	0.440	0.497	0.517	0.459	0.489	0.452	0.039
MHW	0.390	0.344	0.346	0.316	0.360	0.281	0.364	0.349	0.358	0.412	0.405	0.406	0.375	0.381	0.364	0.421	0.440	0.385	0.411	0.374	0.039
MHWN	0.311	0.265	0.266	0.238	0.283	0.204	0.290	0.275	0.279	0.334	0.320	0.323	0.295	0.302	0.288	0.345	0.363	0.310	0.334	0.296	0.038
MSL	0.125	0.080	0.090	0.068	0.121	0.043	0.133	0.116	0.111	0.159	0.141	0.142	0.110	0.122	0.100	0.161	0.181	0.135	0.157	0.121	0.035
MLWN	-0.061	-0.105	-0.087	-0.102	-0.040	-0.119	-0.024	-0.043	-0.056	-0.015	-0.039	-0.038	-0.074	-0.058	-0.089	-0.022	-0.001	-0.039	-0.019	-0.054	0.034
MLW	-0.140	-0.185	-0.166	-0.180	-0.118	-0.196	-0.098	-0.117	-0.135	-0.093	-0.123	-0.122	-0.155	-0.136	-0.165	-0.099	-0.077	-0.114	-0.096	-0.132	0.034
MLWS	-0.219	-0.264	-0.246	-0.257	-0.195	-0.273	-0.172	-0.191	-0.214	-0.171	-0.207	-0.205	-0.235	-0.214	-0.240	-0.175	-0.154	-0.188	-0.174	-0.210	0.035
ISLW	-0.380	-0.421	-0.412	-0.428	-0.373	-0.458	-0.365	-0.386	-0.424	-0.375	-0.410	-0.384	-0.403	-0.365	-0.386	-0.317	-0.297	-0.328	-0.320	-0.381	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.372	0.371	0.353	0.341	0.323	0.323	0.314	0.318	0.334	0.349	0.359	0.361	0.369	0.360	0.376	0.367	0.364	0.350	0.352	0.350	0.020
MR	0.530	0.529	0.512	0.496	0.477	0.477	0.462	0.466	0.493	0.505	0.528	0.528	0.529	0.517	0.528	0.520	0.517	0.498	0.508	0.506	0.023
MSR	0.688	0.687	0.671	0.651	0.632	0.630	0.609	0.614	0.652	0.661	0.696	0.695	0.690	0.673	0.680	0.673	0.671	0.647	0.663	0.662	0.026
R	1.074	1.065	1.071	1.059	1.061	1.076	1.074	1.081	1.155	1.151	1.182	1.125	1.094	1.034	1.029	1.014	1.012	0.983	1.013	1.071	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.265	0.264	0.256	0.248	0.239	0.238	0.231	0.233	0.247	0.252	0.264	0.264	0.265	0.258	0.264	0.260	0.259	0.249	0.254	0.253	0.011
S2	0.079	0.079	0.080	0.078	0.077	0.077	0.074	0.074	0.079	0.078	0.084	0.083	0.080	0.078	0.076	0.076	0.077	0.074	0.078	0.078	0.003
K1	0.101	0.093	0.099	0.100	0.104	0.107	0.110	0.111	0.122	0.116	0.114	0.104	0.101	0.088	0.087	0.086	0.085	0.083	0.086	0.100	0.012
O1	0.060	0.065	0.068	0.070	0.074	0.078	0.083	0.084	0.088	0.088	0.088	0.075	0.068	0.062	0.058	0.057	0.057	0.057	0.060	0.071	0.011
MSF	0.045	0.012	0.024	0.023	0.006	0.007	0.027	0.012	0.016	0.021	0.027	0.016	0.019	0.024	0.020	0.025	0.014	0.022	0.019	0.020	0.009
z0	0.125	0.080	0.090	0.068	0.121	0.043	0.133	0.116	0.111	0.159	0.141	0.142	0.110	0.122	0.100	0.161	0.181	0.135	0.157	0.121	0.035
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	18.376	18.442	19.340	19.764	21.078	19.690	20.364	18.475	17.292	17.063	16.555	15.535	15.077	15.471	15.715	17.713	17.882	18.569	19.495	17.994	1.760
S2	285.167	281.959	283.401	284.369	285.327	285.572	285.873	285.985	285.712	284.678	285.700	285.230	284.399	283.289	284.322	283.775	283.841	283.294	283.630	284.501	1.111
K1	174.150	179.465	179.817	180.108	180.440	177.966	175.936	172.082	163.410	162.949	160.396	159.271	158.403	160.727	162.905	167.526	171.358	175.329	177.880	170.533	8.103
O1	234.416	233.567	233.025	234.663	235.018	236.523	237.833	241.556	245.882	248.980	252.467	257.193	258.769	256.450	254.038	246.631	242.493	242.202	237.508	243.643	8.785
MSF	309.170	329.637	310.197	290.667	13.270	146.907	289.762	204.491	286.818	262.199	281.461	303.170	273.616	346.963	317.758	301.150	304.669	281.612	263.303	269.306	76.381
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.099	0.078	0.086	0.080	0.087	0.063	0.093	0.095	0.088	0.073	0.106	0.079	0.097	0.080	0.089	0.075	0.088	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	55.4	97.9	99.2	95.5	94.1	90.6	93.4	77.5	74.3	81.5	92.1	86.8	98.6	90.7	98.0	91.0	91.0	96.8	90.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.76	04/06/2004 22:30	±0.18	16.9
Lowest Astronomical Tide (LAT)	-0.35	08/09/2010 15:15		

COMMENTS Station installed in Dec 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Palmers Channel at Palmers Island Bridge

MHL2786

Figure A67

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Lake Wooloweyah at Lake Wooloweyah

RECORDING STATION: **Lake Wooloweyah at Lake Wooloweyah**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 204485

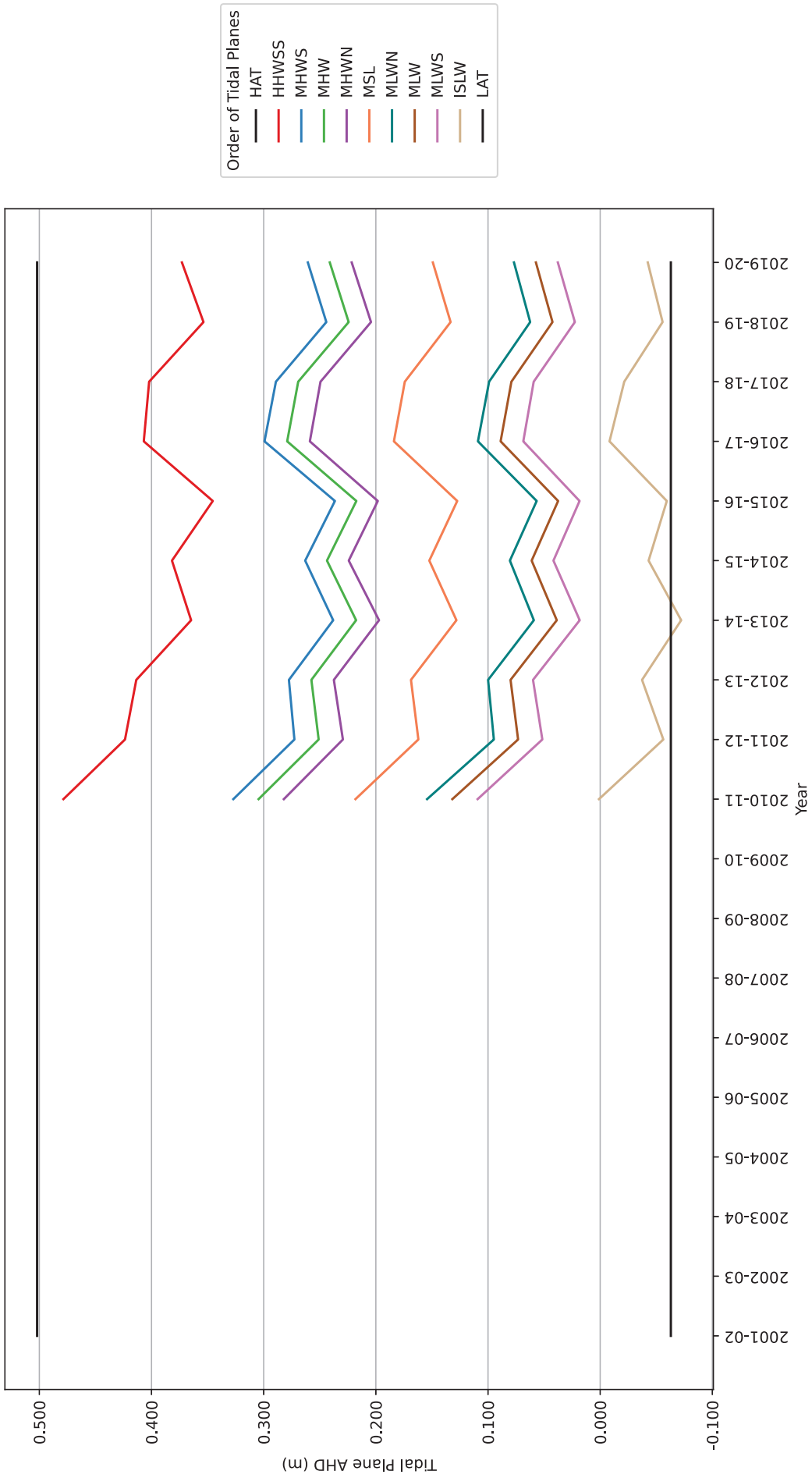
ZONE: 56
EASTING: 533141
NORTHING: 6739053

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS										0.479	0.424	0.414	0.365	0.382	0.345	0.407	0.402	0.354	0.373	0.394	0.040
MHWS										0.327	0.273	0.277	0.238	0.263	0.236	0.299	0.289	0.244	0.261	0.271	0.029
MHW										0.305	0.251	0.257	0.218	0.244	0.217	0.279	0.269	0.224	0.241	0.251	0.028
MHWN										0.282	0.229	0.237	0.197	0.224	0.198	0.259	0.249	0.204	0.222	0.230	0.028
MSL										0.218	0.162	0.169	0.128	0.152	0.127	0.184	0.174	0.133	0.149	0.160	0.028
MLWN										0.154	0.095	0.100	0.059	0.081	0.057	0.109	0.099	0.062	0.077	0.089	0.029
MLW										0.132	0.073	0.080	0.039	0.061	0.037	0.089	0.079	0.043	0.057	0.069	0.029
MLWS										0.109	0.052	0.060	0.018	0.042	0.018	0.069	0.059	0.023	0.038	0.049	0.028
ISLW										0.001	-0.056	-0.037	-0.072	-0.043	-0.059	-0.008	-0.021	-0.056	-0.042	-0.040	0.024
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR										0.128	0.135	0.138	0.138	0.144	0.142	0.150	0.150	0.142	0.145	0.141	0.007
MR										0.173	0.178	0.178	0.179	0.182	0.180	0.190	0.190	0.182	0.184	0.182	0.005
MSR										0.218	0.221	0.218	0.220	0.221	0.218	0.231	0.230	0.222	0.223	0.222	0.005
R										0.477	0.480	0.451	0.437	0.425	0.405	0.415	0.424	0.409	0.415	0.434	0.027
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2										0.086	0.089	0.089	0.089	0.091	0.090	0.095	0.095	0.091	0.092	0.091	0.003
S2										0.023	0.022	0.020	0.020	0.019	0.019	0.020	0.020	0.020	0.020	0.020	0.001
K1										0.061	0.057	0.053	0.050	0.046	0.044	0.043	0.046	0.044	0.044	0.049	0.006
O1										0.048	0.051	0.044	0.041	0.039	0.034	0.034	0.034	0.035	0.036	0.040	0.006
MSF										0.034	0.045	0.022	0.038	0.034	0.034	0.034	0.026	0.040	0.036	0.034	0.007
z0										0.218	0.162	0.169	0.128	0.152	0.127	0.184	0.174	0.133	0.149	0.160	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2										80.617	79.236	78.926	79.392	79.712	80.542	81.491	81.213	82.497	83.626	80.725	1.516
S2										349.109	348.955	348.438	345.053	351.737	346.235	346.235	348.179	346.339	342.798	347.308	2.501
K1										202.498	207.003	206.973	204.323	208.340	208.169	215.201	218.835	221.555	226.205	211.910	8.010
O1										285.879	295.576	301.664	302.790	298.183	295.307	290.218	283.989	282.921	280.677	291.720	8.072
MSF										257.785	281.333	280.177	281.292	323.772	295.712	289.454	295.478	282.880	278.040	286.592	16.886
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
										0.065	0.066	0.093	0.075	0.086	0.070	0.073	0.072	0.083	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
									36.2	53.8	95.9	90.3	99.5	94.7	98.9	96.0	96.9	99.8	95.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.50	16/06/2018 01:00	±0.16	18.4
Lowest Astronomical Tide (LAT)	-0.06	27/10/2017 09:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in June 2009.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

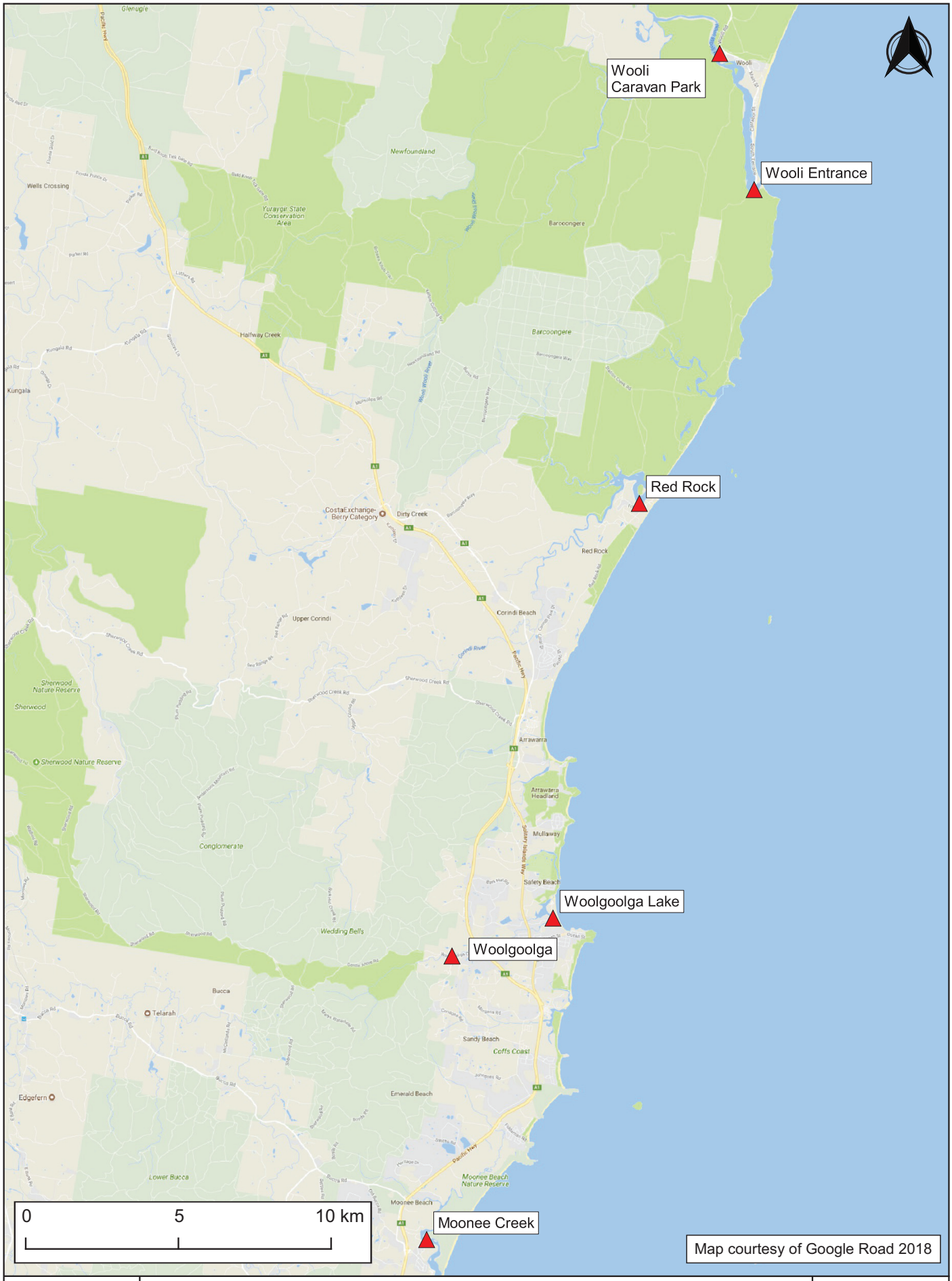


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Wooloweyah at Lake Wooloweyah

MHL2786

Figure A68



NSW GOVERNMENT

STATION LOCATIONS
WOOLGOOLGA REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A69

DRAWING A69.PDF

RECORDING STATION: **Wooli River at Wooli Entrance**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205462

ZONE: 56
EASTING: 525680
NORTHING: 6693338

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Wooli River at Wooli Entrance

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.936	0.925	0.920	0.910	0.961	0.931	0.950	0.954	0.965	0.995	1.006	0.994	0.950	0.947	0.916	0.961	0.958	0.942	0.940	0.951	0.026
MHWS	0.617	0.593	0.577	0.556	0.587	0.544	0.545	0.537	0.547	0.585	0.603	0.614	0.598	0.626	0.609	0.654	0.654	0.633	0.626	0.595	0.037
MHW	0.495	0.470	0.454	0.434	0.464	0.420	0.423	0.416	0.425	0.462	0.480	0.490	0.475	0.506	0.491	0.534	0.533	0.509	0.504	0.473	0.037
MHWN	0.373	0.348	0.331	0.312	0.340	0.296	0.300	0.296	0.304	0.340	0.356	0.366	0.352	0.386	0.373	0.413	0.412	0.386	0.383	0.351	0.038
MSL	0.024	0.002	-0.003	-0.012	0.018	-0.023	-0.004	-0.008	-0.002	0.017	0.035	0.041	0.017	0.045	0.028	0.062	0.059	0.031	0.026	0.019	0.024
MLWN	-0.324	-0.344	-0.337	-0.336	-0.304	-0.342	-0.308	-0.313	-0.307	-0.306	-0.286	-0.284	-0.317	-0.295	-0.317	-0.288	-0.294	-0.325	-0.331	-0.314	0.019
MLW	-0.446	-0.466	-0.460	-0.458	-0.427	-0.466	-0.431	-0.433	-0.428	-0.429	-0.410	-0.408	-0.440	-0.415	-0.435	-0.409	-0.415	-0.448	-0.452	-0.436	0.019
MLWS	-0.568	-0.589	-0.583	-0.580	-0.551	-0.591	-0.553	-0.553	-0.550	-0.551	-0.534	-0.531	-0.563	-0.536	-0.553	-0.530	-0.536	-0.571	-0.573	-0.558	0.020
ISLW	-0.796	-0.826	-0.829	-0.833	-0.818	-0.867	-0.842	-0.851	-0.848	-0.844	-0.821	-0.803	-0.815	-0.765	-0.773	-0.749	-0.753	-0.792	-0.798	-0.812	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.697	0.691	0.668	0.647	0.644	0.638	0.608	0.609	0.610	0.646	0.642	0.649	0.669	0.681	0.690	0.701	0.706	0.711	0.715	0.664	0.035
MR	0.941	0.936	0.914	0.892	0.891	0.886	0.853	0.849	0.854	0.891	0.890	0.897	0.915	0.921	0.926	0.943	0.948	0.957	0.957	0.909	0.034
MSR	1.185	1.182	1.161	1.136	1.138	1.135	1.099	1.090	1.097	1.136	1.137	1.145	1.162	1.162	1.162	1.185	1.190	1.204	1.199	1.153	0.034
R	1.732	1.752	1.749	1.743	1.779	1.798	1.792	1.805	1.813	1.839	1.828	1.798	1.765	1.712	1.689	1.709	1.711	1.734	1.738	1.762	0.044
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.471	0.468	0.457	0.446	0.445	0.443	0.427	0.425	0.427	0.446	0.445	0.449	0.458	0.461	0.463	0.471	0.474	0.479	0.478	0.454	0.017
S2	0.122	0.123	0.123	0.122	0.124	0.124	0.123	0.120	0.122	0.123	0.124	0.124	0.123	0.120	0.118	0.121	0.121	0.123	0.121	0.122	0.002
K1	0.146	0.151	0.157	0.158	0.166	0.169	0.175	0.182	0.180	0.179	0.177	0.170	0.160	0.147	0.142	0.141	0.142	0.142	0.143	0.159	0.015
O1	0.082	0.086	0.089	0.095	0.101	0.108	0.113	0.116	0.118	0.114	0.111	0.102	0.091	0.082	0.078	0.077	0.076	0.079	0.081	0.095	0.015
MSF	0.026	0.009	0.019	0.012	0.012	0.014	0.016	0.005	0.010	0.009	0.019	0.009	0.012	0.019	0.018	0.019	0.007	0.017	0.011	0.014	0.005
z0	0.024	0.002	-0.003	-0.012	0.018	-0.023	-0.004	-0.008	-0.002	0.017	0.035	0.041	0.017	0.045	0.028	0.062	0.059	0.031	0.026	0.019	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	355.451	355.802	356.093	357.123	356.416	355.715	357.458	357.849	359.030	353.024	351.037	351.412	351.600	351.975	352.933	353.817	354.064	355.006	355.461	354.803	2.341
S2	263.682	262.776	263.680	263.537	263.101	263.939	264.708	268.589	269.909	265.123	264.302	263.367	264.795	264.062	264.887	264.178	264.054	263.979	264.494	264.587	1.766
K1	150.042	151.079	151.835	153.036	151.082	150.243	148.181	146.216	143.582	137.973	134.237	132.718	131.768	134.488	136.468	140.504	143.255	146.485	149.664	143.834	7.256
O1	205.543	204.797	203.820	203.981	204.509	205.941	205.913	211.413	215.452	221.584	225.536	228.629	229.941	227.029	224.372	218.168	213.307	210.418	207.409	214.093	9.427
MSF	294.025	48.142	317.749	287.864	45.623	131.660	272.533	115.188	302.193	287.162	267.532	329.696	265.994	338.366	324.923	325.654	303.459	291.814	281.634	254.274	93.865
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.096	0.078	0.082	0.081	0.097	0.073	0.114	0.085	0.106	0.070	0.088	0.085	0.084	0.073	0.076	0.079	0.087	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.2	91.8	98.1	97.4	93.6	98.6	96.4	93.0	91.0	86.6	94.3	87.0	96.7	88.4	94.0	92.6	89.7	94.9	94.3		

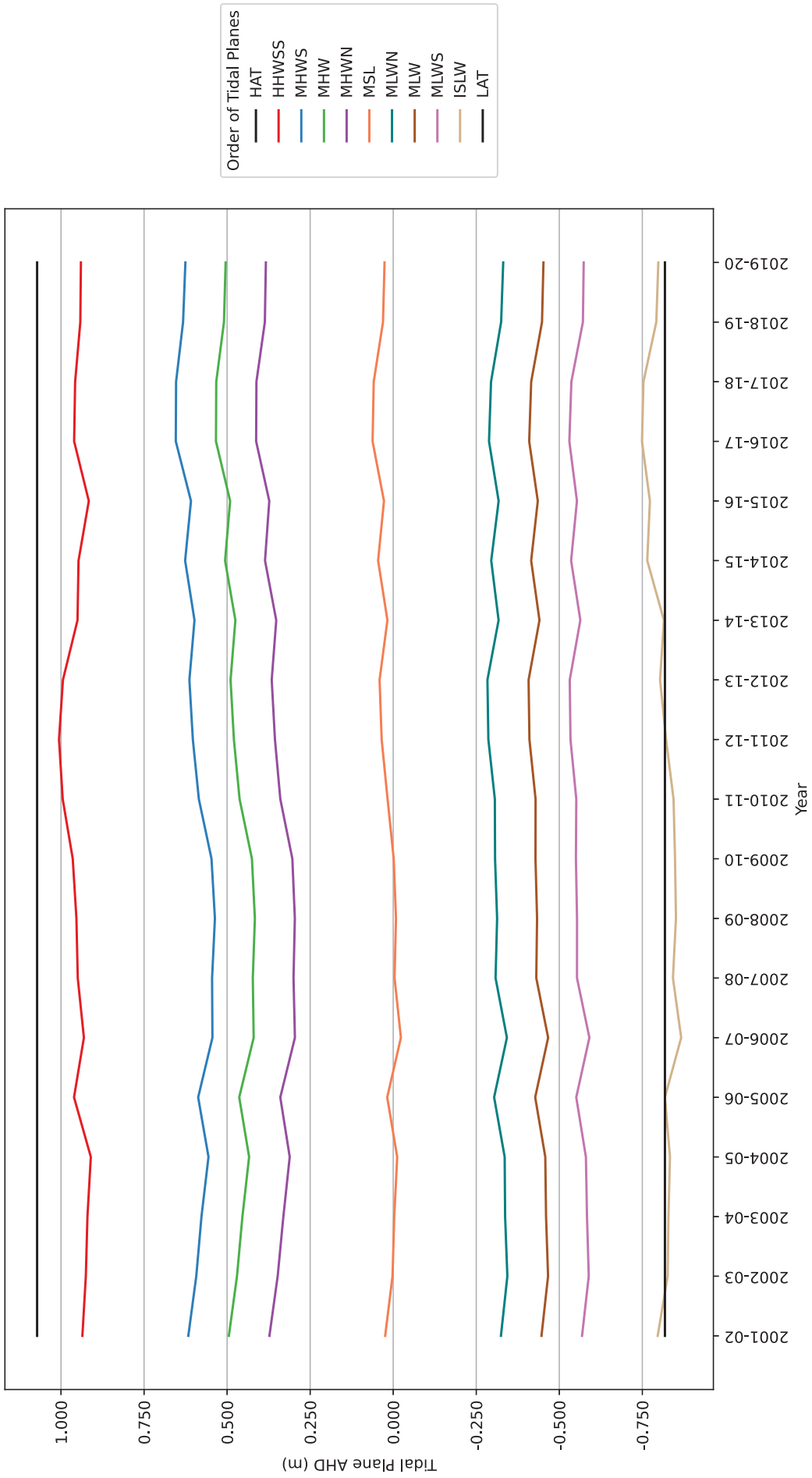
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.07	04/06/2004 21:30	±0.19	5.3
Lowest Astronomical Tide (LAT)	-0.82	27/10/2011 02:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A70

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wooli River at Wooli Entrance

MHL2786

Figure A70

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wooli River at Wooli Caravan Park

RECORDING STATION: **Wooli River at Wooli Caravan Park**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205463

ZONE: 56
EASTING: 524551
NORTHING: 6697797

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.750	0.727	0.735	0.725	0.771	0.743	0.804	0.818	0.804	0.838	0.841	0.822	0.780	0.779	0.749	0.795	0.798	0.759	0.783	0.780	0.036
MHWS	0.466	0.431	0.429	0.409	0.436	0.396	0.439	0.442	0.421	0.464	0.474	0.482	0.462	0.485	0.471	0.518	0.527	0.481	0.499	0.460	0.035
MHW	0.406	0.374	0.369	0.350	0.375	0.338	0.380	0.385	0.362	0.407	0.416	0.424	0.403	0.425	0.412	0.457	0.467	0.420	0.438	0.400	0.035
MHWN	0.346	0.316	0.309	0.291	0.315	0.279	0.321	0.328	0.304	0.349	0.357	0.366	0.344	0.366	0.354	0.396	0.406	0.359	0.378	0.341	0.034
MSL	0.132	0.101	0.102	0.091	0.114	0.082	0.125	0.131	0.106	0.147	0.157	0.160	0.132	0.151	0.135	0.172	0.181	0.132	0.148	0.131	0.027
MLWN	-0.083	-0.113	-0.105	-0.109	-0.088	-0.116	-0.072	-0.066	-0.093	-0.055	-0.044	-0.045	-0.080	-0.065	-0.085	-0.052	-0.045	-0.095	-0.082	-0.078	0.024
MLW	-0.143	-0.171	-0.165	-0.169	-0.148	-0.175	-0.131	-0.123	-0.151	-0.112	-0.102	-0.104	-0.139	-0.124	-0.143	-0.113	-0.106	-0.156	-0.142	-0.138	0.024
MLWS	-0.203	-0.229	-0.225	-0.228	-0.208	-0.233	-0.190	-0.180	-0.209	-0.170	-0.161	-0.162	-0.198	-0.183	-0.201	-0.174	-0.166	-0.217	-0.202	-0.197	0.024
ISLW	-0.405	-0.439	-0.443	-0.453	-0.448	-0.481	-0.451	-0.449	-0.483	-0.437	-0.423	-0.404	-0.425	-0.394	-0.400	-0.372	-0.360	-0.416	-0.405	-0.426	0.033
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.430	0.429	0.414	0.401	0.402	0.395	0.392	0.394	0.396	0.405	0.401	0.411	0.424	0.431	0.439	0.448	0.451	0.454	0.460	0.420	0.023
MR	0.549	0.544	0.534	0.519	0.523	0.512	0.511	0.508	0.513	0.519	0.518	0.528	0.542	0.549	0.555	0.570	0.572	0.576	0.580	0.538	0.024
MSR	0.669	0.660	0.654	0.637	0.644	0.629	0.629	0.622	0.630	0.634	0.635	0.644	0.661	0.668	0.672	0.692	0.694	0.697	0.701	0.656	0.026
R	1.155	1.166	1.179	1.178	1.219	1.224	1.255	1.267	1.287	1.275	1.265	1.226	1.205	1.173	1.149	1.167	1.158	1.175	1.188	1.206	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.275	0.272	0.267	0.259	0.262	0.256	0.255	0.254	0.257	0.260	0.259	0.264	0.271	0.275	0.278	0.285	0.286	0.288	0.290	0.269	0.012
S2	0.060	0.058	0.060	0.059	0.060	0.058	0.059	0.057	0.058	0.057	0.059	0.058	0.059	0.059	0.058	0.061	0.061	0.061	0.060	0.059	0.001
K1	0.118	0.121	0.127	0.128	0.135	0.138	0.144	0.149	0.149	0.147	0.144	0.136	0.129	0.121	0.116	0.117	0.113	0.116	0.118	0.130	0.012
O1	0.085	0.090	0.092	0.097	0.104	0.110	0.117	0.120	0.125	0.120	0.118	0.106	0.098	0.089	0.083	0.080	0.080	0.083	0.085	0.099	0.015
MSF	0.068	0.047	0.059	0.056	0.039	0.035	0.059	0.035	0.053	0.061	0.064	0.047	0.056	0.051	0.054	0.054	0.047	0.059	0.052	0.052	0.009
z0	0.132	0.101	0.102	0.091	0.114	0.082	0.125	0.131	0.106	0.147	0.157	0.160	0.132	0.151	0.135	0.172	0.181	0.132	0.148	0.131	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	37.268	38.107	38.474	39.818	38.332	38.268	37.144	36.063	32.729	33.407	32.722	32.670	32.892	32.644	33.701	33.753	34.373	34.944	34.726	35.370	2.438
S2	308.212	308.343	309.080	308.797	308.563	309.647	308.514	309.510	308.730	310.109	309.535	308.214	309.214	309.322	310.366	307.454	307.873	308.143	305.737	308.703	1.049
K1	185.703	187.403	187.289	188.383	186.203	185.197	182.696	179.813	175.961	172.872	169.333	166.371	165.600	167.170	169.902	173.611	178.057	179.615	181.795	178.051	7.817
O1	240.410	239.226	238.448	238.993	238.467	240.267	240.419	244.928	248.089	253.578	258.101	261.945	263.544	260.175	258.421	252.183	248.071	244.174	240.476	247.890	8.942
MSF	284.560	283.297	287.825	276.981	285.651	263.960	276.347	272.393	281.156	270.863	274.528	283.184	271.671	297.826	286.771	289.109	282.275	279.385	278.659	280.339	7.847
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.096	0.075	0.080	0.075	0.090	0.070	0.094	0.088	0.091	0.069	0.090	0.078	0.085	0.073	0.077	0.076	0.088	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.7	97.2	98.0	98.5	97.2	98.9	95.8	91.6	91.5	87.9	95.0	88.2	97.4	90.9	96.3	93.8	82.2	96.2	90.8		

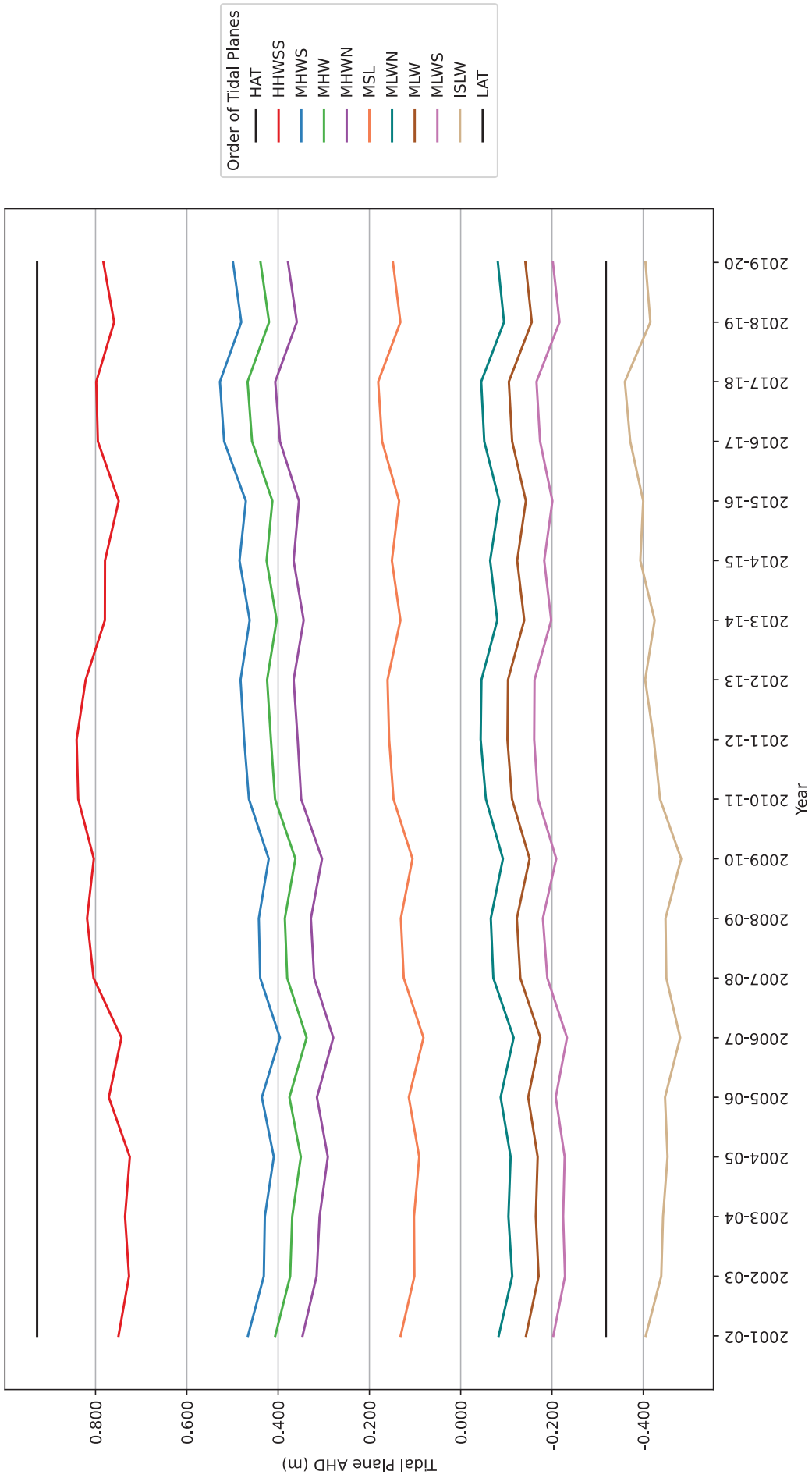
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.93	04/06/2004 22:15	±0.18	5.9
Lowest Astronomical Tide (LAT)	-0.32	27/12/2012 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A71

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wooli River at Wooli Caravan Park

MHL2786

Figure
A71

RECORDING STATION: **Corindi River at Red Rock**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205450

ZONE: 56
EASTING: 521919
NORTHING: 6683065

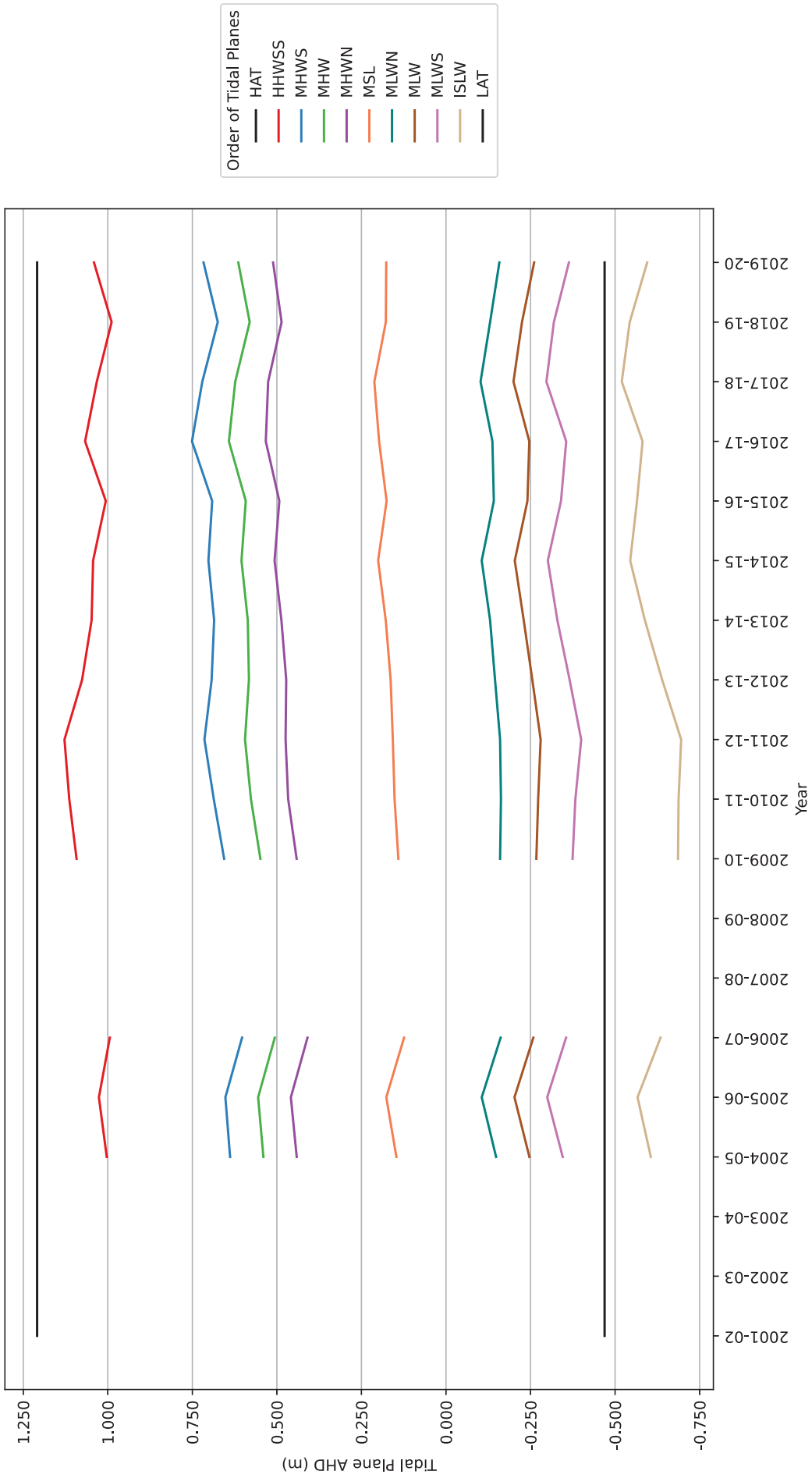
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Corindi River at Red Rock

YEAR	2001-02*	2002-03*	2003-04*	2004-05	2005-06	2006-07	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS				1.003	1.026	0.994			1.092	1.114	1.128	1.076	1.048	1.043	1.006	1.067	1.032	0.989	1.041	1.047	0.044
MHWS				0.638	0.652	0.603			0.656	0.687	0.714	0.693	0.686	0.702	0.691	0.751	0.721	0.675	0.717	0.685	0.038
MHW				0.540	0.555	0.506			0.549	0.577	0.594	0.583	0.586	0.605	0.592	0.642	0.623	0.580	0.614	0.582	0.036
MHWN				0.441	0.459	0.409			0.442	0.467	0.474	0.472	0.487	0.507	0.493	0.533	0.526	0.486	0.511	0.479	0.035
MSL				0.147	0.176	0.124			0.141	0.152	0.157	0.164	0.178	0.201	0.176	0.198	0.212	0.178	0.177	0.170	0.024
MLWN				-0.148	-0.106	-0.162			-0.160	-0.163	-0.160	-0.145	-0.130	-0.106	-0.142	-0.137	-0.102	-0.130	-0.158	-0.139	0.022
MLW				-0.247	-0.203	-0.258			-0.267	-0.273	-0.280	-0.255	-0.230	-0.203	-0.241	-0.246	-0.200	-0.225	-0.261	-0.242	0.027
MLWS				-0.345	-0.299	-0.355			-0.374	-0.383	-0.400	-0.366	-0.329	-0.301	-0.340	-0.356	-0.297	-0.319	-0.364	-0.345	0.032
ISLW				-0.606	-0.566	-0.634			-0.686	-0.688	-0.695	-0.639	-0.588	-0.545	-0.565	-0.581	-0.520	-0.543	-0.595	-0.604	0.057
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR				0.589	0.564	0.571			0.602	0.629	0.634	0.617	0.617	0.613	0.634	0.670	0.628	0.617	0.669	0.618	0.031
MR				0.787	0.758	0.765			0.816	0.849	0.874	0.838	0.816	0.808	0.833	0.888	0.823	0.805	0.875	0.824	0.039
MSR				0.984	0.952	0.958			1.030	1.069	1.114	1.059	1.015	1.004	1.031	1.106	1.018	0.994	1.080	1.030	0.051
R				1.609	1.593	1.628			1.778	1.802	1.823	1.715	1.636	1.588	1.571	1.648	1.552	1.532	1.636	1.651	0.093
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2				0.393	0.379	0.382			0.408	0.425	0.437	0.419	0.408	0.404	0.416	0.444	0.411	0.403	0.437	0.412	0.020
S2				0.099	0.097	0.097			0.107	0.110	0.120	0.110	0.099	0.098	0.099	0.109	0.097	0.094	0.103	0.103	0.007
K1				0.156	0.159	0.164			0.183	0.182	0.180	0.168	0.155	0.149	0.139	0.143	0.138	0.136	0.143	0.157	0.017
O1				0.104	0.108	0.116			0.129	0.123	0.116	0.106	0.104	0.095	0.086	0.083	0.085	0.088	0.088	0.102	0.015
MSF				0.040	0.025	0.023			0.030	0.032	0.027	0.012	0.039	0.030	0.041	0.034	0.033	0.049	0.036	0.032	0.009
z0				0.147	0.176	0.124			0.141	0.152	0.157	0.164	0.178	0.201	0.176	0.198	0.212	0.178	0.177	0.170	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2				7.043	7.433	6.037			0.822	359.031	357.114	0.390	2.132	2.128	2.128	0.499	5.447	6.341	2.804	54.239	128.746
S2				277.040	278.482	277.941			276.358	273.831	272.613	274.922	278.691	278.962	279.140	274.061	281.014	279.141	274.295	276.892	2.555
K1				160.504	159.328	158.312			146.934	141.400	136.911	137.725	138.616	140.948	142.078	144.233	151.025	156.165	154.263	147.746	8.618
O1				211.779	213.302	215.374			220.037	223.958	227.496	233.210	237.168	234.207	231.048	222.348	223.409	220.950	213.503	223.413	8.302
MSF				273.540	298.275	245.728			283.173	252.928	252.313	280.620	266.390	291.513	290.439	291.354	265.447	273.505	271.138	274.026	16.288
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
				0.084	0.079	0.106			0.097	0.103	0.078	0.097	0.077	0.084	0.079	0.080	0.081	0.091	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
				92.1	91.6	97.5	29.9	7.4	95.6	89.1	91.8	88.6	97.4	86.5	94.5	91.6	86.8	94.1	93.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.21	04/06/2004 21:45	±0.19	5.7
Lowest Astronomical Tide (LAT)	-0.47	25/11/2011 02:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Feb 2004.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Corindi River at Red Rock

MHL2786

Figure A72

RECORDING STATION: **Woolgoolga Lake at Woolgoolga Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205455

ZONE: 56
EASTING: 519091
NORTHING: 6669486

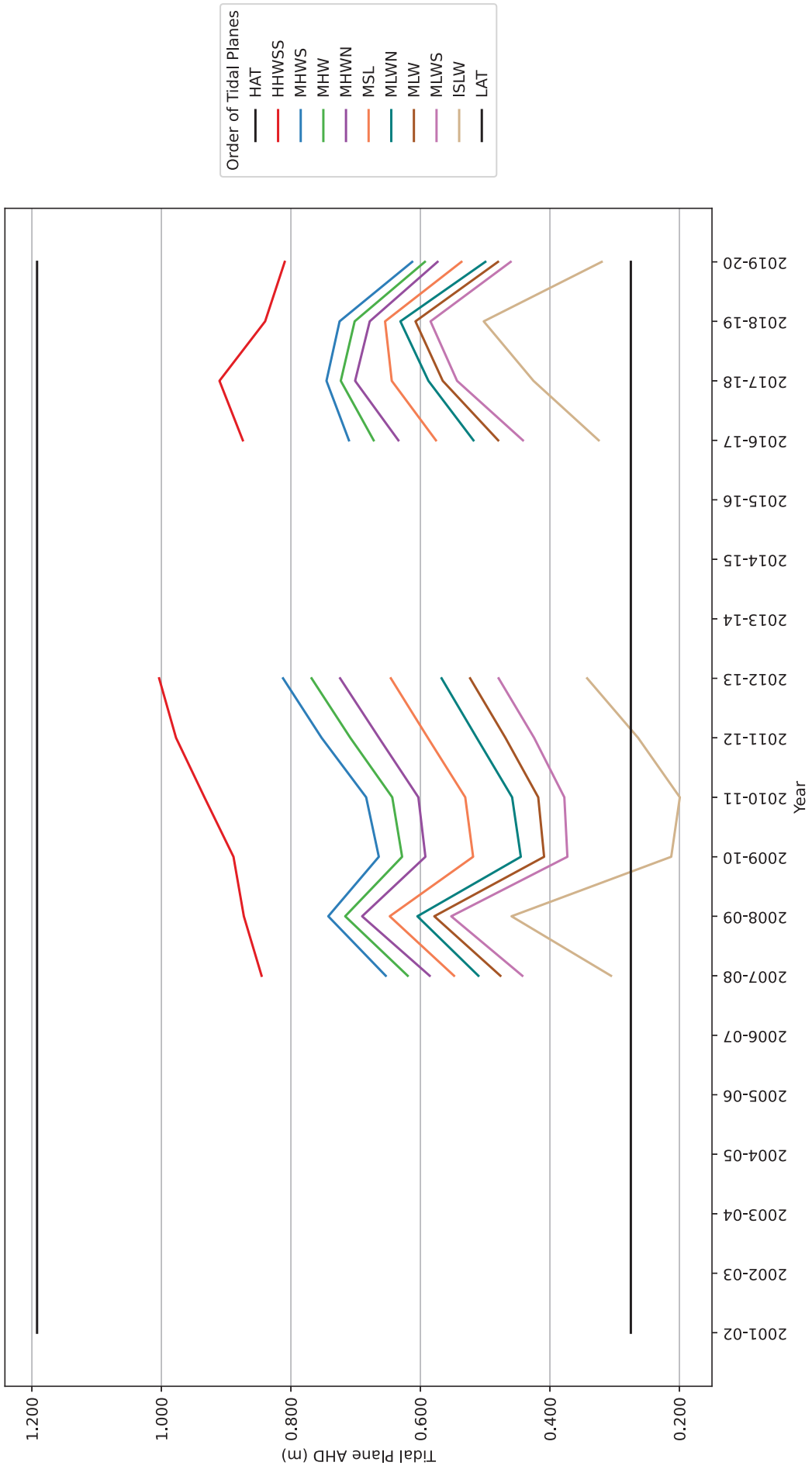
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Woolgoolga Lake at Woolgoolga Lake

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14*	2014-15	2015-16*	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.845	0.873	0.889	0.933	0.977	1.003		0.958		0.874	0.910	0.840	0.810	0.901	0.061
MHWS							0.654	0.742	0.664	0.684	0.753	0.812		0.808		0.710	0.745	0.725	0.613	0.719	0.062
MHW							0.620	0.716	0.628	0.643	0.708	0.768		0.784		0.672	0.723	0.702	0.593	0.687	0.061
MHWN							0.586	0.690	0.592	0.603	0.664	0.724		0.760		0.634	0.701	0.678	0.574	0.655	0.062
MSL							0.548	0.647	0.519	0.531	0.588	0.646		0.722		0.576	0.644	0.655	0.537	0.601	0.065
MLWN							0.510	0.605	0.445	0.458	0.513	0.567		0.683		0.518	0.588	0.631	0.500	0.547	0.074
MLW							0.476	0.579	0.409	0.418	0.469	0.523		0.659		0.480	0.565	0.608	0.480	0.515	0.079
MLWS							0.443	0.552	0.373	0.378	0.424	0.479		0.635		0.442	0.543	0.584	0.461	0.483	0.085
ISLW							0.306	0.459	0.213	0.199	0.264	0.342		0.528		0.325	0.425	0.502	0.320	0.353	0.112
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.075	0.085	0.147	0.145	0.151	0.157		0.077		0.116	0.113	0.047	0.074	0.108	0.038
MR							0.143	0.138	0.219	0.225	0.240	0.245		0.125		0.192	0.157	0.094	0.113	0.172	0.054
MSR							0.211	0.190	0.291	0.306	0.328	0.333		0.173		0.269	0.202	0.140	0.152	0.236	0.071
R							0.540	0.413	0.676	0.734	0.714	0.661		0.430		0.550	0.485	0.338	0.490	0.548	0.132
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.072	0.069	0.110	0.113	0.120	0.122		0.062		0.096	0.079	0.047	0.056	0.086	0.027
S2							0.034	0.026	0.036	0.040	0.044	0.044		0.024		0.038	0.022	0.023	0.020	0.032	0.009
K1							0.067	0.048	0.087	0.090	0.082	0.069		0.051		0.061	0.058	0.046	0.079	0.067	0.015
O1							0.070	0.045	0.074	0.089	0.079	0.068		0.055		0.056	0.060	0.036	0.062	0.063	0.015
MSF							0.063	0.066	0.040	0.060	0.061	0.039		0.061		0.052	0.105	0.036	0.053	0.058	0.019
z0							0.548	0.647	0.519	0.531	0.588	0.646		0.722		0.576	0.644	0.655	0.537	0.601	0.065
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							33.788	18.387	24.838	21.204	11.437	17.440		28.032		32.161	41.767	31.057	333.244	53.941	93.035
S2							296.446	297.562	299.161	283.952	284.327	303.147		314.622		301.682	305.175	315.002	293.917	299.545	10.176
K1							180.577	172.161	166.431	158.868	155.153	158.338		172.377		172.264	182.396	192.361	235.267	176.927	22.374
O1							238.943	230.705	233.537	244.591	244.549	254.567		254.537		248.952	250.774	239.706	226.591	242.496	9.498
MSF							264.781	241.143	296.130	257.874	251.269	218.520		253.786		272.546	252.974	304.144	266.169	261.758	23.840
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.120	0.206	0.207	0.174	0.167	0.148		0.190		0.104	0.126	0.131	0.108		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
							82.3	77.6	96.2	97.2	87.3	60.4	47.3	75.5	48.6	95.0	53.6	53.3	55.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.19	04/06/2008 21:30	±0.38	40.3
Lowest Astronomical Tide (LAT)	0.28	13/03/2008 19:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in May 2007. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Woolgoolga Lake at Woolgoolga Lake

MHL2786

Figure A73

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Moonee Creek at Moonee Creek

RECORDING STATION: **Moonee Creek at Moonee Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205435

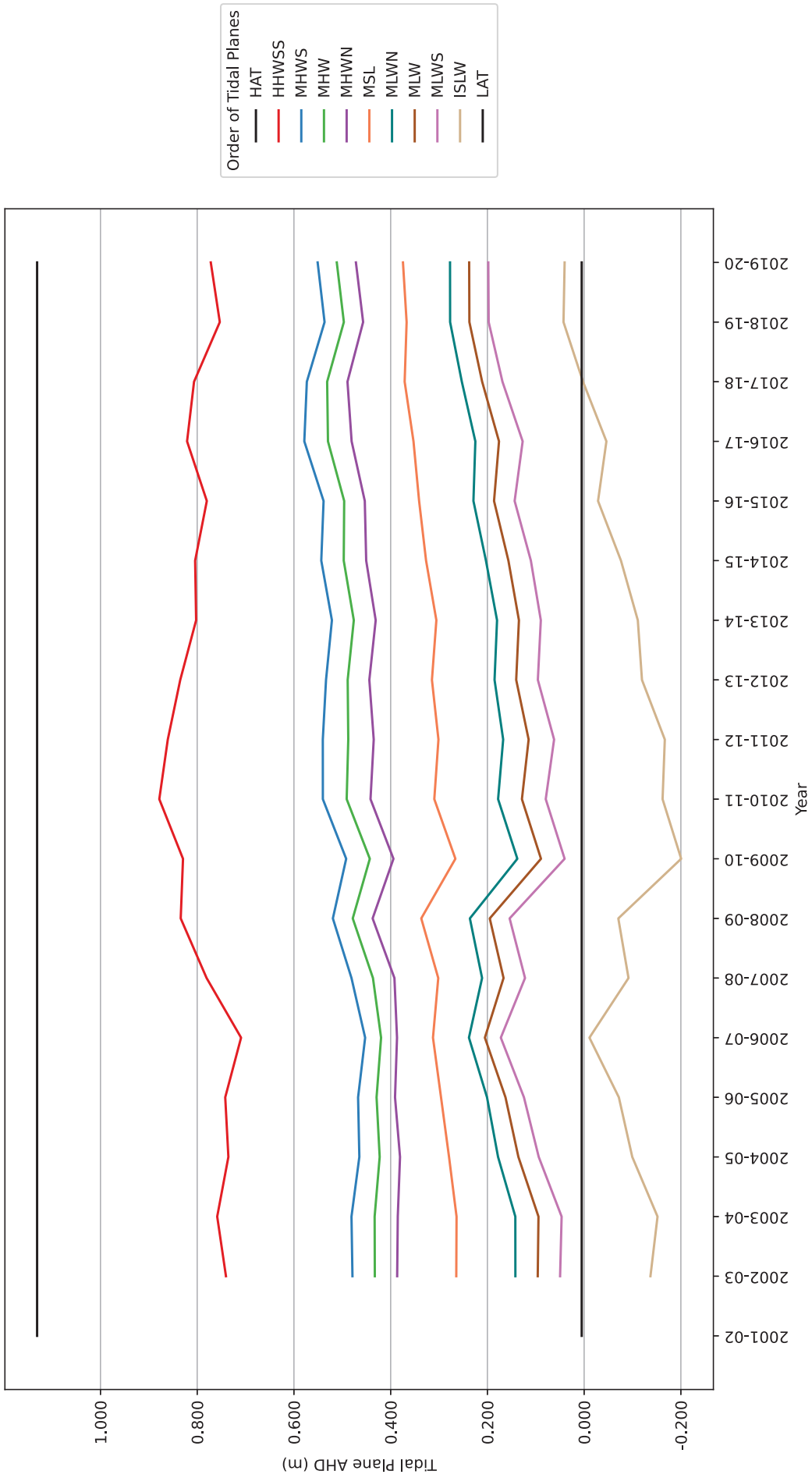
ZONE: 56
EASTING: 514953
NORTHING: 6658959

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.741	0.759	0.736	0.742	0.709	0.781	0.834	0.829	0.878	0.861	0.835	0.802	0.804	0.780	0.821	0.807	0.753	0.772	0.791	0.047
MHWS		0.479	0.481	0.465	0.467	0.453	0.481	0.519	0.492	0.540	0.540	0.534	0.521	0.543	0.539	0.579	0.573	0.537	0.551	0.516	0.038
MHW		0.433	0.433	0.423	0.429	0.420	0.437	0.478	0.443	0.491	0.488	0.489	0.476	0.497	0.496	0.530	0.531	0.497	0.511	0.472	0.037
MHWN		0.387	0.385	0.381	0.391	0.387	0.392	0.437	0.394	0.442	0.435	0.444	0.431	0.451	0.454	0.481	0.489	0.457	0.472	0.428	0.036
MSL		0.264	0.264	0.279	0.296	0.313	0.302	0.337	0.266	0.310	0.301	0.315	0.306	0.327	0.341	0.353	0.371	0.367	0.375	0.316	0.036
MLWN		0.142	0.142	0.178	0.201	0.238	0.211	0.236	0.138	0.178	0.167	0.185	0.180	0.203	0.229	0.225	0.253	0.277	0.277	0.203	0.043
MLW		0.096	0.094	0.136	0.163	0.205	0.167	0.195	0.089	0.129	0.115	0.140	0.135	0.157	0.186	0.176	0.211	0.237	0.238	0.159	0.047
MLWS		0.050	0.047	0.094	0.124	0.172	0.122	0.154	0.040	0.079	0.062	0.096	0.090	0.110	0.144	0.127	0.169	0.197	0.198	0.115	0.050
ISLW		-0.137	-0.152	-0.100	-0.072	-0.011	-0.092	-0.071	-0.201	-0.162	-0.167	-0.120	-0.111	-0.076	-0.029	-0.046	0.002	0.043	0.040	-0.081	0.071
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.244	0.243	0.203	0.190	0.149	0.181	0.201	0.256	0.264	0.268	0.259	0.251	0.248	0.225	0.256	0.236	0.180	0.195	0.225	0.035
MR		0.337	0.339	0.287	0.267	0.215	0.270	0.283	0.354	0.362	0.373	0.348	0.341	0.340	0.310	0.354	0.320	0.260	0.274	0.313	0.044
MSR		0.429	0.434	0.371	0.343	0.281	0.359	0.365	0.452	0.461	0.478	0.438	0.432	0.433	0.395	0.451	0.404	0.339	0.353	0.401	0.053
R		0.878	0.910	0.835	0.814	0.720	0.872	0.905	1.030	1.041	1.028	0.955	0.913	0.880	0.809	0.867	0.804	0.711	0.732	0.872	0.100
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.168	0.169	0.143	0.133	0.107	0.135	0.142	0.177	0.181	0.186	0.174	0.171	0.170	0.155	0.177	0.160	0.130	0.137	0.156	0.022
S2		0.046	0.048	0.042	0.038	0.033	0.044	0.041	0.049	0.049	0.053	0.045	0.045	0.046	0.043	0.049	0.042	0.040	0.040	0.044	0.005
K1		0.101	0.107	0.104	0.103	0.094	0.108	0.117	0.125	0.127	0.121	0.115	0.107	0.100	0.092	0.095	0.091	0.083	0.085	0.104	0.013
O1		0.086	0.091	0.089	0.093	0.090	0.106	0.108	0.116	0.115	0.108	0.101	0.094	0.086	0.080	0.078	0.076	0.072	0.073	0.092	0.014
MSF		0.070	0.080	0.078	0.073	0.067	0.081	0.059	0.069	0.074	0.074	0.062	0.077	0.066	0.076	0.072	0.073	0.082	0.079	0.073	0.006
z0		0.264	0.264	0.279	0.296	0.313	0.302	0.337	0.266	0.310	0.301	0.315	0.306	0.327	0.341	0.353	0.371	0.367	0.375	0.316	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		47.495	47.743	52.311	52.881	56.384	50.658	48.990	40.045	39.605	38.346	41.899	43.341	43.217	46.919	44.532	47.457	51.083	50.213	46.840	5.050
S2		319.142	317.694	321.163	323.178	323.693	320.276	317.544	313.734	307.587	311.091	313.296	313.836	318.424	321.947	316.765	316.153	321.204	317.456	317.455	4.310
K1		194.641	193.172	199.596	199.763	202.238	186.721	187.728	176.174	170.959	167.978	169.014	168.545	172.051	175.461	176.789	183.724	191.801	192.874	183.846	11.885
O1		243.641	244.539	248.287	250.907	256.098	251.696	251.502	248.188	253.216	256.576	264.362	265.507	263.644	264.663	256.205	254.572	255.157	252.295	254.503	6.630
MSF		277.392	279.767	273.171	281.023	275.428	275.637	273.690	278.843	274.226	266.222	270.257	270.798	281.294	282.001	279.328	270.642	274.576	272.810	275.395	4.416
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.099	0.069	0.085	0.068	0.086	0.080	0.086	0.084	0.091	0.073	0.092	0.074	0.078	0.065	0.064	0.066	0.069	0.062		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		79.4	97.4	97.0	83.1	96.3	92.4	87.6	97.0	85.8	92.1	86.5	95.9	86.2	91.8	92.3	87.8	94.5	92.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.13	04/06/2004 22:30	±0.18	8.8
Lowest Astronomical Tide (LAT)	0.01	17/09/2006 12:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Aug 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

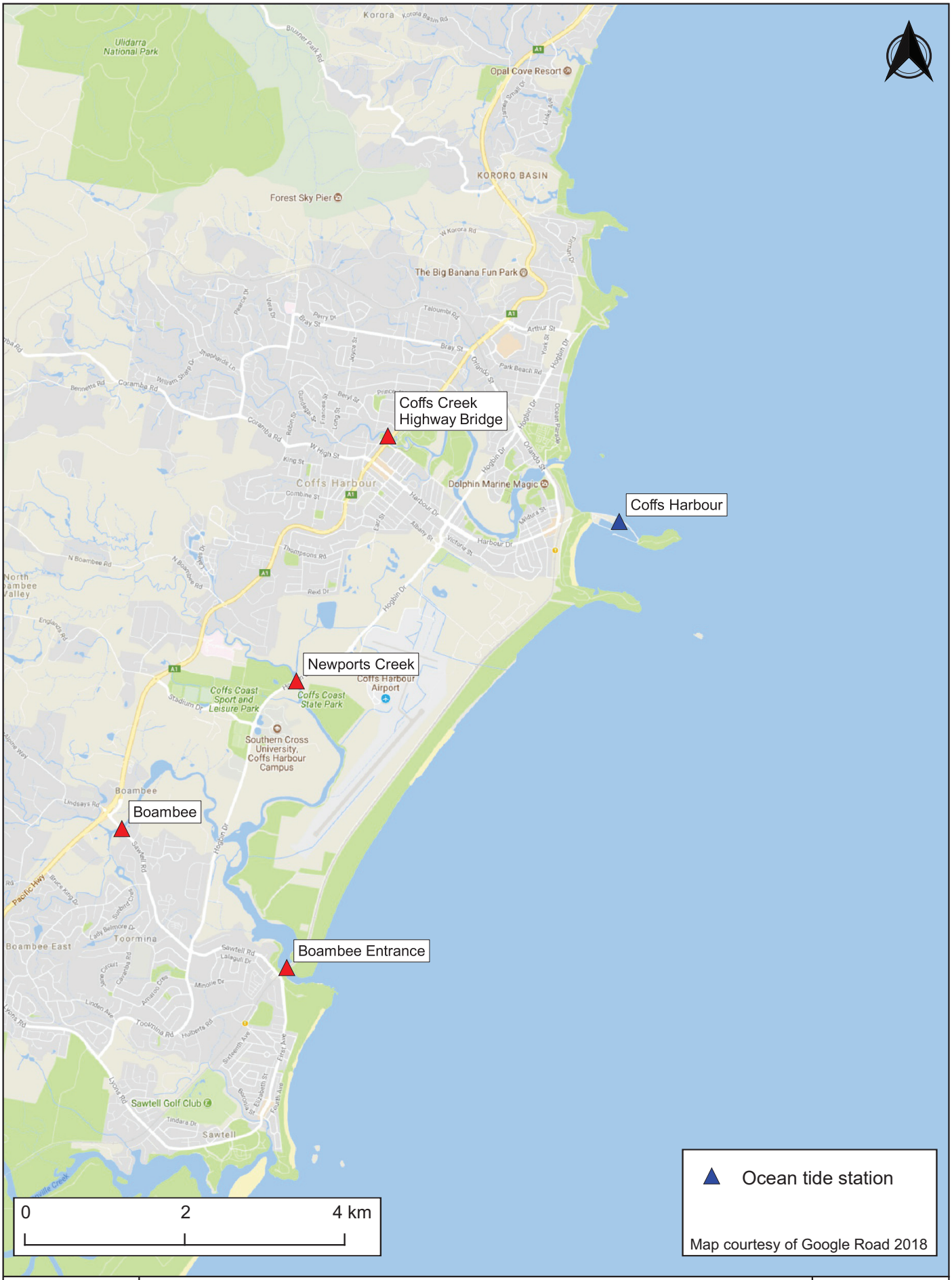


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Moonee Creek at Moonee Creek

MHL2786

Figure A74



NSW GOVERNMENT

STATION LOCATIONS
COFFS HARBOUR REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A75

DRAWING A75.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Coffs Creek at Coffs Creek Highway Bridge

RECORDING STATION: **Coffs Creek at Coffs Creek Highway Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205439

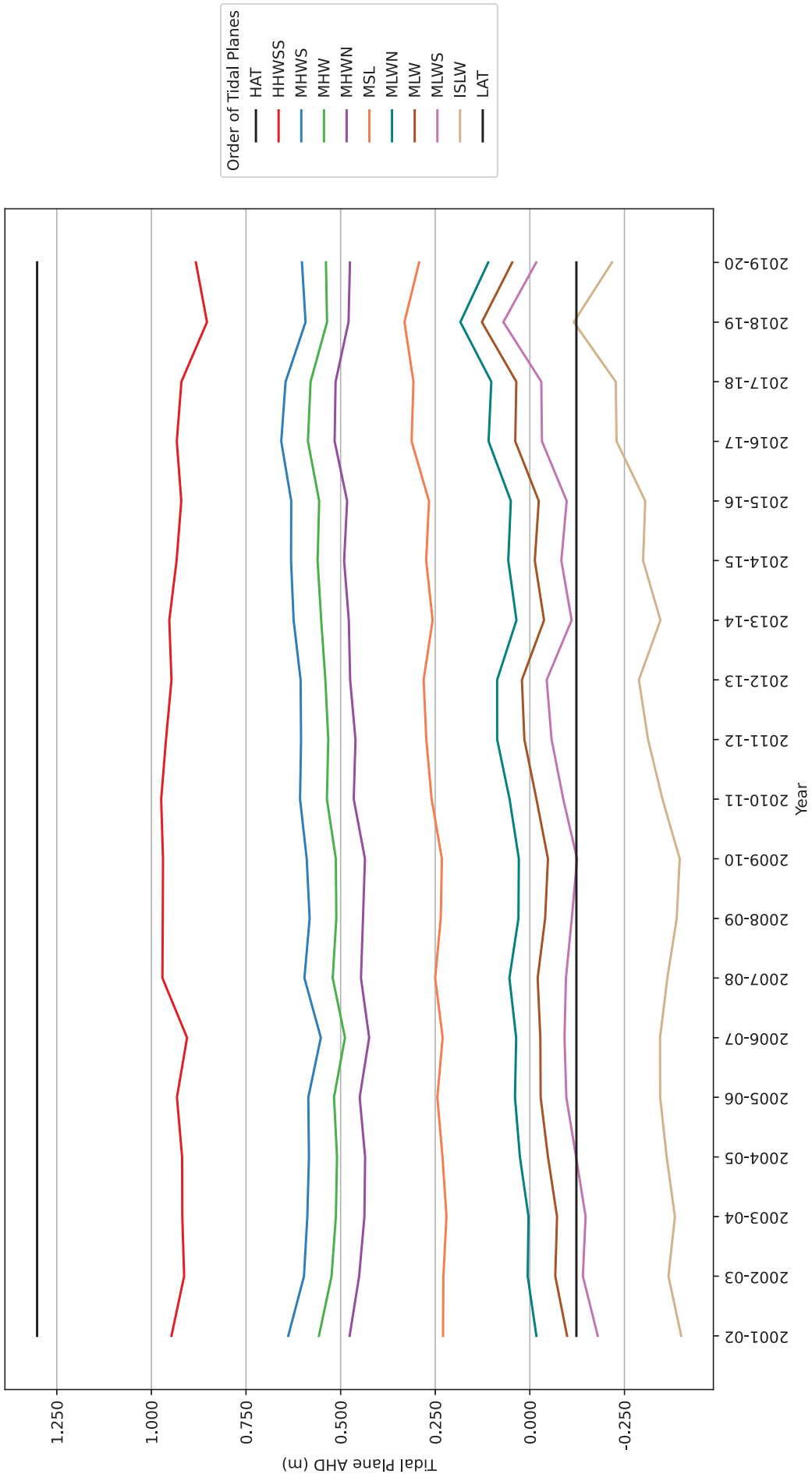
ZONE: 56
EASTING: 511160
NORTHING: 6648716

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.947	0.914	0.918	0.919	0.932	0.906	0.971	0.970	0.969	0.974	0.961	0.947	0.953	0.933	0.921	0.933	0.921	0.853	0.882	0.933	0.032
MHWS	0.638	0.597	0.588	0.584	0.585	0.552	0.596	0.582	0.590	0.607	0.605	0.606	0.624	0.631	0.630	0.657	0.645	0.593	0.602	0.606	0.026
MHW	0.557	0.524	0.513	0.509	0.517	0.488	0.521	0.511	0.513	0.536	0.533	0.540	0.551	0.561	0.557	0.586	0.579	0.536	0.539	0.535	0.025
MHWN	0.476	0.451	0.437	0.435	0.450	0.425	0.446	0.441	0.436	0.465	0.461	0.475	0.478	0.491	0.483	0.516	0.513	0.479	0.475	0.465	0.026
MSL	0.229	0.228	0.220	0.231	0.244	0.230	0.250	0.235	0.232	0.259	0.274	0.281	0.257	0.274	0.267	0.312	0.308	0.331	0.293	0.261	0.032
MLWN	-0.017	0.006	0.004	0.026	0.039	0.036	0.054	0.030	0.029	0.054	0.086	0.086	0.035	0.057	0.050	0.109	0.102	0.184	0.110	0.057	0.047
MLW	-0.098	-0.067	-0.072	-0.048	-0.029	-0.028	-0.021	-0.040	-0.048	-0.017	0.014	0.021	-0.038	-0.013	-0.024	0.038	0.036	0.127	0.047	-0.014	0.052
MLWS	-0.179	-0.140	-0.147	-0.122	-0.096	-0.092	-0.095	-0.111	-0.125	-0.088	-0.057	-0.044	-0.110	-0.083	-0.097	-0.032	-0.030	0.070	-0.017	-0.084	0.056
ISLW	-0.400	-0.366	-0.383	-0.362	-0.344	-0.344	-0.363	-0.388	-0.396	-0.350	-0.312	-0.288	-0.345	-0.299	-0.305	-0.229	-0.227	-0.116	-0.217	-0.318	0.075
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.493	0.445	0.434	0.409	0.410	0.388	0.392	0.411	0.407	0.412	0.374	0.388	0.443	0.434	0.433	0.407	0.411	0.296	0.365	0.408	0.040
MR	0.656	0.591	0.584	0.557	0.546	0.516	0.542	0.552	0.561	0.554	0.518	0.519	0.589	0.574	0.580	0.548	0.544	0.409	0.492	0.549	0.049
MSR	0.818	0.737	0.735	0.706	0.682	0.644	0.691	0.693	0.714	0.696	0.662	0.650	0.735	0.714	0.728	0.689	0.676	0.523	0.619	0.690	0.059
R	1.347	1.280	1.302	1.280	1.277	1.250	1.334	1.358	1.365	1.325	1.274	1.235	1.298	1.233	1.226	1.162	1.148	0.969	1.099	1.251	0.099
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.328	0.296	0.292	0.279	0.273	0.258	0.271	0.276	0.280	0.277	0.259	0.260	0.294	0.287	0.290	0.274	0.272	0.205	0.246	0.275	0.025
S2	0.081	0.073	0.075	0.074	0.068	0.064	0.075	0.070	0.077	0.071	0.072	0.065	0.073	0.070	0.074	0.071	0.066	0.057	0.063	0.070	0.006
K1	0.126	0.129	0.134	0.134	0.137	0.138	0.144	0.150	0.146	0.142	0.137	0.134	0.130	0.121	0.117	0.112	0.112	0.102	0.112	0.129	0.013
O1	0.095	0.097	0.102	0.105	0.111	0.115	0.124	0.128	0.125	0.120	0.118	0.110	0.105	0.095	0.091	0.085	0.085	0.084	0.089	0.104	0.015
MSF	0.065	0.055	0.061	0.059	0.051	0.047	0.068	0.049	0.049	0.054	0.064	0.051	0.061	0.051	0.057	0.059	0.062	0.069	0.071	0.058	0.007
z0	0.229	0.228	0.220	0.231	0.244	0.230	0.250	0.235	0.232	0.259	0.274	0.281	0.257	0.274	0.267	0.312	0.308	0.331	0.293	0.261	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	27.952	33.391	33.301	33.972	32.947	34.697	30.216	27.307	18.441	17.852	23.266	25.189	24.536	23.715	25.772	27.776	29.144	37.585	34.734	28.516	5.583
S2	300.455	306.630	306.312	304.987	307.217	306.222	302.029	302.523	296.752	292.612	296.285	301.446	300.231	300.160	302.674	302.302	302.515	306.562	302.352	302.119	3.896
K1	169.111	175.143	174.218	174.761	172.749	174.072	166.381	163.111	153.405	149.507	152.658	151.726	148.917	150.594	153.348	158.995	163.825	174.143	174.190	163.203	10.266
O1	224.759	226.354	225.838	224.881	225.985	227.234	225.833	227.582	225.239	231.299	240.369	244.311	244.860	241.691	240.237	237.926	233.922	238.404	232.784	232.606	7.295
MSF	278.110	276.765	277.339	266.663	272.713	257.154	270.235	267.440	271.706	270.054	261.177	271.746	267.310	274.554	279.302	276.550	266.719	269.353	266.872	270.619	5.823
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.096	0.075	0.083	0.078	0.091	0.074	0.096	0.083	0.081	0.074	0.084	0.070	0.076	0.068	0.070	0.079	0.070	0.073		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.2	91.3	96.0	93.6	93.6	95.3	91.2	87.2	92.6	74.2	81.0	85.0	93.0	81.1	91.2	89.3	87.4	85.8	92.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.30	04/06/2004 22:00	±0.19	7.7
Lowest Astronomical Tide (LAT)	-0.12	16/10/2017 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Coffs Creek at Coffs Creek Highway Bridge

MHL2786

Figure A76

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Newports Creek at Newports Creek

RECORDING STATION: **Newports Creek at Newports Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205460

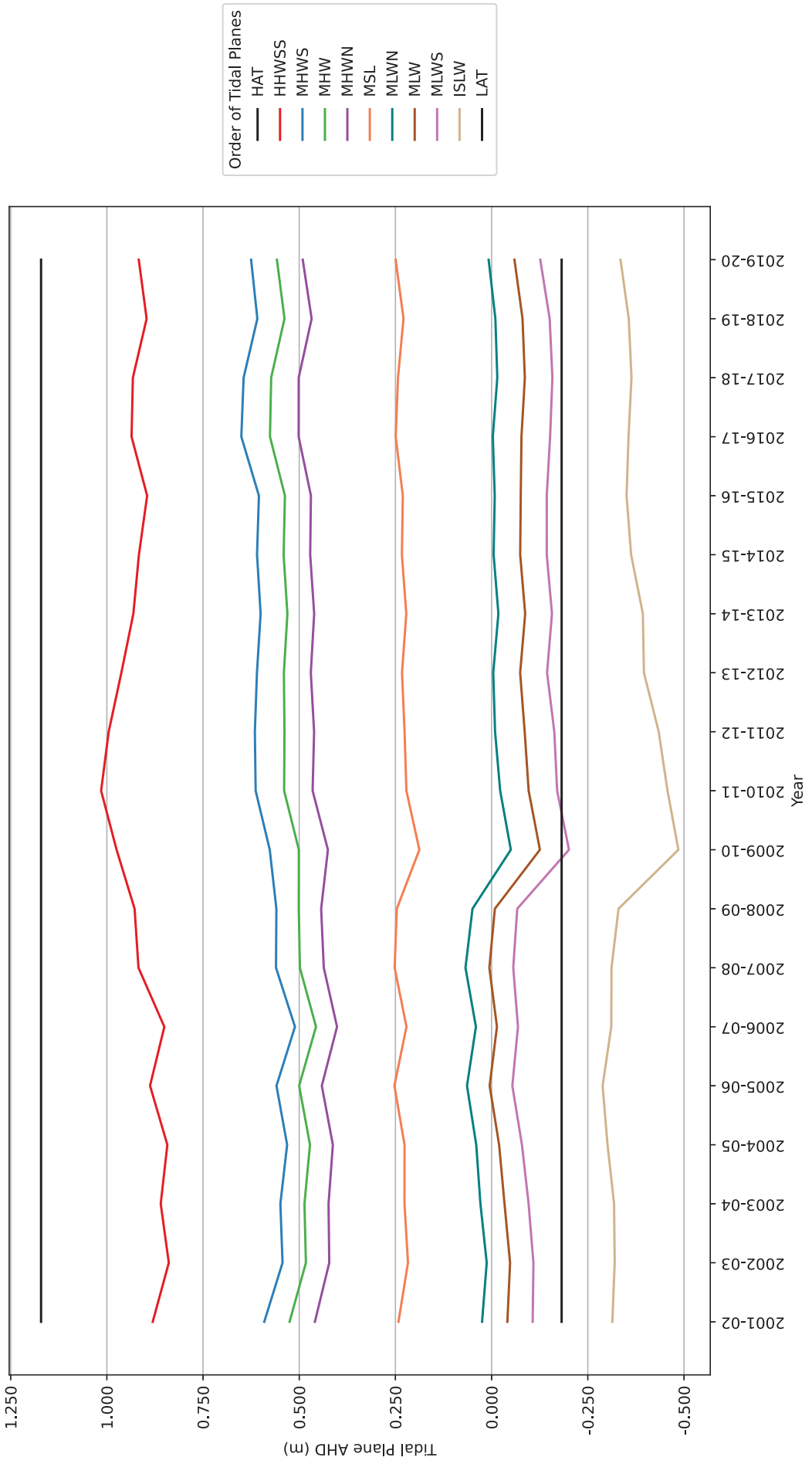
ZONE: 56
EASTING: 510016
NORTHING: 6645652

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.881	0.839	0.860	0.843	0.888	0.851	0.918	0.928	0.975	1.015	0.995	0.962	0.931	0.917	0.895	0.936	0.932	0.897	0.917	0.915	0.050
MHWS	0.591	0.543	0.549	0.531	0.559	0.511	0.560	0.559	0.577	0.613	0.615	0.610	0.600	0.610	0.605	0.650	0.645	0.609	0.625	0.588	0.039
MHW	0.525	0.483	0.486	0.472	0.500	0.456	0.498	0.501	0.501	0.539	0.538	0.540	0.531	0.541	0.537	0.576	0.573	0.538	0.558	0.521	0.033
MHWN	0.459	0.422	0.424	0.413	0.441	0.402	0.436	0.443	0.425	0.465	0.461	0.470	0.461	0.472	0.470	0.502	0.501	0.468	0.491	0.454	0.029
MSL	0.242	0.217	0.226	0.226	0.253	0.221	0.252	0.246	0.188	0.221	0.226	0.233	0.222	0.233	0.231	0.249	0.243	0.229	0.249	0.232	0.016
MLWN	0.025	0.013	0.029	0.040	0.064	0.041	0.068	0.050	-0.050	-0.022	-0.009	-0.004	-0.018	-0.005	-0.008	-0.003	-0.015	-0.010	0.008	0.010	0.032
MLW	-0.041	-0.048	-0.034	-0.019	0.005	-0.014	0.006	-0.008	-0.126	-0.096	-0.086	-0.074	-0.087	-0.074	-0.076	-0.078	-0.086	-0.080	-0.059	-0.057	0.037
MLWS	-0.107	-0.109	-0.096	-0.079	-0.054	-0.069	-0.056	-0.067	-0.201	-0.170	-0.163	-0.144	-0.157	-0.143	-0.143	-0.152	-0.158	-0.151	-0.126	-0.123	0.043
ISLW	-0.314	-0.320	-0.318	-0.301	-0.289	-0.311	-0.312	-0.330	-0.485	-0.457	-0.434	-0.396	-0.393	-0.363	-0.351	-0.356	-0.364	-0.356	-0.335	-0.357	0.054
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.435	0.409	0.395	0.373	0.377	0.361	0.368	0.393	0.475	0.487	0.470	0.474	0.479	0.477	0.478	0.505	0.516	0.478	0.483	0.444	0.052
MR	0.566	0.531	0.520	0.492	0.495	0.470	0.492	0.510	0.627	0.636	0.624	0.614	0.618	0.615	0.613	0.654	0.659	0.619	0.617	0.577	0.063
MSR	0.698	0.652	0.645	0.610	0.613	0.580	0.617	0.626	0.778	0.784	0.778	0.754	0.757	0.753	0.748	0.803	0.803	0.760	0.752	0.711	0.076
R	1.195	1.159	1.178	1.144	1.176	1.162	1.229	1.258	1.460	1.472	1.429	1.358	1.324	1.279	1.246	1.292	1.296	1.253	1.252	1.272	0.100
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.283	0.265	0.260	0.246	0.248	0.235	0.246	0.255	0.313	0.318	0.312	0.307	0.309	0.307	0.306	0.327	0.330	0.309	0.309	0.289	0.032
S2	0.066	0.061	0.063	0.059	0.059	0.055	0.062	0.058	0.076	0.074	0.077	0.070	0.070	0.069	0.068	0.074	0.072	0.071	0.067	0.067	0.007
K1	0.119	0.121	0.127	0.126	0.132	0.134	0.140	0.146	0.160	0.164	0.154	0.146	0.136	0.128	0.122	0.122	0.123	0.120	0.122	0.134	0.014
O1	0.088	0.090	0.095	0.096	0.103	0.109	0.116	0.117	0.125	0.123	0.117	0.106	0.100	0.091	0.085	0.082	0.083	0.085	0.086	0.100	0.014
MSF	0.073	0.051	0.062	0.059	0.048	0.044	0.070	0.046	0.052	0.055	0.056	0.045	0.057	0.049	0.057	0.055	0.048	0.056	0.061	0.055	0.008
z0	0.242	0.217	0.226	0.226	0.253	0.221	0.252	0.246	0.188	0.221	0.226	0.233	0.222	0.233	0.231	0.249	0.243	0.229	0.249	0.232	0.016
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	41.468	45.093	45.704	48.002	46.763	49.890	45.413	42.342	31.078	30.096	31.088	33.022	33.698	35.051	37.117	34.477	36.164	39.333	39.713	39.237	6.307
S2	315.046	318.558	319.634	318.912	322.315	323.287	317.713	320.568	312.475	311.331	311.012	313.877	313.623	316.961	317.943	313.509	315.259	315.273	314.764	316.424	3.538
K1	180.981	185.690	185.577	188.267	185.176	186.522	181.196	176.058	164.903	161.054	159.538	159.163	157.812	160.415	163.118	165.131	168.813	174.789	176.974	172.693	11.025
O1	238.094	237.446	239.073	238.990	239.015	241.289	240.793	242.950	237.737	245.030	248.586	253.398	254.768	253.955	251.203	244.348	239.741	239.108	235.955	243.236	6.161
MSF	282.310	280.992	281.819	270.979	281.791	261.870	273.217	262.752	281.020	266.517	268.359	278.663	270.036	289.843	286.488	286.719	273.239	277.467	268.761	275.939	8.283
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.095	0.077	0.080	0.079	0.094	0.072	0.092	0.090	0.083	0.070	0.094	0.074	0.088	0.073	0.074	0.079	0.088	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.9	94.6	97.0	94.5	92.8	95.4	92.3	88.6	96.0	80.1	88.9	84.8	95.8	85.9	93.9	92.0	88.8	95.5	93.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.17	04/06/2004 22:30	±0.19	7.7
Lowest Astronomical Tide (LAT)	-0.18	14/12/2013 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Newports Creek at Newports Creek

MHL2786

Figure A77

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Boambee Creek at Boambee

RECORDING STATION: **Boambee Creek at Boambee**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205438

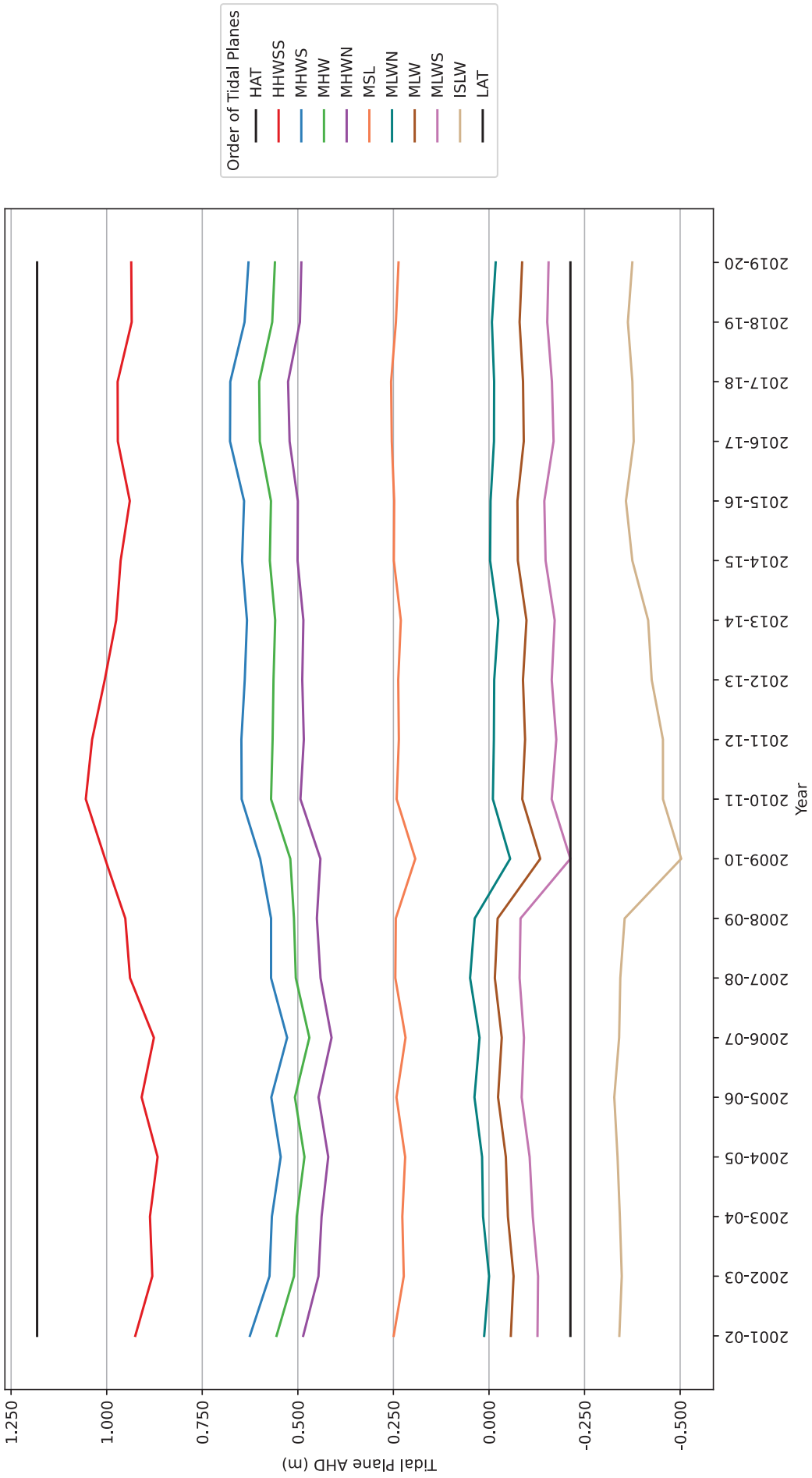
ZONE: 56
EASTING: 507834
NORTHING: 6643805

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.925	0.881	0.887	0.867	0.909	0.876	0.939	0.951	1.004	1.055	1.038	1.005	0.975	0.964	0.940	0.971	0.971	0.935	0.936	0.949	0.053
MHWS	0.625	0.574	0.568	0.545	0.569	0.528	0.570	0.570	0.598	0.647	0.648	0.639	0.633	0.646	0.641	0.677	0.677	0.639	0.629	0.612	0.045
MHW	0.556	0.510	0.503	0.483	0.508	0.470	0.505	0.510	0.520	0.570	0.566	0.564	0.559	0.573	0.570	0.599	0.601	0.567	0.560	0.542	0.039
MHWN	0.486	0.446	0.438	0.420	0.446	0.412	0.441	0.450	0.441	0.493	0.484	0.488	0.485	0.501	0.500	0.522	0.526	0.495	0.491	0.472	0.034
MSL	0.249	0.223	0.227	0.219	0.242	0.218	0.245	0.244	0.193	0.242	0.236	0.237	0.231	0.249	0.248	0.254	0.256	0.243	0.237	0.236	0.015
MLWN	0.013	-0.000	0.016	0.018	0.038	0.025	0.049	0.037	-0.055	-0.010	-0.013	-0.014	-0.024	-0.003	-0.004	-0.013	-0.013	-0.008	-0.018	0.001	0.025
MLW	-0.057	-0.064	-0.050	-0.044	-0.024	-0.033	-0.015	-0.023	-0.134	-0.087	-0.094	-0.089	-0.098	-0.075	-0.074	-0.091	-0.089	-0.080	-0.087	-0.069	0.031
MLWS	-0.127	-0.128	-0.115	-0.106	-0.085	-0.091	-0.080	-0.083	-0.213	-0.164	-0.176	-0.164	-0.172	-0.148	-0.145	-0.169	-0.165	-0.152	-0.156	-0.139	0.037
ISLW	-0.341	-0.347	-0.342	-0.336	-0.328	-0.340	-0.343	-0.355	-0.503	-0.455	-0.455	-0.426	-0.416	-0.375	-0.358	-0.379	-0.375	-0.363	-0.375	-0.380	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.473	0.446	0.422	0.402	0.408	0.387	0.391	0.413	0.496	0.503	0.497	0.502	0.510	0.504	0.504	0.535	0.539	0.502	0.508	0.471	0.051
MR	0.613	0.574	0.552	0.527	0.531	0.503	0.521	0.533	0.654	0.657	0.660	0.653	0.657	0.649	0.645	0.690	0.690	0.647	0.647	0.611	0.063
MSR	0.752	0.702	0.682	0.651	0.655	0.619	0.650	0.653	0.811	0.811	0.824	0.803	0.805	0.794	0.785	0.846	0.841	0.792	0.785	0.751	0.076
R	1.266	1.228	1.229	1.203	1.236	1.217	1.282	1.306	1.507	1.510	1.493	1.431	1.392	1.338	1.298	1.349	1.346	1.298	1.311	1.328	0.098
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.306	0.287	0.276	0.263	0.266	0.252	0.260	0.266	0.327	0.329	0.330	0.326	0.329	0.324	0.322	0.345	0.345	0.324	0.323	0.305	0.032
S2	0.070	0.064	0.065	0.062	0.062	0.058	0.065	0.060	0.079	0.077	0.082	0.075	0.074	0.073	0.070	0.078	0.076	0.072	0.069	0.070	0.007
K1	0.126	0.127	0.132	0.132	0.137	0.139	0.146	0.152	0.164	0.167	0.160	0.154	0.143	0.136	0.127	0.127	0.127	0.124	0.131	0.140	0.014
O1	0.088	0.092	0.095	0.098	0.105	0.110	0.117	0.120	0.125	0.124	0.119	0.108	0.101	0.091	0.086	0.082	0.083	0.086	0.088	0.101	0.015
MSF	0.072	0.050	0.060	0.058	0.045	0.042	0.068	0.046	0.050	0.051	0.054	0.041	0.055	0.046	0.056	0.053	0.046	0.056	0.066	0.053	0.008
z0	0.249	0.223	0.227	0.219	0.242	0.218	0.245	0.244	0.193	0.242	0.236	0.237	0.231	0.249	0.248	0.254	0.256	0.243	0.237	0.236	0.015
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	39.243	41.575	42.145	44.041	42.543	44.598	41.463	40.120	28.389	28.787	28.830	30.129	30.459	31.731	33.382	30.912	32.399	35.517	36.672	35.944	5.767
S2	314.923	316.777	317.966	317.097	318.524	319.211	316.014	319.869	308.929	310.596	310.105	311.935	311.722	314.063	315.025	310.197	311.777	312.182	313.093	314.211	3.380
K1	180.271	183.997	184.464	186.806	183.676	184.510	179.471	176.456	162.660	160.872	158.774	157.669	156.846	158.810	161.980	163.570	166.875	173.069	172.542	171.227	10.899
O1	237.986	237.196	238.341	237.956	238.770	240.246	239.780	242.175	237.143	244.266	248.413	253.548	254.812	253.682	250.006	243.456	238.279	237.471	235.229	242.566	6.375
MSF	282.544	281.542	281.835	271.712	280.561	261.467	272.617	264.417	278.376	267.852	266.259	275.079	268.875	288.128	285.948	284.246	270.922	276.236	269.294	275.153	7.794
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.096	0.078	0.081	0.082	0.095	0.074	0.083	0.084	0.085	0.071	0.091	0.075	0.088	0.072	0.077	0.081	0.084	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.6	94.7	97.0	94.1	94.0	95.8	92.6	73.9	87.3	81.2	88.1	84.9	95.6	85.0	93.2	92.1	87.7	95.1	66.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.18	04/06/2004 22:30	±0.18	10.3
Lowest Astronomical Tide (LAT)	-0.21	04/12/2014 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Boambee Creek at Boambee

MHL2786

Figure
A78

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Boambee Creek at Boambee Entrance

RECORDING STATION: **Boambee Creek at Boambee Entrance**
DATUM: AUSTRALIAN HEIGHT DATUM 205475
AWRC #:

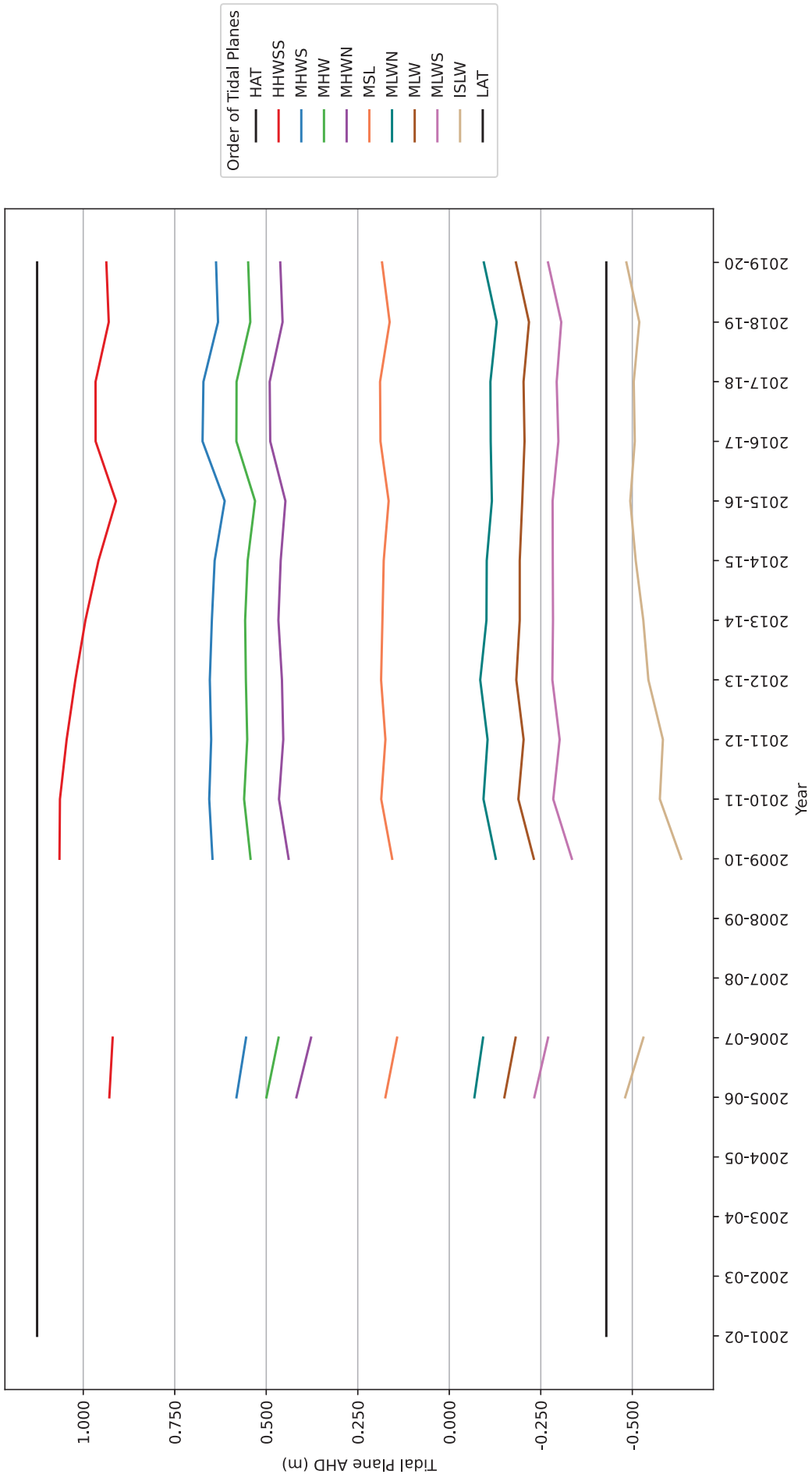
ZONE: 56
EASTING: 509896
NORTHING: 6642068

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06	2006-07	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS					0.929	0.920			1.065	1.064	1.045	1.021	0.994	0.958	0.911	0.966	0.966	0.930	0.937	0.977	0.055
MHWS					0.581	0.555			0.647	0.656	0.650	0.654	0.649	0.641	0.614	0.674	0.672	0.632	0.637	0.635	0.034
MHW					0.499	0.466			0.543	0.561	0.552	0.556	0.558	0.551	0.531	0.582	0.581	0.544	0.549	0.544	0.031
MHWN					0.418	0.378			0.439	0.465	0.453	0.457	0.467	0.461	0.448	0.489	0.491	0.455	0.462	0.452	0.029
MSL					0.174	0.143			0.156	0.186	0.174	0.186	0.183	0.179	0.166	0.188	0.189	0.163	0.184	0.175	0.014
MLWN					-0.069	-0.092			-0.127	-0.093	-0.105	-0.085	-0.102	-0.102	-0.116	-0.113	-0.112	-0.130	-0.094	-0.103	0.017
MLW					-0.151	-0.181			-0.231	-0.189	-0.203	-0.183	-0.192	-0.193	-0.199	-0.206	-0.203	-0.218	-0.182	-0.195	0.020
MLWS					-0.232	-0.270			-0.335	-0.284	-0.302	-0.282	-0.283	-0.283	-0.282	-0.298	-0.293	-0.306	-0.270	-0.286	0.024
ISLW					-0.480	-0.530			-0.634	-0.575	-0.584	-0.544	-0.530	-0.509	-0.494	-0.507	-0.504	-0.519	-0.484	-0.530	0.044
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR					0.486	0.470			0.566	0.559	0.558	0.542	0.568	0.563	0.564	0.602	0.603	0.585	0.556	0.556	0.039
MR					0.650	0.648			0.774	0.749	0.755	0.739	0.750	0.743	0.730	0.787	0.784	0.761	0.732	0.739	0.044
MSR					0.814	0.825			0.982	0.940	0.952	0.936	0.932	0.924	0.896	0.972	0.965	0.938	0.907	0.922	0.051
R					1.409	1.450			1.698	1.639	1.629	1.565	1.524	1.468	1.405	1.473	1.470	1.449	1.421	1.508	0.096
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2					0.325	0.324			0.387	0.375	0.378	0.369	0.375	0.372	0.365	0.394	0.392	0.381	0.366	0.369	0.022
S2					0.082	0.089			0.104	0.095	0.098	0.099	0.091	0.090	0.083	0.092	0.091	0.088	0.088	0.092	0.006
K1					0.147	0.157			0.177	0.174	0.168	0.159	0.148	0.138	0.130	0.130	0.132	0.132	0.133	0.148	0.017
O1					0.101	0.103			0.122	0.118	0.114	0.103	0.098	0.088	0.082	0.079	0.079	0.082	0.081	0.096	0.015
MSF					0.026	0.029			0.028	0.031	0.046	0.018	0.039	0.030	0.043	0.037	0.030	0.040	0.041	0.034	0.008
z0					0.174	0.143			0.156	0.186	0.174	0.186	0.183	0.179	0.166	0.188	0.189	0.163	0.184	0.175	0.014
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2					7.197	5.592			358.979	1.130	1.395	4.142	2.153	2.916	5.040	2.962	4.499	5.811	6.836	31.435	98.434
S2					277.728	277.229			276.327	278.847	277.616	279.823	278.934	279.950	281.803	277.161	278.455	278.102	279.859	278.603	1.485
K1					161.744	161.658			145.104	144.618	140.286	140.269	139.475	141.798	144.999	145.988	149.541	154.840	158.066	148.337	8.102
O1					220.791	222.046			221.338	228.254	234.901	238.943	242.148	239.877	237.062	229.382	225.484	223.507	221.585	229.640	7.944
MSF					285.208	258.637			280.348	251.857	257.912	272.439	264.617	287.895	282.851	283.130	266.915	270.622	262.598	271.156	11.842
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
					0.081	0.110			0.093	0.087	0.095	0.098	0.079	0.091	0.079	0.078	0.084	0.087	0.080		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
					81.7	93.0	49.6	0.0	80.2	76.3	83.8	85.1	95.9	88.3	90.7	94.7	90.6	91.1	94.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.13	04/06/2008 21:15	±0.18	10.6
Lowest Astronomical Tide (LAT)	-0.43	25/11/2011 02:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Mar 2005.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Boambee Creek at Boambee Entrance

MHL2786

Figure
A79

NSW GOVERNMENT

STATION LOCATIONS
BELLINGER RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A80

DRAWING A80.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Bonville Creek at Bonville

RECORDING STATION: **Bonville Creek at Bonville**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205480

ZONE: 56
EASTING: 503975
NORTHING: 6640378

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13*	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS									0.874	0.912	0.781		0.663	0.673	0.653	0.741	0.677	0.626	0.632	0.723	0.102
MHWS									0.531	0.575	0.534		0.500	0.520	0.506	0.555	0.540	0.501	0.521	0.528	0.024
MHW									0.473	0.520	0.502		0.480	0.500	0.486	0.524	0.520	0.481	0.504	0.499	0.019
MHWN									0.415	0.464	0.470		0.459	0.480	0.466	0.494	0.501	0.461	0.487	0.470	0.024
MSL									0.231	0.286	0.380		0.405	0.419	0.403	0.399	0.441	0.415	0.449	0.383	0.070
MLWN									0.046	0.108	0.289		0.350	0.358	0.341	0.304	0.382	0.368	0.410	0.295	0.121
MLW									-0.012	0.053	0.257		0.329	0.338	0.320	0.273	0.362	0.348	0.393	0.266	0.136
MLWS									-0.070	-0.003	0.225		0.309	0.318	0.300	0.243	0.343	0.329	0.376	0.237	0.151
ISLW									-0.315	-0.244	0.049		0.192	0.208	0.195	0.110	0.245	0.239	0.297	0.098	0.211
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR									0.369	0.357	0.181		0.110	0.123	0.126	0.190	0.119	0.093	0.077	0.174	0.105
MR									0.485	0.467	0.245		0.151	0.163	0.166	0.251	0.158	0.133	0.111	0.233	0.136
MSR									0.601	0.577	0.308		0.191	0.203	0.206	0.312	0.197	0.172	0.146	0.291	0.166
R									1.189	1.156	0.732		0.471	0.464	0.458	0.632	0.433	0.387	0.335	0.626	0.310
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2									0.243	0.234	0.122		0.075	0.081	0.083	0.126	0.079	0.066	0.056	0.116	0.068
S2									0.058	0.055	0.032		0.020	0.020	0.020	0.031	0.020	0.020	0.017	0.029	0.015
K1									0.137	0.134	0.092		0.059	0.058	0.056	0.073	0.053	0.048	0.041	0.075	0.035
O1									0.108	0.107	0.085		0.057	0.051	0.049	0.060	0.045	0.041	0.037	0.064	0.027
MSF									0.062	0.060	0.081		0.082	0.059	0.079	0.069	0.073	0.082	0.087	0.074	0.010
z0									0.231	0.286	0.380		0.405	0.419	0.403	0.399	0.441	0.415	0.449	0.383	0.070
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2									38.786	37.495	54.992		62.097	61.679	63.547	58.900	65.170	67.863	68.749	57.928	11.179
S2									319.909	314.634	330.366		335.090	340.975	342.582	333.518	340.266	345.339	340.385	334.306	10.100
K1									173.352	169.510	187.381		192.557	191.113	195.287	192.781	204.630	213.025	212.186	193.182	14.462
O1									245.215	253.792	277.801		293.107	289.271	287.017	276.286	280.451	279.191	279.473	276.160	15.188
MSF									283.033	270.138	274.359		279.456	288.815	289.135	284.531	284.438	285.804	284.135	282.384	6.091
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
									0.117	0.111	0.082		0.075	0.088	0.077	0.077	0.083	0.087	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
									77.8	80.6	92.1	47.0	99.0	89.8	96.9	93.7	91.6	95.4	89.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.94	15/06/2018 23:30	±0.22	17.6
Lowest Astronomical Tide (LAT)	0.12	13/01/2018 01:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Aug 2009.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Bonville Creek at Bonville

MHL2786

Figure A81

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Bellinger River at Repton

RECORDING STATION: **Bellinger River at Repton**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205403

ZONE: 56
EASTING: 502358
NORTHING: 6632218

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.964	0.880	0.895	0.911	0.954	0.875	0.957	0.964		1.050	1.055	1.015	0.992	0.949	0.950	0.963	0.940	0.889	0.900	0.950	0.054
MHWS	0.653	0.578	0.583	0.578	0.608	0.522	0.577	0.581		0.656	0.665	0.655	0.651	0.652	0.657	0.677	0.658	0.603	0.614	0.620	0.044
MHW	0.571	0.511	0.517	0.508	0.535	0.456	0.503	0.504		0.567	0.569	0.564	0.563	0.579	0.582	0.597	0.585	0.533	0.546	0.544	0.038
MHWN	0.489	0.445	0.451	0.437	0.462	0.390	0.430	0.427		0.478	0.473	0.472	0.475	0.506	0.507	0.517	0.511	0.463	0.479	0.467	0.033
MSL	0.190	0.201	0.220	0.190	0.219	0.160	0.199	0.175		0.204	0.182	0.189	0.187	0.245	0.232	0.236	0.236	0.206	0.231	0.206	0.024
MLWN	-0.108	-0.044	-0.012	-0.058	-0.025	-0.070	-0.031	-0.077		-0.070	-0.108	-0.095	-0.101	-0.017	-0.042	-0.044	-0.039	-0.051	-0.018	-0.056	0.032
MLW	-0.190	-0.110	-0.078	-0.129	-0.098	-0.135	-0.104	-0.154		-0.159	-0.205	-0.187	-0.189	-0.090	-0.118	-0.124	-0.112	-0.121	-0.085	-0.133	0.039
MLWS	-0.273	-0.176	-0.144	-0.199	-0.171	-0.201	-0.178	-0.231		-0.248	-0.301	-0.278	-0.276	-0.163	-0.193	-0.205	-0.186	-0.190	-0.152	-0.209	0.048
ISLW	-0.495	-0.392	-0.366	-0.437	-0.418	-0.453	-0.450	-0.504		-0.530	-0.579	-0.535	-0.520	-0.375	-0.402	-0.409	-0.387	-0.395	-0.356	-0.445	0.067
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.597	0.489	0.463	0.496	0.487	0.460	0.461	0.504		0.547	0.582	0.567	0.577	0.524	0.549	0.561	0.550	0.514	0.497	0.524	0.044
MR	0.761	0.622	0.595	0.636	0.633	0.591	0.608	0.657		0.725	0.774	0.751	0.752	0.669	0.699	0.721	0.697	0.654	0.631	0.677	0.060
MSR	0.926	0.754	0.727	0.777	0.778	0.722	0.754	0.811		0.904	0.966	0.934	0.927	0.815	0.849	0.882	0.844	0.793	0.765	0.829	0.078
R	1.459	1.272	1.261	1.348	1.372	1.329	1.407	1.468		1.580	1.635	1.551	1.512	1.324	1.353	1.372	1.327	1.284	1.256	1.395	0.115
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.381	0.311	0.297	0.318	0.316	0.296	0.304	0.329		0.363	0.387	0.375	0.376	0.335	0.350	0.361	0.348	0.327	0.316	0.338	0.030
S2	0.082	0.066	0.066	0.070	0.073	0.066	0.073	0.077		0.089	0.096	0.092	0.088	0.073	0.075	0.080	0.074	0.070	0.067	0.076	0.009
K1	0.138	0.130	0.133	0.142	0.146	0.147	0.157	0.160		0.169	0.169	0.158	0.153	0.128	0.130	0.126	0.125	0.125	0.123	0.142	0.016
O1	0.084	0.086	0.090	0.096	0.101	0.106	0.115	0.114		0.113	0.110	0.099	0.091	0.084	0.080	0.078	0.076	0.080	0.081	0.093	0.014
MSF	0.047	0.040	0.050	0.044	0.020	0.027	0.053	0.019		0.037	0.038	0.016	0.029	0.027	0.044	0.038	0.038	0.044	0.047	0.037	0.011
z0	0.190	0.201	0.220	0.190	0.219	0.160	0.199	0.175		0.204	0.182	0.189	0.187	0.245	0.232	0.236	0.236	0.206	0.231	0.206	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	30.098	38.845	37.824	35.763	35.605	38.472	35.680	28.819		25.887	23.261	25.020	26.642	31.398	31.390	31.088	33.529	37.224	37.369	32.440	4.999
S2	308.423	313.558	313.881	310.674	311.337	315.150	311.975	312.735		308.978	304.787	304.929	308.204	310.786	312.425	310.580	314.530	314.346	312.602	311.106	3.054
K1	171.063	180.958	181.377	178.182	175.407	178.338	173.678	166.343		156.458	151.441	152.211	152.693	160.665	159.628	162.944	167.414	174.594	177.606	167.833	10.383
O1	229.407	235.758	237.178	233.113	233.023	236.541	235.910	235.916		239.902	243.283	248.062	250.747	252.295	249.414	243.126	242.282	242.075	239.090	240.396	6.544
MSF	288.567	286.457	287.894	275.566	307.298	255.246	277.134	263.078		271.291	278.612	277.028	276.042	292.787	293.341	294.948	281.418	284.629	274.918	281.459	12.194
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.098	0.080	0.087	0.087	0.104	0.083	0.103		0.094	0.089	0.101	0.090	0.102	0.076	0.079	0.086	0.090	0.082		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	91.5	92.0	94.2	94.1	84.2	96.5	93.7	87.5	43.8	65.8	80.6	84.2	94.7	79.3	93.2	94.3	87.4	95.4	91.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 22:30	±0.20	14.9
Lowest Astronomical Tide (LAT)	-0.31	25/11/2015 03:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

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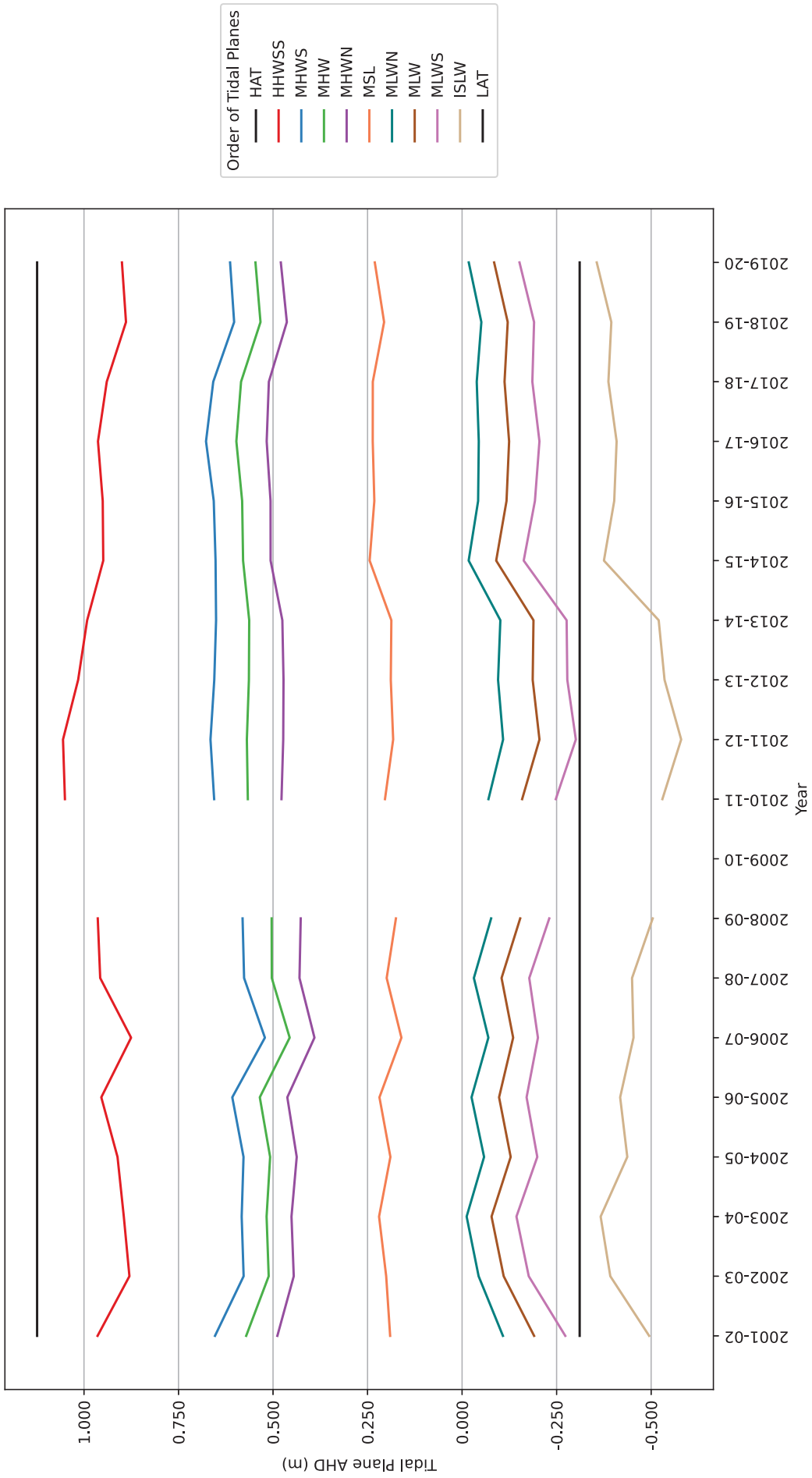
Table A82

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Bellinger River at Repton

MHL2786

Figure A82

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Kalang River at Urunga

RECORDING STATION: **Kalang River at Urunga**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205407

ZONE: 56
EASTING: 501233
NORTHING: 6626813

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.922	0.840	0.818	0.835	0.870	0.816	0.888	0.873	1.007	1.008	0.985	0.950	0.924	0.879	0.868	0.900	0.886	0.828	0.837	0.891	0.061
MHWS	0.611	0.540	0.520	0.516	0.532	0.474	0.521	0.496	0.573	0.616	0.593	0.589	0.584	0.577	0.580	0.617	0.608	0.550	0.554	0.561	0.043
MHW	0.534	0.480	0.464	0.456	0.468	0.418	0.456	0.434	0.480	0.534	0.501	0.502	0.503	0.507	0.511	0.544	0.541	0.488	0.495	0.490	0.035
MHWN	0.457	0.420	0.408	0.396	0.404	0.361	0.391	0.371	0.387	0.453	0.410	0.416	0.421	0.437	0.442	0.471	0.473	0.426	0.436	0.420	0.031
MSL	0.175	0.193	0.206	0.179	0.182	0.151	0.183	0.157	0.092	0.179	0.128	0.141	0.141	0.185	0.184	0.206	0.218	0.194	0.208	0.174	0.032
MLWN	-0.106	-0.034	0.004	-0.038	-0.039	-0.059	-0.026	-0.058	-0.203	-0.096	-0.154	-0.135	-0.139	-0.066	-0.074	-0.059	-0.037	-0.038	-0.019	-0.072	0.053
MLW	-0.183	-0.094	-0.052	-0.098	-0.103	-0.115	-0.091	-0.120	-0.296	-0.177	-0.245	-0.221	-0.221	-0.136	-0.143	-0.132	-0.105	-0.100	-0.078	-0.143	0.064
MLWS	-0.260	-0.154	-0.108	-0.158	-0.168	-0.172	-0.155	-0.183	-0.389	-0.259	-0.337	-0.308	-0.302	-0.206	-0.211	-0.206	-0.172	-0.161	-0.137	-0.213	0.076
ISLW	-0.482	-0.369	-0.321	-0.386	-0.409	-0.416	-0.418	-0.452	-0.699	-0.539	-0.617	-0.565	-0.545	-0.422	-0.417	-0.408	-0.371	-0.360	-0.339	-0.449	0.101
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.562	0.454	0.404	0.434	0.443	0.421	0.418	0.429	0.590	0.549	0.564	0.551	0.560	0.504	0.516	0.530	0.511	0.463	0.454	0.492	0.060
MR	0.717	0.574	0.516	0.554	0.571	0.533	0.547	0.554	0.776	0.711	0.746	0.724	0.724	0.643	0.653	0.676	0.646	0.587	0.573	0.633	0.082
MSR	0.871	0.694	0.628	0.673	0.700	0.645	0.676	0.679	0.963	0.874	0.929	0.897	0.887	0.782	0.791	0.823	0.780	0.711	0.691	0.773	0.105
R	1.404	1.209	1.139	1.221	1.279	1.232	1.305	1.325	1.707	1.546	1.602	1.515	1.469	1.300	1.286	1.308	1.257	1.188	1.176	1.340	0.158
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.358	0.287	0.258	0.277	0.286	0.267	0.273	0.277	0.388	0.356	0.373	0.362	0.362	0.321	0.327	0.338	0.323	0.294	0.286	0.316	0.041
S2	0.077	0.060	0.056	0.060	0.064	0.056	0.065	0.063	0.093	0.081	0.091	0.086	0.082	0.070	0.069	0.073	0.067	0.062	0.059	0.070	0.012
K1	0.137	0.128	0.127	0.136	0.143	0.142	0.152	0.156	0.185	0.167	0.171	0.159	0.150	0.132	0.127	0.124	0.122	0.120	0.121	0.142	0.019
O1	0.085	0.086	0.086	0.093	0.098	0.103	0.111	0.113	0.125	0.113	0.109	0.099	0.093	0.084	0.079	0.078	0.076	0.079	0.081	0.094	0.015
MSF	0.051	0.041	0.048	0.043	0.031	0.028	0.054	0.021	0.035	0.037	0.036	0.017	0.033	0.031	0.045	0.042	0.037	0.045	0.048	0.038	0.010
z0	0.175	0.193	0.206	0.179	0.182	0.151	0.183	0.157	0.092	0.179	0.128	0.141	0.141	0.185	0.184	0.206	0.218	0.194	0.208	0.174	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	28.683	39.606	46.050	42.592	38.444	41.657	39.557	36.041	18.040	22.203	19.430	20.688	21.352	27.864	30.437	30.307	33.379	39.151	40.582	32.424	8.890
S2	307.066	314.992	323.390	318.342	315.675	318.598	316.039	320.205	297.805	303.607	302.558	299.643	302.347	310.770	311.963	310.464	313.819	315.564	315.547	311.494	7.373
K1	170.401	181.134	186.437	182.652	176.354	180.720	175.852	173.763	154.693	155.026	149.531	150.292	148.699	156.720	159.194	162.714	167.559	176.174	179.240	167.745	12.598
O1	228.291	235.081	239.397	235.865	234.635	236.675	237.322	239.013	229.853	240.919	240.390	246.538	248.508	252.177	248.923	242.958	240.783	242.015	239.899	239.960	6.179
MSF	289.568	281.711	291.511	277.404	313.372	264.480	277.031	274.034	292.893	273.940	267.120	261.962	279.071	298.341	288.808	291.858	275.956	282.571	274.918	281.924	12.607
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.091	0.069	0.085	0.081	0.099	0.080	0.080	0.093	0.084	0.093	0.094	0.081	0.090	0.075	0.073	0.081	0.082	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.4	89.3	82.6	86.6	73.2	92.3	93.1	65.1	93.2	71.8	84.4	84.6	93.3	86.2	95.1	95.6	90.4	94.3	91.2		

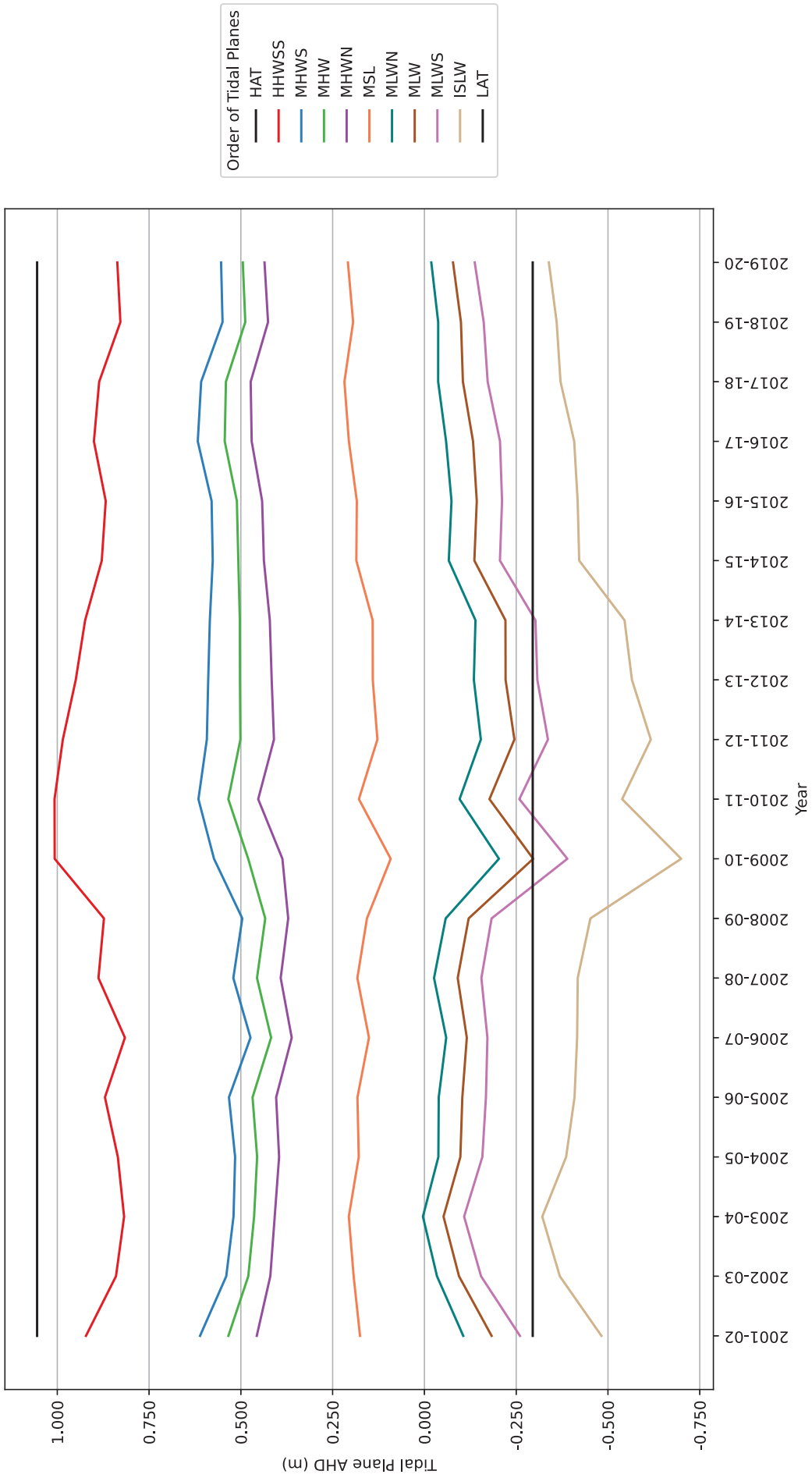
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.05	04/06/2004 22:30	±0.23	13.8
Lowest Astronomical Tide (LAT)	-0.29	24/12/2011 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A83

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Kalang River at Urunga

MHL2786

Figure A83

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Kalang River at Upstream Newry Island

RECORDING STATION: **Kalang River at Upstream Newry Island**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205458

ZONE: 56
EASTING: 497967
NORTHING: 6625223

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.946	0.853	0.837	0.852	0.905	0.860	0.943	0.952	1.067	1.069	1.067	1.018	0.976	0.935	0.932	0.961	0.941	0.874	0.893	0.941	0.073
MHWS	0.634	0.552	0.536	0.531	0.564	0.513	0.566	0.574	0.636	0.655	0.669	0.650	0.631	0.627	0.636	0.674	0.658	0.591	0.608	0.606	0.051
MHW	0.552	0.487	0.476	0.467	0.496	0.452	0.497	0.503	0.539	0.567	0.571	0.557	0.544	0.552	0.563	0.596	0.586	0.525	0.544	0.530	0.042
MHWN	0.471	0.423	0.416	0.403	0.428	0.391	0.428	0.432	0.443	0.479	0.474	0.465	0.457	0.478	0.490	0.518	0.514	0.459	0.479	0.455	0.035
MSL	0.173	0.183	0.199	0.172	0.194	0.165	0.201	0.183	0.136	0.186	0.168	0.168	0.156	0.205	0.212	0.234	0.239	0.209	0.237	0.190	0.028
MLWN	-0.126	-0.057	-0.018	-0.059	-0.041	-0.060	-0.026	-0.065	-0.171	-0.107	-0.139	-0.129	-0.144	-0.068	-0.067	-0.051	-0.036	-0.042	-0.006	-0.074	0.047
MLW	-0.207	-0.122	-0.078	-0.123	-0.109	-0.121	-0.096	-0.137	-0.267	-0.195	-0.236	-0.221	-0.231	-0.142	-0.139	-0.129	-0.108	-0.108	-0.071	-0.150	0.058
MLWS	-0.289	-0.186	-0.138	-0.187	-0.177	-0.182	-0.165	-0.208	-0.364	-0.283	-0.334	-0.313	-0.318	-0.217	-0.212	-0.207	-0.181	-0.174	-0.135	-0.225	0.069
ISLW	-0.512	-0.401	-0.353	-0.416	-0.420	-0.430	-0.434	-0.478	-0.672	-0.579	-0.618	-0.576	-0.565	-0.437	-0.424	-0.412	-0.383	-0.376	-0.339	-0.464	0.095
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.596	0.480	0.434	0.462	0.469	0.451	0.454	0.497	0.613	0.586	0.612	0.593	0.600	0.546	0.557	0.569	0.550	0.502	0.485	0.529	0.062
MR	0.759	0.609	0.554	0.590	0.605	0.573	0.593	0.640	0.807	0.762	0.808	0.778	0.774	0.695	0.702	0.726	0.694	0.633	0.615	0.680	0.085
MSR	0.922	0.738	0.674	0.718	0.741	0.695	0.731	0.783	1.000	0.939	1.003	0.963	0.948	0.843	0.848	0.882	0.838	0.765	0.744	0.830	0.108
R	1.457	1.254	1.190	1.269	1.326	1.289	1.377	1.429	1.739	1.648	1.685	1.594	1.541	1.372	1.357	1.374	1.324	1.249	1.232	1.406	0.163
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.380	0.304	0.277	0.295	0.302	0.287	0.296	0.320	0.403	0.381	0.404	0.389	0.387	0.347	0.351	0.363	0.347	0.317	0.307	0.340	0.042
S2	0.082	0.065	0.060	0.064	0.068	0.061	0.069	0.071	0.097	0.088	0.098	0.092	0.087	0.074	0.073	0.078	0.072	0.066	0.065	0.075	0.012
K1	0.138	0.130	0.128	0.137	0.143	0.145	0.155	0.159	0.184	0.178	0.174	0.163	0.153	0.136	0.131	0.128	0.125	0.123	0.122	0.145	0.019
O1	0.085	0.085	0.087	0.092	0.100	0.103	0.114	0.111	0.124	0.117	0.110	0.100	0.094	0.084	0.081	0.077	0.077	0.078	0.082	0.095	0.015
MSF	0.049	0.040	0.047	0.045	0.027	0.029	0.052	0.022	0.029	0.032	0.032	0.016	0.032	0.029	0.044	0.042	0.035	0.047	0.047	0.037	0.010
z0	0.173	0.183	0.199	0.172	0.194	0.165	0.201	0.183	0.136	0.186	0.168	0.168	0.156	0.205	0.212	0.234	0.239	0.209	0.237	0.190	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	38.365	47.731	53.421	51.086	47.689	49.650	47.729	40.106	28.358	30.974	28.240	29.878	30.577	36.284	38.776	38.826	41.730	47.059	47.831	40.753	8.314
S2	319.681	326.785	333.094	328.981	326.919	329.531	326.509	328.068	312.588	316.071	313.526	312.294	315.487	322.849	323.288	321.921	324.497	325.915	325.801	322.832	6.216
K1	176.173	185.988	190.869	187.636	183.209	185.562	180.402	173.445	161.277	160.733	155.566	156.607	154.362	161.961	164.365	167.801	172.603	180.223	183.315	172.742	12.060
O1	233.405	239.686	244.191	240.118	239.228	240.719	241.189	242.149	235.482	244.229	246.204	251.398	253.224	257.578	252.716	246.213	245.417	246.449	243.655	244.382	6.141
MSF	290.143	286.601	289.478	275.963	298.546	255.500	276.233	265.120	291.007	273.767	274.398	270.933	277.941	297.723	292.381	290.729	274.983	280.156	274.701	280.858	11.382
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.097	0.075	0.086	0.084	0.098	0.077	0.102	0.091	0.088	0.071	0.091	0.083	0.089	0.077	0.073	0.081	0.084	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.6	90.9	91.7	94.7	91.8	95.3	93.1	82.2	93.9	76.5	81.9	83.5	94.3	84.8	94.0	92.3	88.7	86.8	81.5		

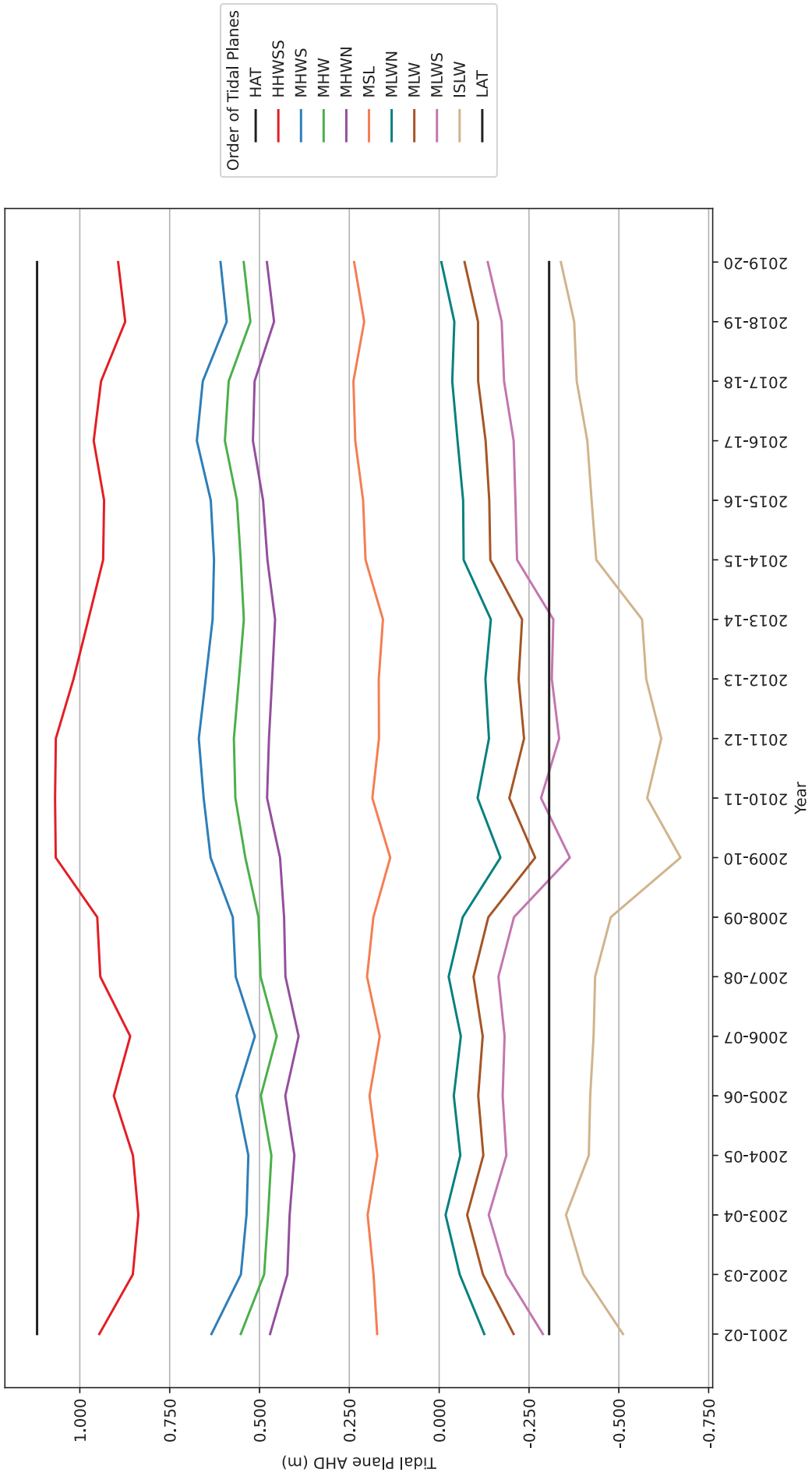
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 23:00	±0.22	14.3
Lowest Astronomical Tide (LAT)	-0.31	05/12/2014 02:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A84

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Kalang River at Upstream Newry Island

MHL2786

Figure A84

NSW GOVERNMENT

STATION LOCATIONS
NAMBUCCA RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A85

DRAWING A85.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Deep Creek at Deep Creek

RECORDING STATION: **Deep Creek at Deep Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205485

ZONE: 56
EASTING: 500253
NORTHING: 6613431

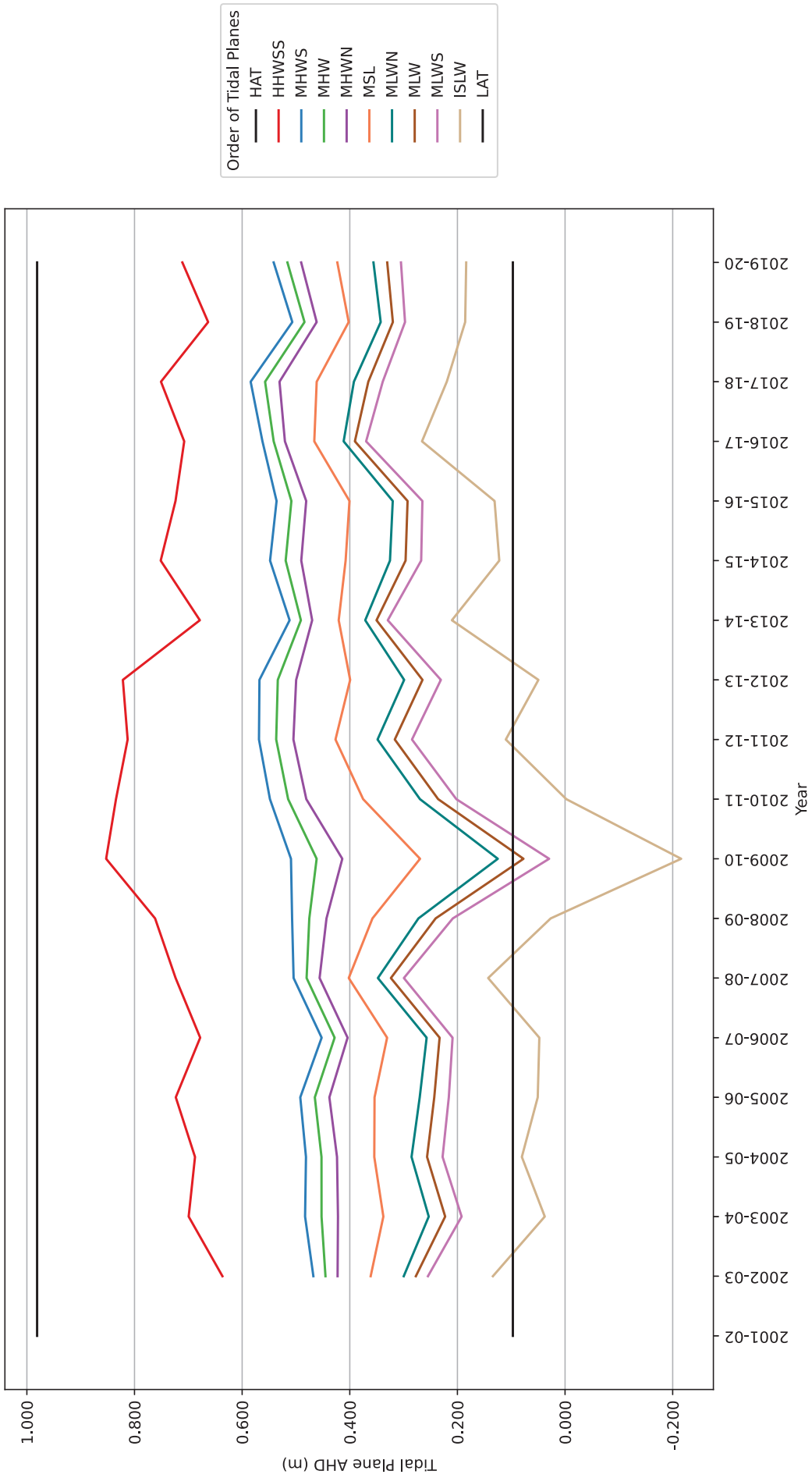
YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.637	0.699	0.688	0.723	0.678	0.724	0.762	0.853	0.834	0.813	0.822	0.679	0.751	0.724	0.708	0.751	0.663	0.711	0.734	0.062
MHWS		0.468	0.483	0.481	0.492	0.452	0.504	0.507	0.509	0.548	0.569	0.568	0.512	0.548	0.536	0.562	0.584	0.507	0.541	0.521	0.038
MHW		0.445	0.453	0.453	0.465	0.428	0.480	0.475	0.462	0.515	0.537	0.534	0.491	0.519	0.509	0.541	0.557	0.484	0.516	0.492	0.038
MHWN		0.423	0.422	0.424	0.438	0.404	0.456	0.443	0.414	0.481	0.505	0.500	0.470	0.490	0.481	0.521	0.531	0.462	0.490	0.464	0.038
MSL		0.361	0.338	0.354	0.354	0.331	0.402	0.358	0.269	0.375	0.427	0.399	0.421	0.408	0.401	0.466	0.461	0.402	0.423	0.386	0.049
MLWN		0.300	0.253	0.285	0.270	0.257	0.348	0.272	0.125	0.270	0.348	0.299	0.371	0.325	0.320	0.411	0.392	0.343	0.356	0.308	0.065
MLW		0.277	0.223	0.256	0.243	0.233	0.324	0.241	0.077	0.236	0.316	0.265	0.350	0.296	0.293	0.391	0.366	0.320	0.330	0.280	0.071
MLWS		0.255	0.192	0.228	0.216	0.209	0.300	0.209	0.030	0.202	0.284	0.231	0.329	0.267	0.265	0.370	0.339	0.297	0.305	0.252	0.076
ISLW		0.134	0.038	0.080	0.051	0.048	0.143	0.027	-0.216	-0.002	0.110	0.049	0.210	0.122	0.131	0.266	0.220	0.186	0.184	0.099	0.109
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.123	0.169	0.138	0.168	0.147	0.108	0.171	0.289	0.211	0.156	0.201	0.099	0.165	0.161	0.109	0.138	0.119	0.134	0.156	0.045
MR		0.168	0.230	0.196	0.222	0.195	0.157	0.235	0.384	0.279	0.220	0.269	0.140	0.223	0.216	0.151	0.192	0.164	0.185	0.213	0.058
MSR		0.213	0.291	0.254	0.276	0.243	0.205	0.299	0.480	0.346	0.284	0.337	0.182	0.281	0.271	0.193	0.245	0.209	0.237	0.269	0.070
R		0.503	0.662	0.607	0.673	0.630	0.581	0.735	1.068	0.837	0.703	0.772	0.468	0.629	0.593	0.442	0.531	0.478	0.527	0.635	0.153
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.084	0.115	0.098	0.111	0.098	0.078	0.117	0.192	0.139	0.110	0.134	0.070	0.111	0.108	0.075	0.096	0.082	0.093	0.106	0.029
S2		0.022	0.031	0.029	0.027	0.024	0.024	0.032	0.048	0.034	0.032	0.034	0.021	0.029	0.028	0.021	0.027	0.023	0.026	0.028	0.006
K1		0.064	0.081	0.079	0.087	0.083	0.079	0.095	0.131	0.105	0.090	0.095	0.061	0.078	0.072	0.053	0.064	0.058	0.065	0.080	0.019
O1		0.057	0.073	0.068	0.078	0.078	0.077	0.087	0.114	0.099	0.085	0.086	0.058	0.068	0.063	0.051	0.055	0.054	0.056	0.073	0.017
MSF		0.079	0.079	0.073	0.064	0.065	0.082	0.067	0.070	0.073	0.087	0.054	0.078	0.071	0.076	0.078	0.060	0.079	0.081	0.073	0.009
z0		0.361	0.338	0.354	0.354	0.331	0.402	0.358	0.269	0.375	0.427	0.399	0.421	0.408	0.401	0.466	0.461	0.402	0.423	0.386	0.049
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		59.263	55.782	58.736	56.763	58.947	60.504	49.255	35.050	46.450	50.201	46.955	56.764	50.168	52.989	58.698	54.587	59.509	58.955	53.865	6.556
S2		331.183	322.918	324.731	320.332	323.164	328.172	323.036	310.610	310.504	333.782	320.722	323.184	327.550	329.115	330.085	323.479	330.320	323.648	324.252	6.274
K1		209.681	201.708	206.327	202.738	204.580	203.886	190.371	171.818	178.160	183.446	179.358	190.673	182.555	184.584	197.553	194.244	202.556	204.536	193.821	11.510
O1		263.092	258.646	260.530	257.848	261.118	263.886	257.504	246.284	265.490	273.160	273.552	287.724	276.580	277.412	279.600	272.618	269.773	265.524	267.241	9.960
MSF		282.532	284.515	279.917	282.780	272.667	271.765	268.549	281.221	273.216	272.220	277.552	281.470	284.677	286.273	287.436	278.927	282.989	276.563	279.182	5.583
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.091	0.070	0.091	0.070	0.084	0.069	0.088	0.102	0.093	0.076	0.107	0.075	0.073	0.065	0.061	0.070	0.081	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		96.7	91.5	97.3	86.2	92.0	79.8	80.7	96.1	87.6	63.5	67.8	86.4	90.6	94.9	91.6	63.0	96.9	96.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.98	04/06/2004 23:00	±0.20	15.2
Lowest Astronomical Tide (LAT)	0.10	07/10/2004 10:15		

COMMENTS

*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Apr 2002. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Deep Creek at Deep Creek

MHL2786

Figure
A86

RECORDING STATION: **Nambucca River at Stuarts Island Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205466

ZONE: 56
EASTING: 499519
NORTHING: 6608564

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS								0.938	0.931	0.895	0.957	0.908	0.868	0.838	0.822	0.866	0.819	0.723	0.737	0.859	0.075
MHWS								0.570	0.537	0.539	0.587	0.567	0.552	0.554	0.553	0.598	0.563	0.480	0.490	0.549	0.035
MHW								0.507	0.463	0.478	0.512	0.494	0.484	0.489	0.492	0.534	0.504	0.424	0.438	0.485	0.031
MHWN								0.443	0.389	0.417	0.437	0.421	0.417	0.424	0.431	0.470	0.444	0.369	0.386	0.421	0.028
MSL								0.229	0.158	0.211	0.205	0.192	0.191	0.203	0.213	0.251	0.228	0.181	0.204	0.205	0.024
MLWN								0.015	-0.073	0.005	-0.027	-0.037	-0.035	-0.019	-0.004	0.032	0.013	-0.008	0.022	-0.010	0.030
MLW								-0.049	-0.147	-0.056	-0.102	-0.110	-0.102	-0.084	-0.065	-0.032	-0.047	-0.063	-0.031	-0.074	0.035
MLWS								-0.113	-0.221	-0.116	-0.177	-0.183	-0.170	-0.148	-0.126	-0.097	-0.107	-0.119	-0.083	-0.138	0.042
ISLW								-0.375	-0.502	-0.370	-0.442	-0.427	-0.395	-0.352	-0.319	-0.288	-0.290	-0.293	-0.259	-0.359	0.074
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR								0.428	0.462	0.412	0.463	0.458	0.452	0.443	0.435	0.438	0.431	0.377	0.364	0.430	0.032
MR								0.556	0.610	0.534	0.614	0.604	0.587	0.573	0.557	0.566	0.550	0.488	0.469	0.559	0.045
MSR								0.683	0.758	0.655	0.765	0.750	0.721	0.702	0.679	0.695	0.670	0.599	0.573	0.688	0.059
R								1.313	1.433	1.265	1.399	1.335	1.263	1.190	1.141	1.154	1.109	1.016	0.995	1.218	0.141
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2								0.278	0.305	0.267	0.307	0.302	0.293	0.286	0.278	0.283	0.275	0.244	0.234	0.279	0.023
S2								0.064	0.074	0.061	0.075	0.073	0.067	0.065	0.061	0.064	0.060	0.055	0.052	0.064	0.007
K1								0.149	0.164	0.146	0.155	0.145	0.135	0.122	0.116	0.115	0.112	0.105	0.105	0.131	0.021
O1								0.113	0.118	0.108	0.109	0.099	0.091	0.081	0.077	0.076	0.071	0.069	0.071	0.090	0.018
MSF								0.044	0.043	0.042	0.048	0.022	0.041	0.029	0.049	0.048	0.037	0.050	0.047	0.042	0.009
z0								0.229	0.158	0.211	0.205	0.192	0.191	0.203	0.213	0.251	0.228	0.181	0.204	0.205	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2								21.432	17.771	22.988	16.461	18.616	20.082	22.421	23.880	23.203	25.720	30.235	33.208	23.001	4.912
S2								296.305	291.004	297.826	292.142	290.946	293.418	296.459	297.937	295.247	298.287	300.374	300.314	295.855	3.340
K1								159.102	156.742	157.367	149.797	149.648	150.036	152.818	156.334	159.543	164.029	173.347	176.845	158.800	8.816
O1								232.683	233.198	246.586	244.365	249.659	252.805	251.434	249.236	243.553	242.273	242.163	241.113	244.089	6.457
MSF								267.965	284.105	261.394	274.191	289.663	274.722	301.273	293.268	286.475	283.828	291.923	270.194	281.584	11.894
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
								0.081	0.097	0.097	0.075	0.097	0.084	0.098	0.075	0.074	0.088	0.091	0.079		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
								55.3	96.9	89.1	88.7	89.7	97.0	89.5	95.0	93.3	90.8	96.9	91.8		

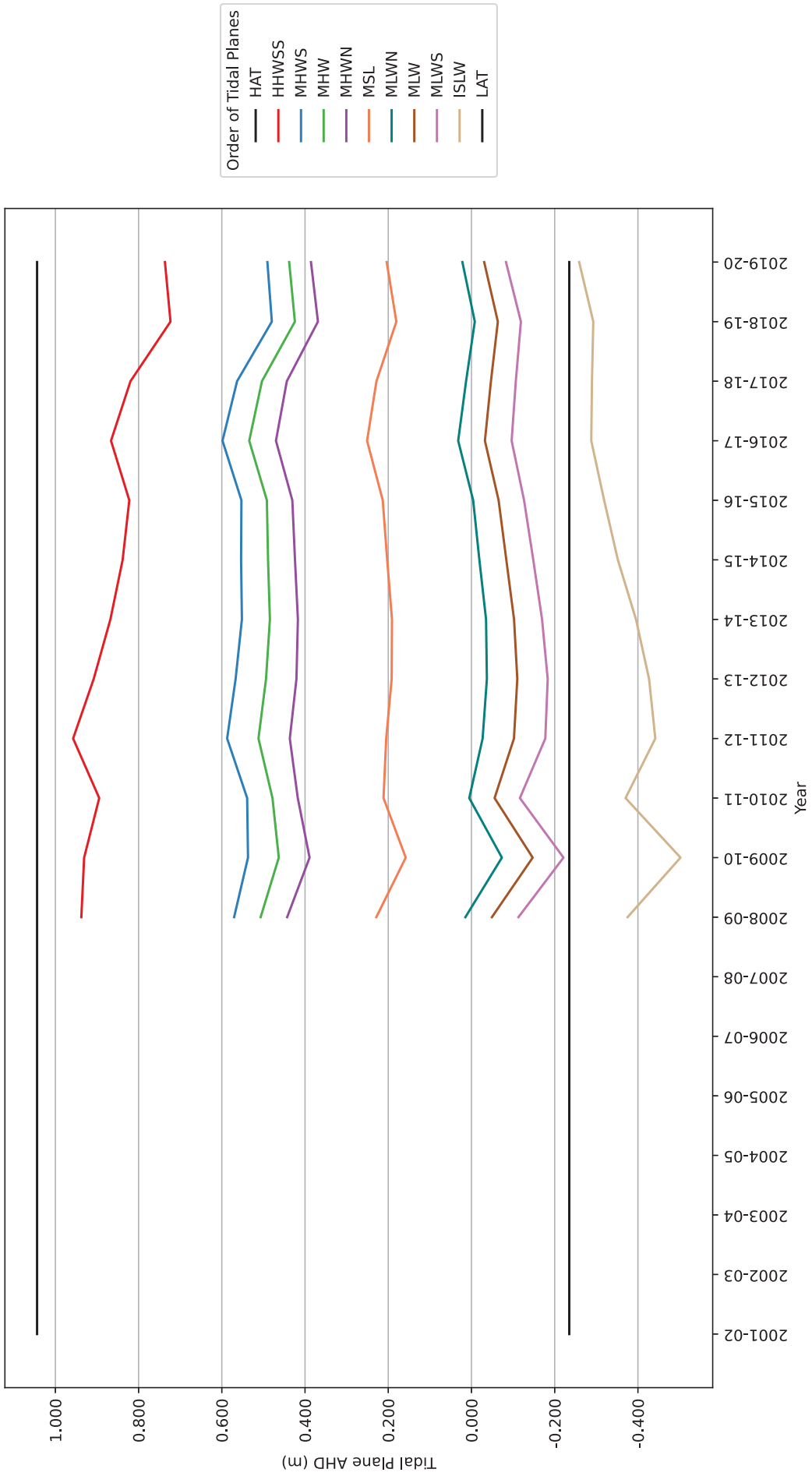
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.04	15/06/2018 22:30	±0.20	7.9
Lowest Astronomical Tide (LAT)	-0.23	24/12/2011 02:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2008.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Nambucca River at Stuarts Island Downstream

Table A88



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Nambucca River at Stuarts Island Downstream

MHL2786

Figure A88

RECORDING STATION: **Nambucca River at Macksville**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205416

ZONE: 56
EASTING: 492382
NORTHING: 6602967

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Nambucca River at Macksville

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.886	0.834	0.803	0.781	0.822	0.773	0.878	0.930	0.961	0.940	0.984	0.955	0.908	0.893	0.859	0.891	0.868	0.795	0.802	0.872	0.065
MHWS	0.590	0.546	0.503	0.490	0.515	0.456	0.521	0.558	0.553	0.572	0.612	0.601	0.585	0.603	0.581	0.618	0.602	0.543	0.543	0.557	0.045
MHW	0.525	0.487	0.444	0.435	0.459	0.404	0.460	0.496	0.478	0.508	0.535	0.526	0.517	0.536	0.517	0.552	0.540	0.486	0.488	0.494	0.040
MHWN	0.460	0.428	0.385	0.381	0.404	0.351	0.399	0.433	0.403	0.444	0.457	0.451	0.448	0.470	0.454	0.485	0.477	0.429	0.434	0.431	0.036
MSL	0.227	0.214	0.178	0.192	0.214	0.167	0.203	0.212	0.146	0.214	0.202	0.200	0.201	0.224	0.212	0.244	0.239	0.220	0.229	0.207	0.024
MLWN	-0.007	-0.001	-0.029	0.003	0.023	-0.018	0.007	-0.010	-0.111	-0.017	-0.054	-0.051	-0.046	-0.021	-0.030	0.003	0.001	0.011	0.023	-0.017	0.032
MLW	-0.072	-0.060	-0.088	-0.051	-0.032	-0.070	-0.054	-0.072	-0.187	-0.081	-0.132	-0.126	-0.115	-0.088	-0.094	-0.063	-0.061	-0.045	-0.031	-0.080	0.038
MLWS	-0.137	-0.119	-0.147	-0.106	-0.087	-0.122	-0.115	-0.135	-0.262	-0.145	-0.209	-0.201	-0.183	-0.154	-0.157	-0.130	-0.123	-0.102	-0.086	-0.143	0.045
ISLW	-0.348	-0.324	-0.362	-0.314	-0.306	-0.348	-0.370	-0.401	-0.553	-0.408	-0.475	-0.453	-0.414	-0.362	-0.356	-0.325	-0.313	-0.283	-0.271	-0.368	0.070
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.466	0.430	0.414	0.377	0.381	0.369	0.392	0.443	0.514	0.462	0.512	0.502	0.495	0.491	0.484	0.481	0.476	0.417	0.410	0.448	0.048
MR	0.596	0.547	0.532	0.487	0.491	0.474	0.514	0.568	0.665	0.589	0.667	0.652	0.631	0.624	0.611	0.615	0.601	0.531	0.519	0.574	0.062
MSR	0.727	0.665	0.650	0.596	0.602	0.578	0.635	0.693	0.815	0.717	0.821	0.802	0.768	0.757	0.738	0.748	0.725	0.645	0.628	0.701	0.076
R	1.233	1.158	1.164	1.096	1.128	1.121	1.247	1.331	1.514	1.348	1.458	1.408	1.323	1.255	1.215	1.216	1.181	1.078	1.073	1.239	0.128
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.298	0.274	0.266	0.243	0.246	0.237	0.257	0.284	0.332	0.295	0.333	0.326	0.316	0.312	0.305	0.307	0.300	0.266	0.260	0.287	0.031
S2	0.065	0.059	0.059	0.055	0.055	0.052	0.061	0.063	0.075	0.064	0.077	0.075	0.068	0.066	0.063	0.067	0.062	0.057	0.055	0.063	0.007
K1	0.126	0.123	0.128	0.122	0.128	0.130	0.145	0.154	0.169	0.153	0.158	0.151	0.139	0.126	0.120	0.118	0.116	0.107	0.110	0.133	0.017
O1	0.086	0.082	0.086	0.086	0.091	0.096	0.110	0.112	0.122	0.110	0.107	0.101	0.093	0.081	0.078	0.077	0.074	0.073	0.075	0.092	0.015
MSF	0.064	0.045	0.057	0.054	0.033	0.031	0.059	0.036	0.045	0.041	0.050	0.029	0.044	0.028	0.053	0.055	0.042	0.049	0.050	0.045	0.011
z0	0.227	0.214	0.178	0.192	0.214	0.167	0.203	0.212	0.146	0.214	0.202	0.200	0.201	0.224	0.212	0.244	0.239	0.220	0.229	0.207	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	47.924	49.047	56.497	55.108	52.699	54.002	49.833	43.721	37.392	41.262	36.581	38.599	39.936	41.436	42.503	42.329	45.034	49.101	50.618	45.980	6.192
S2	322.308	324.461	327.661	326.623	328.074	327.750	324.989	327.058	316.736	321.218	318.186	317.447	320.860	322.225	322.289	319.740	323.823	323.860	323.428	323.091	3.499
K1	184.047	188.113	191.651	192.936	189.027	190.225	182.683	175.525	168.242	169.555	162.980	162.515	162.412	165.056	167.216	171.410	175.686	183.894	186.697	177.362	10.948
O1	242.884	244.045	245.185	246.301	246.301	248.377	245.734	245.747	243.440	255.321	253.857	259.307	261.434	259.170	257.843	252.506	249.939	250.007	249.351	250.355	5.912
MSF	288.879	287.994	291.709	280.521	312.480	259.195	276.741	269.258	284.648	263.590	272.262	280.147	279.136	297.936	289.606	286.824	281.551	292.822	271.396	282.458	12.543
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079	0.094	0.084	0.088	0.079	0.102	0.081	0.094	0.091	0.095	0.076	0.088	0.084	0.093	0.075	0.072	0.089	0.084	0.080		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.8	92.4	95.8	93.7	92.0	96.8	95.0	79.4	96.0	85.9	84.6	83.5	95.5	78.0	93.4	91.0	90.0	96.6	92.1		

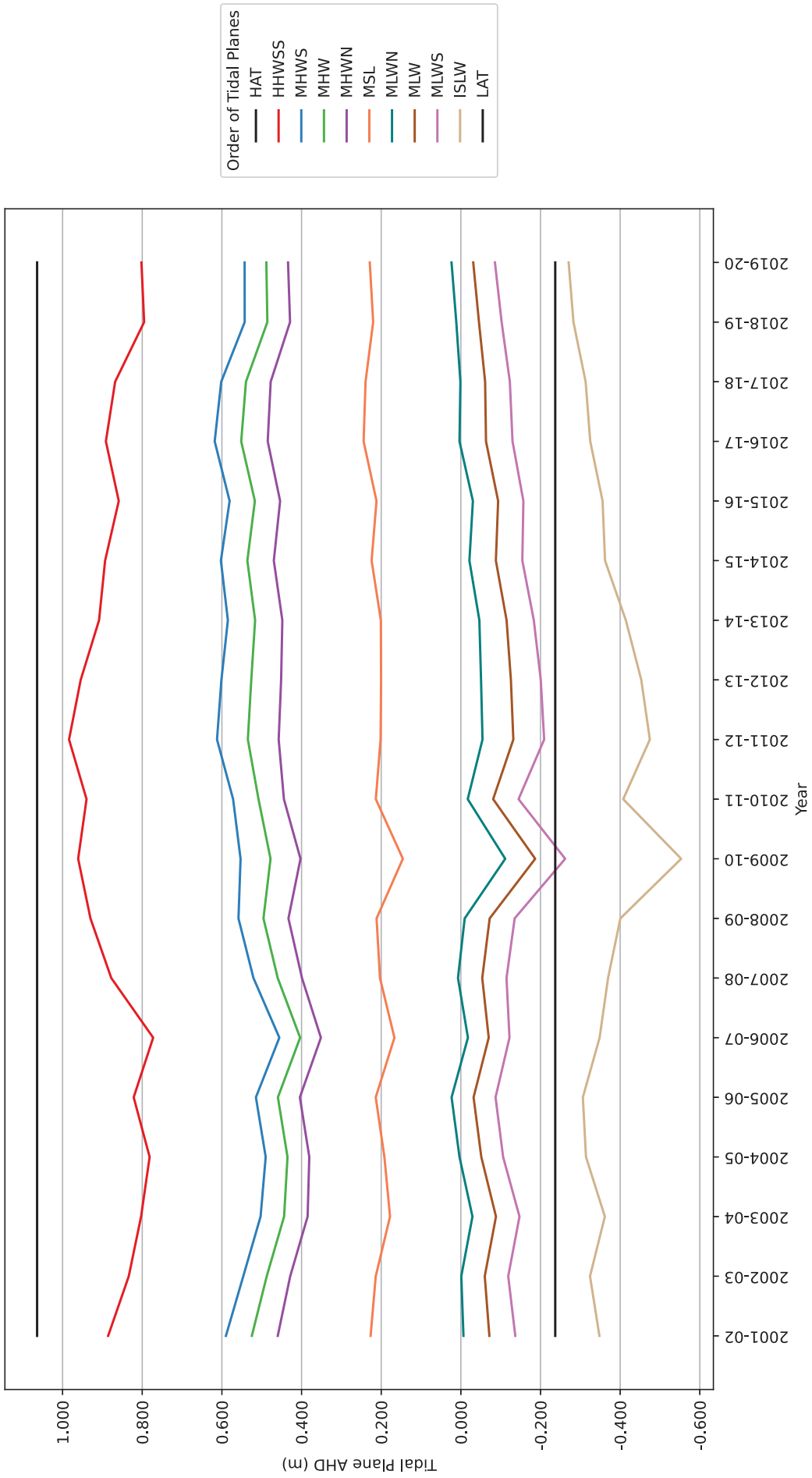
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.06	04/06/2004 23:00	±0.21	16.5
Lowest Astronomical Tide (LAT)	-0.24	05/12/2014 03:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A89

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Nambucca River at Macksville

MHL2786

Figure A89

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Taylors Arm at Utungun

RECORDING STATION: **Taylors Arm at Utungun**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205414

ZONE: 56
EASTING: 485800
NORTHING: 6600344

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.885	0.824	0.837	0.790	0.856	0.814	0.919	0.943	0.986	0.979	1.002	0.968	0.919	0.900	0.893	0.945	0.902	0.828	0.844	0.897	0.064
MHWS	0.598	0.540	0.545	0.507	0.556	0.502	0.571	0.583	0.590	0.616	0.641	0.629	0.608	0.618	0.626	0.681	0.645	0.580	0.591	0.591	0.047
MHW	0.532	0.480	0.483	0.450	0.497	0.449	0.510	0.522	0.516	0.554	0.566	0.557	0.541	0.553	0.563	0.613	0.582	0.521	0.536	0.528	0.043
MHWN	0.465	0.419	0.421	0.394	0.438	0.395	0.450	0.462	0.443	0.492	0.491	0.486	0.474	0.488	0.500	0.546	0.518	0.461	0.480	0.464	0.040
MSL	0.224	0.199	0.205	0.196	0.243	0.206	0.246	0.237	0.184	0.253	0.236	0.235	0.229	0.243	0.258	0.303	0.274	0.245	0.267	0.236	0.030
MLWN	-0.018	-0.020	-0.010	-0.002	0.047	0.016	0.043	0.012	-0.076	0.013	-0.018	-0.016	-0.016	-0.001	0.015	0.060	0.030	0.028	0.054	0.007	0.033
MLW	-0.085	-0.081	-0.072	-0.058	-0.012	-0.038	-0.017	-0.049	-0.149	-0.049	-0.093	-0.087	-0.083	-0.066	-0.048	-0.007	-0.033	-0.032	-0.002	-0.056	0.037
MLWS	-0.151	-0.142	-0.134	-0.115	-0.070	-0.091	-0.078	-0.109	-0.222	-0.111	-0.168	-0.159	-0.150	-0.131	-0.111	-0.074	-0.097	-0.091	-0.057	-0.119	0.041
ISLW	-0.356	-0.344	-0.343	-0.317	-0.285	-0.314	-0.327	-0.367	-0.506	-0.370	-0.426	-0.401	-0.372	-0.333	-0.302	-0.263	-0.280	-0.268	-0.238	-0.337	0.063
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.484	0.439	0.431	0.395	0.391	0.380	0.406	0.450	0.519	0.478	0.509	0.501	0.491	0.489	0.485	0.486	0.488	0.433	0.426	0.457	0.043
MR	0.617	0.561	0.555	0.509	0.509	0.487	0.528	0.571	0.665	0.603	0.659	0.644	0.624	0.619	0.611	0.620	0.615	0.552	0.537	0.583	0.054
MSR	0.750	0.682	0.678	0.622	0.626	0.594	0.649	0.692	0.812	0.728	0.809	0.787	0.757	0.749	0.737	0.755	0.743	0.671	0.649	0.710	0.065
R	1.241	1.168	1.179	1.107	1.142	1.127	1.245	1.310	1.492	1.349	1.428	1.368	1.291	1.233	1.195	1.208	1.182	1.096	1.083	1.234	0.114
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.308	0.280	0.277	0.254	0.254	0.243	0.264	0.286	0.333	0.301	0.329	0.322	0.312	0.310	0.306	0.310	0.308	0.276	0.269	0.292	0.027
S2	0.067	0.061	0.062	0.057	0.059	0.053	0.061	0.061	0.073	0.062	0.075	0.071	0.067	0.065	0.063	0.067	0.064	0.060	0.056	0.063	0.006
K1	0.123	0.122	0.124	0.119	0.124	0.127	0.142	0.150	0.164	0.149	0.154	0.147	0.133	0.123	0.116	0.116	0.112	0.106	0.109	0.130	0.017
O1	0.082	0.081	0.085	0.083	0.091	0.095	0.106	0.108	0.119	0.110	0.104	0.095	0.089	0.079	0.075	0.073	0.071	0.070	0.072	0.089	0.015
MSF	0.064	0.045	0.055	0.048	0.034	0.032	0.062	0.034	0.044	0.036	0.053	0.033	0.043	0.032	0.050	0.055	0.039	0.047	0.047	0.045	0.010
z0	0.224	0.199	0.205	0.196	0.243	0.206	0.246	0.237	0.184	0.253	0.236	0.235	0.229	0.243	0.258	0.303	0.274	0.245	0.267	0.236	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	64.482	69.551	69.299	71.070	68.626	71.250	66.864	62.160	58.231	59.019	55.224	57.177	59.374	60.159	60.569	59.501	62.110	65.578	66.781	63.528	5.022
S2	344.511	351.075	349.304	349.501	349.564	349.363	344.651	348.070	341.884	343.786	341.565	342.593	345.632	348.475	345.501	341.327	345.661	346.735	344.062	345.961	3.047
K1	193.432	198.991	199.411	201.830	197.415	199.223	193.251	187.821	180.197	178.874	172.686	173.210	173.333	175.794	177.760	180.881	186.300	193.561	195.941	187.364	10.329
O1	250.361	252.798	251.374	253.778	253.661	256.143	254.273	254.014	253.734	264.281	262.954	267.999	270.980	268.181	266.473	261.458	257.118	257.964	256.313	258.624	6.383
MSF	288.448	295.344	293.277	286.585	294.932	270.572	279.253	278.016	281.252	266.202	279.393	279.610	277.911	295.298	292.271	288.002	284.955	293.929	273.543	284.147	8.887
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.111	0.084	0.097	0.085	0.109	0.084	0.092	0.097	0.090	0.071	0.097	0.084	0.087	0.072	0.072	0.086	0.086	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.1	95.1	97.5	96.1	93.9	89.5	90.8	79.7	94.5	76.9	74.5	83.1	95.9	83.6	90.6	76.2	85.7	96.5	91.3		

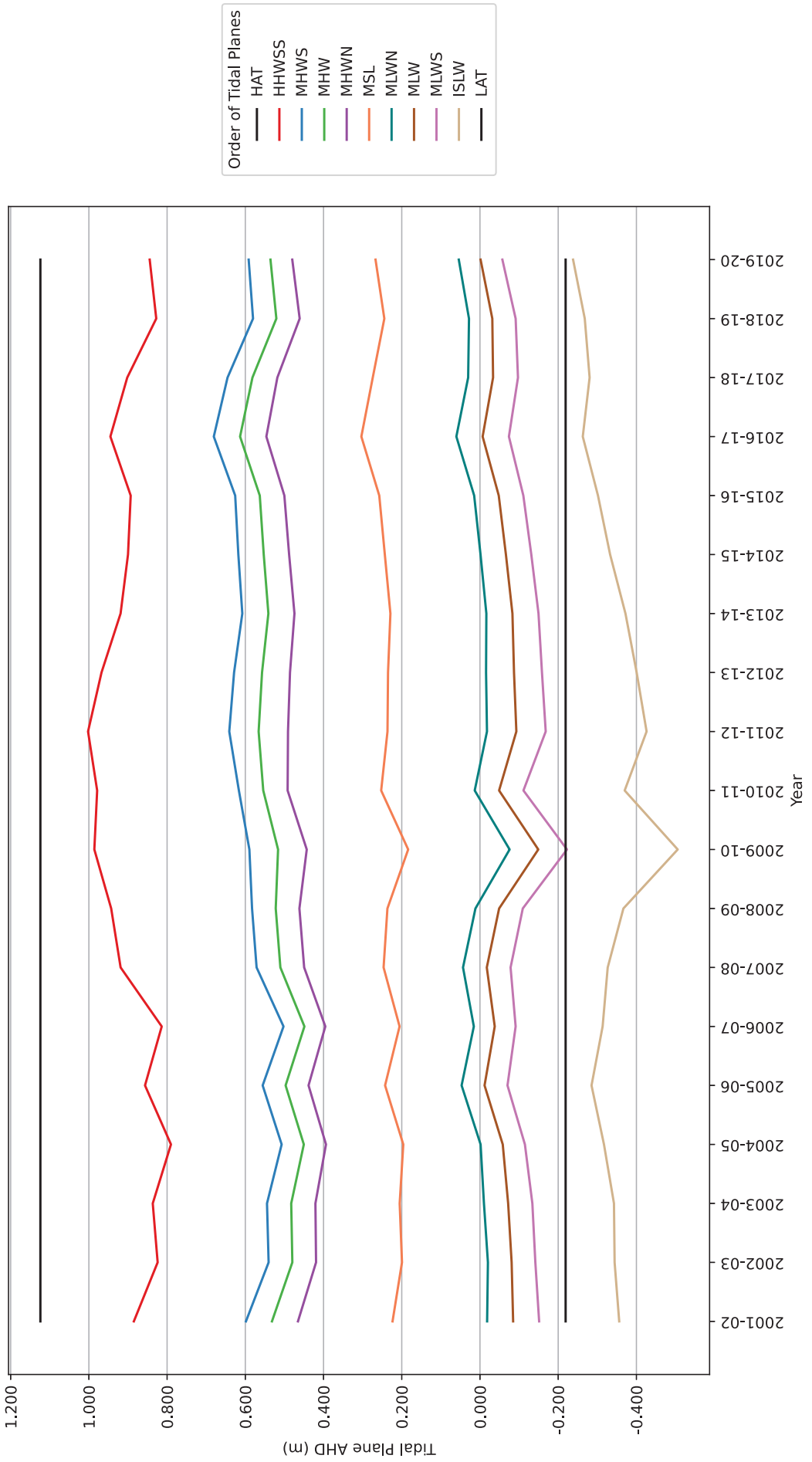
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 23:30	±0.20	18.0
Lowest Astronomical Tide (LAT)	-0.22	05/12/2014 04:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A90

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Taylors Arm at Utungun

MHL2786

Figure A90

RECORDING STATION: **Nambucca River at Bowraville Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205425

ZONE: 56
EASTING: 486768
NORTHING: 6608695

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS									0.928	0.944	0.938	0.893	0.830	0.824	0.817	0.870	0.842	0.764	0.781	0.857	0.062
MHWS									0.582	0.621	0.625	0.607	0.560	0.575	0.582	0.633	0.611	0.544	0.551	0.590	0.031
MHW									0.523	0.567	0.562	0.553	0.503	0.524	0.526	0.574	0.555	0.492	0.500	0.534	0.029
MHWN									0.463	0.513	0.499	0.499	0.446	0.473	0.470	0.514	0.498	0.439	0.449	0.479	0.027
MSL									0.253	0.312	0.325	0.328	0.259	0.284	0.284	0.324	0.301	0.264	0.263	0.291	0.029
MLWN									0.043	0.111	0.150	0.157	0.071	0.095	0.097	0.134	0.103	0.089	0.077	0.102	0.034
MLW									-0.017	0.057	0.088	0.103	0.014	0.044	0.041	0.074	0.047	0.037	0.026	0.047	0.034
MLWS									-0.076	0.003	0.025	0.049	-0.042	-0.006	-0.015	0.015	-0.009	-0.016	-0.026	-0.009	0.033
ISLW									-0.323	-0.228	-0.198	-0.156	-0.235	-0.184	-0.182	-0.155	-0.175	-0.173	-0.189	-0.200	0.048
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR									0.421	0.403	0.349	0.342	0.375	0.378	0.373	0.380	0.395	0.350	0.372	0.376	0.024
MR									0.540	0.511	0.474	0.450	0.489	0.480	0.485	0.499	0.508	0.455	0.474	0.488	0.026
MSR									0.659	0.619	0.600	0.558	0.602	0.581	0.597	0.619	0.620	0.560	0.577	0.599	0.030
R									1.251	1.172	1.136	1.049	1.066	1.009	0.999	1.025	1.017	0.937	0.970	1.057	0.094
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2									0.270	0.255	0.237	0.225	0.244	0.240	0.243	0.250	0.254	0.227	0.237	0.244	0.013
S2									0.059	0.054	0.063	0.054	0.057	0.051	0.056	0.060	0.056	0.052	0.051	0.056	0.004
K1									0.138	0.130	0.122	0.112	0.107	0.102	0.095	0.096	0.095	0.091	0.096	0.108	0.016
O1									0.109	0.101	0.101	0.092	0.086	0.076	0.073	0.073	0.070	0.066	0.068	0.083	0.015
MSF									0.051	0.054	0.059	0.037	0.043	0.028	0.048	0.044	0.041	0.054	0.046	0.046	0.009
z0									0.253	0.312	0.325	0.328	0.259	0.284	0.284	0.324	0.301	0.264	0.263	0.291	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2									61.483	61.816	56.890	58.629	59.313	60.052	61.480	60.481	62.644	66.277	68.448	61.592	3.314
S2									344.196	341.529	335.934	338.154	341.796	345.572	344.905	340.025	344.510	348.241	342.400	342.479	3.531
K1									181.438	176.958	170.183	169.927	168.482	171.910	173.892	178.450	183.206	191.638	194.545	178.239	8.776
O1									252.437	263.011	257.955	262.671	265.510	265.355	262.580	257.860	254.297	253.771	253.218	258.970	5.035
MSF									284.225	263.597	281.605	277.945	277.000	288.311	287.460	279.219	278.984	289.645	269.173	279.742	7.991
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
									0.086	0.103	0.097	0.101	0.076	0.098	0.072	0.076	0.083	0.081	0.085		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
									77.6	78.0	78.8	81.7	95.1	83.3	94.9	91.3	92.7	96.3	94.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.17	15/06/2018 23:45	±0.23	10.8
Lowest Astronomical Tide (LAT)	-0.06	16/10/2013 03:45		

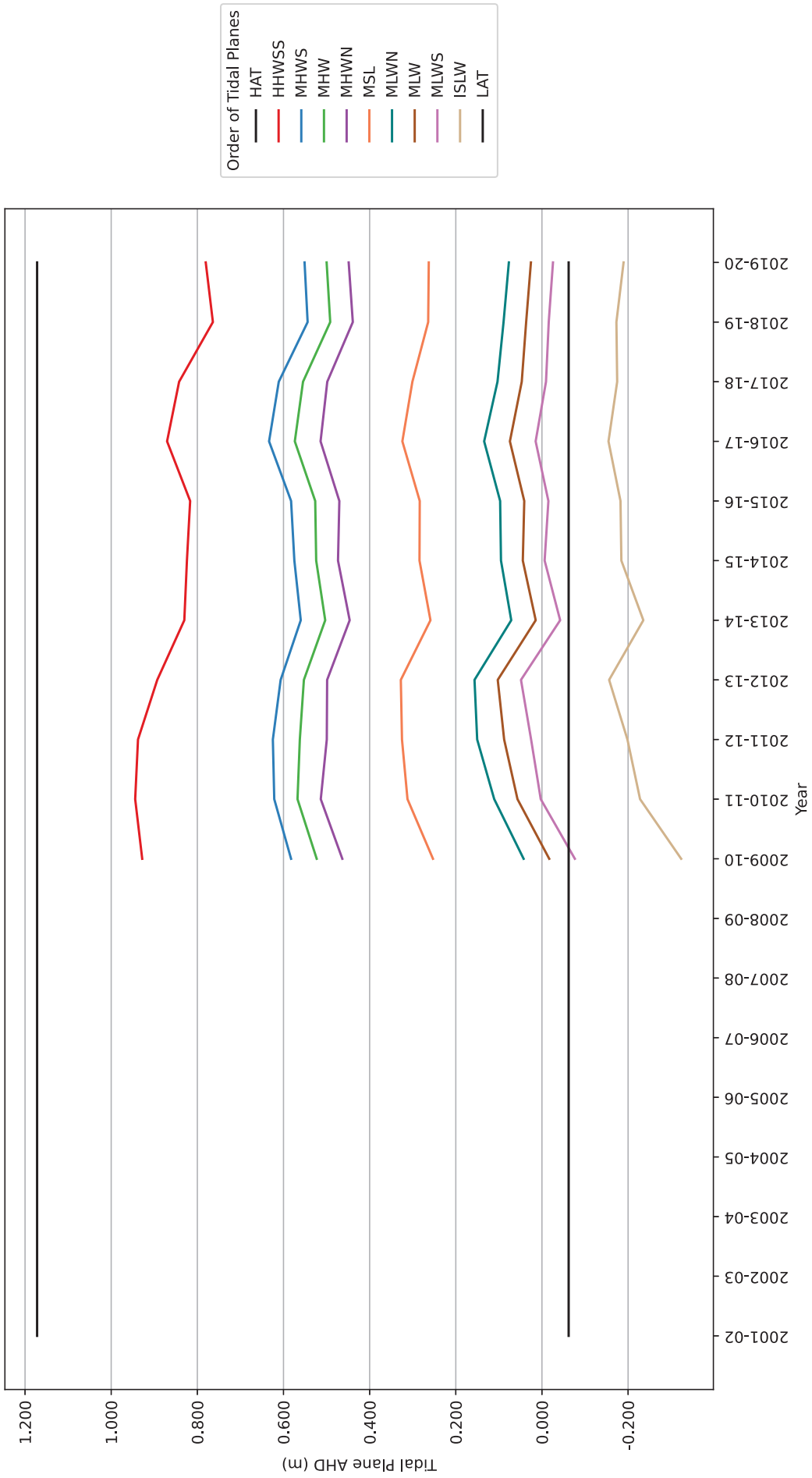
COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Aug 2009.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Nambucca River at Bowraville Downstream

Table A91

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Nambucca River at Bowraville Downstream

MHL2786

Figure A91

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Warrell Creek at Warrell Creek

RECORDING STATION: **Warrell Creek at Warrell Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 205490

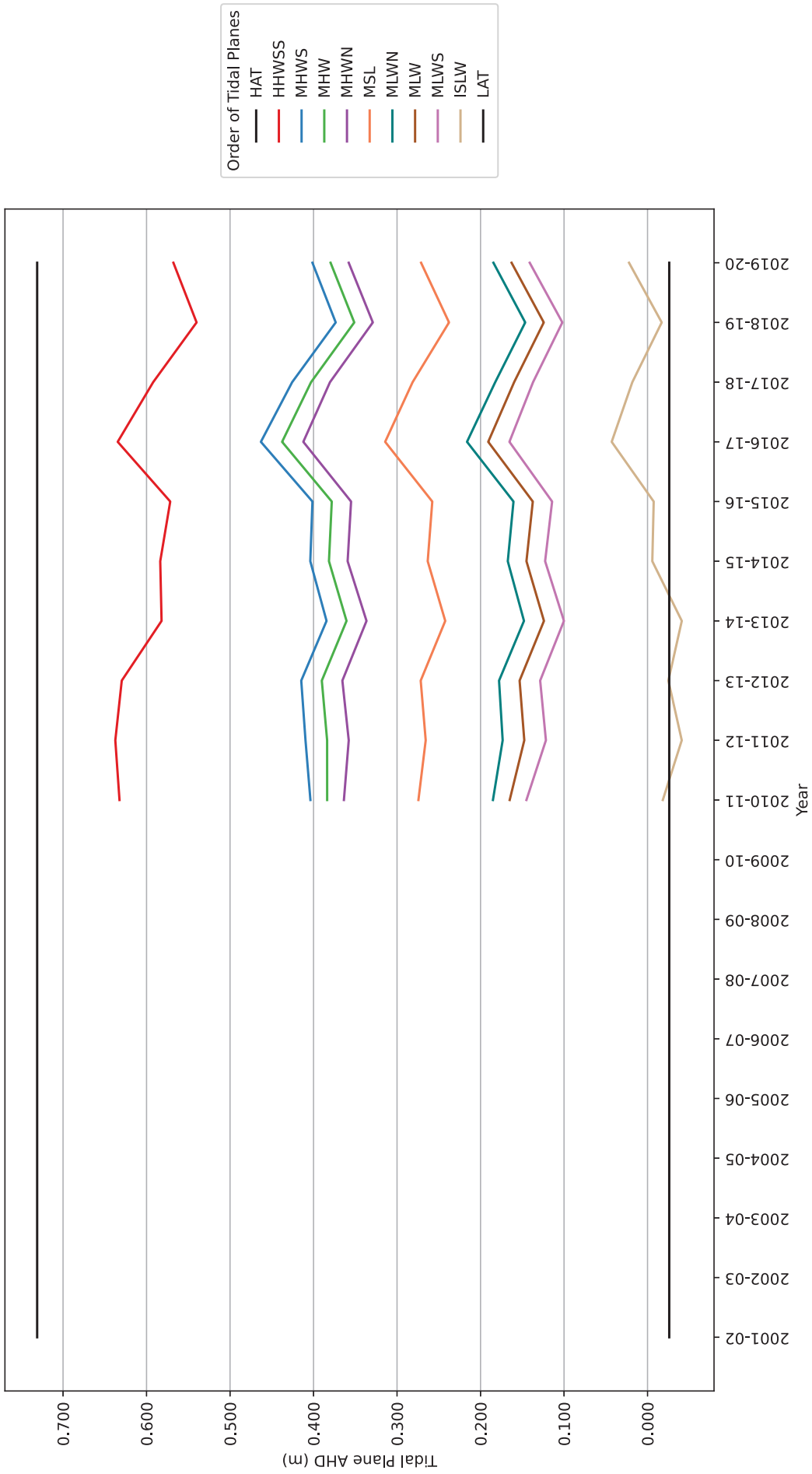
ZONE: 56
EASTING: 491986
NORTHING: 6600076

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS										0.632	0.637	0.630	0.582	0.584	0.572	0.635	0.592	0.540	0.568	0.597	0.034
MHWS										0.404	0.410	0.415	0.384	0.404	0.401	0.463	0.426	0.373	0.401	0.408	0.024
MHW										0.384	0.384	0.390	0.360	0.382	0.378	0.438	0.403	0.351	0.380	0.385	0.023
MHWN										0.364	0.358	0.365	0.337	0.359	0.355	0.412	0.380	0.329	0.358	0.362	0.023
MSL										0.274	0.266	0.272	0.242	0.263	0.258	0.314	0.281	0.238	0.271	0.268	0.021
MLWN										0.185	0.173	0.178	0.148	0.167	0.161	0.216	0.182	0.146	0.185	0.174	0.020
MLW										0.165	0.148	0.153	0.124	0.145	0.137	0.191	0.160	0.124	0.163	0.151	0.020
MLWS										0.145	0.122	0.129	0.100	0.123	0.114	0.165	0.137	0.102	0.141	0.128	0.020
ISLW										-0.018	-0.041	-0.025	-0.041	-0.006	-0.007	0.043	0.018	-0.017	0.022	-0.007	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR										0.178	0.184	0.188	0.189	0.192	0.195	0.196	0.198	0.183	0.173	0.188	0.008
MR										0.219	0.236	0.237	0.236	0.237	0.241	0.247	0.243	0.227	0.217	0.234	0.010
MSR										0.259	0.288	0.286	0.284	0.281	0.287	0.298	0.288	0.271	0.260	0.280	0.013
R										0.651	0.678	0.655	0.623	0.589	0.579	0.592	0.574	0.557	0.546	0.604	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2										0.109	0.118	0.118	0.118	0.118	0.120	0.123	0.122	0.113	0.108	0.117	0.005
S2										0.020	0.026	0.025	0.024	0.022	0.023	0.025	0.023	0.022	0.022	0.023	0.002
K1										0.085	0.087	0.083	0.078	0.072	0.069	0.070	0.068	0.068	0.068	0.075	0.008
O1										0.078	0.076	0.070	0.063	0.056	0.052	0.053	0.051	0.051	0.051	0.060	0.011
MSF										0.061	0.066	0.032	0.055	0.040	0.059	0.057	0.046	0.052	0.057	0.052	0.010
z0										0.274	0.266	0.272	0.242	0.263	0.258	0.314	0.281	0.238	0.271	0.268	0.021
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2										111.039	105.562	107.004	108.082	109.808	111.357	111.417	112.457	115.910	117.747	111.038	3.764
S2										28.840	25.062	27.504	27.264	33.123	32.872	31.105	31.781	34.185	29.735	30.147	2.967
K1										223.985	216.569	215.989	215.921	219.515	220.646	226.132	229.739	236.754	239.347	224.460	8.496
O1										310.167	308.547	313.706	316.240	313.405	311.171	306.864	304.328	300.973	300.428	308.583	5.404
MSF										275.336	281.840	277.582	282.358	305.873	295.490	287.537	281.404	299.971	275.036	286.243	10.742
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
										0.101	0.081	0.095	0.082	0.098	0.081	0.076	0.085	0.094	0.085		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
										72.9	86.5	82.2	99.0	88.3	97.1	93.4	89.9	97.5	94.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.73	16/06/2018 01:45	±0.20	14.6
Lowest Astronomical Tide (LAT)	-0.03	28/09/2017 11:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Feb 2010.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

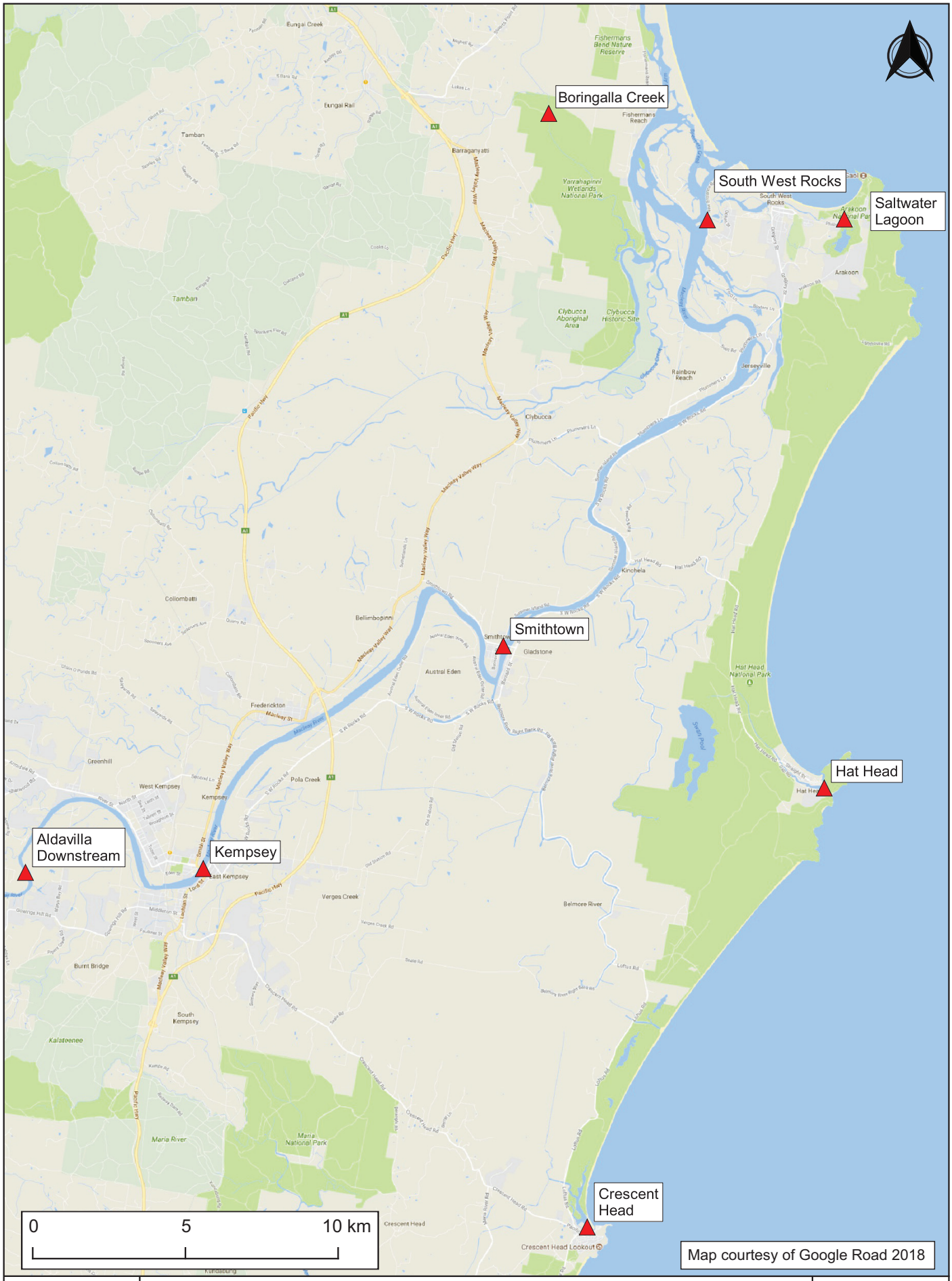


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Warrell Creek at Warrell Creek

MHL2786

Figure A92



NSW GOVERNMENT

STATION LOCATIONS
MACLEAY RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A93

DRAWING A93.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Macleay River at South West Rocks

RECORDING STATION: **Macleay River at South West Rocks**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 206456

ZONE: 56
EASTING: 501638
NORTHING: 6582579

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.974	0.924	0.925	0.931	0.962	0.958	0.990	0.966	1.080	1.073	1.060	1.010	0.973	0.962	0.919	0.962	0.970	0.935	0.941	0.974	0.049
MHWS	0.659	0.603	0.590	0.582	0.607	0.589	0.610	0.577	0.669	0.671	0.670	0.644	0.641	0.657	0.623	0.673	0.680	0.642	0.646	0.633	0.034
MHW	0.548	0.494	0.484	0.477	0.503	0.489	0.511	0.474	0.555	0.563	0.556	0.533	0.532	0.555	0.525	0.573	0.579	0.540	0.544	0.528	0.033
MHWN	0.437	0.386	0.378	0.371	0.398	0.389	0.412	0.372	0.441	0.455	0.441	0.422	0.423	0.453	0.427	0.472	0.479	0.439	0.443	0.423	0.033
MSL	0.094	0.052	0.054	0.059	0.098	0.098	0.128	0.084	0.128	0.151	0.122	0.106	0.107	0.135	0.107	0.149	0.152	0.114	0.123	0.109	0.031
MLWN	-0.249	-0.283	-0.269	-0.253	-0.202	-0.192	-0.155	-0.204	-0.185	-0.153	-0.197	-0.209	-0.208	-0.182	-0.213	-0.174	-0.175	-0.211	-0.196	-0.206	0.036
MLW	-0.360	-0.391	-0.375	-0.359	-0.306	-0.292	-0.254	-0.307	-0.299	-0.261	-0.311	-0.320	-0.317	-0.285	-0.311	-0.274	-0.276	-0.313	-0.298	-0.311	0.037
MLWS	-0.471	-0.499	-0.481	-0.465	-0.411	-0.393	-0.354	-0.409	-0.413	-0.368	-0.425	-0.432	-0.426	-0.387	-0.410	-0.374	-0.376	-0.415	-0.399	-0.416	0.040
ISLW	-0.696	-0.728	-0.721	-0.714	-0.664	-0.656	-0.625	-0.687	-0.706	-0.655	-0.704	-0.693	-0.664	-0.604	-0.620	-0.581	-0.583	-0.624	-0.610	-0.660	0.047
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.687	0.669	0.647	0.624	0.599	0.581	0.567	0.576	0.626	0.608	0.638	0.631	0.631	0.635	0.640	0.646	0.654	0.649	0.639	0.629	0.031
MR	0.909	0.885	0.859	0.836	0.809	0.782	0.765	0.781	0.854	0.824	0.867	0.853	0.849	0.840	0.837	0.846	0.855	0.853	0.842	0.839	0.035
MSR	1.131	1.102	1.071	1.047	1.018	0.982	0.964	0.987	1.082	1.039	1.095	1.075	1.067	1.044	1.033	1.046	1.056	1.057	1.045	1.049	0.042
R	1.669	1.652	1.646	1.645	1.626	1.615	1.615	1.653	1.786	1.728	1.764	1.703	1.637	1.566	1.539	1.543	1.553	1.559	1.551	1.634	0.074
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.454	0.443	0.429	0.418	0.404	0.391	0.383	0.391	0.427	0.412	0.433	0.427	0.424	0.420	0.418	0.423	0.427	0.427	0.421	0.420	0.018
S2	0.111	0.108	0.106	0.106	0.105	0.100	0.099	0.103	0.114	0.108	0.114	0.111	0.109	0.102	0.098	0.100	0.101	0.102	0.101	0.105	0.005
K1	0.146	0.148	0.154	0.157	0.160	0.163	0.168	0.170	0.182	0.177	0.174	0.165	0.153	0.141	0.138	0.135	0.135	0.136	0.136	0.155	0.016
O1	0.079	0.081	0.086	0.093	0.093	0.101	0.103	0.108	0.112	0.110	0.104	0.096	0.085	0.077	0.073	0.072	0.072	0.074	0.075	0.089	0.014
MSF	0.025	0.015	0.016	0.012	0.021	0.003	0.035	0.011	0.010	0.004	0.024	0.007	0.017	0.020	0.020	0.026	0.014	0.019	0.010	0.016	0.008
z0	0.094	0.052	0.054	0.059	0.098	0.098	0.128	0.084	0.128	0.151	0.122	0.106	0.107	0.135	0.107	0.149	0.152	0.114	0.123	0.109	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	358.934	1.411	3.363	3.590	4.412	4.635	3.956	1.906	357.158	358.522	356.277	356.500	356.166	359.102	359.858	2.233	2.792	3.145	3.924	152.520	179.877
S2	269.408	271.137	272.731	272.888	272.817	275.606	275.835	273.993	269.568	272.775	270.904	268.629	270.759	273.294	274.264	274.711	273.920	273.364	273.437	272.634	2.053
K1	148.646	152.006	153.324	153.768	154.041	153.595	151.333	148.005	139.776	138.742	133.715	132.223	132.402	136.329	139.409	142.741	145.675	148.854	152.253	145.097	7.847
O1	211.093	209.839	210.450	211.489	212.383	214.517	217.047	218.349	218.519	226.672	230.181	234.825	234.567	234.902	232.374	227.963	223.886	219.854	216.279	221.326	9.013
MSF	306.391	23.554	308.527	280.671	9.126	158.901	279.134	248.992	347.042	278.371	279.478	84.356	298.449	319.905	316.771	303.921	298.390	308.931	258.840	247.881	101.360
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.094	0.081	0.088	0.071	0.083	0.070	0.076	0.081	0.086	0.070	0.090	0.087	0.081	0.083	0.062	0.076	0.085	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.0	97.7	97.9	93.3	71.1	87.4	92.9	70.7	79.1	83.8	91.2	90.9	94.4	89.9	94.4	90.7	91.5	96.7	92.5		

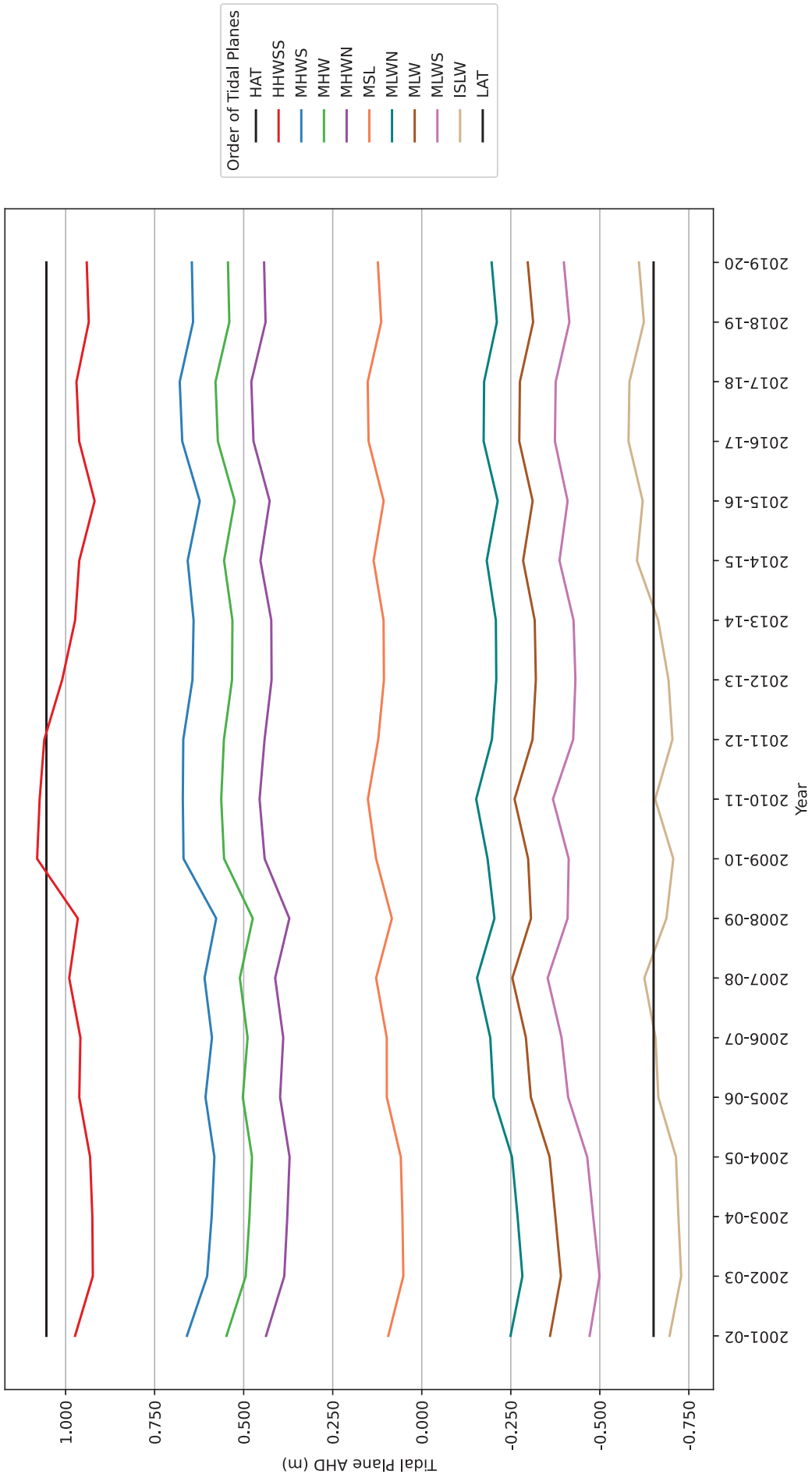
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.05	04/06/2004 21:45	±0.19	6.2
Lowest Astronomical Tide (LAT)	-0.65	27/10/2015 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A94

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Macleay River at South West Rocks

MHL2786

Figure A94

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Korogoro Creek at Hat Head

RECORDING STATION: **Korogoro Creek at Hat Head**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 206465

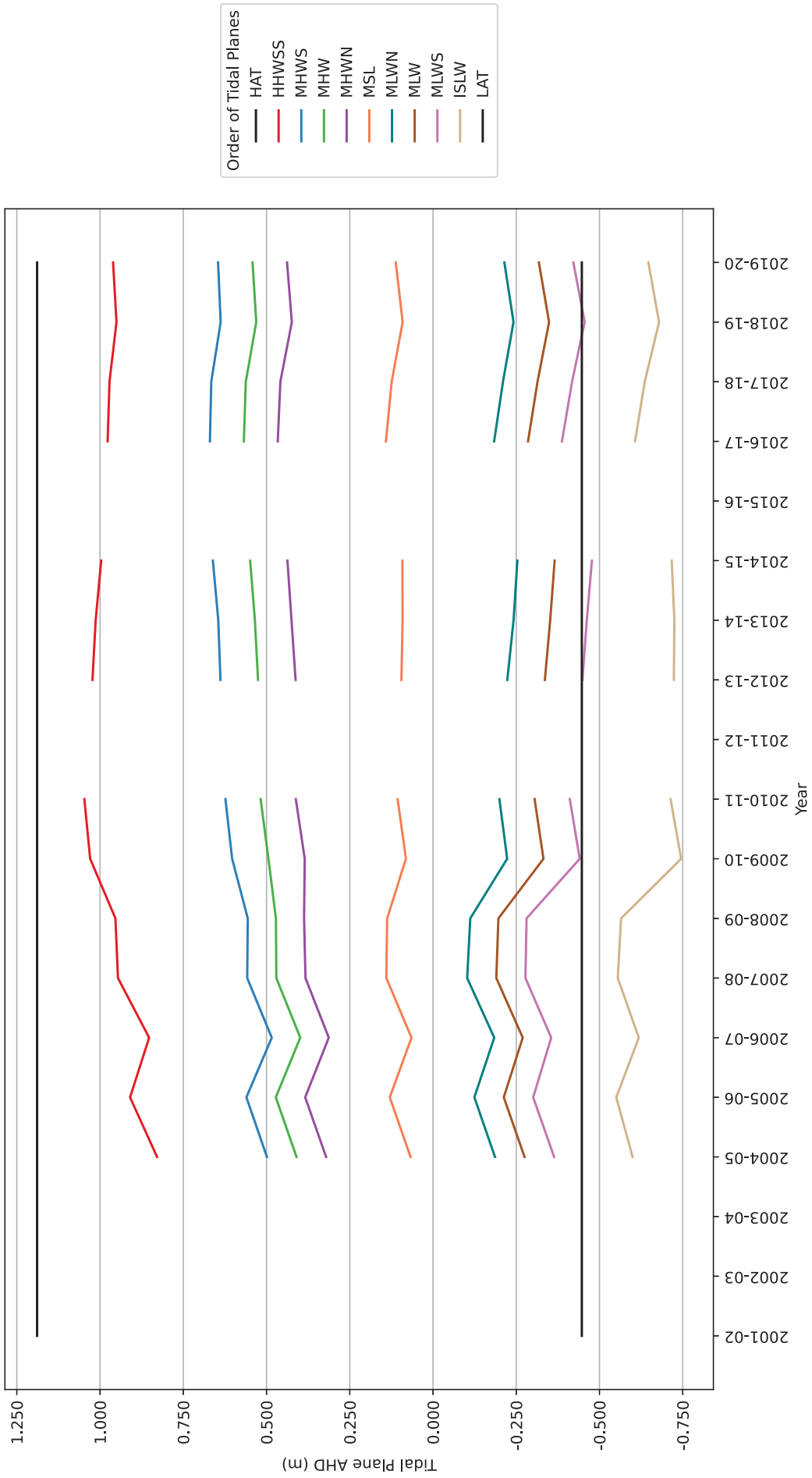
ZONE: 56
EASTING: 505462
NORTHING: 6563993

YEAR	2001-02*	2002-03*	2003-04*	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16*	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS				0.829	0.910	0.852	0.946	0.954	1.030	1.047		1.023	1.013	0.997		0.977	0.972	0.951	0.961	0.961	0.064
MHWS				0.499	0.560	0.484	0.558	0.556	0.603	0.623		0.638	0.645	0.661		0.670	0.666	0.638	0.645	0.603	0.062
MHW				0.410	0.472	0.399	0.470	0.472	0.494	0.518		0.526	0.535	0.549		0.568	0.562	0.531	0.542	0.503	0.053
MHWN				0.321	0.384	0.313	0.383	0.387	0.385	0.412		0.413	0.425	0.437		0.466	0.458	0.424	0.438	0.403	0.045
MSL				0.067	0.130	0.065	0.140	0.138	0.081	0.106		0.095	0.091	0.092		0.141	0.124	0.091	0.112	0.105	0.026
MLWN				-0.186	-0.124	-0.184	-0.103	-0.112	-0.223	-0.199		-0.223	-0.242	-0.253		-0.184	-0.210	-0.242	-0.214	-0.193	0.049
MLW				-0.275	-0.213	-0.270	-0.190	-0.196	-0.332	-0.305		-0.336	-0.352	-0.365		-0.285	-0.314	-0.349	-0.318	-0.293	0.058
MLWS				-0.364	-0.301	-0.355	-0.278	-0.281	-0.441	-0.411		-0.449	-0.462	-0.477		-0.387	-0.418	-0.455	-0.422	-0.393	0.068
ISLW				-0.599	-0.550	-0.618	-0.555	-0.565	-0.745	-0.713		-0.723	-0.725	-0.717		-0.607	-0.636	-0.679	-0.647	-0.649	0.069
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR				0.507	0.508	0.497	0.486	0.499	0.608	0.611		0.636	0.667	0.691		0.650	0.669	0.666	0.653	0.596	0.078
MR				0.685	0.685	0.668	0.661	0.668	0.826	0.823		0.861	0.887	0.914		0.854	0.876	0.879	0.860	0.796	0.098
MSR				0.862	0.861	0.839	0.836	0.837	1.044	1.034		1.087	1.107	1.138		1.057	1.084	1.093	1.067	0.996	0.118
R				1.428	1.460	1.471	1.501	1.519	1.775	1.761		1.746	1.738	1.713		1.584	1.608	1.630	1.608	1.610	0.121
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2				0.342	0.342	0.334	0.330	0.334	0.413	0.411		0.431	0.443	0.457		0.427	0.438	0.440	0.430	0.398	0.049
S2				0.089	0.088	0.086	0.087	0.085	0.109	0.106		0.113	0.110	0.112		0.102	0.104	0.107	0.104	0.100	0.011
K1				0.139	0.145	0.150	0.155	0.159	0.175	0.176		0.164	0.159	0.149		0.135	0.135	0.137	0.136	0.151	0.014
O1				0.097	0.104	0.113	0.122	0.125	0.130	0.127		0.111	0.104	0.091		0.084	0.084	0.087	0.089	0.105	0.017
MSF				0.038	0.033	0.031	0.054	0.032	0.039	0.030		0.011	0.029	0.027		0.045	0.035	0.037	0.036	0.034	0.010
z0				0.067	0.130	0.065	0.140	0.138	0.081	0.106		0.095	0.091	0.092		0.141	0.124	0.091	0.112	0.105	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2				8.348	7.702	6.281	6.065	3.002	353.430	354.433		352.903	352.650	352.511		357.592	356.877	357.286	358.551	230.545	173.482
S2				271.571	279.264	277.289	276.080	277.064	268.786	269.924		266.524	267.582	266.887		270.870	269.451	269.876	269.361	271.466	4.195
K1				156.222	151.244	151.228	147.981	143.039	133.022	132.092		126.168	125.223	126.400		135.405	137.277	141.606	145.016	139.423	10.176
O1				212.600	212.269	212.112	213.857	215.437	215.784	221.649		229.167	228.996	226.343		220.987	216.178	213.046	210.798	217.802	6.457
MSF				293.022	283.816	266.290	274.700	276.191	288.068	269.666		237.522	266.781	296.290		282.751	279.460	284.648	258.603	275.558	15.297
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
				0.082	0.070	0.089	0.058	0.071	0.077	0.084		0.076	0.071	0.075		0.065	0.071	0.078	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
				56.0	88.4	98.3	93.6	91.3	73.5	89.7	0.0	68.7	92.5	87.3	36.3	91.7	91.0	97.1	95.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.19	04/06/2004 21:15	±0.20	4.4
Lowest Astronomical Tide (LAT)	-0.45	28/10/2011 16:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Feb 2004.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Korogoro Creek at Hat Head

MHL2786

Figure A95

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Macleay River at Smithtown

RECORDING STATION: **Macleay River at Smithtown**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 206406

ZONE: 56
EASTING: 494960
NORTHING: 6568643

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.803	0.762	0.808	0.778	0.826	0.777	0.881	0.881	0.878	0.915	0.907	0.851	0.807	0.801	0.787	0.849	0.832	0.796	0.808	0.829	0.046
MHWS	0.535	0.492	0.522	0.483	0.518	0.461	0.537	0.530	0.520	0.563	0.562	0.539	0.510	0.536	0.530	0.599	0.581	0.542	0.550	0.532	0.033
MHW	0.477	0.437	0.463	0.426	0.461	0.404	0.476	0.470	0.463	0.504	0.502	0.482	0.456	0.481	0.476	0.540	0.521	0.481	0.493	0.474	0.032
MHWN	0.420	0.383	0.404	0.370	0.404	0.347	0.416	0.410	0.406	0.446	0.442	0.424	0.401	0.427	0.421	0.481	0.461	0.419	0.436	0.417	0.031
MSL	0.183	0.150	0.164	0.140	0.178	0.125	0.186	0.177	0.186	0.226	0.215	0.193	0.169	0.188	0.170	0.221	0.192	0.157	0.193	0.180	0.026
MLWN	-0.055	-0.082	-0.077	-0.090	-0.048	-0.096	-0.043	-0.056	-0.034	0.006	-0.012	-0.038	-0.063	-0.050	-0.081	-0.039	-0.078	-0.104	-0.051	-0.057	0.028
MLW	-0.112	-0.137	-0.136	-0.147	-0.105	-0.153	-0.104	-0.116	-0.091	-0.052	-0.072	-0.095	-0.118	-0.104	-0.135	-0.098	-0.138	-0.166	-0.107	-0.115	0.028
MLWS	-0.169	-0.191	-0.195	-0.203	-0.162	-0.210	-0.164	-0.176	-0.148	-0.111	-0.132	-0.153	-0.172	-0.159	-0.189	-0.156	-0.198	-0.228	-0.164	-0.173	0.028
ISLW	-0.361	-0.384	-0.399	-0.414	-0.382	-0.436	-0.410	-0.427	-0.403	-0.362	-0.378	-0.375	-0.384	-0.348	-0.373	-0.335	-0.377	-0.409	-0.349	-0.385	0.027
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.474	0.465	0.481	0.460	0.452	0.442	0.458	0.465	0.440	0.440	0.454	0.462	0.464	0.476	0.502	0.520	0.539	0.523	0.487	0.474	0.029
MR	0.589	0.574	0.599	0.573	0.566	0.557	0.580	0.585	0.554	0.557	0.574	0.577	0.573	0.585	0.610	0.637	0.660	0.647	0.601	0.589	0.030
MSR	0.704	0.682	0.717	0.687	0.680	0.671	0.702	0.706	0.668	0.674	0.694	0.692	0.683	0.694	0.719	0.755	0.780	0.770	0.715	0.705	0.032
R	1.165	1.146	1.207	1.191	1.208	1.213	1.290	1.309	1.281	1.278	1.284	1.226	1.191	1.149	1.159	1.184	1.210	1.204	1.157	1.213	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.295	0.287	0.299	0.287	0.283	0.278	0.290	0.293	0.277	0.278	0.287	0.288	0.287	0.293	0.305	0.319	0.330	0.323	0.300	0.295	0.015
S2	0.057	0.054	0.059	0.057	0.057	0.057	0.061	0.060	0.057	0.058	0.060	0.058	0.055	0.055	0.054	0.059	0.060	0.062	0.057	0.058	0.002
K1	0.117	0.118	0.124	0.126	0.131	0.132	0.144	0.147	0.147	0.147	0.145	0.134	0.126	0.115	0.114	0.112	0.113	0.112	0.113	0.127	0.013
O1	0.075	0.076	0.080	0.084	0.089	0.094	0.101	0.104	0.109	0.105	0.101	0.089	0.085	0.074	0.070	0.066	0.066	0.069	0.071	0.085	0.014
MSF	0.041	0.028	0.029	0.030	0.020	0.019	0.043	0.018	0.031	0.038	0.039	0.014	0.033	0.033	0.030	0.038	0.029	0.020	0.023	0.029	0.008
z0	0.183	0.150	0.164	0.140	0.178	0.125	0.186	0.177	0.186	0.226	0.215	0.193	0.169	0.188	0.170	0.221	0.192	0.157	0.193	0.180	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	58.640	62.584	60.987	61.751	61.499	60.210	57.555	56.427	56.226	56.785	54.129	54.044	56.673	56.739	56.213	55.915	55.505	57.203	61.051	57.902	2.649
S2	332.462	337.235	335.672	335.538	336.454	336.003	333.769	334.457	334.267	333.834	331.827	329.725	335.321	335.888	335.522	333.239	333.712	334.674	336.034	334.507	1.816
K1	190.762	195.511	193.592	193.554	191.847	192.769	186.007	183.654	180.890	178.972	171.635	172.862	172.824	173.950	175.803	179.085	180.731	185.981	190.799	183.749	8.141
O1	250.728	250.883	248.058	248.329	249.421	250.516	250.429	252.291	256.943	264.802	265.712	270.630	273.957	272.743	267.939	260.117	255.590	252.433	251.854	257.546	8.906
MSF	297.562	300.651	294.116	280.142	311.879	269.842	282.579	288.073	293.883	289.679	277.582	279.652	283.815	315.593	304.182	285.654	285.532	300.381	297.939	291.512	11.939
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078	0.104	0.078	0.090	0.087	0.092	0.071	0.103	0.082	0.085	0.080	0.101	0.082	0.097	0.078	0.075	0.084	0.085	0.087		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	98.2	97.8	97.5	97.1	97.7	98.8	91.7	82.6	91.1	77.9	82.5	89.3	98.3	90.7	98.4	90.7	96.0	99.2	77.7		

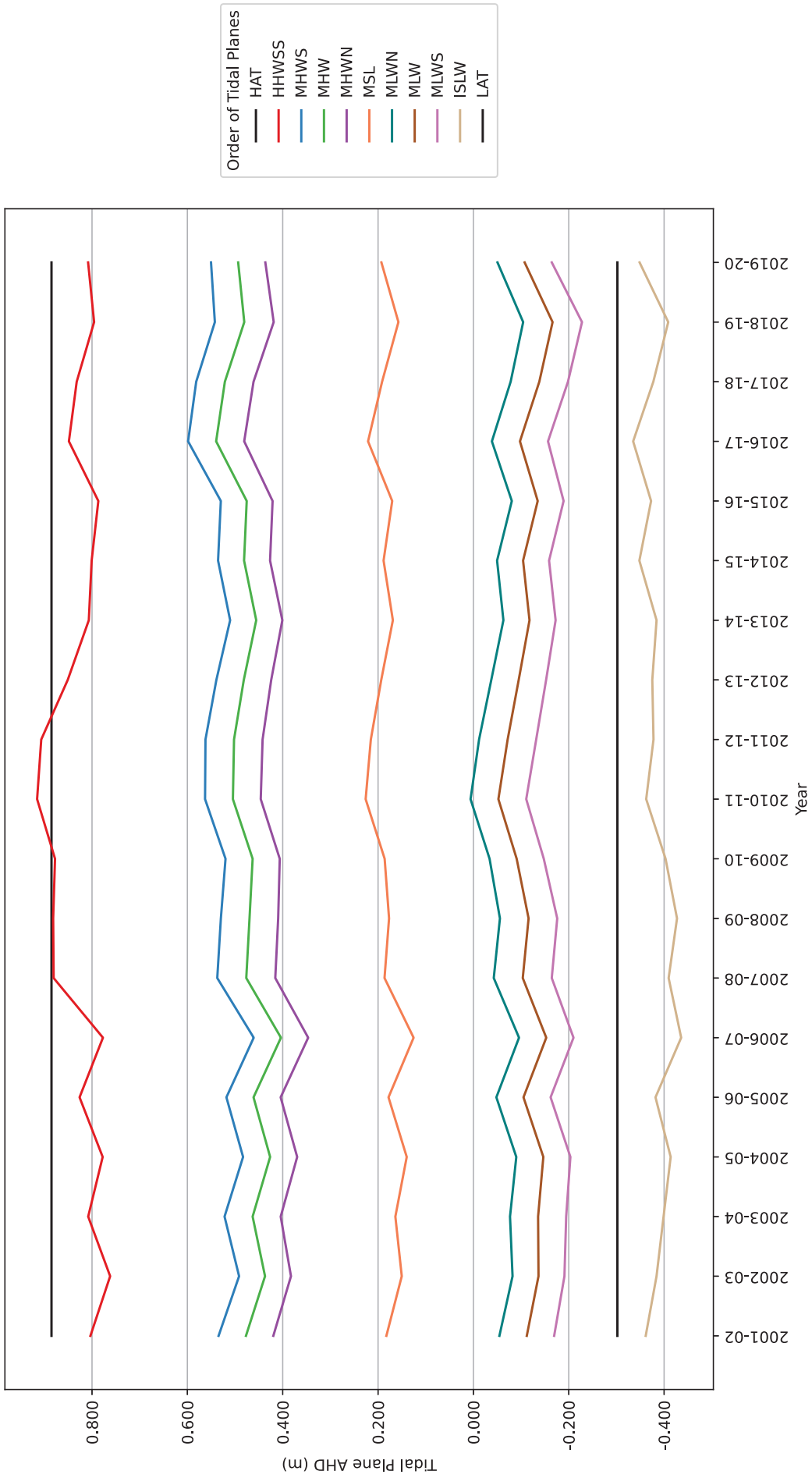
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.89	04/06/2004 23:30	±0.19	27.5
Lowest Astronomical Tide (LAT)	-0.30	24/11/2011 03:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A96

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Macleay River at Smithtown

MHL2786

Figure A96

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Macleay River at Kempsey

RECORDING STATION: **Macleay River at Kempsey**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 206402

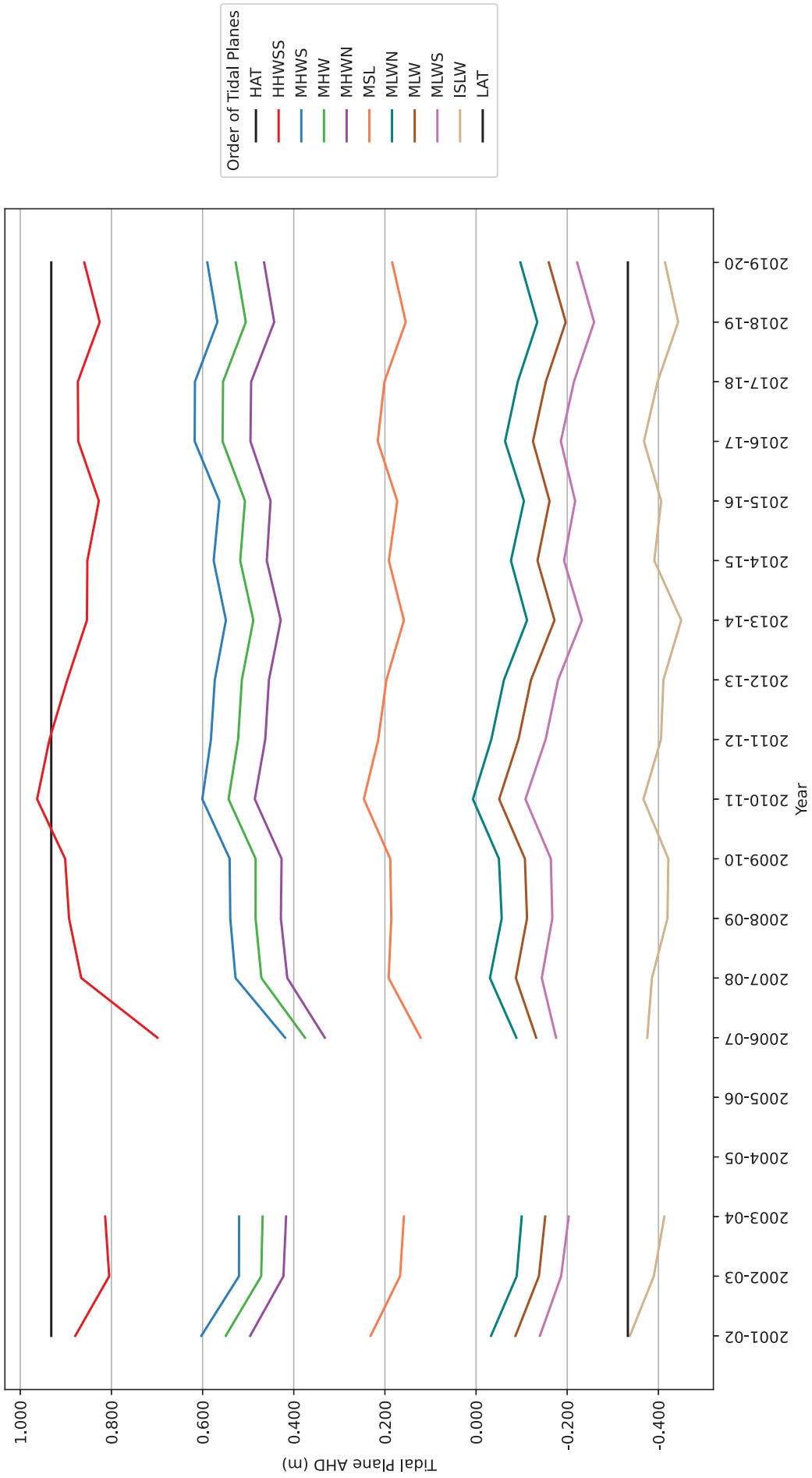
ZONE: 56
EASTING: 485137
NORTHING: 6561355

YEAR	2001-02	2002-03	2003-04	2004-05*	2005-06*	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.879	0.805	0.814			0.699	0.866	0.893	0.902	0.963	0.936	0.897	0.854	0.853	0.828	0.873	0.874	0.826	0.860	0.860	0.058
MHWS	0.603	0.520	0.520			0.419	0.528	0.539	0.541	0.601	0.582	0.573	0.549	0.576	0.563	0.617	0.617	0.567	0.590	0.559	0.048
MHW	0.549	0.471	0.468			0.375	0.471	0.484	0.484	0.543	0.522	0.514	0.489	0.517	0.507	0.556	0.555	0.505	0.527	0.502	0.044
MHWN	0.496	0.423	0.417			0.332	0.414	0.428	0.427	0.485	0.463	0.454	0.429	0.459	0.451	0.495	0.493	0.443	0.465	0.445	0.040
MSL	0.231	0.167	0.158			0.122	0.192	0.186	0.188	0.246	0.215	0.197	0.158	0.191	0.173	0.216	0.201	0.154	0.184	0.187	0.031
MLWN	-0.033	-0.089	-0.100			-0.088	-0.030	-0.056	-0.050	0.007	-0.033	-0.061	-0.112	-0.076	-0.105	-0.064	-0.091	-0.134	-0.097	-0.071	0.036
MLW	-0.086	-0.138	-0.152			-0.132	-0.087	-0.112	-0.107	-0.051	-0.093	-0.121	-0.172	-0.135	-0.161	-0.125	-0.153	-0.197	-0.160	-0.128	0.037
MLWS	-0.140	-0.187	-0.203			-0.175	-0.144	-0.167	-0.164	-0.108	-0.153	-0.180	-0.232	-0.193	-0.217	-0.186	-0.215	-0.259	-0.222	-0.185	0.038
ISLW	-0.337	-0.390	-0.413			-0.376	-0.386	-0.420	-0.422	-0.367	-0.406	-0.411	-0.450	-0.391	-0.406	-0.368	-0.398	-0.443	-0.415	-0.400	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.528	0.512	0.517			0.420	0.445	0.484	0.477	0.479	0.496	0.516	0.540	0.536	0.556	0.559	0.585	0.577	0.562	0.517	0.046
MR	0.636	0.609	0.620			0.507	0.558	0.595	0.591	0.594	0.615	0.634	0.661	0.652	0.668	0.681	0.708	0.702	0.687	0.631	0.053
MSR	0.743	0.707	0.723			0.594	0.672	0.706	0.705	0.709	0.734	0.753	0.781	0.769	0.781	0.803	0.831	0.826	0.811	0.744	0.061
R	1.217	1.195	1.227			1.075	1.252	1.313	1.323	1.330	1.342	1.308	1.304	1.244	1.234	1.241	1.272	1.269	1.274	1.260	0.064
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.318	0.305	0.310			0.254	0.279	0.298	0.295	0.297	0.308	0.317	0.330	0.326	0.334	0.340	0.354	0.351	0.343	0.315	0.027
S2	0.054	0.049	0.052			0.044	0.057	0.055	0.057	0.058	0.060	0.059	0.060	0.058	0.056	0.061	0.062	0.062	0.062	0.057	0.005
K1	0.123	0.126	0.128			0.114	0.140	0.147	0.147	0.148	0.148	0.139	0.131	0.122	0.117	0.115	0.116	0.115	0.119	0.129	0.013
O1	0.075	0.078	0.082			0.086	0.102	0.106	0.111	0.111	0.105	0.092	0.087	0.076	0.072	0.067	0.067	0.070	0.073	0.086	0.016
MSF	0.040	0.030	0.038			0.016	0.042	0.030	0.035	0.043	0.039	0.016	0.036	0.033	0.032	0.037	0.031	0.023	0.026	0.032	0.008
z0	0.231	0.167	0.158			0.122	0.192	0.186	0.188	0.246	0.215	0.197	0.158	0.191	0.173	0.216	0.201	0.154	0.184	0.187	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	85.977	85.811	83.528			87.573	86.342	83.144	84.187	82.114	82.189	80.168	78.562	78.271	77.627	75.464	74.532	74.688	79.625	81.165	4.203
S2	2.102	0.364	1.132			1.722	6.100	5.838	7.813	5.535	7.867	3.925	5.230	4.552	3.965	359.790	359.274	359.170	359.978	87.903	155.336
K1	198.386	209.022	208.353			212.954	202.548	198.914	195.387	190.906	187.578	187.178	184.019	186.661	187.726	190.110	192.097	197.369	200.554	195.868	8.708
O1	261.936	263.167	260.969			265.181	265.666	267.035	270.244	275.735	278.312	281.953	283.949	282.789	278.566	272.146	266.613	262.182	261.328	270.457	8.175
MSF	302.451	297.771	285.766			273.319	285.473	293.333	293.400	288.367	271.894	262.025	287.555	314.376	306.225	287.310	281.327	309.306	282.647	289.562	13.778
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.105	0.091			0.090	0.078	0.113	0.097	0.094	0.080	0.120	0.084	0.110	0.082	0.080	0.086	0.085	0.090		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	54.4	95.1	70.8	0.0	38.4	97.1	82.3	79.7	93.5	79.8	82.9	88.1	97.9	90.0	98.3	88.1	95.7	98.1	93.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.93	05/06/2004 00:30	±0.23	33.7
Lowest Astronomical Tide (LAT)	-0.33	05/11/2010 04:15		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Macleay River at Kempsey

MHL2786

Figure A97

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Macleay River at Aldavilla Downstream

RECORDING STATION: **Macleay River at Aldavilla Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 206459

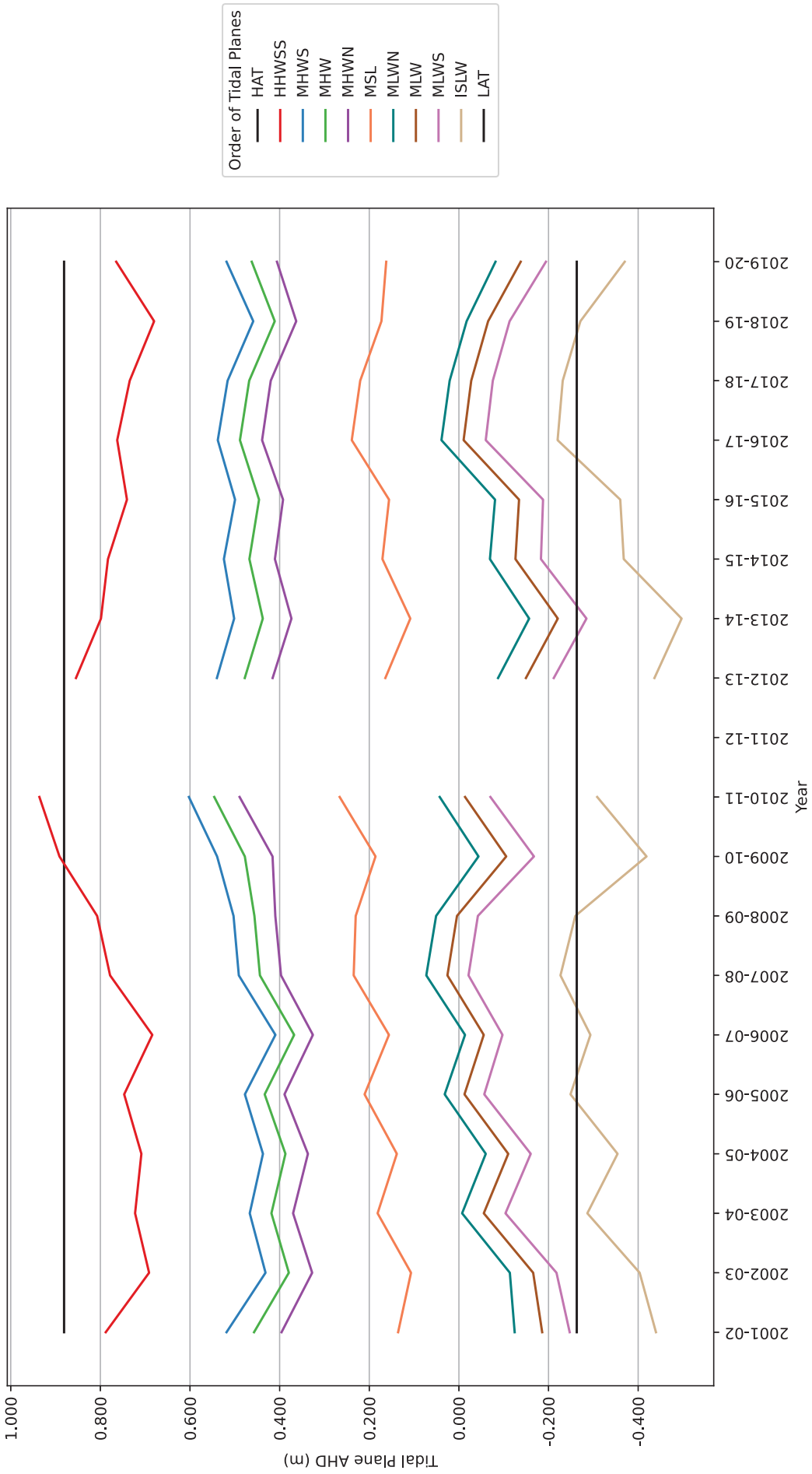
ZONE: 56
EASTING: 479318
NORTHING: 6561231

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.788	0.691	0.723	0.708	0.747	0.684	0.778	0.807	0.891	0.936		0.854	0.799	0.783	0.741	0.762	0.734	0.680	0.765	0.771	0.070
MHWS	0.519	0.431	0.467	0.437	0.478	0.409	0.491	0.503	0.540	0.602		0.540	0.501	0.524	0.499	0.538	0.516	0.459	0.519	0.499	0.047
MHW	0.457	0.379	0.418	0.387	0.433	0.368	0.444	0.456	0.478	0.546		0.478	0.438	0.467	0.446	0.489	0.468	0.411	0.462	0.446	0.043
MHWN	0.396	0.327	0.370	0.337	0.389	0.326	0.397	0.410	0.416	0.489		0.416	0.374	0.411	0.392	0.439	0.420	0.363	0.406	0.393	0.040
MSL	0.136	0.107	0.181	0.138	0.210	0.156	0.235	0.230	0.186	0.266		0.164	0.108	0.171	0.156	0.239	0.220	0.173	0.162	0.180	0.045
MLWN	-0.124	-0.114	-0.007	-0.060	0.032	-0.014	0.073	0.051	-0.044	0.043		-0.087	-0.157	-0.069	-0.081	0.039	0.021	-0.017	-0.082	-0.033	0.067
MLW	-0.186	-0.166	-0.056	-0.110	-0.012	-0.055	0.026	0.004	-0.106	-0.014		-0.150	-0.221	-0.126	-0.134	-0.010	-0.028	-0.065	-0.138	-0.086	0.072
MLWS	-0.247	-0.218	-0.104	-0.160	-0.057	-0.097	-0.021	-0.042	-0.168	-0.070		-0.212	-0.285	-0.183	-0.188	-0.060	-0.076	-0.113	-0.194	-0.139	0.077
ISLW	-0.440	-0.403	-0.287	-0.354	-0.249	-0.294	-0.227	-0.260	-0.419	-0.309		-0.436	-0.497	-0.368	-0.360	-0.220	-0.232	-0.271	-0.370	-0.333	0.084
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.520	0.441	0.377	0.397	0.357	0.339	0.324	0.359	0.460	0.447		0.503	0.530	0.480	0.473	0.400	0.399	0.380	0.488	0.426	0.064
MR	0.643	0.545	0.474	0.497	0.446	0.423	0.418	0.452	0.583	0.560		0.627	0.658	0.594	0.580	0.499	0.495	0.476	0.600	0.532	0.077
MSR	0.766	0.649	0.571	0.597	0.534	0.507	0.512	0.545	0.707	0.673		0.752	0.786	0.707	0.687	0.598	0.592	0.572	0.713	0.637	0.090
R	1.228	1.095	1.009	1.063	0.996	0.978	1.005	1.067	1.310	1.245		1.291	1.296	1.151	1.101	0.983	0.966	0.951	1.135	1.104	0.123
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.321	0.273	0.237	0.249	0.223	0.212	0.209	0.226	0.292	0.280		0.314	0.329	0.297	0.290	0.250	0.248	0.238	0.300	0.266	0.038
S2	0.061	0.052	0.048	0.050	0.044	0.042	0.047	0.047	0.062	0.057		0.062	0.064	0.057	0.054	0.049	0.048	0.048	0.056	0.053	0.007
K1	0.118	0.114	0.109	0.115	0.112	0.115	0.116	0.126	0.145	0.136		0.138	0.129	0.114	0.105	0.098	0.096	0.096	0.108	0.116	0.014
O1	0.075	0.072	0.074	0.079	0.081	0.081	0.089	0.091	0.106	0.102		0.087	0.084	0.071	0.067	0.062	0.060	0.062	0.068	0.078	0.013
MSF	0.041	0.040	0.026	0.032	0.023	0.014	0.028	0.016	0.039	0.042		0.015	0.032	0.026	0.032	0.043	0.035	0.026	0.023	0.030	0.009
z0	0.136	0.107	0.181	0.138	0.210	0.156	0.235	0.230	0.186	0.266		0.164	0.108	0.171	0.156	0.239	0.220	0.173	0.162	0.180	0.045
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	100.339	114.272	125.830	119.826	124.912	129.958	124.268	122.545	94.582	97.945		92.056	91.672	101.491	106.443	114.881	117.515	121.510	104.047	111.338	12.793
S2	25.582	42.738	47.646	41.705	48.881	55.857	47.723	48.615	18.962	25.847		19.172	20.866	31.579	33.511	40.227	42.255	48.421	25.341	36.941	11.929
K1	213.531	223.719	228.977	224.841	226.347	232.295	221.601	219.506	201.983	199.231		193.517	191.736	197.598	201.562	211.103	214.588	221.505	213.014	213.147	12.756
O1	268.071	275.069	277.095	273.780	278.912	283.075	282.664	283.340	274.010	283.093		287.755	289.421	290.327	288.123	285.542	281.490	280.359	270.361	280.694	6.539
MSF	296.844	298.461	277.563	279.214	293.904	245.072	296.802	318.714	293.670	291.124		271.180	286.663	310.826	315.310	290.978	295.482	306.028	297.077	292.495	17.106
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.134	0.090	0.108	0.127	0.094	0.086	0.121	0.105	0.110		0.116	0.084	0.131	0.084	0.084	0.086	0.093	0.098		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.5	88.5	82.4	94.7	84.4	91.0	61.8	67.5	85.2	59.4	41.5	86.1	94.7	86.9	96.8	80.4	88.6	96.6	90.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.88	05/06/2004 01:15	±0.26	50.3
Lowest Astronomical Tide (LAT)	-0.26	15/11/2009 05:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Euroka Upstream (AWRC: 206458) to Aldavilla Downstream in Dec 2011.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Macleay River at Aldavilla Downstream

MHL2786

Figure A98

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Killick Creek at Crescent Head

RECORDING STATION: **Killick Creek at Crescent Head**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207452

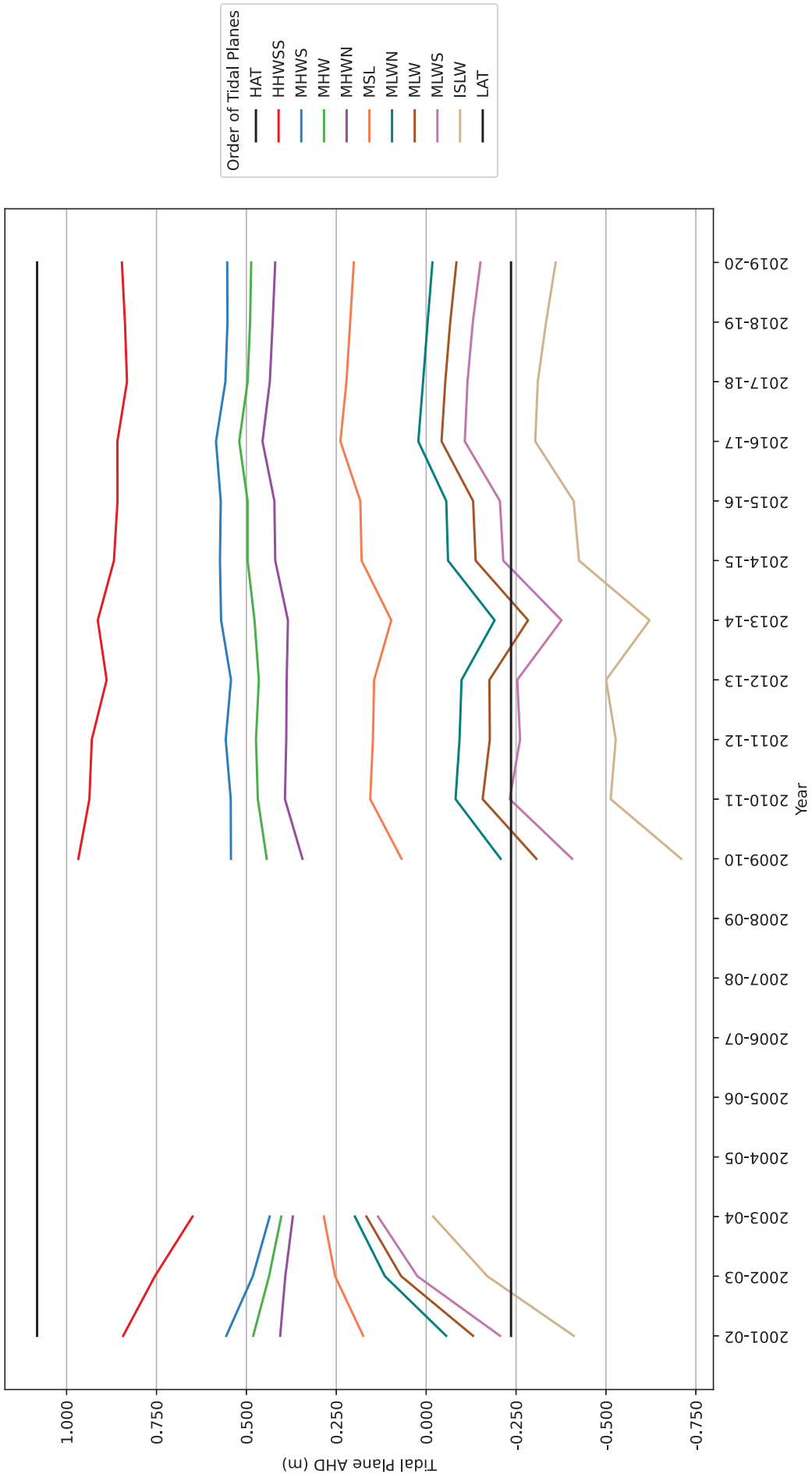
ZONE: 56
EASTING: 497704
NORTHING: 6549628

YEAR	2001-02	2002-03	2003-04	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.843	0.754	0.650						0.967	0.937	0.930	0.889	0.913	0.868	0.858	0.859	0.832	0.838	0.846	0.856	0.080
MHWS	0.556	0.482	0.435						0.543	0.544	0.557	0.543	0.570	0.573	0.571	0.584	0.558	0.553	0.553	0.545	0.040
MHW	0.481	0.437	0.403						0.443	0.468	0.473	0.465	0.477	0.497	0.497	0.520	0.497	0.490	0.487	0.474	0.030
MHWN	0.406	0.392	0.371						0.344	0.393	0.389	0.388	0.384	0.420	0.422	0.455	0.435	0.427	0.420	0.403	0.029
MSL	0.175	0.253	0.285						0.068	0.156	0.148	0.145	0.097	0.179	0.183	0.239	0.222	0.211	0.201	0.183	0.059
MLWN	-0.056	0.115	0.198						-0.207	-0.082	-0.093	-0.098	-0.190	-0.061	-0.056	0.022	0.009	-0.004	-0.017	-0.037	0.107
MLW	-0.131	0.070	0.166						-0.307	-0.157	-0.177	-0.176	-0.283	-0.138	-0.130	-0.043	-0.053	-0.067	-0.084	-0.108	0.124
MLWS	-0.205	0.024	0.134						-0.406	-0.232	-0.261	-0.253	-0.376	-0.214	-0.205	-0.107	-0.115	-0.130	-0.151	-0.179	0.141
ISLW	-0.410	-0.170	-0.019						-0.709	-0.513	-0.527	-0.500	-0.621	-0.425	-0.410	-0.303	-0.310	-0.334	-0.360	-0.401	0.177
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.462	0.277	0.173						0.551	0.474	0.482	0.486	0.575	0.481	0.478	0.433	0.426	0.431	0.437	0.440	0.103
MR	0.612	0.367	0.237						0.750	0.625	0.650	0.641	0.761	0.634	0.627	0.563	0.550	0.557	0.571	0.582	0.137
MSR	0.761	0.458	0.301						0.949	0.776	0.819	0.796	0.947	0.788	0.776	0.692	0.673	0.682	0.704	0.723	0.171
R	1.253	0.925	0.669						1.677	1.450	1.457	1.389	1.535	1.293	1.269	1.162	1.142	1.171	1.206	1.257	0.254
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.306	0.184	0.118						0.375	0.313	0.325	0.321	0.380	0.317	0.314	0.281	0.275	0.278	0.285	0.291	0.068
S2	0.075	0.045	0.032						0.099	0.075	0.084	0.077	0.093	0.077	0.075	0.065	0.062	0.063	0.067	0.071	0.017
K1	0.117	0.106	0.079						0.170	0.152	0.148	0.137	0.143	0.120	0.116	0.110	0.110	0.114	0.118	0.124	0.023
O1	0.088	0.088	0.074						0.134	0.128	0.118	0.110	0.102	0.090	0.089	0.086	0.086	0.089	0.091	0.098	0.018
MSF	0.059	0.071	0.071						0.038	0.049	0.061	0.027	0.041	0.048	0.055	0.062	0.064	0.056	0.065	0.055	0.013
z0	0.175	0.253	0.285						0.068	0.156	0.148	0.145	0.097	0.179	0.183	0.239	0.222	0.211	0.201	0.183	0.059
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	12.953	21.448	17.548						2.927	5.824	5.651	3.145	4.709	4.941	6.833	4.164	4.829	5.239	5.441	7.547	5.641
S2	287.212	299.301	309.939						280.932	284.037	284.942	280.175	284.085	282.193	287.148	285.792	289.103	286.145	284.345	287.525	7.920
K1	159.279	175.493	181.276						141.964	142.635	137.103	136.491	132.899	137.700	143.124	149.628	156.230	160.018	162.005	151.132	15.034
O1	223.991	236.240	241.775						223.779	235.730	236.225	241.166	239.006	242.714	242.890	239.225	239.410	235.035	231.409	236.328	6.189
MSF	283.349	275.834	282.268						277.562	262.331	254.976	261.464	265.272	285.754	274.182	271.853	270.144	272.927	257.950	271.133	9.626
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.089	0.091	0.059						0.091	0.098	0.101	0.099	0.083	0.085	0.083	0.075	0.082	0.085	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	85.3	91.1	66.1	24.3	1.1	2.4	1.0	31.3	99.3	94.6	88.5	91.6	96.8	93.0	96.1	95.1	87.5	97.1	98.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.08	04/06/2004 21:45	±0.26	10.6
Lowest Astronomical Tide (LAT)	-0.24	14/12/2013 00:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Apr 2011.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

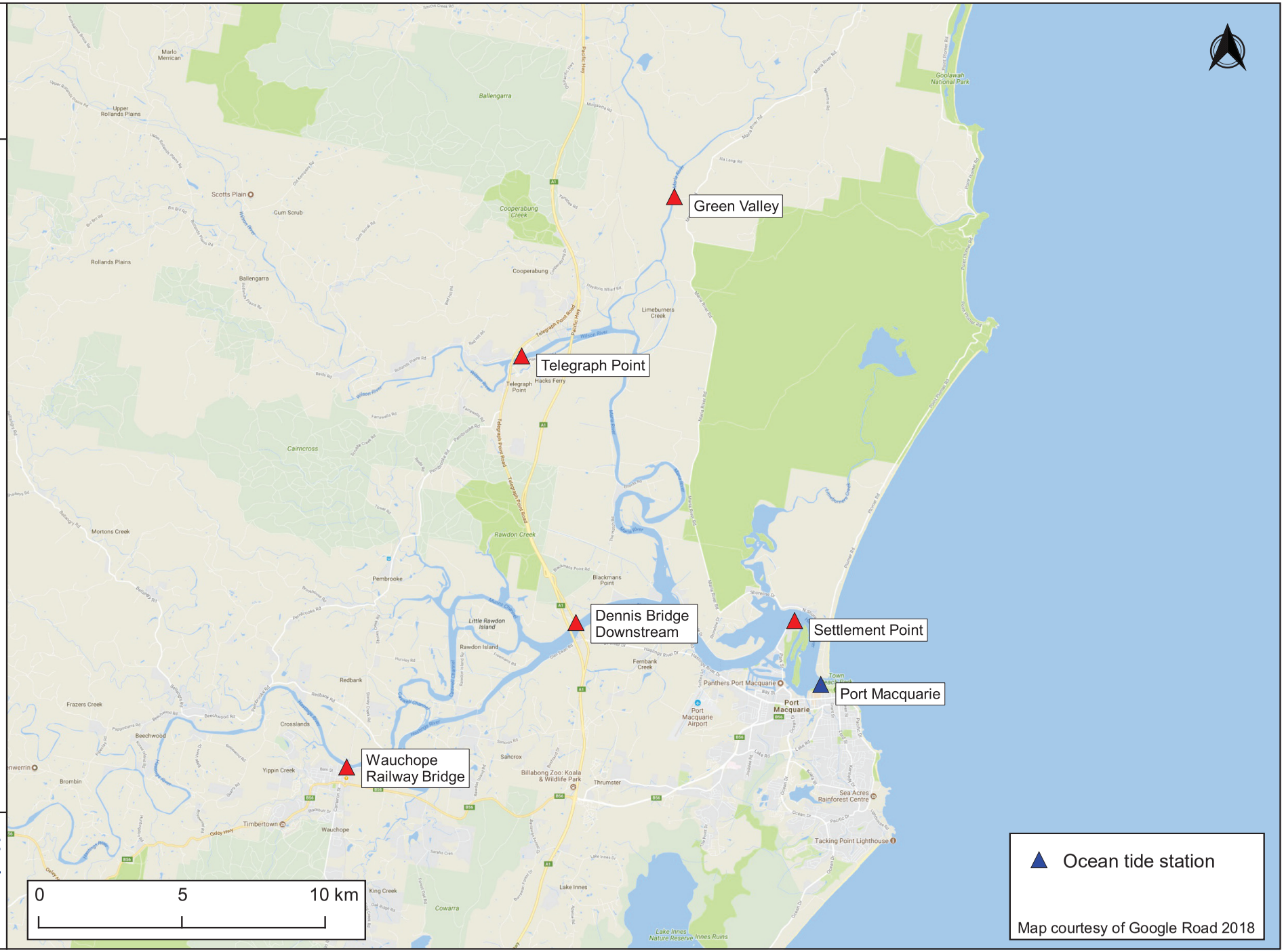
NSW TIDAL PLANE ANALYSIS
Killick Creek at Crescent Head

MHL2786

Figure A99

NSW GOVERNMENT

STATION LOCATIONS
HASTINGS RIVER REGION



Manly Hydraulics Laboratory

Report MHL2786

Figure A100

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Maria River at Green Valley

RECORDING STATION: **Maria River at Green Valley**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207406

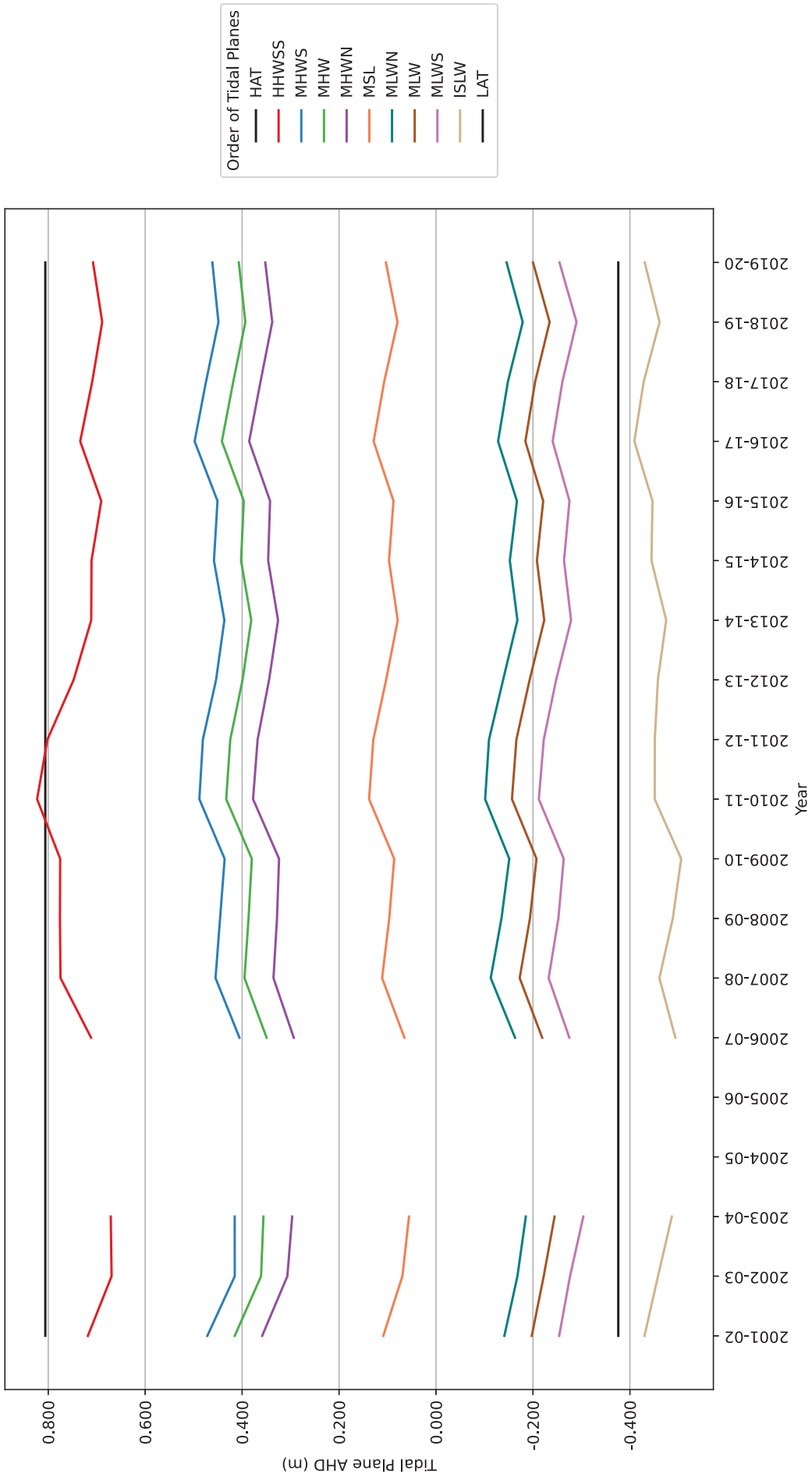
ZONE: 56
EASTING: 486416
NORTHING: 6540068

YEAR	2001-02	2002-03	2003-04	2004-05*	2005-06*	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.718	0.669	0.671			0.712	0.775	0.776	0.775	0.823	0.802	0.748	0.711	0.711	0.691	0.734	0.709	0.689	0.708	0.731	0.045
MHWS	0.472	0.415	0.415			0.405	0.455	0.445	0.436	0.488	0.481	0.454	0.437	0.458	0.451	0.498	0.475	0.449	0.461	0.453	0.026
MHW	0.415	0.361	0.356			0.349	0.395	0.387	0.380	0.433	0.424	0.399	0.381	0.402	0.397	0.442	0.418	0.393	0.407	0.396	0.026
MHWN	0.359	0.307	0.297			0.293	0.335	0.328	0.324	0.377	0.368	0.344	0.326	0.346	0.342	0.385	0.362	0.338	0.352	0.340	0.026
MSL	0.109	0.069	0.056			0.065	0.111	0.096	0.086	0.138	0.129	0.103	0.079	0.097	0.088	0.129	0.107	0.079	0.103	0.097	0.023
MLWN	-0.141	-0.168	-0.185			-0.163	-0.113	-0.135	-0.151	-0.101	-0.109	-0.138	-0.168	-0.152	-0.167	-0.128	-0.148	-0.179	-0.146	-0.147	0.024
MLW	-0.198	-0.222	-0.245			-0.219	-0.173	-0.194	-0.207	-0.157	-0.166	-0.193	-0.223	-0.208	-0.221	-0.184	-0.205	-0.234	-0.200	-0.203	0.024
MLWS	-0.254	-0.276	-0.304			-0.275	-0.232	-0.252	-0.263	-0.212	-0.222	-0.248	-0.279	-0.264	-0.275	-0.241	-0.261	-0.290	-0.255	-0.259	0.024
ISLW	-0.430	-0.458	-0.487			-0.494	-0.461	-0.488	-0.506	-0.451	-0.451	-0.458	-0.475	-0.445	-0.447	-0.409	-0.428	-0.461	-0.431	-0.458	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.500	0.475	0.482			0.457	0.448	0.463	0.475	0.479	0.477	0.483	0.494	0.499	0.509	0.514	0.510	0.517	0.498	0.487	0.020
MR	0.613	0.583	0.601			0.569	0.568	0.581	0.587	0.590	0.590	0.592	0.604	0.610	0.618	0.626	0.623	0.628	0.607	0.599	0.019
MSR	0.726	0.692	0.719			0.681	0.687	0.698	0.700	0.700	0.703	0.702	0.715	0.722	0.726	0.739	0.735	0.739	0.716	0.712	0.018
R	1.148	1.127	1.158			1.205	1.236	1.264	1.281	1.274	1.253	1.205	1.186	1.155	1.137	1.143	1.138	1.150	1.138	1.188	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.306	0.292	0.300			0.284	0.284	0.290	0.294	0.295	0.295	0.296	0.302	0.305	0.309	0.313	0.311	0.314	0.303	0.300	0.009
S2	0.057	0.054	0.059			0.056	0.060	0.059	0.056	0.055	0.056	0.055	0.055	0.056	0.054	0.056	0.056	0.056	0.055	0.056	0.002
K1	0.105	0.107	0.105			0.126	0.129	0.130	0.137	0.133	0.129	0.121	0.116	0.107	0.103	0.101	0.101	0.103	0.104	0.115	0.013
O1	0.071	0.074	0.078			0.093	0.099	0.106	0.105	0.106	0.100	0.089	0.080	0.073	0.068	0.067	0.067	0.068	0.072	0.083	0.015
MSF	0.040	0.021	0.048			0.016	0.051	0.009	0.033	0.045	0.031	0.006	0.032	0.034	0.033	0.033	0.041	0.023	0.029	0.031	0.013
z0	0.109	0.069	0.056			0.065	0.111	0.096	0.086	0.138	0.129	0.103	0.079	0.097	0.088	0.129	0.107	0.079	0.103	0.097	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	94.909	96.929	96.579			95.210	94.079	93.417	87.484	91.195	90.376	90.526	90.903	91.010	92.245	92.424	93.318	94.320	95.299	92.954	2.514
S2	20.338	22.487	25.277			21.680	18.412	20.894	15.014	23.110	21.152	22.358	23.618	22.576	23.690	20.335	22.808	21.969	21.205	21.584	2.315
K1	208.683	210.411	217.616			205.759	203.310	199.339	194.881	193.348	191.215	188.554	188.360	191.381	192.582	196.720	199.167	203.002	207.724	199.532	8.509
O1	268.312	268.431	267.501			266.342	268.844	270.123	273.839	280.870	285.018	289.470	290.456	287.866	284.373	278.007	274.839	270.993	269.686	276.175	8.472
MSF	295.411	294.287	297.128			276.525	275.841	31.721	298.974	260.182	277.711	271.082	287.369	332.706	291.147	303.971	299.248	301.859	279.436	274.976	64.805
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.103	0.080			0.105	0.076	0.091	0.101	0.089	0.078	0.100	0.089	0.102	0.080	0.078	0.078	0.093	0.080		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.6	99.2	60.2	0.0	16.2	78.8	73.2	55.4	84.0	65.4	77.9	85.8	98.7	86.9	94.1	91.6	88.7	99.6	90.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.81	05/06/2004 01:00	±0.19	12.0
Lowest Astronomical Tide (LAT)	-0.38	03/12/2010 03:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Maria River at Green Valley

MHL2786

Figure A101

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wilson River at Telegraph Point

RECORDING STATION: **Wilson River at Telegraph Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207415

ZONE: 56
EASTING: 481082
NORTHING: 6534512

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.726	0.670	0.694	0.687	0.730	0.683	0.771	0.769	0.781	0.822	0.821	0.783	0.748	0.734	0.738	0.761	0.743	0.704	0.719	0.741	0.043
MHWS	0.467	0.406	0.418	0.402	0.430	0.368	0.442	0.436	0.428	0.472	0.485	0.470	0.459	0.469	0.484	0.518	0.496	0.451	0.463	0.451	0.037
MHW	0.409	0.350	0.361	0.345	0.373	0.312	0.384	0.379	0.370	0.413	0.424	0.412	0.400	0.411	0.426	0.459	0.436	0.392	0.406	0.393	0.036
MHWN	0.352	0.295	0.304	0.288	0.316	0.257	0.326	0.322	0.311	0.354	0.362	0.353	0.341	0.352	0.367	0.400	0.376	0.333	0.349	0.335	0.034
MSL	0.097	0.055	0.069	0.050	0.083	0.026	0.098	0.090	0.068	0.112	0.118	0.105	0.090	0.096	0.104	0.140	0.115	0.069	0.093	0.088	0.027
MLWN	-0.157	-0.184	-0.167	-0.188	-0.151	-0.205	-0.129	-0.142	-0.174	-0.130	-0.126	-0.143	-0.162	-0.160	-0.159	-0.121	-0.146	-0.196	-0.163	-0.158	0.024
MLW	-0.215	-0.240	-0.223	-0.245	-0.208	-0.261	-0.187	-0.199	-0.233	-0.189	-0.188	-0.202	-0.220	-0.218	-0.217	-0.180	-0.206	-0.255	-0.220	-0.216	0.023
MLWS	-0.273	-0.295	-0.280	-0.302	-0.265	-0.317	-0.245	-0.255	-0.291	-0.247	-0.249	-0.260	-0.279	-0.277	-0.275	-0.239	-0.266	-0.314	-0.277	-0.274	0.023
ISLW	-0.457	-0.484	-0.478	-0.506	-0.479	-0.542	-0.480	-0.493	-0.543	-0.497	-0.488	-0.483	-0.486	-0.466	-0.457	-0.413	-0.442	-0.494	-0.460	-0.482	0.031
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.509	0.479	0.471	0.475	0.466	0.462	0.455	0.464	0.485	0.484	0.488	0.496	0.503	0.512	0.526	0.521	0.522	0.529	0.511	0.493	0.024
MR	0.624	0.590	0.584	0.590	0.581	0.573	0.571	0.577	0.602	0.602	0.611	0.613	0.620	0.629	0.643	0.639	0.642	0.647	0.626	0.609	0.025
MSR	0.740	0.701	0.698	0.704	0.696	0.685	0.686	0.691	0.720	0.719	0.734	0.730	0.738	0.747	0.759	0.758	0.762	0.765	0.740	0.725	0.027
R	1.183	1.154	1.172	1.193	1.209	1.225	1.250	1.262	1.324	1.319	1.309	1.266	1.234	1.199	1.196	1.174	1.185	1.198	1.179	1.223	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.312	0.295	0.292	0.295	0.290	0.287	0.285	0.289	0.301	0.301	0.306	0.307	0.310	0.315	0.321	0.320	0.321	0.324	0.313	0.304	0.013
S2	0.058	0.055	0.057	0.057	0.057	0.056	0.058	0.057	0.059	0.059	0.062	0.059	0.059	0.059	0.058	0.059	0.060	0.059	0.057	0.058	0.001
K1	0.111	0.112	0.117	0.120	0.124	0.129	0.133	0.134	0.142	0.141	0.136	0.129	0.123	0.112	0.109	0.104	0.107	0.109	0.108	0.121	0.012
O1	0.074	0.077	0.080	0.084	0.090	0.096	0.102	0.104	0.110	0.109	0.103	0.094	0.084	0.076	0.073	0.069	0.069	0.072	0.074	0.086	0.014
MSF	0.042	0.020	0.033	0.031	0.023	0.015	0.046	0.011	0.032	0.035	0.039	0.018	0.029	0.032	0.037	0.037	0.038	0.023	0.029	0.030	0.009
z0	0.097	0.055	0.069	0.050	0.083	0.026	0.098	0.090	0.068	0.112	0.118	0.105	0.090	0.096	0.104	0.140	0.115	0.069	0.093	0.088	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	82.618	83.726	86.342	83.795	82.029	83.143	80.700	78.377	76.300	75.924	75.049	75.109	75.999	75.919	77.961	78.016	78.025	78.888	80.102	79.370	3.412
S2	6.182	7.608	9.663	6.823	6.893	7.702	5.766	5.240	3.494	4.400	2.569	2.482	5.947	4.899	7.657	5.850	5.054	4.325	3.229	5.567	1.912
K1	200.854	202.241	202.811	201.830	199.209	198.961	195.820	190.903	188.304	184.719	182.092	180.926	179.928	182.188	183.272	188.233	190.142	194.141	198.374	191.839	8.100
O1	261.131	260.207	260.104	258.418	258.836	259.102	260.443	261.351	267.073	271.931	275.886	279.383	281.486	278.381	275.949	270.449	265.938	261.987	260.648	266.774	8.025
MSF	296.265	294.188	290.460	275.160	310.029	263.536	278.993	331.418	287.818	250.314	280.080	269.938	283.368	330.530	289.649	310.461	299.052	299.154	267.474	289.889	21.180
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079	0.106	0.088	0.095	0.088	0.099	0.077	0.088	0.082	0.088	0.077	0.099	0.084	0.094	0.076	0.073	0.078	0.096	0.081		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.2	99.4	93.1	96.2	94.8	95.3	85.3	85.3	96.3	88.9	88.6	86.4	97.4	86.5	94.3	84.6	89.8	99.5	95.7		

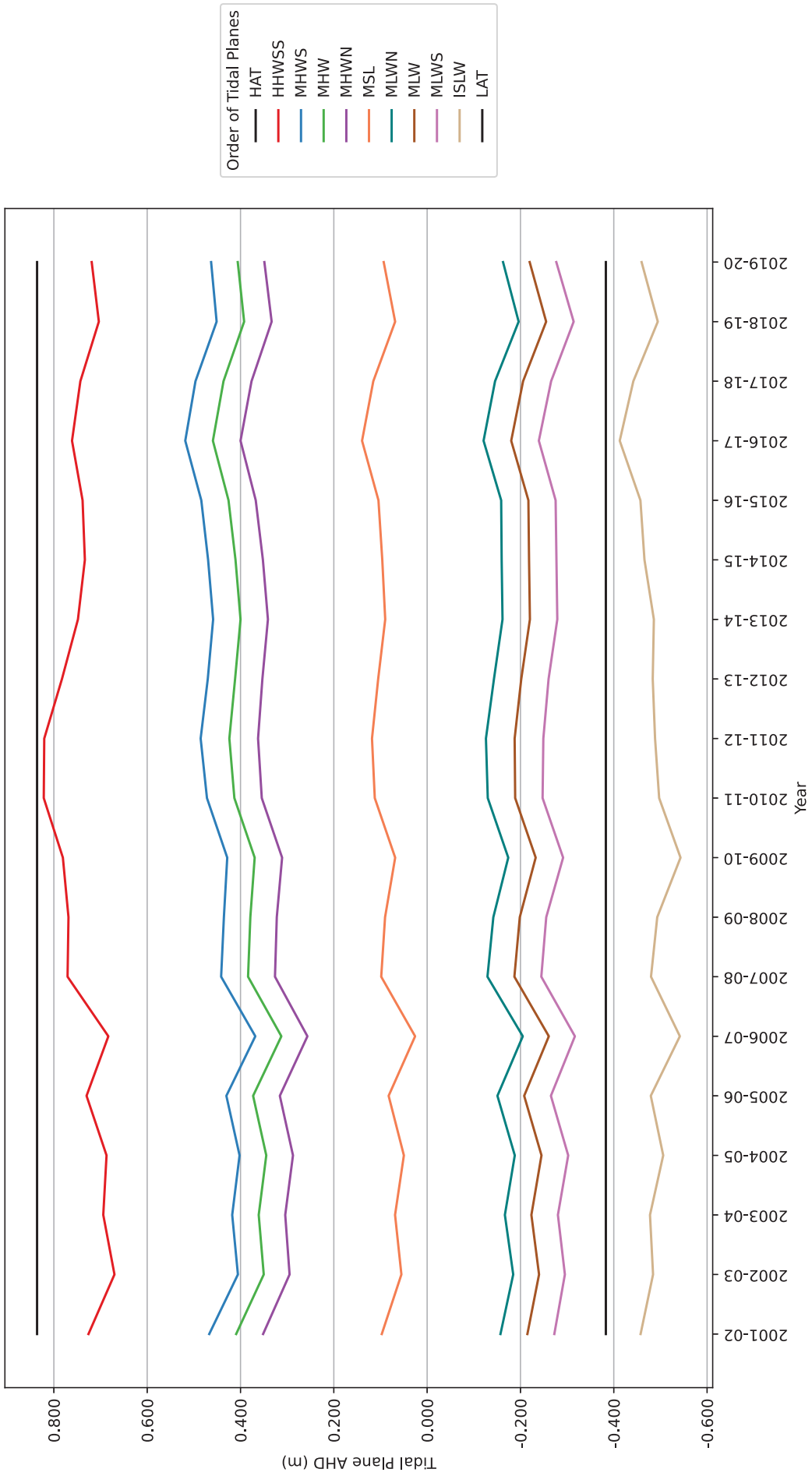
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.84	05/06/2004 00:30	±0.19	16.5
Lowest Astronomical Tide (LAT)	-0.38	24/11/2011 04:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A102

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wilson River at Telegraph Point

MHL2786

Figure A102

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hastings River at Settlement Point

RECORDING STATION: **Hastings River at Settlement Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207418

ZONE: 56
EASTING: 490636
NORTHING: 6525312

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.840	0.795	0.814	0.804	0.849	0.830	0.888	0.907	0.906	0.926	0.914	0.903	0.875	0.866	0.863	0.905	0.874	0.855	0.881	0.868	0.039
MHWS	0.543	0.492	0.496	0.475	0.507	0.470	0.512	0.521	0.508	0.536	0.543	0.558	0.557	0.571	0.577	0.624	0.595	0.573	0.595	0.540	0.043
MHW	0.448	0.397	0.402	0.379	0.411	0.376	0.416	0.423	0.410	0.439	0.444	0.462	0.460	0.475	0.484	0.530	0.501	0.479	0.500	0.444	0.044
MHWN	0.352	0.303	0.308	0.283	0.315	0.281	0.321	0.326	0.311	0.342	0.346	0.366	0.364	0.380	0.390	0.436	0.406	0.384	0.405	0.348	0.044
MSL	0.033	-0.007	0.003	-0.015	0.023	-0.006	0.037	0.038	0.014	0.050	0.054	0.069	0.058	0.070	0.073	0.119	0.086	0.064	0.086	0.045	0.036
MLWN	-0.285	-0.317	-0.301	-0.313	-0.269	-0.294	-0.247	-0.249	-0.283	-0.243	-0.238	-0.227	-0.248	-0.239	-0.245	-0.197	-0.233	-0.256	-0.232	-0.259	0.032
MLW	-0.381	-0.411	-0.395	-0.408	-0.365	-0.389	-0.342	-0.346	-0.382	-0.340	-0.336	-0.324	-0.345	-0.334	-0.338	-0.291	-0.328	-0.350	-0.327	-0.354	0.032
MLWS	-0.477	-0.505	-0.489	-0.504	-0.461	-0.483	-0.438	-0.444	-0.480	-0.437	-0.435	-0.420	-0.441	-0.430	-0.432	-0.385	-0.423	-0.445	-0.422	-0.450	0.032
ISLW	-0.689	-0.722	-0.716	-0.739	-0.705	-0.740	-0.706	-0.719	-0.764	-0.715	-0.700	-0.666	-0.668	-0.641	-0.636	-0.585	-0.622	-0.646	-0.627	-0.685	0.048
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.637	0.619	0.608	0.596	0.583	0.575	0.567	0.574	0.595	0.585	0.583	0.593	0.612	0.618	0.635	0.633	0.639	0.640	0.637	0.607	0.025
MR	0.829	0.808	0.797	0.787	0.776	0.764	0.759	0.769	0.791	0.779	0.781	0.785	0.805	0.809	0.822	0.821	0.829	0.829	0.826	0.798	0.024
MSR	1.020	0.997	0.986	0.979	0.968	0.953	0.950	0.964	0.988	0.973	0.978	0.978	0.998	1.000	1.009	1.009	1.018	1.018	1.016	0.990	0.022
R	1.529	1.516	1.529	1.543	1.555	1.571	1.594	1.626	1.670	1.641	1.614	1.569	1.543	1.507	1.498	1.490	1.497	1.502	1.508	1.553	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.414	0.404	0.398	0.394	0.388	0.382	0.379	0.385	0.396	0.389	0.390	0.393	0.402	0.405	0.411	0.410	0.414	0.415	0.413	0.399	0.012
S2	0.096	0.094	0.094	0.096	0.096	0.094	0.096	0.098	0.098	0.097	0.099	0.096	0.096	0.095	0.094	0.094	0.095	0.095	0.095	0.096	0.001
K1	0.132	0.135	0.141	0.145	0.149	0.156	0.161	0.162	0.167	0.166	0.160	0.149	0.142	0.132	0.128	0.126	0.125	0.127	0.128	0.144	0.015
O1	0.080	0.081	0.086	0.090	0.095	0.101	0.108	0.113	0.117	0.113	0.105	0.097	0.085	0.080	0.075	0.074	0.074	0.074	0.076	0.091	0.015
MSF	0.028	0.007	0.024	0.009	0.018	0.006	0.024	0.011	0.010	0.009	0.022	0.005	0.007	0.020	0.019	0.017	0.020	0.012	0.014	0.015	0.007
z0	0.033	-0.007	0.003	-0.015	0.023	-0.006	0.037	0.038	0.014	0.050	0.054	0.069	0.058	0.070	0.073	0.119	0.086	0.064	0.086	0.045	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	12.786	13.523	14.461	14.307	13.634	13.956	12.591	10.816	8.907	9.439	8.049	8.445	8.601	9.158	9.897	10.813	11.033	11.688	11.995	11.268	2.151
S2	284.453	284.456	285.396	283.968	284.715	285.998	286.358	284.973	284.090	286.026	284.465	283.378	285.478	285.716	285.739	284.751	285.200	284.327	284.380	284.940	0.806
K1	154.873	155.686	156.410	156.612	154.348	153.776	151.488	147.781	144.406	141.037	137.142	137.016	135.550	137.660	138.771	144.052	146.083	149.839	152.285	147.096	7.489
O1	217.400	215.741	214.618	213.852	214.696	216.157	218.954	220.305	225.227	231.503	235.896	237.546	239.648	239.103	233.922	230.389	224.474	220.923	218.751	224.690	9.169
MSF	301.587	359.124	306.410	278.831	5.393	125.586	273.308	72.255	303.250	192.010	275.624	53.333	316.100	357.255	300.906	319.733	312.984	324.468	247.825	248.736	106.557
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.100	0.085	0.087	0.085	0.099	0.073	0.088	0.087	0.092	0.076	0.087	0.084	0.090	0.073	0.068	0.076	0.090	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.5	99.4	98.0	83.6	95.6	98.3	97.0	92.9	83.7	95.1	94.5	85.4	86.3	90.0	96.6	86.2	90.9	95.1	93.0		

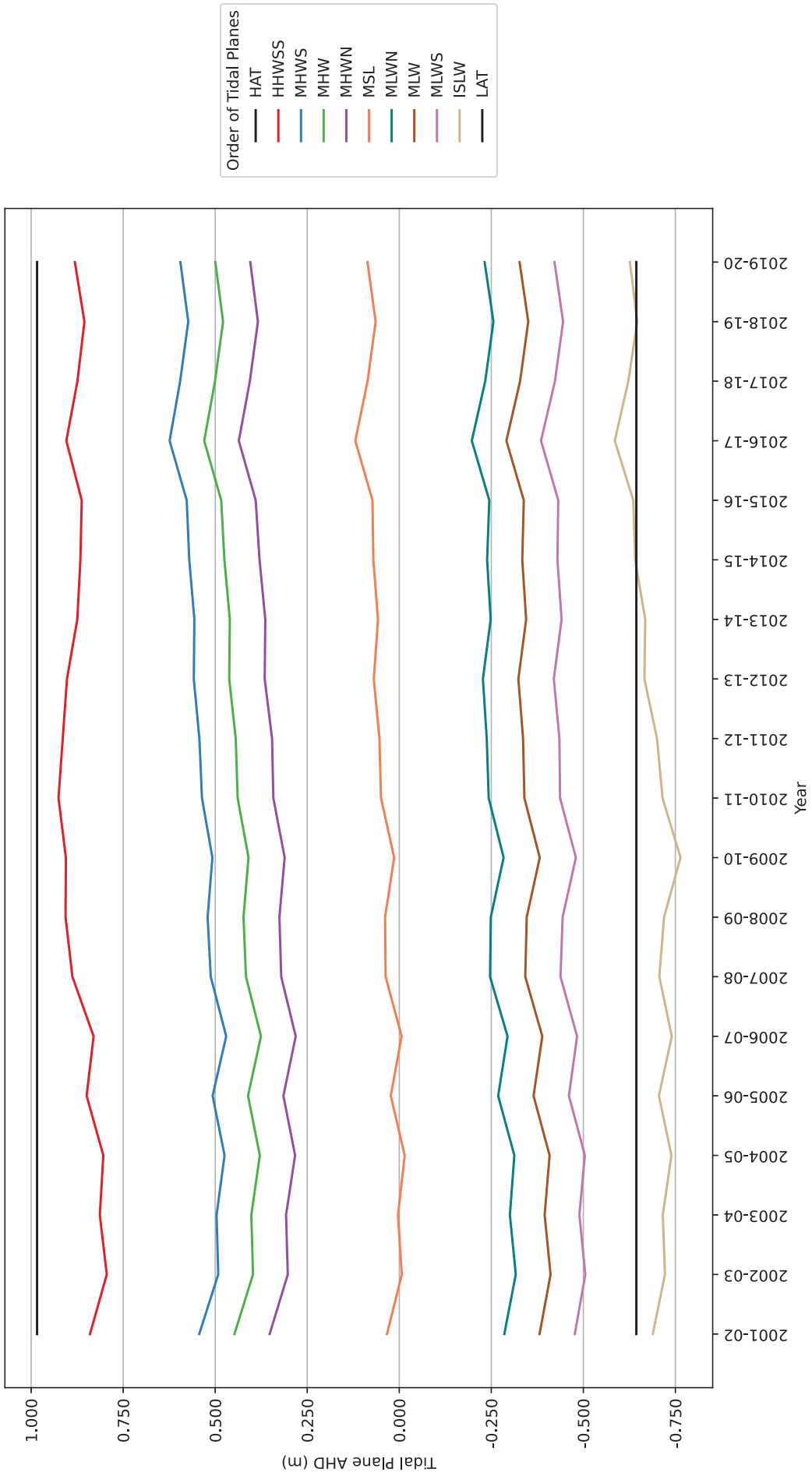
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.98	04/06/2004 22:00	±0.19	5.5
Lowest Astronomical Tide (LAT)	-0.64	27/10/2015 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A103

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hastings River at Settlement Point

MHL2786

Figure A103

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hastings River at Dennis Bridge Downstream

RECORDING STATION: **Hastings River at Dennis Bridge Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207444

ZONE: 56
EASTING: 482995
NORTHING: 6525235

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.902	0.849	0.870	0.874	0.898	0.869	0.912	0.930	0.962	0.966	0.970	0.916	0.894	0.874	0.849	0.878	0.847	0.821	0.827	0.890	0.045
MHWS	0.593	0.530	0.539	0.529	0.542	0.499	0.534	0.545	0.558	0.568	0.586	0.559	0.556	0.566	0.557	0.594	0.566	0.534	0.533	0.552	0.024
MHW	0.496	0.432	0.441	0.427	0.441	0.403	0.434	0.447	0.456	0.464	0.482	0.461	0.458	0.468	0.461	0.499	0.470	0.438	0.437	0.453	0.024
MHWN	0.399	0.334	0.344	0.326	0.339	0.307	0.333	0.350	0.354	0.360	0.378	0.362	0.359	0.370	0.365	0.404	0.374	0.342	0.341	0.355	0.024
MSL	0.047	-0.007	0.007	-0.008	0.013	-0.008	0.031	0.039	0.028	0.038	0.048	0.033	0.022	0.029	0.019	0.058	0.027	-0.005	-0.005	0.021	0.021
MLWN	-0.304	-0.349	-0.330	-0.341	-0.312	-0.323	-0.272	-0.271	-0.299	-0.284	-0.282	-0.296	-0.315	-0.312	-0.326	-0.289	-0.321	-0.353	-0.351	-0.312	0.026
MLW	-0.402	-0.447	-0.428	-0.442	-0.414	-0.420	-0.373	-0.369	-0.401	-0.388	-0.386	-0.395	-0.413	-0.410	-0.423	-0.384	-0.417	-0.449	-0.447	-0.411	0.025
MLWS	-0.499	-0.545	-0.526	-0.544	-0.515	-0.516	-0.473	-0.467	-0.503	-0.492	-0.490	-0.494	-0.512	-0.508	-0.519	-0.479	-0.513	-0.545	-0.543	-0.509	0.024
ISLW	-0.720	-0.772	-0.762	-0.790	-0.770	-0.780	-0.743	-0.741	-0.792	-0.776	-0.764	-0.749	-0.753	-0.728	-0.727	-0.682	-0.714	-0.750	-0.753	-0.751	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.703	0.683	0.674	0.666	0.651	0.630	0.605	0.621	0.652	0.644	0.659	0.658	0.674	0.681	0.691	0.693	0.695	0.696	0.692	0.667	0.028
MR	0.898	0.879	0.869	0.869	0.854	0.822	0.806	0.816	0.856	0.852	0.868	0.855	0.871	0.878	0.884	0.883	0.887	0.887	0.884	0.864	0.025
MSR	1.092	1.075	1.065	1.072	1.057	1.015	1.008	1.012	1.060	1.060	1.076	1.053	1.068	1.074	1.077	1.073	1.079	1.078	1.075	1.062	0.024
R	1.622	1.621	1.633	1.664	1.668	1.650	1.654	1.671	1.754	1.742	1.734	1.665	1.648	1.602	1.576	1.559	1.561	1.571	1.581	1.641	0.059
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.449	0.439	0.435	0.435	0.427	0.411	0.403	0.408	0.428	0.426	0.434	0.428	0.436	0.439	0.442	0.441	0.444	0.444	0.442	0.432	0.013
S2	0.097	0.098	0.098	0.101	0.101	0.096	0.101	0.098	0.102	0.104	0.104	0.099	0.098	0.098	0.096	0.095	0.096	0.096	0.096	0.099	0.003
K1	0.137	0.141	0.147	0.151	0.155	0.159	0.162	0.159	0.171	0.170	0.165	0.154	0.149	0.136	0.130	0.128	0.125	0.128	0.130	0.147	0.015
O1	0.084	0.087	0.089	0.096	0.099	0.105	0.107	0.115	0.118	0.114	0.109	0.101	0.093	0.083	0.078	0.075	0.076	0.077	0.081	0.094	0.015
MSF	0.035	0.011	0.038	0.017	0.022	0.002	0.020	0.011	0.020	0.010	0.029	0.001	0.015	0.027	0.021	0.023	0.025	0.014	0.021	0.019	0.010
z0	0.047	-0.007	0.007	-0.008	0.013	-0.008	0.031	0.039	0.028	0.038	0.048	0.033	0.022	0.029	0.019	0.058	0.027	-0.005	-0.005	0.021	0.021
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	26.183	27.390	27.706	27.635	26.720	27.446	25.431	23.705	22.088	22.566	20.985	21.766	22.276	22.550	23.074	24.537	24.961	25.776	26.541	24.702	2.258
S2	302.156	302.568	302.794	302.798	301.943	303.922	302.284	302.088	300.149	302.107	302.165	300.260	304.298	303.849	303.051	301.644	303.415	301.543	301.646	302.352	1.101
K1	162.606	164.023	163.650	164.646	161.895	162.032	159.211	155.228	153.474	148.993	145.357	144.972	144.110	146.141	146.717	152.383	154.337	158.940	162.189	155.311	7.425
O1	225.532	224.057	222.160	222.169	222.832	223.047	225.327	227.864	231.733	239.180	241.851	247.124	247.511	246.921	242.738	237.112	232.820	228.811	226.167	232.366	9.276
MSF	298.910	1.215	291.828	278.349	345.855	61.594	260.622	352.766	275.274	244.174	273.439	354.073	292.730	341.496	300.418	317.472	300.710	307.691	259.380	271.474	90.912
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.108	0.087	0.088	0.094	0.098	0.066	0.082	0.078	0.093	0.072	0.101	0.088	0.095	0.077	0.074	0.080	0.095	0.082		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	85.1	98.1	88.2	97.6	89.8	94.5	67.4	68.1	87.5	84.5	75.7	89.2	96.8	91.1	98.4	94.9	81.5	92.0	95.2		

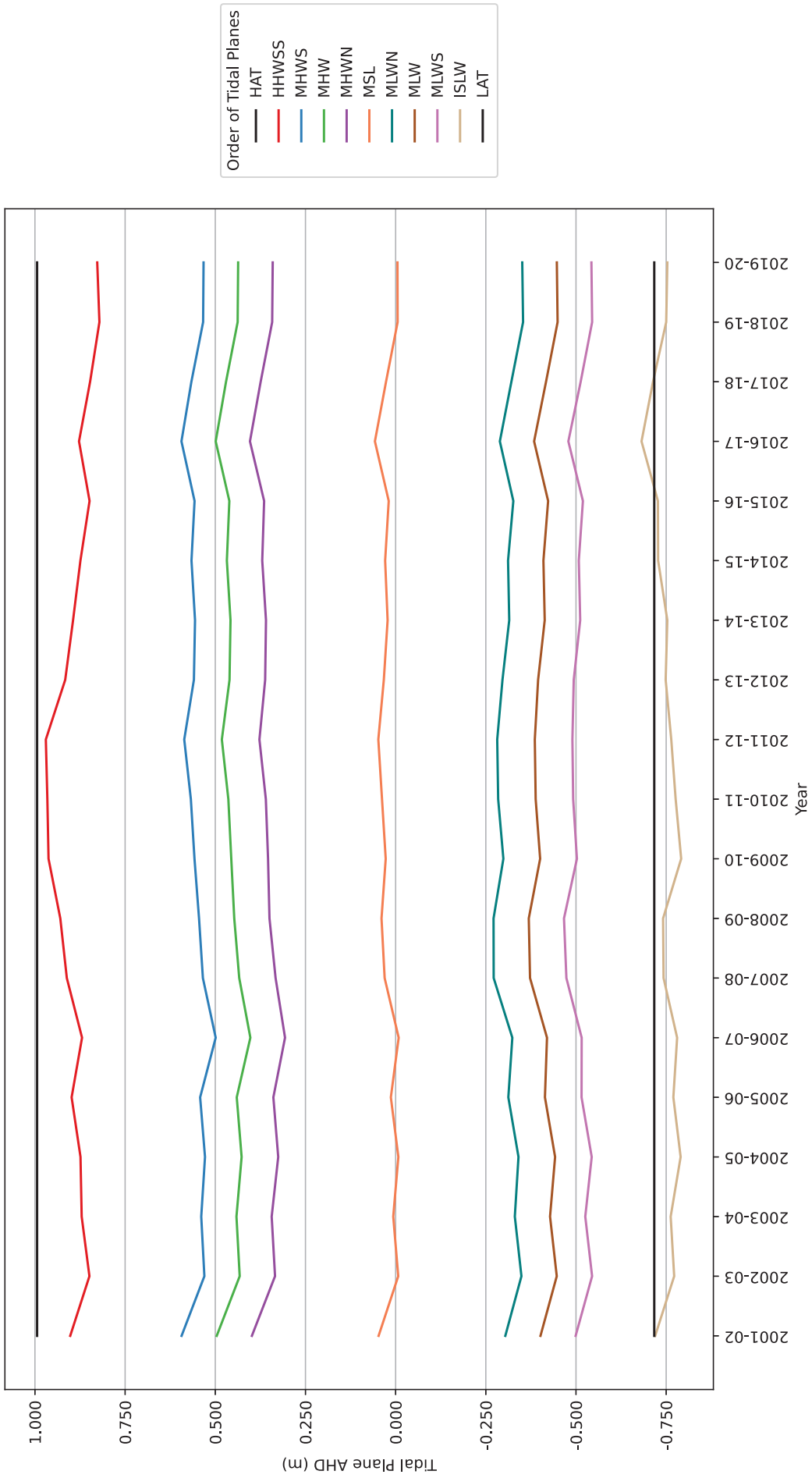
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.99	04/06/2004 22:45	±0.18	9.8
Lowest Astronomical Tide (LAT)	-0.72	27/10/2015 03:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A104

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hastings River at Dennis Bridge Downstream

MHL2786

Figure A104

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hastings River at Wauchope Railway Bridge

RECORDING STATION: **Hastings River at Wauchope Railway Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207401

ZONE: 56
EASTING: 474995
NORTHING: 6520192

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.924	0.851	0.895	0.885	0.925	0.884	0.954	0.957		1.004	1.005	0.968	0.947	0.917	0.918	0.963	0.927	0.894	0.909	0.929	0.041
MHWS	0.610	0.532	0.560	0.539	0.563	0.506	0.567	0.558		0.598	0.620	0.598	0.607	0.607	0.621	0.669	0.638	0.597	0.605	0.589	0.041
MHW	0.509	0.436	0.459	0.438	0.461	0.409	0.468	0.460		0.500	0.517	0.498	0.507	0.507	0.523	0.572	0.539	0.498	0.509	0.489	0.040
MHWN	0.408	0.340	0.359	0.337	0.358	0.311	0.370	0.363		0.402	0.415	0.399	0.406	0.406	0.425	0.474	0.440	0.399	0.413	0.390	0.040
MSL	0.043	-0.011	0.008	-0.011	0.024	-0.021	0.049	0.036		0.071	0.078	0.051	0.054	0.054	0.060	0.108	0.071	0.033	0.050	0.042	0.034
MLWN	-0.321	-0.361	-0.343	-0.359	-0.311	-0.352	-0.272	-0.290		-0.260	-0.258	-0.296	-0.299	-0.298	-0.305	-0.257	-0.298	-0.332	-0.313	-0.307	0.033
MLW	-0.422	-0.457	-0.443	-0.459	-0.413	-0.450	-0.371	-0.388		-0.358	-0.361	-0.396	-0.399	-0.399	-0.403	-0.355	-0.397	-0.431	-0.409	-0.406	0.033
MLWS	-0.523	-0.553	-0.544	-0.560	-0.516	-0.548	-0.469	-0.486		-0.456	-0.463	-0.496	-0.500	-0.500	-0.500	-0.453	-0.496	-0.530	-0.505	-0.505	0.033
ISLW	-0.747	-0.781	-0.783	-0.807	-0.774	-0.817	-0.745	-0.770		-0.746	-0.738	-0.760	-0.742	-0.721	-0.713	-0.662	-0.703	-0.742	-0.722	-0.749	0.038
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.730	0.701	0.702	0.696	0.669	0.663	0.643	0.653		0.662	0.673	0.694	0.706	0.705	0.730	0.731	0.738	0.732	0.726	0.697	0.031
MR	0.931	0.893	0.903	0.897	0.874	0.859	0.839	0.848		0.858	0.878	0.894	0.906	0.906	0.926	0.927	0.936	0.929	0.918	0.896	0.030
MSR	1.133	1.084	1.104	1.098	1.079	1.054	1.035	1.044		1.053	1.083	1.094	1.106	1.107	1.121	1.122	1.134	1.127	1.110	1.094	0.031
R	1.671	1.632	1.679	1.691	1.700	1.701	1.699	1.727		1.750	1.742	1.728	1.689	1.638	1.631	1.625	1.629	1.636	1.631	1.678	0.043
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.466	0.446	0.451	0.449	0.437	0.429	0.420	0.424		0.429	0.439	0.447	0.453	0.453	0.463	0.463	0.468	0.465	0.459	0.448	0.015
S2	0.101	0.096	0.100	0.101	0.102	0.098	0.098	0.098		0.098	0.102	0.100	0.100	0.101	0.098	0.098	0.099	0.099	0.096	0.099	0.002
K1	0.139	0.140	0.146	0.149	0.155	0.160	0.163	0.165		0.169	0.163	0.160	0.150	0.137	0.133	0.131	0.129	0.131	0.133	0.147	0.014
O1	0.086	0.088	0.093	0.098	0.104	0.109	0.114	0.119		0.121	0.112	0.105	0.093	0.084	0.080	0.079	0.078	0.081	0.084	0.096	0.015
MSF	0.032	0.013	0.029	0.022	0.012	0.006	0.036	0.011		0.020	0.031	0.012	0.018	0.025	0.027	0.022	0.028	0.016	0.019	0.021	0.008
z0	0.043	-0.011	0.008	-0.011	0.024	-0.021	0.049	0.036		0.071	0.078	0.051	0.054	0.054	0.060	0.108	0.071	0.033	0.050	0.042	0.034
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	46.271	48.618	46.962	47.078	45.639	47.062	44.381	44.258		42.002	39.371	40.465	41.549	41.444	42.107	43.127	43.794	45.760	45.997	44.216	2.636
S2	329.680	332.006	328.311	329.230	327.988	329.698	326.723	327.948		327.001	325.300	327.016	330.697	330.650	329.404	328.039	330.277	331.043	329.221	328.902	1.746
K1	174.702	177.088	175.395	175.556	172.879	173.553	170.120	167.568		160.367	155.975	156.121	155.086	156.742	157.578	163.381	166.124	170.506	173.493	166.791	7.969
O1	233.288	233.073	231.719	231.135	231.551	232.666	235.442	237.580		248.958	250.819	255.594	256.082	255.640	249.337	245.643	241.042	238.210	235.889	241.315	9.219
MSF	307.957	294.425	296.276	270.354	327.076	258.852	275.122	27.606		255.484	278.872	279.428	290.288	347.240	295.036	297.752	289.663	315.329	262.221	276.055	66.371
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.081	0.112	0.087	0.091	0.091	0.095	0.077	0.092		0.082	0.072	0.098	0.084	0.095	0.074	0.080	0.079	0.097	0.085		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	86.1	89.7	96.4	97.4	95.9	94.9	90.0	83.8	38.6	83.8	84.4	85.8	96.4	86.5	94.6	88.2	91.3	89.1	93.6		

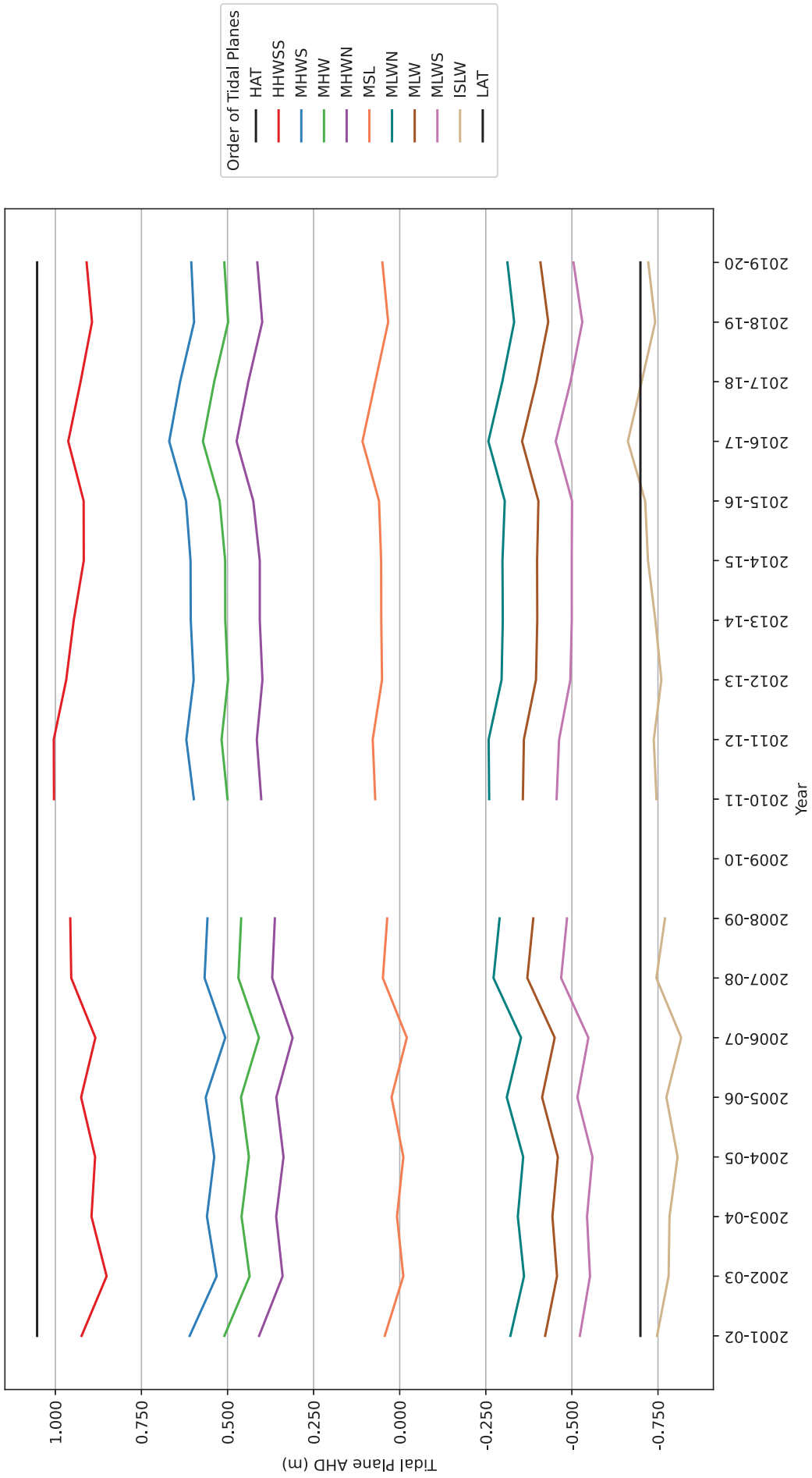
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.05	04/06/2008 22:45	±0.21	10.3
Lowest Astronomical Tide (LAT)	-0.70	27/10/2015 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A105

MHL2786

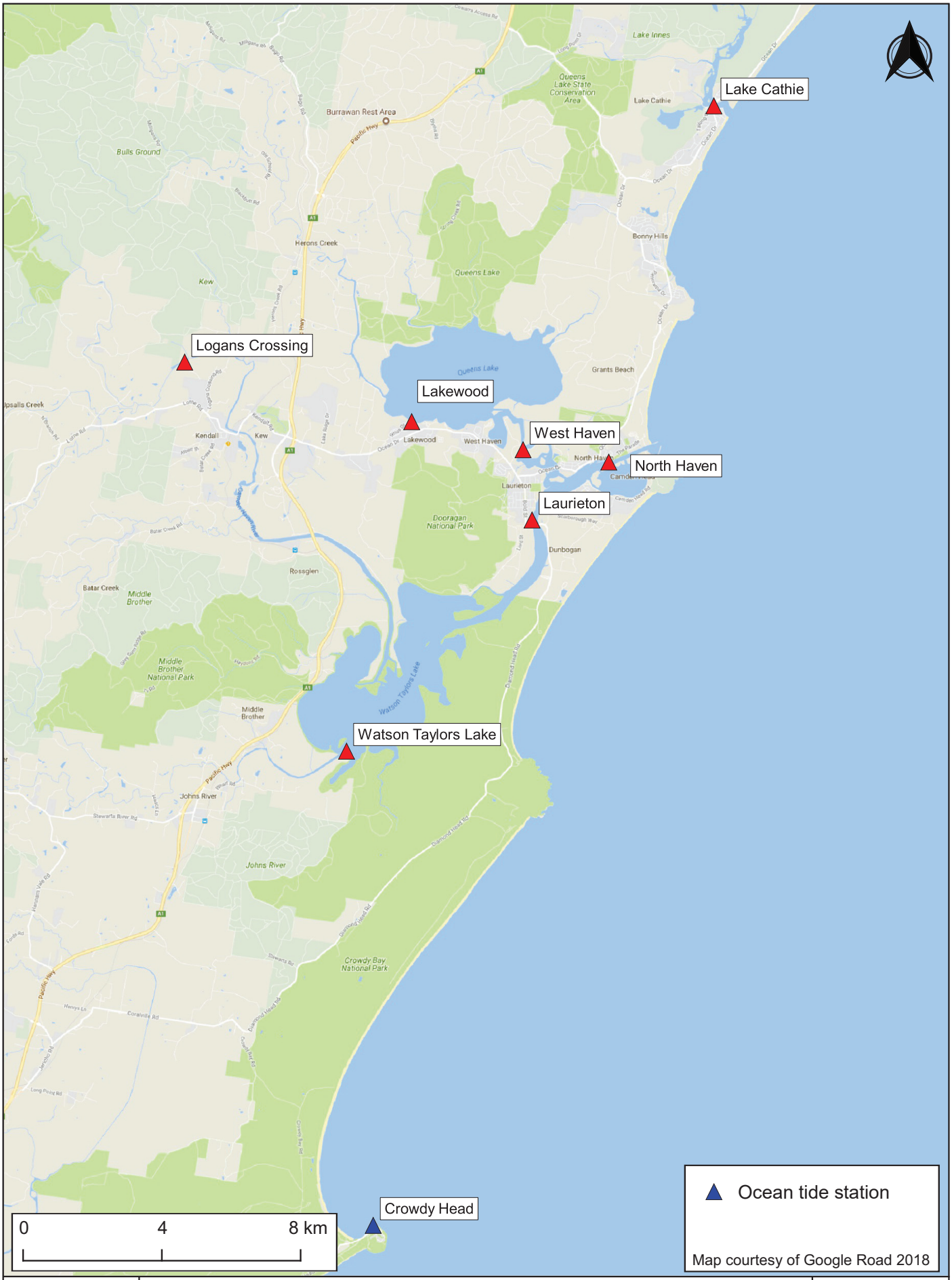


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hastings River at Wauchope Railway Bridge

MHL2786

Figure A105



NSW GOVERNMENT

STATION LOCATIONS
CAMDEN HAVEN REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A106

DRAWING A106.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Camden Haven River at North Haven

RECORDING STATION: **Camden Haven River at North Haven**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207423

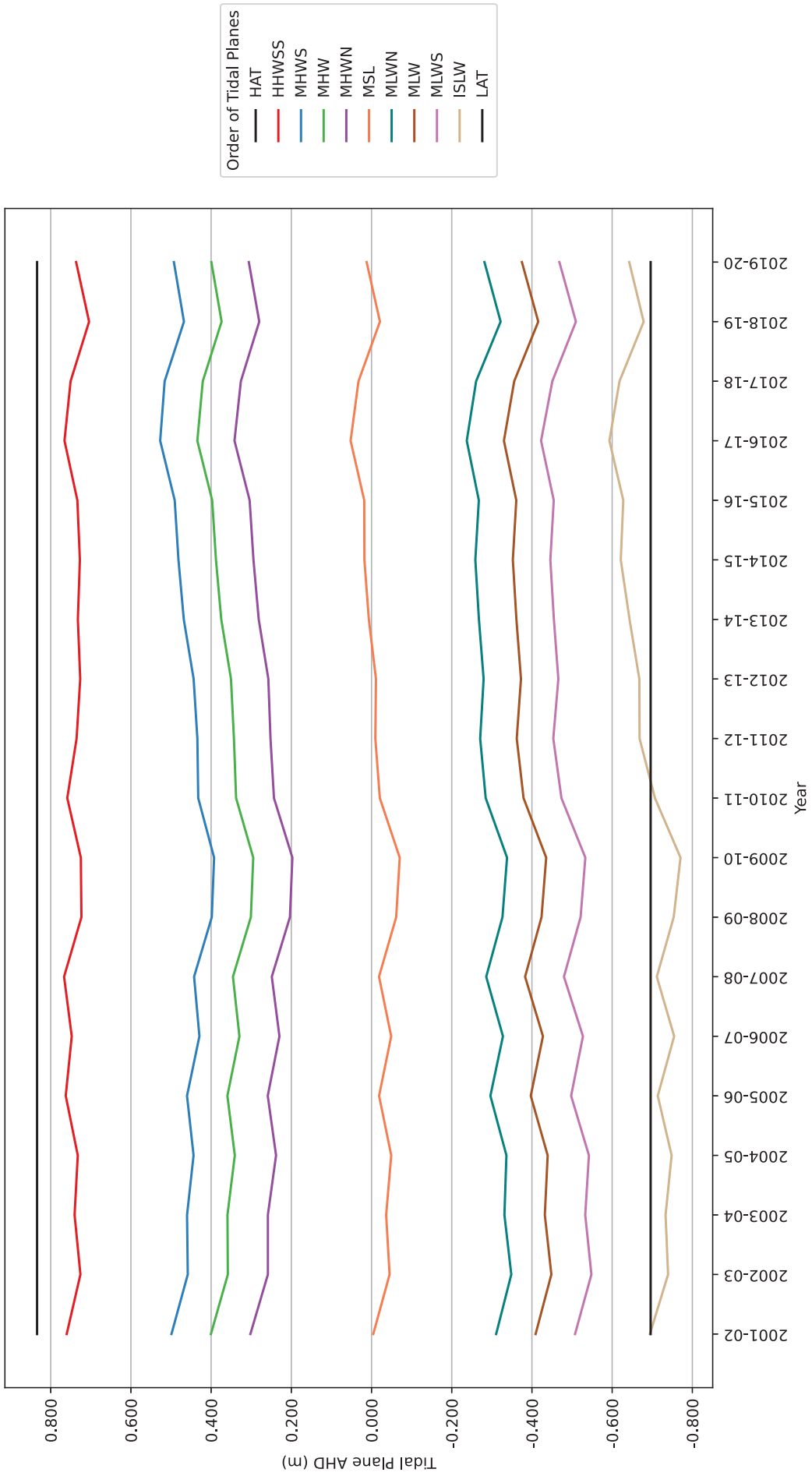
ZONE: 56
EASTING: 483134
NORTHING: 6499413

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.760	0.726	0.740	0.732	0.763	0.748	0.767	0.723	0.725	0.759	0.735	0.726	0.732	0.727	0.734	0.766	0.750	0.704	0.737	0.740	0.017
MHWS	0.499	0.458	0.460	0.444	0.460	0.429	0.442	0.398	0.393	0.432	0.434	0.444	0.468	0.481	0.491	0.527	0.516	0.468	0.493	0.460	0.036
MHW	0.400	0.358	0.359	0.341	0.359	0.329	0.346	0.301	0.295	0.338	0.343	0.350	0.375	0.388	0.397	0.434	0.421	0.374	0.399	0.364	0.037
MHWN	0.302	0.258	0.258	0.238	0.259	0.230	0.249	0.204	0.197	0.243	0.252	0.257	0.281	0.294	0.304	0.342	0.326	0.280	0.306	0.267	0.039
MSL	-0.004	-0.045	-0.036	-0.049	-0.019	-0.049	-0.019	-0.061	-0.070	-0.021	-0.009	-0.011	0.007	0.018	0.018	0.052	0.032	-0.021	0.012	-0.015	0.033
MLWN	-0.311	-0.349	-0.331	-0.336	-0.296	-0.328	-0.286	-0.326	-0.338	-0.285	-0.271	-0.280	-0.268	-0.259	-0.268	-0.237	-0.261	-0.322	-0.282	-0.296	0.033
MLW	-0.409	-0.448	-0.432	-0.439	-0.397	-0.427	-0.383	-0.424	-0.436	-0.379	-0.362	-0.373	-0.361	-0.352	-0.361	-0.330	-0.356	-0.416	-0.375	-0.393	0.035
MLWS	-0.508	-0.548	-0.533	-0.542	-0.498	-0.527	-0.480	-0.521	-0.533	-0.474	-0.453	-0.466	-0.455	-0.446	-0.454	-0.423	-0.451	-0.510	-0.468	-0.489	0.038
ISLW	-0.694	-0.740	-0.733	-0.748	-0.714	-0.755	-0.711	-0.753	-0.771	-0.707	-0.668	-0.668	-0.643	-0.621	-0.628	-0.593	-0.618	-0.679	-0.643	-0.689	0.054
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.613	0.607	0.590	0.574	0.555	0.557	0.535	0.530	0.535	0.528	0.523	0.537	0.549	0.553	0.572	0.579	0.587	0.602	0.588	0.564	0.029
MR	0.810	0.807	0.791	0.780	0.756	0.757	0.728	0.725	0.731	0.717	0.705	0.723	0.736	0.740	0.758	0.764	0.777	0.790	0.774	0.756	0.031
MSR	1.006	1.007	0.993	0.986	0.958	0.956	0.922	0.920	0.926	0.906	0.888	0.909	0.923	0.927	0.945	0.950	0.967	0.977	0.961	0.949	0.035
R	1.454	1.465	1.474	1.481	1.476	1.502	1.478	1.477	1.495	1.465	1.404	1.394	1.376	1.349	1.361	1.359	1.369	1.383	1.379	1.429	0.055
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.405	0.403	0.396	0.390	0.378	0.378	0.364	0.362	0.365	0.358	0.353	0.362	0.368	0.370	0.379	0.382	0.388	0.395	0.387	0.378	0.016
S2	0.098	0.100	0.101	0.103	0.101	0.100	0.097	0.097	0.098	0.094	0.091	0.093	0.093	0.094	0.093	0.093	0.095	0.094	0.093	0.096	0.003
K1	0.117	0.119	0.125	0.126	0.131	0.138	0.139	0.139	0.140	0.139	0.130	0.125	0.119	0.111	0.111	0.109	0.106	0.107	0.109	0.123	0.012
O1	0.070	0.072	0.075	0.080	0.085	0.090	0.093	0.093	0.097	0.094	0.086	0.077	0.070	0.065	0.063	0.062	0.062	0.061	0.065	0.077	0.013
MSF	0.020	0.009	0.025	0.005	0.018	0.009	0.016	0.017	0.009	0.004	0.020	0.006	0.003	0.018	0.014	0.018	0.016	0.012	0.013	0.013	0.006
z0	-0.004	-0.045	-0.036	-0.049	-0.019	-0.049	-0.019	-0.061	-0.070	-0.021	-0.009	-0.011	0.007	0.018	0.018	0.052	0.032	-0.021	0.012	-0.015	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	355.156	355.823	356.043	356.495	356.072	356.101	355.526	354.524	352.875	352.603	352.428	352.200	352.376	352.445	352.962	353.574	353.673	354.683	354.821	354.230	1.525
S2	263.279	263.124	262.961	263.091	262.802	264.006	264.649	264.690	264.500	265.014	264.674	263.418	265.733	263.412	263.289	263.694	264.025	263.907	264.247	263.922	0.799
K1	143.837	144.657	144.886	145.037	144.055	142.818	141.500	139.347	135.388	132.045	128.621	128.357	127.055	128.894	132.162	135.183	136.702	141.072	144.124	137.671	6.514
O1	206.677	202.784	202.595	203.063	203.714	204.614	207.482	209.913	215.372	220.935	226.439	228.433	230.692	228.099	224.529	218.710	212.866	210.421	207.489	213.938	9.894
MSF	301.217	24.007	310.170	278.071	359.672	115.851	295.577	80.440	318.702	190.368	292.536	37.682	294.912	18.108	288.453	323.851	321.426	352.452	236.004	233.658	117.276
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078	0.095	0.082	0.084	0.083	0.097	0.072	0.087	0.087	0.095	0.069	0.088	0.087	0.088	0.070	0.062	0.072	0.092	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.1	99.1	96.4	97.7	92.8	97.9	94.7	96.7	99.5	95.1	91.8	81.1	93.9	87.4	92.6	83.0	87.1	95.3	86.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.83	04/06/2004 21:45	±0.19	4.9
Lowest Astronomical Tide (LAT)	-0.70	29/09/2015 03:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Camden Haven River at North Haven

MHL2786

Figure A107

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Stingray Creek at West Haven

RECORDING STATION: **Stingray Creek at West Haven**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207437

ZONE: 56
EASTING: 480664
NORTHING: 6499768

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.460	0.416	0.452	0.438	0.444	0.417	0.458	0.469	0.462	0.477	0.491	0.479	0.464	0.456	0.437	0.487	0.477	0.456	0.475	0.459	0.021
MHWS	0.305	0.256	0.282	0.260	0.260	0.223	0.254	0.261	0.248	0.269	0.290	0.294	0.291	0.299	0.285	0.340	0.329	0.302	0.320	0.283	0.030
MHW	0.263	0.211	0.238	0.213	0.215	0.178	0.212	0.215	0.205	0.227	0.250	0.253	0.248	0.257	0.244	0.299	0.286	0.258	0.278	0.239	0.031
MHWN	0.220	0.166	0.193	0.167	0.170	0.132	0.170	0.169	0.161	0.186	0.209	0.211	0.205	0.215	0.202	0.258	0.242	0.213	0.236	0.196	0.032
MSL	0.068	0.015	0.042	0.019	0.034	-0.005	0.037	0.035	0.025	0.052	0.074	0.072	0.063	0.074	0.054	0.114	0.093	0.055	0.084	0.053	0.030
MLWN	-0.084	-0.136	-0.109	-0.130	-0.101	-0.142	-0.097	-0.100	-0.111	-0.081	-0.062	-0.067	-0.080	-0.067	-0.094	-0.030	-0.056	-0.104	-0.067	-0.090	0.029
MLW	-0.127	-0.181	-0.153	-0.176	-0.147	-0.187	-0.139	-0.146	-0.155	-0.123	-0.102	-0.109	-0.122	-0.109	-0.136	-0.071	-0.099	-0.149	-0.109	-0.134	0.030
MLWS	-0.170	-0.226	-0.198	-0.222	-0.192	-0.233	-0.181	-0.192	-0.199	-0.164	-0.143	-0.151	-0.165	-0.150	-0.177	-0.112	-0.143	-0.193	-0.151	-0.177	0.032
ISLW	-0.280	-0.341	-0.319	-0.350	-0.323	-0.371	-0.326	-0.340	-0.351	-0.313	-0.286	-0.282	-0.289	-0.263	-0.286	-0.217	-0.249	-0.303	-0.262	-0.303	0.040
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.305	0.303	0.302	0.296	0.271	0.273	0.267	0.269	0.272	0.267	0.271	0.278	0.285	0.282	0.297	0.288	0.298	0.317	0.303	0.287	0.016
MR	0.390	0.392	0.391	0.389	0.361	0.365	0.351	0.361	0.360	0.350	0.352	0.361	0.370	0.366	0.379	0.370	0.385	0.406	0.387	0.373	0.017
MSR	0.475	0.482	0.480	0.482	0.452	0.456	0.435	0.453	0.447	0.433	0.433	0.445	0.455	0.449	0.461	0.452	0.471	0.496	0.471	0.459	0.018
R	0.740	0.757	0.770	0.789	0.767	0.788	0.784	0.809	0.813	0.790	0.778	0.761	0.753	0.720	0.723	0.704	0.726	0.759	0.738	0.761	0.031
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.195	0.196	0.196	0.195	0.181	0.182	0.176	0.181	0.180	0.175	0.176	0.181	0.185	0.183	0.190	0.185	0.192	0.203	0.193	0.187	0.008
S2	0.043	0.045	0.045	0.046	0.045	0.046	0.042	0.046	0.044	0.042	0.040	0.042	0.043	0.042	0.041	0.041	0.043	0.045	0.042	0.043	0.002
K1	0.066	0.068	0.071	0.075	0.076	0.079	0.082	0.084	0.084	0.083	0.080	0.076	0.072	0.065	0.064	0.062	0.063	0.065	0.066	0.073	0.008
O1	0.045	0.047	0.049	0.053	0.055	0.059	0.063	0.065	0.068	0.065	0.063	0.056	0.052	0.048	0.045	0.043	0.043	0.045	0.046	0.053	0.009
MSF	0.040	0.022	0.044	0.031	0.021	0.011	0.040	0.012	0.033	0.022	0.042	0.017	0.025	0.032	0.036	0.040	0.034	0.028	0.030	0.029	0.010
z0	0.068	0.015	0.042	0.019	0.034	-0.005	0.037	0.035	0.025	0.052	0.074	0.072	0.063	0.074	0.054	0.114	0.093	0.055	0.084	0.053	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	13.983	13.980	17.303	15.532	15.136	14.675	15.160	13.208	11.830	11.896	10.752	10.170	10.192	11.318	11.203	13.054	12.338	12.500	13.344	13.030	1.962
S2	278.934	279.746	282.044	281.020	280.035	282.219	281.489	281.093	279.951	283.540	281.861	281.666	281.806	279.204	280.950	280.017	278.904	279.629	281.411	280.817	1.269
K1	166.075	166.321	168.410	166.625	168.295	165.166	165.214	161.551	157.761	154.092	151.016	148.326	147.822	151.023	151.542	158.475	159.535	162.403	166.990	159.823	7.190
O1	230.329	226.467	228.591	226.621	227.468	228.434	233.742	234.119	238.960	245.078	249.308	251.514	252.990	253.152	249.268	244.871	239.856	234.439	232.942	238.324	9.647
MSF	295.882	292.234	297.702	274.891	315.324	263.092	290.551	317.261	293.839	259.907	285.143	291.257	283.238	325.983	292.648	307.069	302.309	297.268	272.504	292.532	17.335
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.091	0.082	0.081	0.085	0.094	0.071	0.083	0.083	0.093	0.071	0.091	0.085	0.084	0.069	0.061	0.068	0.092	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.3	99.4	95.0	97.9	96.4	98.4	94.2	94.6	99.2	97.9	95.5	89.3	97.3	94.2	97.1	92.9	92.4	97.7	95.6		

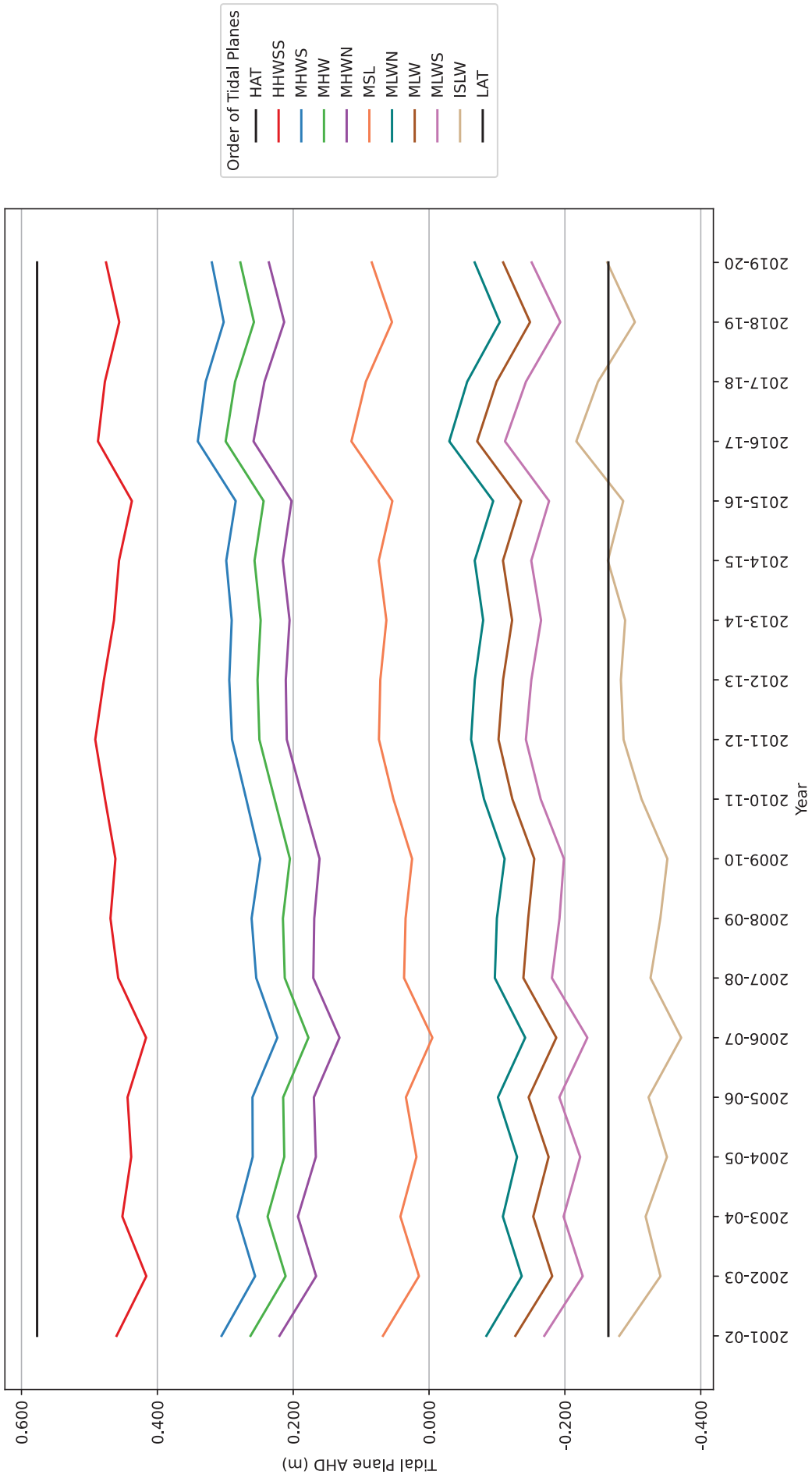
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.58	04/06/2004 22:15	±0.17	7.7
Lowest Astronomical Tide (LAT)	-0.26	23/12/2011 01:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A108

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Stingray Creek at West Haven

MHL2786

Figure A108

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Camden Haven River at Laurieton

RECORDING STATION: **Camden Haven River at Laurieton**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207425

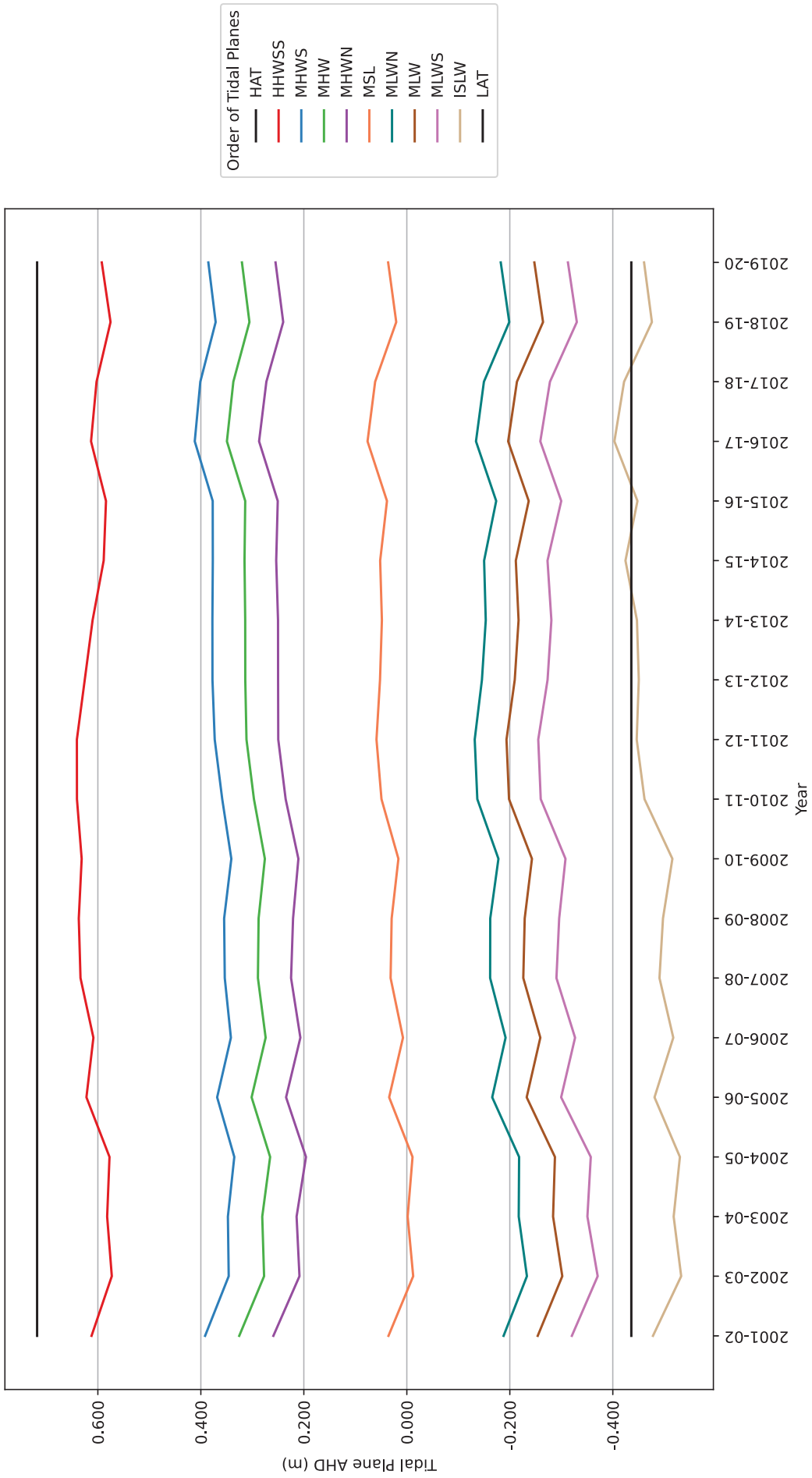
ZONE: 56
EASTING: 480923
NORTHING: 6497744

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.612	0.573	0.582	0.577	0.622	0.609	0.634	0.637	0.631	0.641	0.641	0.625	0.610	0.589	0.584	0.613	0.603	0.575	0.592	0.608	0.023
MHWS	0.392	0.346	0.347	0.335	0.368	0.342	0.354	0.355	0.341	0.358	0.373	0.377	0.378	0.377	0.377	0.412	0.401	0.371	0.385	0.368	0.021
MHW	0.325	0.277	0.281	0.265	0.301	0.274	0.289	0.288	0.276	0.297	0.311	0.314	0.314	0.315	0.314	0.349	0.337	0.306	0.320	0.303	0.023
MHWN	0.259	0.208	0.214	0.196	0.234	0.207	0.225	0.221	0.211	0.235	0.250	0.250	0.250	0.254	0.251	0.287	0.273	0.240	0.255	0.238	0.024
MSL	0.036	-0.012	-0.002	-0.011	0.034	0.007	0.031	0.029	0.016	0.049	0.059	0.052	0.048	0.052	0.039	0.076	0.062	0.021	0.036	0.033	0.025
MLWN	-0.188	-0.233	-0.217	-0.218	-0.166	-0.192	-0.162	-0.162	-0.178	-0.137	-0.132	-0.146	-0.153	-0.150	-0.174	-0.134	-0.150	-0.199	-0.182	-0.172	0.030
MLW	-0.254	-0.302	-0.284	-0.288	-0.233	-0.259	-0.226	-0.229	-0.243	-0.198	-0.194	-0.210	-0.217	-0.212	-0.237	-0.197	-0.214	-0.265	-0.248	-0.237	0.032
MLWS	-0.321	-0.371	-0.351	-0.357	-0.300	-0.327	-0.291	-0.296	-0.308	-0.260	-0.255	-0.273	-0.281	-0.273	-0.300	-0.259	-0.278	-0.330	-0.313	-0.302	0.034
ISLW	-0.478	-0.533	-0.518	-0.530	-0.481	-0.517	-0.491	-0.498	-0.516	-0.462	-0.446	-0.450	-0.447	-0.425	-0.448	-0.403	-0.422	-0.476	-0.461	-0.474	0.038
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.447	0.442	0.431	0.414	0.400	0.399	0.387	0.383	0.389	0.372	0.382	0.396	0.403	0.404	0.424	0.421	0.422	0.439	0.437	0.410	0.023
MR	0.580	0.579	0.565	0.553	0.534	0.533	0.515	0.517	0.519	0.495	0.505	0.523	0.531	0.527	0.551	0.546	0.551	0.570	0.568	0.540	0.025
MSR	0.712	0.717	0.698	0.692	0.668	0.668	0.644	0.651	0.649	0.619	0.628	0.651	0.658	0.650	0.677	0.671	0.679	0.701	0.698	0.670	0.028
R	1.090	1.106	1.100	1.108	1.103	1.126	1.124	1.135	1.147	1.102	1.087	1.076	1.057	1.013	1.032	1.016	1.025	1.051	1.053	1.082	0.041
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.290	0.290	0.282	0.277	0.267	0.267	0.258	0.258	0.259	0.248	0.252	0.262	0.265	0.263	0.275	0.273	0.275	0.285	0.284	0.270	0.013
S2	0.066	0.069	0.067	0.070	0.067	0.067	0.064	0.067	0.065	0.062	0.062	0.064	0.064	0.062	0.063	0.062	0.064	0.066	0.065	0.065	0.002
K1	0.095	0.097	0.101	0.103	0.108	0.112	0.115	0.115	0.118	0.114	0.109	0.103	0.099	0.089	0.090	0.088	0.087	0.089	0.088	0.101	0.011
O1	0.063	0.065	0.067	0.070	0.073	0.079	0.085	0.087	0.090	0.087	0.082	0.074	0.067	0.062	0.058	0.056	0.057	0.057	0.059	0.070	0.011
MSF	0.034	0.016	0.036	0.025	0.024	0.009	0.032	0.005	0.026	0.019	0.035	0.011	0.019	0.025	0.029	0.032	0.029	0.020	0.023	0.024	0.009
z0	0.036	-0.012	-0.002	-0.011	0.034	0.007	0.031	0.029	0.016	0.049	0.059	0.052	0.048	0.052	0.039	0.076	0.062	0.021	0.036	0.033	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	8.240	8.495	9.192	9.400	9.358	9.169	9.212	8.166	6.507	6.764	5.676	4.767	4.844	5.758	5.515	7.049	7.419	7.628	7.677	7.412	1.565
S2	275.130	274.931	274.885	274.866	274.341	277.147	277.276	275.931	275.801	278.852	277.369	276.041	276.955	275.710	276.272	276.000	275.700	275.258	275.294	275.987	1.115
K1	159.849	160.399	160.648	160.885	160.042	158.564	158.480	155.347	151.293	148.333	143.748	142.527	141.344	144.741	144.787	150.548	153.119	156.093	158.795	153.134	6.987
O1	223.250	220.436	220.166	220.702	221.567	222.162	226.780	228.996	232.638	239.383	243.418	245.025	247.218	245.824	242.372	236.518	232.568	227.860	225.961	231.729	9.655
MSF	294.486	297.070	298.541	276.531	334.910	262.756	283.286	326.191	296.264	283.285	284.529	281.308	284.812	331.900	287.891	308.647	304.077	299.865	237.133	293.341	23.144
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.101	0.084	0.086	0.084	0.094	0.073	0.085	0.088	0.093	0.071	0.091	0.084	0.088	0.071	0.071	0.076	0.097	0.081		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.4	99.9	98.5	94.7	92.2	94.3	97.8	91.4	98.8	91.7	93.3	89.0	96.4	92.9	97.7	94.3	93.5	98.3	59.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.72	04/06/2004 22:00	±0.18	6.6
Lowest Astronomical Tide (LAT)	-0.44	25/11/2011 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Camden Haven River at Laurieton

MHL2786

Figure A109

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Queens Lake at Lakewood

RECORDING STATION: **Queens Lake at Lakewood**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207475

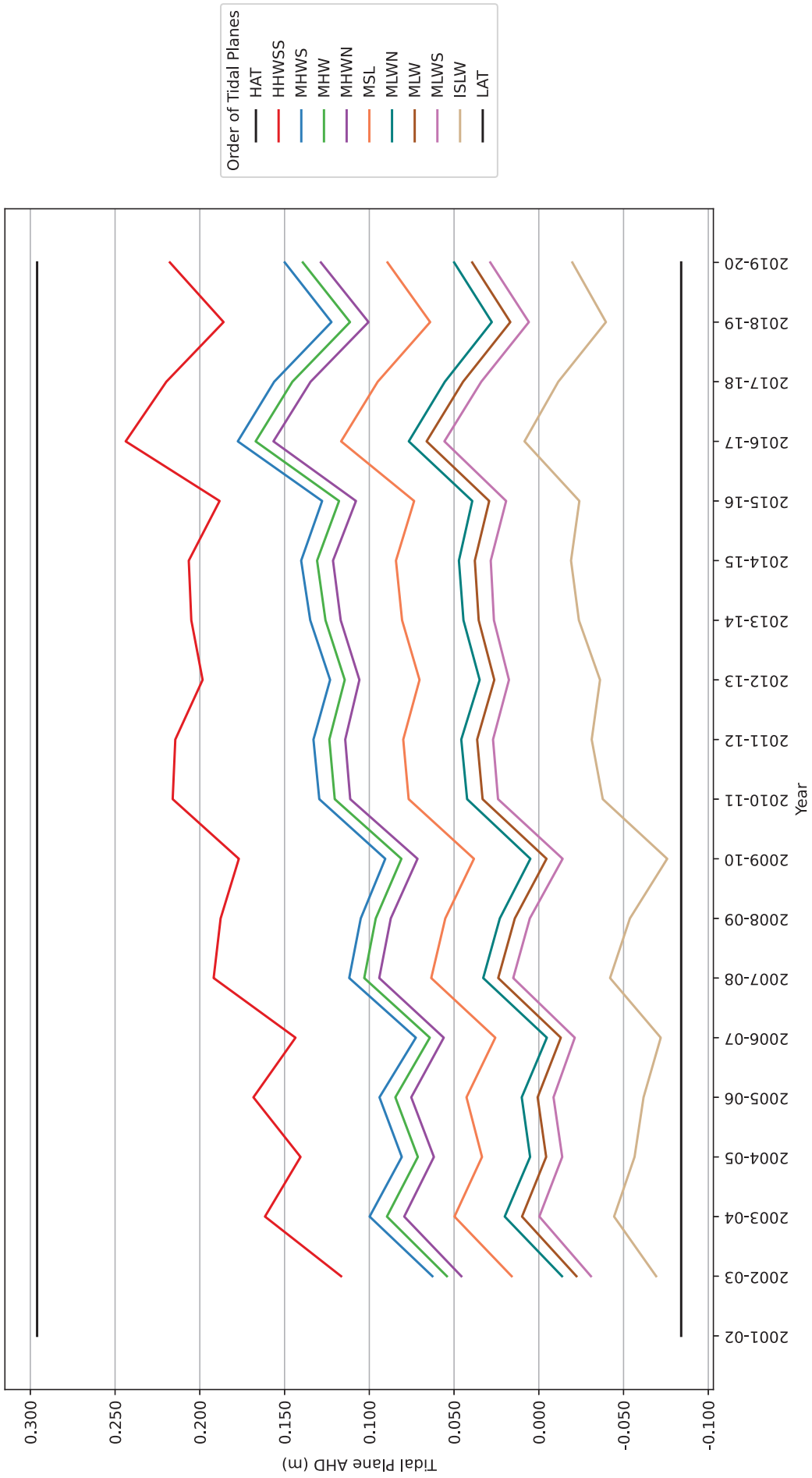
ZONE: 56
EASTING: 477455
NORTHING: 6500578

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.117	0.162	0.141	0.168	0.144	0.192	0.188	0.177	0.216	0.214	0.198	0.205	0.207	0.188	0.244	0.220	0.186	0.218	0.188	0.032
MHWS		0.063	0.100	0.081	0.094	0.073	0.112	0.105	0.091	0.130	0.133	0.123	0.135	0.140	0.128	0.178	0.156	0.122	0.150	0.117	0.030
MHW		0.054	0.090	0.071	0.085	0.064	0.103	0.096	0.081	0.120	0.124	0.114	0.126	0.131	0.118	0.167	0.145	0.111	0.139	0.108	0.030
MHWN		0.046	0.079	0.062	0.075	0.056	0.094	0.087	0.072	0.111	0.114	0.106	0.117	0.121	0.108	0.157	0.135	0.100	0.129	0.098	0.029
MSL		0.016	0.050	0.034	0.043	0.026	0.063	0.055	0.038	0.077	0.080	0.070	0.081	0.084	0.074	0.117	0.095	0.064	0.089	0.064	0.026
MLWN		-0.014	0.020	0.005	0.010	-0.005	0.033	0.023	0.005	0.042	0.046	0.035	0.044	0.047	0.039	0.077	0.055	0.028	0.050	0.030	0.023
MLW		-0.022	0.010	-0.004	0.001	-0.013	0.024	0.014	-0.005	0.033	0.036	0.026	0.035	0.038	0.029	0.066	0.045	0.017	0.039	0.021	0.023
MLWS		-0.031	-0.000	-0.014	-0.009	-0.021	0.015	0.005	-0.014	0.024	0.027	0.018	0.026	0.028	0.019	0.056	0.034	0.006	0.029	0.011	0.022
ISLW		-0.069	-0.044	-0.056	-0.062	-0.072	-0.042	-0.054	-0.076	-0.038	-0.031	-0.036	-0.024	-0.019	-0.024	0.008	-0.012	-0.040	-0.020	-0.039	0.023
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.059	0.059	0.057	0.065	0.061	0.061	0.064	0.067	0.069	0.068	0.071	0.072	0.074	0.069	0.080	0.079	0.073	0.079	0.068	0.007
MR		0.076	0.080	0.076	0.084	0.077	0.079	0.082	0.086	0.087	0.087	0.088	0.090	0.093	0.089	0.101	0.101	0.095	0.100	0.087	0.008
MSR		0.094	0.100	0.095	0.103	0.094	0.097	0.100	0.105	0.105	0.106	0.106	0.108	0.112	0.109	0.122	0.122	0.116	0.121	0.106	0.009
R		0.186	0.206	0.197	0.230	0.215	0.234	0.241	0.253	0.254	0.246	0.234	0.229	0.226	0.212	0.235	0.231	0.226	0.237	0.227	0.018
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.038	0.040	0.038	0.042	0.039	0.040	0.041	0.043	0.044	0.044	0.044	0.045	0.047	0.044	0.050	0.050	0.047	0.050	0.044	0.004
S2		0.009	0.010	0.009	0.009	0.008	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.009	0.010	0.011	0.011	0.011	0.011	0.010	0.001
K1		0.021	0.025	0.023	0.029	0.029	0.031	0.032	0.033	0.033	0.030	0.029	0.028	0.027	0.024	0.027	0.026	0.027	0.027	0.028	0.003
O1		0.017	0.019	0.020	0.024	0.022	0.026	0.027	0.029	0.029	0.028	0.025	0.022	0.021	0.019	0.020	0.019	0.019	0.021	0.023	0.004
MSF		0.021	0.026	0.024	0.021	0.014	0.041	0.014	0.036	0.031	0.042	0.013	0.029	0.034	0.034	0.039	0.038	0.029	0.034	0.029	0.009
z0		0.016	0.050	0.034	0.043	0.026	0.063	0.055	0.038	0.077	0.080	0.070	0.081	0.084	0.074	0.117	0.095	0.064	0.089	0.064	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		98.729	97.730	98.294	95.977	97.186	96.847	95.022	92.598	92.471	91.539	90.981	90.772	91.507	92.278	92.149	92.496	93.660	93.484	94.096	2.689
S2		24.997	14.553	16.281	10.583	7.557	12.295	11.928	11.595	10.064	6.801	5.000	8.960	10.067	4.014	10.238	13.222	14.659	5.732	11.030	4.889
K1		227.680	232.573	229.276	231.688	228.967	228.565	224.005	223.709	217.800	215.829	216.466	212.060	214.721	215.316	220.761	224.667	228.172	229.225	223.416	6.576
O1		285.040	289.979	284.269	291.445	290.289	296.572	298.768	302.463	306.690	312.474	308.767	313.712	310.092	306.411	305.656	297.967	296.202	295.041	299.546	9.198
MSF		338.363	315.376	272.469	308.403	293.468	292.910	298.703	302.773	280.166	291.665	303.962	292.871	325.289	293.533	308.133	304.299	298.598	282.913	300.216	15.769
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.073	0.067	0.064	0.087	0.082	0.066	0.073	0.078	0.091	0.071	0.088	0.072	0.079	0.062	0.060	0.066	0.079	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	48.1	76.1	83.2	79.0	85.5	95.1	97.0	87.7	99.7	96.1	96.4	92.0	97.0	94.5	96.1	89.5	94.7	98.6	96.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.30	05/06/2004 01:00	±0.16	29.2
Lowest Astronomical Tide (LAT)	-0.08	19/09/2003 10:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Dec 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Queens Lake at Lakewood

MHL2786

Figure
A110

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Watson Taylors Lake at Watson Taylors Lake

RECORDING STATION: **Watson Taylors Lake at Watson Taylors Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 207480

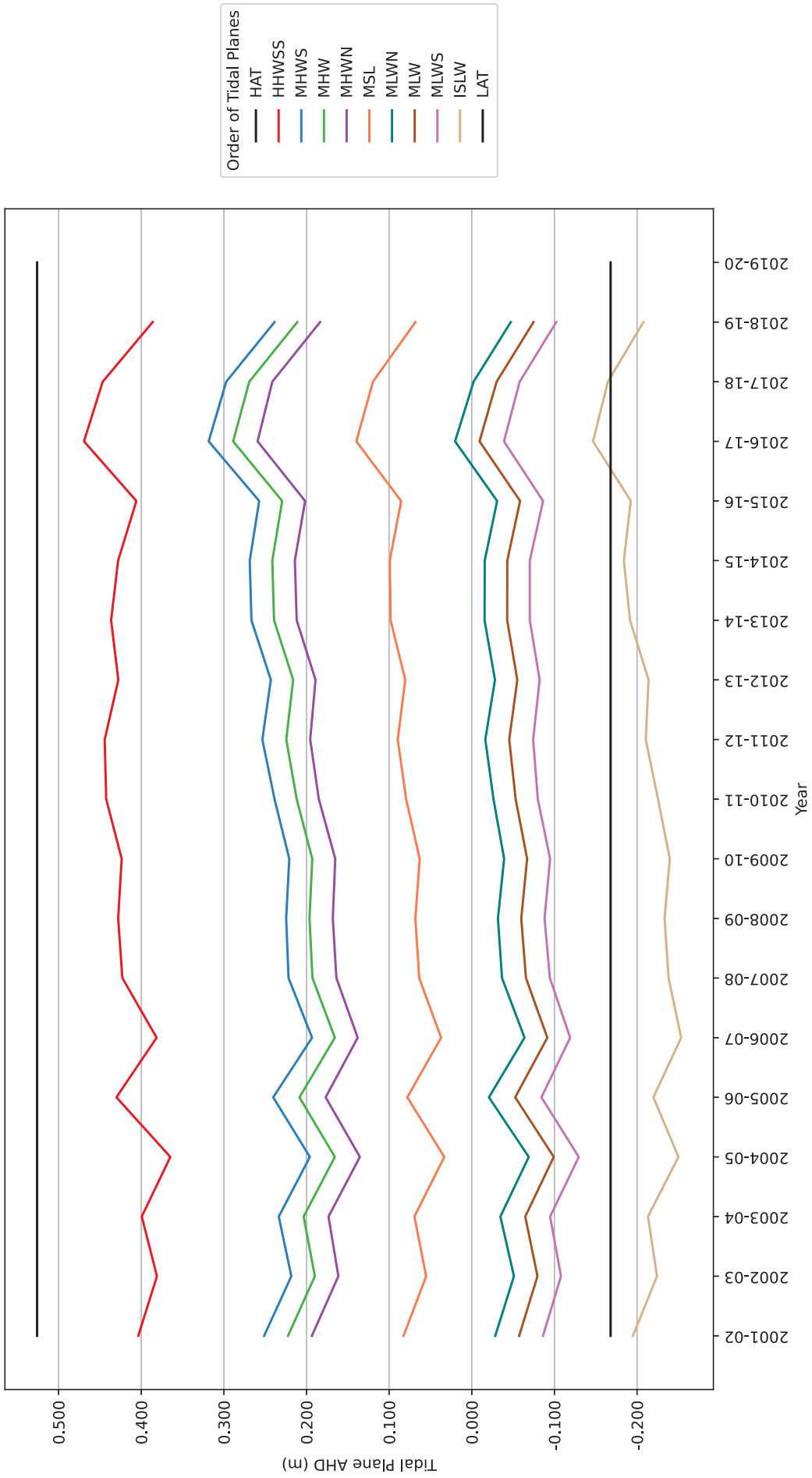
ZONE: 56
EASTING: 475578
NORTHING: 6491082

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.404	0.381	0.399	0.365	0.430	0.381	0.423	0.428	0.424	0.442	0.444	0.428	0.436	0.428	0.406	0.469	0.447	0.386		0.418	0.027
MHWS	0.251	0.218	0.234	0.196	0.240	0.193	0.222	0.225	0.221	0.239	0.253	0.243	0.267	0.269	0.257	0.318	0.297	0.239		0.243	0.032
MHW	0.222	0.190	0.203	0.166	0.209	0.166	0.193	0.196	0.193	0.212	0.224	0.216	0.239	0.241	0.229	0.289	0.269	0.211		0.215	0.032
MHWN	0.193	0.161	0.173	0.135	0.177	0.138	0.164	0.168	0.165	0.185	0.196	0.189	0.212	0.214	0.202	0.259	0.241	0.184		0.187	0.032
MSL	0.083	0.055	0.069	0.033	0.078	0.037	0.064	0.068	0.063	0.079	0.090	0.081	0.098	0.099	0.085	0.140	0.120	0.068		0.078	0.026
MLWN	-0.028	-0.051	-0.035	-0.069	-0.021	-0.064	-0.037	-0.032	-0.039	-0.026	-0.016	-0.028	-0.015	-0.016	-0.031	0.020	-0.002	-0.047		-0.030	0.021
MLW	-0.057	-0.080	-0.065	-0.099	-0.053	-0.091	-0.066	-0.060	-0.067	-0.053	-0.045	-0.055	-0.043	-0.043	-0.058	-0.009	-0.030	-0.075		-0.058	0.021
MLWS	-0.086	-0.108	-0.095	-0.129	-0.084	-0.119	-0.095	-0.088	-0.095	-0.080	-0.074	-0.082	-0.070	-0.070	-0.086	-0.039	-0.058	-0.102		-0.087	0.021
ISLW	-0.195	-0.224	-0.213	-0.250	-0.220	-0.253	-0.238	-0.233	-0.240	-0.225	-0.211	-0.214	-0.192	-0.184	-0.192	-0.147	-0.165	-0.208		-0.211	0.029
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.222	0.212	0.208	0.204	0.198	0.202	0.200	0.200	0.204	0.211	0.212	0.217	0.227	0.230	0.232	0.239	0.244	0.231		0.216	0.014
MR	0.280	0.269	0.268	0.265	0.261	0.257	0.258	0.256	0.260	0.265	0.270	0.271	0.282	0.284	0.288	0.298	0.299	0.286		0.273	0.014
MSR	0.337	0.326	0.328	0.325	0.325	0.312	0.316	0.313	0.316	0.319	0.328	0.325	0.337	0.339	0.344	0.357	0.355	0.341		0.330	0.013
R	0.599	0.605	0.613	0.615	0.650	0.635	0.661	0.661	0.663	0.668	0.655	0.642	0.628	0.612	0.598	0.616	0.611	0.594		0.629	0.025
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.140	0.135	0.134	0.132	0.131	0.129	0.129	0.128	0.130	0.132	0.135	0.136	0.141	0.142	0.144	0.149	0.150	0.143		0.137	0.007
S2	0.029	0.028	0.030	0.030	0.032	0.028	0.029	0.028	0.028	0.027	0.029	0.027	0.027	0.027	0.028	0.030	0.028	0.028		0.028	0.001
K1	0.061	0.069	0.069	0.070	0.078	0.075	0.080	0.082	0.080	0.082	0.075	0.075	0.069	0.066	0.062	0.064	0.063	0.061		0.071	0.007
O1	0.048	0.048	0.050	0.050	0.057	0.059	0.064	0.063	0.065	0.063	0.062	0.057	0.052	0.048	0.044	0.044	0.043	0.044		0.053	0.008
MSF	0.040	0.028	0.038	0.027	0.016	0.019	0.039	0.014	0.030	0.023	0.036	0.011	0.028	0.032	0.037	0.038	0.025	0.023		0.028	0.009
z0	0.083	0.055	0.069	0.033	0.078	0.037	0.064	0.068	0.063	0.079	0.090	0.081	0.098	0.099	0.085	0.140	0.120	0.068		0.078	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	86.237	87.580	87.494	87.971	86.151	86.335	84.491	84.449	82.297	80.948	80.329	80.972	80.190	79.953	80.831	80.900	81.486	84.455		83.504	2.909
S2	4.595	5.041	7.308	8.365	8.718	4.804	2.552	5.499	3.712	0.370	0.639	3.701	3.183	2.343	0.722	359.508	359.200	3.543		43.545	114.918
K1	218.010	213.851	219.256	219.236	211.977	215.017	210.076	208.744	205.580	201.404	197.418	198.729	194.845	197.343	198.018	201.880	205.311	211.659		207.131	8.172
O1	271.976	271.794	272.808	270.763	270.520	271.481	273.524	275.711	281.289	288.032	289.595	294.334	295.744	293.605	289.434	283.048	277.247	274.301		280.289	9.156
MSF	295.152	282.126	298.007	267.024	306.307	282.840	285.266	294.005	296.118	263.438	286.169	302.484	285.257	314.559	289.790	295.731	287.328	289.477		290.060	12.404
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.090	0.075	0.079	0.078	0.080	0.065	0.072	0.072	0.085	0.071	0.089	0.075	0.078	0.064	0.058	0.061	0.078			
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	56.7	99.2	98.0	98.9	77.2	99.7	98.4	94.6	93.7	97.1	95.9	89.9	97.2	93.6	98.0	94.0	81.9	98.5			

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.53	05/06/2004 00:30	±0.17	18.1
Lowest Astronomical Tide (LAT)	-0.17	18/09/2003 09:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Dec 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

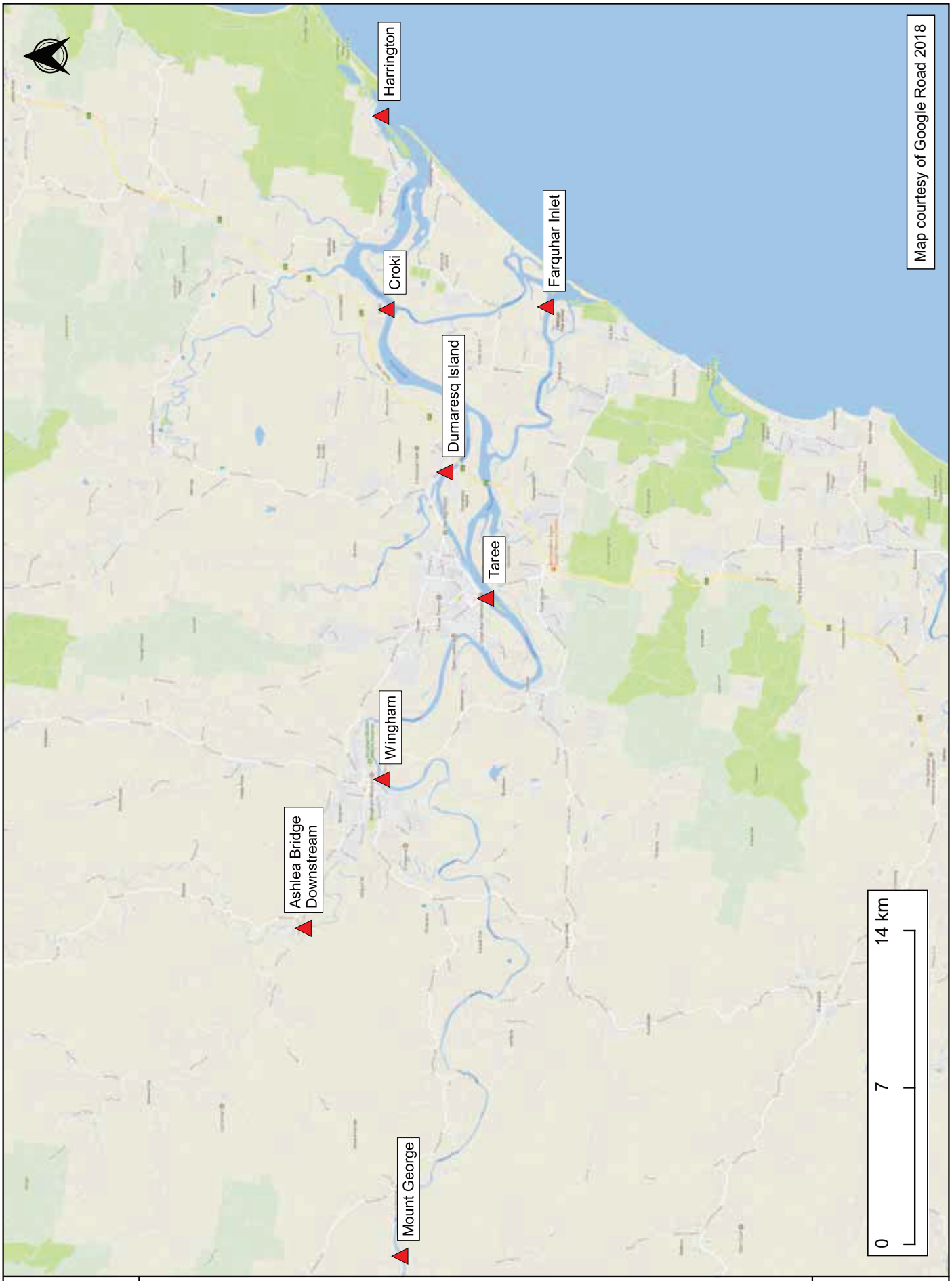


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Watson Taylors Lake at Watson Taylors Lake

MHL2786

Figure A111



NSW GOVERNMENT

STATION LOCATIONS
MANNING RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A112

DRAWING A112.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manning River at Harrington

RECORDING STATION: **Manning River at Harrington**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208425

ZONE: 56
EASTING: 470255
NORTHING: 6473391

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06*	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.917	0.863	0.833	0.805			0.733	0.771	0.836	0.928	1.024	0.958	0.903	0.926	0.892	0.915	0.880	0.854	0.898	0.879	0.070
MHWS	0.600	0.551	0.530	0.492			0.439	0.453	0.474	0.552	0.608	0.581	0.568	0.610	0.591	0.621	0.596	0.567	0.599	0.555	0.058
MHW	0.498	0.453	0.430	0.394			0.365	0.378	0.396	0.461	0.493	0.484	0.475	0.511	0.493	0.527	0.505	0.472	0.506	0.461	0.050
MHWN	0.395	0.355	0.330	0.296			0.292	0.304	0.317	0.371	0.377	0.388	0.381	0.411	0.396	0.432	0.415	0.378	0.412	0.368	0.045
MSL	0.085	0.063	0.059	0.012			0.094	0.110	0.108	0.121	0.070	0.115	0.108	0.128	0.109	0.162	0.145	0.098	0.136	0.101	0.036
MLWN	-0.225	-0.229	-0.213	-0.272			-0.103	-0.083	-0.102	-0.128	-0.237	-0.158	-0.166	-0.155	-0.178	-0.107	-0.124	-0.182	-0.141	-0.165	0.055
MLW	-0.328	-0.327	-0.313	-0.370			-0.177	-0.158	-0.180	-0.219	-0.353	-0.255	-0.259	-0.254	-0.275	-0.202	-0.214	-0.277	-0.234	-0.259	0.064
MLWS	-0.431	-0.425	-0.413	-0.469			-0.251	-0.233	-0.259	-0.309	-0.468	-0.352	-0.353	-0.353	-0.373	-0.297	-0.305	-0.372	-0.328	-0.352	0.073
ISLW	-0.657	-0.648	-0.629	-0.692			-0.460	-0.460	-0.518	-0.578	-0.766	-0.621	-0.592	-0.579	-0.588	-0.506	-0.508	-0.577	-0.541	-0.583	0.082
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.620	0.585	0.543	0.568			0.394	0.387	0.419	0.499	0.614	0.546	0.547	0.566	0.575	0.538	0.539	0.560	0.553	0.533	0.069
MR	0.826	0.780	0.743	0.764			0.542	0.536	0.576	0.680	0.845	0.739	0.734	0.764	0.769	0.728	0.720	0.750	0.740	0.720	0.089
MSR	1.032	0.976	0.943	0.961			0.690	0.686	0.733	0.861	1.076	0.933	0.921	0.963	0.963	0.918	0.901	0.939	0.927	0.907	0.109
R	1.574	1.511	1.461	1.496			1.193	1.231	1.354	1.506	1.790	1.579	1.496	1.505	1.479	1.422	1.387	1.430	1.440	1.462	0.134
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.413	0.390	0.371	0.382			0.271	0.268	0.288	0.340	0.423	0.370	0.367	0.382	0.384	0.364	0.360	0.375	0.370	0.360	0.045
S2	0.103	0.098	0.100	0.098			0.074	0.075	0.078	0.090	0.116	0.097	0.093	0.099	0.097	0.095	0.090	0.095	0.094	0.094	0.010
K1	0.137	0.132	0.129	0.133			0.122	0.129	0.144	0.154	0.173	0.156	0.142	0.135	0.129	0.125	0.120	0.120	0.127	0.136	0.014
O1	0.089	0.091	0.087	0.090			0.088	0.098	0.115	0.115	0.124	0.114	0.097	0.091	0.086	0.084	0.082	0.084	0.087	0.095	0.013
MSF	0.034	0.020	0.038	0.019			0.044	0.008	0.028	0.025	0.027	0.022	0.019	0.018	0.036	0.030	0.036	0.029	0.034	0.028	0.009
z0	0.085	0.063	0.059	0.012			0.094	0.110	0.108	0.121	0.070	0.115	0.108	0.128	0.109	0.162	0.145	0.098	0.136	0.101	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	354.269	354.137	353.402	354.490			356.672	359.129	0.373	354.163	351.478	355.164	355.118	351.571	351.559	353.657	352.953	352.160	353.959	333.191	85.787
S2	262.944	262.461	261.798	262.650			264.233	268.961	269.742	266.777	263.844	267.342	267.093	264.312	262.750	264.229	262.256	262.209	262.220	264.460	2.547
K1	144.333	146.594	146.484	146.555			150.958	149.805	147.600	135.876	127.901	130.539	129.196	129.299	131.196	137.507	140.918	142.089	146.529	140.199	8.048
O1	202.003	202.706	202.097	202.334			215.267	219.746	225.485	223.603	218.101	227.495	229.556	224.562	222.140	218.759	214.486	209.787	208.213	215.667	9.532
MSF	286.775	300.143	303.887	295.879			276.106	339.371	299.550	249.097	270.502	285.244	280.129	326.860	283.794	290.171	293.069	289.010	265.241	290.284	21.294
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.087	0.106	0.093	0.101			0.097	0.087	0.093	0.092	0.085	0.094	0.097	0.085	0.080	0.080	0.086	0.101	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.9	94.3	87.6	73.6	0.0	0.0	62.8	80.5	85.2	83.2	86.5	81.1	90.5	70.1	90.7	86.6	84.5	78.6	90.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	04/06/2004 21:15	±0.21	10.7
Lowest Astronomical Tide (LAT)	-0.47	27/10/2011 02:15		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A113

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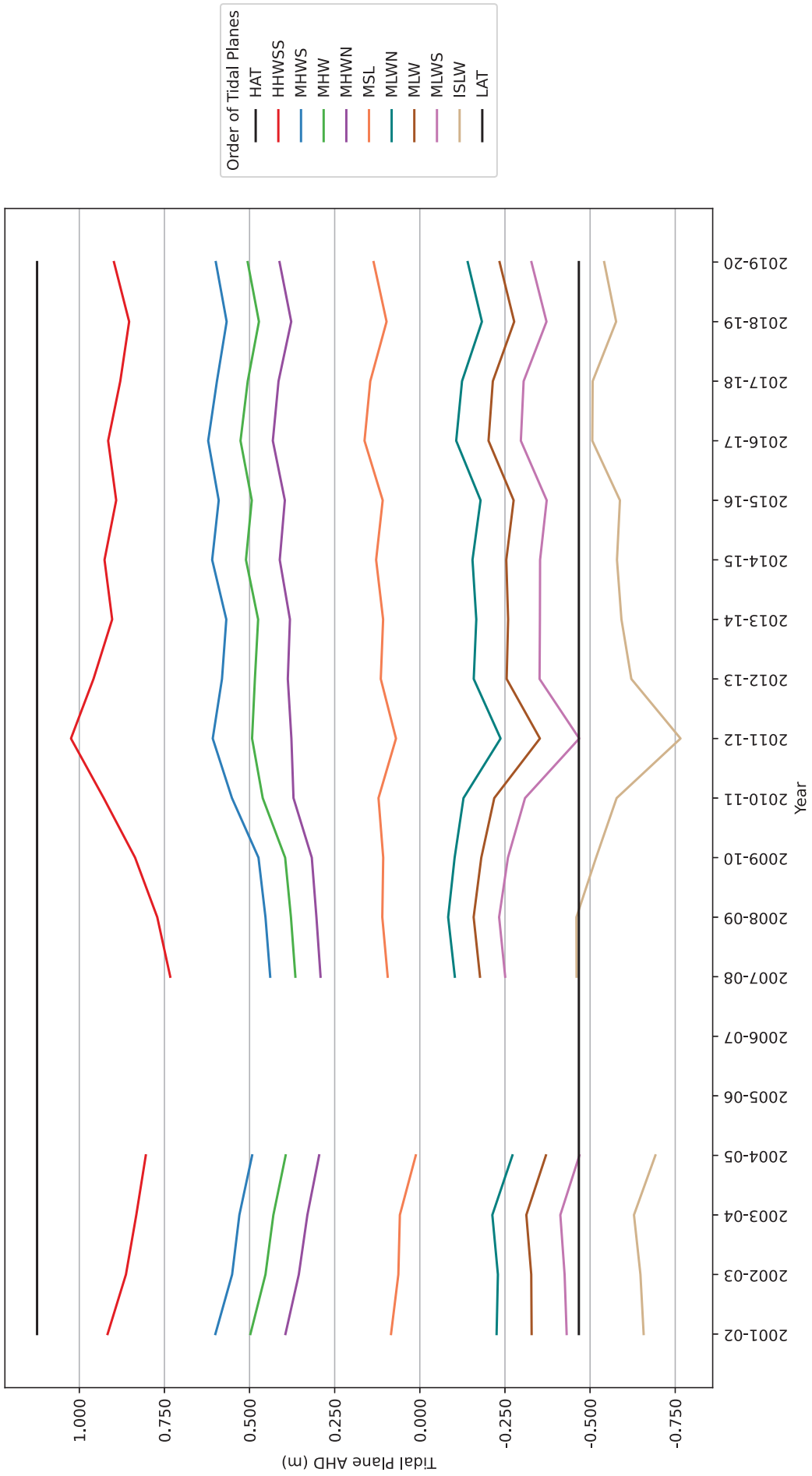


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Harrington

MHL2786

Figure A113

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manning River at Croki

RECORDING STATION: **Manning River at Croki**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208404

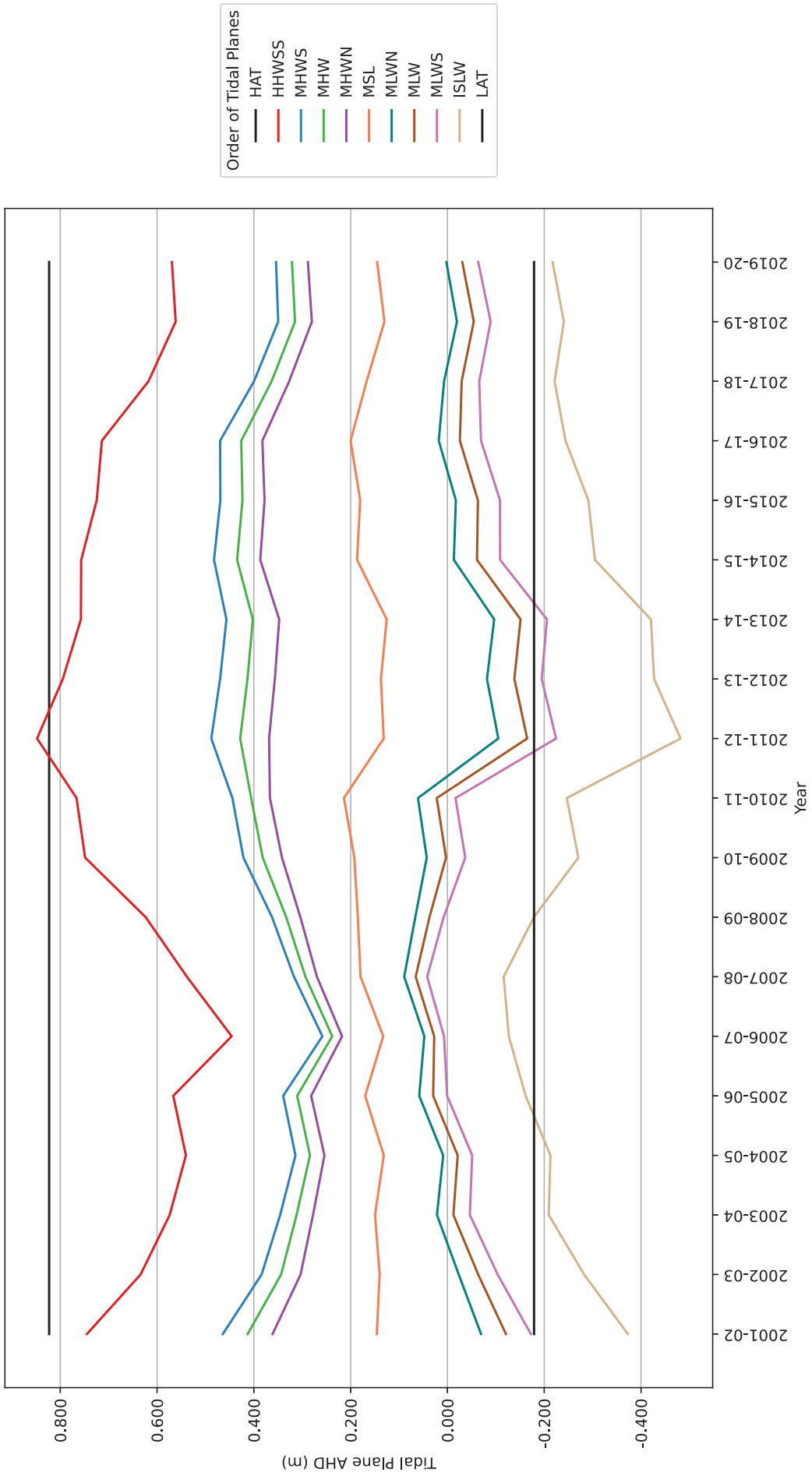
ZONE: 56
EASTING: 461590
NORTHING: 6473115

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.745	0.634	0.574	0.540	0.566	0.446	0.538	0.624	0.749	0.766	0.848	0.795	0.757	0.757	0.725	0.714	0.618	0.562	0.569	0.659	0.110
MHWS	0.464	0.384	0.346	0.314	0.339	0.258	0.317	0.362	0.422	0.444	0.488	0.470	0.457	0.482	0.469	0.470	0.400	0.350	0.354	0.399	0.069
MHW	0.413	0.344	0.312	0.284	0.310	0.238	0.293	0.333	0.382	0.406	0.428	0.413	0.402	0.435	0.424	0.426	0.363	0.315	0.321	0.360	0.059
MHWN	0.361	0.303	0.278	0.254	0.282	0.218	0.270	0.304	0.342	0.367	0.369	0.357	0.348	0.387	0.378	0.382	0.327	0.280	0.288	0.321	0.050
MSL	0.146	0.140	0.150	0.131	0.170	0.133	0.179	0.185	0.192	0.214	0.132	0.137	0.125	0.187	0.180	0.200	0.167	0.130	0.145	0.160	0.028
MLWN	-0.069	-0.023	0.022	0.009	0.058	0.048	0.089	0.066	0.043	0.061	-0.105	-0.082	-0.097	-0.013	-0.017	0.018	0.007	-0.020	0.002	-0.000	0.057
MLW	-0.121	-0.064	-0.012	-0.021	0.029	0.027	0.066	0.037	0.003	0.022	-0.165	-0.138	-0.151	-0.061	-0.063	-0.026	-0.029	-0.054	-0.031	-0.040	0.066
MLWS	-0.172	-0.104	-0.046	-0.051	0.001	0.007	0.042	0.008	-0.037	-0.017	-0.225	-0.195	-0.206	-0.109	-0.109	-0.069	-0.066	-0.089	-0.064	-0.079	0.077
ISLW	-0.373	-0.282	-0.209	-0.213	-0.162	-0.127	-0.116	-0.179	-0.271	-0.247	-0.482	-0.427	-0.421	-0.305	-0.291	-0.244	-0.221	-0.241	-0.217	-0.265	0.101
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.431	0.327	0.256	0.245	0.223	0.170	0.180	0.237	0.299	0.306	0.474	0.438	0.444	0.400	0.395	0.364	0.320	0.300	0.286	0.321	0.091
MR	0.534	0.407	0.324	0.305	0.281	0.211	0.228	0.296	0.379	0.383	0.593	0.551	0.553	0.496	0.487	0.452	0.393	0.369	0.352	0.400	0.113
MSR	0.637	0.488	0.392	0.365	0.339	0.251	0.275	0.355	0.458	0.461	0.712	0.665	0.662	0.591	0.578	0.539	0.465	0.439	0.418	0.478	0.135
R	1.118	0.916	0.783	0.753	0.728	0.573	0.655	0.802	1.019	1.013	1.330	1.222	1.178	1.062	1.016	0.958	0.839	0.802	0.787	0.924	0.203
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.267	0.204	0.162	0.153	0.140	0.105	0.114	0.148	0.189	0.192	0.297	0.276	0.277	0.248	0.243	0.226	0.196	0.185	0.176	0.200	0.057
S2	0.051	0.040	0.034	0.030	0.029	0.020	0.024	0.029	0.040	0.039	0.060	0.057	0.055	0.048	0.046	0.044	0.036	0.035	0.033	0.039	0.011
K1	0.117	0.103	0.092	0.091	0.091	0.074	0.084	0.102	0.125	0.124	0.146	0.132	0.125	0.114	0.106	0.102	0.089	0.087	0.087	0.105	0.019
O1	0.084	0.076	0.071	0.071	0.071	0.059	0.074	0.085	0.109	0.106	0.111	0.100	0.090	0.082	0.076	0.072	0.066	0.064	0.066	0.081	0.016
MSF	0.052	0.040	0.061	0.039	0.038	0.011	0.066	0.026	0.048	0.048	0.045	0.038	0.029	0.024	0.054	0.044	0.044	0.034	0.049	0.041	0.013
z0	0.146	0.140	0.150	0.131	0.170	0.133	0.179	0.185	0.192	0.214	0.132	0.137	0.125	0.187	0.180	0.200	0.167	0.130	0.145	0.160	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	49.758	56.338	62.407	62.291	62.869	67.522	62.642	59.105	53.020	51.759	40.880	43.439	42.772	47.308	49.108	52.997	55.929	57.874	57.277	54.489	7.585
S2	322.950	326.045	333.410	330.851	331.741	336.919	323.394	334.449	329.052	329.646	321.611	320.314	324.319	327.150	327.771	326.296	330.008	330.119	326.444	328.026	4.441
K1	185.178	194.221	201.938	201.534	203.977	209.156	197.669	193.048	183.965	180.005	162.592	165.509	162.507	170.817	172.298	179.472	188.347	193.367	198.663	186.540	14.614
O1	241.097	248.825	255.727	256.366	257.746	266.148	262.057	260.190	257.781	265.688	252.445	259.237	261.935	262.590	261.822	259.827	257.004	256.400	255.180	257.793	5.879
MSF	284.664	290.572	295.737	276.505	311.117	272.138	279.720	285.813	280.922	271.115	279.032	283.183	281.597	312.729	284.433	288.913	289.858	283.676	255.007	284.565	13.039
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.083	0.113	0.093	0.099	0.086	0.090	0.086	0.099	0.088	0.091	0.075	0.090	0.094	0.084	0.076	0.080	0.088	0.101	0.093		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.2	96.1	94.1	92.3	83.1	87.8	66.6	82.5	86.4	85.5	76.2	78.0	90.1	82.2	91.0	90.4	91.0	97.0	65.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.82	04/06/2004 23:15	±0.25	37.3
Lowest Astronomical Tide (LAT)	-0.18	02/01/2011 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Croki

MHL2786

Figure A114

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manning River at Dumaresq Island

RECORDING STATION: **Manning River at Dumaresq Island**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208430

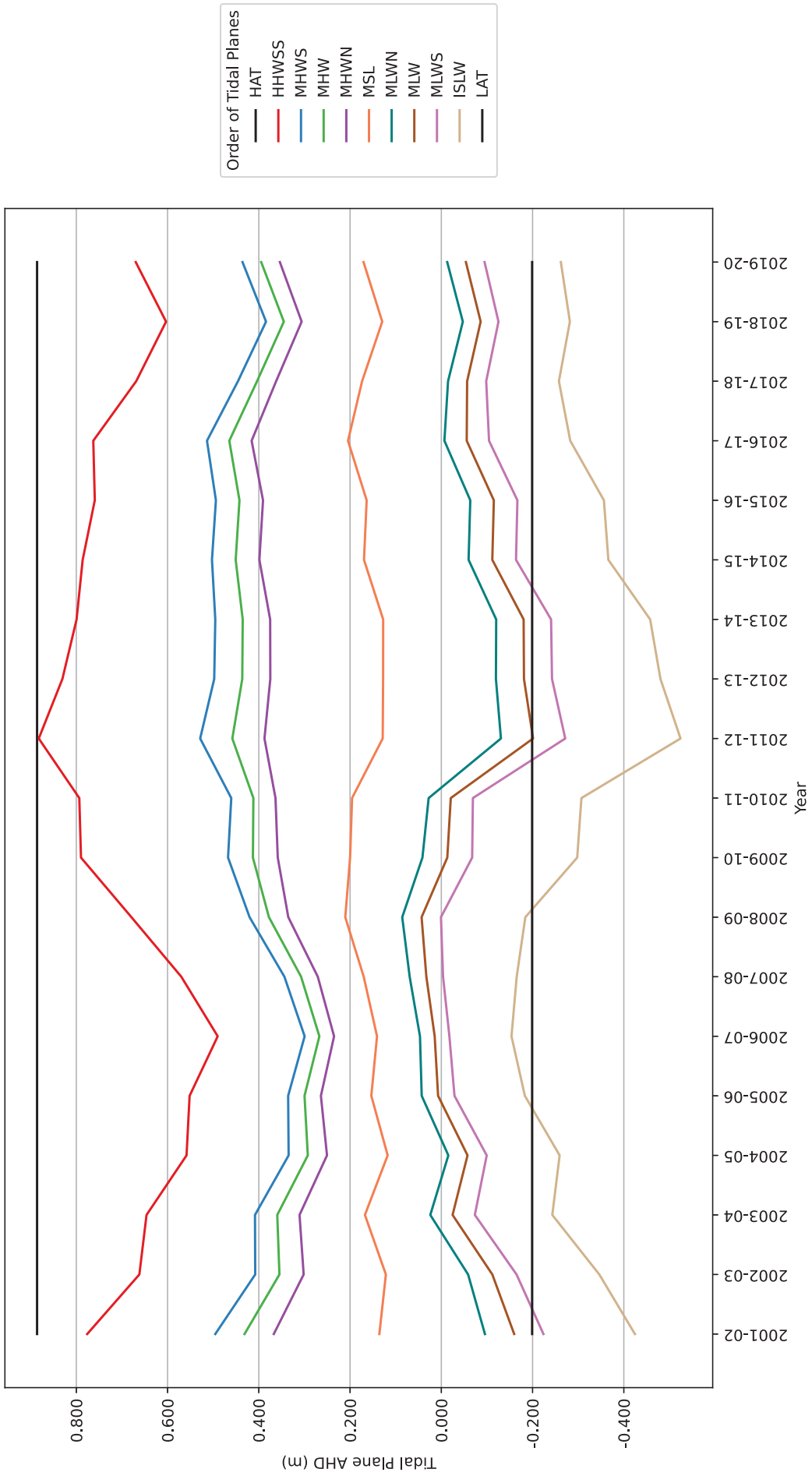
ZONE: 56
EASTING: 454329
NORTHING: 6470475

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.776	0.662	0.646	0.558	0.552	0.490	0.570	0.679	0.790	0.793	0.882	0.830	0.799	0.786	0.759	0.763	0.669	0.603	0.670	0.699	0.110
MHWS	0.495	0.408	0.408	0.335	0.336	0.300	0.344	0.420	0.467	0.460	0.529	0.498	0.495	0.503	0.494	0.514	0.446	0.384	0.436	0.435	0.069
MHW	0.431	0.355	0.360	0.293	0.300	0.267	0.307	0.378	0.413	0.412	0.458	0.436	0.435	0.451	0.442	0.465	0.404	0.345	0.395	0.387	0.061
MHWN	0.367	0.302	0.311	0.251	0.264	0.235	0.271	0.335	0.358	0.363	0.388	0.375	0.375	0.399	0.391	0.416	0.362	0.306	0.354	0.338	0.054
MSL	0.136	0.122	0.167	0.118	0.153	0.141	0.170	0.211	0.200	0.196	0.128	0.128	0.127	0.169	0.164	0.205	0.174	0.129	0.170	0.158	0.030
MLWN	-0.096	-0.059	0.024	-0.015	0.043	0.047	0.069	0.086	0.041	0.028	-0.131	-0.120	-0.120	-0.060	-0.063	-0.007	-0.015	-0.047	-0.013	-0.021	0.066
MLW	-0.160	-0.112	-0.025	-0.057	0.007	0.015	0.033	0.043	-0.013	-0.021	-0.201	-0.181	-0.180	-0.112	-0.115	-0.056	-0.057	-0.086	-0.054	-0.070	0.075
MLWS	-0.224	-0.165	-0.073	-0.099	-0.029	-0.018	-0.004	0.001	-0.068	-0.069	-0.272	-0.243	-0.241	-0.164	-0.167	-0.105	-0.098	-0.125	-0.095	-0.119	0.084
ISLW	-0.424	-0.346	-0.243	-0.259	-0.183	-0.154	-0.165	-0.184	-0.298	-0.307	-0.524	-0.480	-0.458	-0.366	-0.356	-0.283	-0.258	-0.282	-0.262	-0.307	0.107
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.463	0.360	0.287	0.266	0.221	0.188	0.201	0.250	0.317	0.336	0.518	0.494	0.495	0.459	0.454	0.423	0.377	0.353	0.367	0.359	0.105
MR	0.591	0.467	0.384	0.350	0.293	0.253	0.275	0.335	0.426	0.433	0.659	0.617	0.616	0.562	0.558	0.520	0.460	0.431	0.449	0.457	0.123
MSR	0.719	0.573	0.482	0.434	0.365	0.317	0.348	0.419	0.535	0.530	0.800	0.740	0.736	0.666	0.661	0.618	0.544	0.509	0.531	0.554	0.141
R	1.200	1.008	0.889	0.818	0.735	0.644	0.735	0.863	1.088	1.101	1.407	1.311	1.257	1.152	1.116	1.045	0.926	0.885	0.932	1.006	0.208
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.295	0.233	0.192	0.175	0.146	0.126	0.137	0.167	0.213	0.216	0.330	0.309	0.308	0.281	0.279	0.260	0.230	0.216	0.224	0.228	0.061
S2	0.064	0.053	0.049	0.042	0.036	0.032	0.037	0.042	0.054	0.048	0.070	0.061	0.060	0.052	0.052	0.049	0.042	0.039	0.041	0.049	0.010
K1	0.114	0.101	0.096	0.089	0.086	0.077	0.085	0.099	0.121	0.125	0.138	0.136	0.127	0.117	0.111	0.104	0.093	0.091	0.096	0.106	0.018
O1	0.087	0.080	0.074	0.071	0.069	0.059	0.076	0.086	0.110	0.113	0.114	0.102	0.090	0.085	0.079	0.074	0.066	0.066	0.071	0.083	0.017
MSF	0.049	0.048	0.063	0.044	0.030	0.013	0.063	0.029	0.052	0.047	0.054	0.038	0.031	0.021	0.052	0.042	0.040	0.031	0.049	0.042	0.013
z0	0.136	0.122	0.167	0.118	0.153	0.141	0.170	0.211	0.200	0.196	0.128	0.128	0.127	0.169	0.164	0.205	0.174	0.129	0.170	0.158	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	59.348	66.180	72.343	73.514	76.258	77.386	74.643	69.585	63.306	61.682	50.122	53.107	53.595	57.837	59.335	63.276	67.142	69.194	67.907	65.040	8.088
S2	326.583	328.951	331.413	329.645	336.319	331.873	327.651	332.932	330.771	328.270	328.574	332.947	337.238	339.183	337.815	338.761	341.624	342.088	338.828	333.761	5.009
K1	188.990	199.547	207.064	208.420	203.326	214.820	205.886	199.513	189.857	184.091	165.806	170.708	167.766	175.482	176.513	184.687	193.161	197.750	199.214	191.190	14.710
O1	244.699	251.681	259.175	260.072	264.233	270.313	265.946	264.997	260.472	269.108	257.890	263.311	266.629	267.999	264.653	264.236	261.309	261.047	257.101	261.835	6.155
MSF	289.698	288.710	293.956	272.106	318.727	279.539	275.966	297.918	287.355	265.922	284.570	279.487	283.518	307.518	289.337	288.396	293.471	294.997	269.453	287.402	12.783
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.113	0.080	0.098	0.077	0.088	0.086	0.100	0.084	0.091	0.072	0.090	0.093	0.089	0.077	0.080	0.090	0.102	0.082		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	78.8	92.2	75.9	82.9	57.3	80.6	73.2	76.0	91.9	87.3	62.8	78.6	90.2	83.2	93.5	92.0	92.1	98.7	93.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.89	04/06/2004 23:45	±0.22	30.8
Lowest Astronomical Tide (LAT)	-0.20	16/09/2005 15:00		

COMMENTS Station installed in Aug 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Dumaresq Island

MHL2786

Figure A115

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manning River at Taree

RECORDING STATION: **Manning River at Taree**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208410

ZONE: 56
EASTING: 448687
NORTHING: 6468633

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.817	0.703	0.648	0.602	0.606	0.485	0.602	0.681	0.809	0.820	0.922	0.858	0.829	0.812	0.788	0.793	0.704	0.631	0.696	0.727	0.113
MHWS	0.522	0.432	0.401	0.361	0.365	0.278	0.359	0.403	0.470	0.486	0.545	0.516	0.519	0.521	0.516	0.535	0.473	0.405	0.453	0.451	0.075
MHW	0.462	0.383	0.358	0.326	0.331	0.252	0.330	0.368	0.423	0.442	0.475	0.451	0.455	0.465	0.461	0.483	0.428	0.362	0.409	0.403	0.064
MHWN	0.402	0.335	0.316	0.291	0.296	0.225	0.302	0.333	0.376	0.398	0.405	0.387	0.392	0.409	0.406	0.431	0.383	0.319	0.364	0.356	0.054
MSL	0.144	0.132	0.156	0.137	0.156	0.115	0.181	0.188	0.198	0.218	0.127	0.125	0.129	0.164	0.163	0.204	0.180	0.129	0.167	0.159	0.030
MLWN	-0.114	-0.071	-0.003	-0.016	0.016	0.004	0.061	0.043	0.019	0.037	-0.152	-0.137	-0.135	-0.081	-0.081	-0.023	-0.022	-0.061	-0.029	-0.039	0.065
MLW	-0.174	-0.120	-0.046	-0.051	-0.018	-0.022	0.032	0.008	-0.028	-0.007	-0.222	-0.201	-0.198	-0.137	-0.135	-0.075	-0.067	-0.103	-0.074	-0.086	0.076
MLWS	-0.234	-0.168	-0.088	-0.086	-0.053	-0.049	0.003	-0.027	-0.075	-0.051	-0.292	-0.266	-0.262	-0.192	-0.190	-0.128	-0.113	-0.146	-0.119	-0.133	0.087
ISLW	-0.444	-0.362	-0.265	-0.259	-0.225	-0.197	-0.171	-0.225	-0.317	-0.290	-0.561	-0.510	-0.483	-0.400	-0.384	-0.312	-0.278	-0.308	-0.292	-0.331	0.109
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.515	0.406	0.319	0.307	0.279	0.221	0.241	0.289	0.357	0.361	0.557	0.523	0.526	0.490	0.487	0.454	0.405	0.380	0.393	0.395	0.103
MR	0.636	0.503	0.404	0.377	0.349	0.274	0.299	0.360	0.451	0.449	0.697	0.653	0.654	0.602	0.597	0.558	0.495	0.465	0.483	0.490	0.127
MSR	0.756	0.600	0.489	0.447	0.418	0.327	0.356	0.430	0.545	0.538	0.837	0.782	0.781	0.713	0.706	0.663	0.586	0.551	0.572	0.584	0.151
R	1.261	1.066	0.913	0.861	0.831	0.682	0.773	0.906	1.126	1.110	1.483	1.367	1.312	1.212	1.172	1.104	0.981	0.939	0.988	1.057	0.212
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.318	0.252	0.202	0.188	0.174	0.137	0.149	0.180	0.226	0.225	0.348	0.326	0.327	0.301	0.298	0.279	0.248	0.233	0.241	0.245	0.063
S2	0.060	0.049	0.042	0.035	0.035	0.026	0.029	0.035	0.047	0.044	0.070	0.065	0.064	0.056	0.055	0.052	0.045	0.043	0.045	0.047	0.012
K1	0.121	0.113	0.102	0.098	0.097	0.083	0.094	0.109	0.132	0.130	0.155	0.140	0.130	0.122	0.114	0.109	0.097	0.094	0.100	0.113	0.019
O1	0.089	0.081	0.075	0.074	0.075	0.065	0.079	0.089	0.110	0.108	0.114	0.104	0.092	0.086	0.080	0.075	0.068	0.068	0.073	0.085	0.015
MSF	0.051	0.050	0.058	0.041	0.037	0.021	0.063	0.031	0.043	0.047	0.046	0.036	0.027	0.021	0.053	0.042	0.040	0.032	0.048	0.041	0.012
z0	0.144	0.132	0.156	0.137	0.156	0.115	0.181	0.188	0.198	0.218	0.127	0.125	0.129	0.164	0.163	0.204	0.180	0.129	0.167	0.159	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	63.055	72.325	78.573	80.188	79.639	82.564	78.902	75.536	66.398	65.880	54.890	57.259	57.644	61.555	62.978	66.965	71.234	73.036	71.641	69.487	8.509
S2	339.825	347.247	352.392	353.864	352.390	357.470	350.001	355.699	346.410	346.686	337.567	339.831	344.793	346.327	345.026	345.708	350.069	351.764	347.377	347.918	5.370
K1	190.952	202.090	209.509	210.466	211.287	216.002	205.686	201.247	190.163	187.406	169.945	173.210	171.029	177.363	179.046	186.946	195.035	200.055	201.079	193.606	14.511
O1	246.096	254.272	261.815	262.480	264.616	270.932	265.953	265.872	262.382	271.182	257.609	265.585	268.887	268.828	266.497	266.293	263.482	262.701	258.852	263.386	6.035
MSF	283.335	288.242	298.603	272.290	303.134	277.185	286.557	294.399	292.858	274.897	281.698	288.098	283.785	305.642	288.048	286.363	294.942	299.154	270.389	287.875	10.053
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.109	0.088	0.092	0.084	0.093	0.083	0.096	0.080	0.083	0.068	0.088	0.086	0.086	0.078	0.079	0.087	0.102	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	85.9	83.2	74.4	92.3	91.1	86.6	65.5	80.2	87.5	80.3	68.5	75.7	87.3	82.5	93.0	90.7	90.9	98.5	93.8		

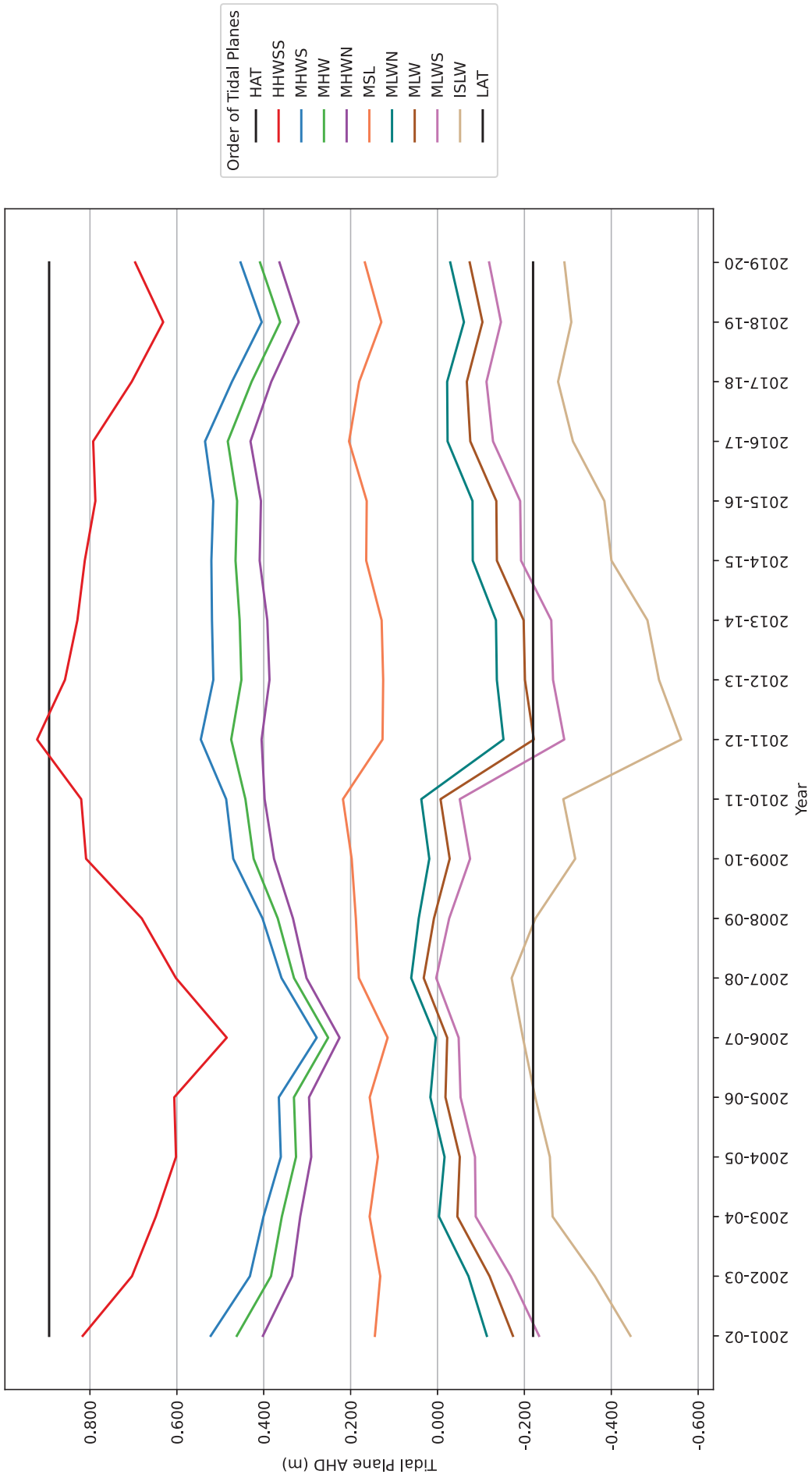
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.89	04/06/2004 23:45	±0.22	34.4
Lowest Astronomical Tide (LAT)	-0.22	26/12/2012 03:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A116

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Taree

MHL2786

Figure A116

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manning River at Wingham

RECORDING STATION: **Manning River at Wingham**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208400

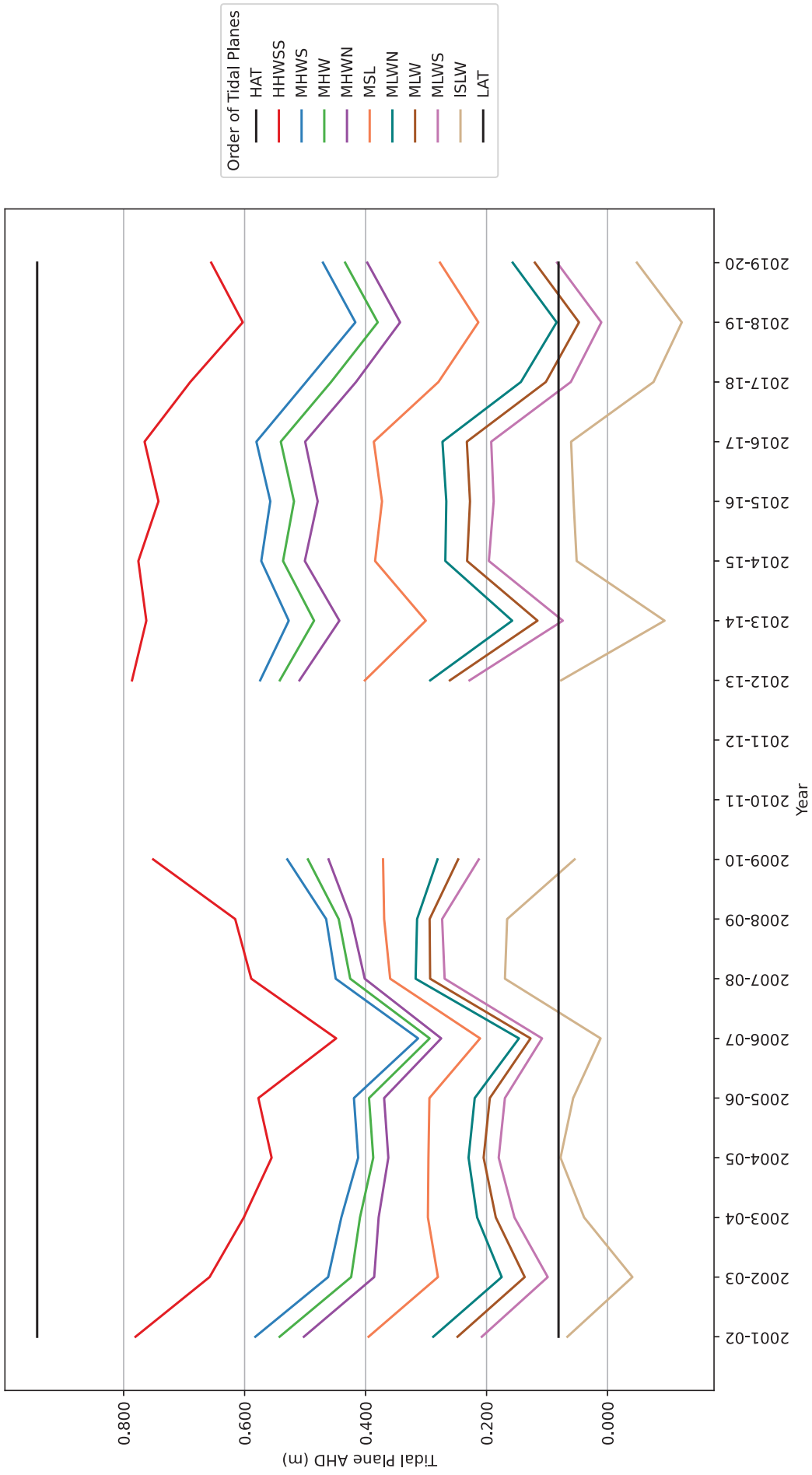
ZONE: 56
EASTING: 440559
NORTHING: 6473212

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11*	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.780	0.658	0.601	0.555	0.577	0.449	0.589	0.616	0.751			0.786	0.763	0.776	0.742	0.765	0.690	0.603	0.655	0.668	0.099
MHWS	0.582	0.462	0.440	0.412	0.419	0.313	0.449	0.465	0.529			0.574	0.527	0.572	0.558	0.581	0.498	0.417	0.470	0.487	0.076
MHW	0.542	0.424	0.409	0.387	0.394	0.294	0.425	0.444	0.495			0.542	0.485	0.536	0.518	0.540	0.457	0.380	0.434	0.453	0.071
MHWN	0.502	0.386	0.378	0.362	0.369	0.275	0.401	0.424	0.461			0.509	0.443	0.500	0.479	0.500	0.416	0.343	0.397	0.420	0.066
MSL	0.395	0.280	0.297	0.296	0.294	0.211	0.359	0.369	0.371			0.401	0.300	0.384	0.373	0.386	0.280	0.214	0.277	0.323	0.061
MLWN	0.288	0.175	0.216	0.230	0.220	0.146	0.317	0.315	0.281			0.293	0.158	0.268	0.267	0.273	0.143	0.084	0.157	0.225	0.070
MLW	0.248	0.137	0.185	0.205	0.195	0.127	0.293	0.294	0.247			0.261	0.116	0.232	0.227	0.233	0.102	0.047	0.120	0.192	0.072
MLWS	0.208	0.099	0.154	0.180	0.170	0.108	0.269	0.273	0.213			0.228	0.074	0.196	0.188	0.192	0.061	0.010	0.083	0.159	0.075
ISLW	0.066	-0.041	0.039	0.078	0.057	0.011	0.170	0.166	0.054			0.077	-0.094	0.051	0.056	0.060	-0.076	-0.123	-0.049	0.030	0.082
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.214	0.211	0.163	0.133	0.150	0.129	0.084	0.109	0.180			0.216	0.286	0.232	0.213	0.227	0.273	0.259	0.240	0.195	0.059
MR	0.294	0.287	0.225	0.182	0.200	0.167	0.132	0.150	0.248			0.281	0.369	0.304	0.291	0.308	0.355	0.333	0.314	0.261	0.073
MSR	0.374	0.363	0.286	0.232	0.250	0.205	0.180	0.192	0.317			0.346	0.453	0.376	0.369	0.388	0.438	0.407	0.387	0.327	0.087
R	0.714	0.699	0.563	0.478	0.521	0.437	0.419	0.450	0.697			0.709	0.857	0.725	0.686	0.705	0.766	0.726	0.704	0.639	0.132
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.147	0.143	0.112	0.091	0.100	0.083	0.066	0.075	0.124			0.141	0.185	0.152	0.145	0.154	0.178	0.166	0.157	0.131	0.036
S2	0.040	0.038	0.031	0.025	0.025	0.019	0.024	0.021	0.034			0.032	0.042	0.036	0.039	0.040	0.041	0.037	0.037	0.033	0.008
K1	0.077	0.075	0.060	0.055	0.061	0.052	0.050	0.055	0.081			0.081	0.088	0.079	0.072	0.070	0.076	0.074	0.072	0.069	0.012
O1	0.065	0.065	0.055	0.048	0.051	0.045	0.049	0.053	0.078			0.070	0.080	0.066	0.060	0.062	0.061	0.059	0.060	0.060	0.010
MSF	0.041	0.039	0.032	0.030	0.025	0.022	0.046	0.007	0.059			0.034	0.039	0.012	0.050	0.035	0.039	0.020	0.037	0.033	0.013
z0	0.395	0.280	0.297	0.296	0.294	0.211	0.359	0.369	0.371			0.401	0.300	0.384	0.373	0.386	0.280	0.214	0.277	0.323	0.061
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	87.254	98.763	98.599	104.222	103.121	103.775	102.286	101.086	88.859			85.616	87.489	89.896	89.948	92.273	94.743	99.017	102.534	95.852	6.648
S2	9.733	19.475	23.682	20.866	17.086	28.325	8.446	19.883	2.636			10.884	15.051	20.952	7.830	9.838	20.420	27.885	19.407	16.612	7.332
K1	197.982	209.867	211.304	213.678	214.752	219.399	207.402	208.744	194.446			183.776	183.448	188.020	186.243	195.900	204.864	210.319	212.943	202.535	11.852
O1	251.127	257.312	256.559	255.495	261.998	267.230	267.219	259.716	259.338			270.640	278.214	277.081	270.069	267.803	267.252	266.865	264.843	264.633	7.434
MSF	276.894	300.439	293.766	275.590	306.806	221.098	299.565	351.691	287.741			277.291	294.989	267.760	293.241	302.564	286.965	293.223	260.966	287.682	26.286
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.129	0.096	0.116	0.101	0.115	0.099	0.118	0.110			0.122	0.113	0.142	0.081	0.091	0.111	0.083	0.151		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	71.4	93.7	94.6	92.4	85.9	94.2	63.9	71.1	86.3	42.3	45.3	76.9	89.9	82.4	84.9	85.4	95.9	85.2	81.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.94	05/06/2004 00:30	±0.28	70.3
Lowest Astronomical Tide (LAT)	0.08	13/11/2013 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Wingham

MHL2786

Figure
A117

RECORDING STATION: **Manning River at Farquhar Inlet**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 208415

ZONE: 56
EASTING: 461745
NORTHING: 6466021

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.727	0.645	0.608	0.565	0.585	0.472	0.568	0.614	0.680	0.746	0.825	0.775	0.749	0.731	0.733	0.754	0.676	0.634	0.710	0.674	0.089
MHWS	0.451	0.389	0.371	0.338	0.353	0.273	0.336	0.348	0.359	0.428	0.469	0.454	0.449	0.457	0.473	0.509	0.455	0.419	0.480	0.411	0.064
MHW	0.401	0.348	0.333	0.306	0.321	0.248	0.310	0.317	0.319	0.390	0.410	0.398	0.393	0.408	0.423	0.461	0.411	0.379	0.439	0.369	0.056
MHWN	0.352	0.308	0.295	0.273	0.289	0.223	0.285	0.285	0.278	0.353	0.350	0.343	0.338	0.358	0.373	0.413	0.368	0.339	0.398	0.327	0.048
MSL	0.145	0.137	0.149	0.134	0.161	0.118	0.174	0.163	0.136	0.204	0.120	0.122	0.113	0.144	0.160	0.210	0.178	0.158	0.219	0.155	0.031
MLWN	-0.062	-0.033	0.003	-0.005	0.032	0.012	0.063	0.040	-0.006	0.055	-0.110	-0.099	-0.112	-0.071	-0.053	0.007	-0.011	-0.022	0.041	-0.017	0.055
MLW	-0.112	-0.074	-0.035	-0.038	0.000	-0.013	0.038	0.009	-0.046	0.018	-0.169	-0.155	-0.167	-0.120	-0.103	-0.041	-0.055	-0.062	-0.000	-0.059	0.063
MLWS	-0.161	-0.114	-0.073	-0.070	-0.032	-0.038	0.012	-0.023	-0.087	-0.020	-0.229	-0.211	-0.222	-0.169	-0.153	-0.090	-0.098	-0.102	-0.042	-0.101	0.072
ISLW	-0.358	-0.297	-0.242	-0.232	-0.197	-0.180	-0.154	-0.213	-0.316	-0.247	-0.483	-0.440	-0.437	-0.365	-0.338	-0.265	-0.257	-0.256	-0.205	-0.288	0.093
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.414	0.341	0.291	0.278	0.257	0.211	0.221	0.245	0.284	0.298	0.460	0.442	0.450	0.429	0.427	0.407	0.379	0.361	0.357	0.345	0.082
MR	0.513	0.422	0.368	0.343	0.321	0.261	0.272	0.308	0.365	0.372	0.579	0.553	0.560	0.528	0.526	0.503	0.466	0.441	0.439	0.429	0.102
MSR	0.612	0.503	0.444	0.408	0.385	0.311	0.324	0.371	0.446	0.447	0.698	0.665	0.671	0.627	0.625	0.599	0.553	0.522	0.522	0.512	0.121
R	1.085	0.941	0.850	0.797	0.782	0.652	0.722	0.826	0.996	0.994	1.308	1.214	1.186	1.096	1.071	1.019	0.933	0.890	0.915	0.962	0.173
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.257	0.211	0.184	0.172	0.161	0.130	0.136	0.154	0.182	0.186	0.289	0.277	0.280	0.264	0.263	0.251	0.233	0.221	0.220	0.214	0.051
S2	0.050	0.041	0.038	0.032	0.032	0.025	0.026	0.032	0.041	0.037	0.059	0.056	0.055	0.049	0.050	0.048	0.043	0.040	0.041	0.042	0.010
K1	0.113	0.104	0.096	0.092	0.092	0.078	0.088	0.101	0.121	0.124	0.144	0.131	0.124	0.114	0.108	0.102	0.092	0.089	0.093	0.106	0.017
O1	0.084	0.078	0.073	0.071	0.074	0.064	0.078	0.089	0.108	0.104	0.110	0.098	0.090	0.082	0.078	0.073	0.066	0.065	0.071	0.082	0.014
MSF	0.051	0.043	0.058	0.038	0.037	0.017	0.063	0.024	0.050	0.044	0.046	0.033	0.030	0.026	0.053	0.043	0.040	0.033	0.047	0.041	0.012
z0	0.145	0.137	0.149	0.134	0.161	0.118	0.174	0.163	0.136	0.204	0.120	0.122	0.113	0.144	0.160	0.210	0.178	0.158	0.219	0.155	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	48.160	62.307	73.205	74.892	76.070	80.293	75.122	65.319	50.002	52.950	44.902	48.394	50.528	56.729	58.955	64.260	71.074	72.762	69.886	62.937	11.353
S2	316.413	329.247	341.294	342.759	345.100	347.829	339.782	339.476	321.832	328.044	322.548	323.900	331.231	336.090	334.541	337.826	345.404	347.739	339.752	335.306	9.436
K1	182.254	195.215	205.663	206.766	209.152	214.652	203.088	195.061	182.390	180.179	163.025	166.004	165.088	174.594	176.157	184.236	194.249	199.850	199.910	189.344	15.865
O1	238.534	249.688	258.805	261.002	262.873	271.537	265.786	263.338	254.812	265.106	253.884	261.818	264.586	265.776	263.746	263.279	263.647	262.528	258.420	260.482	7.250
MSF	283.065	293.030	294.399	273.646	305.947	264.816	279.783	282.675	289.494	268.959	283.445	286.318	286.290	304.006	285.505	287.264	293.537	297.750	276.660	286.136	10.787
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.110	0.089	0.096	0.084	0.093	0.083	0.094	0.086	0.082	0.077	0.091	0.093	0.101	0.079	0.078	0.088	0.097	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	84.6	96.3	94.8	93.5	90.5	89.1	72.8	81.5	83.2	84.8	81.3	81.8	90.5	89.1	93.8	88.1	87.5	94.2	84.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.82	04/06/2004 23:45	±0.22	26.7
Lowest Astronomical Tide (LAT)	-0.20	26/12/2012 03:00		

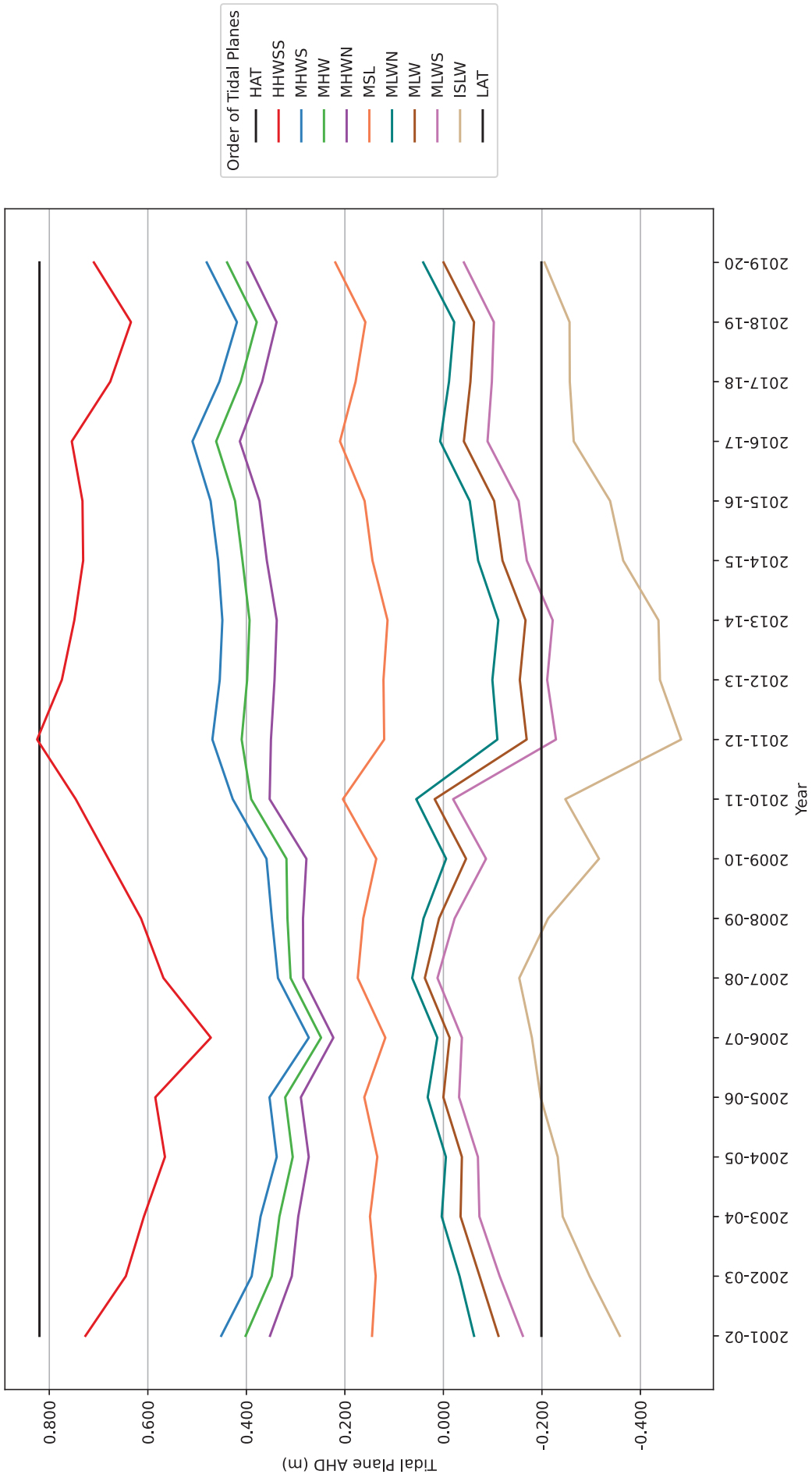
COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Manning River at Farquhar Inlet

Table A118

MHL2786

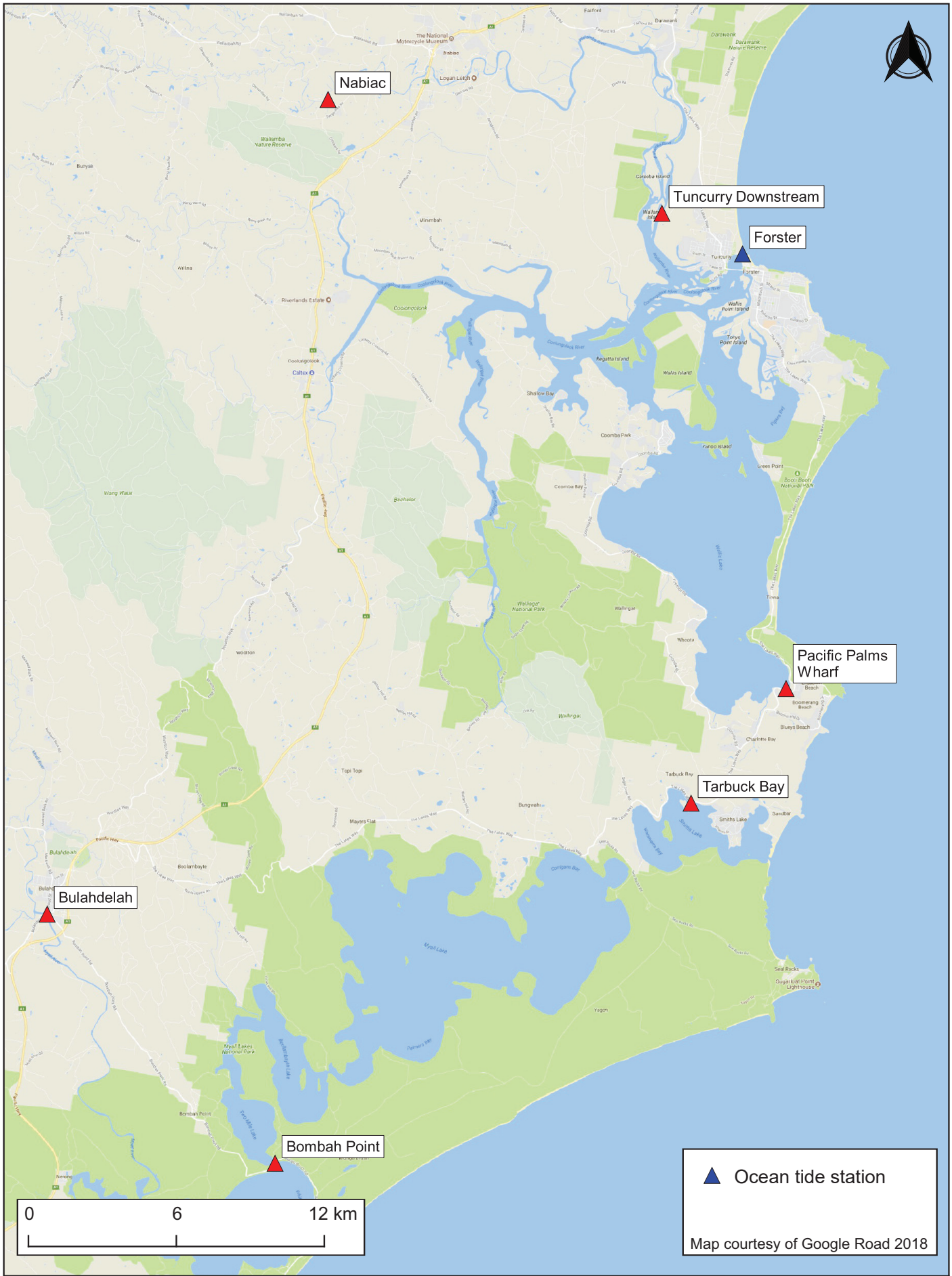


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manning River at Farquhar Inlet

MHL2786

Figure A118



NSW GOVERNMENT

STATION LOCATIONS
GREAT LAKES REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A119

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Wallamba River at Tuncurry Downstream

RECORDING STATION: **Wallamba River at Tuncurry Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209401D

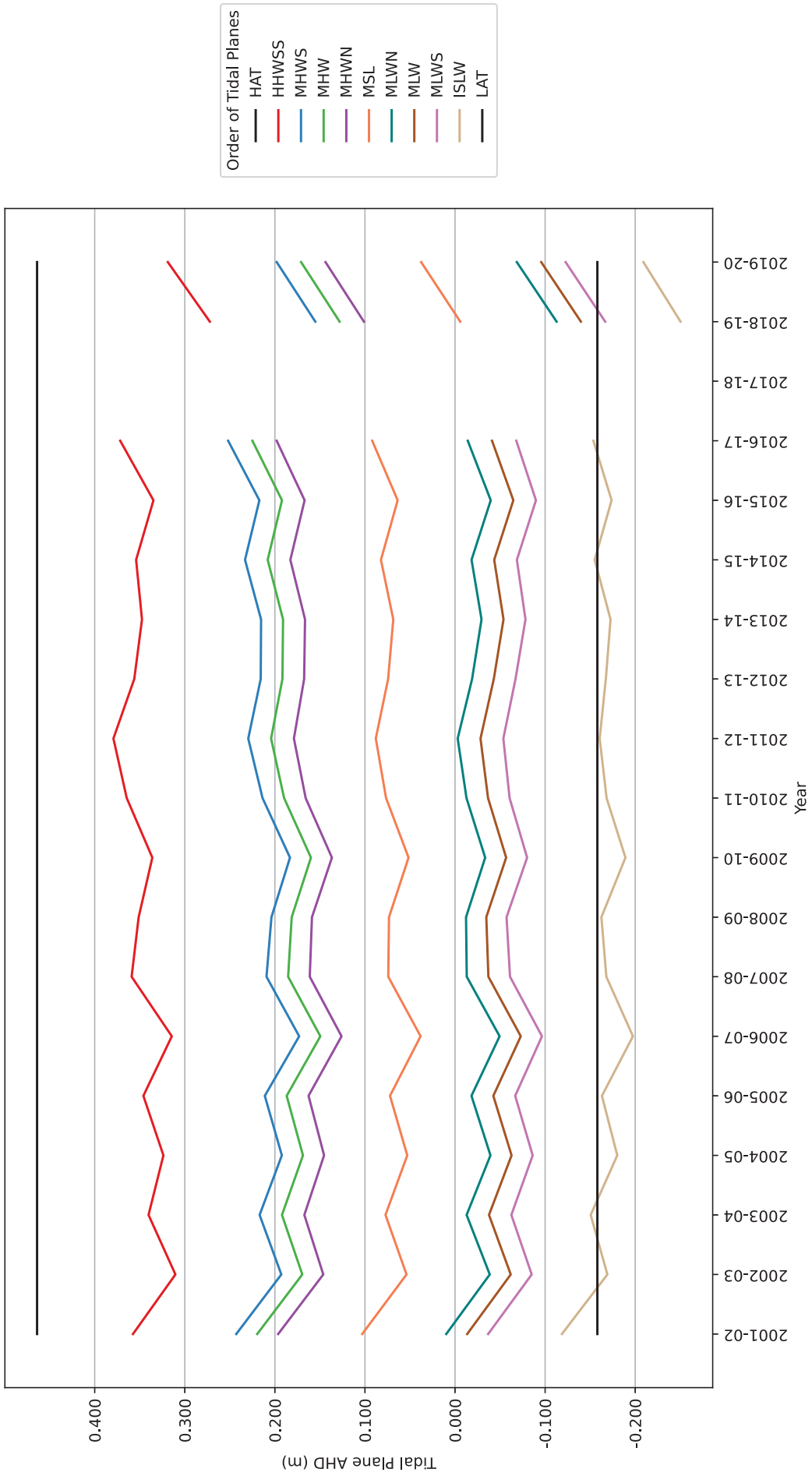
ZONE: 56
EASTING: 450368
NORTHING: 6441818

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.358	0.310	0.340	0.324	0.346	0.314	0.359	0.351	0.336	0.364	0.379	0.356	0.348	0.354	0.335	0.372		0.272	0.319	0.341	0.026
MHWS	0.243	0.193	0.217	0.192	0.211	0.173	0.209	0.204	0.183	0.214	0.230	0.216	0.215	0.233	0.217	0.252		0.155	0.198	0.209	0.024
MHW	0.220	0.170	0.192	0.169	0.187	0.150	0.185	0.181	0.160	0.190	0.204	0.192	0.191	0.208	0.192	0.225		0.128	0.171	0.184	0.024
MHWN	0.196	0.146	0.167	0.145	0.163	0.126	0.161	0.159	0.137	0.166	0.179	0.168	0.167	0.183	0.167	0.198		0.101	0.144	0.160	0.024
MSL	0.103	0.054	0.077	0.053	0.072	0.038	0.074	0.073	0.052	0.077	0.088	0.074	0.069	0.082	0.064	0.092		-0.006	0.038	0.065	0.025
MLWN	0.010	-0.039	-0.013	-0.039	-0.018	-0.049	-0.013	-0.012	-0.033	-0.013	-0.003	-0.019	-0.029	-0.018	-0.040	-0.014		-0.113	-0.069	-0.029	0.028
MLW	-0.013	-0.062	-0.038	-0.063	-0.042	-0.073	-0.037	-0.035	-0.057	-0.037	-0.028	-0.043	-0.054	-0.043	-0.065	-0.041		-0.140	-0.096	-0.054	0.028
MLWS	-0.037	-0.085	-0.063	-0.086	-0.067	-0.097	-0.061	-0.057	-0.080	-0.061	-0.054	-0.067	-0.078	-0.069	-0.090	-0.068		-0.167	-0.123	-0.078	0.029
ISLW	-0.119	-0.169	-0.151	-0.180	-0.163	-0.198	-0.168	-0.162	-0.189	-0.168	-0.161	-0.167	-0.173	-0.155	-0.174	-0.154		-0.250	-0.209	-0.173	0.027
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.187	0.185	0.180	0.185	0.181	0.175	0.174	0.171	0.170	0.179	0.182	0.186	0.196	0.201	0.207	0.212		0.214	0.212	0.189	0.015
MR	0.233	0.231	0.230	0.232	0.229	0.223	0.222	0.216	0.217	0.226	0.233	0.235	0.245	0.251	0.257	0.266		0.268	0.267	0.238	0.017
MSR	0.280	0.278	0.279	0.278	0.278	0.270	0.270	0.261	0.263	0.274	0.283	0.283	0.294	0.302	0.307	0.320		0.322	0.321	0.287	0.019
R	0.476	0.480	0.491	0.504	0.509	0.512	0.527	0.514	0.525	0.533	0.540	0.523	0.520	0.509	0.509	0.525		0.523	0.528	0.514	0.017
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.117	0.116	0.115	0.116	0.115	0.111	0.111	0.108	0.108	0.113	0.116	0.117	0.122	0.126	0.128	0.133		0.134	0.133	0.119	0.009
S2	0.023	0.023	0.025	0.023	0.024	0.024	0.024	0.022	0.023	0.024	0.025	0.024	0.024	0.025	0.025	0.027		0.027	0.027	0.025	0.001
K1	0.048	0.049	0.052	0.055	0.056	0.057	0.060	0.060	0.060	0.061	0.060	0.057	0.056	0.051	0.050	0.052		0.050	0.052	0.055	0.004
O1	0.034	0.035	0.037	0.039	0.040	0.044	0.047	0.045	0.049	0.047	0.047	0.043	0.038	0.035	0.034	0.033		0.034	0.035	0.040	0.006
MSF	0.037	0.028	0.043	0.029	0.020	0.019	0.037	0.013	0.028	0.019	0.040	0.013	0.027	0.027	0.032	0.040		0.021	0.026	0.028	0.009
z0	0.103	0.054	0.077	0.053	0.072	0.038	0.074	0.073	0.052	0.077	0.088	0.074	0.069	0.082	0.064	0.092		-0.006	0.038	0.065	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	45.652	46.865	48.208	47.756	47.356	47.515	45.906	47.508	42.568	42.410	41.473	41.270	40.548	40.320	40.578	37.988		39.936	39.569	43.524	3.482
S2	315.306	318.213	319.067	317.937	319.177	319.310	318.382	323.253	316.143	319.863	315.575	316.670	317.088	316.596	316.409	310.396		311.862	311.112	316.798	3.218
K1	189.555	191.683	191.487	191.625	189.470	188.956	186.101	184.837	179.676	174.680	172.363	170.264	168.711	169.954	172.676	176.561		181.067	184.076	181.319	8.357
O1	246.623	245.132	245.207	245.380	245.709	246.216	247.731	251.675	255.133	262.033	263.986	265.729	267.877	266.814	261.742	255.813		247.777	241.805	253.466	8.958
MSF	297.365	298.063	303.557	276.621	313.774	275.697	290.595	268.023	296.215	271.395	289.431	321.425	287.876	316.293	290.928	311.895		294.467	270.962	293.032	16.271
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.069	0.081	0.069	0.081	0.080	0.086	0.063	0.073	0.076	0.086	0.066	0.084	0.080	0.078	0.064	0.060		0.095	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.5	97.9	97.1	96.8	98.0	97.3	98.1	92.4	99.3	97.6	96.0	93.2	99.1	95.1	97.9	88.7	40.5	99.9	98.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.46	04/06/2004 23:00	±0.17	22.8
Lowest Astronomical Tide (LAT)	-0.16	24/01/2013 01:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Tuncurry (AWRC: 209401) in Jun 2016.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallamba River at Tuncurry Downstream

MHL2786

Figure A120

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wallis Lakes at Pacific Palms Wharf

RECORDING STATION: **Wallis Lakes at Pacific Palms Wharf**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209406

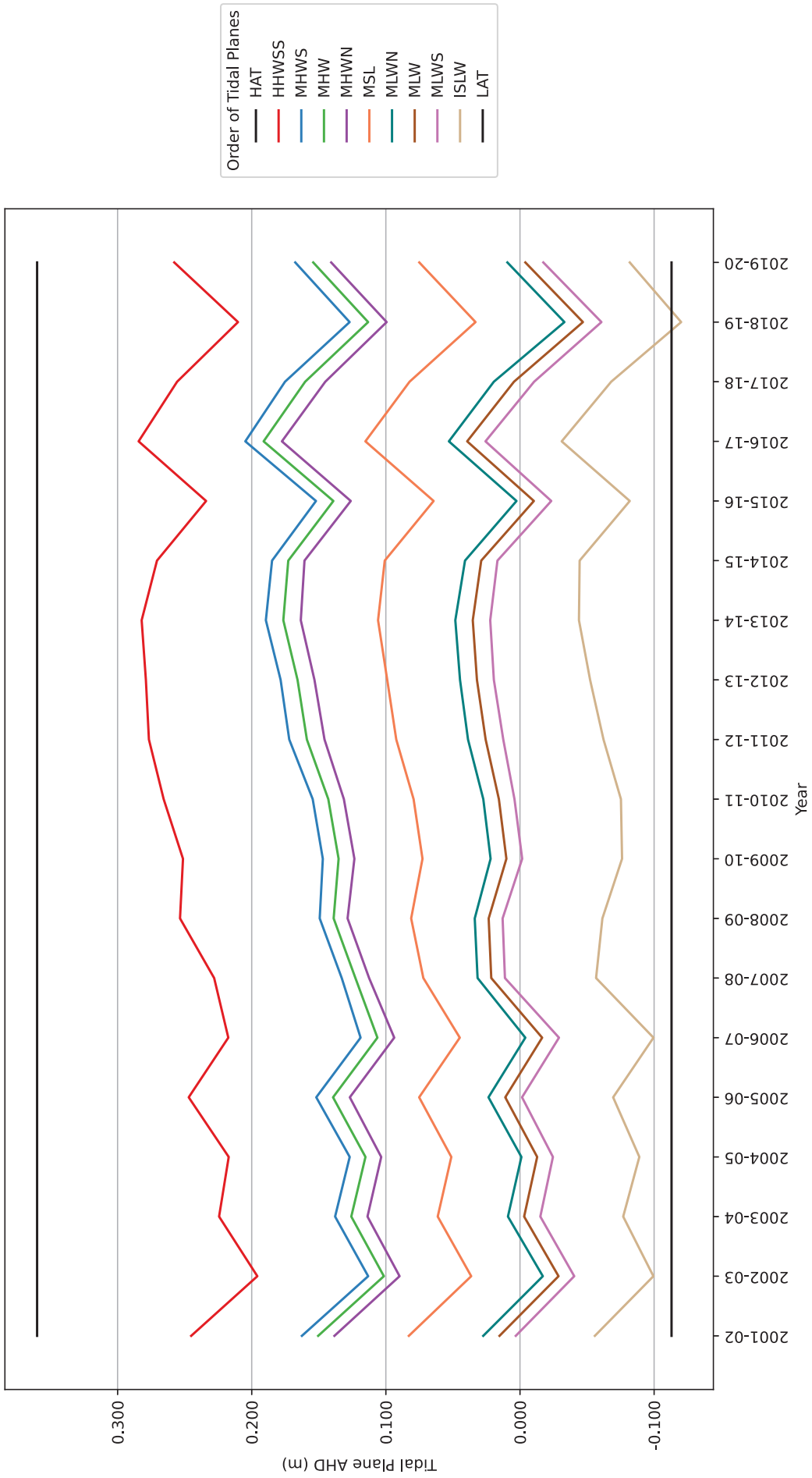
ZONE: 56
EASTING: 455401
NORTHING: 6422551

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.245	0.196	0.224	0.217	0.247	0.217	0.228	0.253	0.251	0.266	0.277	0.279	0.282	0.271	0.234	0.284	0.256	0.210	0.258	0.247	0.026
MHWS	0.163	0.113	0.138	0.127	0.152	0.119	0.133	0.149	0.147	0.155	0.172	0.178	0.189	0.185	0.152	0.205	0.175	0.127	0.168	0.155	0.025
MHW	0.150	0.101	0.126	0.115	0.139	0.106	0.123	0.139	0.135	0.143	0.159	0.166	0.176	0.173	0.139	0.191	0.160	0.113	0.154	0.143	0.025
MHWN	0.138	0.090	0.114	0.103	0.127	0.094	0.112	0.129	0.123	0.131	0.146	0.153	0.163	0.161	0.126	0.177	0.145	0.099	0.141	0.130	0.024
MSL	0.083	0.036	0.061	0.051	0.075	0.045	0.072	0.081	0.073	0.079	0.092	0.099	0.106	0.101	0.064	0.115	0.082	0.033	0.075	0.075	0.023
MLWN	0.027	-0.017	0.009	-0.001	0.023	-0.004	0.032	0.034	0.022	0.027	0.039	0.045	0.048	0.041	0.003	0.053	0.019	-0.033	0.009	0.020	0.023
MLW	0.015	-0.029	-0.003	-0.013	0.011	-0.017	0.021	0.023	0.010	0.016	0.026	0.032	0.035	0.029	-0.010	0.039	0.004	-0.047	-0.004	0.007	0.023
MLWS	0.003	-0.040	-0.015	-0.025	-0.002	-0.029	0.011	0.013	-0.002	0.004	0.012	0.019	0.022	0.017	-0.023	0.026	-0.011	-0.061	-0.017	-0.005	0.023
ISLW	-0.056	-0.099	-0.077	-0.089	-0.069	-0.100	-0.057	-0.061	-0.076	-0.075	-0.062	-0.052	-0.044	-0.044	-0.082	-0.031	-0.068	-0.120	-0.082	-0.071	0.022
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.111	0.107	0.105	0.105	0.103	0.098	0.081	0.095	0.102	0.104	0.107	0.109	0.115	0.120	0.124	0.124	0.126	0.133	0.131	0.110	0.013
MR	0.135	0.130	0.129	0.128	0.128	0.123	0.101	0.116	0.125	0.127	0.133	0.134	0.141	0.144	0.149	0.152	0.156	0.160	0.158	0.135	0.015
MSR	0.159	0.154	0.153	0.152	0.153	0.148	0.122	0.136	0.149	0.150	0.160	0.159	0.167	0.168	0.175	0.179	0.186	0.188	0.185	0.160	0.017
R	0.301	0.295	0.301	0.306	0.316	0.317	0.285	0.315	0.327	0.341	0.339	0.331	0.326	0.315	0.316	0.315	0.324	0.330	0.340	0.318	0.015
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.068	0.065	0.064	0.064	0.064	0.061	0.051	0.058	0.063	0.064	0.067	0.067	0.071	0.072	0.075	0.076	0.078	0.080	0.079	0.068	0.008
S2	0.012	0.012	0.012	0.012	0.013	0.013	0.010	0.010	0.012	0.012	0.013	0.013	0.013	0.012	0.013	0.014	0.015	0.014	0.013	0.012	0.001
K1	0.034	0.034	0.034	0.036	0.038	0.038	0.034	0.040	0.041	0.043	0.041	0.039	0.037	0.035	0.033	0.033	0.033	0.034	0.037	0.036	0.003
O1	0.025	0.025	0.027	0.029	0.030	0.032	0.034	0.035	0.034	0.036	0.034	0.033	0.029	0.026	0.025	0.024	0.025	0.025	0.028	0.029	0.004
MSF	0.038	0.028	0.040	0.027	0.021	0.023	0.047	0.013	0.026	0.019	0.041	0.014	0.029	0.028	0.033	0.031	0.037	0.019	0.027	0.028	0.009
z0	0.083	0.036	0.061	0.051	0.075	0.045	0.072	0.081	0.073	0.079	0.092	0.099	0.106	0.101	0.064	0.115	0.082	0.033	0.075	0.075	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	89.132	90.691	91.464	91.461	91.442	91.624	104.790	97.736	87.573	87.231	85.969	86.318	85.898	86.214	86.725	88.459	89.808	88.856	88.890	90.015	4.589
S2	350.096	351.406	355.491	350.096	350.794	352.739	13.816	6.601	353.463	356.571	351.481	350.862	354.261	353.349	347.470	350.902	355.589	348.236	346.221	315.760	107.716
K1	226.274	227.738	229.690	228.418	227.045	225.974	219.963	226.403	217.612	213.247	208.745	208.449	205.136	209.589	208.539	216.367	216.562	225.683	226.398	219.360	8.343
O1	279.826	279.372	278.574	279.488	280.433	284.181	288.848	290.239	289.824	297.981	300.641	301.325	304.514	302.207	296.267	290.823	287.012	283.036	282.794	289.336	8.788
MSF	298.659	296.068	306.697	291.229	316.326	279.375	296.892	292.230	293.200	277.181	294.226	296.709	289.703	313.891	292.795	304.683	303.188	297.820	279.735	295.821	10.485
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.082	0.071	0.076	0.081	0.084	0.063	0.069	0.081	0.085	0.067	0.084	0.078	0.077	0.064	0.055	0.071	0.100	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.8	98.7	98.4	98.2	98.2	98.0	56.0	97.4	97.9	98.8	96.1	92.5	97.6	93.8	97.9	90.0	66.9	94.8	97.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.36	05/06/2004 00:45	±0.17	31.4
Lowest Astronomical Tide (LAT)	-0.11	20/09/2003 11:30		

COMMENTS Station relocated from Tiona (AWRC: 209403) in Oct 2013.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

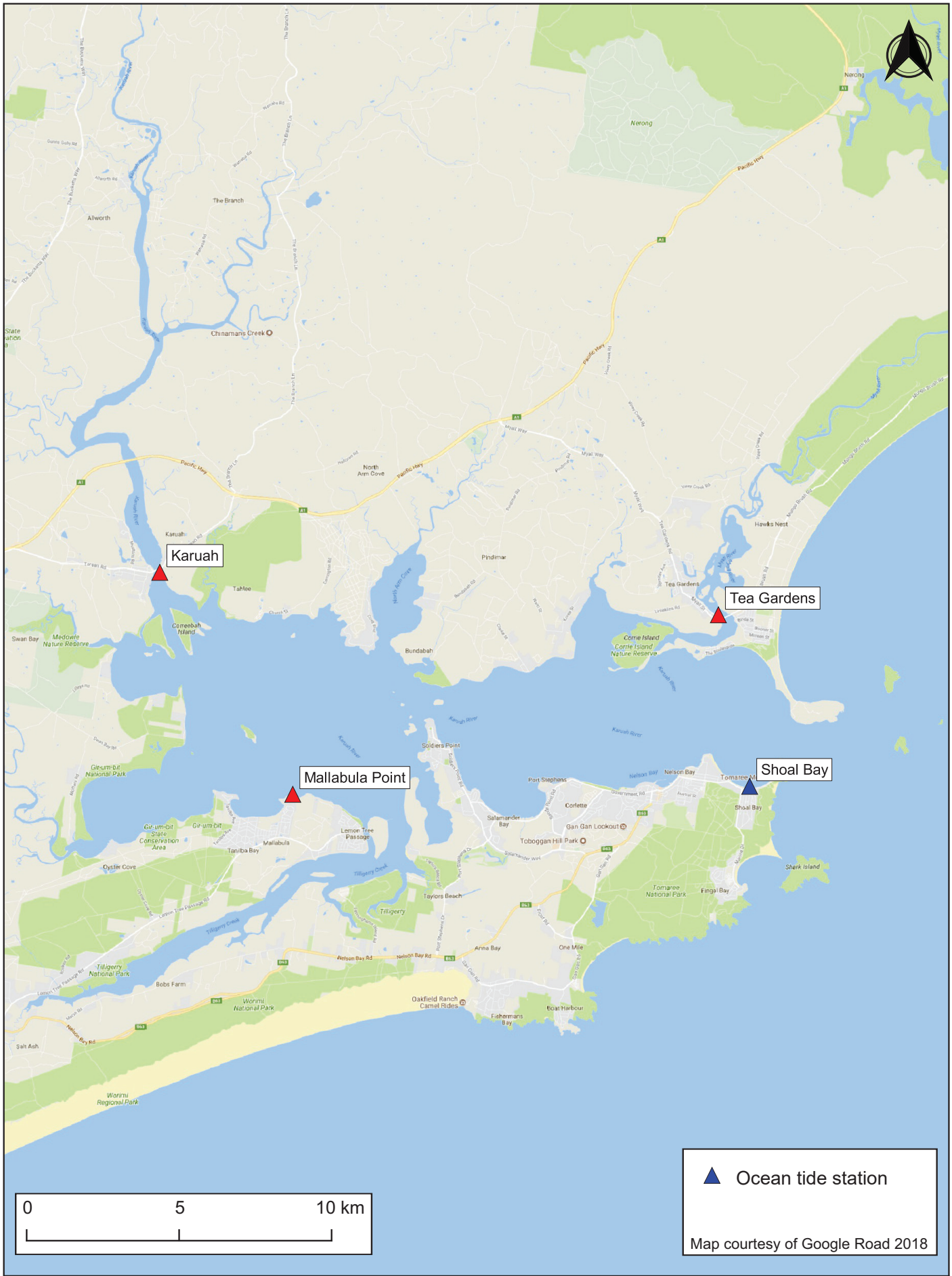


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallis Lakes at Pacific Palms Wharf

MHL2786

Figure A121



NSW GOVERNMENT

STATION LOCATIONS
PORT STEPHENS REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A122

DRAWING A122.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Myall River at Tea Gardens

RECORDING STATION: **Myall River at Tea Gardens**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209480

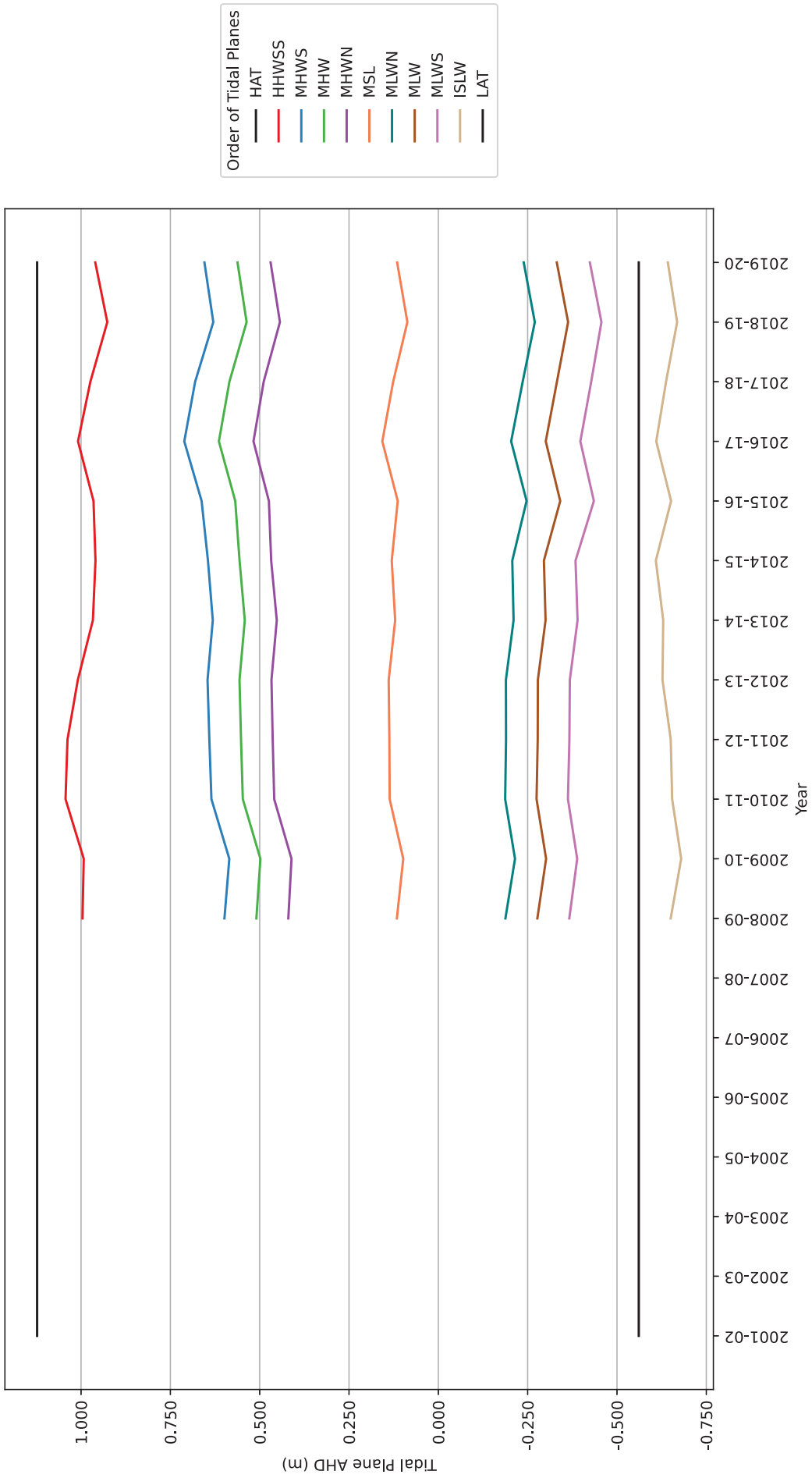
ZONE: 56
EASTING: 421723
NORTHING: 6385111

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS								0.996	0.992	1.043	1.038	1.009	0.967	0.960	0.965	1.008	0.974	0.927	0.960	0.987	0.034
MHWS								0.599	0.585	0.635	0.641	0.646	0.631	0.645	0.663	0.711	0.681	0.630	0.655	0.643	0.033
MHW								0.509	0.498	0.547	0.552	0.557	0.542	0.556	0.568	0.614	0.585	0.537	0.562	0.552	0.031
MHWN								0.420	0.411	0.459	0.464	0.467	0.452	0.468	0.474	0.517	0.489	0.443	0.470	0.461	0.028
MSL								0.116	0.098	0.136	0.137	0.139	0.121	0.130	0.114	0.157	0.126	0.087	0.115	0.123	0.019
MLWN								-0.188	-0.215	-0.187	-0.189	-0.189	-0.211	-0.207	-0.247	-0.204	-0.236	-0.270	-0.239	-0.215	0.027
MLW								-0.277	-0.302	-0.275	-0.278	-0.279	-0.300	-0.295	-0.341	-0.301	-0.332	-0.363	-0.332	-0.306	0.029
MLWS								-0.367	-0.389	-0.363	-0.367	-0.368	-0.390	-0.384	-0.435	-0.397	-0.428	-0.456	-0.424	-0.397	0.031
ISLW								-0.650	-0.680	-0.654	-0.650	-0.627	-0.629	-0.609	-0.651	-0.610	-0.637	-0.668	-0.642	-0.642	0.021
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR								0.608	0.626	0.646	0.653	0.656	0.663	0.675	0.721	0.721	0.725	0.713	0.708	0.676	0.041
MR								0.786	0.800	0.822	0.830	0.835	0.842	0.852	0.910	0.915	0.917	0.900	0.894	0.858	0.046
MSR								0.965	0.974	0.998	1.008	1.014	1.021	1.029	1.098	1.109	1.108	1.086	1.079	1.041	0.053
R								1.646	1.672	1.698	1.688	1.636	1.596	1.568	1.617	1.618	1.611	1.595	1.603	1.629	0.040
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2								0.393	0.400	0.411	0.415	0.418	0.421	0.426	0.455	0.457	0.458	0.450	0.447	0.429	0.023
S2								0.089	0.087	0.088	0.089	0.089	0.090	0.088	0.094	0.097	0.096	0.093	0.093	0.091	0.003
K1								0.168	0.172	0.173	0.169	0.159	0.148	0.141	0.138	0.137	0.134	0.135	0.138	0.151	0.016
O1								0.116	0.119	0.118	0.115	0.101	0.091	0.084	0.078	0.075	0.075	0.077	0.080	0.094	0.018
MSF								0.018	0.036	0.025	0.049	0.020	0.031	0.030	0.035	0.036	0.036	0.023	0.030	0.031	0.009
z0								0.116	0.098	0.136	0.137	0.139	0.121	0.130	0.114	0.157	0.126	0.087	0.115	0.123	0.019
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2								27.822	27.663	26.782	25.606	26.464	27.131	27.498	22.148	22.618	24.745	27.388	27.272	26.095	1.951
S2								315.136	313.878	315.407	315.023	315.620	315.726	315.897	308.948	306.200	308.468	311.422	309.839	312.630	3.463
K1								145.632	146.393	140.672	138.495	136.269	135.671	137.077	135.455	139.287	143.364	148.695	151.096	141.509	5.397
O1								221.370	223.437	229.813	235.412	238.984	240.858	238.410	229.538	223.743	221.614	217.256	214.022	227.871	8.991
MSF								321.989	273.208	263.240	279.400	277.138	281.678	305.185	280.297	294.210	287.029	294.242	260.349	284.830	17.311
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
								0.075	0.091	0.089	0.069	0.089	0.092	0.078	0.069	0.068	0.081	0.096	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
								52.8	91.4	91.8	97.9	92.4	98.9	94.6	98.2	93.9	96.5	99.1	97.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.12	23/06/2009 22:00	±0.19	3.1
Lowest Astronomical Tide (LAT)	-0.56	08/10/2014 03:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Dec 2008.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Myall River at Tea Gardens

MHL2786

Figure A123

RECORDING STATION: **Karuah River at Karuah**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209485

ZONE: 56
EASTING: 403411
NORTHING: 6386503

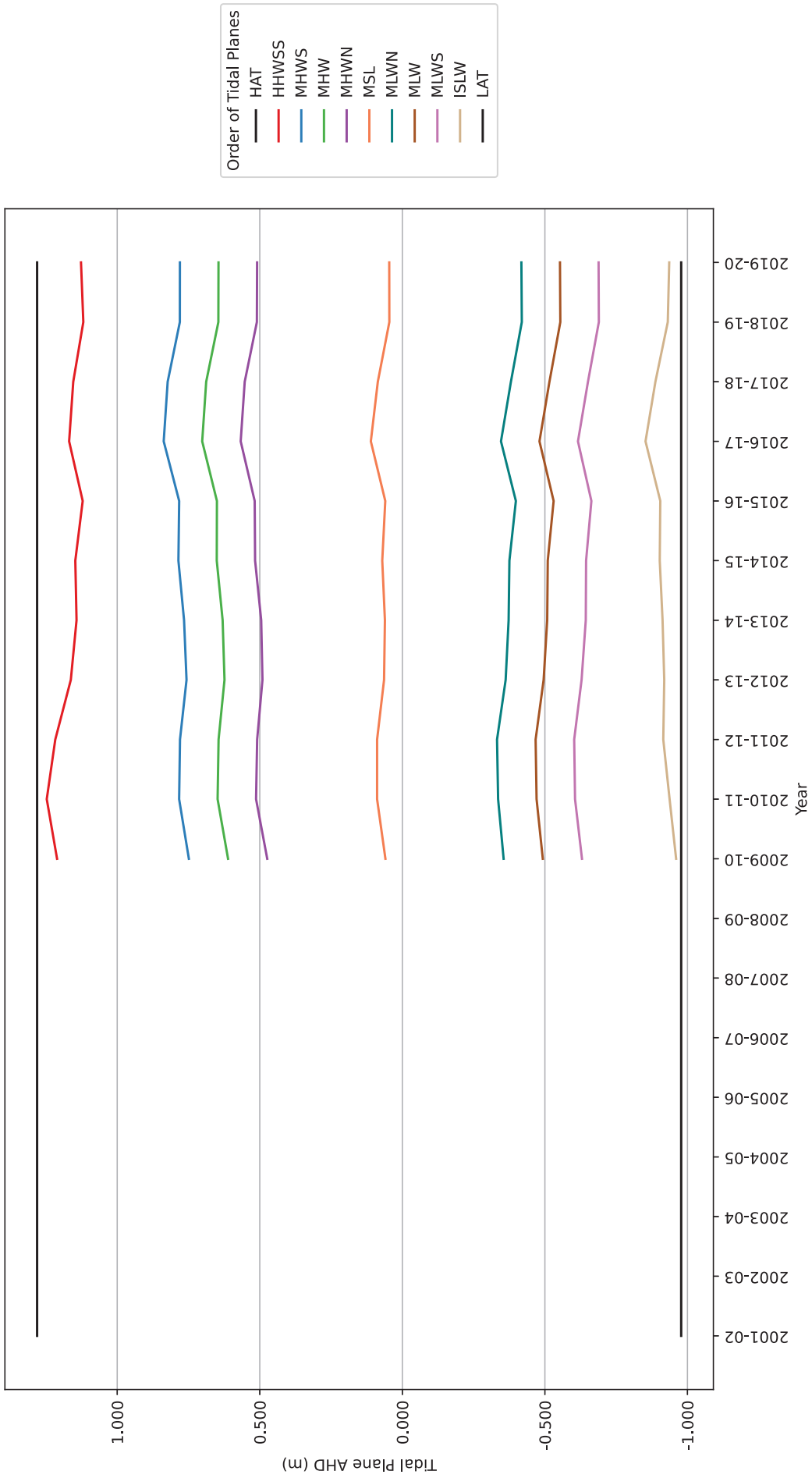
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Karuah River at Karuah

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS									1.211	1.247	1.217	1.163	1.143	1.147	1.121	1.169	1.154	1.119	1.127	1.165	0.042
MHWS									0.749	0.783	0.780	0.757	0.766	0.785	0.783	0.837	0.823	0.780	0.780	0.784	0.026
MHW									0.611	0.648	0.644	0.624	0.630	0.651	0.650	0.702	0.688	0.645	0.645	0.649	0.026
MHWN									0.474	0.513	0.509	0.491	0.495	0.516	0.518	0.567	0.553	0.510	0.509	0.514	0.026
MSL									0.059	0.089	0.089	0.064	0.061	0.070	0.060	0.110	0.086	0.046	0.046	0.071	0.020
MLWN									-0.355	-0.336	-0.332	-0.362	-0.373	-0.376	-0.398	-0.346	-0.381	-0.419	-0.418	-0.372	0.030
MLW									-0.493	-0.471	-0.467	-0.496	-0.508	-0.510	-0.531	-0.481	-0.516	-0.554	-0.553	-0.507	0.030
MLWS									-0.630	-0.606	-0.603	-0.629	-0.643	-0.644	-0.663	-0.616	-0.651	-0.689	-0.688	-0.642	0.030
ISLW									-0.960	-0.937	-0.915	-0.919	-0.913	-0.903	-0.905	-0.853	-0.888	-0.931	-0.936	-0.914	0.029
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR									0.829	0.849	0.841	0.853	0.868	0.892	0.916	0.913	0.934	0.929	0.927	0.886	0.039
MR									1.104	1.119	1.112	1.119	1.138	1.161	1.181	1.183	1.204	1.199	1.198	1.156	0.039
MSR									1.379	1.389	1.383	1.386	1.409	1.430	1.446	1.453	1.474	1.470	1.468	1.426	0.038
R									2.171	2.185	2.132	2.081	2.055	2.050	2.026	2.022	2.042	2.050	2.063	2.080	0.057
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2									0.552	0.559	0.556	0.560	0.569	0.580	0.590	0.591	0.602	0.600	0.599	0.578	0.019
S2									0.137	0.135	0.135	0.133	0.135	0.134	0.132	0.135	0.135	0.135	0.135	0.135	0.001
K1									0.199	0.204	0.195	0.184	0.173	0.168	0.159	0.157	0.156	0.159	0.162	0.174	0.018
O1									0.131	0.128	0.118	0.106	0.097	0.091	0.083	0.080	0.080	0.083	0.086	0.098	0.019
MSF									0.016	0.006	0.023	0.013	0.008	0.009	0.012	0.017	0.018	0.008	0.015	0.013	0.005
z0									0.059	0.089	0.089	0.064	0.061	0.070	0.060	0.110	0.086	0.046	0.046	0.071	0.020
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2									13.640	13.895	13.243	12.569	12.353	13.068	13.711	14.287	15.072	15.599	16.307	13.977	1.246
S2									299.566	299.133	297.218	297.247	297.640	298.135	298.741	297.154	297.474	297.940	297.683	297.994	0.819
K1									130.299	129.581	126.326	123.361	123.721	125.202	127.522	131.956	135.314	139.132	141.365	130.344	6.081
O1									206.628	212.757	218.440	221.458	223.108	219.955	216.862	211.483	207.606	200.960	198.580	212.531	8.301
MSF									296.633	178.692	283.191	53.813	292.031	352.995	279.615	313.014	313.866	345.002	244.958	268.528	85.689
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
									0.083	0.085	0.073	0.090	0.084	0.080	0.070	0.068	0.070	0.089	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
									53.5	97.1	88.7	94.7	98.2	94.2	98.9	95.4	95.2	98.2	96.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.28	24/06/2013 22:00	±0.19	1.8
Lowest Astronomical Tide (LAT)	-0.98	10/09/2014 04:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Dec 2009.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Karuah River at Karuah

MHL2786

Figure A124

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Karuah River at Mallabulla Point

RECORDING STATION: **Karuah River at Mallabulla Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 209461

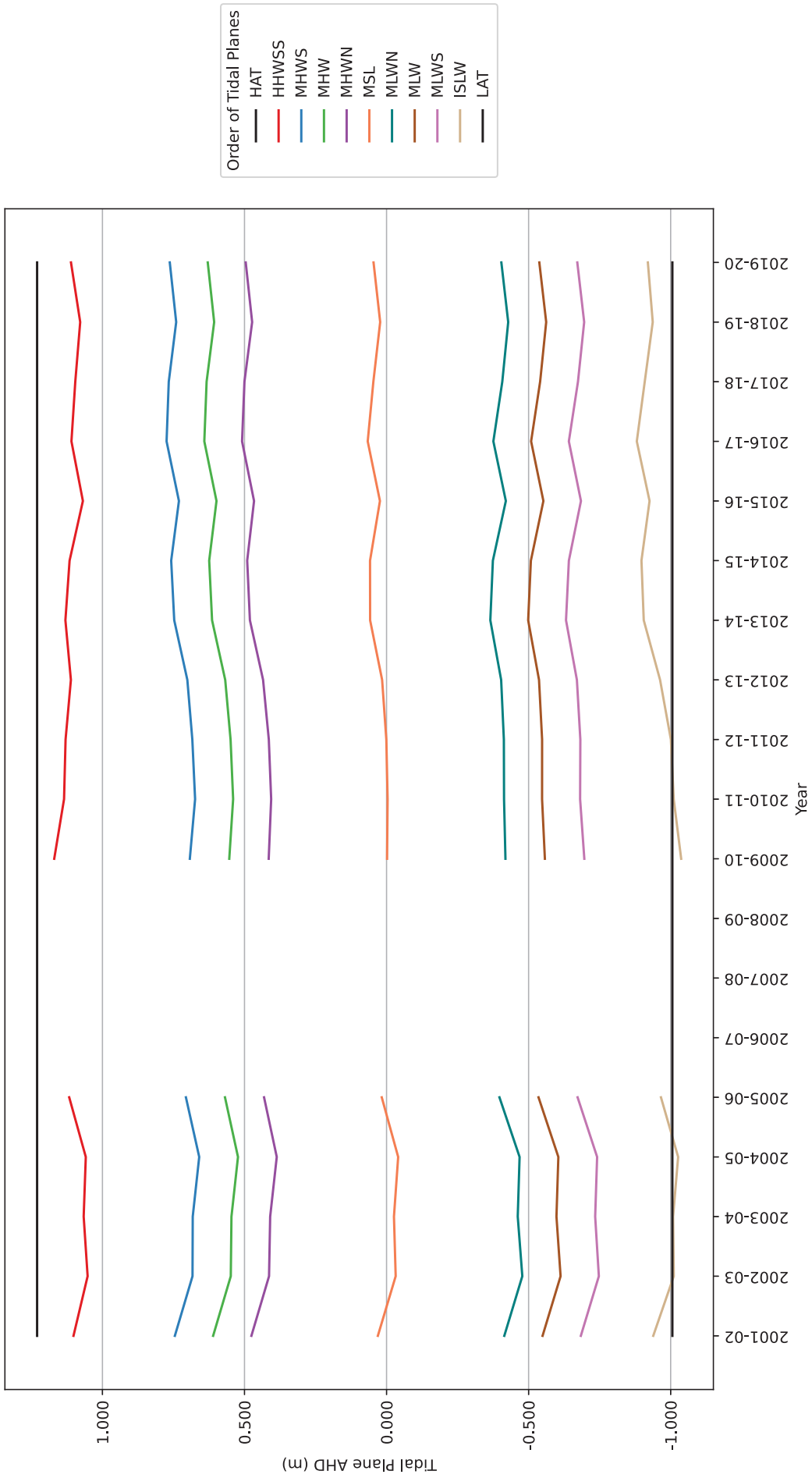
ZONE: 56
EASTING: 407770
NORTHING: 6379228

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.102	1.052	1.066	1.059	1.117				1.170	1.135	1.130	1.111	1.130	1.116	1.069	1.109	1.096	1.078	1.111	1.103	0.032
MHWS	0.745	0.683	0.682	0.659	0.706				0.692	0.674	0.684	0.701	0.747	0.758	0.731	0.774	0.767	0.740	0.763	0.719	0.038
MHW	0.610	0.548	0.546	0.523	0.569				0.554	0.540	0.549	0.568	0.614	0.624	0.599	0.641	0.633	0.607	0.629	0.585	0.039
MHWN	0.476	0.414	0.410	0.386	0.431				0.415	0.406	0.414	0.435	0.481	0.491	0.466	0.509	0.500	0.473	0.496	0.450	0.040
MSL	0.031	-0.032	-0.026	-0.041	0.017				-0.002	-0.004	0.001	0.016	0.058	0.058	0.023	0.066	0.046	0.022	0.046	0.017	0.033
MLWN	-0.414	-0.478	-0.462	-0.468	-0.397				-0.418	-0.414	-0.413	-0.403	-0.365	-0.374	-0.420	-0.376	-0.407	-0.428	-0.404	-0.415	0.032
MLW	-0.549	-0.613	-0.598	-0.605	-0.535				-0.557	-0.547	-0.548	-0.537	-0.498	-0.508	-0.552	-0.509	-0.541	-0.562	-0.538	-0.550	0.033
MLWS	-0.684	-0.747	-0.734	-0.741	-0.672				-0.696	-0.681	-0.682	-0.670	-0.632	-0.642	-0.684	-0.642	-0.674	-0.696	-0.671	-0.684	0.034
ISLW	-0.939	-1.011	-1.009	-1.026	-0.966				-1.037	-1.011	-1.001	-0.963	-0.905	-0.897	-0.926	-0.881	-0.909	-0.937	-0.920	-0.959	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.890	0.891	0.871	0.855	0.829				0.833	0.820	0.827	0.838	0.846	0.865	0.886	0.885	0.908	0.901	0.900	0.865	0.030
MR	1.160	1.161	1.144	1.128	1.104				1.111	1.087	1.097	1.105	1.113	1.132	1.151	1.150	1.174	1.169	1.167	1.134	0.029
MSR	1.429	1.430	1.417	1.401	1.379				1.389	1.355	1.366	1.371	1.379	1.400	1.415	1.416	1.440	1.436	1.434	1.404	0.028
R	2.041	2.063	2.075	2.085	2.083				2.207	2.146	2.131	2.074	2.036	2.013	1.995	1.990	2.004	2.015	2.031	2.062	0.060
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.580	0.580	0.572	0.564	0.552				0.555	0.544	0.548	0.552	0.556	0.566	0.575	0.575	0.587	0.584	0.584	0.567	0.014
S2	0.135	0.135	0.136	0.136	0.138				0.139	0.134	0.135	0.133	0.133	0.134	0.132	0.133	0.133	0.134	0.134	0.135	0.002
K1	0.165	0.170	0.176	0.181	0.187				0.210	0.202	0.198	0.187	0.177	0.168	0.159	0.157	0.155	0.158	0.163	0.176	0.017
O1	0.090	0.093	0.098	0.104	0.106				0.131	0.128	0.121	0.106	0.096	0.088	0.083	0.082	0.080	0.084	0.086	0.098	0.016
MSF	0.017	0.013	0.029	0.005	0.009				0.010	0.006	0.022	0.013	0.006	0.014	0.014	0.018	0.019	0.008	0.013	0.014	0.006
z0	0.031	-0.032	-0.026	-0.041	0.017				-0.002	-0.004	0.001	0.016	0.058	0.058	0.023	0.066	0.046	0.022	0.046	0.017	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	10.388	10.678	11.046	11.631	11.386				7.892	9.099	7.891	7.229	7.113	7.075	7.611	8.329	8.909	9.401	9.997	9.105	1.587
S2	288.328	288.458	287.487	286.421	287.316				288.218	291.539	290.441	288.783	289.193	288.689	289.167	288.297	288.360	288.899	288.825	288.651	1.179
K1	138.021	140.997	140.428	140.534	138.659				130.073	126.483	122.604	120.804	121.321	122.128	123.837	128.905	131.343	134.678	137.424	131.140	7.599
O1	194.452	192.444	192.094	191.848	193.160				202.939	210.847	215.700	217.550	217.683	214.713	213.062	207.651	202.768	197.595	196.256	203.798	9.998
MSF	294.373	306.123	298.993	253.153	346.454				288.462	166.299	281.014	59.123	252.954	342.959	268.343	304.971	304.259	344.669	248.651	272.550	72.339
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.081	0.074	0.075	0.090				0.087	0.085	0.071	0.085	0.077	0.068	0.069	0.067	0.070	0.090	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.8	99.9	93.7	99.2	95.8	44.4	0.0	25.6	98.6	95.1	99.4	95.4	93.5	91.3	98.0	94.6	95.5	97.3	96.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.23	04/06/2008 21:30	±0.19	2.8
Lowest Astronomical Tide (LAT)	-1.01	29/09/2015 03:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

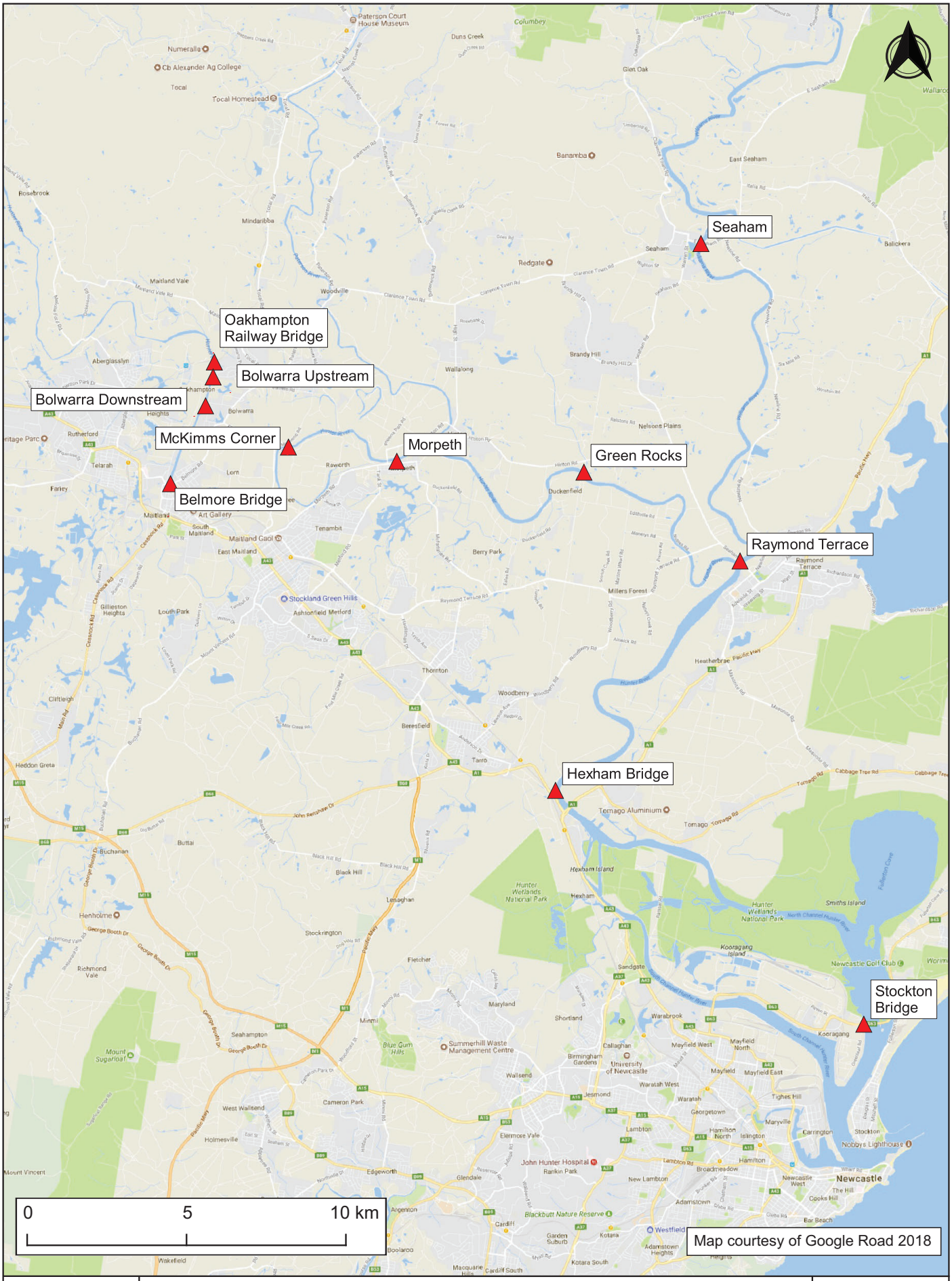


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Karuah River at Mallabulla Point

MHL2786

Figure A125



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STATION LOCATIONS
HUNTER RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A126

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Stockton Bridge

RECORDING STATION: **Hunter River at Stockton Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210456

ZONE: 56
EASTING: 386238
NORTHING: 6360819

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.030	0.998	1.002	0.981	1.027	1.010	1.016	1.049	1.066	1.097	1.053	1.055	1.044	1.009	0.989	1.035	1.005	0.983	0.994	1.023	0.031
MHWS	0.700	0.654	0.648	0.613	0.643	0.607	0.606	0.625	0.633	0.673	0.650	0.675	0.689	0.682	0.676	0.730	0.705	0.678	0.683	0.662	0.035
MHW	0.572	0.525	0.520	0.485	0.514	0.477	0.478	0.496	0.504	0.546	0.523	0.547	0.563	0.556	0.552	0.606	0.582	0.555	0.561	0.535	0.037
MHWN	0.444	0.397	0.392	0.356	0.385	0.347	0.350	0.368	0.375	0.420	0.397	0.419	0.437	0.430	0.428	0.483	0.460	0.432	0.438	0.408	0.038
MSL	0.031	-0.018	-0.005	-0.037	0.002	-0.032	-0.024	-0.004	0.000	0.043	0.023	0.035	0.048	0.037	0.021	0.080	0.055	0.028	0.035	0.017	0.032
MLWN	-0.383	-0.433	-0.402	-0.430	-0.381	-0.411	-0.398	-0.376	-0.375	-0.334	-0.351	-0.349	-0.341	-0.356	-0.385	-0.323	-0.349	-0.375	-0.368	-0.375	0.031
MLW	-0.511	-0.561	-0.530	-0.558	-0.510	-0.540	-0.526	-0.505	-0.503	-0.460	-0.478	-0.477	-0.467	-0.482	-0.509	-0.447	-0.472	-0.499	-0.490	-0.501	0.032
MLWS	-0.639	-0.690	-0.659	-0.687	-0.639	-0.670	-0.654	-0.633	-0.632	-0.586	-0.604	-0.604	-0.593	-0.608	-0.634	-0.571	-0.595	-0.622	-0.613	-0.628	0.033
ISLW	-0.875	-0.935	-0.911	-0.950	-0.913	-0.958	-0.947	-0.936	-0.941	-0.889	-0.893	-0.876	-0.846	-0.842	-0.857	-0.789	-0.809	-0.840	-0.835	-0.886	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.827	0.831	0.794	0.786	0.765	0.758	0.748	0.744	0.750	0.754	0.748	0.768	0.778	0.786	0.813	0.806	0.809	0.807	0.807	0.783	0.029
MR	1.083	1.087	1.051	1.043	1.024	1.017	1.004	1.001	1.007	1.006	1.001	1.024	1.030	1.038	1.062	1.053	1.054	1.054	1.051	1.036	0.027
MSR	1.339	1.343	1.307	1.300	1.282	1.277	1.260	1.258	1.265	1.259	1.254	1.279	1.282	1.290	1.310	1.301	1.300	1.300	1.295	1.290	0.025
R	1.905	1.933	1.913	1.932	1.940	1.967	1.963	1.985	2.007	1.987	1.946	1.931	1.890	1.851	1.846	1.824	1.814	1.823	1.829	1.910	0.062
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.542	0.543	0.525	0.521	0.512	0.509	0.502	0.500	0.504	0.503	0.501	0.512	0.515	0.519	0.531	0.527	0.527	0.527	0.526	0.518	0.013
S2	0.128	0.128	0.128	0.128	0.129	0.130	0.128	0.129	0.129	0.126	0.127	0.128	0.126	0.126	0.124	0.124	0.123	0.123	0.122	0.127	0.002
K1	0.153	0.160	0.164	0.169	0.175	0.181	0.183	0.187	0.191	0.188	0.181	0.173	0.164	0.154	0.148	0.144	0.140	0.143	0.146	0.165	0.017
O1	0.082	0.086	0.089	0.095	0.099	0.106	0.110	0.117	0.119	0.115	0.107	0.098	0.089	0.080	0.076	0.074	0.074	0.075	0.076	0.093	0.016
MSF	0.009	0.008	0.023	0.003	0.012	0.013	0.010	0.023	0.002	0.009	0.016	0.008	0.003	0.010	0.010	0.010	0.011	0.010	0.007	0.010	0.006
z0	0.031	-0.018	-0.005	-0.037	0.002	-0.032	-0.024	-0.004	0.000	0.043	0.023	0.035	0.048	0.037	0.021	0.080	0.055	0.028	0.035	0.017	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	357.998	358.283	358.774	359.150	359.181	358.657	357.136	356.513	355.350	356.079	355.690	354.828	354.692	354.567	355.037	356.244	356.508	356.901	357.554	356.797	1.557
S2	270.114	269.912	269.194	268.736	269.644	269.730	268.495	270.192	269.613	271.207	270.613	269.078	270.015	269.612	269.767	269.439	269.873	269.631	269.832	269.721	0.615
K1	127.044	129.341	128.935	129.035	127.535	127.335	123.955	121.220	118.193	114.880	111.711	110.616	109.755	109.910	112.186	117.197	119.958	123.191	126.096	120.426	7.195
O1	187.632	184.641	184.672	184.449	185.811	185.887	189.260	191.978	195.799	201.293	207.031	207.216	209.261	207.417	203.818	199.380	195.136	189.153	188.379	194.643	8.986
MSF	309.986	336.647	312.151	152.686	29.157	99.529	319.214	77.648	20.076	106.446	280.867	82.299	76.668	20.917	262.398	329.493	317.891	15.962	182.636	175.404	124.741
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.083	0.075	0.080	0.088	0.085	0.079	0.076	0.082	0.088	0.072	0.085	0.079	0.078	0.070	0.063	0.068	0.089	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.5	98.2	97.2	98.9	95.1	95.0	98.9	99.1	98.0	95.4	95.4	89.1	91.9	91.4	95.7	85.6	92.0	96.0	95.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.16	04/06/2008 21:00	±0.19	2.4
Lowest Astronomical Tide (LAT)	-0.94	09/09/2014 02:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A127

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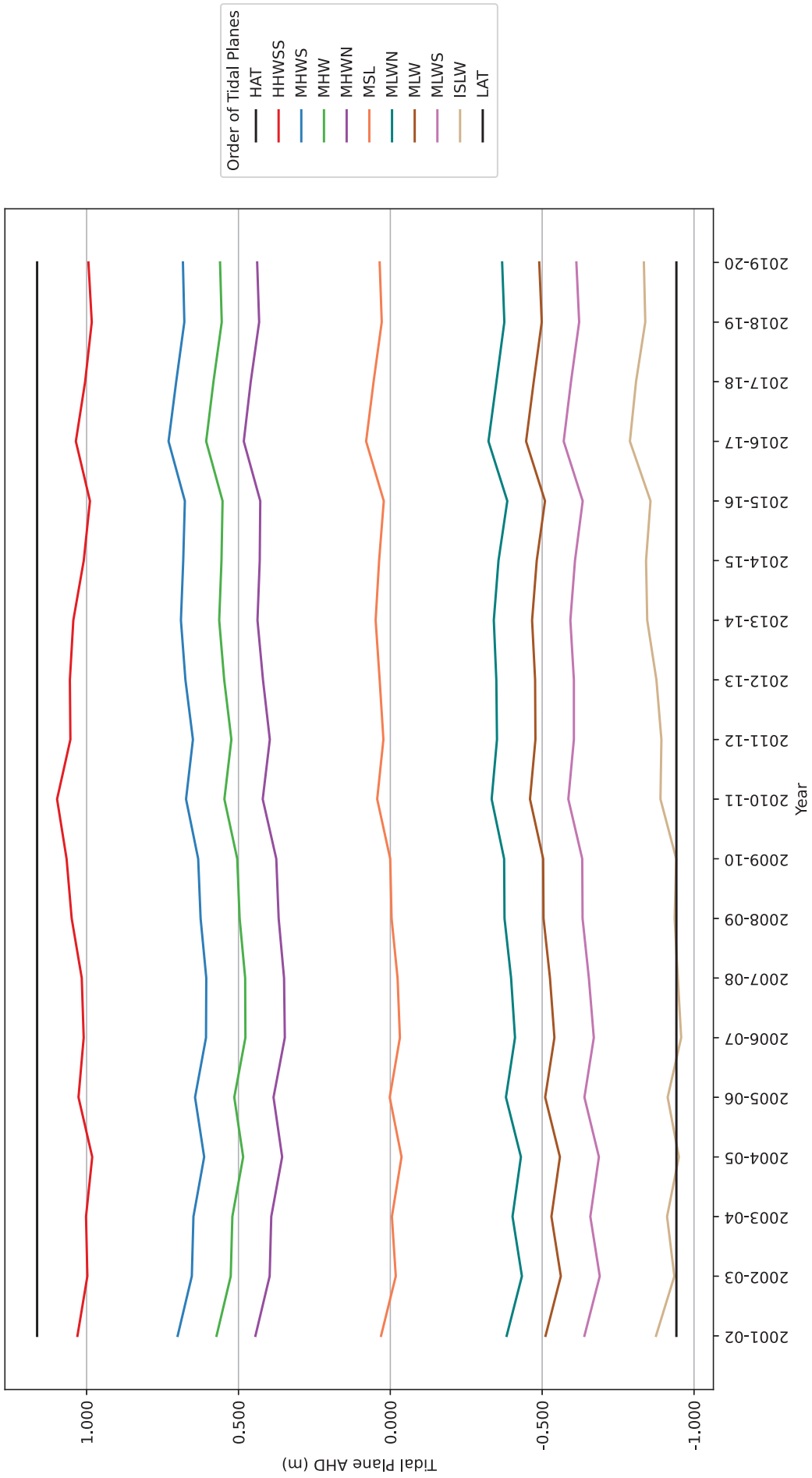


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Stockton Bridge

MHL2786

Figure
A127

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Hexham Bridge

RECORDING STATION: **Hunter River at Hexham Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210448

ZONE: 56
EASTING: 376568
NORTHING: 6368156

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.053	0.993	1.010	0.975	1.038	1.008	1.067	1.072	1.067	1.126	1.102	1.056	1.031	1.018	0.986	1.030	0.991	0.967	0.991	1.031	0.044
MHWS	0.732	0.661	0.667	0.621	0.668	0.618	0.671	0.659	0.653	0.709	0.707	0.688	0.688	0.702	0.688	0.738	0.702	0.675	0.687	0.681	0.032
MHW	0.623	0.555	0.560	0.513	0.561	0.514	0.561	0.556	0.545	0.601	0.600	0.583	0.583	0.599	0.589	0.635	0.601	0.576	0.588	0.576	0.032
MHWN	0.514	0.450	0.453	0.406	0.453	0.410	0.451	0.454	0.437	0.493	0.493	0.479	0.479	0.497	0.491	0.532	0.500	0.478	0.489	0.471	0.033
MSL	0.102	0.043	0.057	0.016	0.076	0.041	0.081	0.079	0.069	0.118	0.122	0.102	0.099	0.115	0.101	0.141	0.106	0.089	0.101	0.087	0.031
MLWN	-0.311	-0.363	-0.338	-0.373	-0.302	-0.328	-0.290	-0.296	-0.300	-0.256	-0.250	-0.275	-0.281	-0.268	-0.288	-0.251	-0.288	-0.301	-0.288	-0.297	0.034
MLW	-0.420	-0.469	-0.446	-0.481	-0.409	-0.432	-0.400	-0.399	-0.408	-0.364	-0.357	-0.379	-0.385	-0.370	-0.387	-0.353	-0.389	-0.399	-0.387	-0.402	0.035
MLWS	-0.528	-0.575	-0.553	-0.588	-0.517	-0.536	-0.510	-0.501	-0.516	-0.473	-0.464	-0.483	-0.490	-0.472	-0.486	-0.456	-0.490	-0.498	-0.486	-0.506	0.036
ISLW	-0.758	-0.812	-0.798	-0.841	-0.781	-0.815	-0.793	-0.796	-0.811	-0.770	-0.746	-0.746	-0.735	-0.698	-0.698	-0.665	-0.696	-0.707	-0.703	-0.756	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.824	0.813	0.791	0.779	0.755	0.738	0.741	0.750	0.737	0.749	0.743	0.754	0.760	0.765	0.778	0.783	0.787	0.778	0.777	0.769	0.025
MR	1.042	1.024	1.006	0.994	0.970	0.946	0.961	0.955	0.953	0.966	0.957	0.962	0.969	0.970	0.976	0.988	0.989	0.975	0.975	0.978	0.025
MSR	1.260	1.236	1.220	1.209	1.185	1.153	1.181	1.160	1.169	1.182	1.172	1.171	1.177	1.174	1.174	1.194	1.191	1.173	1.174	1.187	0.027
R	1.810	1.805	1.807	1.816	1.819	1.823	1.860	1.868	1.877	1.895	1.849	1.803	1.765	1.716	1.684	1.695	1.688	1.674	1.693	1.787	0.073
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.521	0.512	0.503	0.497	0.485	0.473	0.481	0.477	0.477	0.483	0.479	0.481	0.484	0.485	0.488	0.494	0.495	0.488	0.488	0.489	0.012
S2	0.109	0.106	0.107	0.108	0.107	0.104	0.110	0.102	0.108	0.108	0.107	0.104	0.104	0.102	0.099	0.103	0.101	0.099	0.099	0.105	0.004
K1	0.146	0.150	0.155	0.157	0.165	0.171	0.173	0.176	0.178	0.180	0.173	0.163	0.154	0.144	0.137	0.135	0.133	0.134	0.138	0.156	0.016
O1	0.084	0.087	0.090	0.096	0.099	0.108	0.110	0.118	0.117	0.117	0.109	0.100	0.091	0.082	0.076	0.074	0.074	0.075	0.079	0.094	0.016
MSF	0.023	0.024	0.040	0.015	0.017	0.005	0.026	0.006	0.024	0.016	0.031	0.014	0.018	0.019	0.030	0.027	0.029	0.019	0.027	0.022	0.009
z0	0.102	0.043	0.057	0.016	0.076	0.041	0.081	0.079	0.069	0.118	0.122	0.102	0.099	0.115	0.101	0.141	0.106	0.089	0.101	0.087	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	20.675	22.968	23.250	23.731	24.445	24.433	19.119	19.098	18.234	17.285	16.031	17.779	17.942	18.933	19.062	19.718	21.586	23.173	24.055	20.606	2.732
S2	297.421	300.632	299.104	298.668	301.252	301.846	296.619	295.924	297.458	298.619	296.305	297.060	299.142	300.654	299.933	297.944	300.046	301.920	301.455	299.053	1.936
K1	143.825	148.046	147.238	147.011	145.891	147.250	141.161	137.887	136.113	131.628	129.146	128.287	127.799	129.903	131.916	135.821	139.912	144.066	146.498	138.916	7.395
O1	206.316	204.792	204.644	204.194	205.655	206.335	207.225	210.604	214.487	219.135	225.182	229.338	231.619	229.802	227.460	221.087	217.612	212.886	210.544	215.206	9.691
MSF	293.904	291.435	296.839	267.465	309.796	277.069	287.707	349.139	278.844	271.532	278.716	287.686	282.120	299.569	277.382	304.255	283.993	300.320	262.348	289.480	19.221
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.080	0.077	0.088	0.086	0.081	0.073	0.082	0.079	0.077	0.069	0.087	0.081	0.079	0.069	0.063	0.075	0.088	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.9	99.6	95.3	98.1	96.8	93.2	94.9	88.9	98.0	91.8	87.3	88.2	95.3	88.6	94.3	93.4	92.4	97.1	84.4		

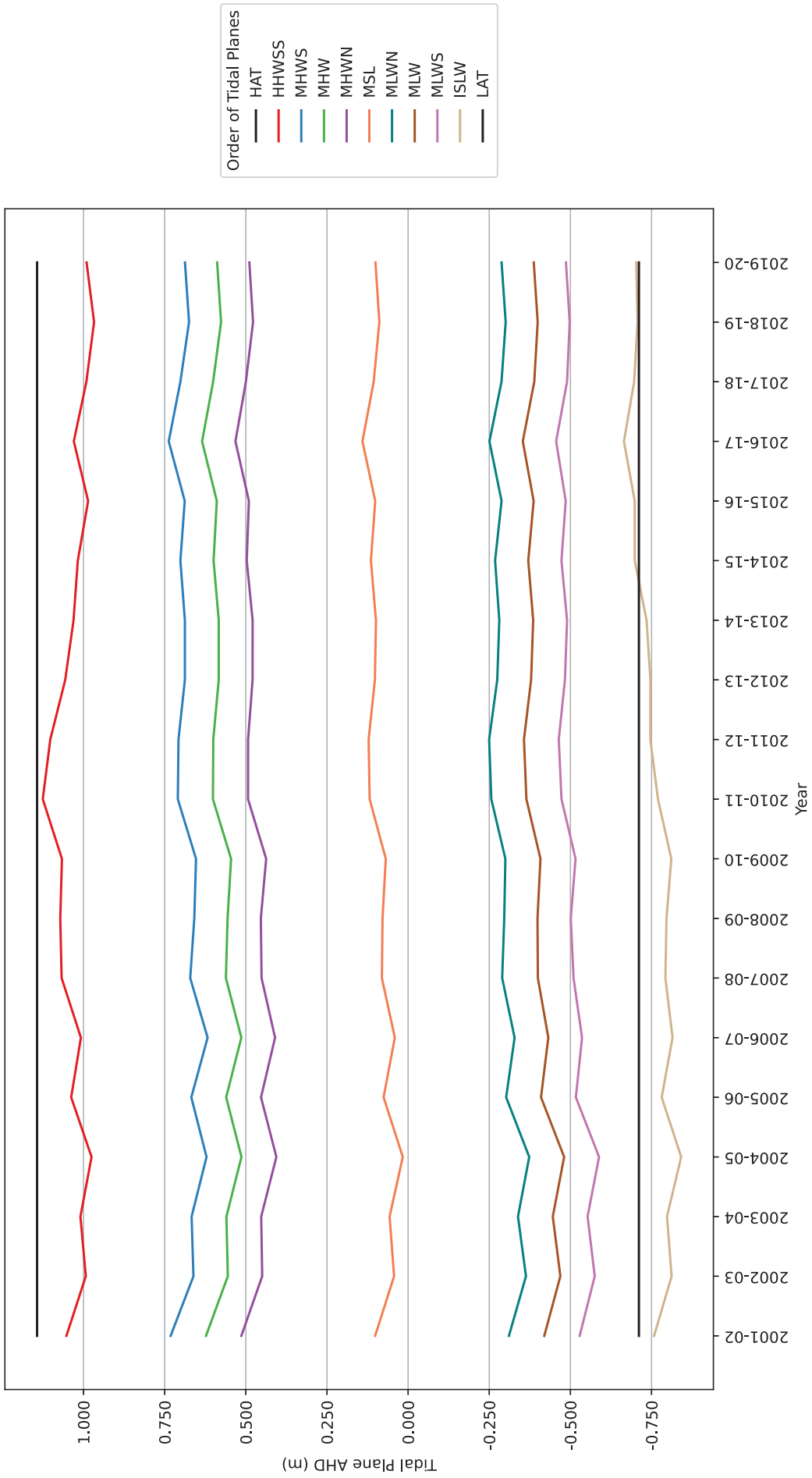
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.14	04/06/2008 21:45	±0.19	4.7
Lowest Astronomical Tide (LAT)	-0.71	28/09/2015 03:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A128

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Hexham Bridge

MHL2786

Figure A128

RECORDING STATION: **Williams River at Raymond Terrace**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210450

ZONE: 56
EASTING: 382357
NORTHING: 6375355

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		1.000	1.061	1.071	1.144	1.084	1.082	1.075	1.047	1.101	1.067	1.032	1.002	0.994	0.954	1.006	0.985	0.996	1.029	1.041	0.049
MHWS		0.677	0.721	0.721	0.773	0.695	0.699	0.676	0.653	0.705	0.693	0.688	0.682	0.695	0.675	0.735	0.711	0.711	0.733	0.703	0.028
MHW		0.578	0.618	0.618	0.669	0.591	0.602	0.585	0.561	0.612	0.605	0.600	0.595	0.606	0.595	0.647	0.622	0.619	0.640	0.609	0.026
MHWN		0.478	0.514	0.515	0.565	0.488	0.506	0.493	0.468	0.519	0.518	0.512	0.507	0.517	0.514	0.560	0.533	0.527	0.547	0.516	0.025
MSL		0.079	0.118	0.121	0.182	0.107	0.152	0.143	0.126	0.168	0.181	0.165	0.156	0.156	0.153	0.199	0.160	0.141	0.160	0.148	0.029
MLWN		-0.320	-0.279	-0.273	-0.201	-0.275	-0.201	-0.207	-0.215	-0.183	-0.155	-0.182	-0.196	-0.204	-0.209	-0.161	-0.213	-0.245	-0.227	-0.219	0.044
MLW		-0.420	-0.382	-0.376	-0.305	-0.378	-0.298	-0.299	-0.308	-0.276	-0.243	-0.270	-0.283	-0.293	-0.289	-0.249	-0.302	-0.337	-0.320	-0.313	0.048
MLWS		-0.519	-0.485	-0.479	-0.410	-0.482	-0.395	-0.391	-0.400	-0.369	-0.330	-0.358	-0.371	-0.382	-0.370	-0.337	-0.391	-0.429	-0.414	-0.406	0.053
ISLW		-0.750	-0.728	-0.729	-0.675	-0.760	-0.668	-0.676	-0.682	-0.652	-0.598	-0.604	-0.599	-0.596	-0.569	-0.531	-0.586	-0.633	-0.625	-0.648	0.066
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.799	0.793	0.789	0.766	0.763	0.707	0.701	0.683	0.703	0.673	0.694	0.703	0.721	0.722	0.721	0.747	0.771	0.774	0.735	0.041
MR		0.998	1.000	0.994	0.974	0.970	0.900	0.884	0.868	0.888	0.848	0.870	0.878	0.899	0.884	0.896	0.924	0.956	0.960	0.922	0.050
MSR		1.196	1.207	1.199	1.183	1.176	1.094	1.067	1.054	1.074	1.023	1.046	1.053	1.078	1.046	1.072	1.102	1.140	1.147	1.109	0.062
R		1.750	1.789	1.801	1.819	1.845	1.750	1.751	1.729	1.754	1.665	1.636	1.601	1.589	1.523	1.537	1.571	1.629	1.654	1.688	0.100
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.499	0.500	0.497	0.487	0.485	0.450	0.442	0.434	0.444	0.424	0.435	0.439	0.450	0.442	0.448	0.462	0.478	0.480	0.461	0.025
S2		0.099	0.103	0.103	0.104	0.103	0.097	0.092	0.093	0.093	0.088	0.088	0.088	0.089	0.081	0.088	0.089	0.092	0.093	0.093	0.007
K1		0.144	0.151	0.154	0.163	0.170	0.164	0.168	0.165	0.168	0.160	0.148	0.140	0.132	0.125	0.123	0.124	0.129	0.132	0.148	0.017
O1		0.087	0.091	0.096	0.103	0.108	0.109	0.117	0.116	0.115	0.108	0.098	0.088	0.081	0.074	0.071	0.071	0.074	0.079	0.094	0.016
MSF		0.032	0.046	0.018	0.026	0.012	0.039	0.018	0.034	0.025	0.037	0.018	0.028	0.027	0.035	0.033	0.037	0.024	0.027	0.029	0.009
z0		0.079	0.118	0.121	0.182	0.107	0.152	0.143	0.126	0.168	0.181	0.165	0.156	0.156	0.153	0.199	0.160	0.141	0.160	0.148	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		41.551	41.293	41.676	41.649	41.474	41.541	41.011	40.429	39.719	41.173	40.486	40.653	40.457	42.251	42.228	42.332	42.408	43.398	41.429	0.898
S2		323.608	321.496	322.603	322.786	323.453	323.542	326.078	325.528	325.679	325.765	325.902	327.125	326.492	328.227	325.240	325.810	325.157	324.442	324.941	1.729
K1		160.112	159.293	158.421	156.374	157.473	157.017	153.350	150.817	147.186	146.172	144.073	142.940	143.907	147.419	152.229	154.636	156.285	158.617	152.573	5.888
O1		217.637	215.964	216.403	216.890	217.068	224.707	227.555	230.813	235.834	243.291	246.678	248.481	245.134	242.795	236.770	232.968	226.152	223.497	230.480	11.477
MSF		290.232	299.061	285.644	306.475	293.499	279.998	287.497	280.690	262.323	276.238	291.721	282.730	299.140	283.347	302.542	284.386	285.741	263.092	286.353	11.903
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.083	0.077	0.089	0.081	0.081	0.081	0.082	0.082	0.084	0.074	0.094	0.078	0.081	0.073	0.066	0.076	0.091	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		99.3	96.6	96.5	88.0	91.3	91.1	93.5	88.4	91.9	84.3	90.0	96.9	85.0	90.9	85.2	90.9	98.3	96.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.17	04/06/2008 22:30	±0.19	26.7
Lowest Astronomical Tide (LAT)	-0.58	08/10/2014 04:15		

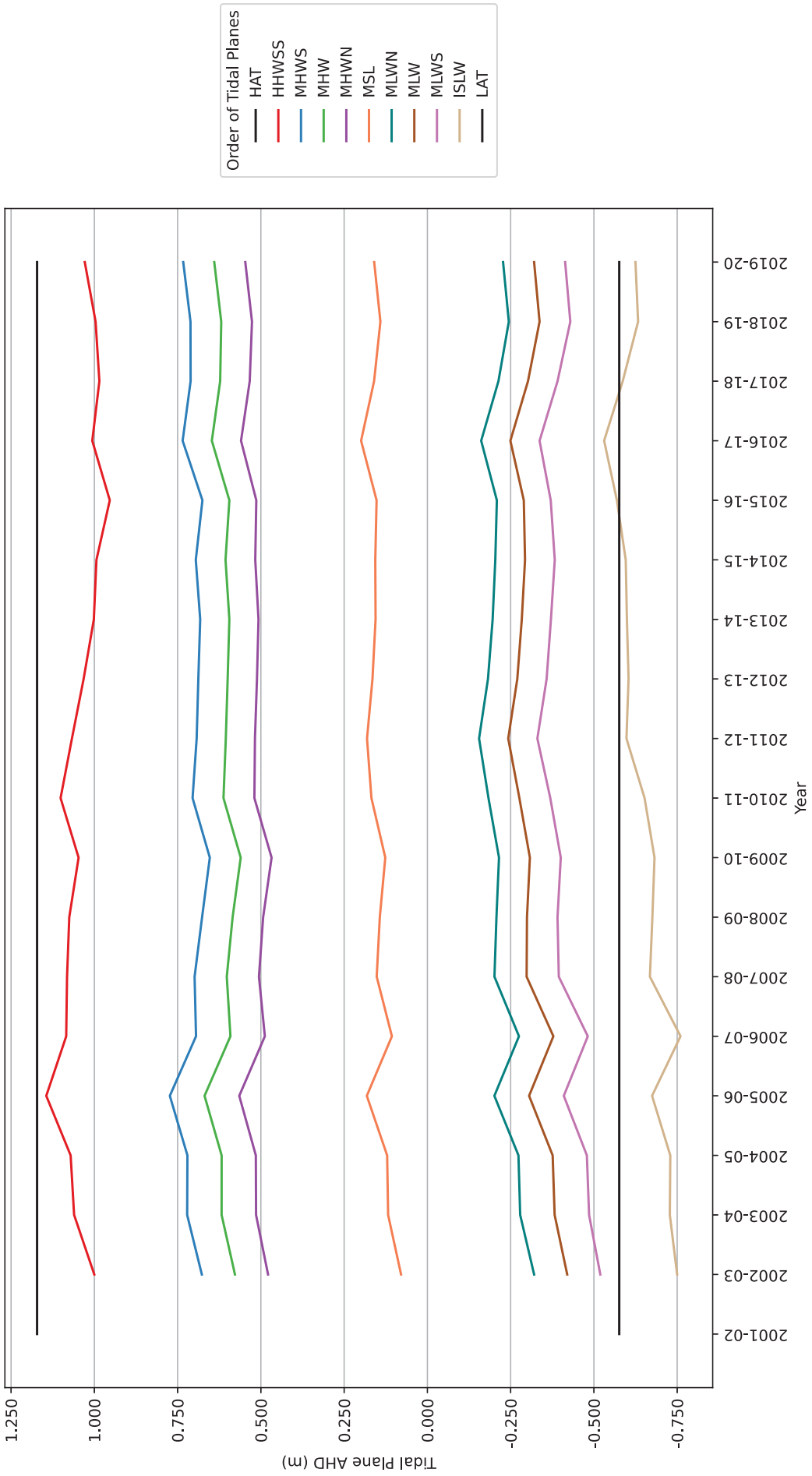
COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Williams River at Raymond Terrace

Table A129

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Williams River at Raymond Terrace

MHL2786

Figure
A129

RECORDING STATION: **Williams River at Seaham** ZONE: 56
DATUM: AUSTRALIAN HEIGHT DATUM EASTING: 381130
AWRC #: 210462 NORTHING: 6385316

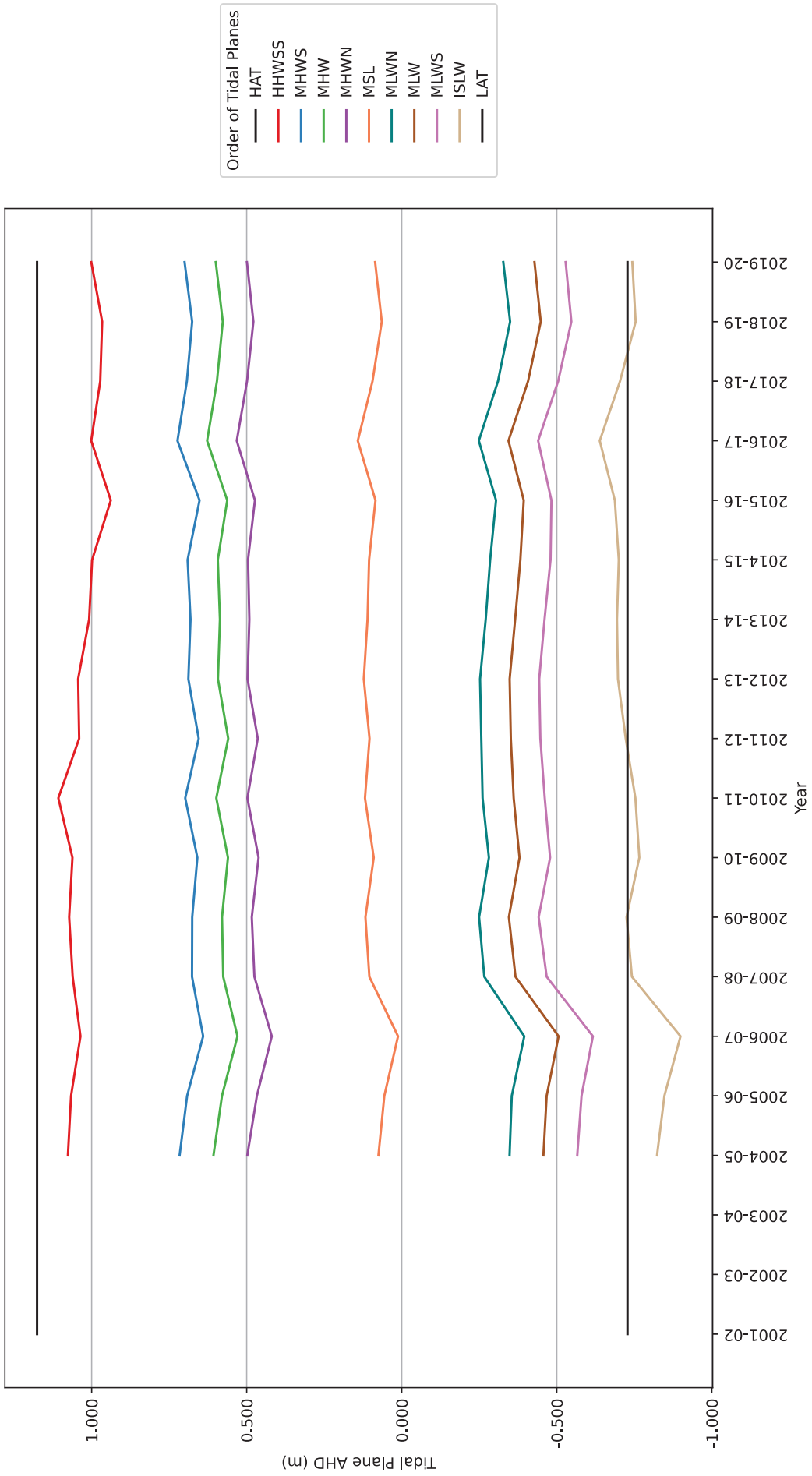
NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Williams River at Seaham

YEAR	2001-02	2002-03*	2003-04*	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.096			1.077	1.066	1.036	1.061	1.072	1.062	1.107	1.040	1.044	1.008	0.999	0.938	1.001	0.972	0.966	1.001	1.032	0.048
MHWS	0.796			0.716	0.692	0.640	0.676	0.676	0.659	0.698	0.655	0.688	0.681	0.691	0.652	0.723	0.693	0.676	0.700	0.689	0.035
MHW	0.692			0.607	0.580	0.530	0.576	0.580	0.560	0.598	0.560	0.593	0.586	0.593	0.563	0.628	0.596	0.577	0.600	0.589	0.035
MHWN	0.588			0.498	0.467	0.419	0.475	0.483	0.462	0.498	0.464	0.497	0.491	0.496	0.473	0.532	0.499	0.478	0.499	0.489	0.035
MSL	0.179			0.075	0.056	0.012	0.104	0.117	0.090	0.119	0.104	0.122	0.110	0.105	0.085	0.142	0.094	0.064	0.086	0.098	0.036
MLWN	-0.230			-0.348	-0.355	-0.395	-0.266	-0.249	-0.281	-0.261	-0.256	-0.253	-0.271	-0.285	-0.304	-0.249	-0.310	-0.349	-0.327	-0.294	0.047
MLW	-0.335			-0.457	-0.467	-0.506	-0.367	-0.345	-0.380	-0.361	-0.352	-0.348	-0.366	-0.382	-0.393	-0.344	-0.407	-0.448	-0.428	-0.393	0.051
MLWS	-0.439			-0.566	-0.580	-0.616	-0.467	-0.442	-0.478	-0.461	-0.447	-0.443	-0.460	-0.480	-0.483	-0.440	-0.504	-0.547	-0.529	-0.493	0.055
ISLW	-0.654			-0.823	-0.847	-0.899	-0.742	-0.725	-0.766	-0.753	-0.722	-0.697	-0.694	-0.700	-0.687	-0.638	-0.704	-0.754	-0.743	-0.738	0.067
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.818			0.846	0.822	0.814	0.741	0.733	0.743	0.758	0.721	0.750	0.762	0.781	0.777	0.781	0.809	0.828	0.827	0.783	0.039
MR	1.027			1.064	1.047	1.036	0.942	0.925	0.940	0.959	0.911	0.941	0.952	0.976	0.956	0.972	1.003	1.025	1.028	0.983	0.047
MSR	1.236			1.282	1.272	1.257	1.144	1.117	1.137	1.159	1.102	1.131	1.142	1.170	1.135	1.163	1.197	1.223	1.229	1.182	0.057
R	1.750			1.900	1.913	1.935	1.803	1.797	1.828	1.861	1.762	1.741	1.702	1.698	1.625	1.640	1.676	1.720	1.745	1.770	0.093
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.513			0.532	0.523	0.518	0.471	0.463	0.470	0.479	0.456	0.470	0.476	0.488	0.478	0.486	0.502	0.513	0.514	0.491	0.024
S2	0.104			0.109	0.112	0.111	0.101	0.096	0.099	0.100	0.095	0.095	0.095	0.097	0.089	0.096	0.097	0.099	0.101	0.100	0.006
K1	0.134			0.158	0.163	0.172	0.165	0.168	0.169	0.172	0.163	0.155	0.144	0.138	0.129	0.125	0.125	0.132	0.135	0.150	0.018
O1	0.081			0.100	0.104	0.111	0.110	0.116	0.118	0.120	0.113	0.099	0.090	0.082	0.075	0.073	0.074	0.076	0.080	0.095	0.017
MSF	0.052			0.019	0.022	0.012	0.043	0.018	0.035	0.028	0.037	0.015	0.026	0.030	0.036	0.034	0.037	0.025	0.027	0.029	0.010
z0	0.179			0.075	0.056	0.012	0.104	0.117	0.090	0.119	0.104	0.122	0.110	0.105	0.085	0.142	0.094	0.064	0.086	0.098	0.036
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	43.590			43.676	43.625	43.704	44.675	43.956	42.750	41.515	43.167	42.554	42.612	42.507	44.477	44.532	44.341	44.536	45.510	43.631	1.016
S2	324.486			325.610	326.127	325.783	328.102	330.447	329.330	328.840	329.703	328.449	330.393	329.618	331.645	328.090	328.042	328.657	327.292	328.271	1.926
K1	158.892			159.919	158.158	159.106	158.634	154.751	152.830	148.464	147.172	145.050	144.382	144.676	148.822	151.673	154.685	157.896	160.132	153.250	5.801
O1	226.033			217.731	217.824	217.246	225.993	228.869	231.879	237.130	244.357	247.336	248.866	245.334	243.700	238.041	232.826	227.158	224.718	232.649	10.676
MSF	283.743			280.002	301.672	273.208	283.321	282.121	283.726	271.493	273.862	272.975	282.980	308.035	284.414	315.710	288.984	289.534	262.572	284.609	13.515
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.065			0.086	0.098	0.091	0.081	0.079	0.078	0.083	0.080	0.089	0.076	0.083	0.080	0.067	0.078	0.094	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	51.3	40.9	25.9	84.1	96.6	72.6	88.6	91.1	97.0	88.9	83.7	86.9	92.8	87.6	93.6	81.0	95.0	98.7	96.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.18	04/06/2008 22:45	±0.20	11.4
Lowest Astronomical Tide (LAT)	-0.73	08/10/2014 04:15		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Williams River at Seaham

MHL2786

Figure A130

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Green Rocks

RECORDING STATION: **Hunter River at Green Rocks**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210432

ZONE: 56
EASTING: 377459
NORTHING: 6378142

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.957	0.929	0.980	0.950	1.015	0.975	1.030	0.975	0.976	1.050	0.999	0.987	0.945	0.927	0.892	0.953	0.911	0.912	0.972	0.965	0.041
MHWS	0.662	0.620	0.654	0.612	0.660	0.597	0.658	0.595	0.596	0.666	0.629	0.647	0.636	0.638	0.621	0.692	0.651	0.640	0.685	0.640	0.028
MHW	0.579	0.534	0.564	0.521	0.566	0.503	0.575	0.516	0.514	0.584	0.550	0.570	0.558	0.556	0.549	0.614	0.573	0.559	0.598	0.557	0.029
MHWN	0.496	0.448	0.474	0.429	0.472	0.410	0.492	0.437	0.433	0.501	0.472	0.492	0.479	0.475	0.478	0.537	0.494	0.478	0.511	0.474	0.031
MSL	0.132	0.072	0.099	0.053	0.104	0.043	0.160	0.110	0.107	0.167	0.155	0.162	0.143	0.130	0.138	0.198	0.145	0.115	0.137	0.125	0.040
MLWN	-0.232	-0.304	-0.275	-0.323	-0.264	-0.324	-0.172	-0.217	-0.219	-0.167	-0.163	-0.167	-0.193	-0.215	-0.201	-0.140	-0.205	-0.247	-0.237	-0.225	0.054
MLW	-0.315	-0.390	-0.365	-0.415	-0.358	-0.417	-0.256	-0.297	-0.301	-0.249	-0.241	-0.245	-0.271	-0.297	-0.273	-0.217	-0.283	-0.328	-0.324	-0.308	0.059
MLWS	-0.399	-0.476	-0.456	-0.506	-0.452	-0.510	-0.339	-0.376	-0.383	-0.332	-0.319	-0.323	-0.349	-0.378	-0.345	-0.295	-0.362	-0.409	-0.411	-0.390	0.064
ISLW	-0.609	-0.697	-0.688	-0.748	-0.706	-0.780	-0.605	-0.647	-0.654	-0.606	-0.584	-0.566	-0.571	-0.585	-0.538	-0.482	-0.547	-0.604	-0.616	-0.623	0.075
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.728	0.752	0.749	0.752	0.736	0.734	0.664	0.654	0.652	0.667	0.635	0.659	0.673	0.690	0.679	0.677	0.699	0.725	0.748	0.699	0.040
MR	0.895	0.924	0.930	0.935	0.924	0.920	0.831	0.813	0.815	0.833	0.792	0.815	0.829	0.853	0.822	0.832	0.856	0.887	0.922	0.865	0.049
MSR	1.061	1.095	1.110	1.118	1.111	1.107	0.997	0.971	0.979	0.999	0.948	0.970	0.985	1.016	0.966	0.986	1.013	1.049	1.096	1.030	0.059
R	1.566	1.626	1.668	1.698	1.721	1.755	1.635	1.622	1.630	1.656	1.583	1.553	1.516	1.512	1.431	1.434	1.458	1.516	1.588	1.588	0.094
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.447	0.462	0.465	0.468	0.462	0.460	0.415	0.406	0.408	0.417	0.396	0.407	0.414	0.427	0.411	0.416	0.428	0.443	0.461	0.432	0.025
S2	0.083	0.086	0.090	0.091	0.094	0.093	0.083	0.079	0.082	0.083	0.078	0.078	0.078	0.081	0.072	0.077	0.078	0.081	0.087	0.083	0.006
K1	0.130	0.136	0.144	0.147	0.154	0.163	0.157	0.158	0.158	0.161	0.154	0.144	0.134	0.128	0.121	0.116	0.116	0.123	0.128	0.141	0.016
O1	0.081	0.085	0.089	0.095	0.100	0.107	0.109	0.114	0.114	0.112	0.111	0.099	0.087	0.079	0.073	0.070	0.070	0.072	0.077	0.092	0.016
MSF	0.042	0.036	0.051	0.026	0.029	0.016	0.050	0.027	0.042	0.030	0.039	0.015	0.031	0.028	0.039	0.037	0.040	0.028	0.032	0.034	0.010
z0	0.132	0.072	0.099	0.053	0.104	0.043	0.160	0.110	0.107	0.167	0.155	0.162	0.143	0.130	0.138	0.198	0.145	0.115	0.137	0.125	0.040
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	57.141	55.541	55.128	54.567	53.712	53.081	56.595	55.724	53.860	53.526	56.410	55.193	55.142	54.193	57.518	57.489	56.625	55.665	55.098	55.379	1.345
S2	340.150	339.183	336.464	336.511	336.880	335.976	340.123	341.433	340.143	339.979	343.278	342.655	343.772	342.360	345.224	342.182	342.151	340.597	338.007	340.372	2.681
K1	170.178	171.335	169.826	168.387	166.199	166.577	168.482	163.968	161.306	157.457	156.687	155.105	153.711	153.958	159.651	162.301	165.423	166.664	167.156	163.388	5.773
O1	233.662	228.995	226.754	226.701	226.927	226.492	235.822	237.531	241.159	246.838	254.743	258.042	258.934	255.184	253.483	248.539	243.912	236.532	233.097	240.703	11.525
MSF	280.522	290.738	302.212	270.984	296.938	285.291	280.968	296.058	283.632	278.846	274.978	273.363	282.117	303.132	282.164	301.127	287.949	287.755	272.922	285.879	10.152
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.089	0.079	0.085	0.100	0.083	0.080	0.091	0.084	0.079	0.079	0.093	0.075	0.092	0.077	0.066	0.073	0.089	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	94.8	99.1	96.4	97.6	97.7	92.0	86.0	91.7	98.7	84.9	81.7	87.1	93.7	89.7	93.2	86.7	95.5	96.7	97.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.07	04/06/2008 23:00	±0.21	13.7
Lowest Astronomical Tide (LAT)	-0.56	08/10/2014 04:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A131

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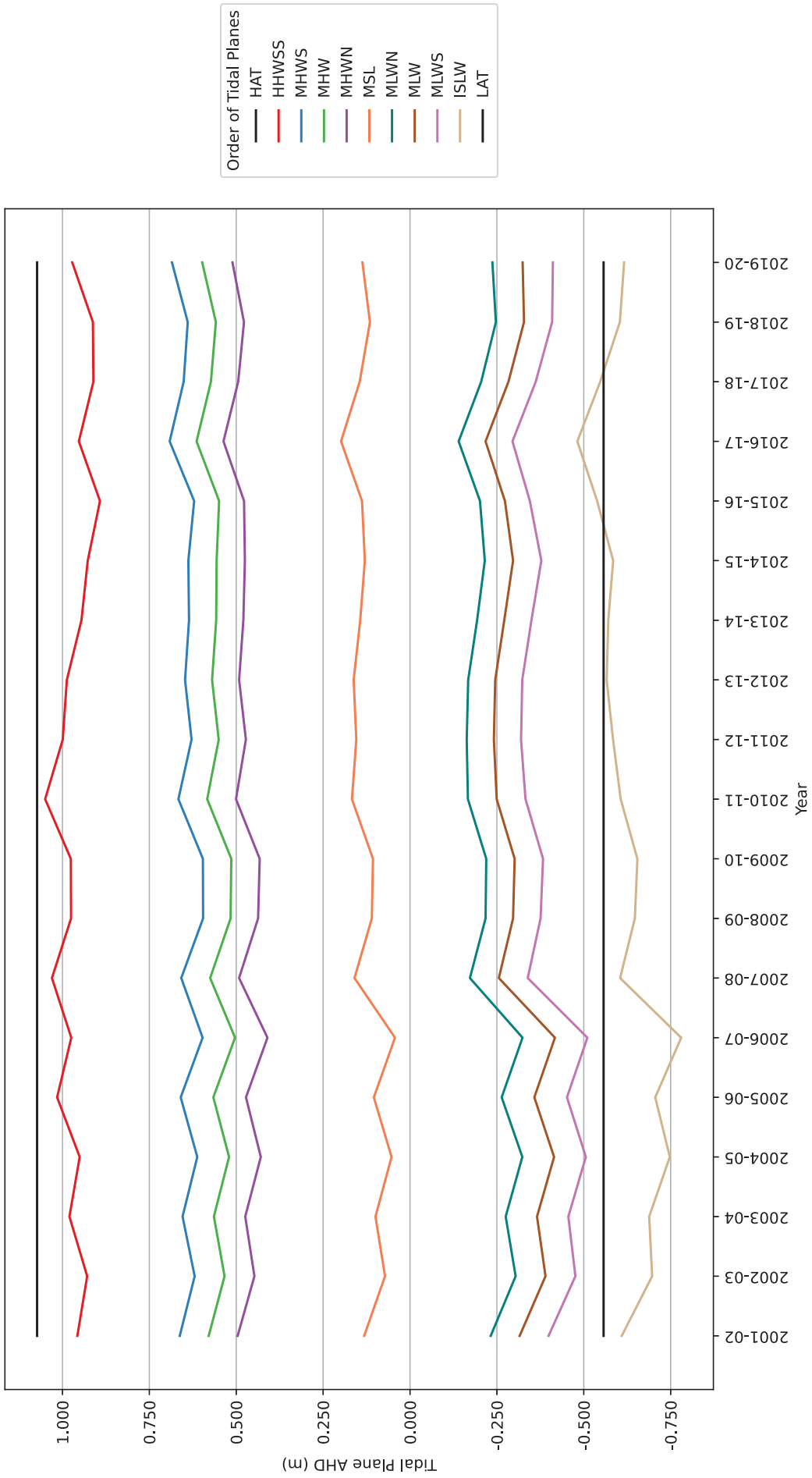


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Green Rocks

MHL2786

Figure A131

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Morpeth

RECORDING STATION: **Hunter River at Morpeth**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210430

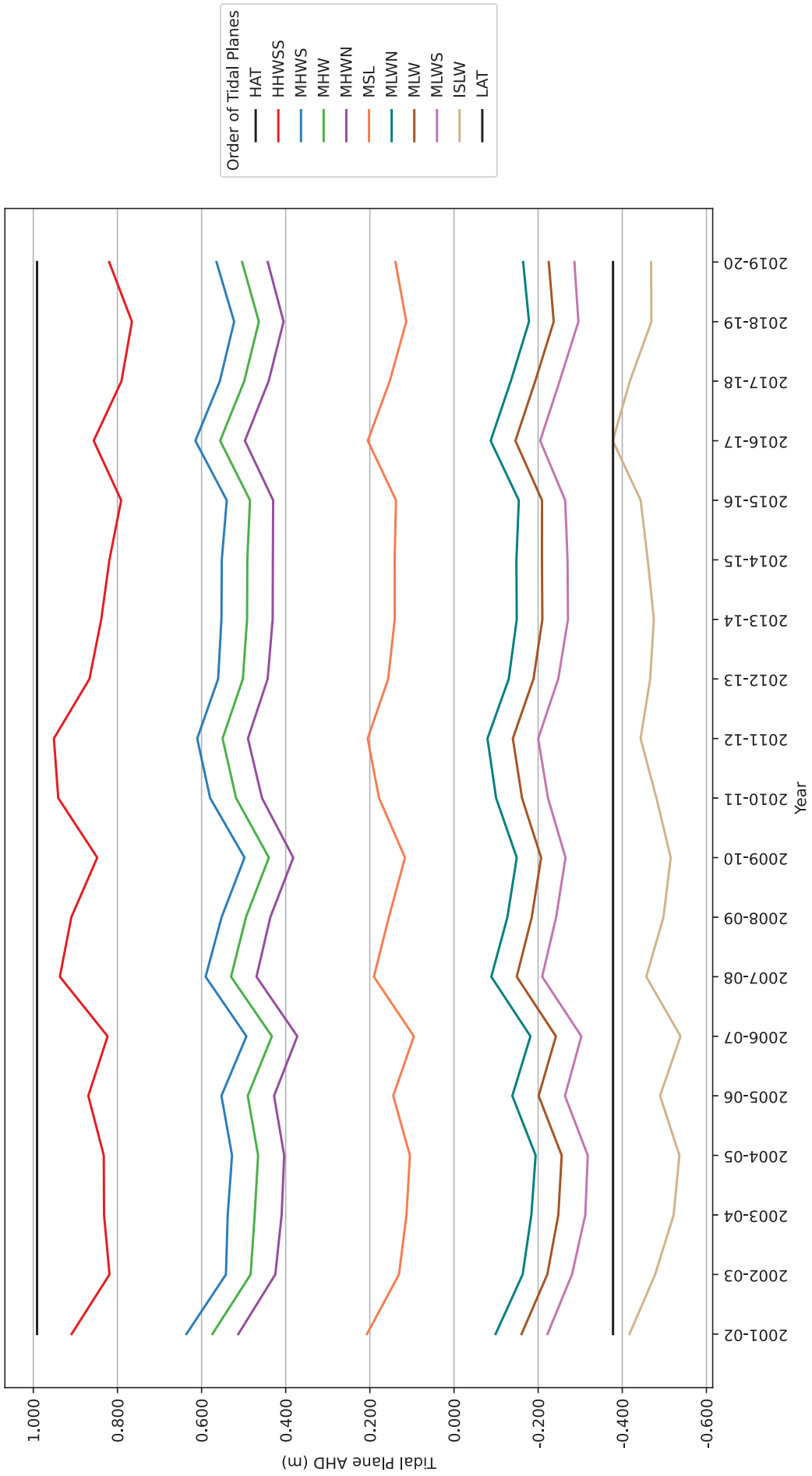
ZONE: 56
EASTING: 371590
NORTHING: 6378484

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.909	0.819	0.832	0.832	0.869	0.823	0.937	0.910	0.848	0.941	0.951	0.867	0.838	0.819	0.791	0.856	0.790	0.765	0.820	0.854	0.054
MHWS	0.636	0.542	0.538	0.528	0.553	0.493	0.590	0.552	0.498	0.580	0.610	0.561	0.553	0.552	0.540	0.615	0.557	0.523	0.564	0.557	0.037
MHW	0.574	0.483	0.474	0.466	0.490	0.433	0.530	0.494	0.440	0.518	0.550	0.502	0.492	0.491	0.485	0.556	0.499	0.464	0.504	0.497	0.037
MHWN	0.513	0.425	0.410	0.404	0.428	0.372	0.470	0.437	0.382	0.456	0.490	0.443	0.431	0.431	0.430	0.497	0.441	0.405	0.443	0.437	0.037
MSL	0.207	0.131	0.113	0.105	0.145	0.095	0.190	0.155	0.116	0.178	0.205	0.156	0.141	0.141	0.138	0.205	0.153	0.113	0.139	0.149	0.035
MLWN	-0.099	-0.163	-0.184	-0.194	-0.139	-0.182	-0.089	-0.127	-0.149	-0.100	-0.080	-0.130	-0.149	-0.148	-0.154	-0.087	-0.135	-0.178	-0.164	-0.140	0.035
MLW	-0.161	-0.222	-0.248	-0.256	-0.201	-0.242	-0.149	-0.185	-0.207	-0.162	-0.140	-0.189	-0.210	-0.209	-0.209	-0.146	-0.193	-0.237	-0.225	-0.200	0.035
MLWS	-0.222	-0.280	-0.312	-0.318	-0.264	-0.303	-0.210	-0.243	-0.265	-0.223	-0.200	-0.248	-0.271	-0.270	-0.264	-0.205	-0.251	-0.296	-0.286	-0.260	0.036
ISLW	-0.417	-0.478	-0.522	-0.536	-0.490	-0.538	-0.457	-0.498	-0.515	-0.481	-0.444	-0.466	-0.475	-0.461	-0.444	-0.377	-0.418	-0.469	-0.468	-0.471	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.611	0.588	0.594	0.598	0.566	0.554	0.558	0.564	0.531	0.556	0.569	0.573	0.580	0.579	0.584	0.584	0.576	0.583	0.607	0.577	0.019
MR	0.735	0.705	0.722	0.722	0.691	0.675	0.679	0.679	0.647	0.680	0.690	0.691	0.702	0.700	0.694	0.702	0.692	0.701	0.729	0.697	0.021
MSR	0.858	0.823	0.850	0.846	0.817	0.796	0.800	0.795	0.763	0.803	0.811	0.808	0.824	0.822	0.804	0.820	0.808	0.818	0.851	0.817	0.023
R	1.326	1.297	1.354	1.368	1.359	1.362	1.394	1.407	1.363	1.422	1.395	1.333	1.313	1.280	1.235	1.234	1.208	1.235	1.288	1.325	0.065
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.367	0.353	0.361	0.361	0.346	0.338	0.340	0.340	0.324	0.340	0.345	0.345	0.351	0.350	0.347	0.351	0.346	0.350	0.364	0.348	0.010
S2	0.062	0.059	0.064	0.062	0.063	0.060	0.060	0.058	0.058	0.062	0.060	0.059	0.061	0.061	0.055	0.059	0.058	0.059	0.061	0.060	0.002
K1	0.116	0.119	0.127	0.129	0.134	0.139	0.144	0.146	0.142	0.149	0.142	0.128	0.122	0.115	0.109	0.106	0.102	0.107	0.111	0.126	0.015
O1	0.079	0.078	0.083	0.088	0.092	0.097	0.104	0.110	0.108	0.109	0.102	0.091	0.082	0.075	0.070	0.067	0.064	0.066	0.071	0.086	0.015
MSF	0.049	0.046	0.058	0.039	0.040	0.027	0.061	0.037	0.048	0.045	0.048	0.022	0.038	0.040	0.045	0.039	0.047	0.036	0.036	0.042	0.009
z0	0.207	0.131	0.113	0.105	0.145	0.095	0.190	0.155	0.116	0.178	0.205	0.156	0.141	0.141	0.138	0.205	0.153	0.113	0.139	0.149	0.035
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	88.162	90.058	89.253	89.140	88.892	90.262	87.881	86.790	86.830	85.235	84.791	84.222	83.278	84.018	85.548	85.462	86.858	86.769	85.886	86.807	2.094
S2	13.717	16.519	13.701	13.856	15.144	16.295	15.392	16.391	15.669	15.933	14.099	14.730	15.197	15.805	16.865	12.628	14.248	13.363	11.316	14.783	1.465
K1	190.697	195.356	193.446	192.235	191.665	192.555	189.115	184.730	183.559	178.729	176.706	175.166	172.977	173.571	178.592	181.116	186.149	188.329	188.720	184.916	7.250
O1	253.675	251.856	249.893	249.721	251.256	251.616	256.181	258.026	262.184	267.028	271.178	274.786	276.451	275.012	270.775	266.014	262.841	256.762	253.227	260.973	9.345
MSF	288.517	290.302	301.076	274.597	290.005	296.661	287.421	295.689	285.101	286.217	275.362	293.861	285.624	302.909	276.790	293.825	289.008	286.757	277.114	288.255	8.191
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.085	0.080	0.090	0.098	0.081	0.086	0.088	0.076	0.085	0.085	0.104	0.082	0.090	0.080	0.067	0.084	0.090	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	83.4	98.1	96.1	96.4	97.8	91.3	81.5	87.1	99.0	84.0	71.7	81.1	93.1	86.1	93.6	82.7	98.2	99.3	94.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.99	03/06/2004 23:30	±0.20	27.8
Lowest Astronomical Tide (LAT)	-0.38	16/10/2013 03:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Morpeth

MHL2786

Figure A132

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at McKimms Corner

RECORDING STATION: **Hunter River at McKimms Corner**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210455

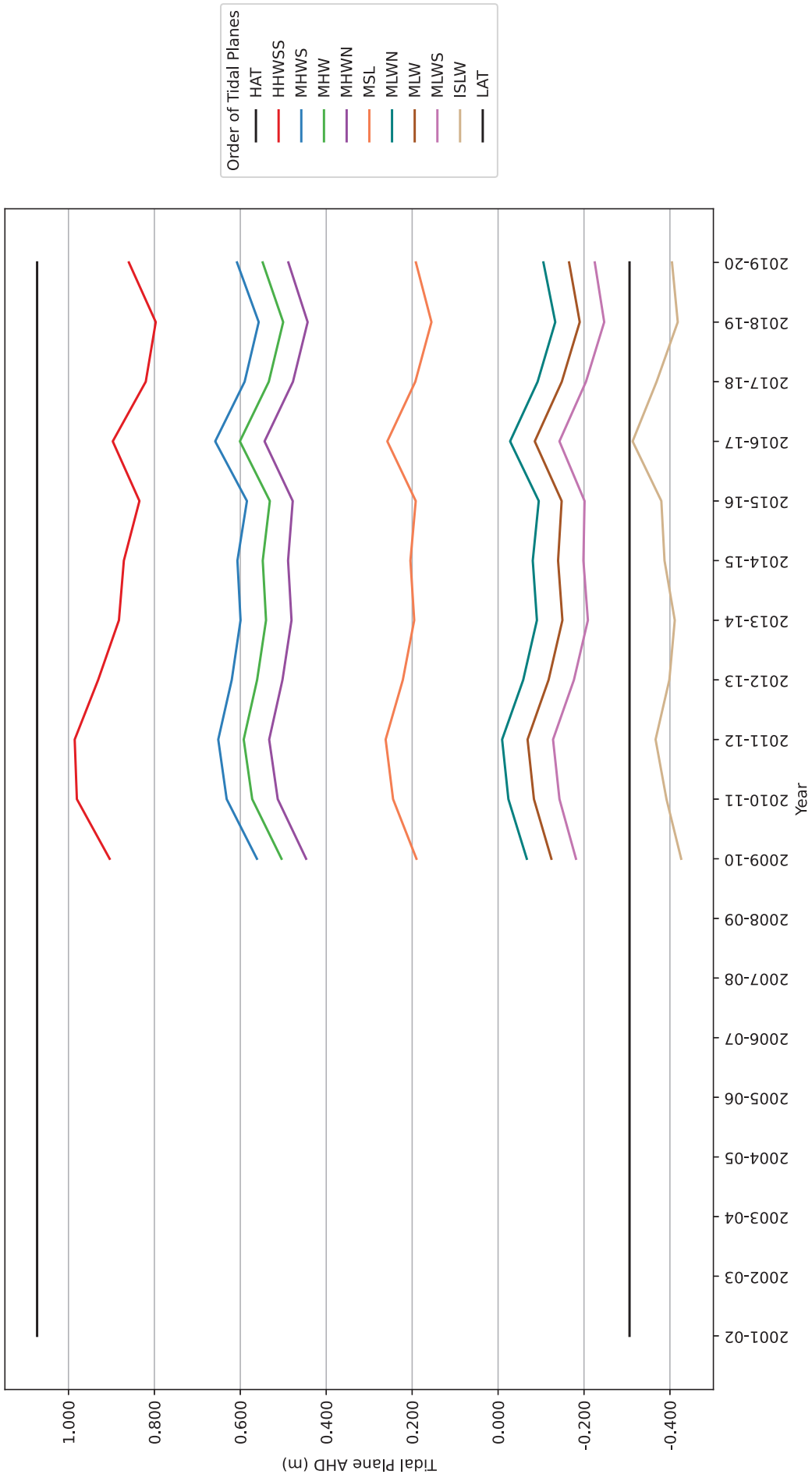
ZONE: 56
EASTING: 368191
NORTHING: 6378929

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS									0.904	0.980	0.986	0.931	0.883	0.871	0.835	0.897	0.820	0.797	0.859	0.888	0.061
MHWS									0.561	0.632	0.651	0.620	0.599	0.607	0.585	0.658	0.590	0.557	0.608	0.606	0.033
MHW									0.504	0.572	0.592	0.561	0.540	0.548	0.531	0.601	0.534	0.500	0.548	0.548	0.032
MHWN									0.447	0.513	0.533	0.502	0.481	0.489	0.478	0.544	0.477	0.443	0.488	0.490	0.031
MSL									0.190	0.244	0.262	0.222	0.195	0.204	0.192	0.258	0.193	0.155	0.191	0.210	0.033
MLWN									-0.067	-0.024	-0.009	-0.059	-0.090	-0.081	-0.095	-0.028	-0.092	-0.133	-0.106	-0.071	0.038
MLW									-0.124	-0.083	-0.069	-0.118	-0.150	-0.140	-0.148	-0.085	-0.148	-0.190	-0.165	-0.129	0.038
MLWS									-0.181	-0.143	-0.128	-0.177	-0.209	-0.199	-0.201	-0.143	-0.205	-0.247	-0.225	-0.187	0.037
ISLW									-0.426	-0.392	-0.367	-0.399	-0.411	-0.387	-0.380	-0.313	-0.369	-0.418	-0.405	-0.388	0.031
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR									0.514	0.537	0.542	0.560	0.571	0.570	0.573	0.572	0.569	0.576	0.594	0.562	0.022
MR									0.628	0.656	0.661	0.678	0.690	0.687	0.679	0.686	0.682	0.690	0.713	0.677	0.022
MSR									0.743	0.775	0.779	0.796	0.808	0.805	0.786	0.801	0.795	0.804	0.833	0.793	0.023
R									1.330	1.372	1.352	1.330	1.294	1.258	1.215	1.210	1.189	1.215	1.264	1.275	0.064
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2									0.314	0.328	0.330	0.339	0.345	0.344	0.340	0.343	0.341	0.345	0.357	0.339	0.011
S2									0.057	0.059	0.059	0.059	0.059	0.059	0.053	0.057	0.056	0.057	0.060	0.058	0.002
K1									0.138	0.142	0.138	0.130	0.120	0.114	0.109	0.104	0.101	0.106	0.109	0.119	0.015
O1									0.107	0.107	0.101	0.092	0.083	0.075	0.070	0.066	0.063	0.066	0.071	0.082	0.017
MSF									0.053	0.047	0.051	0.019	0.040	0.038	0.047	0.039	0.046	0.037	0.035	0.041	0.009
z0									0.190	0.244	0.262	0.222	0.195	0.204	0.192	0.258	0.193	0.155	0.191	0.210	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2									91.246	90.316	89.838	90.040	89.895	90.900	92.478	92.466	93.908	94.016	93.225	91.666	1.612
S2									24.056	23.086	21.570	22.619	23.571	24.347	25.440	21.967	22.871	22.103	19.971	22.873	1.493
K1									185.513	182.869	180.378	178.670	177.715	178.603	183.603	185.805	191.591	193.127	193.854	184.703	5.914
O1									265.554	270.055	275.253	278.540	280.809	279.929	276.366	270.297	267.735	261.625	258.409	271.325	7.527
MSF									291.124	288.333	266.165	286.319	283.571	301.195	278.381	296.143	290.011	288.048	280.830	286.374	9.319
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
									0.080	0.086	0.093	0.107	0.083	0.091	0.079	0.072	0.082	0.093	0.080		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	13.4	4.5	5.4	7.2	13.6	4.0	23.9	15.2	67.6	80.5	67.9	86.9	95.2	89.0	91.5	86.9	98.6	99.4	95.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.07	03/06/2004 23:45	±0.20	28.4
Lowest Astronomical Tide (LAT)	-0.31	27/10/2012 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at McKimms Corner

MHL2786

Figure A133

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Belmore Bridge

RECORDING STATION: **Hunter River at Belmore Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210458

ZONE: 56
EASTING: 364492
NORTHING: 6377780

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.854	0.765	0.808	0.762	0.795	0.728	0.865	0.825	0.823	0.909	0.934	0.875	0.828	0.817	0.773	0.852	0.762	0.740	0.790	0.816	0.056
MHWS	0.620	0.515	0.544	0.485	0.504	0.427	0.568	0.509	0.504	0.585	0.628	0.587	0.564	0.567	0.544	0.627	0.541	0.513	0.551	0.546	0.052
MHW	0.567	0.466	0.489	0.433	0.451	0.377	0.522	0.466	0.457	0.534	0.576	0.537	0.515	0.516	0.498	0.576	0.491	0.463	0.500	0.497	0.051
MHWN	0.513	0.417	0.434	0.382	0.399	0.327	0.475	0.423	0.410	0.483	0.524	0.487	0.466	0.465	0.453	0.526	0.441	0.413	0.448	0.447	0.051
MSL	0.302	0.185	0.199	0.142	0.161	0.097	0.290	0.213	0.195	0.261	0.311	0.244	0.219	0.218	0.215	0.277	0.184	0.157	0.183	0.213	0.057
MLWN	0.091	-0.046	-0.037	-0.097	-0.076	-0.133	0.105	0.003	-0.020	0.039	0.098	0.002	-0.027	-0.029	-0.023	0.028	-0.073	-0.099	-0.081	-0.020	0.068
MLW	0.037	-0.096	-0.092	-0.149	-0.129	-0.182	0.058	-0.040	-0.066	-0.012	0.046	-0.048	-0.076	-0.080	-0.068	-0.022	-0.123	-0.148	-0.133	-0.070	0.069
MLWS	-0.017	-0.145	-0.147	-0.201	-0.181	-0.232	0.012	-0.083	-0.113	-0.063	-0.006	-0.098	-0.126	-0.132	-0.114	-0.073	-0.173	-0.198	-0.185	-0.120	0.069
ISLW	-0.184	-0.323	-0.335	-0.399	-0.389	-0.447	-0.200	-0.309	-0.341	-0.295	-0.225	-0.304	-0.314	-0.310	-0.278	-0.233	-0.331	-0.360	-0.355	-0.312	0.068
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.422	0.463	0.471	0.479	0.475	0.460	0.370	0.420	0.430	0.444	0.426	0.486	0.494	0.494	0.476	0.498	0.515	0.512	0.529	0.466	0.040
MR	0.529	0.562	0.581	0.583	0.580	0.559	0.464	0.506	0.524	0.546	0.530	0.585	0.592	0.596	0.566	0.599	0.615	0.611	0.633	0.566	0.042
MSR	0.637	0.660	0.690	0.686	0.685	0.659	0.557	0.591	0.617	0.648	0.634	0.685	0.690	0.699	0.657	0.700	0.714	0.711	0.736	0.666	0.045
R	1.038	1.088	1.143	1.161	1.184	1.175	1.066	1.134	1.164	1.204	1.159	1.179	1.143	1.127	1.051	1.085	1.094	1.100	1.145	1.128	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.265	0.281	0.290	0.291	0.290	0.280	0.232	0.253	0.262	0.273	0.265	0.293	0.296	0.298	0.283	0.299	0.307	0.306	0.316	0.283	0.021
S2	0.054	0.049	0.055	0.052	0.053	0.050	0.047	0.043	0.047	0.051	0.052	0.050	0.049	0.051	0.045	0.050	0.050	0.050	0.052	0.050	0.003
K1	0.095	0.105	0.111	0.114	0.120	0.124	0.117	0.124	0.127	0.128	0.119	0.119	0.111	0.105	0.098	0.096	0.097	0.099	0.103	0.111	0.011
O1	0.071	0.074	0.078	0.084	0.088	0.091	0.095	0.102	0.101	0.104	0.099	0.087	0.078	0.073	0.066	0.065	0.061	0.063	0.067	0.082	0.014
MSF	0.039	0.048	0.050	0.039	0.038	0.028	0.061	0.026	0.051	0.038	0.041	0.033	0.047	0.043	0.051	0.047	0.045	0.039	0.039	0.042	0.008
z0	0.302	0.185	0.199	0.142	0.161	0.097	0.290	0.213	0.195	0.261	0.311	0.244	0.219	0.218	0.215	0.277	0.184	0.157	0.183	0.213	0.057
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	115.179	117.505	114.693	115.966	115.772	116.388	116.097	115.101	118.460	109.362	106.598	107.162	108.836	109.076	111.613	109.156	111.905	112.299	111.056	112.749	3.664
S2	41.953	47.834	41.906	43.910	45.733	47.253	41.630	45.201	50.995	39.394	31.995	43.598	42.817	44.997	43.892	43.961	42.965	42.394	38.872	43.226	3.939
K1	209.047	213.781	210.917	209.985	209.485	211.703	206.779	202.618	204.487	192.387	189.929	190.442	189.095	190.171	194.553	196.572	204.785	205.448	206.387	202.030	8.542
O1	270.026	267.218	265.819	265.732	266.676	268.115	270.941	273.314	280.685	282.185	285.269	288.784	292.875	289.334	286.393	281.056	278.633	273.473	270.828	276.703	8.945
MSF	295.764	286.219	305.544	268.860	288.637	285.835	292.637	292.646	289.125	311.256	287.329	288.960	291.357	299.146	279.675	288.102	288.752	287.758	283.033	290.033	9.070
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.089	0.095	0.091	0.102	0.093	0.077	0.083	0.114	0.076	0.096	0.088	0.123	0.093	0.105	0.081	0.090	0.088	0.088	0.086		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	72.2	97.4	94.5	96.2	95.2	92.2	61.2	79.8	97.9	66.4	50.7	78.7	91.0	85.6	88.3	77.5	99.1	99.1	94.5		

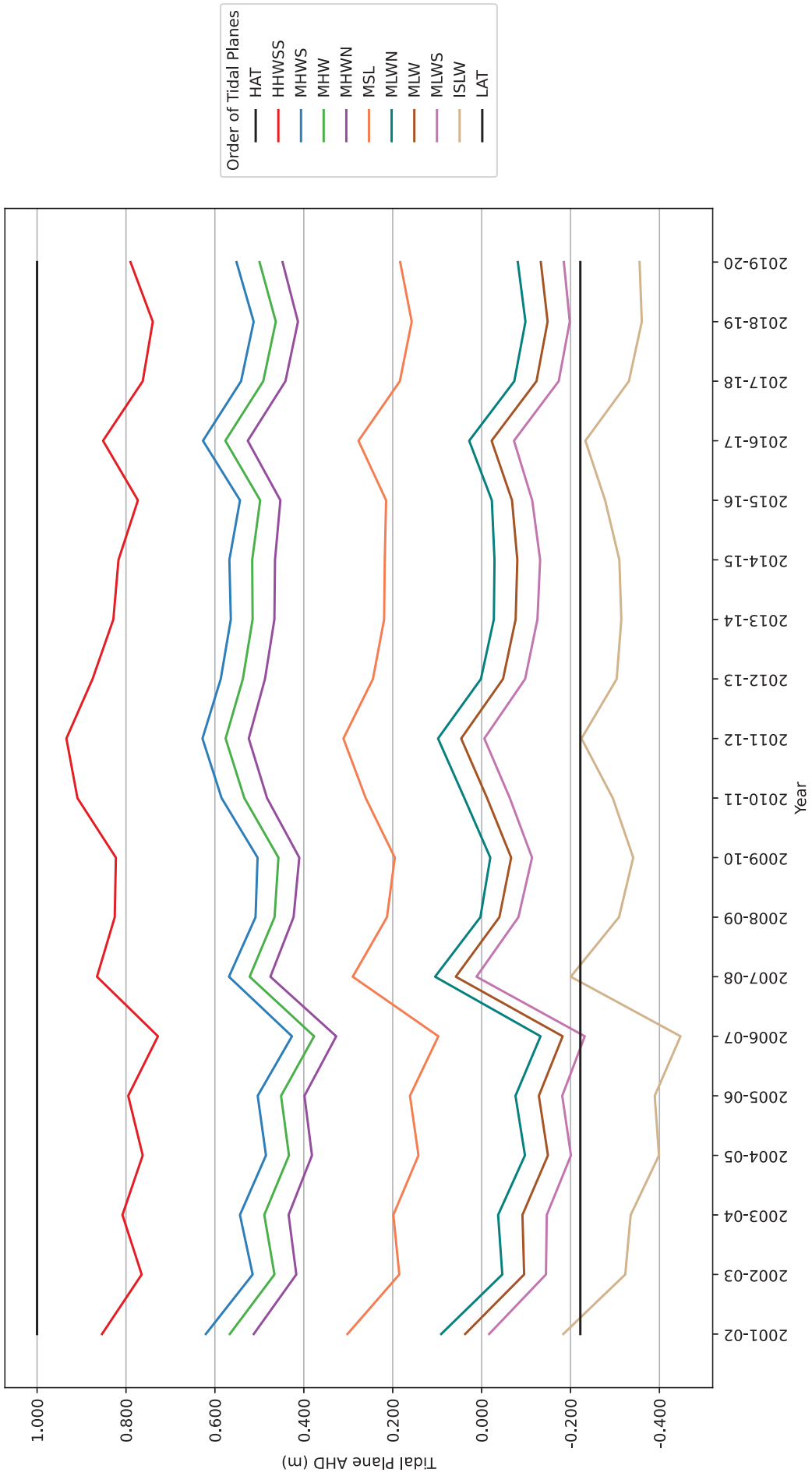
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.00	05/06/2004 01:00	±0.24	46.3
Lowest Astronomical Tide (LAT)	-0.22	08/12/2011 04:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A134

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Belmore Bridge

MHL2786

Figure
A134

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Bolwarra Downstream

RECORDING STATION: **Hunter River at Bolwarra Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210451

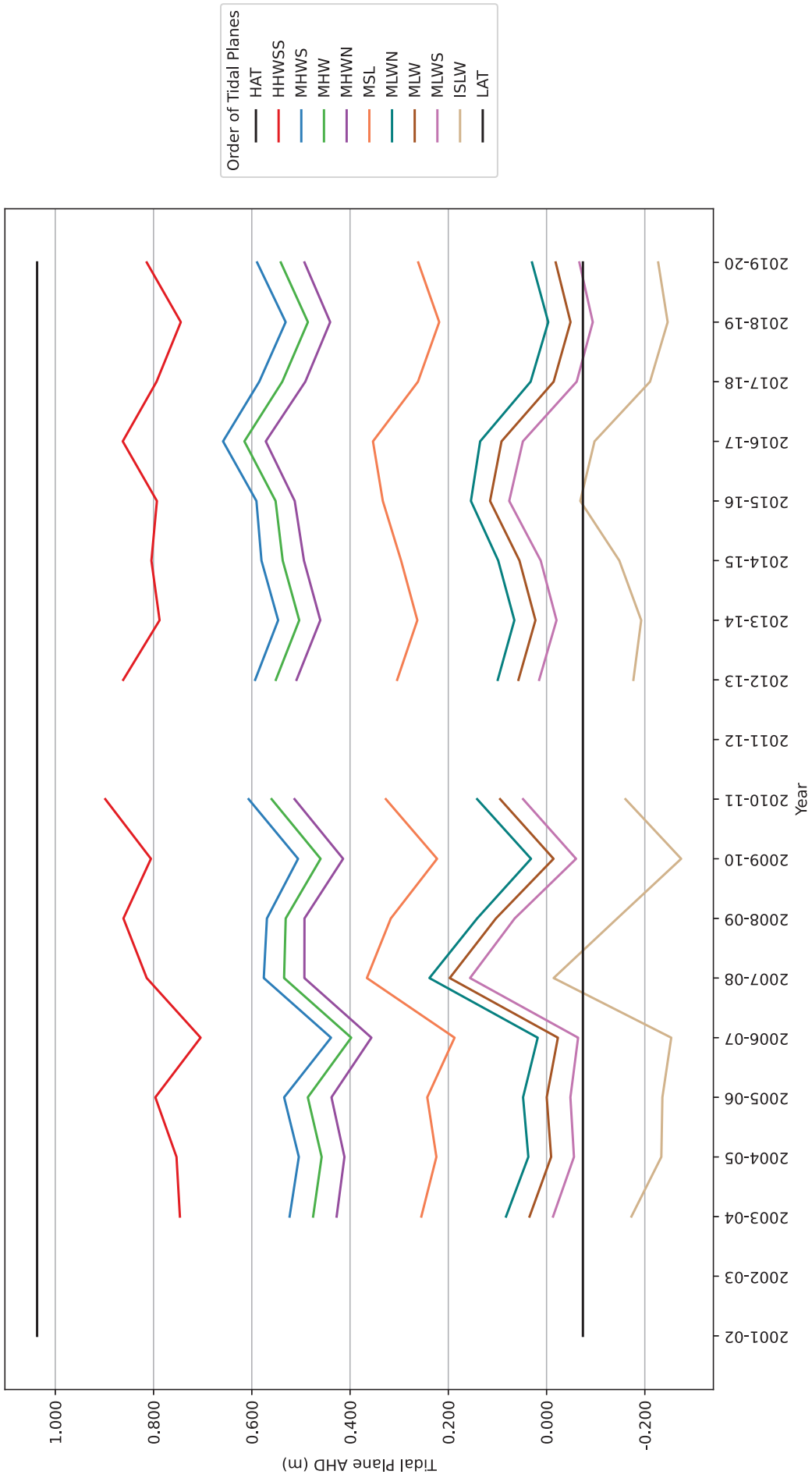
ZONE: 56
EASTING: 365591
NORTHING: 6380224

YEAR	2001-02*	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			0.746	0.753	0.796	0.704	0.814	0.861	0.805	0.898		0.862	0.788	0.804	0.793	0.863	0.794	0.744	0.814	0.803	0.051
MHWS			0.523	0.504	0.534	0.439	0.576	0.569	0.506	0.606		0.593	0.546	0.580	0.591	0.659	0.585	0.531	0.589	0.558	0.052
MHW			0.475	0.458	0.486	0.398	0.534	0.531	0.460	0.560		0.551	0.503	0.537	0.552	0.615	0.538	0.486	0.541	0.514	0.052
MHWN			0.427	0.411	0.438	0.357	0.493	0.493	0.414	0.513		0.509	0.461	0.494	0.513	0.572	0.491	0.440	0.493	0.470	0.052
MSL			0.255	0.224	0.243	0.187	0.366	0.317	0.223	0.327		0.304	0.263	0.296	0.333	0.353	0.262	0.218	0.261	0.277	0.053
MLWN			0.082	0.037	0.048	0.018	0.238	0.141	0.032	0.141		0.099	0.066	0.098	0.154	0.135	0.032	-0.003	0.030	0.084	0.065
MLW			0.035	-0.009	-0.000	-0.023	0.197	0.103	-0.014	0.095		0.057	0.023	0.055	0.115	0.092	-0.014	-0.049	-0.019	0.040	0.066
MLWS			-0.013	-0.056	-0.049	-0.064	0.156	0.065	-0.060	0.048		0.015	-0.020	0.012	0.076	0.048	-0.061	-0.094	-0.067	-0.004	0.068
ISLW			-0.173	-0.234	-0.236	-0.254	-0.014	-0.144	-0.274	-0.161		-0.177	-0.193	-0.148	-0.069	-0.098	-0.211	-0.247	-0.227	-0.179	0.072
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.345	0.374	0.390	0.339	0.254	0.351	0.382	0.372		0.410	0.395	0.395	0.359	0.436	0.459	0.444	0.463	0.386	0.053
MR			0.441	0.467	0.486	0.421	0.337	0.428	0.474	0.465		0.494	0.481	0.482	0.437	0.523	0.552	0.535	0.560	0.474	0.056
MSR			0.536	0.560	0.583	0.503	0.420	0.504	0.566	0.559		0.578	0.567	0.568	0.515	0.610	0.646	0.625	0.656	0.562	0.059
R			0.919	0.987	1.032	0.958	0.828	1.005	1.079	1.059		1.038	0.980	0.952	0.862	0.960	1.004	0.991	1.041	0.981	0.068
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.220	0.234	0.243	0.210	0.169	0.214	0.237	0.233		0.247	0.240	0.241	0.218	0.262	0.276	0.267	0.280	0.237	0.028
S2			0.048	0.046	0.048	0.041	0.041	0.038	0.046	0.047		0.042	0.043	0.043	0.039	0.043	0.047	0.045	0.048	0.044	0.003
K1			0.091	0.100	0.105	0.107	0.090	0.114	0.118	0.113		0.108	0.095	0.090	0.083	0.086	0.089	0.090	0.095	0.098	0.011
O1			0.069	0.078	0.083	0.083	0.080	0.095	0.096	0.096		0.084	0.077	0.070	0.062	0.060	0.060	0.062	0.066	0.076	0.013
MSF			0.040	0.034	0.034	0.026	0.046	0.030	0.050	0.022		0.034	0.050	0.045	0.051	0.054	0.045	0.037	0.035	0.040	0.009
z0			0.255	0.224	0.243	0.187	0.366	0.317	0.223	0.327		0.304	0.263	0.296	0.333	0.353	0.262	0.218	0.261	0.277	0.053
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			122.614	126.662	127.077	133.971	124.002	120.766	125.298	116.785		114.675	117.507	117.961	121.208	117.843	122.310	124.087	121.904	122.167	4.809
S2			50.630	55.705	56.182	67.354	45.750	50.360	57.853	47.054		46.311	50.557	56.882	50.992	54.428	53.786	54.413	47.240	52.844	5.506
K1			213.348	215.432	214.574	221.997	207.808	205.110	207.701	195.092		194.147	194.928	195.741	199.041	201.396	211.475	213.782	213.130	206.544	8.843
O1			267.450	269.769	270.754	276.313	272.292	277.186	283.587	285.345		291.043	292.926	294.228	291.957	285.196	286.430	280.779	277.906	281.448	8.734
MSF			298.627	271.844	291.085	275.487	292.430	304.717	286.517	318.443		318.268	293.128	298.155	274.821	292.068	288.412	289.769	289.708	292.718	13.302
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.105	0.108	0.103	0.073	0.085	0.108	0.080	0.119		0.137	0.108	0.121	0.084	0.108	0.088	0.093	0.089		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	13.3	17.9	94.7	94.9	97.3	92.1	59.9	79.8	91.3	63.3	49.7	81.0	91.0	85.5	87.4	72.8	98.8	99.0	91.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.04	05/06/2004 01:15	±0.26	48.8
Lowest Astronomical Tide (LAT)	-0.07	16/10/2013 05:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Bolwarra Downstream

MHL2786

Figure
A135

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hunter River at Bolwarra Upstream

RECORDING STATION: **Hunter River at Bolwarra Upstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210459

ZONE: 56
EASTING: 365828
NORTHING: 6381130

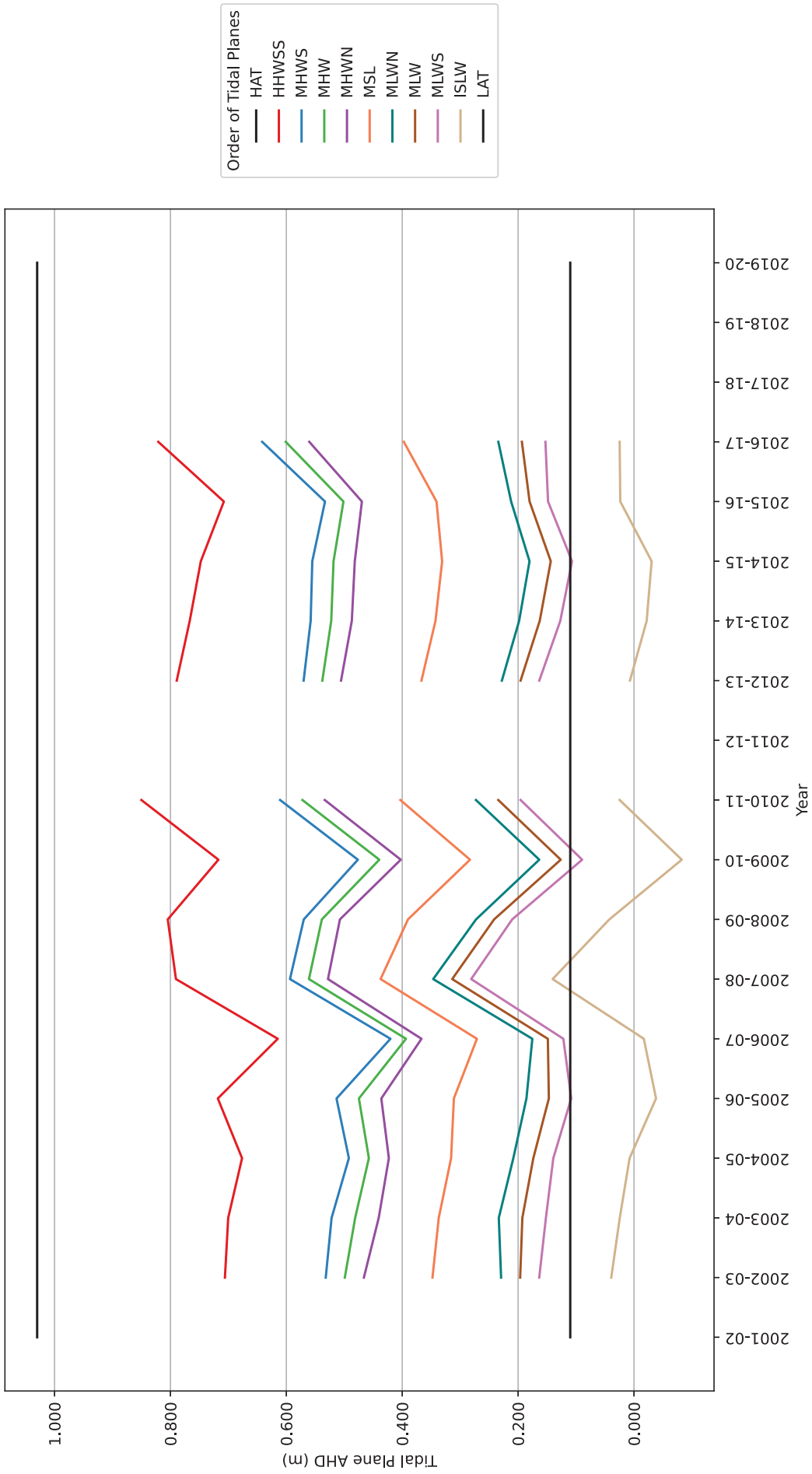
YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*	2018-19*	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.706	0.700	0.676	0.718	0.615	0.790	0.805	0.717	0.850		0.789	0.767	0.748	0.708	0.821				0.744	0.064
MHWS		0.532	0.522	0.492	0.513	0.420	0.594	0.570	0.476	0.611		0.570	0.558	0.555	0.533	0.642				0.542	0.057
MHW		0.499	0.481	0.458	0.475	0.393	0.561	0.539	0.439	0.572		0.538	0.522	0.519	0.501	0.601				0.507	0.055
MHWN		0.466	0.441	0.423	0.436	0.367	0.528	0.507	0.402	0.534		0.506	0.487	0.482	0.470	0.560				0.472	0.054
MSL		0.348	0.337	0.316	0.311	0.271	0.437	0.390	0.283	0.403		0.367	0.343	0.331	0.341	0.397				0.348	0.047
MLWN		0.229	0.233	0.208	0.186	0.175	0.347	0.273	0.163	0.273		0.228	0.198	0.180	0.212	0.234				0.224	0.048
MLW		0.196	0.193	0.174	0.147	0.149	0.314	0.241	0.126	0.234		0.196	0.163	0.144	0.180	0.193				0.189	0.049
MLWS		0.164	0.152	0.139	0.108	0.122	0.281	0.210	0.089	0.196		0.163	0.127	0.107	0.148	0.153				0.154	0.049
ISLW		0.039	0.025	0.008	-0.038	-0.017	0.140	0.043	-0.083	0.025		0.007	-0.022	-0.030	0.024	0.025				0.010	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.237	0.207	0.215	0.250	0.191	0.182	0.235	0.239	0.261		0.278	0.289	0.302	0.258	0.326				0.248	0.042
MR		0.303	0.289	0.284	0.328	0.245	0.247	0.297	0.313	0.338		0.342	0.360	0.375	0.321	0.408				0.318	0.046
MSR		0.368	0.370	0.353	0.405	0.298	0.313	0.360	0.387	0.415		0.407	0.431	0.448	0.385	0.489				0.388	0.051
R		0.667	0.676	0.669	0.756	0.632	0.650	0.762	0.800	0.825		0.782	0.789	0.778	0.684	0.796				0.733	0.066
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.151	0.144	0.142	0.164	0.122	0.124	0.149	0.157	0.169		0.171	0.180	0.187	0.161	0.204				0.159	0.023
S2		0.033	0.041	0.035	0.039	0.027	0.033	0.031	0.037	0.039		0.032	0.036	0.037	0.032	0.041				0.035	0.004
K1		0.068	0.070	0.070	0.079	0.075	0.072	0.088	0.091	0.088		0.085	0.080	0.072	0.069	0.072				0.077	0.008
O1		0.056	0.057	0.062	0.067	0.064	0.068	0.080	0.081	0.083		0.072	0.069	0.066	0.055	0.056				0.067	0.009
MSF		0.038	0.027	0.025	0.020	0.017	0.041	0.017	0.035	0.009		0.025	0.040	0.048	0.045	0.042				0.031	0.012
z0		0.348	0.337	0.316	0.311	0.271	0.437	0.390	0.283	0.403		0.367	0.343	0.331	0.341	0.397				0.348	0.047
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		124.422	123.787	126.951	127.755	143.894	128.394	125.627	130.846	121.416		120.172	124.655	122.725	128.529	121.436				126.472	5.900
S2		60.308	57.127	52.874	55.980	74.817	50.856	53.398	59.022	49.196		54.738	56.202	65.808	54.125	60.419				57.491	6.575
K1		214.434	214.587	214.327	214.926	224.525	209.489	208.777	209.228	196.872		195.657	196.135	196.259	201.780	194.941				206.567	9.549
O1		266.955	269.272	268.036	269.061	278.366	273.956	275.463	283.323	285.757		289.672	294.868	295.738	293.948	289.628				281.003	10.697
MSF		289.156	302.069	270.163	284.355	258.065	292.479	324.449	287.582	315.745		311.187	284.461	293.159	275.102	287.907				291.134	17.869
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.101	0.101	0.108	0.100	0.080	0.092	0.119	0.082	0.126		0.146	0.113	0.120	0.095	0.103					
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	15.5	56.7	91.2	94.8	96.5	90.1	64.6	79.5	96.2	63.1	47.7	81.8	80.4	71.9	88.7	54.8	24.7	20.2			

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.03	05/06/2004 01:30	±0.29	47.5
Lowest Astronomical Tide (LAT)	0.11	17/10/2013 07:30		

COMMENTS

*No data collected for the period or insufficient data for meaningful analysis.
Data from 2000 - 2002 does not capture the full tidal range and has been removed from analysis. Station decommissioned in Sep 2019.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Bolwarra Upstream

MHL2786

Figure A136

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hunter River at Oakhampton Railway Bridge

RECORDING STATION: **Hunter River at Oakhampton Railway Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210475

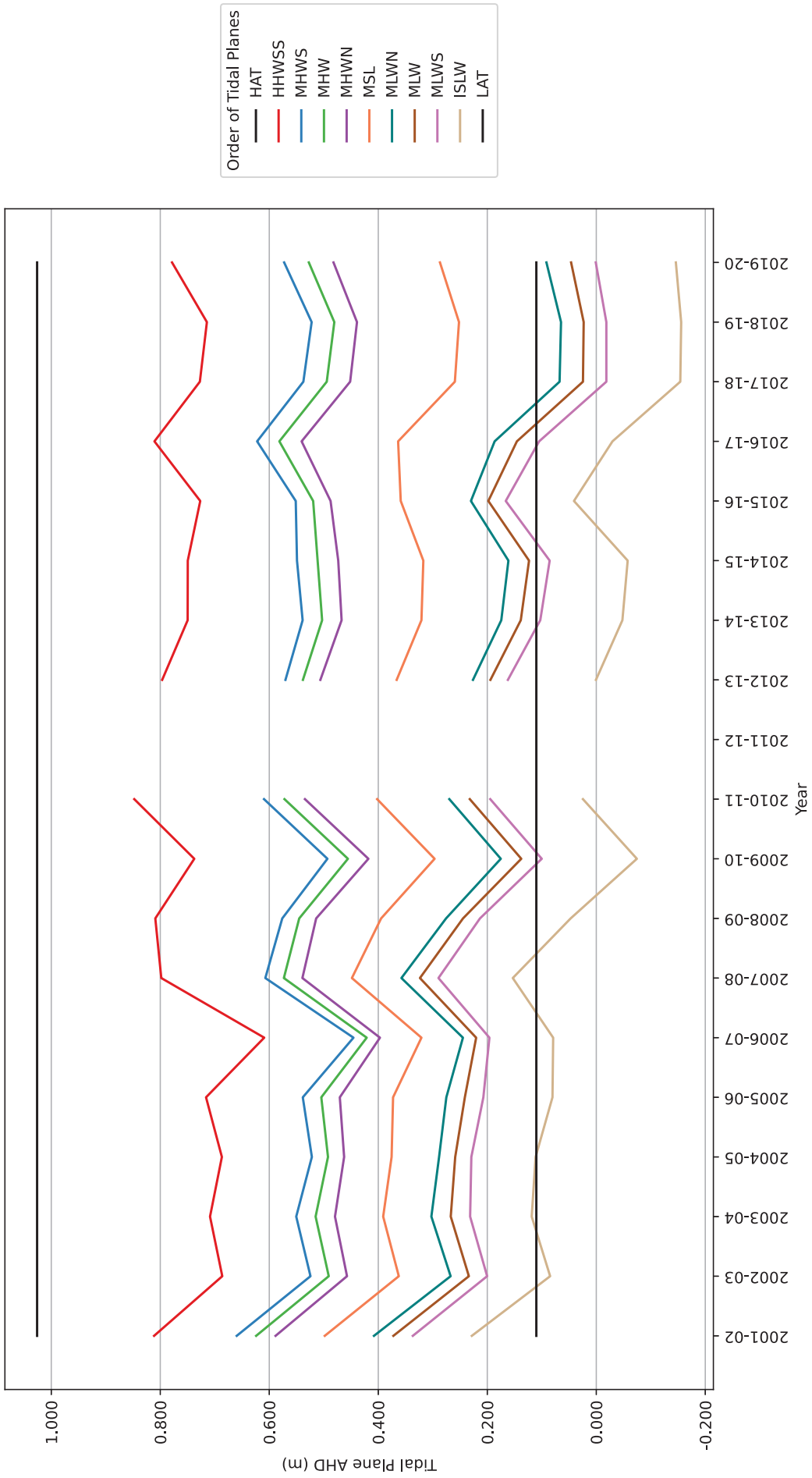
ZONE: 56
EASTING: 365866
NORTHING: 6381600

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.811	0.686	0.709	0.687	0.716	0.609	0.798	0.809	0.738	0.848		0.797	0.750	0.750	0.727	0.811	0.727	0.714	0.778	0.748	0.059
MHWS	0.660	0.524	0.551	0.522	0.539	0.445	0.607	0.576	0.493	0.610		0.570	0.539	0.549	0.551	0.622	0.537	0.522	0.573	0.555	0.050
MHW	0.624	0.491	0.515	0.492	0.505	0.421	0.573	0.545	0.456	0.572		0.538	0.503	0.511	0.519	0.582	0.495	0.481	0.527	0.519	0.048
MHWN	0.588	0.457	0.479	0.463	0.471	0.397	0.539	0.514	0.418	0.535		0.506	0.467	0.473	0.488	0.541	0.452	0.439	0.482	0.484	0.047
MSL	0.498	0.362	0.391	0.376	0.373	0.321	0.448	0.395	0.297	0.402		0.366	0.321	0.317	0.359	0.364	0.259	0.252	0.287	0.355	0.063
MLWN	0.408	0.267	0.303	0.288	0.275	0.245	0.358	0.276	0.175	0.270		0.226	0.174	0.161	0.230	0.187	0.067	0.065	0.091	0.226	0.094
MLW	0.372	0.234	0.267	0.259	0.241	0.220	0.324	0.245	0.138	0.232		0.194	0.139	0.123	0.198	0.146	0.024	0.023	0.046	0.190	0.097
MLWS	0.337	0.200	0.231	0.229	0.207	0.196	0.290	0.213	0.100	0.195		0.162	0.103	0.086	0.166	0.105	-0.018	-0.018	0.001	0.155	0.100
ISLW	0.228	0.085	0.119	0.111	0.080	0.079	0.153	0.047	-0.074	0.024		0.001	-0.048	-0.058	0.041	-0.030	-0.154	-0.156	-0.146	0.017	0.109
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.181	0.190	0.177	0.174	0.195	0.152	0.182	0.238	0.243	0.265		0.280	0.293	0.312	0.258	0.354	0.384	0.374	0.391	0.258	0.079
MR	0.252	0.257	0.248	0.233	0.263	0.201	0.250	0.301	0.318	0.340		0.344	0.364	0.388	0.321	0.436	0.470	0.458	0.481	0.329	0.088
MSR	0.323	0.324	0.319	0.293	0.331	0.249	0.318	0.363	0.393	0.415		0.408	0.436	0.464	0.385	0.517	0.556	0.541	0.572	0.400	0.097
R	0.583	0.602	0.590	0.576	0.636	0.530	0.645	0.762	0.812	0.823		0.796	0.798	0.807	0.686	0.840	0.882	0.870	0.924	0.731	0.124
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.126	0.129	0.124	0.117	0.132	0.100	0.125	0.150	0.159	0.170		0.172	0.182	0.194	0.161	0.218	0.235	0.229	0.241	0.165	0.044
S2	0.036	0.034	0.036	0.030	0.034	0.024	0.034	0.031	0.038	0.038		0.032	0.036	0.038	0.032	0.041	0.043	0.042	0.045	0.036	0.005
K1	0.057	0.063	0.061	0.062	0.068	0.063	0.070	0.087	0.093	0.090		0.087	0.082	0.079	0.069	0.075	0.078	0.079	0.084	0.075	0.011
O1	0.051	0.053	0.052	0.056	0.059	0.054	0.066	0.079	0.082	0.080		0.075	0.069	0.064	0.056	0.060	0.057	0.059	0.063	0.063	0.010
MSF	0.018	0.033	0.021	0.025	0.014	0.017	0.033	0.020	0.035	0.016		0.028	0.042	0.038	0.047	0.043	0.035	0.035	0.024	0.029	0.010
z0	0.498	0.362	0.391	0.376	0.373	0.321	0.448	0.395	0.297	0.402		0.366	0.321	0.317	0.359	0.364	0.259	0.252	0.287	0.355	0.063
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	121.269	124.964	122.608	126.220	127.034	143.223	127.758	124.454	130.065	120.791		120.702	126.829	126.246	129.002	122.683	127.914	129.100	127.181	126.558	5.086
S2	47.758	54.900	55.179	50.105	52.478	74.536	49.165	51.513	61.023	54.567		51.211	57.404	65.457	55.583	64.446	60.383	60.961	56.019	56.816	6.740
K1	208.979	214.006	213.405	213.953	212.841	222.814	210.886	206.480	208.723	197.853		197.526	199.694	199.441	203.550	204.260	213.063	215.457	215.693	208.812	7.166
O1	269.372	267.669	266.933	267.528	268.754	277.288	272.093	274.947	282.867	287.096		291.973	295.702	295.768	293.473	289.058	289.384	283.285	281.236	280.802	10.468
MSF	279.341	283.594	309.563	286.491	295.481	250.354	292.028	321.596	290.398	280.010		327.899	291.887	293.504	274.508	280.821	275.520	274.750	304.135	289.549	18.261
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.085	0.096	0.092	0.099	0.093	0.073	0.091	0.116	0.075	0.128		0.145	0.127	0.133	0.096	0.124	0.084	0.081	0.095		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	74.1	97.2	91.8	93.5	94.6	91.8	61.8	78.2	98.5	61.3	45.8	81.1	91.9	85.5	88.4	76.1	89.5	80.6	73.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.03	05/06/2004 01:30	±0.26	69.3
Lowest Astronomical Tide (LAT)	0.11	17/10/2013 07:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

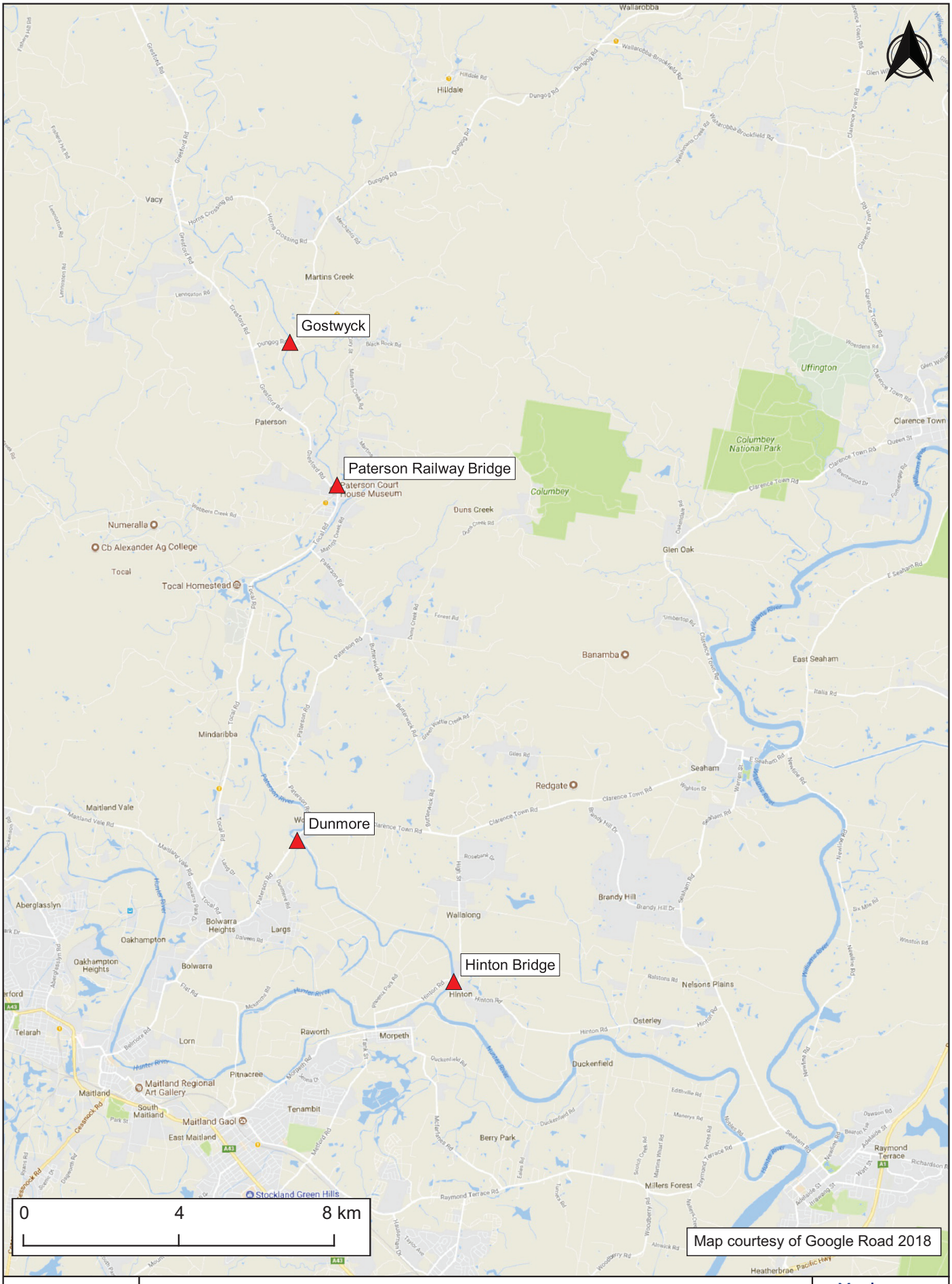


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hunter River at Oakhampton Railway Bridge

MHL2786

Figure
A137



NSW GOVERNMENT

STATION LOCATIONS
PATERSON RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A138

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Paterson River at Hinton Bridge

RECORDING STATION: **Paterson River at Hinton Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210410

ZONE: 56
EASTING: 373306
NORTHING: 6379619

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.874	0.815	0.835	0.807	0.862	0.817	0.922	0.898	0.842	0.907	0.896	0.844	0.858	0.847	0.809	0.868	0.810	0.790	0.851	0.850	0.038
MHWS	0.602	0.541	0.547	0.510	0.549	0.492	0.579	0.549	0.488	0.545	0.546	0.530	0.571	0.581	0.559	0.627	0.576	0.548	0.597	0.555	0.036
MHW	0.540	0.482	0.485	0.451	0.487	0.432	0.519	0.492	0.429	0.483	0.484	0.471	0.510	0.521	0.504	0.569	0.519	0.490	0.536	0.495	0.036
MHWN	0.478	0.423	0.423	0.392	0.426	0.372	0.458	0.434	0.371	0.421	0.422	0.411	0.450	0.460	0.449	0.510	0.462	0.432	0.476	0.435	0.036
MSL	0.174	0.132	0.133	0.100	0.148	0.101	0.184	0.159	0.107	0.146	0.143	0.127	0.160	0.172	0.158	0.220	0.175	0.142	0.174	0.150	0.030
MLWN	-0.129	-0.160	-0.156	-0.192	-0.130	-0.170	-0.090	-0.117	-0.157	-0.130	-0.136	-0.158	-0.130	-0.116	-0.132	-0.070	-0.111	-0.148	-0.127	-0.135	0.028
MLW	-0.191	-0.218	-0.219	-0.252	-0.191	-0.230	-0.151	-0.174	-0.215	-0.191	-0.198	-0.217	-0.191	-0.177	-0.187	-0.129	-0.169	-0.207	-0.187	-0.194	0.028
MLWS	-0.253	-0.277	-0.281	-0.311	-0.253	-0.290	-0.211	-0.232	-0.274	-0.253	-0.260	-0.276	-0.251	-0.237	-0.243	-0.188	-0.226	-0.265	-0.248	-0.254	0.029
ISLW	-0.447	-0.473	-0.486	-0.523	-0.477	-0.523	-0.456	-0.481	-0.527	-0.512	-0.510	-0.501	-0.456	-0.427	-0.421	-0.359	-0.393	-0.437	-0.430	-0.465	0.047
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.607	0.583	0.579	0.584	0.556	0.542	0.548	0.551	0.528	0.551	0.558	0.569	0.581	0.577	0.581	0.581	0.573	0.580	0.602	0.570	0.020
MR	0.731	0.700	0.704	0.703	0.679	0.662	0.669	0.666	0.645	0.674	0.682	0.688	0.701	0.698	0.691	0.698	0.687	0.697	0.724	0.689	0.021
MSR	0.855	0.818	0.828	0.821	0.802	0.783	0.790	0.781	0.762	0.798	0.806	0.806	0.822	0.818	0.802	0.815	0.802	0.813	0.845	0.809	0.022
R	1.321	1.289	1.321	1.331	1.339	1.340	1.378	1.379	1.370	1.419	1.406	1.345	1.315	1.275	1.230	1.227	1.203	1.227	1.281	1.315	0.063
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.366	0.350	0.352	0.351	0.339	0.331	0.335	0.333	0.322	0.337	0.341	0.344	0.351	0.349	0.346	0.349	0.344	0.348	0.362	0.345	0.010
S2	0.062	0.059	0.062	0.059	0.062	0.060	0.061	0.058	0.058	0.062	0.062	0.059	0.060	0.060	0.055	0.059	0.057	0.058	0.061	0.060	0.002
K1	0.117	0.119	0.125	0.126	0.132	0.136	0.141	0.142	0.146	0.149	0.145	0.132	0.122	0.116	0.109	0.105	0.103	0.106	0.111	0.125	0.015
O1	0.077	0.077	0.081	0.086	0.092	0.096	0.104	0.107	0.107	0.110	0.105	0.092	0.083	0.074	0.069	0.067	0.065	0.066	0.070	0.086	0.016
MSF	0.049	0.045	0.056	0.038	0.039	0.028	0.060	0.028	0.045	0.039	0.054	0.022	0.039	0.037	0.045	0.041	0.045	0.035	0.036	0.041	0.010
z0	0.174	0.132	0.133	0.100	0.148	0.101	0.184	0.159	0.107	0.146	0.143	0.127	0.160	0.172	0.158	0.220	0.175	0.142	0.174	0.150	0.030
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	90.290	89.464	89.721	90.860	90.435	89.381	87.362	87.756	86.032	84.791	83.699	85.748	84.523	84.457	86.107	85.882	86.987	87.058	85.940	87.184	2.246
S2	16.205	16.000	14.530	15.160	16.234	16.502	15.326	17.961	15.563	15.730	13.994	15.823	16.173	16.342	18.224	14.016	14.961	14.122	11.992	15.519	1.436
K1	193.280	195.436	193.947	193.358	192.843	192.300	188.921	185.296	183.172	178.574	174.836	174.959	173.535	173.450	178.685	181.147	185.884	188.153	188.375	185.061	7.630
O1	256.109	251.653	250.594	250.599	251.540	251.269	256.462	257.695	261.933	266.668	271.689	276.024	276.473	274.574	271.385	265.490	262.542	256.774	253.149	261.191	9.277
MSF	289.568	293.205	301.530	277.372	289.375	300.662	286.805	290.920	285.730	282.256	276.152	291.453	285.810	301.513	280.590	296.655	291.506	289.452	277.787	288.860	7.853
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.088	0.077	0.091	0.088	0.079	0.081	0.089	0.079	0.089	0.092	0.130	0.078	0.087	0.073	0.068	0.077	0.090	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	86.0	97.1	95.6	89.3	97.8	91.0	82.6	87.2	98.9	86.9	75.9	87.8	94.1	87.7	91.1	86.0	97.0	98.9	94.5		

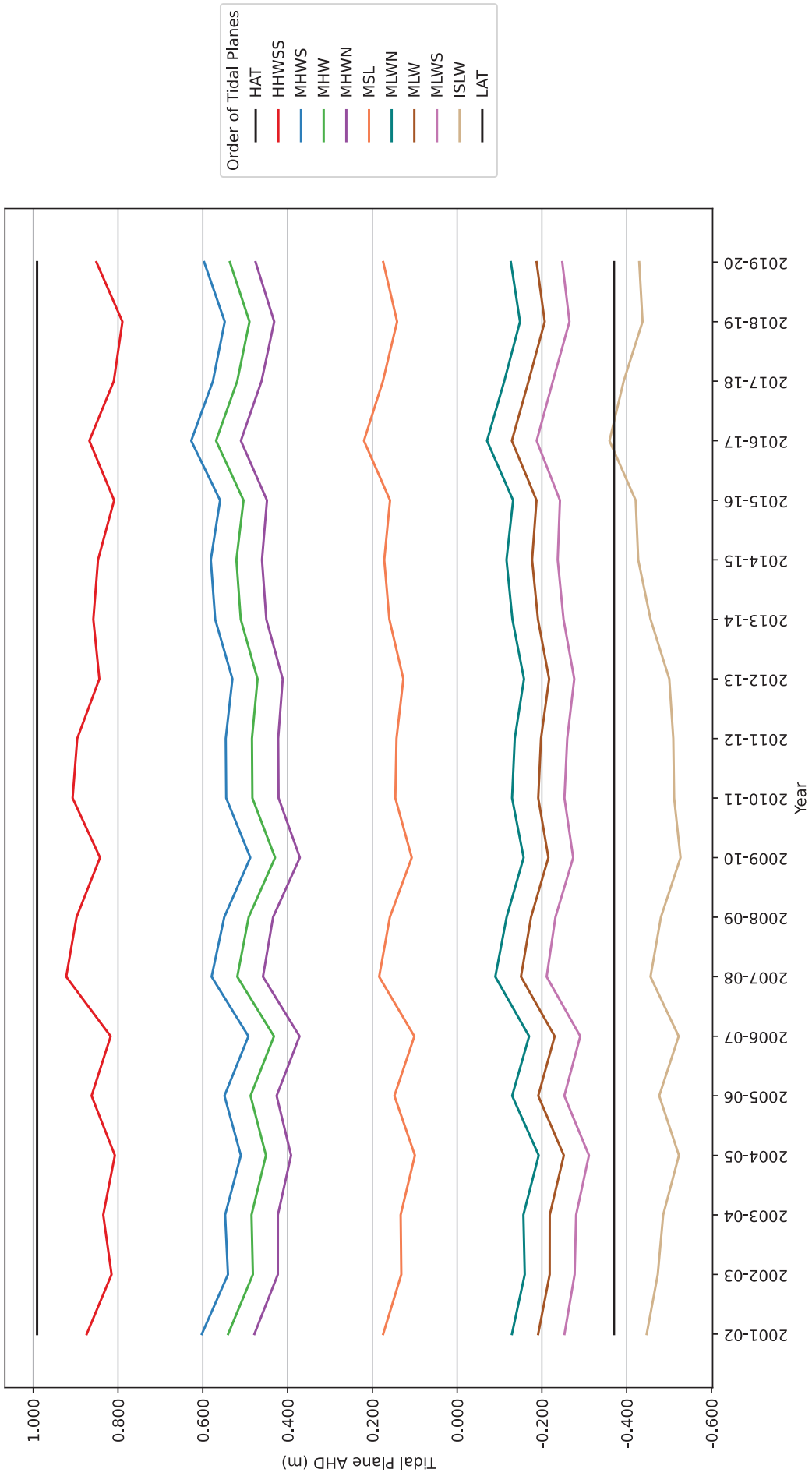
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.99	03/06/2004 23:30	±0.21	21.0
Lowest Astronomical Tide (LAT)	-0.37	16/10/2013 03:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A139

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Paterson River at Hinton Bridge

MHL2786

Figure
A139

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Paterson River at Dunmore

RECORDING STATION: **Paterson River at Dunmore**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210409

ZONE: 56
EASTING: 369277
NORTHING: 6383252

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.909	0.826	0.861	0.864	0.895	0.849	0.955	0.917	0.831	0.927	0.909	0.850	0.822	0.822	0.800	0.870	0.800	0.793	0.844	0.860	0.047
MHWS	0.637	0.549	0.569	0.560	0.580	0.520	0.610	0.561	0.480	0.563	0.559	0.531	0.534	0.553	0.550	0.627	0.565	0.551	0.588	0.563	0.037
MHW	0.574	0.489	0.504	0.496	0.517	0.457	0.548	0.500	0.420	0.500	0.497	0.470	0.472	0.491	0.494	0.567	0.507	0.491	0.526	0.501	0.036
MHWN	0.511	0.428	0.440	0.433	0.454	0.395	0.485	0.439	0.361	0.437	0.435	0.408	0.410	0.429	0.438	0.506	0.448	0.431	0.464	0.440	0.036
MSL	0.202	0.131	0.142	0.134	0.170	0.115	0.203	0.152	0.091	0.155	0.146	0.117	0.112	0.131	0.138	0.207	0.152	0.132	0.154	0.147	0.031
MLWN	-0.107	-0.166	-0.157	-0.166	-0.114	-0.164	-0.079	-0.135	-0.178	-0.127	-0.142	-0.174	-0.186	-0.168	-0.162	-0.092	-0.144	-0.167	-0.156	-0.146	0.030
MLW	-0.170	-0.227	-0.221	-0.229	-0.178	-0.226	-0.142	-0.196	-0.238	-0.190	-0.204	-0.235	-0.248	-0.230	-0.218	-0.152	-0.203	-0.227	-0.218	-0.208	0.030
MLWS	-0.233	-0.287	-0.286	-0.293	-0.241	-0.289	-0.204	-0.257	-0.298	-0.253	-0.266	-0.297	-0.310	-0.292	-0.274	-0.213	-0.261	-0.287	-0.280	-0.269	0.030
ISLW	-0.427	-0.485	-0.495	-0.510	-0.466	-0.524	-0.451	-0.511	-0.548	-0.513	-0.516	-0.525	-0.515	-0.484	-0.453	-0.386	-0.429	-0.460	-0.463	-0.482	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.617	0.594	0.597	0.599	0.568	0.559	0.564	0.574	0.539	0.563	0.577	0.583	0.596	0.597	0.600	0.598	0.592	0.598	0.620	0.586	0.021
MR	0.744	0.715	0.726	0.726	0.695	0.684	0.689	0.696	0.658	0.690	0.701	0.705	0.720	0.721	0.712	0.719	0.709	0.718	0.744	0.709	0.021
MSR	0.870	0.836	0.855	0.852	0.821	0.808	0.815	0.818	0.778	0.816	0.825	0.828	0.844	0.846	0.824	0.840	0.826	0.837	0.868	0.832	0.022
R	1.336	1.310	1.356	1.373	1.361	1.372	1.406	1.427	1.379	1.440	1.425	1.374	1.338	1.306	1.253	1.255	1.229	1.253	1.307	1.342	0.063
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.372	0.358	0.363	0.363	0.347	0.342	0.345	0.348	0.329	0.345	0.350	0.353	0.360	0.361	0.356	0.360	0.355	0.359	0.372	0.355	0.010
S2	0.063	0.060	0.064	0.063	0.063	0.062	0.063	0.061	0.060	0.063	0.062	0.061	0.062	0.062	0.056	0.060	0.058	0.060	0.062	0.061	0.002
K1	0.118	0.120	0.127	0.129	0.133	0.138	0.143	0.146	0.143	0.149	0.145	0.134	0.123	0.117	0.109	0.106	0.103	0.107	0.112	0.126	0.015
O1	0.077	0.077	0.082	0.088	0.092	0.097	0.103	0.108	0.107	0.111	0.105	0.093	0.083	0.075	0.070	0.067	0.065	0.066	0.071	0.086	0.016
MSF	0.044	0.045	0.056	0.042	0.039	0.025	0.064	0.032	0.049	0.041	0.054	0.019	0.039	0.038	0.045	0.042	0.046	0.036	0.037	0.042	0.010
z0	0.202	0.131	0.142	0.134	0.170	0.115	0.203	0.152	0.091	0.155	0.146	0.117	0.112	0.131	0.138	0.207	0.152	0.132	0.154	0.147	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	101.797	103.553	103.492	102.813	102.793	102.382	100.630	99.828	99.644	98.086	97.599	98.035	96.783	95.985	97.714	97.253	98.404	98.832	97.569	99.642	2.471
S2	31.111	32.916	30.697	30.964	31.253	31.885	30.961	32.769	31.428	31.258	30.559	31.953	30.971	29.967	32.053	27.783	28.334	28.141	25.786	30.568	1.834
K1	198.979	203.104	201.867	200.429	199.851	200.032	196.392	192.169	191.084	186.657	183.052	181.667	180.227	180.418	185.971	188.003	193.274	194.963	195.502	192.297	7.631
O1	261.896	258.909	258.198	257.332	258.019	258.041	262.319	264.640	268.675	273.165	279.388	283.116	283.375	281.455	276.852	272.413	270.034	262.749	259.472	267.897	9.360
MSF	294.420	292.775	305.540	284.084	289.859	298.095	286.892	296.124	285.765	283.759	276.738	320.950	279.267	302.546	277.758	295.546	289.687	288.484	279.857	290.955	10.925
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.088	0.078	0.090	0.093	0.079	0.082	0.095	0.079	0.091	0.093	0.115	0.083	0.090	0.079	0.071	0.081	0.089	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	80.5	97.9	95.1	91.8	97.0	90.3	76.2	89.1	98.7	86.0	76.3	90.3	96.8	88.9	92.7	85.6	97.6	99.0	95.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.99	04/06/2004 00:00	±0.20	30.2
Lowest Astronomical Tide (LAT)	-0.39	16/10/2013 04:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A140

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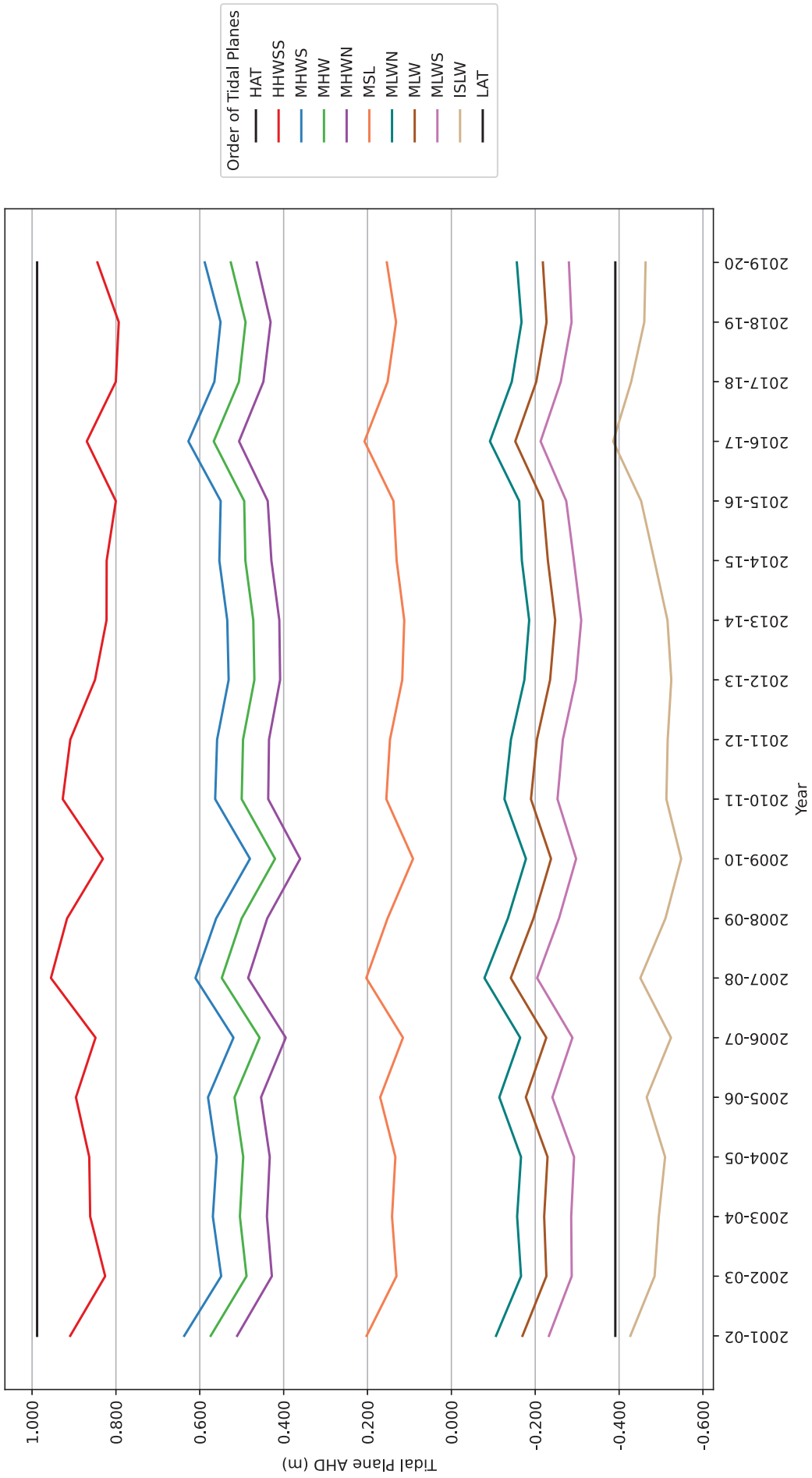


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Paterson River at Dunmore

MHL2786

Figure A140

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Paterson River at Paterson Railway Bridge

RECORDING STATION: **Paterson River at Paterson Railway Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210406

ZONE: 56
EASTING: 370303
NORTHING: 6392399

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.928	0.820	0.876	0.896	0.955	0.949	0.996	0.936	0.906	1.006	1.000	0.921	0.875	0.869	0.827	0.888	0.807	0.781	0.823	0.898	0.067
MHWS	0.664	0.554	0.593	0.599	0.652	0.632	0.653	0.608	0.566	0.655	0.669	0.610	0.594	0.609	0.583	0.650	0.577	0.542	0.578	0.610	0.039
MHW	0.600	0.490	0.525	0.536	0.585	0.569	0.587	0.554	0.505	0.592	0.608	0.550	0.533	0.548	0.527	0.590	0.518	0.482	0.518	0.548	0.038
MHWN	0.537	0.427	0.457	0.473	0.517	0.505	0.522	0.501	0.444	0.530	0.547	0.489	0.471	0.487	0.471	0.530	0.458	0.423	0.458	0.487	0.037
MSL	0.233	0.135	0.162	0.179	0.232	0.227	0.255	0.244	0.179	0.256	0.278	0.199	0.176	0.197	0.188	0.236	0.165	0.123	0.160	0.201	0.044
MLWN	-0.071	-0.157	-0.134	-0.116	-0.054	-0.051	-0.012	-0.012	-0.085	-0.017	0.009	-0.091	-0.120	-0.092	-0.096	-0.057	-0.129	-0.176	-0.137	-0.084	0.053
MLW	-0.135	-0.220	-0.202	-0.179	-0.121	-0.114	-0.078	-0.065	-0.146	-0.080	-0.052	-0.151	-0.181	-0.153	-0.151	-0.117	-0.188	-0.236	-0.197	-0.146	0.053
MLWS	-0.198	-0.283	-0.270	-0.241	-0.188	-0.177	-0.144	-0.119	-0.207	-0.142	-0.113	-0.212	-0.242	-0.215	-0.207	-0.177	-0.248	-0.296	-0.257	-0.207	0.053
ISLW	-0.387	-0.473	-0.472	-0.454	-0.405	-0.404	-0.389	-0.353	-0.450	-0.393	-0.350	-0.434	-0.443	-0.400	-0.381	-0.347	-0.412	-0.466	-0.432	-0.413	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.607	0.584	0.591	0.590	0.571	0.556	0.534	0.513	0.529	0.547	0.538	0.580	0.591	0.578	0.566	0.587	0.587	0.599	0.595	0.571	0.027
MR	0.735	0.710	0.727	0.715	0.706	0.683	0.666	0.619	0.651	0.672	0.660	0.701	0.714	0.701	0.678	0.707	0.706	0.719	0.715	0.694	0.030
MSR	0.863	0.837	0.864	0.840	0.840	0.809	0.797	0.726	0.773	0.796	0.782	0.822	0.836	0.824	0.790	0.827	0.825	0.838	0.836	0.817	0.033
R	1.315	1.293	1.348	1.351	1.360	1.353	1.384	1.290	1.356	1.399	1.351	1.354	1.319	1.268	1.208	1.235	1.218	1.247	1.255	1.311	0.058
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.368	0.355	0.364	0.357	0.353	0.341	0.333	0.310	0.326	0.336	0.330	0.350	0.357	0.351	0.339	0.354	0.353	0.359	0.358	0.347	0.015
S2	0.064	0.063	0.068	0.063	0.067	0.063	0.066	0.053	0.061	0.062	0.061	0.060	0.061	0.061	0.056	0.060	0.059	0.060	0.060	0.062	0.003
K1	0.111	0.114	0.121	0.126	0.128	0.132	0.143	0.131	0.137	0.141	0.133	0.128	0.119	0.110	0.105	0.102	0.100	0.105	0.105	0.121	0.014
O1	0.077	0.076	0.080	0.086	0.089	0.094	0.102	0.104	0.106	0.110	0.104	0.093	0.082	0.075	0.070	0.068	0.064	0.065	0.069	0.085	0.015
MSF	0.055	0.045	0.049	0.049	0.045	0.022	0.057	0.034	0.048	0.045	0.045	0.022	0.044	0.039	0.048	0.045	0.047	0.034	0.031	0.042	0.010
z0	0.233	0.135	0.162	0.179	0.232	0.227	0.255	0.244	0.179	0.256	0.278	0.199	0.176	0.197	0.188	0.236	0.165	0.123	0.160	0.201	0.044
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	119.422	123.933	123.213	123.188	122.874	124.426	121.736	118.901	118.105	117.703	115.719	116.711	117.302	117.524	119.106	119.233	121.508	122.584	122.585	120.304	2.739
S2	53.829	57.203	54.909	53.863	55.469	58.971	47.634	51.903	54.982	55.268	50.472	56.194	56.535	55.508	57.759	52.625	57.008	55.963	54.959	54.792	2.681
K1	209.939	214.281	213.194	211.807	209.771	212.479	205.575	203.893	202.470	196.492	193.896	193.785	192.929	193.577	198.607	202.316	208.297	210.124	211.964	204.495	7.591
O1	271.091	269.418	268.872	268.189	269.264	270.330	271.954	275.411	278.686	286.261	290.895	292.585	296.438	293.310	289.624	285.674	283.126	277.331	274.478	279.628	9.673
MSF	279.900	295.230	309.820	298.170	296.287	302.560	297.350	313.864	284.704	285.354	301.683	309.044	286.033	306.497	283.003	303.886	284.899	294.035	282.480	295.516	10.565
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.095	0.098	0.087	0.115	0.093	0.097	0.086	0.103	0.091	0.100	0.101	0.125	0.081	0.107	0.085	0.092	0.092	0.091	0.093		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.9	97.1	95.2	90.8	86.8	87.3	50.9	76.4	90.2	74.4	61.1	87.6	93.7	86.8	88.3	87.1	98.2	96.0	107.5		

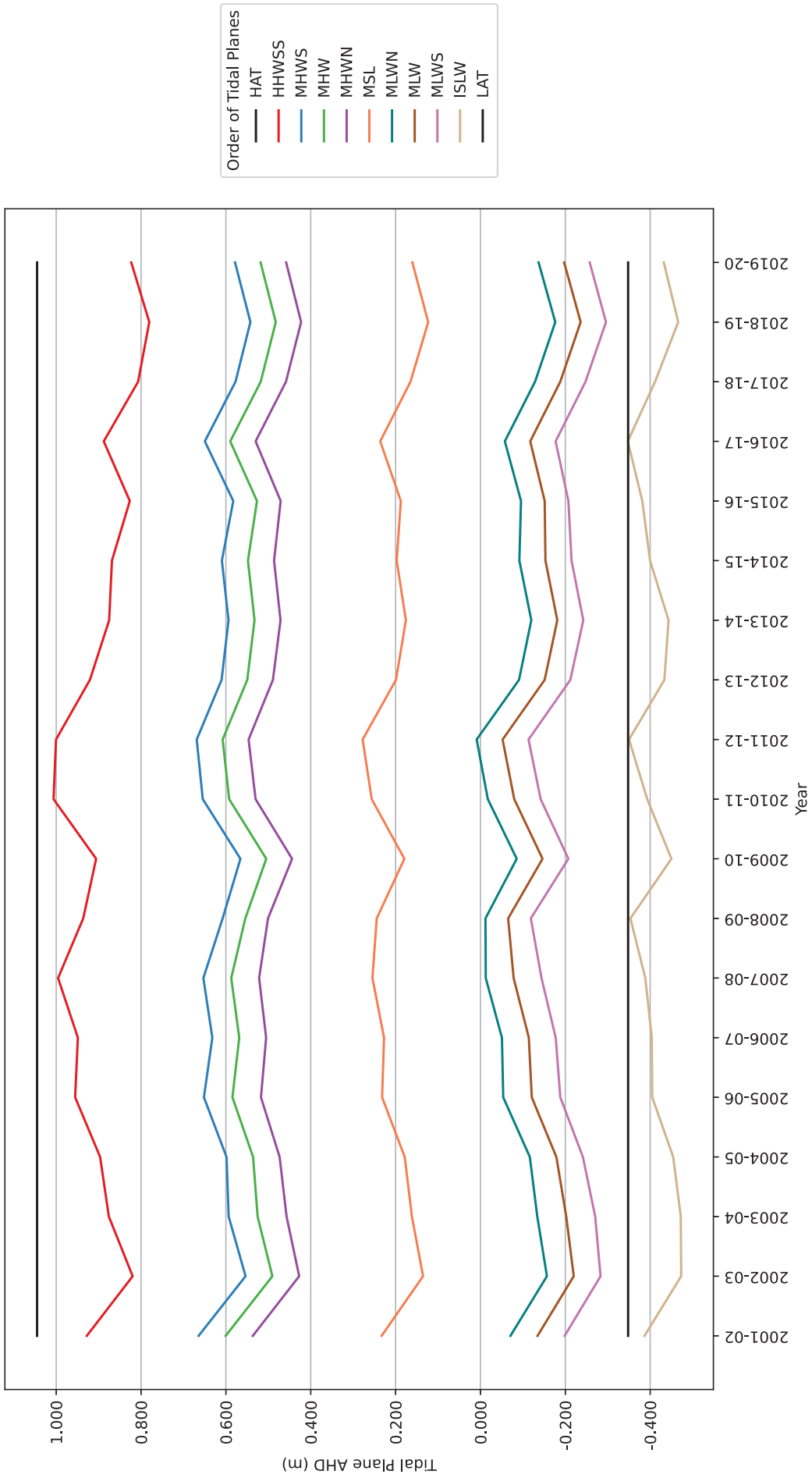
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.04	04/06/2004 00:45	±0.22	51.0
Lowest Astronomical Tide (LAT)	-0.35	14/11/2013 04:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A141

MHL2786

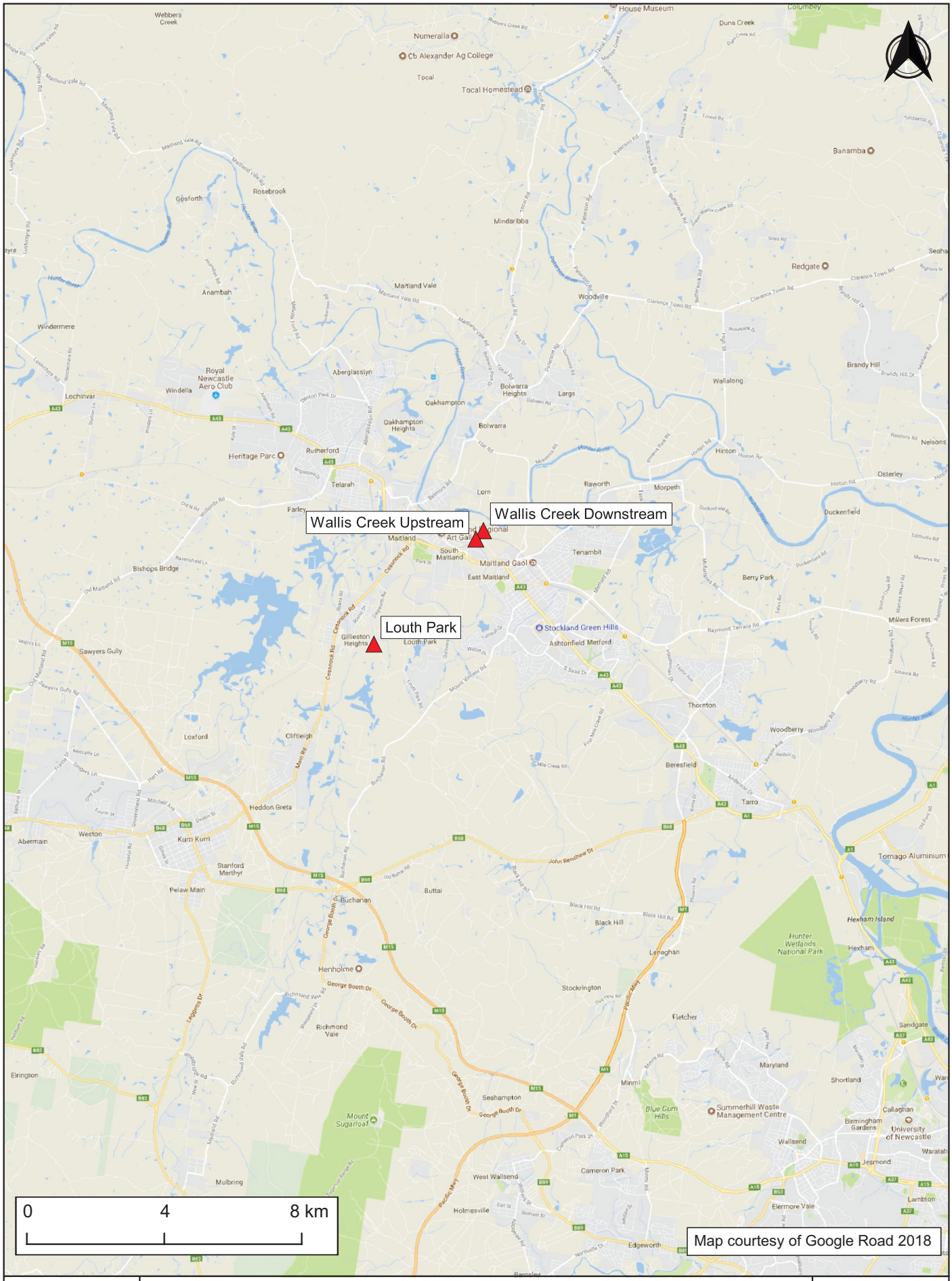


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Paterson River at Paterson Railway Bridge

MHL2786

Figure A141



NSW GOVERNMENT

STATION LOCATIONS
WALLIS CREEK REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A142

DRAWING A142.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Wallis Creek at Wallis Creek Upstream

RECORDING STATION: **Wallis Creek at Wallis Creek Upstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210428

ZONE: 56
EASTING: 365828
NORTHING: 6381130

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.856	0.767	0.774	0.778	0.664	0.720	0.736	0.797	0.706	0.720	0.822	0.775	0.791	0.760	0.726	0.730	0.719	0.732	0.798	0.756	0.046
MHWS	0.609	0.517	0.530	0.523	0.455	0.447	0.530	0.563	0.459	0.510	0.604	0.546	0.549	0.549	0.534	0.589	0.532	0.514	0.571	0.533	0.046
MHW	0.562	0.466	0.481	0.477	0.411	0.405	0.498	0.528	0.421	0.478	0.564	0.507	0.504	0.506	0.496	0.554	0.485	0.465	0.521	0.491	0.046
MHWN	0.515	0.416	0.433	0.432	0.368	0.363	0.467	0.494	0.383	0.445	0.523	0.468	0.459	0.462	0.458	0.519	0.437	0.417	0.471	0.449	0.047
MSL	0.261	0.172	0.208	0.203	0.203	0.152	0.322	0.310	0.196	0.269	0.352	0.271	0.221	0.248	0.250	0.333	0.217	0.170	0.221	0.241	0.057
MLWN	0.008	-0.073	-0.017	-0.025	0.038	-0.058	0.177	0.127	0.009	0.094	0.181	0.074	-0.017	0.035	0.042	0.146	-0.004	-0.076	-0.029	0.033	0.080
MLW	-0.040	-0.123	-0.066	-0.071	-0.006	-0.100	0.146	0.093	-0.028	0.061	0.141	0.035	-0.062	-0.009	0.004	0.111	-0.051	-0.125	-0.079	-0.009	0.085
MLWS	-0.087	-0.173	-0.115	-0.116	-0.049	-0.142	0.114	0.058	-0.066	0.028	0.100	-0.004	-0.107	-0.052	-0.034	0.076	-0.098	-0.174	-0.129	-0.051	0.090
ISLW	-0.263	-0.352	-0.289	-0.298	-0.198	-0.337	-0.032	-0.110	-0.243	-0.121	-0.056	-0.168	-0.279	-0.202	-0.172	-0.025	-0.232	-0.330	-0.291	-0.210	0.103
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.507	0.489	0.450	0.457	0.330	0.422	0.289	0.366	0.373	0.351	0.341	0.394	0.476	0.428	0.416	0.374	0.441	0.493	0.499	0.416	0.064
MR	0.602	0.590	0.547	0.548	0.417	0.505	0.352	0.436	0.449	0.417	0.423	0.472	0.566	0.514	0.492	0.443	0.535	0.590	0.600	0.500	0.074
MSR	0.697	0.690	0.645	0.639	0.503	0.589	0.415	0.505	0.525	0.482	0.504	0.550	0.656	0.601	0.568	0.512	0.630	0.688	0.701	0.584	0.085
R	1.119	1.119	1.063	1.077	0.862	1.057	0.768	0.907	0.948	0.841	0.878	0.943	1.070	0.962	0.898	0.755	0.951	1.062	1.089	0.967	0.115
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.301	0.295	0.274	0.274	0.208	0.253	0.176	0.218	0.225	0.208	0.211	0.236	0.283	0.257	0.246	0.222	0.268	0.295	0.300	0.250	0.037
S2	0.047	0.050	0.049	0.045	0.043	0.042	0.031	0.035	0.038	0.033	0.041	0.039	0.045	0.043	0.038	0.035	0.047	0.049	0.050	0.042	0.006
K1	0.103	0.104	0.102	0.104	0.085	0.111	0.081	0.092	0.099	0.085	0.087	0.094	0.099	0.088	0.081	0.062	0.080	0.092	0.096	0.092	0.012
O1	0.073	0.075	0.072	0.078	0.064	0.084	0.066	0.075	0.077	0.064	0.069	0.070	0.074	0.063	0.056	0.039	0.054	0.064	0.065	0.067	0.010
MSF	0.059	0.046	0.053	0.041	0.034	0.032	0.040	0.015	0.047	0.032	0.033	0.023	0.045	0.033	0.053	0.027	0.049	0.037	0.033	0.039	0.011
z0	0.261	0.172	0.208	0.203	0.203	0.152	0.322	0.310	0.196	0.269	0.352	0.271	0.221	0.248	0.250	0.333	0.217	0.170	0.221	0.241	0.057
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	102.081	103.549	107.382	108.559	117.442	108.515	111.113	106.537	107.837	106.733	103.999	105.523	101.300	105.213	105.893	108.256	105.307	102.425	102.872	106.344	3.729
S2	34.369	34.629	38.572	38.751	53.806	34.747	37.916	36.340	43.407	26.895	29.896	40.917	34.841	36.476	38.751	46.033	38.703	33.711	28.011	37.199	6.232
K1	203.024	205.969	209.396	206.441	214.766	205.010	205.016	202.233	197.965	192.007	190.642	191.284	184.568	189.195	193.114	199.946	200.420	200.645	201.589	199.644	7.755
O1	265.620	263.078	264.740	262.835	268.795	264.627	270.398	274.115	279.706	286.902	285.758	287.660	290.779	289.218	286.382	283.800	278.209	269.670	267.094	275.757	10.110
MSF	276.554	284.433	306.175	274.616	293.957	280.026	282.733	320.579	290.163	315.057	313.707	301.894	297.568	321.544	279.365	298.532	290.968	282.839	289.264	294.736	14.925
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.088	0.089	0.087	0.111	0.108	0.091	0.081	0.114	0.100	0.114	0.107	0.132	0.099	0.124	0.084	0.091	0.102	0.091	0.091		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	81.0	84.2	85.3	92.9	96.1	89.5	54.4	72.7	98.2	74.4	50.6	82.4	89.4	83.4	88.8	79.3	96.9	93.9	80.4		

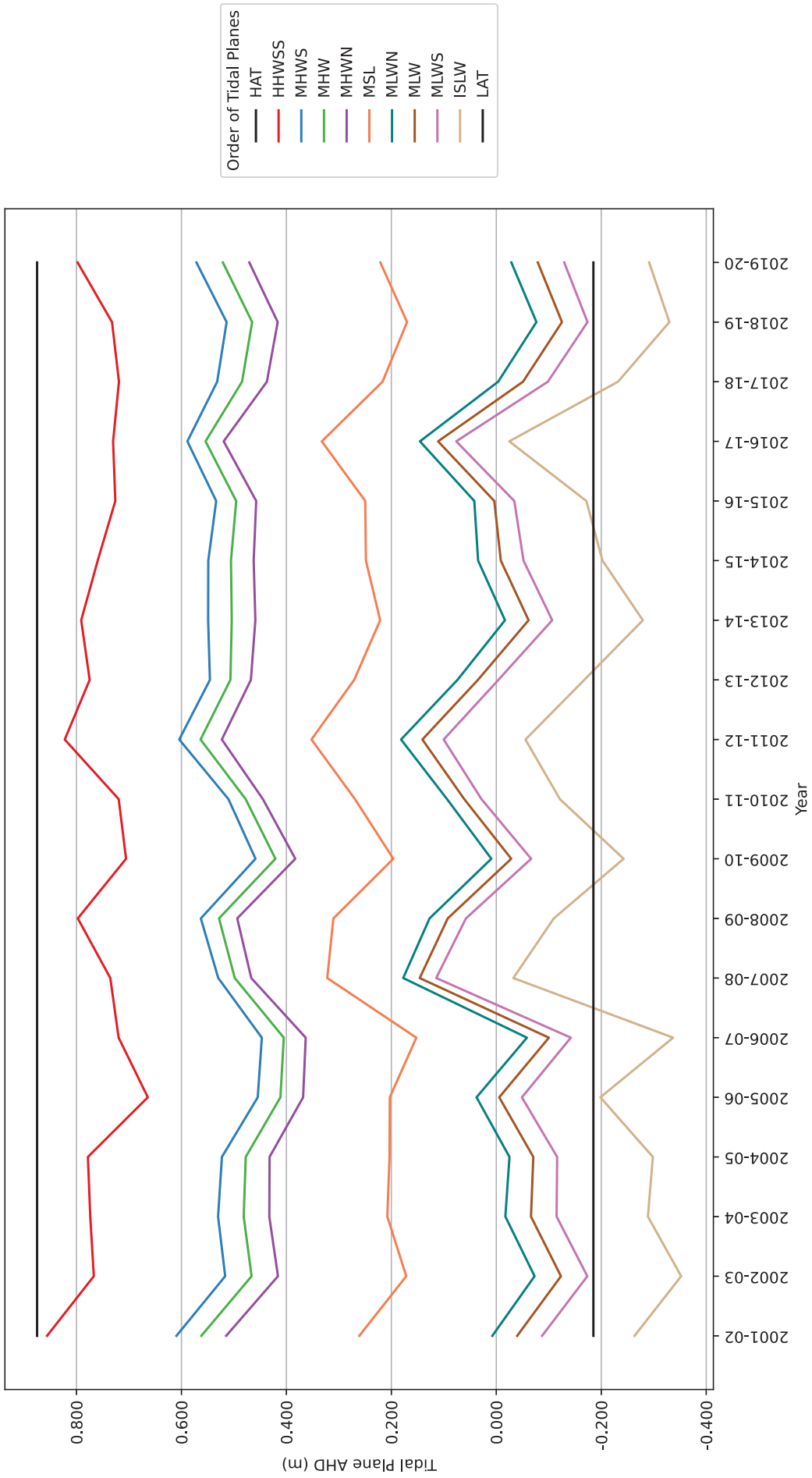
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.88	04/06/2004 00:15	±0.26	60.5
Lowest Astronomical Tide (LAT)	-0.18	14/11/2013 04:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A143

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallis Creek at Wallis Creek Upstream

MHL2786

Figure
A143

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wallis Creek at Wallis Creek Downstream

RECORDING STATION: **Wallis Creek at Wallis Creek Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 210457

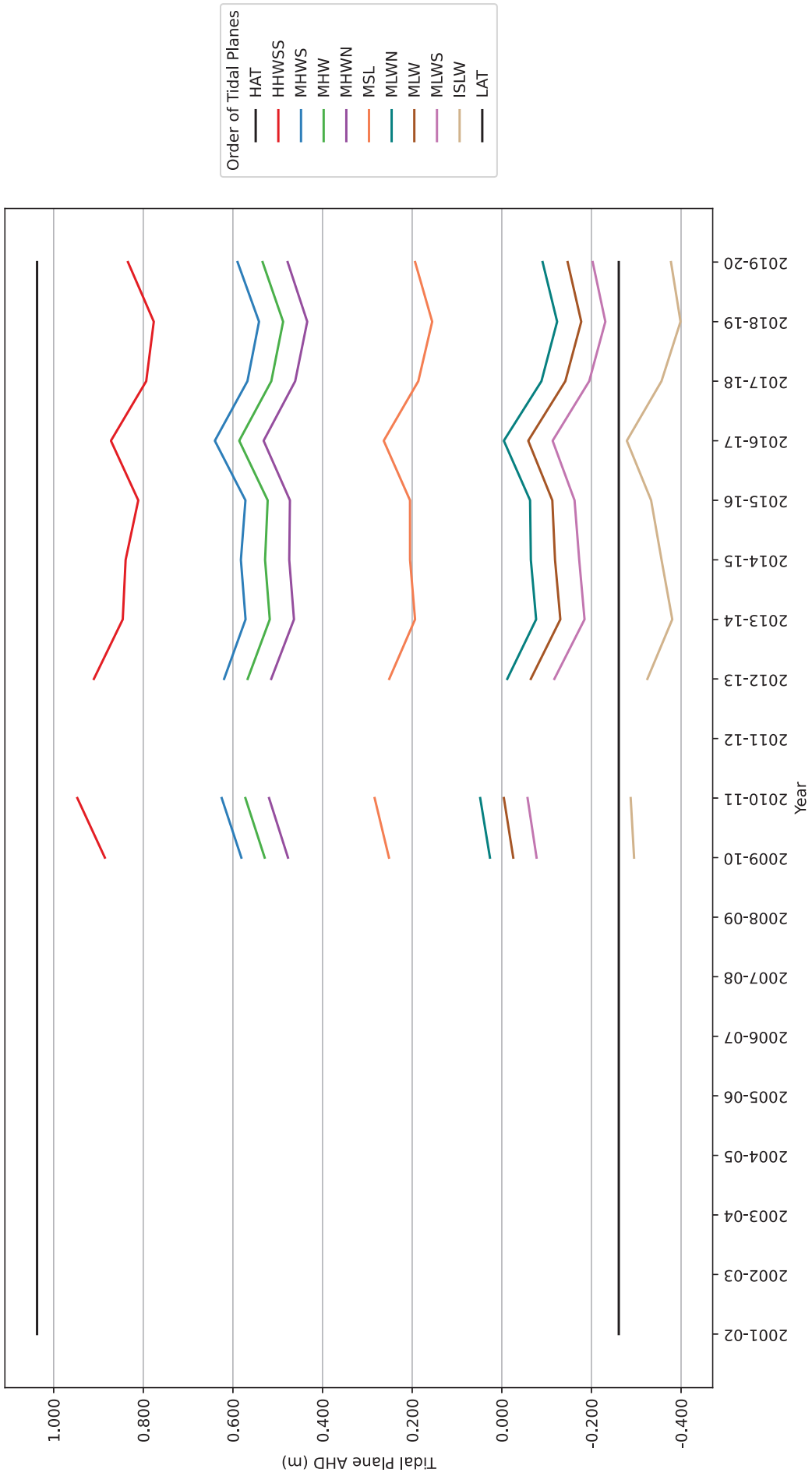
ZONE: 56
EASTING: 365591
NORTHING: 6380224

YEAR	2001-02	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08	2008-09*	2009-10	2010-11	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.914						0.909		0.886	0.947		0.910	0.846	0.839	0.811	0.872	0.793	0.777	0.834	0.862	0.053
MHWS	0.674						0.614		0.581	0.625		0.620	0.572	0.582	0.572	0.640	0.568	0.542	0.590	0.598	0.037
MHW	0.616						0.560		0.529	0.572		0.567	0.518	0.528	0.522	0.586	0.514	0.488	0.534	0.545	0.036
MHWN	0.559						0.507		0.477	0.519		0.515	0.464	0.474	0.473	0.532	0.461	0.434	0.478	0.491	0.035
MSL	0.299						0.287		0.252	0.284		0.251	0.194	0.205	0.205	0.263	0.186	0.155	0.193	0.231	0.047
MLWN	0.038						0.066		0.026	0.048		-0.012	-0.077	-0.065	-0.063	-0.005	-0.088	-0.123	-0.091	-0.029	0.064
MLW	-0.019						0.013		-0.026	-0.005		-0.065	-0.131	-0.119	-0.113	-0.059	-0.142	-0.177	-0.147	-0.082	0.064
MLWS	-0.076						-0.040		-0.078	-0.057		-0.117	-0.185	-0.173	-0.162	-0.113	-0.195	-0.231	-0.203	-0.136	0.064
ISLW	-0.248						-0.251		-0.295	-0.288		-0.325	-0.380	-0.356	-0.333	-0.279	-0.356	-0.399	-0.378	-0.324	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.520						0.441		0.451	0.471		0.527	0.540	0.539	0.536	0.536	0.549	0.558	0.569	0.520	0.042
MR	0.635						0.547		0.555	0.577		0.632	0.648	0.647	0.635	0.645	0.656	0.665	0.681	0.627	0.043
MSR	0.750						0.654		0.659	0.682		0.737	0.756	0.755	0.734	0.754	0.763	0.773	0.792	0.734	0.045
R	1.161						1.160		1.181	1.235		1.235	1.226	1.196	1.144	1.151	1.150	1.175	1.212	1.186	0.034
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.318						0.274		0.277	0.288		0.316	0.324	0.324	0.318	0.322	0.328	0.333	0.340	0.313	0.022
S2	0.057						0.053		0.052	0.053		0.053	0.054	0.054	0.050	0.054	0.053	0.054	0.056	0.054	0.002
K1	0.100						0.118		0.122	0.131		0.119	0.115	0.109	0.104	0.100	0.099	0.103	0.106	0.110	0.010
O1	0.071						0.093		0.095	0.099		0.088	0.081	0.074	0.067	0.066	0.062	0.065	0.069	0.078	0.013
MSF	0.048						0.050		0.055	0.046		0.021	0.046	0.042	0.050	0.038	0.048	0.039	0.035	0.043	0.009
z0	0.299						0.287		0.252	0.284		0.251	0.194	0.205	0.205	0.263	0.186	0.155	0.193	0.231	0.047
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	99.743						99.598		101.968	97.497		96.788	97.437	98.760	99.799	99.544	101.332	101.098	100.655	99.518	1.642
S2	30.517						24.068		38.026	24.825		33.876	32.065	33.516	31.803	29.904	30.798	29.676	28.467	30.628	3.813
K1	198.841						197.427		192.318	187.044		178.272	182.807	184.356	187.965	190.028	196.944	198.401	199.638	191.170	7.186
O1	263.699						264.747		271.623	273.455		285.530	285.484	284.204	279.812	274.644	272.754	266.286	263.269	273.792	8.402
MSF	285.156						297.863		279.618	309.411		280.649	286.644	301.934	275.415	292.140	285.751	288.084	279.638	288.525	10.141
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079						0.077		0.078	0.088		0.102	0.090	0.104	0.082	0.084	0.086	0.092	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	54.0	22.1	45.7	46.5	36.3	25.3	51.8	44.9	61.7	58.3	45.9	63.1	93.9	86.6	90.5	84.3	98.6	99.2	95.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.04	04/06/2004 00:00	±0.22	43.1
Lowest Astronomical Tide (LAT)	-0.26	14/11/2013 03:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

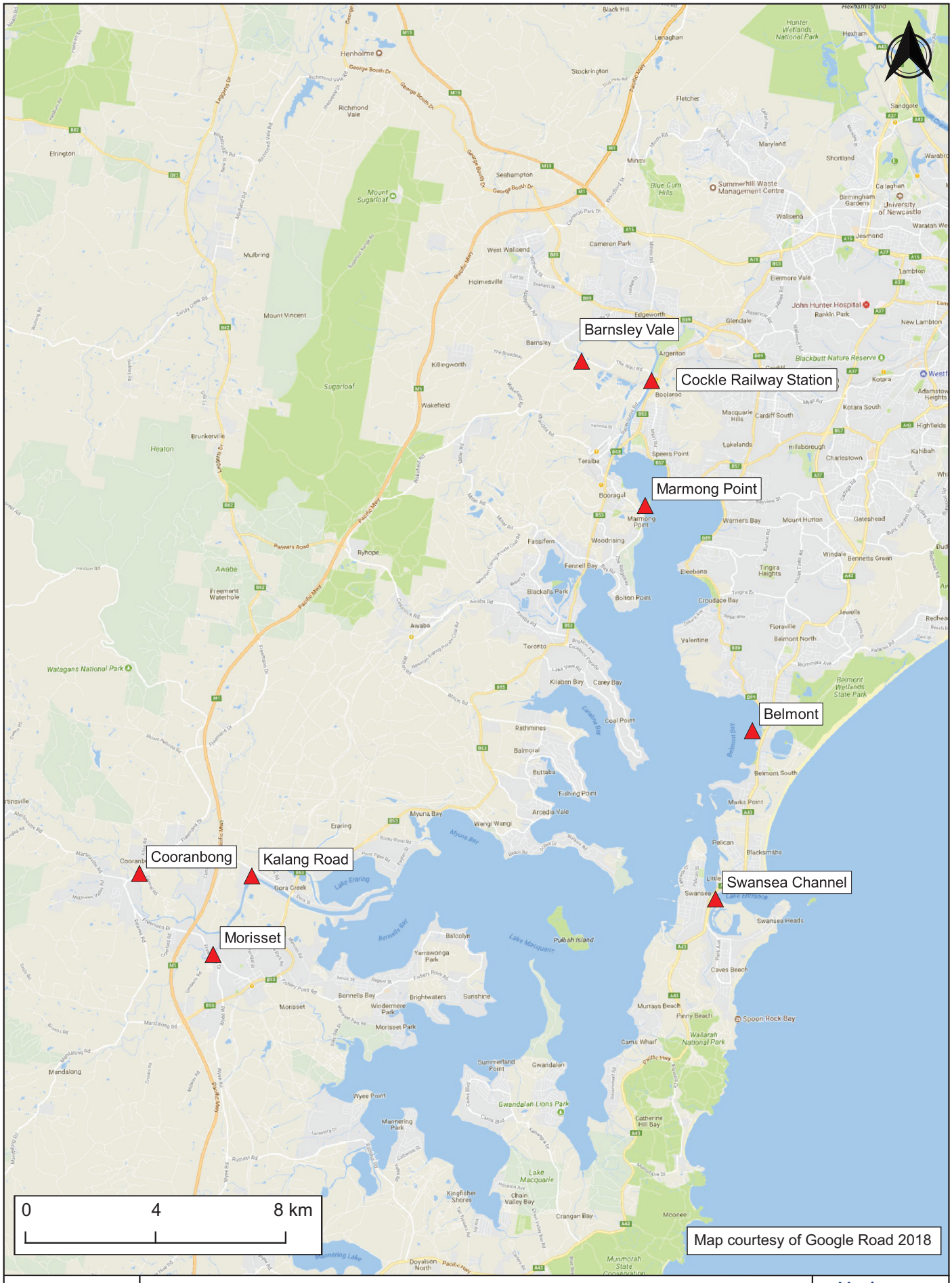


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallis Creek at Wallis Creek Downstream

MHL2786

Figure A144



NSW GOVERNMENT

STATION LOCATIONS
LAKE MACQUARIE REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A145

DRAWING A145.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Macquarie at Marmong Point

RECORDING STATION: **Lake Macquarie at Marmong Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211460

ZONE: 56
EASTING: 370992
NORTHING: 6350370

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.238	0.184	0.194	0.178	0.211	0.184	0.222		0.206	0.250	0.255	0.262	0.283	0.240	0.225	0.277	0.239	0.215	0.243	0.228	0.032
MHWS	0.182	0.129	0.134	0.117	0.145	0.118	0.147		0.127	0.171	0.177	0.191	0.216	0.181	0.164	0.217	0.181	0.156	0.181	0.163	0.031
MHW	0.173	0.120	0.125	0.108	0.135	0.108	0.138		0.117	0.162	0.167	0.180	0.206	0.171	0.154	0.205	0.170	0.146	0.170	0.153	0.030
MHWN	0.164	0.111	0.115	0.099	0.126	0.098	0.128		0.107	0.153	0.157	0.170	0.196	0.160	0.144	0.194	0.160	0.136	0.159	0.143	0.030
MSL	0.125	0.073	0.077	0.061	0.088	0.061	0.090		0.069	0.112	0.116	0.128	0.152	0.116	0.096	0.146	0.113	0.089	0.112	0.101	0.027
MLWN	0.086	0.035	0.039	0.024	0.051	0.025	0.052		0.031	0.071	0.075	0.086	0.109	0.072	0.048	0.099	0.066	0.042	0.065	0.060	0.025
MLW	0.077	0.026	0.029	0.015	0.041	0.015	0.042		0.021	0.062	0.065	0.076	0.099	0.062	0.038	0.087	0.056	0.032	0.054	0.050	0.025
MLWS	0.068	0.017	0.020	0.006	0.032	0.005	0.033		0.011	0.053	0.054	0.066	0.088	0.051	0.028	0.076	0.045	0.022	0.043	0.040	0.025
ISLW	0.028	-0.023	-0.023	-0.038	-0.015	-0.042	-0.021		-0.046	-0.003	-0.001	0.014	0.040	0.009	-0.015	0.033	0.004	-0.021	-0.001	-0.007	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.077	0.075	0.077	0.074	0.075	0.074	0.076		0.076	0.081	0.082	0.084	0.087	0.088	0.095	0.095	0.093	0.094	0.095	0.083	0.008
MR	0.096	0.093	0.095	0.093	0.094	0.093	0.095		0.096	0.100	0.102	0.104	0.108	0.109	0.115	0.118	0.114	0.114	0.116	0.103	0.009
MSR	0.114	0.111	0.114	0.111	0.113	0.112	0.115		0.116	0.119	0.123	0.125	0.128	0.130	0.136	0.141	0.135	0.134	0.137	0.123	0.010
R	0.209	0.207	0.217	0.216	0.226	0.226	0.242		0.251	0.253	0.256	0.248	0.243	0.231	0.240	0.244	0.235	0.236	0.244	0.235	0.015
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.048	0.047	0.048	0.046	0.047	0.046	0.048		0.048	0.050	0.051	0.052	0.054	0.054	0.058	0.059	0.057	0.057	0.058	0.052	0.005
S2	0.009	0.009	0.009	0.009	0.010	0.010	0.010		0.010	0.009	0.010	0.010	0.010	0.010	0.010	0.011	0.010	0.010	0.011	0.010	0.001
K1	0.023	0.023	0.026	0.025	0.027	0.027	0.030		0.032	0.032	0.031	0.030	0.029	0.026	0.027	0.026	0.025	0.026	0.026	0.027	0.003
O1	0.017	0.016	0.017	0.018	0.020	0.021	0.023		0.025	0.024	0.024	0.022	0.019	0.016	0.017	0.017	0.017	0.017	0.018	0.019	0.003
MSF	0.035	0.027	0.038	0.019	0.020	0.013	0.029		0.034	0.014	0.035	0.011	0.021	0.021	0.025	0.029	0.033	0.014	0.025	0.025	0.008
z0	0.125	0.073	0.077	0.061	0.088	0.061	0.090		0.069	0.112	0.116	0.128	0.152	0.116	0.096	0.146	0.113	0.089	0.112	0.101	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	82.988	83.240	83.710	83.971	83.656	82.341	81.151		80.614	80.255	78.463	77.686	79.524	82.244	78.703	79.975	80.253	80.353	80.647	81.099	1.927
S2	352.015	354.931	353.786	352.020	355.801	350.603	354.646		355.032	355.353	355.367	351.324	356.665	357.503	355.043	350.691	351.635	353.490	349.430	353.630	2.321
K1	210.981	212.897	212.057	211.919	211.174	208.594	205.915		199.638	197.192	192.788	191.674	190.814	191.638	192.962	197.853	201.234	204.497	208.109	202.330	8.173
O1	278.710	274.675	275.362	275.600	274.745	275.960	275.946		286.958	290.035	293.852	296.935	299.067	300.398	292.280	286.894	284.953	279.831	277.192	284.411	9.137
MSF	309.767	308.517	311.981	292.349	316.504	273.951	310.570		298.128	282.613	289.313	330.414	292.018	321.117	289.722	317.340	305.561	310.930	274.205	301.944	16.163
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.071	0.067	0.068	0.079	0.082	0.065		0.063	0.079	0.064	0.084	0.069	0.077	0.065	0.056	0.065	0.087	0.063		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.3	99.7	98.8	99.4	99.3	97.3	93.8	28.1	53.6	97.6	98.6	91.4	95.8	94.2	95.9	97.9	97.0	98.8	97.2		

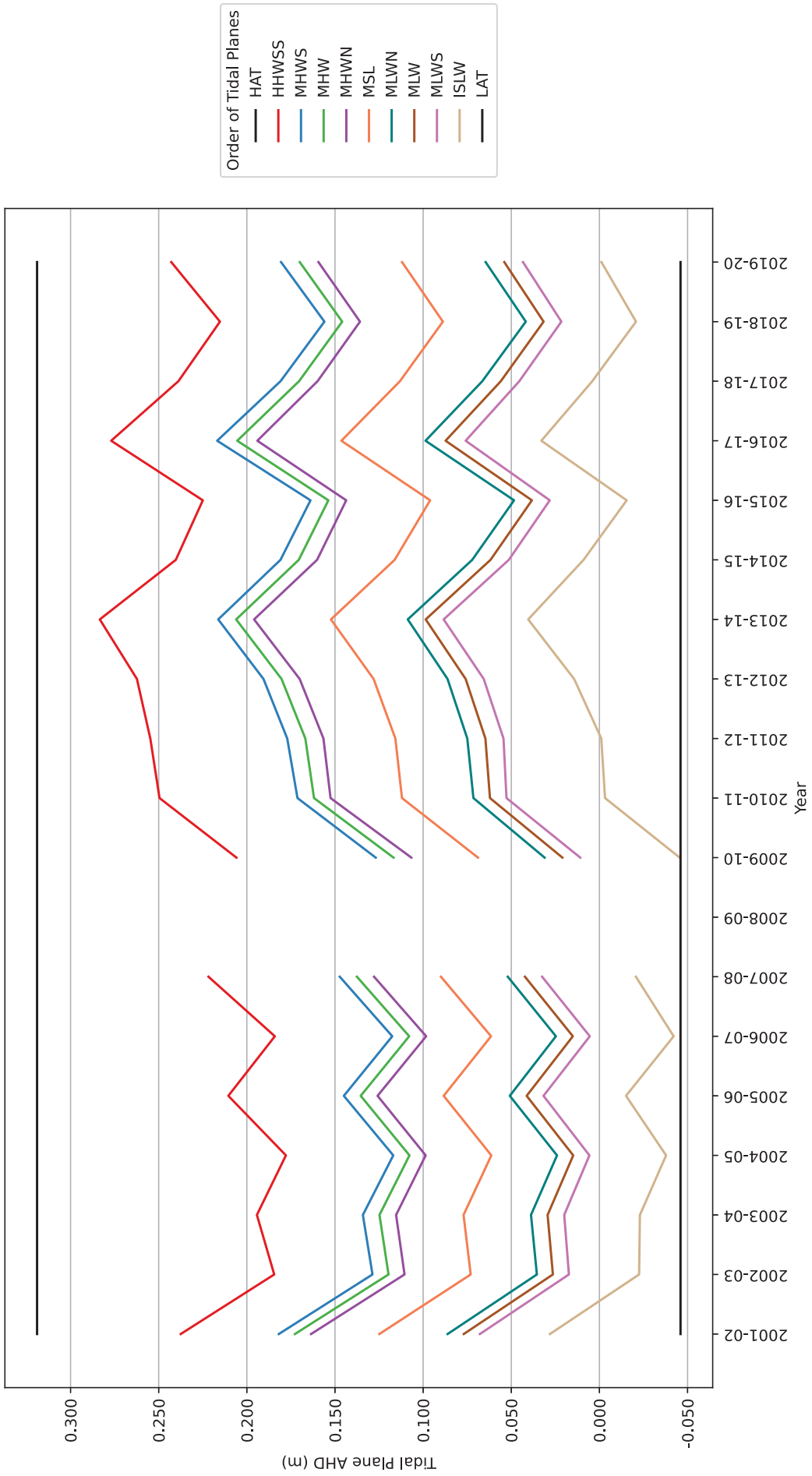
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.32	18/05/2003 00:30	±0.17	34.7
Lowest Astronomical Tide (LAT)	-0.05	19/09/2003 10:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A146

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Macquarie at Marmong Point

MHL2786

Figure A146

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cockle Creek at Cockle Railway Station

RECORDING STATION: **Cockle Creek at Cockle Railway Station**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211455

ZONE: 56
EASTING: 371189
NORTHING: 6354213

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.216	0.180	0.205	0.210	0.225	0.191	0.200	0.193	0.223	0.236	0.258	0.251	0.257	0.249	0.232	0.280	0.244	0.229	0.247	0.228	0.027
MHWS	0.160	0.122	0.145	0.148	0.156	0.120	0.125	0.114	0.142	0.160	0.180	0.174	0.188	0.187	0.171	0.220	0.183	0.169	0.183	0.160	0.028
MHW	0.150	0.112	0.135	0.138	0.146	0.109	0.114	0.103	0.131	0.150	0.169	0.163	0.178	0.176	0.161	0.208	0.172	0.158	0.172	0.150	0.028
MHWN	0.140	0.103	0.125	0.128	0.136	0.099	0.103	0.092	0.121	0.139	0.158	0.151	0.167	0.165	0.150	0.197	0.161	0.146	0.161	0.139	0.027
MSL	0.101	0.063	0.086	0.090	0.096	0.060	0.065	0.054	0.081	0.098	0.117	0.109	0.122	0.119	0.102	0.148	0.112	0.098	0.111	0.096	0.024
MLWN	0.061	0.024	0.046	0.051	0.056	0.022	0.026	0.016	0.041	0.056	0.075	0.067	0.076	0.074	0.054	0.099	0.064	0.050	0.062	0.054	0.021
MLW	0.051	0.014	0.036	0.041	0.046	0.012	0.015	0.005	0.031	0.046	0.064	0.055	0.066	0.062	0.044	0.087	0.052	0.039	0.050	0.043	0.021
MLWS	0.041	0.004	0.027	0.031	0.036	0.001	0.005	-0.005	0.020	0.035	0.053	0.043	0.056	0.051	0.033	0.076	0.041	0.027	0.039	0.032	0.021
ISLW	0.001	-0.037	-0.016	-0.013	-0.014	-0.050	-0.049	-0.062	-0.038	-0.019	-0.003	-0.011	0.007	0.007	-0.010	0.032	-0.002	-0.016	-0.007	-0.016	0.023
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.080	0.079	0.079	0.077	0.079	0.076	0.077	0.076	0.079	0.083	0.084	0.084	0.091	0.091	0.096	0.098	0.097	0.096	0.099	0.085	0.008
MR	0.099	0.098	0.099	0.097	0.100	0.098	0.099	0.098	0.101	0.104	0.105	0.108	0.112	0.114	0.117	0.121	0.120	0.119	0.122	0.107	0.009
MSR	0.118	0.118	0.119	0.117	0.120	0.119	0.120	0.119	0.122	0.125	0.126	0.131	0.132	0.136	0.138	0.144	0.142	0.142	0.144	0.128	0.010
R	0.215	0.217	0.222	0.223	0.239	0.242	0.250	0.256	0.261	0.255	0.261	0.262	0.250	0.242	0.243	0.248	0.246	0.245	0.254	0.244	0.015
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.049	0.049	0.049	0.049	0.050	0.049	0.049	0.049	0.050	0.052	0.053	0.054	0.056	0.057	0.059	0.060	0.060	0.059	0.061	0.053	0.005
S2	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.010	0.011	0.012	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.001
K1	0.023	0.025	0.026	0.026	0.029	0.030	0.031	0.031	0.033	0.030	0.032	0.032	0.029	0.027	0.026	0.026	0.027	0.026	0.028	0.028	0.003
O1	0.017	0.017	0.017	0.019	0.020	0.022	0.024	0.026	0.025	0.024	0.024	0.023	0.020	0.017	0.018	0.017	0.016	0.017	0.018	0.020	0.003
MSF	0.037	0.027	0.041	0.015	0.020	0.009	0.028	0.009	0.022	0.017	0.036	0.010	0.021	0.022	0.025	0.031	0.032	0.013	0.025	0.023	0.010
z0	0.101	0.063	0.086	0.090	0.096	0.060	0.065	0.054	0.081	0.098	0.117	0.109	0.122	0.119	0.102	0.148	0.112	0.098	0.111	0.096	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	88.062	85.796	86.617	86.547	86.761	84.526	83.945	82.514	83.916	82.609	81.788	79.920	79.240	80.075	80.599	81.513	81.782	82.687	82.316	83.222	2.587
S2	359.189	0.860	0.112	354.532	358.066	354.301	0.165	357.001	357.564	1.449	357.153	356.735	359.106	2.593	359.255	1.489	1.443	357.468	351.993	225.814	176.295
K1	212.607	214.636	212.946	213.673	211.362	213.072	207.683	204.139	204.819	201.151	194.353	188.227	190.775	192.765	194.295	199.660	199.322	205.077	208.962	203.659	8.567
O1	278.574	275.135	277.074	277.296	276.293	275.470	278.579	279.188	286.060	293.308	296.032	298.712	300.450	301.933	291.088	287.888	286.298	276.280	278.504	284.956	9.348
MSF	311.035	309.132	312.359	289.471	309.707	281.682	305.211	20.626	286.751	283.645	287.812	357.559	291.034	321.491	294.769	315.682	304.620	326.469	275.040	288.637	67.736
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.070	0.065	0.071	0.074	0.078	0.081	0.080	0.073	0.070	0.080	0.066	0.091	0.071	0.076	0.064	0.056	0.069	0.081	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	97.1	99.4	97.6	98.0	97.5	96.3	94.0	96.7	98.8	92.6	94.7	81.7	97.3	92.5	97.9	96.1	95.2	96.7	96.8		

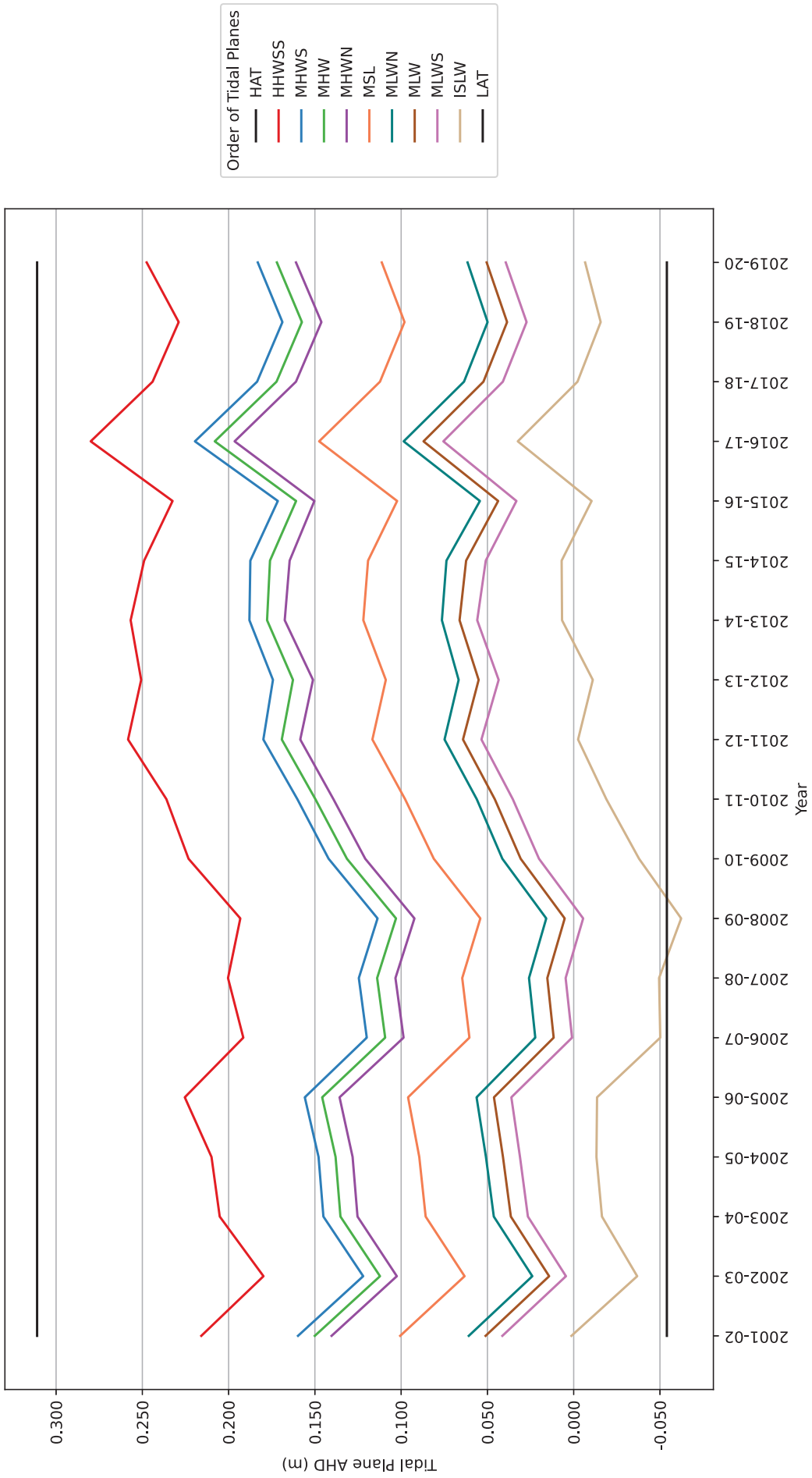
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.31	18/05/2003 00:30	±0.16	40.7
Lowest Astronomical Tide (LAT)	-0.05	19/09/2003 10:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A147

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cockle Creek at Cockle Railway Station

MHL2786

Figure A147

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Macquarie at Belmont

RECORDING STATION: **Lake Macquarie at Belmont**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211461

ZONE: 56
EASTING: 374287
NORTHING: 6343446

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.210	0.150	0.161	0.152	0.194	0.162	0.197	0.195	0.205	0.243	0.237	0.203	0.216	0.222	0.202	0.258	0.225	0.197	0.225	0.203	0.030
MHWS	0.154	0.095	0.102	0.091	0.129	0.094	0.123	0.118	0.128	0.166	0.161	0.137	0.150	0.164	0.145	0.200	0.169	0.140	0.164	0.138	0.030
MHW	0.145	0.086	0.092	0.082	0.120	0.085	0.113	0.109	0.119	0.157	0.151	0.129	0.140	0.154	0.135	0.190	0.160	0.130	0.154	0.129	0.030
MHWN	0.136	0.078	0.083	0.073	0.111	0.075	0.104	0.100	0.110	0.147	0.141	0.120	0.130	0.144	0.126	0.180	0.150	0.121	0.144	0.120	0.029
MSL	0.098	0.040	0.045	0.036	0.073	0.039	0.066	0.062	0.072	0.108	0.101	0.082	0.088	0.100	0.080	0.133	0.103	0.074	0.097	0.079	0.027
MLWN	0.060	0.003	0.008	-0.001	0.036	0.002	0.029	0.024	0.034	0.068	0.061	0.044	0.045	0.057	0.034	0.087	0.057	0.028	0.050	0.038	0.024
MLW	0.051	-0.006	-0.002	-0.010	0.026	-0.007	0.019	0.015	0.025	0.059	0.051	0.036	0.035	0.047	0.025	0.077	0.047	0.018	0.040	0.029	0.024
MLWS	0.042	-0.015	-0.011	-0.019	0.017	-0.017	0.010	0.005	0.016	0.049	0.041	0.027	0.025	0.037	0.015	0.066	0.037	0.009	0.030	0.019	0.024
ISLW	0.002	-0.054	-0.054	-0.062	-0.030	-0.065	-0.043	-0.050	-0.039	-0.006	-0.014	-0.020	-0.022	-0.004	-0.026	0.025	-0.003	-0.032	-0.014	-0.027	0.024
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.076	0.075	0.075	0.074	0.075	0.073	0.075	0.076	0.076	0.079	0.080	0.076	0.085	0.088	0.092	0.093	0.093	0.093	0.094	0.082	0.008
MR	0.094	0.092	0.094	0.092	0.093	0.092	0.094	0.095	0.094	0.098	0.100	0.093	0.105	0.107	0.111	0.113	0.113	0.112	0.114	0.100	0.009
MSR	0.112	0.110	0.113	0.110	0.112	0.111	0.113	0.113	0.113	0.117	0.120	0.110	0.125	0.127	0.129	0.134	0.132	0.131	0.134	0.119	0.009
R	0.207	0.204	0.215	0.214	0.224	0.228	0.240	0.245	0.244	0.249	0.250	0.223	0.237	0.227	0.227	0.233	0.228	0.229	0.239	0.230	0.013
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.047	0.046	0.047	0.046	0.047	0.046	0.047	0.047	0.047	0.049	0.050	0.047	0.052	0.054	0.055	0.057	0.056	0.056	0.057	0.050	0.004
S2	0.009	0.009	0.009	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.010	0.009	0.010	0.010	0.009	0.010	0.010	0.010	0.010	0.009	0.000
K1	0.023	0.023	0.025	0.025	0.027	0.027	0.030	0.031	0.031	0.031	0.030	0.027	0.028	0.025	0.025	0.025	0.023	0.025	0.026	0.027	0.003
O1	0.016	0.016	0.018	0.018	0.019	0.021	0.023	0.024	0.024	0.024	0.024	0.020	0.019	0.017	0.016	0.017	0.017	0.016	0.018	0.019	0.003
MSF	0.034	0.027	0.038	0.019	0.020	0.014	0.032	0.009	0.023	0.011	0.037	0.015	0.024	0.021	0.024	0.029	0.031	0.014	0.024	0.023	0.009
z0	0.098	0.040	0.045	0.036	0.073	0.039	0.066	0.062	0.072	0.108	0.101	0.082	0.088	0.100	0.080	0.133	0.103	0.074	0.097	0.079	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	80.991	82.385	82.727	83.198	82.593	81.630	80.139	80.034	79.277	77.778	75.913	77.086	77.132	76.984	77.960	78.868	79.100	79.452	79.723	79.630	2.183
S2	347.945	347.688	349.017	347.072	348.354	344.467	350.089	351.331	346.698	350.218	348.433	354.325	348.951	348.215	348.403	348.056	348.482	348.718	346.447	348.574	2.040
K1	208.595	212.512	210.685	209.844	209.440	208.460	205.876	202.735	200.359	193.804	190.371	188.386	186.690	190.173	191.350	197.791	199.808	204.447	207.896	201.012	8.584
O1	276.488	274.693	273.759	274.786	275.307	274.397	277.483	280.027	285.438	289.451	293.776	297.794	298.442	296.791	289.361	287.591	280.904	276.615	276.109	283.116	8.825
MSF	310.564	308.814	312.476	292.976	319.407	273.628	303.999	4.124	300.818	278.391	291.455	20.697	289.018	325.447	290.083	314.594	305.438	308.415	273.007	269.650	91.889
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.071	0.067	0.069	0.078	0.082	0.065	0.062	0.073	0.082	0.072	0.083	0.074	0.072	0.063	0.054	0.064	0.084	0.063		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	96.1	99.9	99.0	99.5	99.3	97.7	99.5	99.6	99.5	88.7	97.1	94.3	99.4	94.6	96.6	98.7	98.1	98.9	97.4		

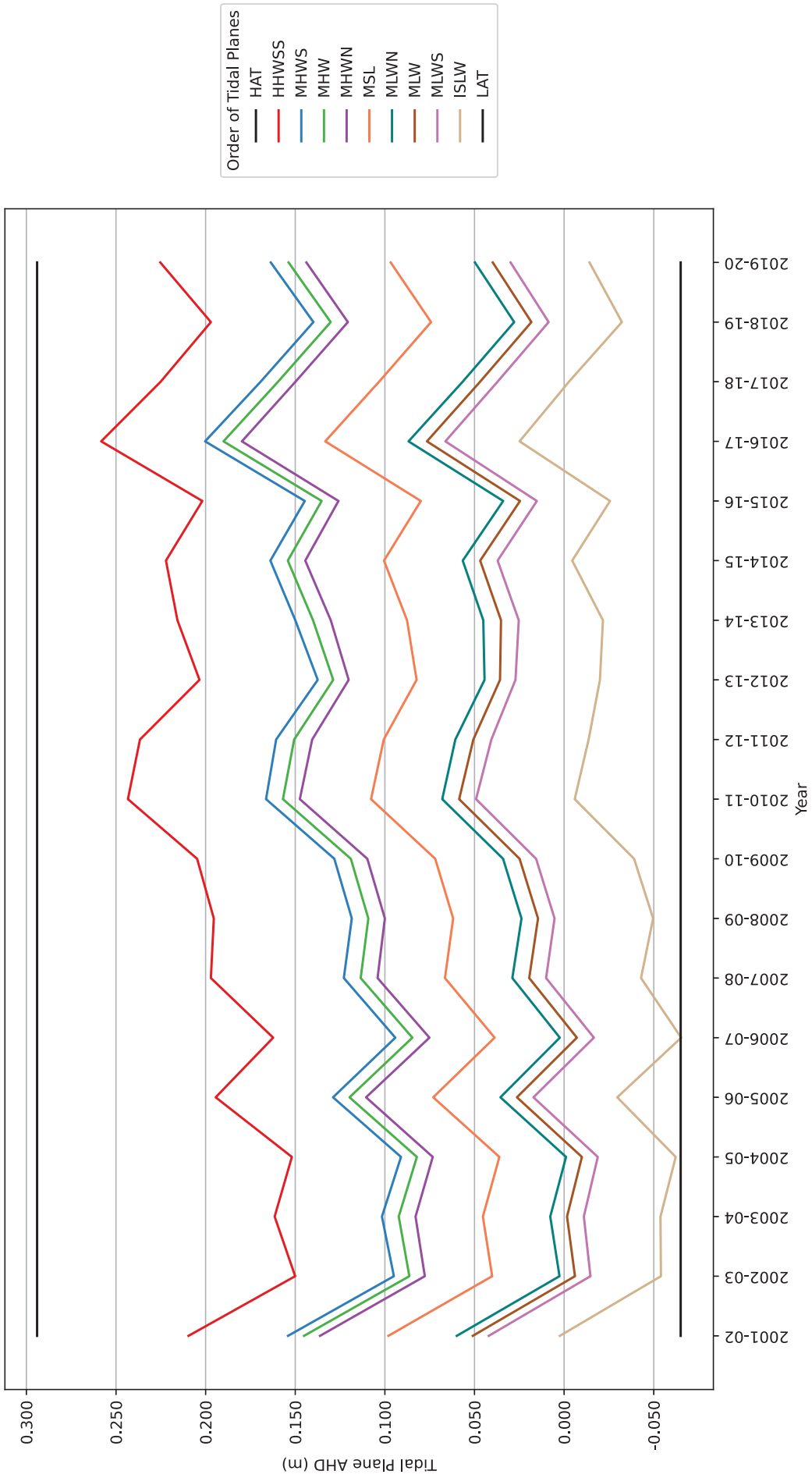
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.29	05/06/2004 00:30	±0.14	27.6
Lowest Astronomical Tide (LAT)	-0.07	19/09/2003 10:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A148

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Macquarie at Belmont

MHL2786

Figure A148

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Macquarie at Swansea Channel

RECORDING STATION: **Lake Macquarie at Swansea Channel**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211462

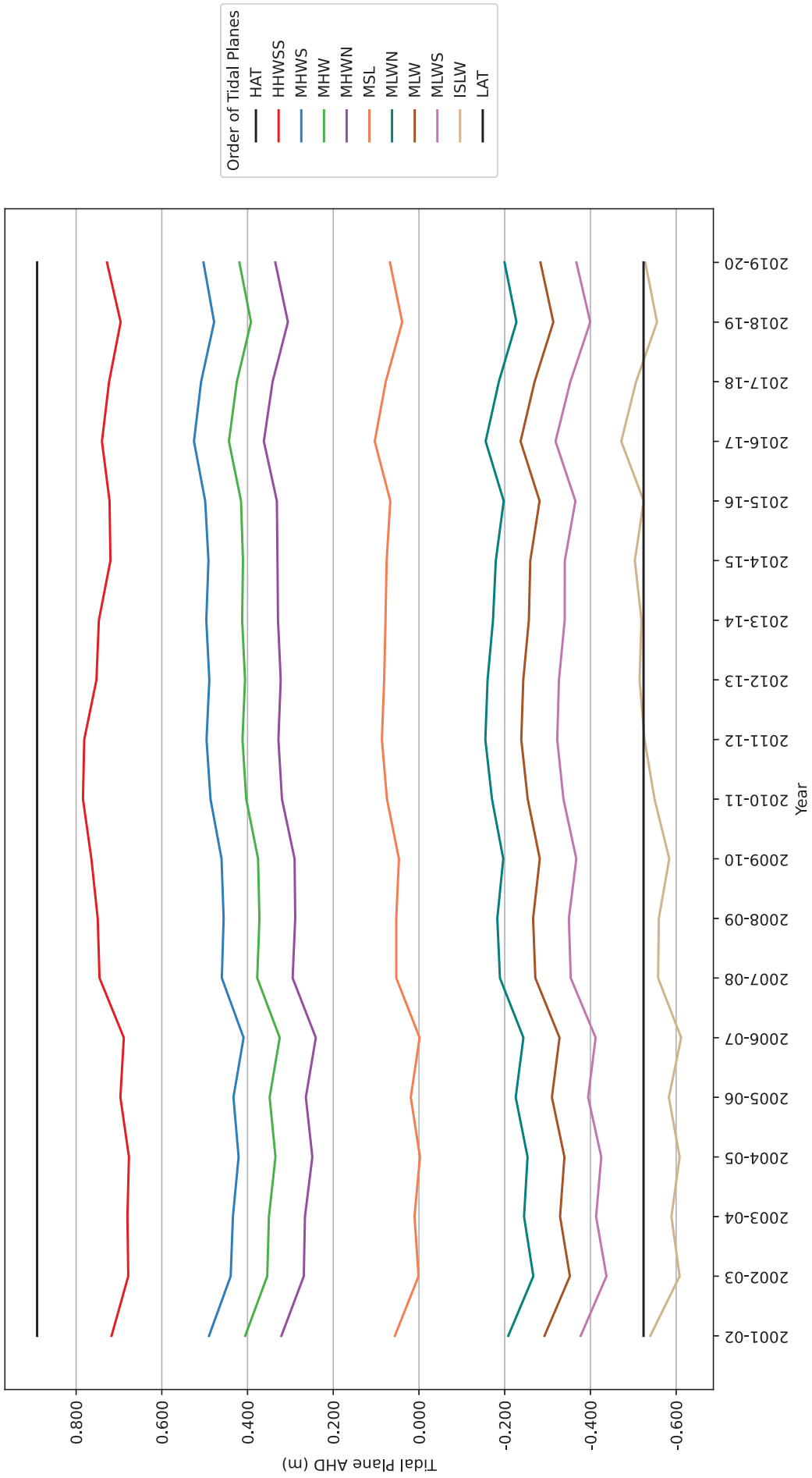
ZONE: 56
EASTING: 373155
NORTHING: 6338270

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.717	0.678	0.680	0.677	0.697	0.689	0.745	0.750	0.764	0.784	0.781	0.753	0.747	0.720	0.722	0.740	0.723	0.696	0.728	0.726	0.034
MHWS	0.490	0.439	0.434	0.421	0.433	0.409	0.460	0.456	0.461	0.486	0.496	0.489	0.496	0.491	0.499	0.525	0.508	0.478	0.503	0.472	0.033
MHW	0.405	0.354	0.350	0.335	0.348	0.325	0.377	0.372	0.375	0.403	0.412	0.406	0.413	0.411	0.415	0.443	0.425	0.392	0.419	0.388	0.033
MHWN	0.321	0.269	0.266	0.249	0.264	0.241	0.295	0.289	0.290	0.320	0.328	0.323	0.329	0.330	0.332	0.362	0.342	0.306	0.335	0.305	0.034
MSL	0.056	0.001	0.010	-0.002	0.019	-0.001	0.053	0.053	0.047	0.075	0.087	0.081	0.078	0.075	0.067	0.103	0.078	0.039	0.068	0.052	0.032
MLWN	-0.208	-0.267	-0.245	-0.253	-0.226	-0.244	-0.189	-0.183	-0.197	-0.170	-0.155	-0.160	-0.173	-0.179	-0.198	-0.156	-0.186	-0.227	-0.200	-0.201	0.034
MLW	-0.293	-0.352	-0.329	-0.339	-0.310	-0.328	-0.272	-0.266	-0.282	-0.254	-0.239	-0.243	-0.256	-0.260	-0.281	-0.237	-0.270	-0.314	-0.283	-0.285	0.035
MLWS	-0.377	-0.437	-0.413	-0.425	-0.395	-0.412	-0.354	-0.350	-0.367	-0.337	-0.323	-0.327	-0.340	-0.340	-0.365	-0.319	-0.353	-0.400	-0.367	-0.368	0.036
ISLW	-0.540	-0.608	-0.589	-0.608	-0.583	-0.612	-0.558	-0.560	-0.584	-0.550	-0.526	-0.515	-0.519	-0.504	-0.524	-0.472	-0.507	-0.555	-0.528	-0.550	0.040
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.529	0.536	0.511	0.502	0.490	0.484	0.484	0.472	0.487	0.490	0.483	0.483	0.502	0.509	0.529	0.517	0.528	0.533	0.535	0.505	0.022
MR	0.698	0.706	0.679	0.674	0.659	0.653	0.649	0.639	0.657	0.657	0.651	0.649	0.669	0.670	0.697	0.681	0.695	0.705	0.702	0.673	0.022
MSR	0.867	0.877	0.847	0.846	0.827	0.821	0.814	0.806	0.828	0.823	0.818	0.816	0.836	0.831	0.864	0.844	0.862	0.878	0.870	0.841	0.023
R	1.257	1.286	1.269	1.285	1.280	1.300	1.303	1.309	1.348	1.334	1.307	1.267	1.266	1.224	1.246	1.212	1.230	1.251	1.256	1.275	0.036
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.349	0.353	0.340	0.337	0.329	0.326	0.324	0.319	0.329	0.328	0.325	0.325	0.334	0.335	0.348	0.340	0.347	0.353	0.351	0.337	0.011
S2	0.084	0.085	0.084	0.086	0.084	0.084	0.083	0.084	0.085	0.083	0.084	0.083	0.084	0.080	0.084	0.082	0.083	0.086	0.084	0.084	0.001
K1	0.103	0.108	0.111	0.114	0.116	0.123	0.123	0.126	0.130	0.129	0.124	0.116	0.112	0.104	0.102	0.099	0.098	0.100	0.103	0.113	0.011
O1	0.059	0.063	0.065	0.068	0.072	0.077	0.080	0.084	0.087	0.084	0.080	0.072	0.067	0.060	0.057	0.054	0.056	0.056	0.058	0.068	0.011
MSF	0.025	0.019	0.034	0.011	0.011	0.011	0.025	0.009	0.015	0.007	0.030	0.006	0.012	0.016	0.020	0.023	0.026	0.010	0.017	0.017	0.008
z0	0.056	0.001	0.010	-0.002	0.019	-0.001	0.053	0.053	0.047	0.075	0.087	0.081	0.078	0.075	0.067	0.103	0.078	0.039	0.068	0.052	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	354.790	354.896	355.598	355.860	355.765	354.756	354.092	353.199	351.884	351.343	351.011	351.531	352.830	355.295	352.602	354.744	353.688	353.810	354.652	353.808	1.559
S2	262.792	263.253	262.833	262.274	263.017	263.502	263.498	265.048	262.675	264.651	264.217	262.901	265.657	267.982	264.878	265.667	263.339	263.839	263.743	263.988	1.395
K1	129.373	131.367	131.691	131.003	130.472	129.387	127.188	123.893	120.161	116.517	113.738	112.071	111.663	112.812	114.126	119.669	122.374	125.322	128.581	122.706	7.371
O1	193.900	191.037	191.184	191.135	191.346	192.982	195.250	199.013	201.652	207.330	212.603	215.223	217.238	216.281	212.100	208.410	202.631	196.314	195.828	201.656	9.527
MSF	296.230	298.788	300.927	276.326	326.982	257.323	294.883	24.982	295.552	260.652	279.881	355.809	270.183	324.942	273.981	304.785	295.049	323.340	258.299	279.943	66.979
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.079	0.071	0.074	0.082	0.087	0.069	0.067	0.077	0.081	0.065	0.079	0.076	0.079	0.063	0.063	0.066	0.088	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.1	99.0	98.1	99.2	98.3	96.6	99.2	98.7	98.1	97.0	96.7	91.3	96.2	92.3	97.2	89.7	95.4	97.9	96.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.89	04/06/2008 20:45	±0.17	4.6
Lowest Astronomical Tide (LAT)	-0.52	28/09/2015 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Macquarie at Swansea Channel

MHL2786

Figure A149

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Dora Creek at Kalang Road

RECORDING STATION: **Dora Creek at Kalang Road**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211475

ZONE: 56
EASTING: 358900
NORTHING: 6338978

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.259	0.201	0.196	0.206	0.234	0.197	0.233	0.228	0.228	0.275	0.263	0.269	0.259	0.233	0.234	0.283	0.242	0.223	0.249	0.237	0.026
MHWS	0.198	0.138	0.130	0.140	0.160	0.121	0.156	0.143	0.142	0.191	0.189	0.199	0.189	0.164	0.169	0.218	0.180	0.158	0.180	0.167	0.027
MHW	0.187	0.128	0.119	0.129	0.149	0.111	0.146	0.132	0.130	0.179	0.176	0.187	0.177	0.151	0.156	0.205	0.167	0.145	0.168	0.155	0.026
MHWN	0.177	0.118	0.108	0.119	0.139	0.101	0.136	0.121	0.119	0.168	0.163	0.175	0.165	0.137	0.144	0.193	0.155	0.132	0.155	0.143	0.026
MSL	0.132	0.073	0.064	0.076	0.095	0.058	0.094	0.077	0.073	0.122	0.120	0.128	0.119	0.089	0.092	0.139	0.102	0.080	0.101	0.097	0.024
MLWN	0.087	0.028	0.021	0.033	0.052	0.015	0.051	0.033	0.027	0.077	0.077	0.082	0.072	0.042	0.040	0.086	0.049	0.027	0.046	0.050	0.024
MLW	0.076	0.018	0.010	0.023	0.041	0.004	0.041	0.022	0.016	0.065	0.064	0.070	0.060	0.028	0.028	0.073	0.036	0.014	0.034	0.038	0.023
MLWS	0.066	0.008	-0.001	0.012	0.031	-0.006	0.032	0.011	0.005	0.054	0.051	0.058	0.048	0.015	0.015	0.060	0.023	0.001	0.021	0.027	0.023
ISLW	0.022	-0.037	-0.048	-0.035	-0.022	-0.060	-0.023	-0.050	-0.057	-0.006	-0.002	0.008	-0.002	-0.035	-0.032	0.014	-0.021	-0.045	-0.028	-0.024	0.024
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.090	0.090	0.087	0.086	0.086	0.086	0.085	0.088	0.092	0.090	0.086	0.092	0.093	0.096	0.103	0.107	0.106	0.104	0.109	0.093	0.008
MR	0.111	0.110	0.109	0.107	0.108	0.107	0.105	0.110	0.114	0.114	0.112	0.117	0.117	0.123	0.129	0.132	0.131	0.130	0.134	0.117	0.010
MSR	0.132	0.130	0.130	0.128	0.130	0.127	0.124	0.131	0.137	0.138	0.138	0.141	0.141	0.149	0.154	0.158	0.157	0.156	0.160	0.140	0.012
R	0.237	0.238	0.243	0.242	0.256	0.257	0.256	0.278	0.284	0.281	0.266	0.261	0.262	0.268	0.266	0.269	0.263	0.268	0.276	0.262	0.014
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.056	0.055	0.054	0.053	0.054	0.053	0.052	0.055	0.057	0.057	0.056	0.058	0.058	0.061	0.064	0.066	0.066	0.065	0.067	0.058	0.005
S2	0.010	0.010	0.011	0.010	0.011	0.010	0.010	0.011	0.011	0.012	0.013	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.001
K1	0.026	0.027	0.029	0.028	0.032	0.032	0.032	0.035	0.036	0.036	0.031	0.031	0.030	0.031	0.029	0.028	0.028	0.029	0.030	0.031	0.003
O1	0.018	0.018	0.018	0.019	0.021	0.022	0.022	0.026	0.026	0.023	0.022	0.020	0.020	0.018	0.018	0.018	0.016	0.017	0.018	0.020	0.003
MSF	0.034	0.028	0.046	0.020	0.025	0.014	0.030	0.010	0.023	0.023	0.039	0.006	0.024	0.029	0.025	0.028	0.031	0.014	0.025	0.025	0.010
z0	0.132	0.073	0.064	0.076	0.095	0.058	0.094	0.077	0.073	0.122	0.120	0.128	0.119	0.089	0.092	0.139	0.102	0.080	0.101	0.097	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	93.560	95.323	96.210	96.584	95.320	95.282	95.275	91.842	89.394	89.447	87.693	87.680	85.635	86.679	87.530	87.556	88.340	89.468	90.080	90.995	3.713
S2	7.265	12.059	11.131	13.243	8.967	10.484	14.629	15.925	9.916	15.550	12.186	12.386	9.482	15.621	10.559	9.722	10.521	11.252	9.729	11.612	2.443
K1	221.668	220.907	220.615	222.740	222.609	218.680	217.715	212.900	208.830	204.975	200.330	197.433	198.061	188.555	199.111	204.581	207.604	211.565	213.508	210.126	10.222
O1	279.099	282.197	282.937	280.984	280.561	278.638	282.029	286.677	291.765	292.339	296.187	303.093	305.182	300.713	296.606	293.063	287.840	282.854	281.834	288.663	8.527
MSF	307.527	304.671	311.216	298.350	323.907	283.465	307.363	2.941	304.128	310.168	293.113	333.285	281.106	322.280	290.347	315.148	305.724	308.874	273.822	288.286	70.707
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.074	0.066	0.072	0.075	0.080	0.066	0.061	0.073	0.075	0.065	0.075	0.074	0.064	0.062	0.055	0.064	0.085	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	78.4	98.0	97.8	99.2	96.4	97.4	99.0	99.2	98.5	83.8	89.7	81.5	93.0	168.4	98.4	98.6	98.8	99.6	98.2		

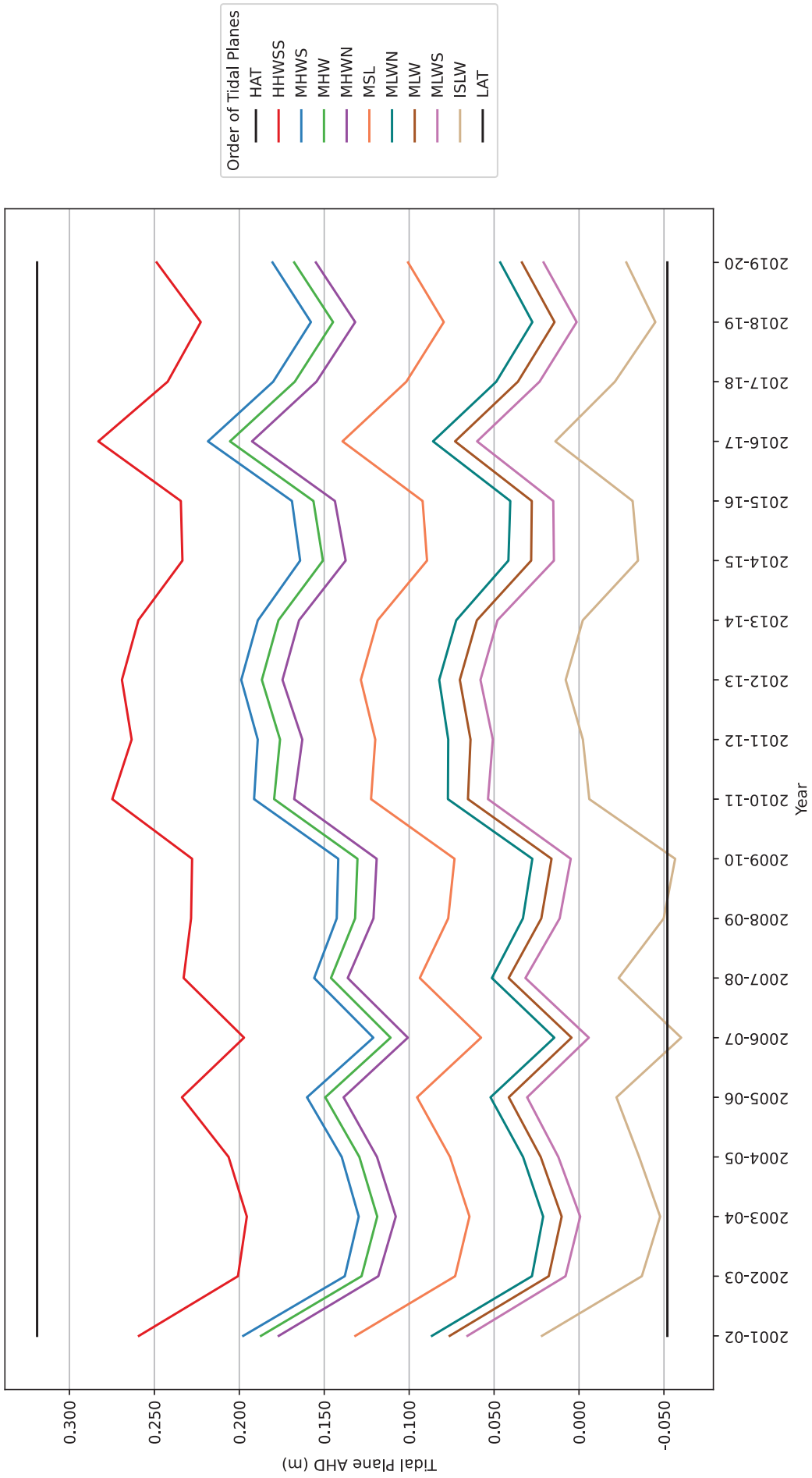
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.32	18/05/2003 00:45	±0.16	40.1
Lowest Astronomical Tide (LAT)	-0.05	01/09/2002 11:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A150

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Dora Creek at Kalang Road

MHL2786

Figure
A150

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Stockton Creek at Morisset

RECORDING STATION: **Stockton Creek at Morisset**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211480

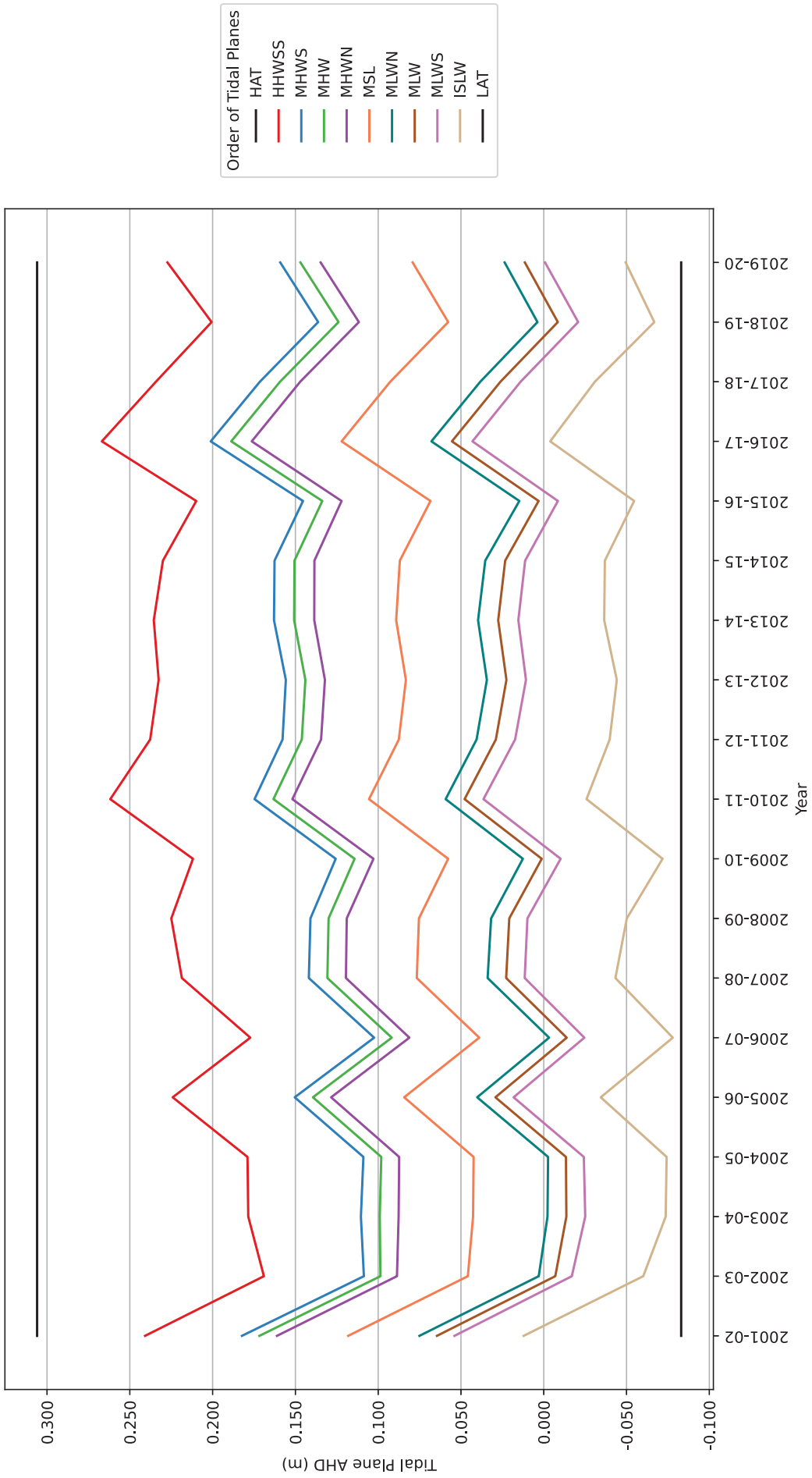
ZONE: 56
EASTING: 357710
NORTHING: 6336566

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.241	0.169	0.178	0.179	0.224	0.177	0.219	0.225	0.212	0.262	0.238	0.233	0.236	0.230	0.210	0.267	0.234	0.201	0.227	0.219	0.028
MHWS	0.182	0.109	0.110	0.109	0.150	0.102	0.142	0.141	0.126	0.175	0.158	0.156	0.163	0.163	0.145	0.201	0.171	0.136	0.159	0.147	0.027
MHW	0.172	0.099	0.099	0.098	0.139	0.092	0.131	0.130	0.114	0.163	0.146	0.144	0.151	0.151	0.134	0.189	0.159	0.124	0.147	0.136	0.027
MHWN	0.161	0.089	0.088	0.087	0.128	0.081	0.119	0.119	0.103	0.152	0.134	0.132	0.139	0.139	0.122	0.176	0.147	0.112	0.135	0.124	0.026
MSL	0.118	0.046	0.043	0.042	0.084	0.039	0.077	0.075	0.058	0.106	0.088	0.083	0.089	0.087	0.068	0.122	0.093	0.058	0.079	0.077	0.025
MLWN	0.075	0.003	-0.002	-0.003	0.040	-0.003	0.034	0.032	0.013	0.059	0.041	0.034	0.040	0.035	0.015	0.068	0.038	0.004	0.024	0.029	0.023
MLW	0.065	-0.007	-0.014	-0.013	0.029	-0.014	0.023	0.021	0.001	0.048	0.029	0.023	0.028	0.023	0.003	0.055	0.026	-0.008	0.011	0.017	0.023
MLWS	0.054	-0.017	-0.025	-0.024	0.018	-0.025	0.012	0.010	-0.010	0.036	0.017	0.011	0.015	0.011	-0.009	0.043	0.014	-0.021	-0.001	0.006	0.023
ISLW	0.012	-0.060	-0.074	-0.074	-0.034	-0.078	-0.043	-0.050	-0.072	-0.026	-0.040	-0.044	-0.037	-0.037	-0.055	-0.004	-0.031	-0.067	-0.049	-0.045	0.024
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.086	0.086	0.090	0.090	0.088	0.084	0.086	0.087	0.090	0.093	0.094	0.098	0.099	0.103	0.107	0.109	0.109	0.108	0.111	0.096	0.009
MR	0.107	0.106	0.113	0.112	0.110	0.106	0.108	0.109	0.113	0.115	0.117	0.121	0.123	0.127	0.131	0.133	0.133	0.132	0.136	0.119	0.011
MSR	0.128	0.126	0.135	0.133	0.132	0.127	0.130	0.131	0.136	0.138	0.140	0.145	0.148	0.151	0.154	0.158	0.157	0.157	0.160	0.141	0.012
R	0.229	0.229	0.252	0.253	0.259	0.255	0.262	0.275	0.284	0.288	0.278	0.277	0.272	0.267	0.264	0.271	0.265	0.267	0.277	0.264	0.016
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.054	0.053	0.056	0.056	0.055	0.053	0.054	0.055	0.057	0.058	0.059	0.061	0.062	0.064	0.065	0.067	0.067	0.066	0.068	0.059	0.005
S2	0.011	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.011	0.001
K1	0.025	0.027	0.030	0.030	0.032	0.031	0.032	0.035	0.036	0.037	0.034	0.033	0.032	0.030	0.028	0.030	0.028	0.029	0.030	0.031	0.003
O1	0.016	0.017	0.018	0.020	0.020	0.022	0.023	0.025	0.025	0.026	0.023	0.022	0.020	0.018	0.018	0.017	0.017	0.017	0.019	0.020	0.003
MSF	0.031	0.038	0.043	0.019	0.023	0.012	0.032	0.008	0.025	0.016	0.035	0.010	0.022	0.021	0.025	0.028	0.031	0.015	0.025	0.024	0.010
z0	0.118	0.046	0.043	0.042	0.084	0.039	0.077	0.075	0.058	0.106	0.088	0.083	0.089	0.087	0.068	0.122	0.093	0.058	0.079	0.077	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	93.563	95.024	96.311	97.405	95.115	95.597	95.805	92.055	90.341	88.895	88.496	87.196	87.081	87.122	87.804	87.927	88.728	89.825	90.072	91.282	3.620
S2	9.603	9.245	12.108	15.502	14.611	11.639	14.177	15.274	13.397	12.796	7.275	7.936	5.387	5.250	0.687	9.306	8.443	9.583	5.285	9.869	4.022
K1	217.749	216.640	221.527	220.715	220.152	220.416	217.292	212.773	208.342	205.182	200.412	198.584	197.296	196.562	198.521	209.247	207.765	210.461	213.190	210.149	8.698
O1	283.317	283.140	281.325	281.097	283.283	281.130	283.890	286.630	291.848	293.773	297.382	301.809	303.875	300.642	294.791	293.531	287.622	282.566	280.926	289.083	7.813
MSF	308.683	298.202	314.653	292.396	329.868	281.954	304.606	358.399	302.301	294.242	293.022	346.643	291.422	315.101	286.994	314.491	307.967	310.969	274.427	306.649	21.005
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.065	0.070	0.066	0.075	0.079	0.077	0.062	0.060	0.069	0.074	0.068	0.091	0.071	0.072	0.065	0.056	0.063	0.086	0.064		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	94.0	53.2	97.6	99.3	97.5	97.2	98.0	99.4	99.4	96.5	97.9	94.7	99.1	95.3	95.3	98.0	98.2	98.1	97.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.31	05/06/2004 00:45	±0.16	37.1
Lowest Astronomical Tide (LAT)	-0.08	19/09/2003 10:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

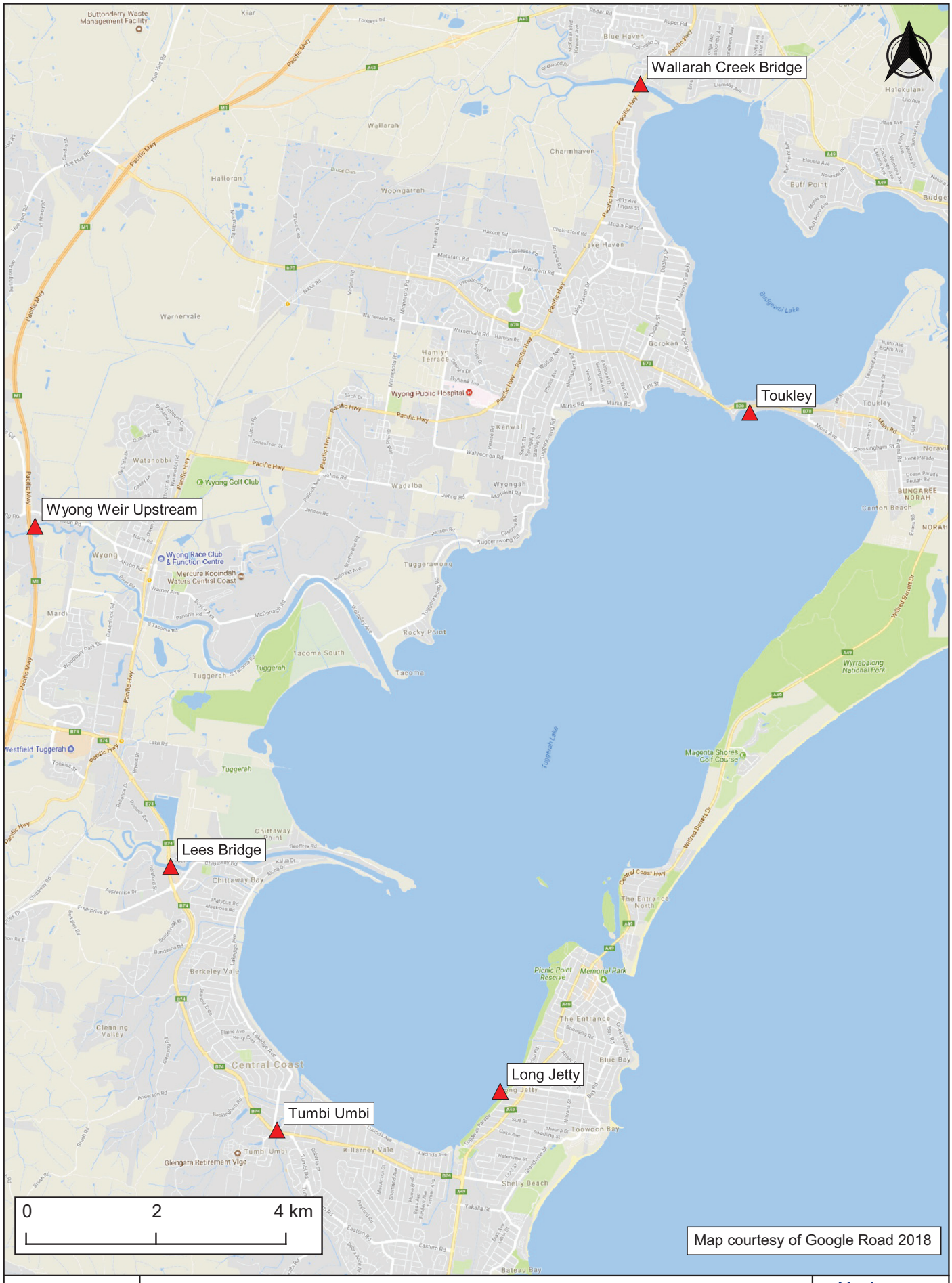


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Stockton Creek at Morisset

MHL2786

Figure A151



NSW GOVERNMENT

STATION LOCATIONS
TUGGERAH LAKES REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A152

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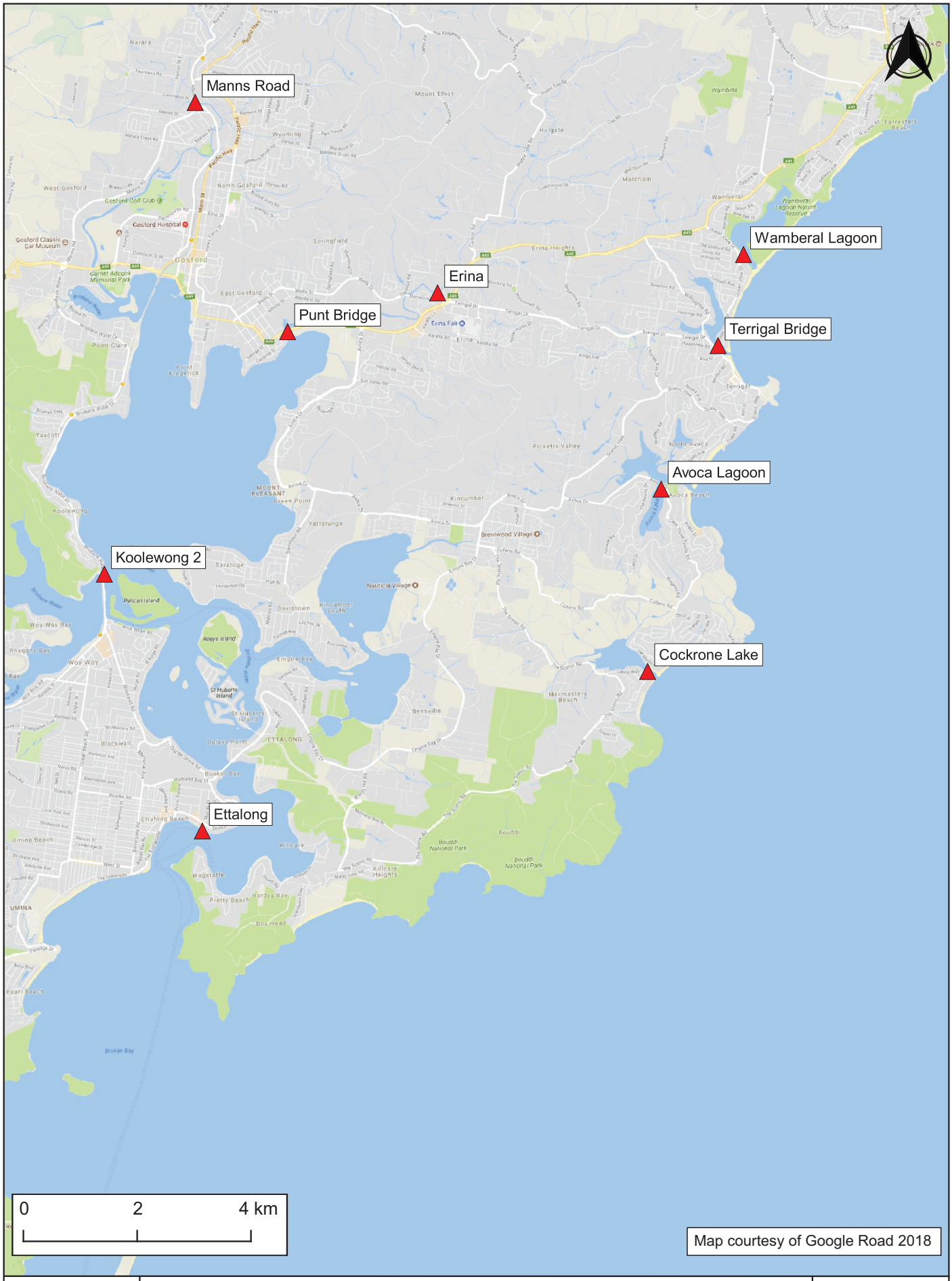

NSW GOVERNMENT

STATION LOCATIONS
BRISBANE WATER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A153

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Narara Creek at Manns Road

RECORDING STATION: **Narara Creek at Manns Road**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 211435

ZONE: 56
EASTING: 345890
NORTHING: 6302955

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.647	0.647	0.643	0.617	0.650	0.638	0.668	0.663	0.659	0.670	0.632	0.645	0.649	0.638	0.612	0.653	0.634	0.614	0.639	0.643	0.017
MHWS	0.427	0.440	0.421	0.393	0.412	0.399	0.399	0.384	0.384	0.401	0.384	0.400	0.418	0.426	0.410	0.455	0.435	0.415	0.432	0.412	0.020
MHW	0.378	0.391	0.369	0.343	0.362	0.349	0.352	0.338	0.338	0.357	0.341	0.357	0.374	0.380	0.366	0.409	0.388	0.368	0.386	0.366	0.020
MHWN	0.329	0.343	0.317	0.294	0.312	0.300	0.306	0.292	0.293	0.314	0.297	0.314	0.330	0.334	0.323	0.363	0.341	0.320	0.341	0.319	0.020
MSL	0.119	0.133	0.116	0.099	0.118	0.110	0.129	0.111	0.112	0.133	0.136	0.132	0.141	0.141	0.130	0.164	0.138	0.119	0.143	0.127	0.015
MLWN	-0.092	-0.077	-0.085	-0.096	-0.075	-0.081	-0.048	-0.071	-0.070	-0.048	-0.025	-0.050	-0.049	-0.052	-0.063	-0.036	-0.066	-0.082	-0.056	-0.064	0.019
MLW	-0.141	-0.126	-0.137	-0.145	-0.125	-0.130	-0.095	-0.117	-0.115	-0.091	-0.068	-0.093	-0.093	-0.098	-0.106	-0.082	-0.113	-0.130	-0.101	-0.111	0.021
MLWS	-0.190	-0.175	-0.189	-0.194	-0.176	-0.180	-0.141	-0.163	-0.160	-0.135	-0.112	-0.135	-0.137	-0.144	-0.150	-0.127	-0.160	-0.177	-0.147	-0.157	0.024
ISLW	-0.346	-0.322	-0.348	-0.354	-0.345	-0.350	-0.333	-0.362	-0.357	-0.327	-0.288	-0.310	-0.302	-0.296	-0.295	-0.269	-0.302	-0.319	-0.295	-0.322	0.027
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.421	0.420	0.403	0.390	0.386	0.380	0.354	0.363	0.363	0.362	0.322	0.364	0.379	0.387	0.386	0.399	0.408	0.402	0.397	0.383	0.025
MR	0.519	0.518	0.506	0.488	0.487	0.479	0.447	0.455	0.453	0.449	0.409	0.450	0.467	0.478	0.473	0.491	0.502	0.497	0.488	0.477	0.028
MSR	0.617	0.615	0.609	0.586	0.588	0.578	0.540	0.547	0.544	0.535	0.496	0.535	0.554	0.569	0.560	0.582	0.596	0.593	0.579	0.570	0.032
R	0.993	0.969	0.991	0.971	0.995	0.988	1.001	1.025	1.016	0.996	0.920	0.955	0.951	0.934	0.907	0.923	0.936	0.933	0.934	0.965	0.035
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.260	0.259	0.253	0.244	0.244	0.240	0.224	0.227	0.227	0.224	0.204	0.225	0.233	0.239	0.236	0.245	0.251	0.249	0.244	0.238	0.014
S2	0.049	0.049	0.052	0.049	0.050	0.050	0.047	0.046	0.045	0.043	0.044	0.043	0.044	0.046	0.044	0.046	0.047	0.048	0.045	0.047	0.003
K1	0.091	0.086	0.091	0.092	0.096	0.096	0.106	0.108	0.108	0.106	0.096	0.099	0.095	0.090	0.085	0.084	0.083	0.083	0.086	0.094	0.009
O1	0.066	0.061	0.068	0.068	0.074	0.074	0.086	0.091	0.089	0.086	0.080	0.076	0.070	0.062	0.060	0.058	0.059	0.059	0.062	0.071	0.011
MSF	0.032	0.042	0.040	0.032	0.019	0.034	0.032	0.011	0.032	0.017	0.038	0.016	0.028	0.021	0.031	0.034	0.038	0.022	0.023	0.028	0.009
z0	0.119	0.133	0.116	0.099	0.118	0.110	0.129	0.111	0.112	0.133	0.136	0.132	0.141	0.141	0.130	0.164	0.138	0.119	0.143	0.127	0.015
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	69.322	69.263	70.543	71.888	72.377	71.035	71.682	71.139	70.770	69.174	71.603	70.842	70.266	71.220	72.376	71.381	71.134	69.291	69.289	70.768	1.066
S2	347.476	350.827	348.357	349.923	352.872	349.566	352.657	354.302	353.478	355.309	352.748	354.498	353.662	357.671	354.672	350.573	352.838	352.759	346.399	352.136	2.869
K1	184.225	185.553	187.400	187.175	184.760	184.597	183.647	180.896	178.445	173.350	172.295	169.544	168.335	171.766	172.465	178.616	179.686	180.957	183.238	179.313	6.206
O1	247.566	242.801	244.835	245.200	246.401	246.507	249.312	252.087	258.998	264.559	268.294	271.808	272.121	269.220	268.047	262.964	257.448	251.319	249.151	256.244	10.302
MSF	295.776	286.612	288.300	269.872	297.447	272.657	282.831	315.502	273.806	278.685	272.990	297.397	273.892	303.828	276.995	295.510	290.625	299.899	267.926	286.345	13.390
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.068	0.066	0.069	0.075	0.073	0.067	0.069	0.073	0.083	0.069	0.085	0.077	0.076	0.068	0.066	0.069	0.082	0.066		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.1	64.5	77.3	77.7	83.3	66.0	73.6	91.9	97.0	88.4	93.8	91.9	95.3	90.6	94.0	86.3	93.5	96.1	92.5		

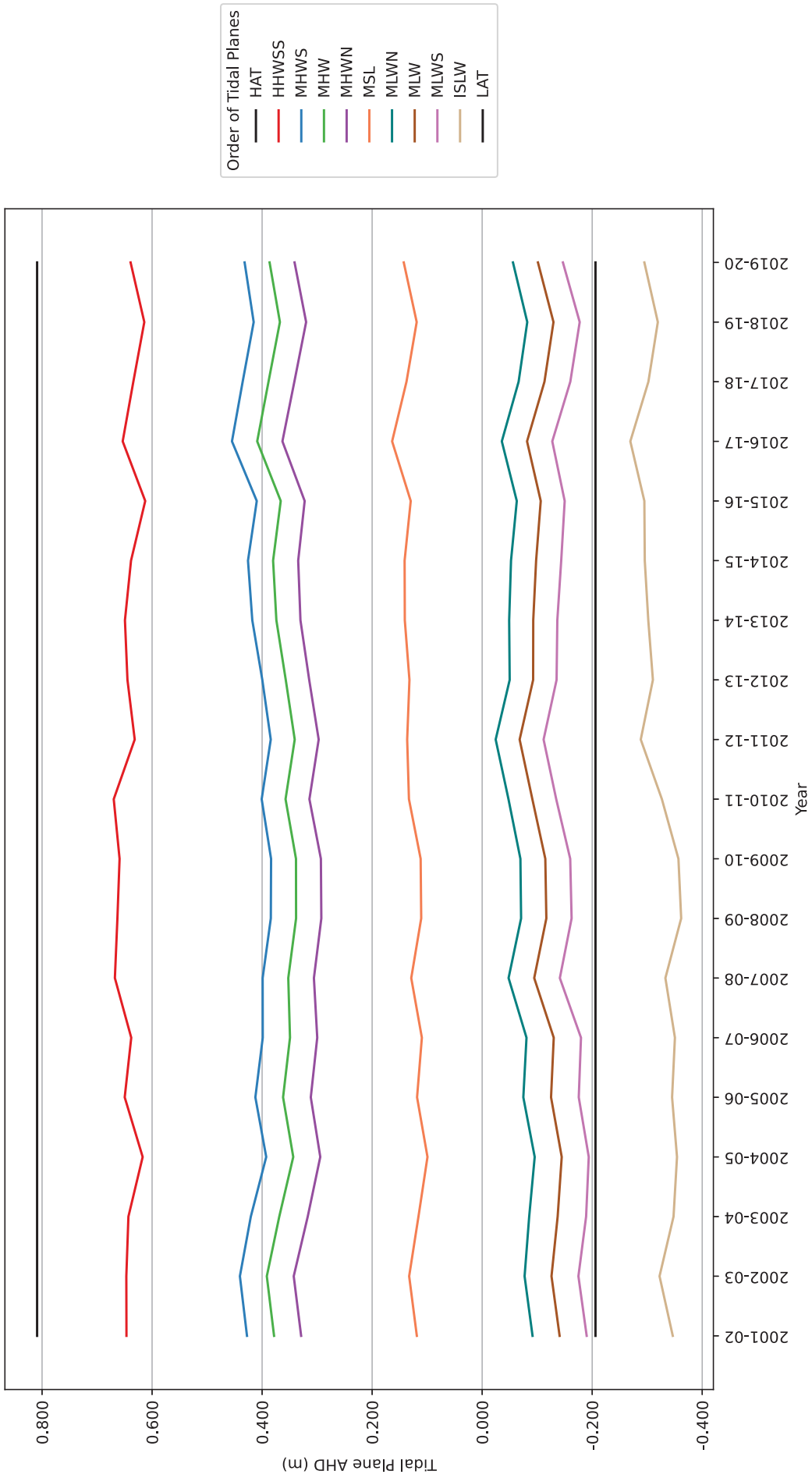
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.81	04/06/2004 23:45	±0.17	15.6
Lowest Astronomical Tide (LAT)	-0.21	16/10/2013 03:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A154

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Narara Creek at Manns Road

MHL2786

Figure
A154

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Erina Creek at Erina

RECORDING STATION: **Erina Creek at Erina**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212436

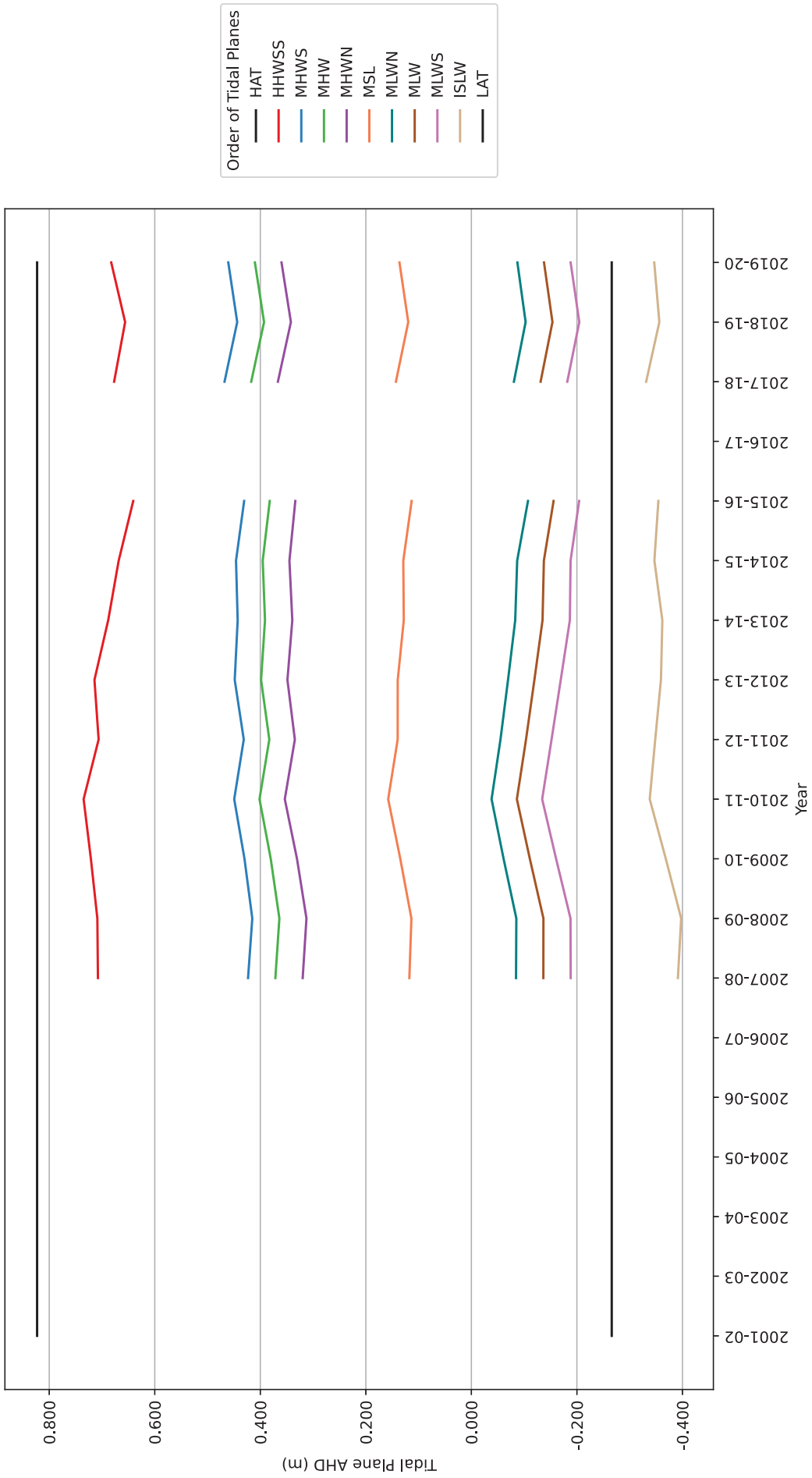
ZONE: 56
EASTING: 350150
NORTHING: 6299610

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17*	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.708	0.709	0.721	0.735	0.706	0.714	0.688	0.668	0.641		0.677	0.656	0.683	0.692	0.028
MHWS							0.423	0.415	0.430	0.449	0.431	0.448	0.443	0.446	0.431		0.468	0.444	0.461	0.441	0.015
MHW							0.371	0.364	0.380	0.402	0.383	0.399	0.391	0.395	0.382		0.417	0.393	0.410	0.391	0.015
MHWN							0.320	0.313	0.330	0.354	0.335	0.349	0.339	0.345	0.334		0.367	0.342	0.360	0.340	0.016
MSL							0.118	0.114	0.135	0.158	0.140	0.140	0.128	0.129	0.113		0.143	0.120	0.136	0.131	0.013
MLWN							-0.085	-0.085	-0.061	-0.038	-0.055	-0.069	-0.083	-0.087	-0.107		-0.081	-0.103	-0.087	-0.078	0.020
MLW							-0.136	-0.137	-0.111	-0.086	-0.104	-0.119	-0.135	-0.137	-0.156		-0.131	-0.154	-0.138	-0.129	0.020
MLWS							-0.188	-0.188	-0.161	-0.134	-0.152	-0.169	-0.187	-0.188	-0.204		-0.182	-0.205	-0.188	-0.179	0.021
ISLW							-0.391	-0.398	-0.368	-0.338	-0.348	-0.359	-0.362	-0.347	-0.354		-0.331	-0.356	-0.347	-0.358	0.020
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.404	0.398	0.392	0.392	0.390	0.418	0.422	0.432	0.441		0.447	0.445	0.447	0.419	0.023
MR							0.508	0.500	0.491	0.488	0.486	0.518	0.526	0.533	0.538		0.548	0.547	0.548	0.519	0.024
MSR							0.611	0.603	0.591	0.584	0.583	0.618	0.630	0.634	0.635		0.650	0.648	0.649	0.620	0.025
R							1.099	1.106	1.090	1.073	1.055	1.074	1.050	1.015	0.995		1.008	1.012	1.029	1.051	0.038
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.254	0.250	0.246	0.244	0.243	0.259	0.263	0.266	0.269		0.274	0.273	0.274	0.260	0.012
S2							0.052	0.051	0.050	0.048	0.048	0.050	0.052	0.051	0.048		0.051	0.051	0.050	0.050	0.001
K1							0.115	0.116	0.115	0.113	0.111	0.108	0.102	0.093	0.089		0.089	0.091	0.093	0.103	0.011
O1							0.088	0.094	0.093	0.091	0.086	0.082	0.074	0.066	0.061		0.061	0.061	0.065	0.077	0.014
MSF							0.034	0.012	0.030	0.022	0.042	0.013	0.027	0.023	0.032		0.038	0.020	0.026	0.026	0.009
z0							0.118	0.114	0.135	0.158	0.140	0.140	0.128	0.129	0.113		0.143	0.120	0.136	0.131	0.013
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							58.746	58.412	58.472	58.533	58.396	56.193	56.990	56.911	58.165		58.884	59.193	59.286	58.182	0.970
S2							337.440	340.298	340.578	341.597	340.665	338.804	340.513	339.169	340.883		339.111	338.466	337.752	339.606	1.330
K1							176.656	173.438	171.677	167.032	164.634	161.506	161.180	162.231	164.641		172.330	174.569	177.228	168.927	6.032
O1							244.184	247.074	252.367	259.751	265.618	266.768	266.942	265.390	262.926		253.171	248.274	245.343	256.484	8.992
MSF							286.129	339.452	275.313	272.939	278.419	305.635	283.779	308.521	267.457		289.853	301.016	257.266	288.815	22.181
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.075	0.071	0.089	0.091	0.074	0.090	0.087	0.082	0.088		0.073	0.092	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
							96.9	98.6	82.5	86.4	96.0	92.4	96.6	92.9	94.2	35.8	92.5	97.6	94.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.82	04/06/2008 23:00	±0.17	10.0
Lowest Astronomical Tide (LAT)	-0.27	16/10/2013 02:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Jun 2007.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Erina Creek at Erina

MHL2786

Figure A155

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Erina Creek at Punt Bridge

RECORDING STATION: **Erina Creek at Punt Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212433

ZONE: 56
EASTING: 347514
NORTHING: 6298928

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.669	0.628	0.633	0.618	0.668	0.637	0.681	0.676	0.681	0.698	0.677	0.673	0.676	0.656	0.641	0.697	0.654	0.628	0.660	0.661	0.024
MHWS	0.448	0.401	0.399	0.376	0.408	0.367	0.396	0.386	0.394	0.413	0.404	0.414	0.432	0.437	0.431	0.489	0.448	0.421	0.443	0.416	0.029
MHW	0.398	0.352	0.348	0.327	0.357	0.318	0.346	0.337	0.346	0.366	0.358	0.366	0.383	0.388	0.383	0.440	0.400	0.373	0.395	0.367	0.030
MHWN	0.348	0.303	0.298	0.278	0.306	0.269	0.296	0.288	0.298	0.319	0.312	0.318	0.334	0.339	0.335	0.391	0.351	0.325	0.348	0.319	0.030
MSL	0.130	0.091	0.089	0.072	0.103	0.070	0.097	0.093	0.106	0.126	0.120	0.113	0.126	0.128	0.119	0.172	0.134	0.108	0.129	0.112	0.024
MLWN	-0.087	-0.122	-0.119	-0.133	-0.099	-0.129	-0.102	-0.101	-0.086	-0.067	-0.072	-0.091	-0.081	-0.083	-0.098	-0.046	-0.082	-0.109	-0.089	-0.095	0.022
MLW	-0.137	-0.170	-0.169	-0.182	-0.150	-0.179	-0.152	-0.151	-0.134	-0.114	-0.118	-0.139	-0.131	-0.132	-0.146	-0.096	-0.131	-0.157	-0.137	-0.143	0.022
MLWS	-0.187	-0.219	-0.220	-0.231	-0.201	-0.228	-0.202	-0.200	-0.181	-0.161	-0.165	-0.187	-0.180	-0.181	-0.194	-0.145	-0.179	-0.205	-0.185	-0.192	0.023
ISLW	-0.345	-0.382	-0.387	-0.404	-0.387	-0.421	-0.405	-0.407	-0.386	-0.364	-0.359	-0.372	-0.354	-0.337	-0.343	-0.294	-0.326	-0.352	-0.340	-0.367	0.032
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.435	0.425	0.416	0.410	0.405	0.399	0.397	0.389	0.384	0.387	0.384	0.409	0.416	0.422	0.433	0.437	0.433	0.434	0.437	0.413	0.019
MR	0.535	0.522	0.518	0.508	0.508	0.497	0.498	0.488	0.480	0.480	0.477	0.505	0.514	0.520	0.529	0.536	0.530	0.530	0.532	0.511	0.020
MSR	0.635	0.620	0.619	0.606	0.610	0.595	0.598	0.587	0.575	0.574	0.569	0.600	0.612	0.618	0.625	0.634	0.627	0.626	0.628	0.608	0.021
R	1.014	1.010	1.021	1.023	1.054	1.058	1.086	1.083	1.067	1.062	1.036	1.044	1.030	0.994	0.984	0.991	0.981	0.980	1.001	1.027	0.034
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.268	0.261	0.259	0.254	0.254	0.248	0.249	0.244	0.240	0.240	0.238	0.252	0.257	0.260	0.264	0.268	0.265	0.265	0.266	0.255	0.010
S2	0.050	0.049	0.051	0.049	0.051	0.049	0.050	0.049	0.048	0.047	0.046	0.048	0.049	0.049	0.048	0.049	0.049	0.048	0.048	0.049	0.001
K1	0.093	0.095	0.098	0.101	0.106	0.110	0.115	0.114	0.113	0.114	0.108	0.106	0.102	0.094	0.089	0.090	0.087	0.088	0.091	0.101	0.010
O1	0.065	0.067	0.069	0.073	0.079	0.083	0.088	0.093	0.091	0.090	0.086	0.079	0.072	0.063	0.061	0.059	0.060	0.059	0.064	0.074	0.012
MSF	0.031	0.031	0.045	0.025	0.022	0.013	0.032	0.014	0.027	0.020	0.042	0.014	0.025	0.022	0.031	0.033	0.036	0.021	0.026	0.027	0.009
z0	0.130	0.091	0.089	0.072	0.103	0.070	0.097	0.093	0.106	0.126	0.120	0.113	0.126	0.128	0.119	0.172	0.134	0.108	0.129	0.112	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	58.490	59.818	59.742	60.451	59.568	58.913	57.997	57.621	57.112	57.390	57.366	55.475	55.606	56.436	56.396	57.080	58.400	58.282	58.534	57.930	1.414
S2	336.878	337.204	336.595	336.228	337.699	336.975	336.470	339.283	338.826	340.178	339.336	338.153	338.468	339.930	339.268	336.672	338.216	336.795	336.166	337.860	1.316
K1	178.166	180.803	180.962	180.968	178.344	178.094	176.508	173.514	170.614	168.231	164.819	161.907	160.403	162.129	163.939	168.548	172.526	174.757	177.662	172.258	7.045
O1	243.179	240.957	240.215	240.798	240.797	242.138	243.905	246.646	252.421	258.682	264.601	265.655	265.157	265.241	260.313	255.725	252.225	246.809	244.608	251.056	9.624
MSF	288.340	291.681	289.900	269.897	311.302	262.270	287.047	349.666	272.633	269.818	275.783	316.541	278.097	307.858	276.650	290.135	287.859	302.778	258.660	288.785	21.830
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.073	0.079	0.074	0.075	0.084	0.090	0.074	0.068	0.075	0.087	0.073	0.086	0.081	0.085	0.071	0.061	0.071	0.090	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	91.4	99.6	97.9	98.8	96.6	96.9	99.0	97.1	97.8	97.4	97.3	94.9	96.7	91.0	96.6	89.3	94.0	97.8	95.3		

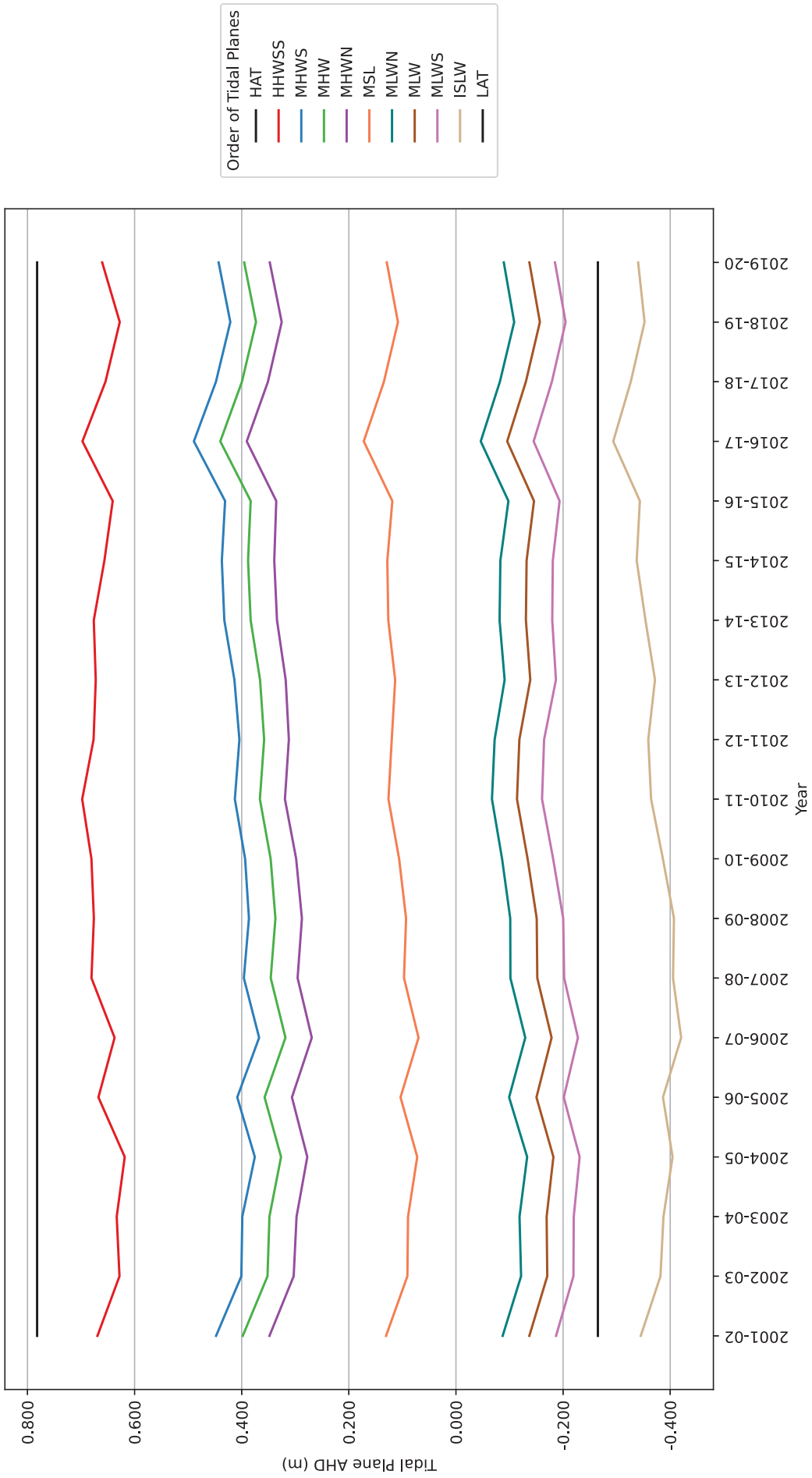
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.78	04/06/2004 23:30	±0.16	11.7
Lowest Astronomical Tide (LAT)	-0.27	05/11/2010 03:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A156

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Erina Creek at Punt Bridge

MHL2786

Figure
A156

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Brisbane Water at Ettalong

RECORDING STATION: **Brisbane Water at Ettalong**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212423

ZONE: 56
EASTING: 346015
NORTHING: 6290156

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07*	2007-08*	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.829	0.801	0.800	0.800	0.869				0.839	0.850	0.814	0.831	0.836	0.821	0.800	0.857	0.835	0.800	0.831	0.826	0.022
MHWS	0.572	0.536	0.528	0.517	0.571				0.508	0.523	0.497	0.533	0.557	0.567	0.560	0.617	0.596	0.563	0.580	0.551	0.033
MHW	0.490	0.456	0.445	0.436	0.485				0.430	0.447	0.422	0.454	0.474	0.483	0.480	0.533	0.514	0.481	0.499	0.471	0.031
MHWN	0.408	0.375	0.363	0.354	0.399				0.352	0.371	0.348	0.376	0.391	0.399	0.400	0.449	0.431	0.400	0.418	0.390	0.029
MSL	0.118	0.089	0.085	0.077	0.123				0.098	0.117	0.095	0.103	0.109	0.113	0.108	0.155	0.135	0.106	0.126	0.110	0.020
MLWN	-0.173	-0.197	-0.193	-0.200	-0.152				-0.157	-0.137	-0.157	-0.169	-0.172	-0.173	-0.185	-0.140	-0.161	-0.188	-0.166	-0.170	0.019
MLW	-0.255	-0.278	-0.275	-0.281	-0.238				-0.235	-0.213	-0.232	-0.247	-0.255	-0.257	-0.264	-0.223	-0.244	-0.270	-0.247	-0.251	0.020
MLWS	-0.337	-0.358	-0.357	-0.362	-0.325				-0.312	-0.289	-0.307	-0.326	-0.338	-0.341	-0.344	-0.307	-0.326	-0.351	-0.328	-0.332	0.021
ISLW	-0.521	-0.547	-0.552	-0.564	-0.538				-0.549	-0.523	-0.533	-0.539	-0.537	-0.522	-0.516	-0.478	-0.497	-0.520	-0.508	-0.528	0.022
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.582	0.572	0.557	0.554	0.551				0.509	0.509	0.505	0.544	0.563	0.573	0.585	0.589	0.593	0.589	0.584	0.560	0.030
MR	0.746	0.733	0.721	0.716	0.723				0.665	0.660	0.654	0.702	0.729	0.740	0.744	0.756	0.757	0.751	0.746	0.722	0.034
MSR	0.909	0.894	0.885	0.879	0.895				0.820	0.812	0.803	0.859	0.895	0.908	0.904	0.923	0.922	0.914	0.908	0.883	0.039
R	1.350	1.348	1.353	1.364	1.407				1.389	1.373	1.348	1.369	1.373	1.343	1.316	1.336	1.332	1.320	1.339	1.354	0.024
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.373	0.367	0.360	0.358	0.362				0.332	0.330	0.327	0.351	0.364	0.370	0.372	0.378	0.379	0.376	0.373	0.361	0.017
S2	0.082	0.080	0.082	0.081	0.086				0.078	0.076	0.075	0.079	0.083	0.084	0.080	0.084	0.082	0.081	0.081	0.081	0.003
K1	0.111	0.114	0.118	0.121	0.128				0.134	0.134	0.129	0.125	0.120	0.111	0.106	0.106	0.104	0.103	0.110	0.117	0.010
O1	0.072	0.075	0.077	0.081	0.086				0.103	0.100	0.097	0.088	0.079	0.070	0.066	0.066	0.066	0.066	0.070	0.079	0.013
MSF	0.026	0.027	0.038	0.016	0.020				0.024	0.013	0.038	0.007	0.017	0.015	0.025	0.026	0.029	0.021	0.022	0.023	0.008
z0	0.118	0.089	0.085	0.077	0.123				0.098	0.117	0.095	0.103	0.109	0.113	0.108	0.155	0.135	0.106	0.126	0.110	0.020
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	4.928	5.663	5.972	6.099	4.893				3.270	3.237	3.112	1.113	0.249	0.959	1.711	2.335	2.952	3.651	4.533	3.417	1.832
S2	273.100	272.558	273.044	272.366	272.049				274.099	276.972	276.395	273.683	273.149	272.724	274.076	271.832	272.872	272.793	274.036	273.484	1.426
K1	139.883	141.861	142.582	142.069	139.229				133.222	130.166	127.263	123.625	120.729	122.110	124.508	129.249	132.994	135.058	139.154	132.731	7.589
O1	206.164	203.496	203.347	203.279	203.125				215.640	223.220	228.307	228.482	227.126	225.986	223.878	216.879	212.766	209.784	207.562	214.940	9.963
MSF	284.694	294.307	288.874	267.434	305.165				269.170	257.256	275.458	339.126	268.715	322.657	268.319	291.719	285.744	314.435	258.838	286.994	23.597
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.073	0.082	0.072	0.075	0.082				0.077	0.081	0.071	0.084	0.080	0.078	0.069	0.062	0.071	0.088	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.1	91.7	96.9	96.4	89.6	43.4	0.0	3.9	86.2	96.0	97.9	93.1	95.3	92.7	96.5	90.1	90.5	93.7	94.4		

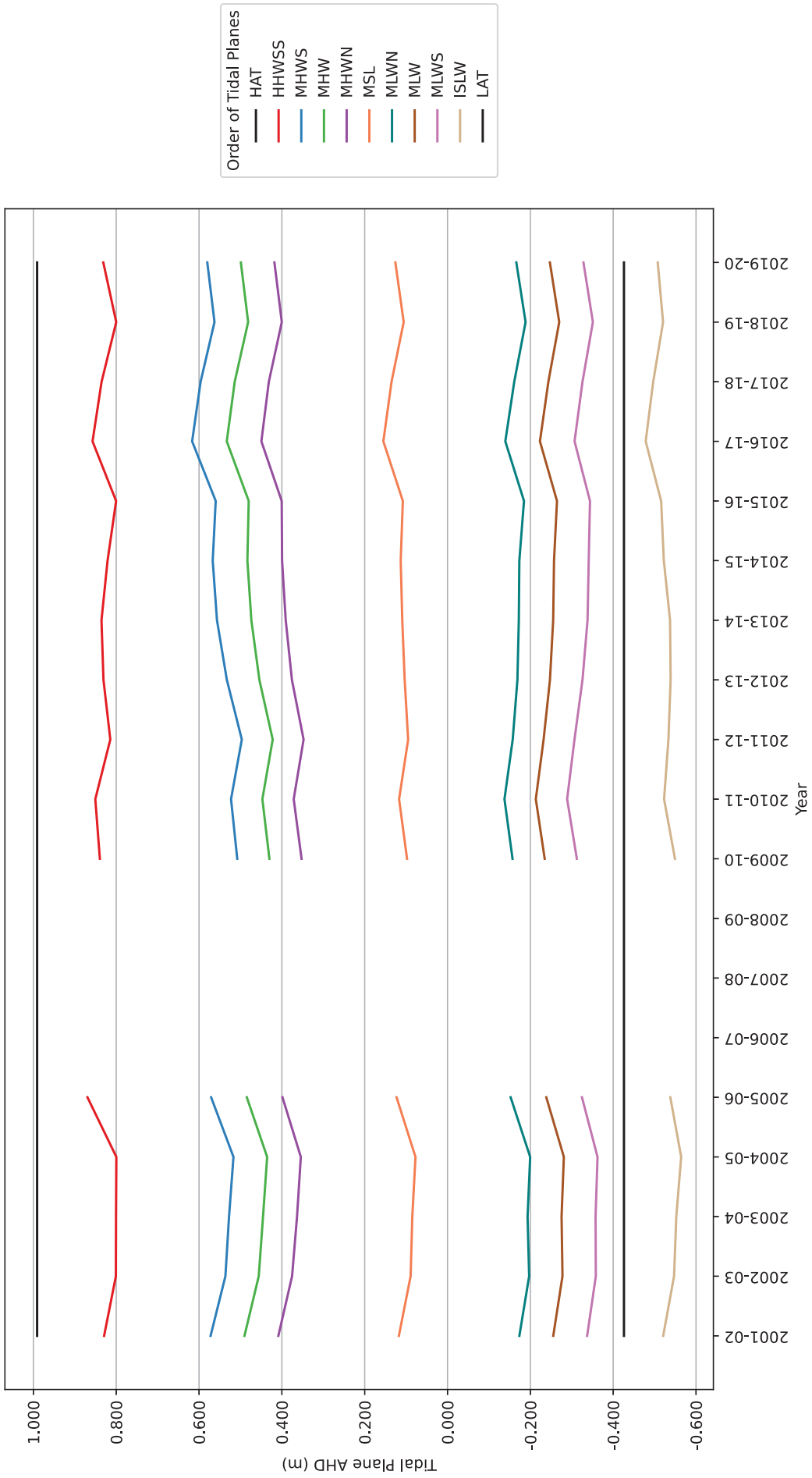
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.99	04/06/2004 21:30	±0.17	6.8
Lowest Astronomical Tide (LAT)	-0.43	29/09/2015 03:30		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A157

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Brisbane Water at Ettalong

MHL2786

Figure A157

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Brisbane Water at Koolewong 2

RECORDING STATION: **Brisbane Water at Koolewong 2**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 2124301

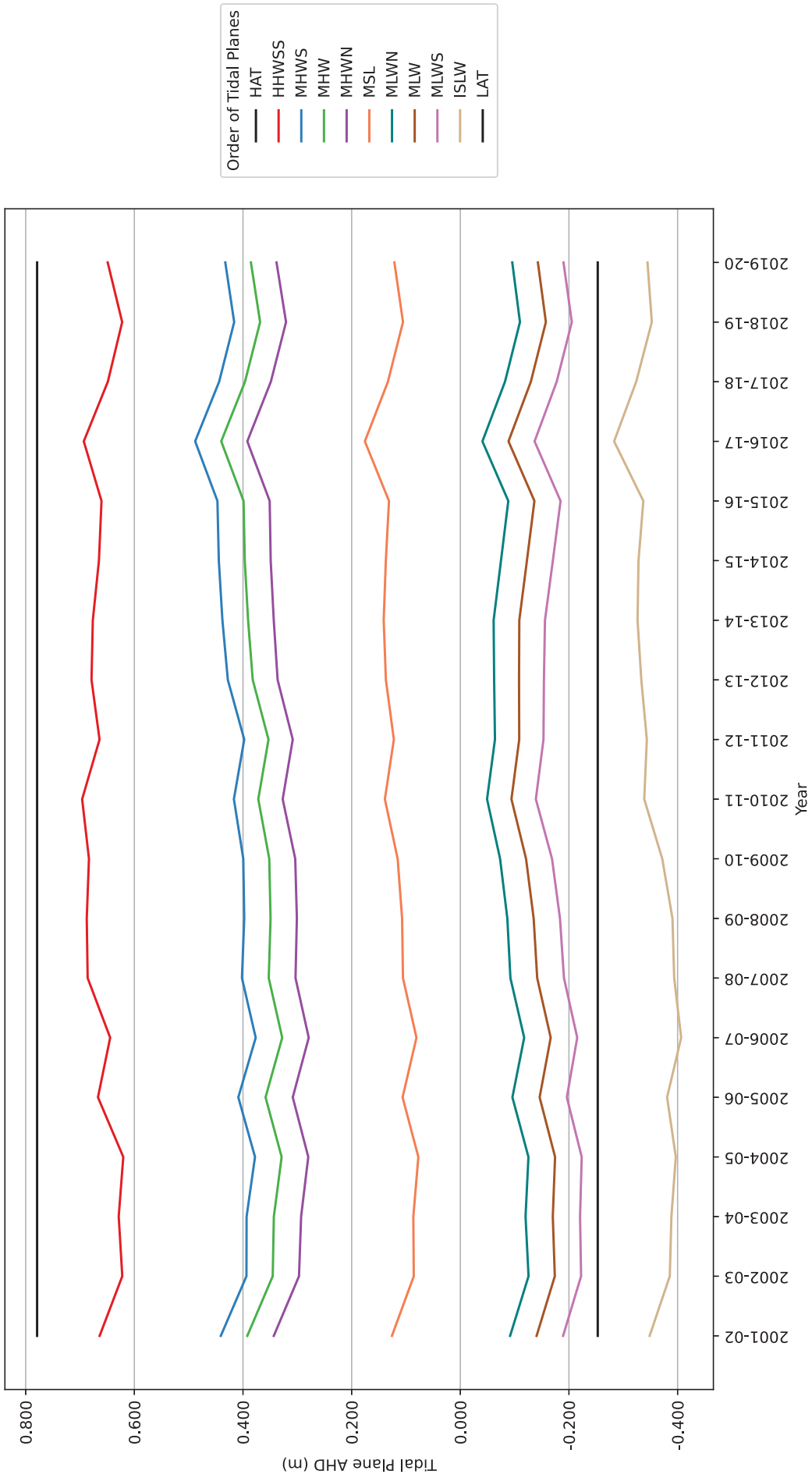
ZONE: 56
EASTING: 344294
NORTHING: 6294668

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.664	0.622	0.629	0.620	0.667	0.644	0.686	0.688	0.684	0.696	0.664	0.679	0.676	0.665	0.660	0.693	0.649	0.622	0.649	0.661	0.025
MHWS	0.441	0.394	0.393	0.378	0.409	0.377	0.402	0.398	0.399	0.417	0.398	0.428	0.438	0.445	0.447	0.488	0.444	0.416	0.433	0.418	0.028
MHW	0.392	0.345	0.343	0.329	0.359	0.328	0.353	0.349	0.352	0.372	0.353	0.382	0.391	0.397	0.399	0.440	0.396	0.369	0.385	0.370	0.029
MHWN	0.343	0.297	0.293	0.280	0.308	0.279	0.303	0.301	0.304	0.327	0.308	0.336	0.343	0.349	0.351	0.392	0.349	0.321	0.338	0.322	0.029
MSL	0.126	0.086	0.086	0.077	0.106	0.081	0.106	0.107	0.115	0.139	0.122	0.137	0.141	0.137	0.131	0.176	0.133	0.105	0.121	0.118	0.025
MLWN	-0.092	-0.126	-0.120	-0.125	-0.096	-0.118	-0.092	-0.087	-0.073	-0.049	-0.064	-0.062	-0.061	-0.075	-0.088	-0.041	-0.082	-0.110	-0.096	-0.087	0.025
MLW	-0.140	-0.174	-0.170	-0.174	-0.146	-0.166	-0.142	-0.135	-0.121	-0.094	-0.108	-0.108	-0.109	-0.123	-0.136	-0.089	-0.130	-0.158	-0.143	-0.135	0.026
MLWS	-0.189	-0.222	-0.220	-0.223	-0.196	-0.215	-0.191	-0.183	-0.169	-0.139	-0.153	-0.154	-0.156	-0.170	-0.185	-0.137	-0.177	-0.205	-0.190	-0.183	0.027
ISLW	-0.349	-0.386	-0.389	-0.397	-0.381	-0.407	-0.394	-0.391	-0.372	-0.339	-0.343	-0.333	-0.326	-0.328	-0.337	-0.283	-0.324	-0.353	-0.345	-0.356	0.033
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.435	0.423	0.413	0.405	0.404	0.397	0.396	0.387	0.377	0.376	0.372	0.399	0.405	0.424	0.439	0.433	0.431	0.431	0.434	0.409	0.022
MR	0.533	0.519	0.513	0.503	0.505	0.494	0.494	0.484	0.473	0.466	0.462	0.490	0.499	0.519	0.535	0.529	0.526	0.526	0.528	0.505	0.023
MSR	0.630	0.616	0.614	0.601	0.605	0.592	0.593	0.581	0.568	0.556	0.551	0.582	0.594	0.615	0.632	0.625	0.621	0.621	0.623	0.601	0.025
R	1.012	1.008	1.017	1.017	1.048	1.051	1.080	1.078	1.055	1.035	1.007	1.012	1.003	0.993	0.997	0.976	0.973	0.975	0.994	1.017	0.032
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.266	0.260	0.257	0.252	0.252	0.247	0.247	0.242	0.236	0.233	0.231	0.245	0.250	0.260	0.268	0.264	0.263	0.263	0.264	0.253	0.012
S2	0.049	0.048	0.050	0.049	0.050	0.049	0.049	0.048	0.048	0.045	0.045	0.046	0.047	0.048	0.048	0.048	0.048	0.048	0.047	0.048	0.001
K1	0.094	0.096	0.099	0.100	0.106	0.110	0.115	0.115	0.113	0.112	0.106	0.103	0.100	0.094	0.091	0.087	0.087	0.088	0.092	0.100	0.009
O1	0.065	0.067	0.069	0.074	0.079	0.082	0.088	0.092	0.090	0.088	0.084	0.076	0.071	0.063	0.061	0.059	0.060	0.059	0.063	0.073	0.012
MSF	0.032	0.031	0.044	0.021	0.021	0.013	0.032	0.011	0.032	0.019	0.040	0.013	0.024	0.021	0.033	0.032	0.037	0.023	0.027	0.027	0.009
z0	0.126	0.086	0.086	0.077	0.106	0.081	0.106	0.107	0.115	0.139	0.122	0.137	0.141	0.137	0.131	0.176	0.133	0.105	0.121	0.118	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	58.348	59.885	60.597	60.491	59.246	58.484	57.752	57.321	56.625	56.639	56.170	55.574	55.470	55.554	55.712	56.176	57.438	57.589	57.901	57.525	1.651
S2	336.302	337.430	337.260	337.914	337.143	336.813	335.761	338.422	339.545	339.626	337.718	338.243	338.106	338.899	339.225	334.722	337.523	336.828	336.316	337.568	1.296
K1	178.446	181.312	181.151	180.698	178.579	177.949	176.565	173.451	169.260	168.061	164.641	162.613	160.414	161.564	163.931	168.223	172.622	174.589	176.894	172.156	7.101
O1	243.412	240.773	240.276	240.062	240.900	242.098	243.982	246.949	252.892	258.228	263.714	265.578	265.669	264.727	260.238	254.465	251.577	246.938	244.214	250.879	9.537
MSF	288.226	290.693	290.618	261.127	310.772	271.768	287.921	339.009	287.111	273.124	276.012	314.476	276.731	293.730	273.928	293.288	286.740	306.797	253.856	288.207	19.850
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.075	0.081	0.073	0.075	0.085	0.090	0.072	0.070	0.076	0.083	0.071	0.079	0.080	0.081	0.069	0.061	0.070	0.091	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.9	100.0	98.6	75.2	97.4	97.7	99.2	99.4	75.2	97.6	98.2	94.5	96.2	89.1	94.4	90.1	94.8	95.3	96.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.78	04/06/2004 23:30	±0.17	12.6
Lowest Astronomical Tide (LAT)	-0.25	05/11/2010 03:30		

COMMENTS Station relocated from Koolewong (AWRC: 212422) in Jul 2016.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

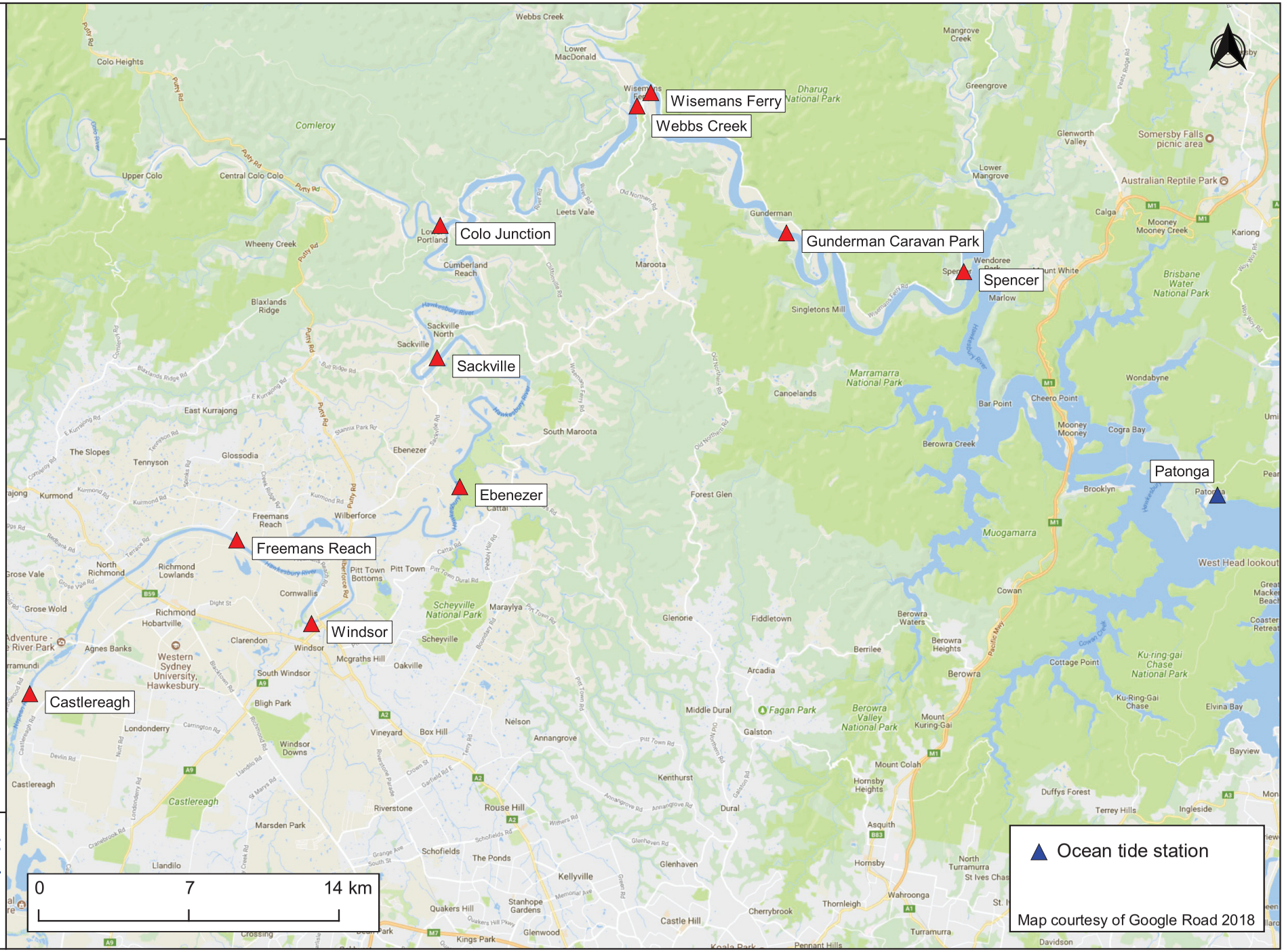
NSW TIDAL PLANE ANALYSIS
Brisbane Water at Koolewong 2

MHL2786

Figure A158

NSW GOVERNMENT

STATION LOCATIONS
HAWKESBURY RIVER REGION



Manly Hydraulics Laboratory

Report MHL2786

Figure A159

DRAWING A159.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Spencer

RECORDING STATION: **Hawkesbury River at Spencer**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212431

ZONE: 56
EASTING: 327772
NORTHING: 6296497

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.121	1.065	1.070	1.068	1.109	1.088	1.152	1.157	1.144	1.167	1.156	1.145	1.139	1.113	1.096	1.146	1.089	1.068	1.103	1.116	0.035
MHWS	0.820	0.753	0.749	0.734	0.757	0.719	0.764	0.758	0.750	0.778	0.784	0.791	0.813	0.815	0.808	0.865	0.809	0.786	0.807	0.782	0.036
MHW	0.695	0.631	0.626	0.611	0.633	0.595	0.633	0.630	0.624	0.652	0.657	0.664	0.689	0.692	0.684	0.740	0.687	0.664	0.683	0.657	0.036
MHWN	0.570	0.509	0.502	0.488	0.509	0.471	0.502	0.502	0.497	0.527	0.530	0.538	0.565	0.569	0.560	0.615	0.565	0.541	0.559	0.533	0.037
MSL	0.130	0.070	0.076	0.069	0.100	0.066	0.101	0.102	0.098	0.126	0.130	0.123	0.143	0.139	0.117	0.174	0.115	0.096	0.117	0.110	0.028
MLWN	-0.311	-0.368	-0.350	-0.350	-0.310	-0.340	-0.301	-0.298	-0.302	-0.275	-0.270	-0.291	-0.278	-0.292	-0.327	-0.266	-0.335	-0.349	-0.325	-0.313	0.030
MLW	-0.436	-0.491	-0.473	-0.473	-0.434	-0.463	-0.432	-0.426	-0.428	-0.400	-0.397	-0.418	-0.402	-0.415	-0.450	-0.391	-0.457	-0.472	-0.449	-0.437	0.029
MLWS	-0.560	-0.613	-0.596	-0.596	-0.558	-0.587	-0.563	-0.554	-0.555	-0.526	-0.524	-0.544	-0.527	-0.538	-0.574	-0.516	-0.579	-0.595	-0.573	-0.562	0.028
ISLW	-0.776	-0.836	-0.826	-0.834	-0.809	-0.851	-0.840	-0.839	-0.836	-0.804	-0.790	-0.797	-0.759	-0.751	-0.780	-0.717	-0.779	-0.796	-0.784	-0.800	0.036
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.881	0.877	0.852	0.838	0.820	0.811	0.803	0.800	0.799	0.803	0.800	0.829	0.843	0.861	0.887	0.881	0.900	0.890	0.884	0.845	0.037
MR	1.131	1.122	1.098	1.084	1.067	1.058	1.065	1.056	1.052	1.053	1.054	1.082	1.092	1.107	1.135	1.131	1.144	1.136	1.132	1.095	0.034
MSR	1.380	1.366	1.345	1.330	1.314	1.306	1.327	1.312	1.305	1.303	1.308	1.335	1.340	1.353	1.383	1.380	1.388	1.382	1.380	1.344	0.031
R	1.897	1.901	1.896	1.902	1.918	1.938	1.991	1.997	1.980	1.971	1.947	1.942	1.899	1.865	1.875	1.863	1.869	1.864	1.886	1.916	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.565	0.561	0.549	0.542	0.533	0.529	0.532	0.528	0.526	0.526	0.527	0.541	0.546	0.554	0.567	0.565	0.572	0.568	0.566	0.547	0.017
S2	0.125	0.122	0.123	0.123	0.124	0.124	0.131	0.128	0.126	0.125	0.127	0.127	0.124	0.123	0.124	0.125	0.122	0.123	0.124	0.125	0.002
K1	0.133	0.138	0.142	0.145	0.152	0.158	0.165	0.165	0.165	0.164	0.158	0.153	0.143	0.133	0.129	0.127	0.125	0.126	0.132	0.145	0.015
O1	0.082	0.085	0.088	0.094	0.099	0.105	0.112	0.120	0.116	0.114	0.108	0.099	0.089	0.080	0.076	0.074	0.075	0.075	0.079	0.093	0.016
MSF	0.011	0.013	0.025	0.005	0.012	0.009	0.012	0.019	0.008	0.000	0.022	0.010	0.005	0.011	0.013	0.014	0.021	0.010	0.008	0.012	0.006
z0	0.130	0.070	0.076	0.069	0.100	0.066	0.101	0.102	0.098	0.126	0.130	0.123	0.143	0.139	0.117	0.174	0.115	0.096	0.117	0.110	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	22.620	22.985	23.299	24.136	23.468	22.392	21.632	19.315	18.346	19.193	19.696	18.030	18.261	18.796	18.626	20.299	20.157	20.655	21.118	20.686	1.989
S2	298.306	298.424	297.520	296.870	297.382	297.449	295.904	296.403	296.146	298.096	297.403	295.876	297.124	296.888	297.185	295.749	297.503	296.479	296.106	296.990	0.824
K1	141.908	143.844	143.897	143.819	142.216	142.081	138.941	135.092	132.061	128.861	125.922	125.944	123.847	125.048	126.161	131.555	135.259	137.633	140.230	134.964	7.300
O1	203.576	200.616	199.839	201.259	200.840	201.940	203.200	205.871	210.939	216.825	221.565	222.107	223.332	223.583	219.078	215.630	210.745	205.262	203.827	210.002	8.776
MSF	323.221	296.187	296.044	233.637	2.205	142.365	309.146	45.115	297.063	319.727	281.977	31.297	317.066	355.487	256.720	316.748	295.577	11.290	217.457	228.859	119.264
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.081	0.071	0.078	0.085	0.087	0.069	0.061	0.086	0.080	0.068	0.089	0.075	0.072	0.069	0.060	0.072	0.090	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.5	98.9	97.7	96.3	95.2	96.1	97.5	82.5	96.8	98.3	94.0	89.9	93.5	92.9	85.8	88.2	96.8	97.9	95.4		

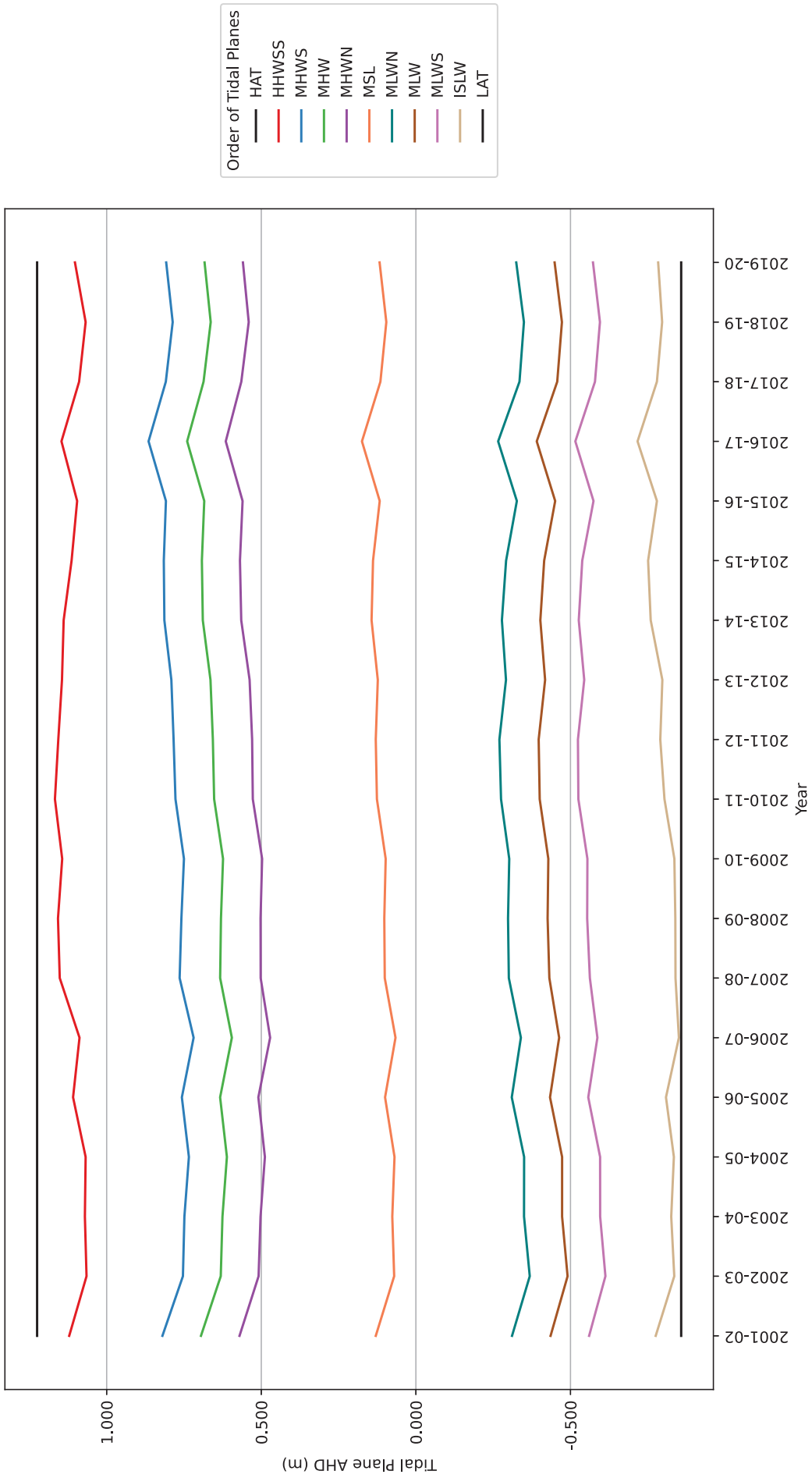
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.23	04/06/2008 22:00	±0.19	6.1
Lowest Astronomical Tide (LAT)	-0.86	09/09/2014 03:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A160

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Spencer

MHL2786

Figure A160

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hawkesbury River at Gunderman Caravan Park

RECORDING STATION: **Hawkesbury River at Gunderman Caravan Park**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212429

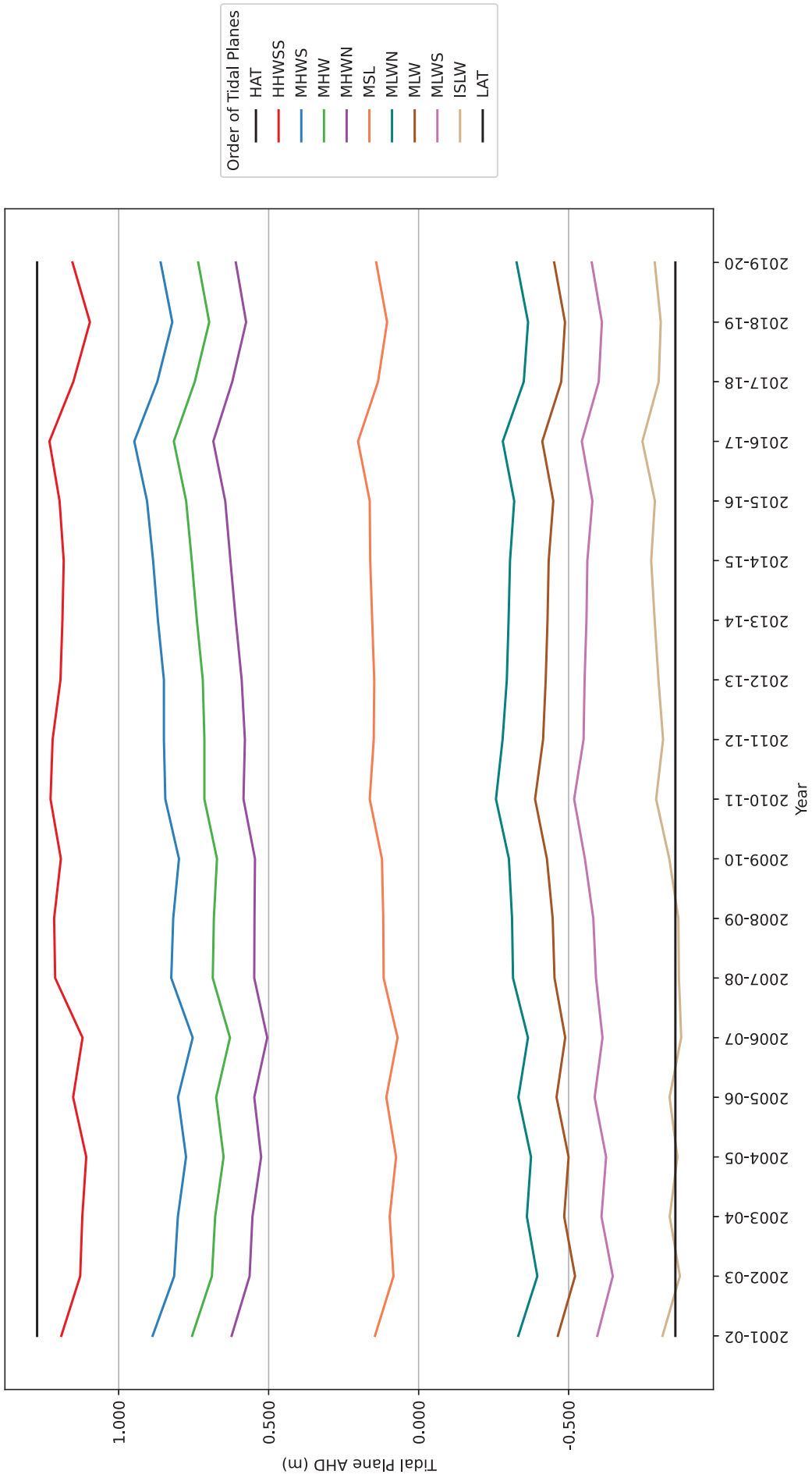
ZONE: 56
EASTING: 319440
NORTHING: 6298151

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.191	1.128	1.121	1.108	1.152	1.120	1.212	1.215	1.193	1.227	1.220	1.194	1.188	1.183	1.197	1.231	1.151	1.096	1.154	1.173	0.043
MHWS	0.887	0.815	0.803	0.775	0.802	0.753	0.825	0.818	0.799	0.845	0.849	0.849	0.869	0.885	0.905	0.948	0.871	0.821	0.860	0.841	0.047
MHW	0.755	0.689	0.678	0.650	0.675	0.629	0.686	0.683	0.672	0.714	0.714	0.720	0.739	0.756	0.775	0.816	0.746	0.698	0.735	0.712	0.046
MHWN	0.623	0.564	0.554	0.525	0.548	0.505	0.548	0.547	0.546	0.584	0.579	0.590	0.610	0.627	0.645	0.685	0.621	0.575	0.609	0.583	0.045
MSL	0.146	0.084	0.097	0.075	0.108	0.070	0.117	0.118	0.122	0.163	0.150	0.148	0.155	0.161	0.163	0.202	0.135	0.105	0.141	0.129	0.034
MLWN	-0.332	-0.396	-0.361	-0.375	-0.333	-0.365	-0.315	-0.311	-0.301	-0.258	-0.280	-0.294	-0.300	-0.305	-0.319	-0.281	-0.351	-0.365	-0.327	-0.325	0.037
MLW	-0.464	-0.522	-0.485	-0.500	-0.460	-0.489	-0.453	-0.447	-0.428	-0.388	-0.415	-0.424	-0.430	-0.434	-0.449	-0.412	-0.476	-0.488	-0.452	-0.453	0.034
MLWS	-0.596	-0.647	-0.610	-0.625	-0.587	-0.613	-0.591	-0.582	-0.554	-0.518	-0.550	-0.553	-0.560	-0.563	-0.579	-0.544	-0.600	-0.611	-0.577	-0.582	0.032
ISLW	-0.813	-0.871	-0.837	-0.863	-0.837	-0.875	-0.868	-0.866	-0.836	-0.792	-0.815	-0.800	-0.787	-0.775	-0.788	-0.746	-0.800	-0.807	-0.787	-0.819	0.037
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.956	0.959	0.915	0.900	0.881	0.869	0.863	0.859	0.847	0.842	0.859	0.884	0.909	0.932	0.963	0.965	0.972	0.940	0.936	0.908	0.045
MR	1.219	1.211	1.164	1.150	1.135	1.118	1.139	1.130	1.100	1.102	1.129	1.143	1.169	1.190	1.224	1.229	1.222	1.186	1.187	1.166	0.043
MSR	1.483	1.462	1.412	1.400	1.389	1.366	1.416	1.401	1.353	1.363	1.399	1.403	1.429	1.448	1.485	1.492	1.472	1.432	1.437	1.423	0.042
R	2.004	1.999	1.958	1.971	1.988	1.996	2.080	2.081	2.028	2.019	2.035	1.994	1.975	1.959	1.985	1.977	1.952	1.903	1.941	1.992	0.044
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.610	0.605	0.582	0.575	0.567	0.559	0.570	0.565	0.550	0.551	0.565	0.572	0.585	0.595	0.612	0.614	0.611	0.593	0.593	0.583	0.021
S2	0.132	0.126	0.124	0.125	0.127	0.124	0.138	0.135	0.127	0.130	0.135	0.130	0.130	0.129	0.130	0.132	0.125	0.123	0.125	0.129	0.004
K1	0.135	0.139	0.141	0.144	0.152	0.157	0.165	0.165	0.164	0.162	0.158	0.150	0.141	0.133	0.132	0.128	0.125	0.123	0.132	0.145	0.014
O1	0.083	0.085	0.087	0.093	0.098	0.105	0.112	0.118	0.117	0.111	0.107	0.096	0.086	0.080	0.076	0.074	0.075	0.073	0.078	0.092	0.016
MSF	0.019	0.019	0.031	0.011	0.017	0.003	0.020	0.011	0.025	0.013	0.035	0.010	0.014	0.017	0.026	0.020	0.025	0.010	0.014	0.018	0.008
z0	0.146	0.084	0.097	0.075	0.108	0.070	0.117	0.118	0.122	0.163	0.150	0.148	0.155	0.161	0.163	0.202	0.135	0.105	0.141	0.129	0.034
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	38.933	39.561	40.400	41.338	40.595	39.524	38.557	37.560	36.436	36.392	36.577	34.456	34.800	35.711	35.327	36.795	36.714	37.896	38.050	37.664	2.014
S2	314.347	315.342	315.213	314.444	314.728	315.008	311.653	313.745	314.406	313.917	313.411	311.883	313.067	313.475	312.481	310.841	314.634	314.730	313.430	313.724	1.268
K1	150.665	152.452	153.133	152.675	150.964	151.005	147.417	144.620	139.625	137.898	134.388	133.502	131.291	134.169	135.641	139.865	144.589	146.638	150.013	143.713	7.565
O1	211.843	208.849	208.686	209.958	209.386	210.653	211.598	214.975	220.968	224.454	230.644	232.790	231.889	232.754	226.799	223.185	220.056	215.148	212.381	218.790	8.905
MSF	305.257	294.110	296.081	259.367	334.128	166.234	303.504	37.974	276.036	290.693	283.483	354.509	289.570	316.307	271.080	305.155	302.166	324.267	255.433	277.124	69.617
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.082	0.070	0.079	0.088	0.088	0.070	0.072	0.064	0.077	0.067	0.080	0.079	0.076	0.070	0.058	0.072	0.093	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.8	99.8	94.1	99.5	92.6	95.7	97.6	99.0	56.9	94.5	91.6	89.3	86.2	91.4	81.2	77.8	88.5	99.3	92.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.27	04/06/2008 22:30	±0.19	7.8
Lowest Astronomical Tide (LAT)	-0.86	09/09/2014 04:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Gunderman Caravan Park

MHL2786

Figure A161

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hawkesbury River at Wisemans Ferry

RECORDING STATION: **Hawkesbury River at Wisemans Ferry**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212460

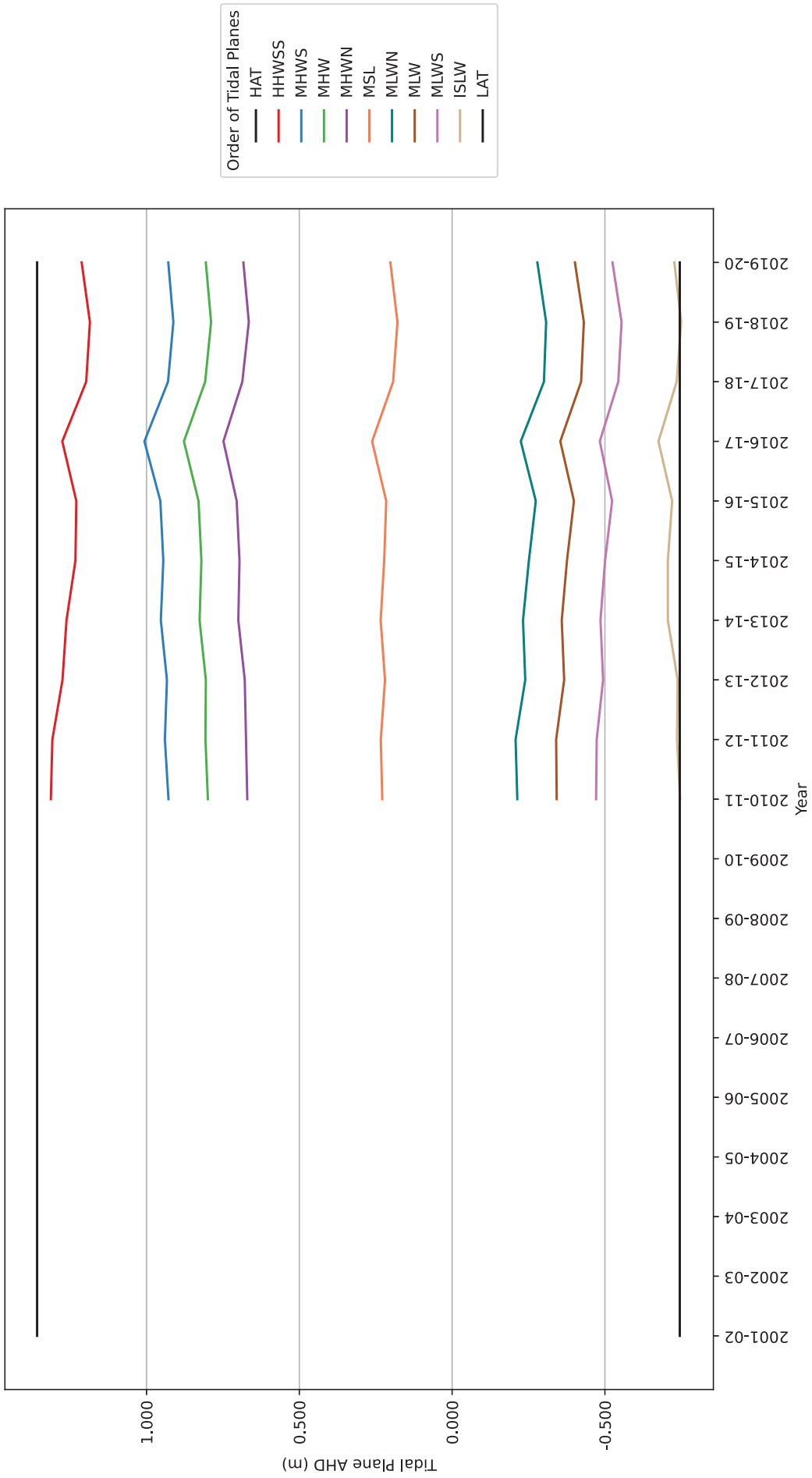
ZONE: 56
EASTING: 312963
NORTHING: 6304569

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS										1.313	1.308	1.275	1.262	1.233	1.230	1.276	1.197	1.185	1.212	1.249	0.045
MHWS										0.928	0.940	0.933	0.953	0.945	0.955	1.007	0.930	0.912	0.929	0.943	0.026
MHW										0.799	0.807	0.806	0.826	0.820	0.830	0.878	0.808	0.789	0.806	0.817	0.025
MHWN										0.670	0.674	0.679	0.700	0.696	0.705	0.748	0.686	0.665	0.683	0.691	0.024
MSL										0.228	0.233	0.220	0.234	0.222	0.216	0.262	0.193	0.179	0.202	0.219	0.023
MLWN										-0.213	-0.208	-0.239	-0.232	-0.251	-0.274	-0.225	-0.301	-0.308	-0.279	-0.253	0.036
MLW										-0.342	-0.340	-0.367	-0.359	-0.376	-0.399	-0.354	-0.422	-0.431	-0.402	-0.379	0.033
MLWS										-0.471	-0.473	-0.494	-0.486	-0.501	-0.524	-0.483	-0.544	-0.555	-0.525	-0.505	0.030
ISLW										-0.746	-0.736	-0.738	-0.706	-0.706	-0.720	-0.675	-0.735	-0.750	-0.727	-0.724	0.023
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR										0.884	0.882	0.918	0.932	0.947	0.979	0.973	0.987	0.973	0.962	0.944	0.039
MR										1.141	1.148	1.173	1.185	1.196	1.229	1.232	1.230	1.220	1.208	1.196	0.034
MSR										1.399	1.413	1.427	1.439	1.446	1.478	1.490	1.473	1.467	1.454	1.449	0.030
R										2.059	2.044	2.013	1.968	1.939	1.950	1.951	1.932	1.935	1.939	1.973	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2										0.571	0.574	0.586	0.593	0.598	0.614	0.616	0.615	0.610	0.604	0.598	0.017
S2										0.129	0.133	0.127	0.127	0.125	0.125	0.129	0.122	0.123	0.123	0.126	0.003
K1										0.161	0.155	0.147	0.136	0.127	0.124	0.122	0.120	0.123	0.126	0.134	0.015
O1										0.114	0.108	0.097	0.084	0.078	0.072	0.070	0.072	0.072	0.076	0.084	0.016
MSF										0.016	0.034	0.011	0.019	0.018	0.023	0.028	0.032	0.010	0.019	0.021	0.008
z0										0.228	0.233	0.220	0.234	0.222	0.216	0.262	0.193	0.179	0.202	0.219	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2										48.871	48.734	44.922	45.396	46.407	46.083	47.536	47.491	48.693	49.264	47.340	1.562
S2										327.418	326.558	323.430	325.023	325.405	324.669	322.721	326.540	325.923	325.446	325.313	1.440
K1										144.491	141.204	139.460	137.657	139.051	141.461	145.715	151.016	153.204	156.415	144.967	6.511
O1										233.763	238.350	240.624	240.726	239.836	236.048	231.964	226.736	221.596	219.832	232.947	7.794
MSF										278.218	289.029	359.547	296.533	306.606	275.510	305.375	289.158	313.001	257.700	297.068	27.517
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
										0.083	0.071	0.090	0.078	0.087	0.073	0.063	0.074	0.087	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
										98.3	93.2	93.3	96.3	94.5	97.8	92.0	98.9	97.5	96.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.36	24/06/2013 23:15	±0.19	4.8
Lowest Astronomical Tide (LAT)	-0.74	09/09/2010 04:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Jun 2010. DPIE took ownership of the station in Jul 2017.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Wisemans Ferry

MHL2786

Figure A162

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Webbs Creek

RECORDING STATION: **Hawkesbury River at Webbs Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212408

ZONE: 56
EASTING: 312331
NORTHING: 6303939

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.258	1.169	1.179	1.207	1.238	1.190	1.297	1.282	1.267	1.306	1.299	1.276	1.261	1.256	1.227	1.286	1.221	1.219	1.239	1.246	0.041
MHWS	0.956	0.859	0.861	0.872	0.886	0.823	0.908	0.889	0.874	0.912	0.925	0.922	0.945	0.956	0.943	1.007	0.942	0.939	0.947	0.914	0.045
MHW	0.820	0.741	0.734	0.748	0.758	0.698	0.771	0.754	0.744	0.780	0.792	0.791	0.815	0.831	0.817	0.880	0.820	0.814	0.822	0.786	0.044
MHWN	0.684	0.624	0.606	0.624	0.630	0.573	0.633	0.619	0.615	0.649	0.658	0.659	0.686	0.706	0.691	0.753	0.697	0.689	0.697	0.657	0.044
MSL	0.188	0.122	0.131	0.165	0.168	0.122	0.181	0.172	0.164	0.195	0.208	0.192	0.212	0.224	0.193	0.257	0.196	0.192	0.207	0.184	0.034
MLWN	-0.307	-0.380	-0.344	-0.295	-0.295	-0.330	-0.270	-0.274	-0.286	-0.258	-0.242	-0.274	-0.261	-0.259	-0.304	-0.238	-0.306	-0.306	-0.284	-0.290	0.035
MLW	-0.443	-0.497	-0.472	-0.419	-0.423	-0.455	-0.408	-0.409	-0.416	-0.390	-0.376	-0.406	-0.391	-0.384	-0.430	-0.365	-0.428	-0.431	-0.409	-0.418	0.033
MLWS	-0.579	-0.615	-0.599	-0.543	-0.551	-0.580	-0.545	-0.544	-0.545	-0.521	-0.510	-0.538	-0.521	-0.509	-0.557	-0.493	-0.551	-0.556	-0.534	-0.547	0.031
ISLW	-0.795	-0.836	-0.826	-0.783	-0.802	-0.842	-0.823	-0.824	-0.826	-0.803	-0.777	-0.790	-0.747	-0.723	-0.759	-0.692	-0.750	-0.755	-0.742	-0.784	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.991	1.003	0.950	0.919	0.925	0.903	0.904	0.893	0.901	0.906	0.900	0.933	0.947	0.965	0.994	0.991	1.003	0.995	0.981	0.948	0.041
MR	1.263	1.239	1.205	1.167	1.181	1.153	1.178	1.163	1.160	1.170	1.168	1.196	1.207	1.215	1.247	1.246	1.248	1.245	1.231	1.204	0.037
MSR	1.535	1.474	1.461	1.415	1.436	1.403	1.453	1.433	1.419	1.433	1.435	1.460	1.466	1.465	1.500	1.500	1.493	1.495	1.481	1.461	0.034
R	2.053	2.005	2.005	1.990	2.039	2.031	2.119	2.106	2.093	2.109	2.076	2.066	2.008	1.979	1.987	1.978	1.971	1.974	1.981	2.030	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.631	0.619	0.603	0.584	0.590	0.577	0.589	0.581	0.580	0.585	0.584	0.598	0.603	0.607	0.624	0.623	0.624	0.622	0.615	0.602	0.018
S2	0.136	0.118	0.128	0.124	0.128	0.125	0.137	0.135	0.130	0.132	0.134	0.132	0.130	0.125	0.126	0.127	0.122	0.125	0.125	0.128	0.005
K1	0.131	0.138	0.140	0.146	0.152	0.155	0.165	0.164	0.164	0.166	0.158	0.155	0.140	0.134	0.128	0.126	0.125	0.126	0.129	0.144	0.015
O1	0.084	0.084	0.086	0.093	0.099	0.106	0.113	0.117	0.116	0.116	0.109	0.097	0.085	0.080	0.074	0.073	0.074	0.074	0.079	0.093	0.016
MSF	0.027	0.024	0.038	0.009	0.021	0.005	0.027	0.014	0.027	0.017	0.036	0.016	0.022	0.027	0.028	0.031	0.037	0.017	0.023	0.023	0.009
z0	0.188	0.122	0.131	0.165	0.168	0.122	0.181	0.172	0.164	0.195	0.208	0.192	0.212	0.224	0.193	0.257	0.196	0.192	0.207	0.184	0.034
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	56.767	59.517	55.939	60.239	55.358	54.817	52.938	54.917	50.730	49.721	49.959	48.025	48.544	49.272	48.604	50.324	50.255	51.439	51.821	52.589	3.716
S2	330.972	332.936	329.678	331.945	328.687	329.776	326.149	332.009	329.221	327.886	328.102	325.766	328.023	327.953	327.403	325.460	329.672	328.640	327.998	328.857	2.072
K1	159.477	163.018	162.328	162.790	159.355	159.536	155.499	154.326	149.216	146.281	142.777	143.098	141.388	142.562	143.594	148.492	152.061	154.797	158.193	152.568	7.668
O1	221.688	218.866	217.573	218.209	218.421	220.221	220.466	224.940	229.921	233.619	238.798	239.005	240.443	241.062	237.450	232.716	228.469	223.225	222.068	227.745	8.541
MSF	294.674	285.364	300.048	259.828	300.960	248.233	293.669	333.815	281.481	283.666	285.901	305.881	269.844	304.121	271.457	293.041	290.466	335.660	264.199	289.595	22.287
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.069	0.100	0.078	0.081	0.088	0.102	0.075	0.077	0.086	0.085	0.070	0.085	0.068	0.077	0.071	0.061	0.073	0.084	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	62.0	85.7	96.0	89.3	95.7	94.2	96.6	96.8	78.6	96.3	88.0	73.4	76.3	82.7	95.5	78.2	92.9	91.4	94.0		

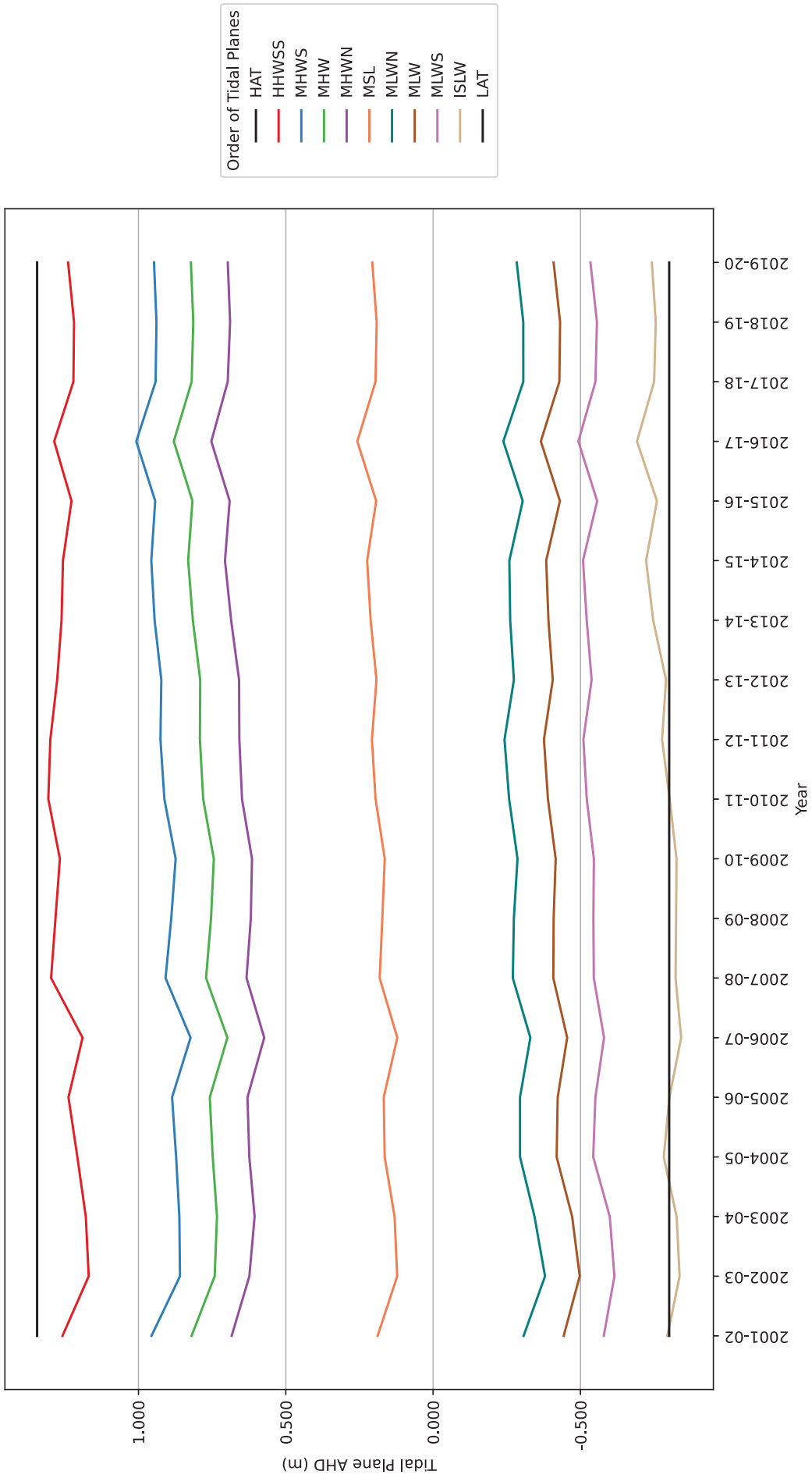
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.34	04/06/2008 23:00	±0.21	7.3
Lowest Astronomical Tide (LAT)	-0.80	10/09/2014 05:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A163

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Webbs Creek

MHL2786

Figure A163

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Colo Junction

RECORDING STATION: **Hawkesbury River at Colo Junction**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212407

ZONE: 56
EASTING: 303217
NORTHING: 6298185

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.238	1.172	1.181	1.186	1.234	1.179	1.247	1.266	1.280	1.309	1.277	1.249	1.259	1.232	1.196	1.268	1.205	1.196	1.207	1.231	0.040
MHWS	0.957	0.883	0.884	0.871	0.905	0.833	0.889	0.893	0.904	0.939	0.917	0.924	0.963	0.957	0.932	1.011	0.948	0.934	0.934	0.920	0.040
MHW	0.840	0.772	0.773	0.758	0.790	0.721	0.766	0.772	0.791	0.821	0.795	0.811	0.850	0.845	0.822	0.898	0.839	0.822	0.824	0.806	0.041
MHWN	0.724	0.662	0.661	0.645	0.674	0.610	0.643	0.650	0.678	0.702	0.673	0.698	0.737	0.734	0.713	0.786	0.731	0.710	0.714	0.692	0.042
MSL	0.256	0.193	0.208	0.196	0.232	0.177	0.217	0.219	0.243	0.265	0.246	0.256	0.284	0.273	0.241	0.315	0.250	0.232	0.245	0.239	0.034
MLWN	-0.212	-0.275	-0.245	-0.254	-0.210	-0.257	-0.208	-0.212	-0.192	-0.171	-0.181	-0.187	-0.169	-0.189	-0.230	-0.156	-0.230	-0.246	-0.224	-0.213	0.033
MLW	-0.328	-0.386	-0.357	-0.367	-0.326	-0.368	-0.331	-0.334	-0.305	-0.290	-0.303	-0.300	-0.281	-0.300	-0.339	-0.269	-0.339	-0.358	-0.335	-0.327	0.032
MLWS	-0.444	-0.497	-0.468	-0.480	-0.442	-0.480	-0.455	-0.456	-0.418	-0.408	-0.425	-0.413	-0.394	-0.412	-0.449	-0.382	-0.447	-0.471	-0.445	-0.441	0.031
ISLW	-0.645	-0.703	-0.680	-0.704	-0.676	-0.727	-0.710	-0.722	-0.687	-0.673	-0.682	-0.645	-0.606	-0.608	-0.638	-0.565	-0.631	-0.657	-0.640	-0.663	0.043
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.936	0.937	0.907	0.898	0.884	0.866	0.851	0.862	0.870	0.873	0.855	0.884	0.906	0.922	0.942	0.942	0.961	0.956	0.938	0.905	0.036
MR	1.168	1.158	1.129	1.125	1.116	1.090	1.097	1.106	1.096	1.110	1.098	1.111	1.131	1.146	1.161	1.167	1.178	1.181	1.159	1.133	0.031
MSR	1.401	1.379	1.352	1.351	1.347	1.313	1.343	1.350	1.322	1.347	1.342	1.337	1.357	1.369	1.381	1.393	1.395	1.405	1.379	1.361	0.027
R	1.883	1.876	1.861	1.890	1.910	1.907	1.958	1.988	1.966	1.982	1.959	1.894	1.864	1.840	1.834	1.834	1.836	1.853	1.847	1.894	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.584	0.579	0.565	0.562	0.558	0.545	0.549	0.553	0.548	0.555	0.549	0.555	0.566	0.573	0.581	0.584	0.589	0.590	0.579	0.567	0.015
S2	0.116	0.111	0.111	0.113	0.116	0.112	0.123	0.122	0.113	0.119	0.122	0.113	0.113	0.112	0.110	0.113	0.109	0.112	0.110	0.114	0.004
K1	0.123	0.127	0.130	0.135	0.140	0.147	0.149	0.153	0.154	0.153	0.150	0.140	0.130	0.122	0.117	0.116	0.113	0.116	0.120	0.133	0.014
O1	0.078	0.080	0.082	0.089	0.094	0.101	0.107	0.113	0.115	0.112	0.107	0.092	0.082	0.074	0.071	0.068	0.070	0.071	0.075	0.089	0.016
MSF	0.036	0.038	0.050	0.028	0.027	0.017	0.045	0.025	0.050	0.038	0.048	0.028	0.035	0.039	0.041	0.043	0.043	0.027	0.033	0.036	0.009
z0	0.256	0.193	0.208	0.196	0.232	0.177	0.217	0.219	0.243	0.265	0.246	0.256	0.284	0.273	0.241	0.315	0.250	0.232	0.245	0.239	0.034
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	74.224	74.710	75.485	75.878	75.342	74.439	74.265	73.026	71.781	71.801	71.983	70.053	70.128	70.946	71.016	72.493	72.213	72.789	73.621	72.958	1.801
S2	353.151	354.075	353.796	352.695	352.917	353.715	351.318	351.723	350.747	353.715	352.590	351.910	353.253	353.224	353.086	350.795	354.277	352.990	352.442	352.759	1.045
K1	173.302	175.719	175.828	175.007	172.809	174.294	170.820	168.159	168.765	160.889	156.641	158.883	156.248	157.721	159.591	164.174	168.076	170.151	173.904	167.420	7.049
O1	236.691	233.027	233.143	233.726	233.043	234.206	236.669	238.477	244.646	250.509	255.310	257.606	259.465	257.503	254.257	249.645	244.733	239.710	238.312	243.720	9.608
MSF	292.601	283.244	291.913	268.031	297.387	275.954	296.430	311.879	297.343	282.987	284.215	289.484	291.093	300.763	275.398	292.857	287.593	297.594	272.041	288.885	10.924
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.084	0.072	0.080	0.084	0.091	0.073	0.064	0.088	0.083	0.075	0.089	0.071	0.076	0.077	0.061	0.071	0.092	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.4	99.6	97.7	99.2	95.8	95.1	80.1	55.1	58.2	87.9	87.0	84.4	89.8	88.4	94.0	82.3	96.0	97.8	95.8		

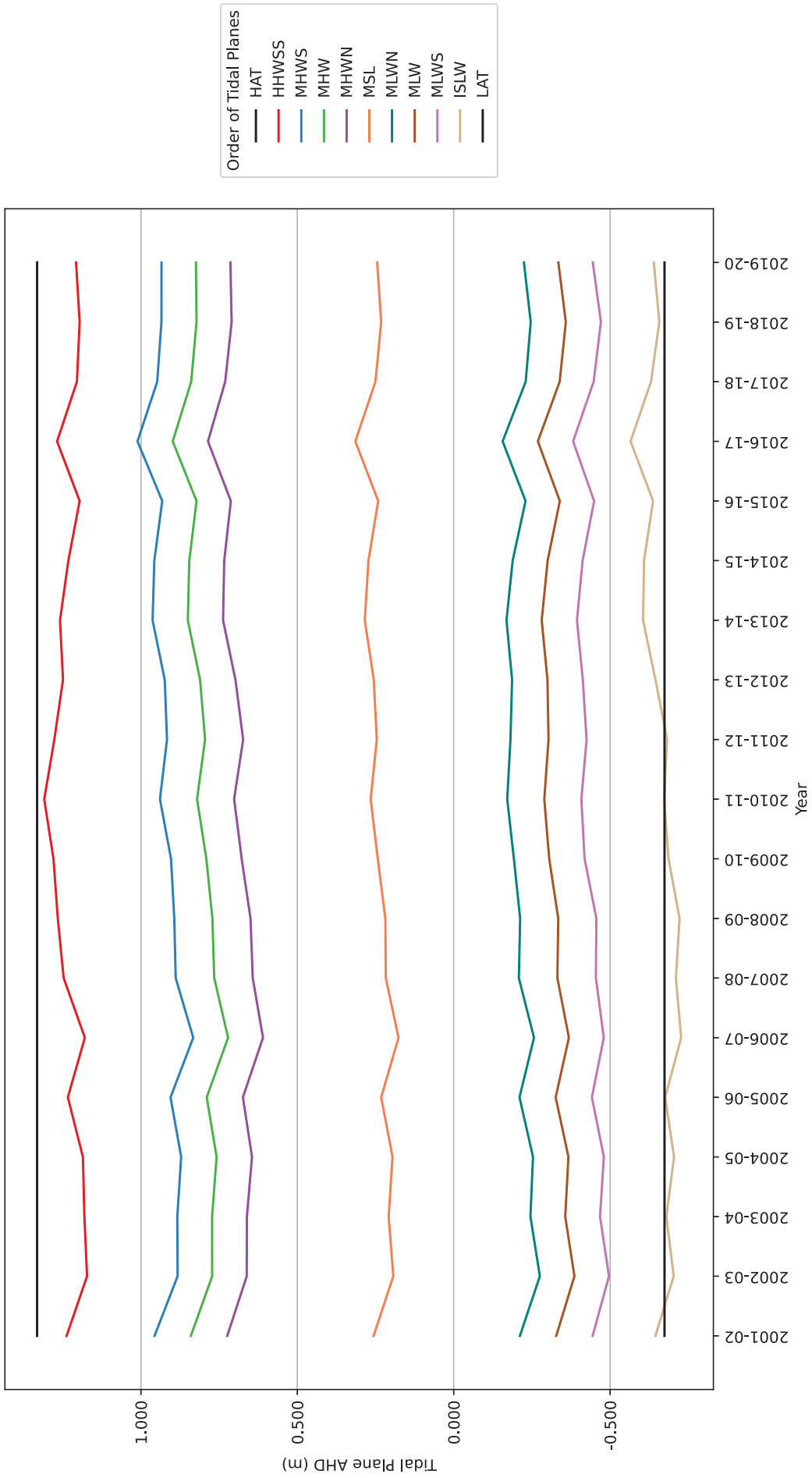
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.33	04/06/2008 23:45	±0.19	10.4
Lowest Astronomical Tide (LAT)	-0.67	09/09/2014 05:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A164

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Colo Junction

MHL2786

Figure A164

RECORDING STATION: **Hawkesbury River at Sackville**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212406

ZONE: 56
EASTING: 303203
NORTHING: 6292012

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Hawkesbury River at Sackville

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.104	1.038	1.055	1.078	1.119	1.074	1.173	1.155	1.161	1.194	1.168	1.119	1.095	1.093	1.081	1.138	1.066	1.062	1.098	1.109	0.045
MHWS	0.858	0.783	0.795	0.804	0.831	0.771	0.849	0.823	0.830	0.859	0.854	0.836	0.838	0.858	0.854	0.915	0.846	0.837	0.862	0.837	0.033
MHW	0.768	0.698	0.708	0.717	0.741	0.686	0.752	0.728	0.738	0.767	0.761	0.749	0.752	0.774	0.771	0.829	0.764	0.752	0.777	0.749	0.033
MHWN	0.678	0.612	0.621	0.629	0.652	0.601	0.654	0.633	0.646	0.674	0.669	0.661	0.667	0.689	0.687	0.742	0.681	0.667	0.693	0.661	0.033
MSL	0.287	0.220	0.243	0.254	0.279	0.239	0.286	0.270	0.279	0.306	0.304	0.297	0.298	0.313	0.300	0.357	0.295	0.282	0.313	0.285	0.031
MLWN	-0.104	-0.171	-0.135	-0.121	-0.094	-0.123	-0.083	-0.094	-0.087	-0.063	-0.061	-0.068	-0.071	-0.063	-0.088	-0.029	-0.090	-0.102	-0.067	-0.090	0.032
MLW	-0.194	-0.257	-0.221	-0.208	-0.183	-0.208	-0.180	-0.188	-0.179	-0.155	-0.154	-0.155	-0.157	-0.147	-0.172	-0.115	-0.173	-0.187	-0.151	-0.178	0.032
MLWS	-0.284	-0.343	-0.308	-0.296	-0.273	-0.293	-0.277	-0.283	-0.272	-0.248	-0.247	-0.242	-0.242	-0.232	-0.255	-0.202	-0.255	-0.272	-0.236	-0.266	0.032
ISLW	-0.460	-0.525	-0.494	-0.491	-0.479	-0.509	-0.509	-0.520	-0.508	-0.488	-0.471	-0.444	-0.426	-0.400	-0.417	-0.361	-0.412	-0.433	-0.404	-0.461	0.048
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.782	0.783	0.756	0.750	0.745	0.724	0.737	0.727	0.733	0.737	0.730	0.729	0.738	0.752	0.776	0.771	0.772	0.769	0.760	0.751	0.020
MR	0.962	0.954	0.929	0.925	0.925	0.894	0.932	0.916	0.917	0.922	0.915	0.904	0.909	0.921	0.943	0.944	0.937	0.939	0.929	0.927	0.017
MSR	1.142	1.126	1.103	1.100	1.104	1.064	1.126	1.105	1.101	1.107	1.101	1.078	1.081	1.090	1.110	1.117	1.102	1.109	1.098	1.103	0.018
R	1.564	1.563	1.548	1.569	1.598	1.583	1.682	1.676	1.669	1.682	1.640	1.563	1.521	1.493	1.497	1.499	1.479	1.495	1.502	1.570	0.071
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.481	0.477	0.465	0.463	0.462	0.447	0.466	0.458	0.459	0.461	0.458	0.452	0.455	0.461	0.471	0.472	0.468	0.470	0.464	0.464	0.008
S2	0.090	0.086	0.087	0.088	0.090	0.085	0.097	0.095	0.092	0.093	0.093	0.087	0.086	0.085	0.083	0.087	0.082	0.085	0.085	0.088	0.004
K1	0.106	0.110	0.112	0.116	0.121	0.126	0.133	0.134	0.135	0.136	0.128	0.118	0.110	0.102	0.099	0.098	0.095	0.098	0.101	0.115	0.014
O1	0.069	0.073	0.074	0.079	0.085	0.090	0.098	0.104	0.102	0.103	0.096	0.084	0.074	0.066	0.063	0.061	0.062	0.063	0.068	0.080	0.015
MSF	0.052	0.049	0.058	0.041	0.042	0.026	0.048	0.028	0.046	0.046	0.063	0.033	0.046	0.040	0.051	0.063	0.054	0.042	0.051	0.046	0.010
z0	0.287	0.220	0.243	0.254	0.279	0.239	0.286	0.270	0.279	0.306	0.304	0.297	0.298	0.313	0.300	0.357	0.295	0.282	0.313	0.285	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	96.884	97.270	98.044	98.459	97.856	96.884	95.359	94.126	94.014	94.271	94.694	92.199	92.000	92.625	92.899	94.489	94.216	94.775	95.798	95.098	2.006
S2	15.444	16.823	16.760	15.146	15.608	15.586	11.544	13.711	15.892	16.647	15.912	14.829	15.667	15.558	15.608	13.714	16.928	15.311	15.192	15.362	1.279
K1	190.953	192.589	192.041	191.062	189.841	189.811	187.618	183.975	181.084	177.587	175.692	175.584	174.034	175.500	177.175	182.313	186.167	187.735	191.767	184.344	6.687
O1	255.245	251.762	250.175	251.425	250.833	250.681	253.191	256.390	261.106	267.280	273.347	277.765	279.939	276.805	273.115	269.489	265.041	259.594	257.827	262.158	10.335
MSF	291.633	285.789	292.261	270.121	299.017	270.718	293.198	301.615	283.338	282.063	288.006	293.019	290.177	302.987	277.285	291.537	287.314	292.924	274.749	287.776	9.506
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079	0.077	0.072	0.076	0.083	0.087	0.068	0.072	0.075	0.078	0.076	0.084	0.079	0.076	0.072	0.058	0.069	0.090	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.5	99.8	98.9	98.8	96.8	92.1	74.5	96.8	95.9	93.7	85.9	89.2	94.6	90.2	93.1	77.5	97.1	95.7	84.4		

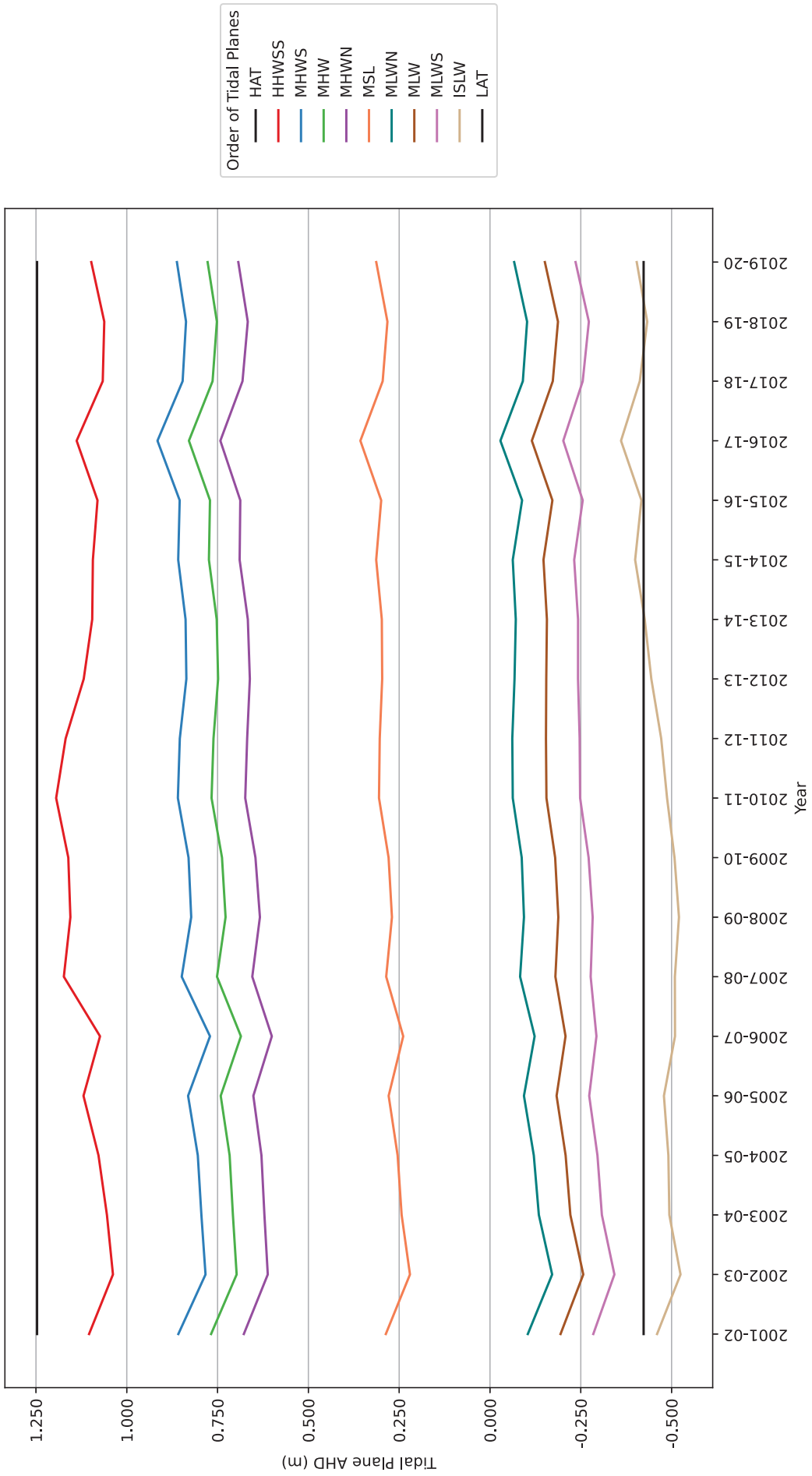
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.25	05/06/2008 00:30	±0.19	13.3
Lowest Astronomical Tide (LAT)	-0.42	08/10/2014 05:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A165

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Sackville

MHL2786

Figure A165

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Ebenezer

RECORDING STATION: **Hawkesbury River at Ebenezer**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212427

ZONE: 56
EASTING: 304388
NORTHING: 6286030

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.979	0.901	0.904	0.916	0.957	0.922	1.043	1.009	0.994	1.035	1.017	0.971	0.961	0.933	0.917	0.995	0.908	0.893	0.930	0.957	0.048
MHWS	0.766	0.686	0.682	0.680	0.708	0.660	0.756	0.721	0.706	0.751	0.747	0.722	0.734	0.729	0.723	0.800	0.718	0.700	0.726	0.722	0.034
MHW	0.702	0.628	0.621	0.620	0.645	0.599	0.685	0.654	0.642	0.687	0.683	0.664	0.677	0.673	0.668	0.741	0.661	0.642	0.667	0.661	0.033
MHWN	0.638	0.569	0.559	0.559	0.582	0.539	0.614	0.587	0.579	0.623	0.618	0.605	0.619	0.618	0.613	0.682	0.604	0.584	0.608	0.600	0.033
MSL	0.317	0.259	0.258	0.254	0.283	0.242	0.307	0.288	0.281	0.327	0.328	0.321	0.337	0.335	0.317	0.383	0.308	0.288	0.308	0.302	0.035
MLWN	-0.005	-0.051	-0.043	-0.050	-0.017	-0.055	-0.000	-0.012	-0.018	0.031	0.037	0.036	0.054	0.051	0.020	0.084	0.013	-0.008	0.008	0.004	0.039
MLW	-0.069	-0.109	-0.105	-0.111	-0.080	-0.115	-0.072	-0.079	-0.081	-0.033	-0.027	-0.022	-0.003	-0.004	-0.035	0.025	-0.044	-0.066	-0.051	-0.057	0.040
MLWS	-0.133	-0.168	-0.167	-0.172	-0.143	-0.176	-0.143	-0.146	-0.145	-0.097	-0.091	-0.081	-0.061	-0.060	-0.090	-0.034	-0.101	-0.124	-0.110	-0.118	0.042
ISLW	-0.285	-0.321	-0.326	-0.340	-0.320	-0.363	-0.348	-0.352	-0.351	-0.300	-0.284	-0.258	-0.223	-0.206	-0.228	-0.173	-0.237	-0.262	-0.256	-0.286	0.056
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.643	0.620	0.602	0.609	0.599	0.594	0.614	0.598	0.597	0.593	0.581	0.569	0.565	0.567	0.593	0.598	0.592	0.591	0.600	0.596	0.019
MR	0.771	0.737	0.726	0.731	0.725	0.715	0.756	0.732	0.724	0.721	0.709	0.686	0.680	0.678	0.703	0.716	0.705	0.708	0.718	0.718	0.023
MSR	0.899	0.854	0.850	0.852	0.851	0.836	0.898	0.867	0.850	0.849	0.838	0.804	0.795	0.789	0.813	0.834	0.819	0.825	0.837	0.840	0.030
R	1.263	1.222	1.230	1.256	1.277	1.286	1.390	1.361	1.345	1.335	1.301	1.229	1.184	1.138	1.145	1.168	1.145	1.156	1.185	1.243	0.079
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.386	0.369	0.363	0.365	0.362	0.357	0.378	0.366	0.362	0.360	0.355	0.343	0.340	0.339	0.351	0.358	0.353	0.354	0.359	0.359	0.012
S2	0.064	0.059	0.062	0.061	0.063	0.061	0.071	0.067	0.063	0.064	0.064	0.059	0.057	0.055	0.055	0.059	0.057	0.058	0.059	0.061	0.004
K1	0.089	0.090	0.092	0.097	0.102	0.106	0.115	0.113	0.114	0.112	0.107	0.099	0.093	0.085	0.081	0.083	0.079	0.082	0.085	0.096	0.012
O1	0.063	0.064	0.066	0.071	0.076	0.082	0.090	0.092	0.092	0.091	0.086	0.078	0.069	0.061	0.058	0.057	0.056	0.056	0.060	0.072	0.013
MSF	0.066	0.055	0.069	0.054	0.052	0.038	0.062	0.042	0.057	0.058	0.076	0.051	0.061	0.056	0.059	0.072	0.064	0.046	0.054	0.057	0.010
z0	0.317	0.259	0.258	0.254	0.283	0.242	0.307	0.288	0.281	0.327	0.328	0.321	0.337	0.335	0.317	0.383	0.308	0.288	0.308	0.302	0.035
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	128.816	129.879	131.032	132.004	131.192	131.341	128.392	128.080	126.545	126.931	126.864	123.189	122.910	123.866	123.709	124.914	125.016	126.043	126.207	127.207	2.921
S2	48.615	51.075	51.272	51.449	51.536	53.222	47.259	50.411	50.562	51.430	49.655	46.383	47.821	47.755	46.347	46.034	49.287	48.482	46.968	49.240	2.143
K1	214.442	216.055	215.631	213.937	213.011	212.936	209.336	206.836	202.734	199.984	198.820	198.311	196.961	199.811	202.561	205.715	210.115	211.600	214.875	207.562	6.697
O1	276.942	274.918	273.428	274.238	273.045	273.498	276.333	279.099	283.481	291.061	297.178	302.598	303.001	303.079	297.384	293.717	288.947	284.172	280.336	285.603	11.080
MSF	290.747	286.387	292.627	274.401	297.977	286.882	292.124	300.446	283.311	288.019	287.816	291.840	291.922	290.788	277.951	293.767	286.812	288.694	272.413	288.154	7.179
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.082	0.072	0.081	0.086	0.087	0.076	0.075	0.079	0.078	0.078	0.093	0.084	0.077	0.079	0.059	0.071	0.094	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.6	99.5	98.7	97.8	95.6	93.4	94.5	97.5	91.7	94.7	81.8	88.2	93.4	85.6	87.8	74.8	98.2	98.0	94.3		

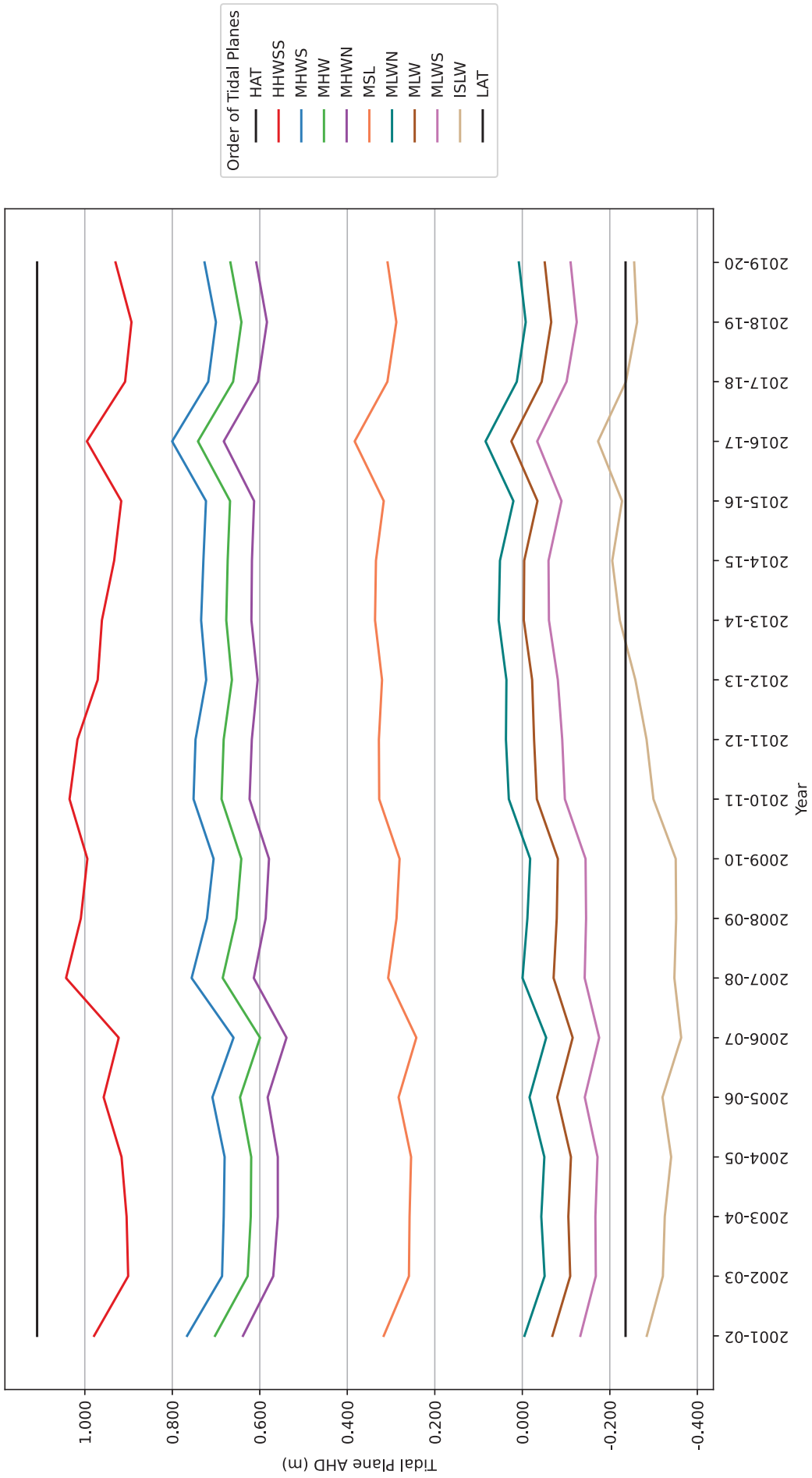
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.11	05/06/2004 01:45	±0.19	23.5
Lowest Astronomical Tide (LAT)	-0.24	26/10/2012 04:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A166

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Ebenezer

MHL2786

Figure A166

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Windsor

RECORDING STATION: **Hawkesbury River at Windsor**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212426

ZONE: 56
EASTING: 297588
NORTHING: 6279514

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.980	0.885	0.901	0.909	0.946	0.923	1.023	1.002	0.985	1.041	1.014	0.939	0.921	0.870	0.893	0.978	0.886	0.877	0.892	0.940	0.055
MHWS	0.782	0.687	0.695	0.688	0.713	0.675	0.752	0.731	0.714	0.772	0.757	0.704	0.698	0.697	0.706	0.798	0.710	0.697	0.702	0.720	0.035
MHW	0.727	0.636	0.640	0.632	0.656	0.618	0.688	0.671	0.657	0.716	0.701	0.654	0.655	0.656	0.658	0.747	0.660	0.646	0.651	0.667	0.034
MHWN	0.672	0.584	0.585	0.577	0.600	0.561	0.625	0.610	0.601	0.659	0.644	0.604	0.613	0.614	0.611	0.696	0.610	0.594	0.601	0.614	0.033
MSL	0.370	0.291	0.292	0.277	0.306	0.267	0.328	0.320	0.311	0.372	0.367	0.341	0.349	0.352	0.344	0.422	0.342	0.323	0.330	0.332	0.037
MLWN	0.067	-0.001	-0.000	-0.022	0.013	-0.028	0.030	0.030	0.021	0.084	0.090	0.079	0.085	0.089	0.077	0.149	0.073	0.051	0.059	0.050	0.045
MLW	0.013	-0.053	-0.055	-0.078	-0.044	-0.084	-0.033	-0.031	-0.036	0.028	0.033	0.029	0.042	0.047	0.030	0.098	0.023	0.000	0.009	-0.003	0.048
MLWS	-0.042	-0.104	-0.110	-0.134	-0.100	-0.141	-0.097	-0.092	-0.093	-0.029	-0.023	-0.022	-0.001	0.006	-0.018	0.047	-0.026	-0.051	-0.041	-0.056	0.052
ISLW	-0.184	-0.246	-0.258	-0.292	-0.267	-0.318	-0.290	-0.285	-0.286	-0.221	-0.207	-0.190	-0.160	-0.117	-0.151	-0.082	-0.152	-0.180	-0.177	-0.214	0.067
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.605	0.585	0.585	0.599	0.587	0.589	0.595	0.580	0.580	0.575	0.555	0.525	0.528	0.526	0.534	0.547	0.537	0.543	0.542	0.564	0.028
MR	0.715	0.689	0.695	0.711	0.700	0.703	0.722	0.702	0.693	0.688	0.667	0.625	0.614	0.609	0.629	0.649	0.636	0.645	0.643	0.670	0.037
MSR	0.824	0.792	0.805	0.822	0.813	0.817	0.848	0.823	0.807	0.801	0.780	0.725	0.699	0.692	0.723	0.751	0.736	0.748	0.743	0.776	0.047
R	1.164	1.131	1.159	1.201	1.213	1.241	1.313	1.287	1.271	1.262	1.221	1.128	1.081	0.987	1.044	1.060	1.039	1.057	1.069	1.154	0.098
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.357	0.344	0.347	0.355	0.350	0.351	0.361	0.351	0.347	0.344	0.334	0.313	0.307	0.304	0.314	0.324	0.318	0.323	0.321	0.335	0.019
S2	0.055	0.052	0.055	0.056	0.057	0.057	0.063	0.061	0.057	0.057	0.056	0.050	0.043	0.041	0.047	0.051	0.050	0.051	0.050	0.053	0.006
K1	0.082	0.083	0.087	0.090	0.096	0.100	0.108	0.106	0.107	0.107	0.104	0.094	0.096	0.067	0.078	0.075	0.074	0.077	0.079	0.090	0.013
O1	0.059	0.058	0.061	0.068	0.071	0.077	0.085	0.087	0.086	0.085	0.079	0.074	0.064	0.056	0.056	0.054	0.052	0.052	0.057	0.067	0.013
MSF	0.068	0.053	0.070	0.055	0.053	0.039	0.068	0.043	0.064	0.058	0.076	0.057	0.053	0.064	0.061	0.074	0.065	0.050	0.057	0.059	0.010
z0	0.370	0.291	0.292	0.277	0.306	0.267	0.328	0.320	0.311	0.372	0.367	0.341	0.349	0.352	0.344	0.422	0.342	0.323	0.330	0.332	0.037
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	148.353	149.479	149.742	149.604	148.678	148.250	147.035	146.770	145.750	146.176	147.107	146.940	149.339	150.126	149.546	150.261	150.401	150.450	151.855	148.730	1.692
S2	74.851	77.966	75.631	74.714	74.380	75.281	70.397	72.694	73.691	74.837	72.582	73.720	76.594	78.366	78.533	75.642	78.685	75.985	76.261	75.306	2.194
K1	228.492	231.399	228.695	226.748	225.089	225.332	223.084	220.676	216.941	214.204	215.083	216.095	207.133	229.416	219.036	222.277	228.100	227.960	232.511	223.067	6.819
O1	291.638	289.015	285.966	286.193	284.845	284.677	289.577	291.532	296.038	304.078	312.278	316.293	319.011	320.171	313.375	307.110	304.844	299.127	296.555	299.596	12.253
MSF	298.437	287.642	293.857	276.769	300.282	288.266	292.784	301.583	287.221	290.693	292.545	295.051	295.685	296.246	280.080	298.193	286.887	291.424	274.646	290.963	7.543
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.080	0.092	0.075	0.083	0.088	0.090	0.079	0.083	0.090	0.084	0.078	0.104	0.094	0.084	0.088	0.067	0.073	0.095	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.3	99.1	98.3	96.7	92.9	92.2	92.4	96.8	89.0	91.4	73.3	88.6	80.3	80.4	89.2	67.2	92.8	96.4	94.1		

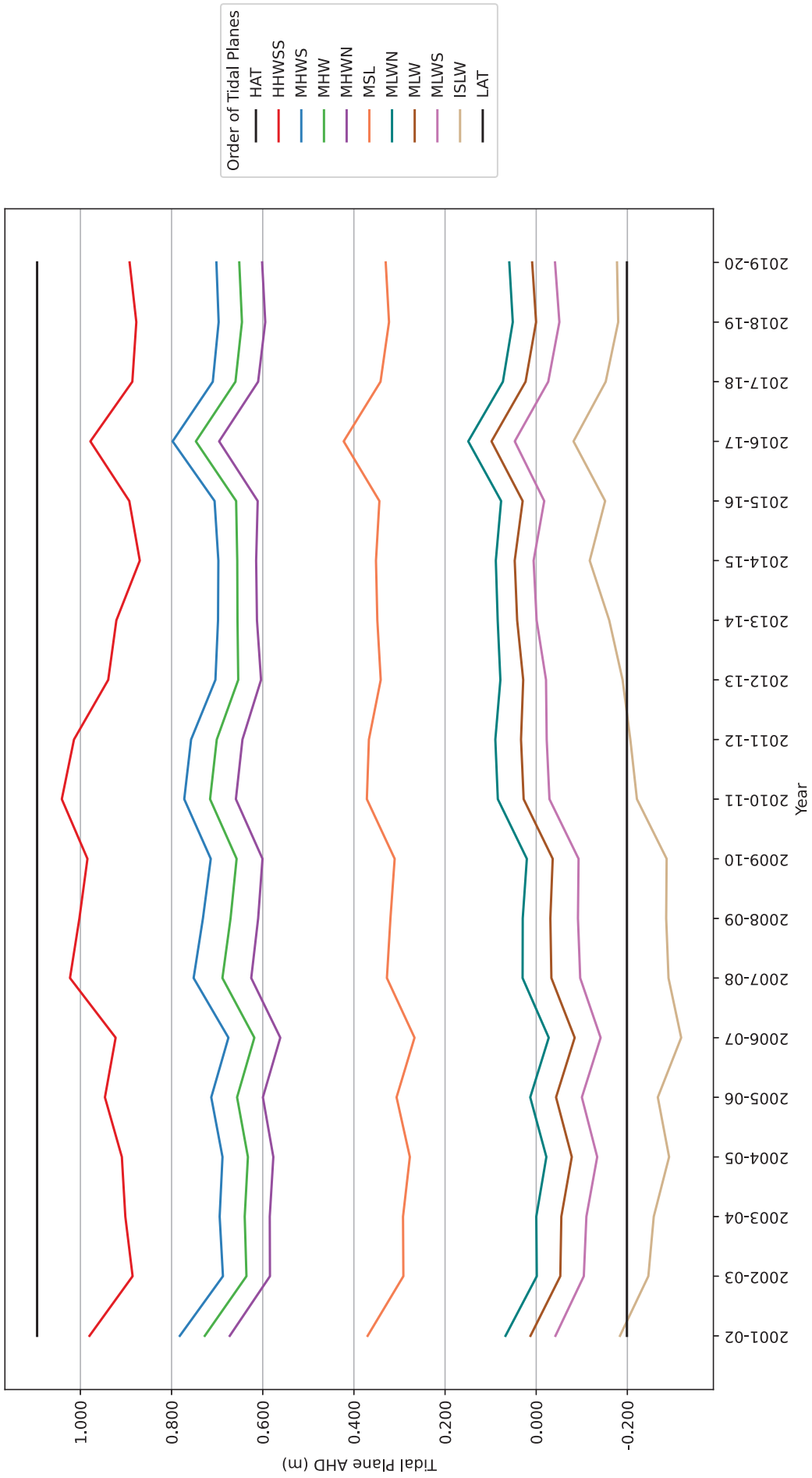
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.09	05/06/2008 02:00	±0.20	30.8
Lowest Astronomical Tide (LAT)	-0.20	26/10/2012 05:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A167

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Windsor

MHL2786

Figure
A167

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Hawkesbury River at Freemans Reach

RECORDING STATION: **Hawkesbury River at Freemans Reach**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 212410

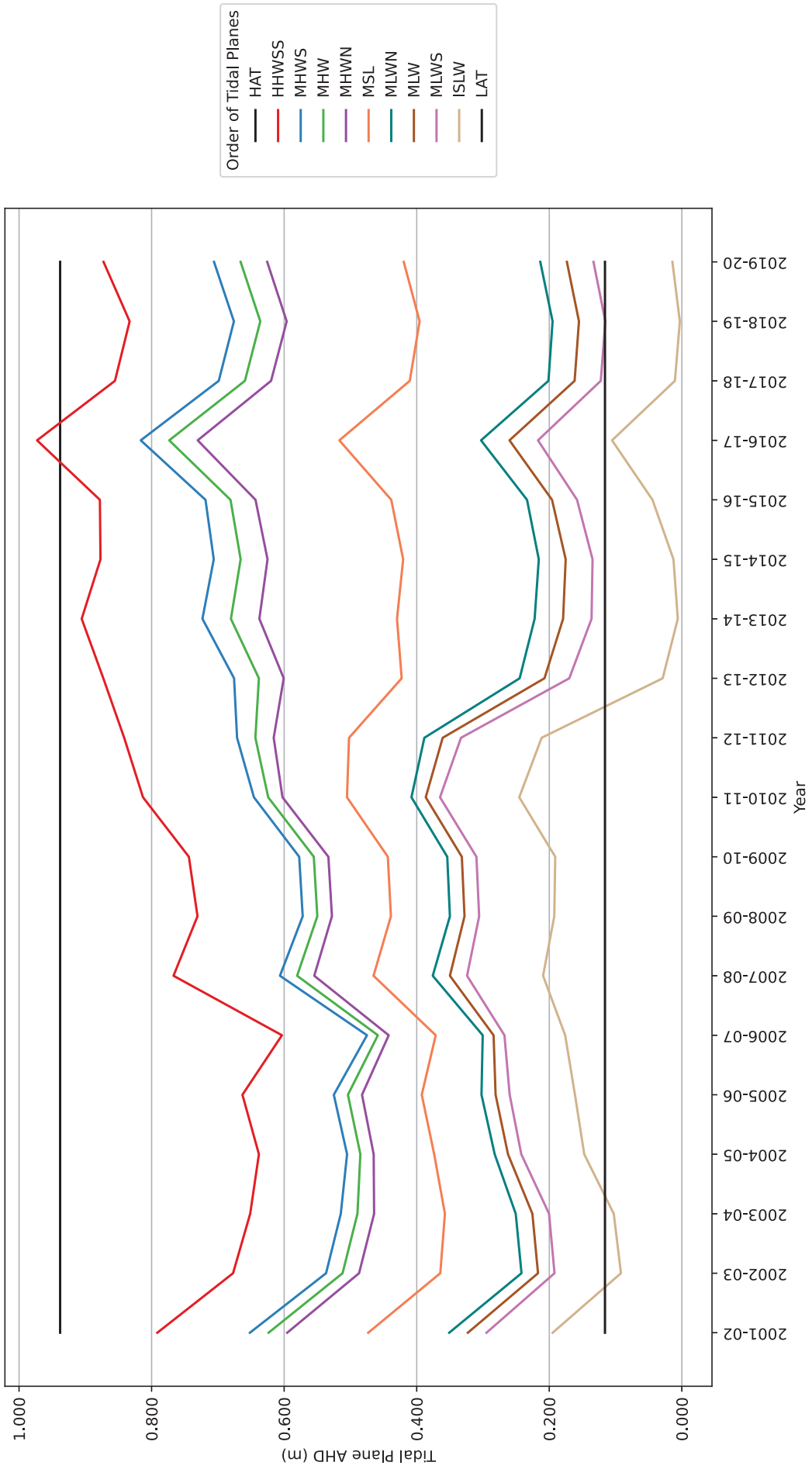
ZONE: 56
EASTING: 294009
NORTHING: 6283328

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.791	0.677	0.651	0.638	0.663	0.603	0.767	0.731	0.744	0.813	0.841	0.873	0.905	0.877	0.878	0.973	0.855	0.833	0.873	0.789	0.105
MHWS	0.652	0.537	0.515	0.505	0.525	0.475	0.606	0.572	0.577	0.646	0.671	0.676	0.723	0.706	0.719	0.816	0.699	0.676	0.706	0.632	0.092
MHW	0.624	0.512	0.489	0.485	0.504	0.459	0.580	0.550	0.555	0.624	0.643	0.638	0.680	0.666	0.681	0.773	0.659	0.636	0.666	0.601	0.084
MHWN	0.595	0.487	0.464	0.465	0.483	0.442	0.555	0.528	0.533	0.603	0.616	0.601	0.637	0.625	0.643	0.730	0.620	0.596	0.626	0.571	0.077
MSL	0.473	0.364	0.357	0.374	0.392	0.371	0.465	0.439	0.444	0.505	0.502	0.423	0.430	0.420	0.438	0.517	0.410	0.396	0.420	0.428	0.048
MLWN	0.351	0.242	0.251	0.282	0.302	0.300	0.376	0.350	0.354	0.408	0.388	0.245	0.222	0.216	0.234	0.303	0.201	0.195	0.214	0.286	0.069
MLW	0.323	0.217	0.226	0.262	0.281	0.284	0.350	0.328	0.332	0.386	0.361	0.207	0.179	0.175	0.196	0.260	0.162	0.155	0.173	0.256	0.075
MLWS	0.295	0.192	0.200	0.242	0.260	0.268	0.324	0.306	0.310	0.365	0.333	0.170	0.136	0.135	0.158	0.217	0.122	0.115	0.133	0.225	0.081
ISLW	0.195	0.092	0.103	0.147	0.161	0.176	0.209	0.192	0.191	0.245	0.212	0.029	0.006	0.013	0.044	0.105	0.010	0.003	0.014	0.113	0.085
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.244	0.245	0.214	0.183	0.180	0.142	0.179	0.178	0.179	0.195	0.227	0.356	0.415	0.409	0.410	0.427	0.418	0.401	0.412	0.285	0.110
MR	0.301	0.295	0.264	0.223	0.223	0.175	0.231	0.222	0.223	0.238	0.283	0.431	0.501	0.490	0.485	0.513	0.497	0.481	0.492	0.346	0.128
MSR	0.357	0.345	0.314	0.263	0.265	0.207	0.282	0.266	0.267	0.281	0.338	0.506	0.587	0.571	0.561	0.599	0.576	0.560	0.573	0.406	0.145
R	0.596	0.585	0.549	0.491	0.502	0.427	0.558	0.538	0.553	0.568	0.630	0.844	0.899	0.864	0.834	0.867	0.845	0.830	0.858	0.676	0.163
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.150	0.147	0.132	0.111	0.111	0.087	0.115	0.111	0.112	0.119	0.141	0.215	0.251	0.245	0.243	0.257	0.249	0.240	0.246	0.173	0.064
S2	0.028	0.025	0.025	0.020	0.021	0.016	0.026	0.022	0.022	0.022	0.028	0.037	0.043	0.041	0.038	0.043	0.039	0.040	0.040	0.030	0.009
K1	0.056	0.056	0.054	0.051	0.054	0.049	0.060	0.059	0.063	0.062	0.063	0.077	0.075	0.070	0.066	0.064	0.065	0.067	0.068	0.062	0.008
O1	0.044	0.044	0.043	0.044	0.045	0.043	0.054	0.054	0.056	0.058	0.058	0.064	0.055	0.052	0.048	0.047	0.047	0.046	0.051	0.050	0.006
MSF	0.071	0.055	0.069	0.063	0.061	0.042	0.074	0.050	0.064	0.059	0.072	0.059	0.058	0.055	0.069	0.073	0.068	0.049	0.062	0.062	0.009
z0	0.473	0.364	0.357	0.374	0.392	0.371	0.465	0.439	0.444	0.505	0.502	0.423	0.430	0.420	0.438	0.517	0.410	0.396	0.420	0.428	0.048
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	211.014	213.069	215.302	222.869	221.716	226.581	220.215	218.152	216.724	213.528	204.558	192.914	186.099	188.417	189.874	188.853	189.964	192.073	191.116	205.423	14.409
S2	132.728	135.412	137.003	139.725	143.093	151.620	138.433	144.593	138.233	135.378	128.655	118.169	115.445	119.011	116.171	116.337	117.921	120.596	115.126	129.666	11.799
K1	275.022	277.108	277.749	283.378	283.781	288.182	277.530	273.885	271.639	263.908	255.301	243.786	236.373	239.499	241.346	246.181	251.746	253.682	257.153	263.013	16.893
O1	333.610	331.351	333.241	338.416	338.650	344.906	339.653	342.641	347.467	350.958	352.697	342.226	339.983	340.516	336.431	327.821	325.084	322.273	319.522	337.234	9.162
MSF	294.912	288.140	301.921	283.254	300.033	296.867	303.233	299.680	293.103	286.141	298.158	288.893	296.828	288.257	282.061	298.051	289.488	305.513	285.751	293.699	7.074
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078	0.085	0.075	0.097	0.088	0.091	0.072	0.081	0.080	0.077	0.076	0.086	0.076	0.075	0.074	0.056	0.063	0.090	0.065		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.3	98.1	99.4	93.8	90.5	90.4	78.7	90.1	94.8	79.7	63.7	79.3	76.1	79.9	75.8	53.2	86.1	78.3	84.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.94	05/06/2004 04:15	±0.22	64.4
Lowest Astronomical Tide (LAT)	0.12	11/08/2008 17:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

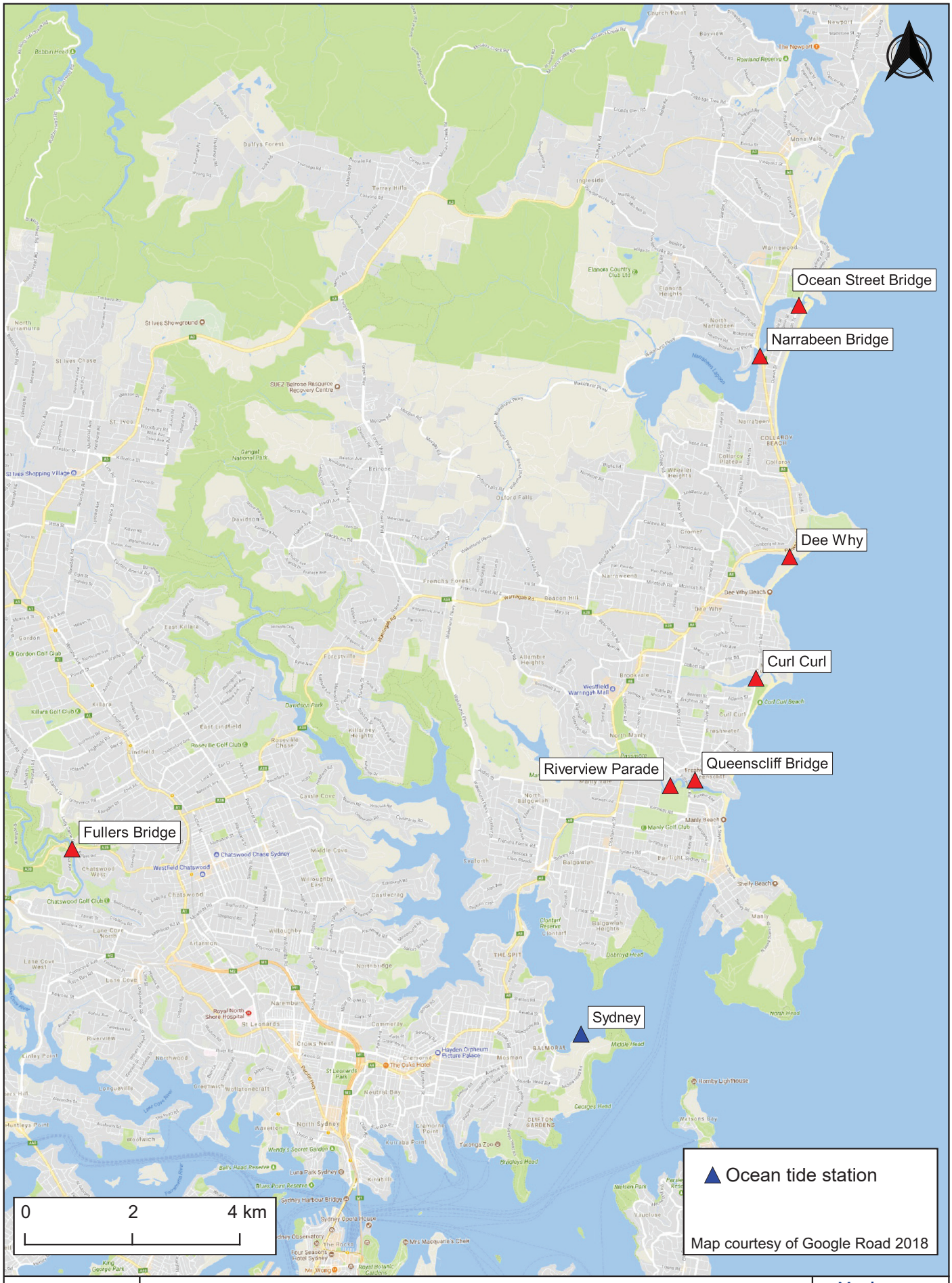


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Hawkesbury River at Freemans Reach

MHL2786

Figure
A168



NSW GOVERNMENT

STATION LOCATIONS
NORTH SYDNEY REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A169

DRAWING A169.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Narrabeen Lagoon at Ocean Street Bridge

RECORDING STATION: **Narrabeen Lagoon at Ocean Street Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213408D

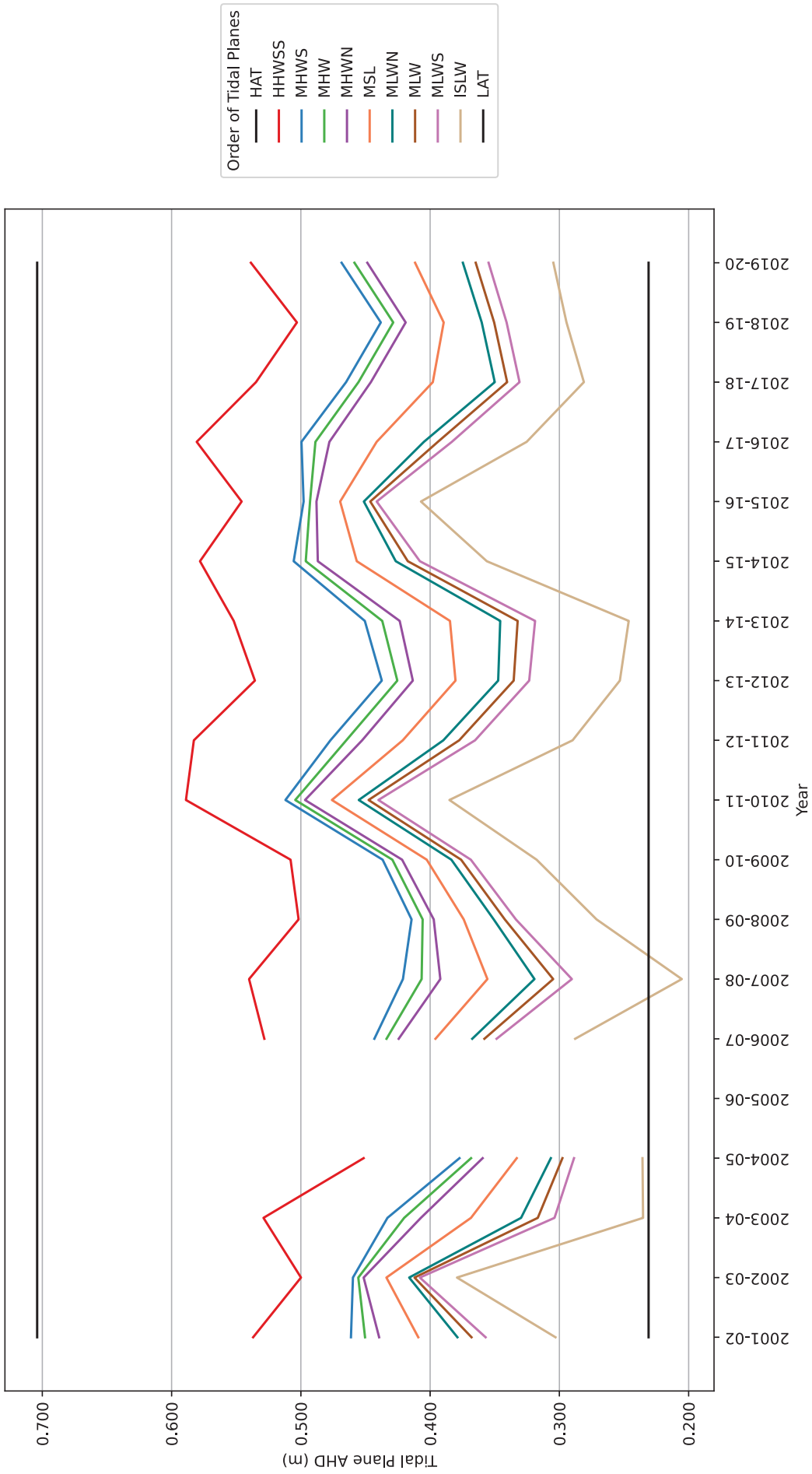
ZONE: 56
EASTING: 342897
NORTHING: 6269396

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06^	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.537	0.500	0.529	0.451		0.528	0.540	0.502	0.508	0.589	0.583	0.536	0.552	0.578	0.546	0.581	0.535	0.503	0.539	0.535	0.035
MHWS	0.461	0.460	0.433	0.377		0.443	0.421	0.414	0.437	0.512	0.477	0.437	0.451	0.506	0.498	0.500	0.465	0.438	0.468	0.455	0.035
MHW	0.450	0.456	0.420	0.368		0.434	0.407	0.406	0.429	0.504	0.465	0.425	0.437	0.496	0.493	0.489	0.455	0.429	0.459	0.446	0.036
MHWN	0.439	0.451	0.407	0.359		0.424	0.392	0.397	0.422	0.497	0.453	0.413	0.424	0.487	0.488	0.478	0.446	0.419	0.449	0.436	0.037
MSL	0.409	0.434	0.368	0.333		0.396	0.356	0.374	0.403	0.476	0.421	0.380	0.385	0.457	0.470	0.441	0.398	0.389	0.412	0.406	0.039
MLWN	0.379	0.416	0.330	0.307		0.367	0.319	0.351	0.384	0.455	0.390	0.347	0.346	0.427	0.451	0.405	0.350	0.360	0.375	0.375	0.043
MLW	0.368	0.412	0.317	0.298		0.358	0.305	0.342	0.376	0.448	0.378	0.335	0.332	0.417	0.446	0.394	0.340	0.350	0.365	0.366	0.044
MLWS	0.357	0.408	0.304	0.289		0.349	0.290	0.334	0.369	0.440	0.365	0.323	0.319	0.408	0.441	0.383	0.331	0.341	0.355	0.356	0.046
ISLW	0.303	0.379	0.235	0.236		0.288	0.205	0.271	0.318	0.385	0.290	0.253	0.246	0.356	0.407	0.325	0.281	0.294	0.305	0.299	0.056
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.061	0.035	0.078	0.053		0.057	0.073	0.046	0.038	0.042	0.063	0.066	0.078	0.060	0.037	0.073	0.096	0.059	0.074	0.060	0.017
MR	0.082	0.043	0.103	0.071		0.076	0.102	0.064	0.053	0.057	0.087	0.090	0.105	0.079	0.047	0.095	0.115	0.078	0.094	0.080	0.021
MSR	0.104	0.052	0.129	0.089		0.095	0.131	0.081	0.068	0.072	0.112	0.114	0.132	0.098	0.057	0.116	0.134	0.097	0.114	0.100	0.026
R	0.234	0.121	0.294	0.216		0.240	0.335	0.230	0.190	0.204	0.293	0.282	0.306	0.222	0.139	0.255	0.254	0.209	0.234	0.236	0.055
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.041	0.022	0.052	0.035		0.038	0.051	0.032	0.027	0.028	0.044	0.045	0.052	0.039	0.023	0.047	0.058	0.039	0.047	0.040	0.011
S2	0.011	0.004	0.013	0.009		0.009	0.014	0.009	0.008	0.008	0.012	0.012	0.013	0.009	0.005	0.011	0.010	0.010	0.010	0.010	0.003
K1	0.029	0.015	0.035	0.026		0.032	0.041	0.031	0.025	0.028	0.037	0.035	0.037	0.027	0.018	0.032	0.027	0.024	0.024	0.029	0.007
O1	0.025	0.013	0.034	0.027		0.029	0.044	0.032	0.026	0.027	0.039	0.035	0.035	0.025	0.016	0.026	0.023	0.022	0.027	0.028	0.008
MSF	0.074	0.042	0.083	0.063		0.035	0.066	0.046	0.070	0.059	0.058	0.052	0.061	0.054	0.061	0.046	0.052	0.055	0.064	0.058	0.012
z0	0.409	0.434	0.368	0.333		0.396	0.356	0.374	0.403	0.476	0.421	0.380	0.385	0.457	0.470	0.441	0.398	0.389	0.412	0.406	0.039
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	59.296	53.963	56.871	61.839		49.371	52.081	56.918	57.142	56.420	46.099	52.706	48.351	50.327	53.025	42.713	19.914	47.578	28.432	49.614	10.559
S2	336.176	315.243	332.947	329.017		321.863	325.208	332.299	333.964	336.035	326.964	327.370	320.912	333.009	349.481	330.385	312.279	329.394	326.516	328.837	8.408
K1	206.704	195.084	205.622	209.821		199.316	196.334	198.606	197.210	200.966	183.974	185.784	177.491	187.413	195.467	190.152	180.488	199.038	190.871	194.463	8.998
O1	276.715	276.902	269.818	273.577		271.137	270.526	275.148	281.921	287.015	279.364	291.734	287.491	292.697	289.566	275.959	260.103	269.264	262.475	277.301	9.581
MSF	296.411	304.669	294.477	293.507		283.405	283.872	291.902	289.353	289.100	276.700	293.482	284.227	289.694	291.759	285.206	282.834	285.992	264.516	287.839	8.595
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.089	0.074	0.073		0.102	0.077	0.092	0.084	0.075	0.085	0.094	0.081	0.073	0.066	0.078	0.089	0.080	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	94.3	85.4	96.4	82.5	66.5	81.3	98.2	90.7	95.2	69.7	89.8	89.1	97.4	86.7	60.5	91.4	76.1	70.2	116.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.70	04/06/2004 22:45	±0.20	62.5
Lowest Astronomical Tide (LAT)	0.23	31/01/2004 23:45		

COMMENTS
^Estuary entrance was closed for this period resulting in non-tidal data.
Station was relocated from Narrabeen Caravan Park (AWRC: 213408) in May 2017. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Narrabeen Lagoon at Ocean Street Bridge

MHL2786

Figure A170

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Narrabeen Lagoon at Narrabeen Bridge

RECORDING STATION: **Narrabeen Lagoon at Narrabeen Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213422

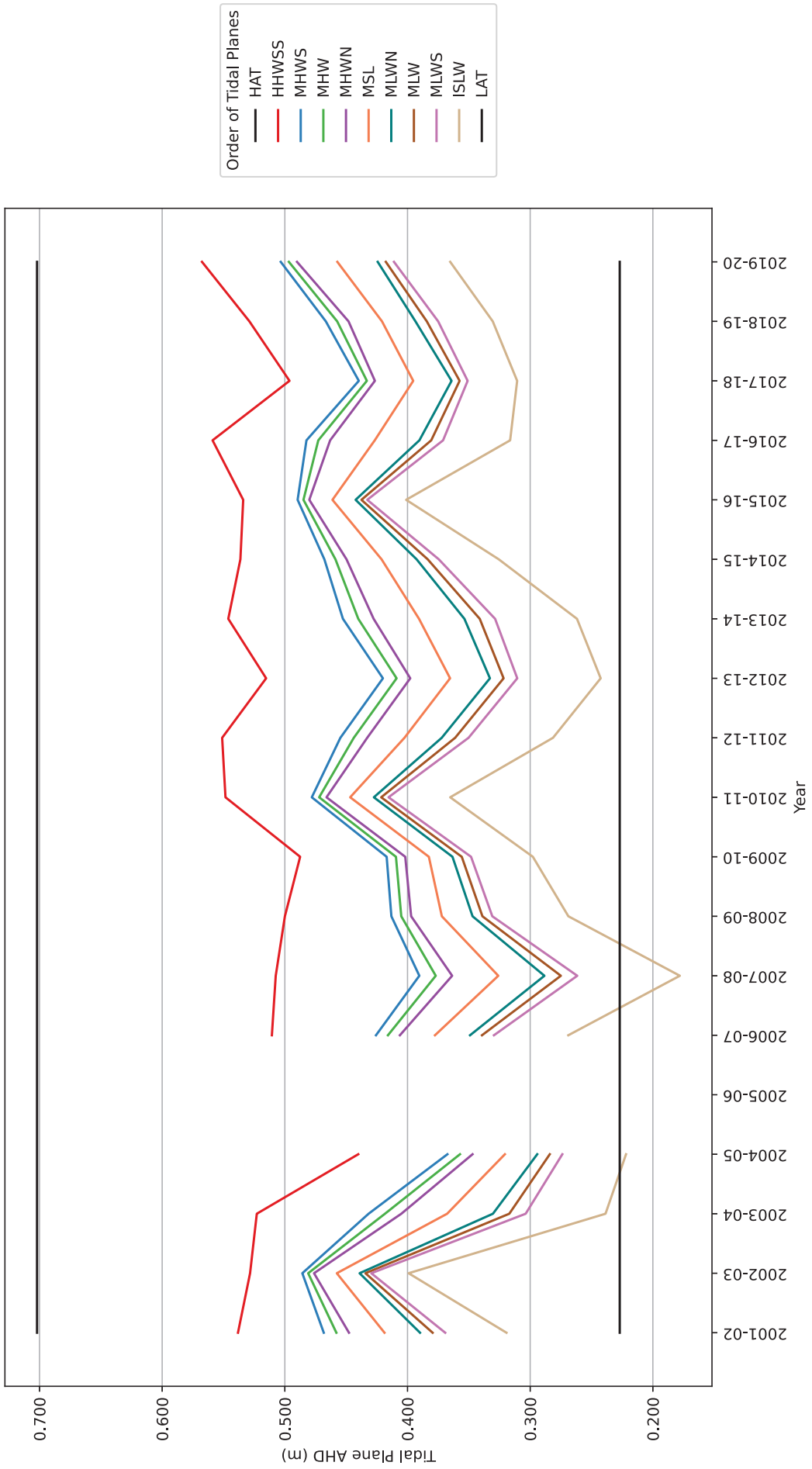
ZONE: 56
EASTING: 342174
NORTHING: 6268454

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06^	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.538	0.528	0.523	0.440		0.511	0.507	0.500	0.488	0.548	0.551	0.515	0.546	0.536	0.534	0.559	0.496	0.529	0.568	0.523	0.030
MHWS	0.468	0.486	0.432	0.367		0.426	0.390	0.413	0.417	0.478	0.455	0.420	0.453	0.468	0.490	0.482	0.440	0.467	0.503	0.447	0.037
MHW	0.458	0.481	0.418	0.357		0.416	0.377	0.405	0.409	0.472	0.444	0.409	0.440	0.459	0.485	0.473	0.433	0.457	0.497	0.438	0.038
MHWN	0.448	0.476	0.405	0.347		0.406	0.364	0.397	0.402	0.466	0.433	0.398	0.428	0.450	0.480	0.463	0.427	0.448	0.490	0.429	0.040
MSL	0.419	0.458	0.368	0.321		0.378	0.326	0.372	0.383	0.447	0.402	0.365	0.391	0.421	0.461	0.427	0.395	0.421	0.457	0.401	0.042
MLWN	0.390	0.439	0.330	0.294		0.349	0.288	0.347	0.363	0.427	0.372	0.333	0.354	0.393	0.442	0.390	0.364	0.394	0.424	0.372	0.045
MLW	0.380	0.434	0.317	0.284		0.339	0.275	0.339	0.356	0.421	0.361	0.322	0.341	0.384	0.438	0.381	0.358	0.384	0.418	0.363	0.047
MLWS	0.369	0.430	0.304	0.274		0.330	0.262	0.331	0.348	0.415	0.350	0.311	0.329	0.375	0.433	0.371	0.351	0.375	0.411	0.354	0.049
ISLW	0.319	0.399	0.239	0.222		0.269	0.178	0.269	0.298	0.365	0.281	0.243	0.262	0.326	0.401	0.316	0.311	0.331	0.365	0.300	0.061
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.058	0.037	0.075	0.053		0.057	0.075	0.050	0.039	0.039	0.061	0.065	0.074	0.057	0.038	0.073	0.062	0.055	0.066	0.057	0.013
MR	0.078	0.047	0.101	0.073		0.077	0.102	0.066	0.054	0.051	0.083	0.087	0.099	0.075	0.047	0.092	0.076	0.073	0.079	0.076	0.018
MSR	0.099	0.056	0.128	0.094		0.096	0.129	0.082	0.069	0.063	0.104	0.110	0.124	0.093	0.057	0.111	0.089	0.092	0.092	0.094	0.022
R	0.219	0.129	0.284	0.218		0.242	0.329	0.231	0.190	0.183	0.270	0.273	0.284	0.211	0.133	0.243	0.186	0.198	0.202	0.224	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.039	0.023	0.051	0.037		0.038	0.051	0.033	0.027	0.025	0.041	0.044	0.050	0.038	0.024	0.046	0.038	0.037	0.040	0.038	0.009
S2	0.010	0.005	0.013	0.010		0.010	0.013	0.008	0.008	0.006	0.011	0.011	0.013	0.009	0.005	0.010	0.007	0.009	0.007	0.009	0.003
K1	0.027	0.016	0.034	0.026		0.029	0.041	0.031	0.024	0.025	0.034	0.033	0.034	0.025	0.017	0.029	0.021	0.024	0.018	0.027	0.007
O1	0.023	0.014	0.032	0.026		0.032	0.043	0.031	0.026	0.025	0.035	0.035	0.033	0.024	0.015	0.025	0.019	0.020	0.028	0.027	0.007
MSF	0.071	0.041	0.077	0.068		0.039	0.063	0.042	0.069	0.051	0.060	0.044	0.055	0.051	0.059	0.053	0.059	0.053	0.080	0.058	0.012
z0	0.419	0.458	0.368	0.321		0.378	0.326	0.372	0.383	0.447	0.402	0.365	0.391	0.421	0.461	0.427	0.395	0.421	0.457	0.401	0.042
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	73.188	69.364	71.663	76.191		67.702	70.020	72.439	71.745	72.541	65.799	67.037	68.725	70.085	72.491	68.586	72.399	70.463	68.028	70.470	2.596
S2	351.917	344.188	351.741	345.422		341.065	343.765	347.582	348.337	343.368	347.208	350.173	344.287	350.568	349.631	352.780	344.698	1.776	2.364	308.937	111.690
K1	216.299	213.754	213.936	209.706		218.599	207.716	208.817	204.577	205.557	199.723	196.022	190.061	196.103	198.471	199.941	208.091	218.557	214.319	206.680	8.478
O1	282.141	291.006	279.215	279.040		286.512	280.110	285.381	290.799	300.844	290.037	302.831	300.678	303.212	302.492	290.268	290.420	285.564	283.966	290.251	8.448
MSF	294.466	304.109	296.164	288.914		275.973	282.640	295.262	290.348	277.241	273.729	287.346	285.994	292.587	288.880	288.057	285.384	288.792	276.141	287.335	7.994
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.080	0.076	0.086		0.110	0.081	0.102	0.085	0.082	0.090	0.091	0.072	0.079	0.073	0.076	0.088	0.083	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.2	79.1	97.4	86.6	66.3	79.0	99.0	89.5	96.3	78.3	90.8	78.1	96.3	91.5	59.1	94.7	72.3	71.5	173.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.70	04/06/2004 23:45	±0.18	52.7
Lowest Astronomical Tide (LAT)	0.23	01/02/2004 00:15		

COMMENTS
^Estuary entrance was closed for this period resulting in non-tidal data.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Narrabeen Lagoon at Narrabeen Bridge

MHL2786

Figure A171

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Manly Lagoon at Riverview Parade

RECORDING STATION: **Manly Lagoon at Riverview Parade**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213413

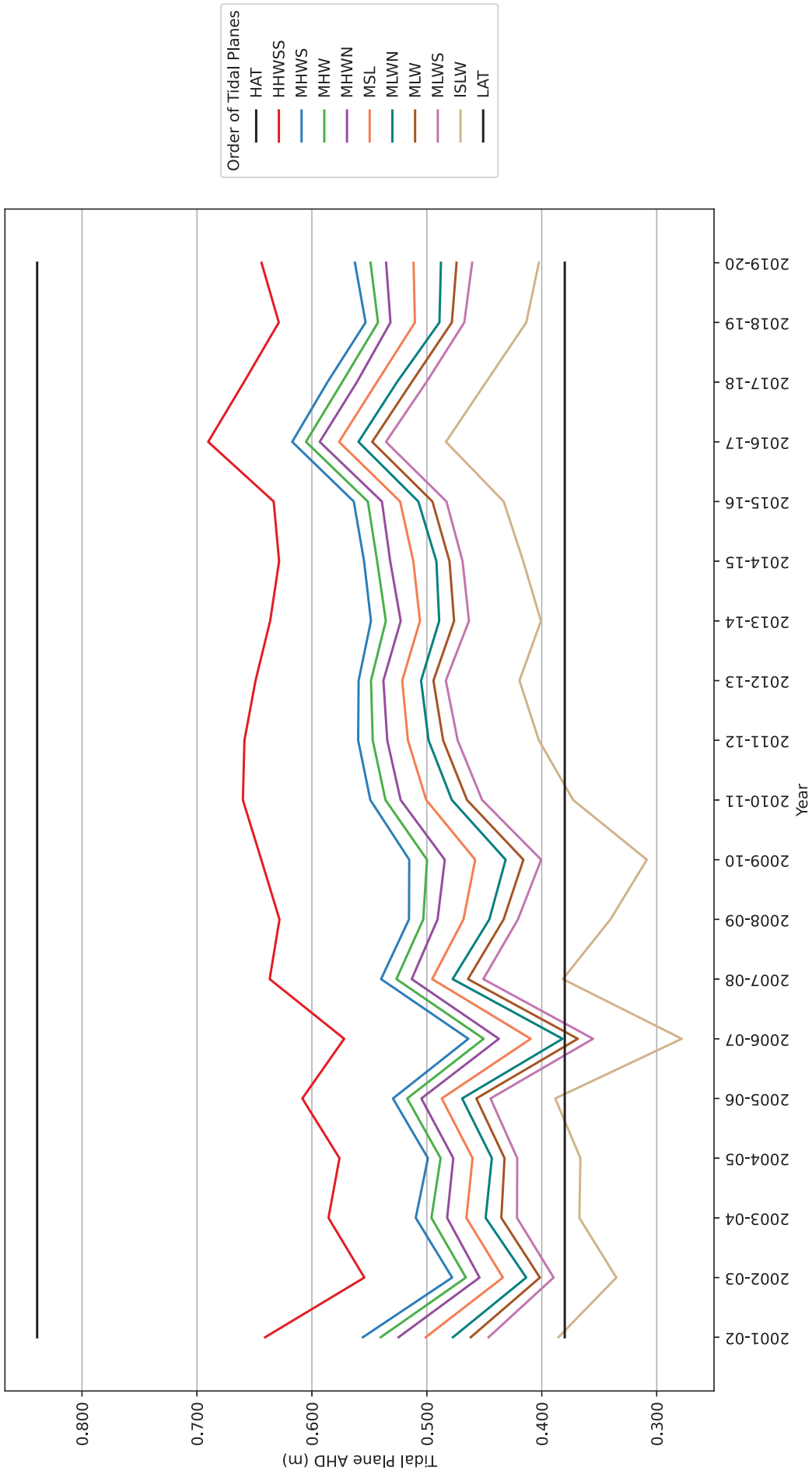
ZONE: 56
EASTING: 340504
NORTHING: 6260457

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.641	0.554	0.586	0.576	0.608	0.572	0.637	0.628	0.644	0.660	0.659	0.649	0.636	0.629	0.633	0.690	0.659	0.629	0.644	0.628	0.035
MHWS	0.556	0.478	0.510	0.499	0.529	0.464	0.540	0.516	0.515	0.549	0.560	0.559	0.549	0.555	0.564	0.617	0.586	0.553	0.563	0.540	0.037
MHW	0.540	0.466	0.496	0.488	0.517	0.451	0.526	0.503	0.500	0.536	0.547	0.549	0.536	0.543	0.551	0.605	0.574	0.542	0.549	0.527	0.037
MHWN	0.525	0.454	0.482	0.477	0.505	0.437	0.513	0.491	0.484	0.523	0.534	0.538	0.523	0.532	0.539	0.593	0.561	0.532	0.535	0.515	0.037
MSL	0.501	0.434	0.466	0.460	0.487	0.410	0.495	0.468	0.458	0.500	0.516	0.521	0.506	0.512	0.523	0.576	0.543	0.510	0.512	0.495	0.039
MLWN	0.477	0.414	0.449	0.443	0.469	0.382	0.478	0.446	0.431	0.478	0.498	0.505	0.489	0.492	0.507	0.559	0.526	0.489	0.488	0.475	0.041
MLW	0.462	0.402	0.435	0.432	0.457	0.369	0.464	0.433	0.416	0.465	0.486	0.494	0.476	0.480	0.495	0.548	0.513	0.478	0.474	0.462	0.041
MLWS	0.446	0.390	0.422	0.421	0.445	0.355	0.451	0.421	0.401	0.452	0.473	0.483	0.463	0.469	0.483	0.536	0.500	0.467	0.461	0.449	0.042
ISLW	0.386	0.335	0.367	0.366	0.388	0.278	0.382	0.340	0.309	0.373	0.402	0.419	0.401	0.416	0.433	0.483	0.448	0.413	0.403	0.387	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.047	0.041	0.033	0.034	0.035	0.055	0.036	0.045	0.053	0.045	0.036	0.033	0.033	0.040	0.032	0.034	0.035	0.043	0.048	0.040	0.007
MR	0.078	0.064	0.061	0.056	0.060	0.082	0.062	0.070	0.084	0.071	0.061	0.054	0.059	0.063	0.056	0.058	0.060	0.064	0.075	0.065	0.009
MSR	0.109	0.088	0.088	0.078	0.085	0.108	0.089	0.095	0.115	0.097	0.087	0.076	0.085	0.086	0.081	0.082	0.086	0.086	0.102	0.091	0.011
R	0.255	0.219	0.218	0.210	0.220	0.294	0.255	0.288	0.335	0.287	0.256	0.230	0.236	0.212	0.200	0.207	0.211	0.215	0.241	0.242	0.037
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.039	0.032	0.030	0.028	0.030	0.041	0.031	0.035	0.042	0.035	0.031	0.027	0.030	0.031	0.028	0.029	0.030	0.032	0.037	0.033	0.004
S2	0.016	0.012	0.014	0.011	0.012	0.013	0.013	0.012	0.015	0.013	0.013	0.011	0.013	0.011	0.012	0.012	0.013	0.011	0.014	0.013	0.001
K1	0.033	0.028	0.027	0.028	0.029	0.038	0.035	0.041	0.045	0.040	0.034	0.031	0.031	0.027	0.025	0.026	0.027	0.027	0.030	0.032	0.006
O1	0.028	0.026	0.028	0.027	0.027	0.039	0.034	0.040	0.047	0.040	0.037	0.034	0.032	0.025	0.025	0.026	0.025	0.027	0.028	0.031	0.007
MSF	0.045	0.041	0.049	0.038	0.044	0.039	0.043	0.026	0.049	0.042	0.044	0.030	0.042	0.037	0.035	0.040	0.044	0.036	0.042	0.040	0.006
z0	0.501	0.434	0.466	0.460	0.487	0.410	0.495	0.468	0.458	0.500	0.516	0.521	0.506	0.512	0.523	0.576	0.543	0.510	0.512	0.495	0.039
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	63.992	74.870	71.113	71.970	70.635	62.805	60.355	61.509	58.451	60.351	58.598	59.857	62.003	57.819	61.779	60.491	59.126	60.092	62.178	63.052	5.123
S2	337.541	348.167	337.248	332.535	332.543	332.754	329.293	330.447	327.716	323.862	331.361	337.369	331.299	321.094	333.031	340.444	331.382	330.208	326.067	332.335	6.114
K1	201.448	212.065	209.154	209.665	204.052	201.237	194.106	191.075	189.569	183.345	185.034	180.426	181.125	182.560	183.041	184.126	192.172	194.983	197.555	193.512	10.390
O1	262.025	272.921	269.339	261.886	265.726	266.014	264.455	263.891	270.385	272.715	277.055	283.372	284.806	286.821	278.882	279.589	269.500	267.270	267.609	271.803	7.822
MSF	292.646	286.409	288.820	290.577	281.733	263.809	275.652	274.821	277.597	285.174	276.613	286.267	283.877	286.385	288.844	301.644	283.856	282.375	274.460	283.240	8.297
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.052	0.072	0.060	0.058	0.063	0.071	0.056	0.068	0.070	0.062	0.056	0.061	0.051	0.060	0.058	0.042	0.038	0.055	0.056		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.5	95.5	95.1	95.2	92.6	93.3	94.8	96.7	97.1	95.8	88.7	92.0	96.0	86.0	89.9	87.7	97.4	94.0	92.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.84	04/06/2004 23:15	±0.14	31.0
Lowest Astronomical Tide (LAT)	0.38	10/02/2003 17:15		

COMMENTS Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manly Lagoon at Riverview Parade

MHL2786

Figure A172

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Manly Lagoon at Queenscliff Bridge

RECORDING STATION: **Manly Lagoon at Queenscliff Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213414

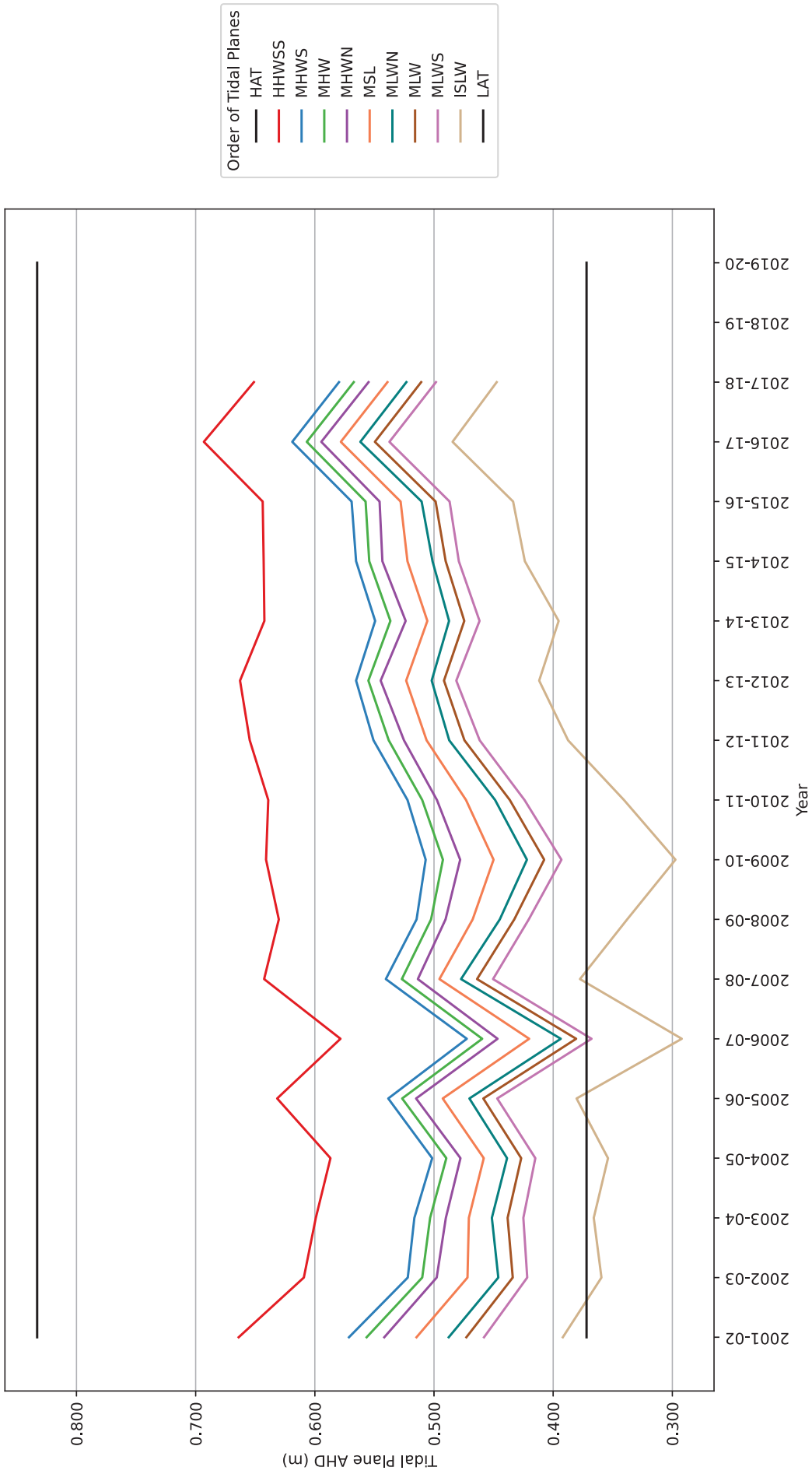
ZONE: 56
EASTING: 340963
NORTHING: 6260561

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.664	0.609	0.599	0.587	0.632	0.578	0.643	0.630	0.641	0.639	0.655	0.663	0.642	0.643	0.644	0.693	0.651			0.636	0.029
MHWS	0.571	0.522	0.516	0.502	0.538	0.472	0.540	0.515	0.507	0.522	0.551	0.565	0.549	0.565	0.569	0.619	0.580			0.541	0.035
MHW	0.557	0.510	0.503	0.490	0.527	0.460	0.527	0.502	0.493	0.510	0.538	0.555	0.537	0.554	0.557	0.607	0.567			0.529	0.036
MHWN	0.542	0.498	0.490	0.478	0.515	0.447	0.514	0.490	0.478	0.498	0.525	0.545	0.524	0.543	0.546	0.595	0.555			0.517	0.036
MSL	0.515	0.472	0.471	0.458	0.493	0.420	0.495	0.468	0.450	0.473	0.506	0.523	0.506	0.522	0.528	0.578	0.539			0.495	0.038
MLWN	0.488	0.446	0.451	0.439	0.470	0.394	0.477	0.445	0.422	0.449	0.487	0.502	0.487	0.501	0.510	0.562	0.523			0.474	0.041
MLW	0.473	0.434	0.438	0.427	0.459	0.381	0.464	0.433	0.408	0.436	0.474	0.492	0.475	0.490	0.499	0.550	0.511			0.461	0.041
MLWS	0.458	0.422	0.425	0.415	0.447	0.368	0.450	0.420	0.393	0.424	0.462	0.481	0.462	0.479	0.487	0.537	0.498			0.449	0.042
ISLW	0.392	0.359	0.366	0.354	0.380	0.292	0.378	0.338	0.297	0.341	0.387	0.412	0.395	0.424	0.434	0.484	0.447			0.381	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.054	0.052	0.039	0.039	0.045	0.053	0.036	0.046	0.056	0.049	0.038	0.043	0.036	0.042	0.035	0.033	0.032			0.043	0.008
MR	0.084	0.076	0.065	0.063	0.068	0.079	0.063	0.070	0.085	0.073	0.064	0.063	0.062	0.064	0.059	0.057	0.057			0.068	0.009
MSR	0.113	0.100	0.091	0.087	0.091	0.105	0.090	0.094	0.114	0.098	0.089	0.084	0.088	0.086	0.082	0.082	0.081			0.093	0.010
R	0.272	0.250	0.233	0.233	0.251	0.286	0.265	0.292	0.344	0.298	0.267	0.251	0.247	0.219	0.210	0.209	0.204			0.255	0.037
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.042	0.038	0.033	0.031	0.034	0.039	0.032	0.035	0.042	0.037	0.032	0.032	0.031	0.032	0.029	0.029	0.028			0.034	0.004
S2	0.015	0.012	0.013	0.012	0.012	0.013	0.013	0.012	0.014	0.012	0.013	0.010	0.013	0.011	0.012	0.012	0.012			0.012	0.001
K1	0.035	0.033	0.029	0.030	0.035	0.038	0.036	0.042	0.047	0.042	0.035	0.033	0.033	0.029	0.026	0.026	0.026			0.034	0.006
O1	0.031	0.030	0.030	0.031	0.032	0.038	0.037	0.041	0.049	0.042	0.039	0.037	0.033	0.027	0.027	0.027	0.025			0.034	0.007
MSF	0.047	0.040	0.048	0.037	0.044	0.038	0.050	0.023	0.048	0.042	0.045	0.027	0.043	0.040	0.037	0.039	0.045			0.041	0.007
z0	0.515	0.472	0.471	0.458	0.493	0.420	0.495	0.468	0.450	0.473	0.506	0.523	0.506	0.522	0.528	0.578	0.539			0.495	0.038
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	58.579	57.551	62.959	59.728	48.294	62.545	56.860	52.290	49.247	47.930	52.286	56.013	59.615	60.793	60.799	61.147	66.351			57.234	5.474
S2	336.790	341.152	335.541	328.319	323.210	333.967	330.934	322.125	326.339	320.770	320.165	320.849	329.127	327.355	334.850	341.601	337.098			330.011	7.177
K1	199.150	203.661	201.907	202.688	191.967	200.698	193.500	185.475	182.584	174.748	178.391	185.825	180.733	182.652	183.137	184.295	197.099			189.912	9.466
O1	262.067	264.761	264.179	257.269	254.591	264.925	266.678	261.779	266.100	266.422	274.742	282.432	285.355	290.148	280.390	280.549	273.485			270.346	10.321
MSF	291.026	283.388	287.925	292.417	282.642	260.221	280.625	267.952	276.368	284.719	277.441	278.411	283.052	287.644	282.505	301.272	283.927			282.443	9.283
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.059	0.061	0.061	0.063	0.059	0.072	0.058	0.073	0.063	0.070	0.056	0.066	0.052	0.060	0.059	0.041	0.040				
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.9	93.5	96.8	91.8	95.3	88.9	81.0	85.0	97.5	96.4	89.1	60.1	97.1	90.3	92.4	87.6	98.2				

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.83	04/06/2004 23:15	±0.14	25.8
Lowest Astronomical Tide (LAT)	0.37	10/02/2003 17:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Manly Lagoon at Queenscliff Bridge

MHL2786

Figure A173

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lane Cove River at Fullers Bridge

RECORDING STATION: **Lane Cove River at Fullers Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213476

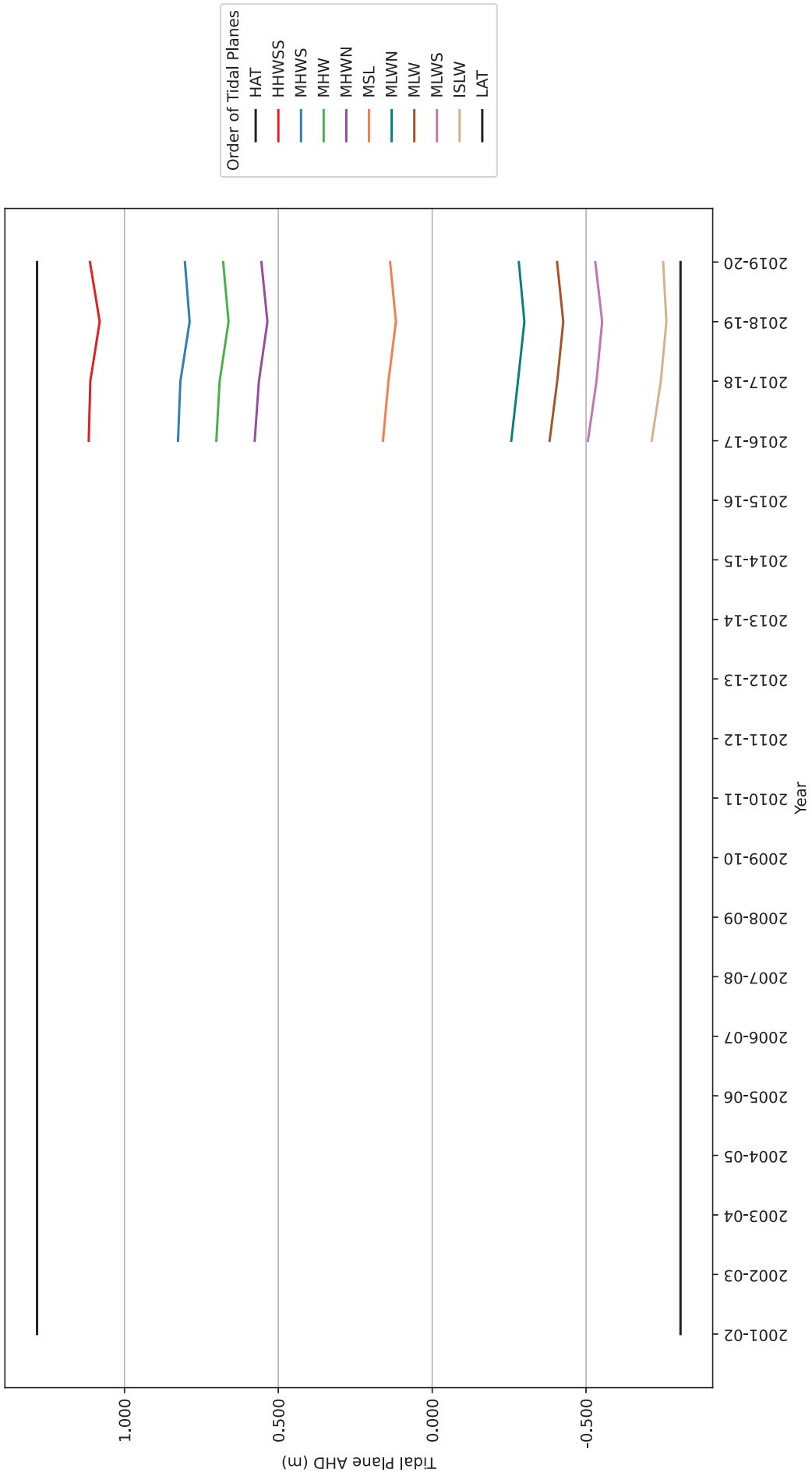
ZONE: 56
EASTING: 329370
NORTHING: 6259278

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11*	2011-12*	2012-13*	2013-14*	2014-15*	2015-16*	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS																1.116	1.111	1.081	1.112	1.105	0.016
MHWS																0.826	0.818	0.788	0.804	0.809	0.017
MHW																0.701	0.691	0.662	0.679	0.683	0.017
MHWN																0.577	0.563	0.535	0.555	0.558	0.017
MSL																0.160	0.142	0.118	0.137	0.139	0.017
MLWN																-0.257	-0.279	-0.300	-0.282	-0.279	0.017
MLW																-0.382	-0.406	-0.426	-0.406	-0.405	0.018
MLWS																-0.506	-0.534	-0.552	-0.530	-0.531	0.019
ISLW																-0.713	-0.743	-0.761	-0.751	-0.742	0.020
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR																0.834	0.842	0.835	0.837	0.837	0.003
MR																1.083	1.097	1.088	1.085	1.088	0.006
MSR																1.332	1.352	1.340	1.334	1.340	0.009
R																1.830	1.854	1.842	1.863	1.847	0.014
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2																0.542	0.548	0.544	0.543	0.544	0.003
S2																0.125	0.128	0.126	0.124	0.126	0.002
K1																0.129	0.130	0.130	0.136	0.131	0.003
O1																0.078	0.079	0.079	0.085	0.080	0.003
MSF																0.015	0.016	0.008	0.009	0.012	0.004
z0																0.160	0.142	0.118	0.137	0.139	0.017
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2																353.461	353.750	354.380	355.451	354.261	0.881
S2																266.083	266.121	266.087	266.174	266.116	0.042
K1																118.101	121.833	124.735	128.103	123.193	4.253
O1																200.082	194.481	190.531	188.887	193.495	4.980
MSF																299.720	293.292	354.920	268.347	304.070	36.501
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
																0.074	0.080	0.095	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
																88.3	90.2	93.5	89.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.28	24/06/2017 20:45	±0.19	1.9
Lowest Astronomical Tide (LAT)	-0.81	31/08/2019 02:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Apr 2016.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

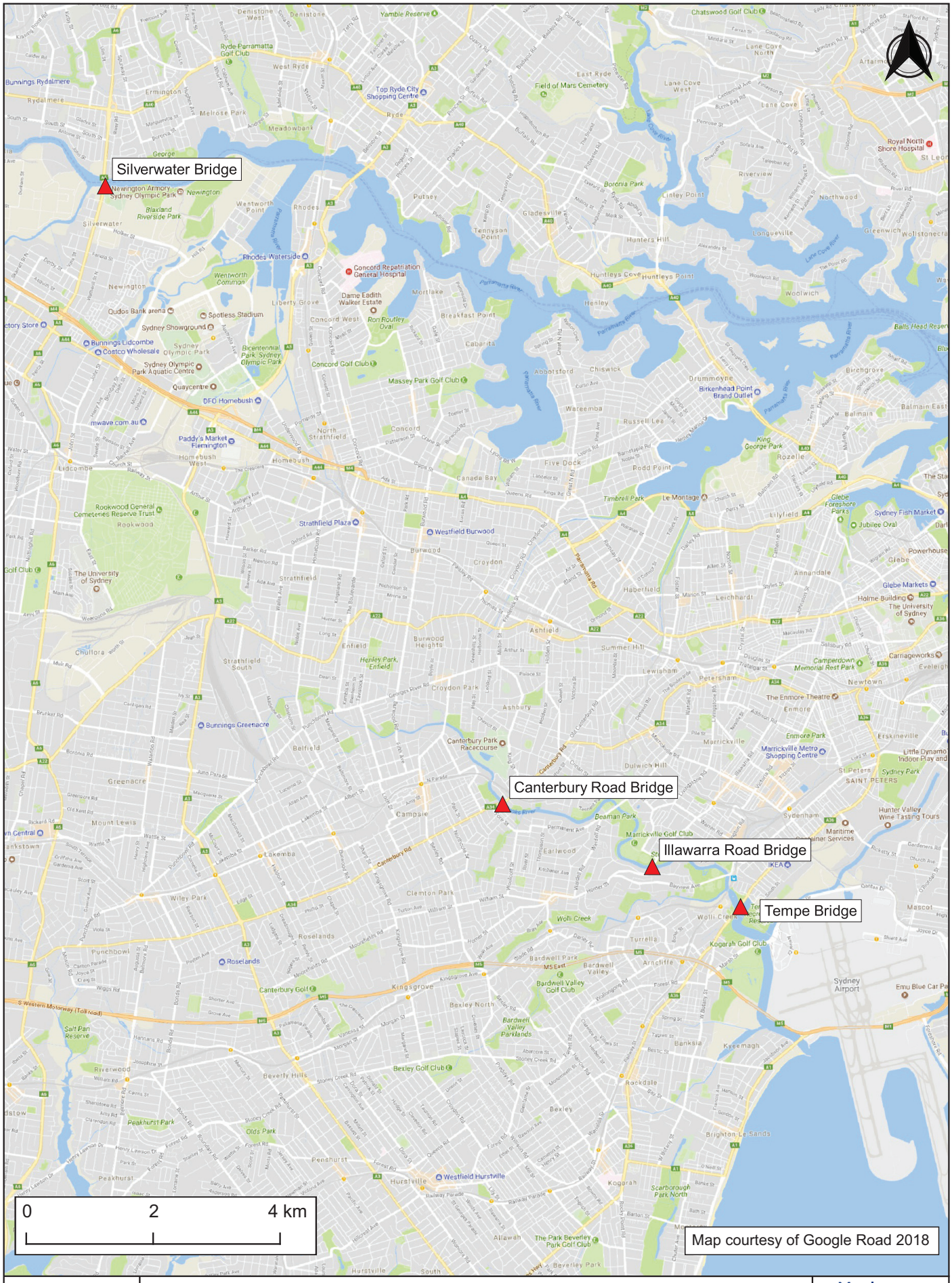


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lane Cove River at Fullers Bridge

MHL2786

Figure A174



NSW GOVERNMENT

STATION LOCATIONS
PARRAMATTA RIVER AND COOKS RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A175

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Parramatta River at Silverwater Bridge

RECORDING STATION: **Parramatta River at Silverwater Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213435

ZONE: 56
EASTING: 319683
NORTHING: 6255592

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08*	2008-09*	2009-10*	2010-11*	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS												1.118	1.093	1.087	1.072	1.130	1.082	1.051	1.089	1.090	0.025
MHWS												0.753	0.761	0.780	0.778	0.839	0.788	0.756	0.780	0.779	0.027
MHW												0.626	0.632	0.652	0.652	0.713	0.659	0.627	0.653	0.652	0.028
MHWN												0.499	0.502	0.524	0.525	0.587	0.529	0.497	0.526	0.524	0.029
MSL												0.102	0.098	0.111	0.101	0.158	0.096	0.068	0.098	0.104	0.025
MLWN												-0.296	-0.307	-0.302	-0.323	-0.272	-0.337	-0.361	-0.330	-0.316	0.028
MLW												-0.422	-0.436	-0.430	-0.450	-0.397	-0.467	-0.490	-0.457	-0.444	0.029
MLWS												-0.549	-0.566	-0.558	-0.576	-0.523	-0.596	-0.620	-0.584	-0.572	0.030
ISLW												-0.810	-0.803	-0.777	-0.786	-0.731	-0.806	-0.831	-0.805	-0.794	0.030
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR												0.795	0.809	0.826	0.848	0.858	0.866	0.858	0.856	0.840	0.026
MR												1.049	1.068	1.082	1.101	1.110	1.125	1.117	1.110	1.095	0.026
MSR												1.303	1.327	1.339	1.354	1.362	1.385	1.376	1.364	1.351	0.027
R												1.928	1.896	1.865	1.857	1.862	1.888	1.882	1.893	1.884	0.023
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2												0.524	0.534	0.541	0.551	0.555	0.563	0.558	0.555	0.548	0.013
S2												0.127	0.129	0.128	0.127	0.126	0.130	0.129	0.127	0.128	0.001
K1												0.155	0.145	0.135	0.131	0.129	0.130	0.131	0.137	0.137	0.009
O1												0.106	0.093	0.084	0.079	0.079	0.080	0.079	0.084	0.085	0.009
MSF												0.016	0.001	0.007	0.007	0.012	0.015	0.007	0.005	0.009	0.005
z0												0.102	0.098	0.111	0.101	0.158	0.096	0.068	0.098	0.104	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2												354.254	354.330	355.175	355.309	356.285	356.564	357.364	358.200	355.935	1.417
S2												269.813	270.671	270.584	271.290	269.642	270.424	270.077	270.511	270.377	0.525
K1												113.766	112.243	114.161	115.730	120.084	124.531	127.031	130.090	119.704	6.787
O1												213.283	212.861	211.757	208.298	204.039	196.455	192.691	190.710	203.762	9.292
MSF												59.166	69.371	34.048	255.523	302.191	295.935	47.361	232.823	162.052	119.537
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
												0.087	0.081	0.081	0.073	0.060	0.072	0.092	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
												94.8	95.8	93.3	97.9	91.6	97.4	99.1	95.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.27	24/06/2013 21:15	±0.19	2.5
Lowest Astronomical Tide (LAT)	-0.89	10/09/2014 03:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Apr 2012.

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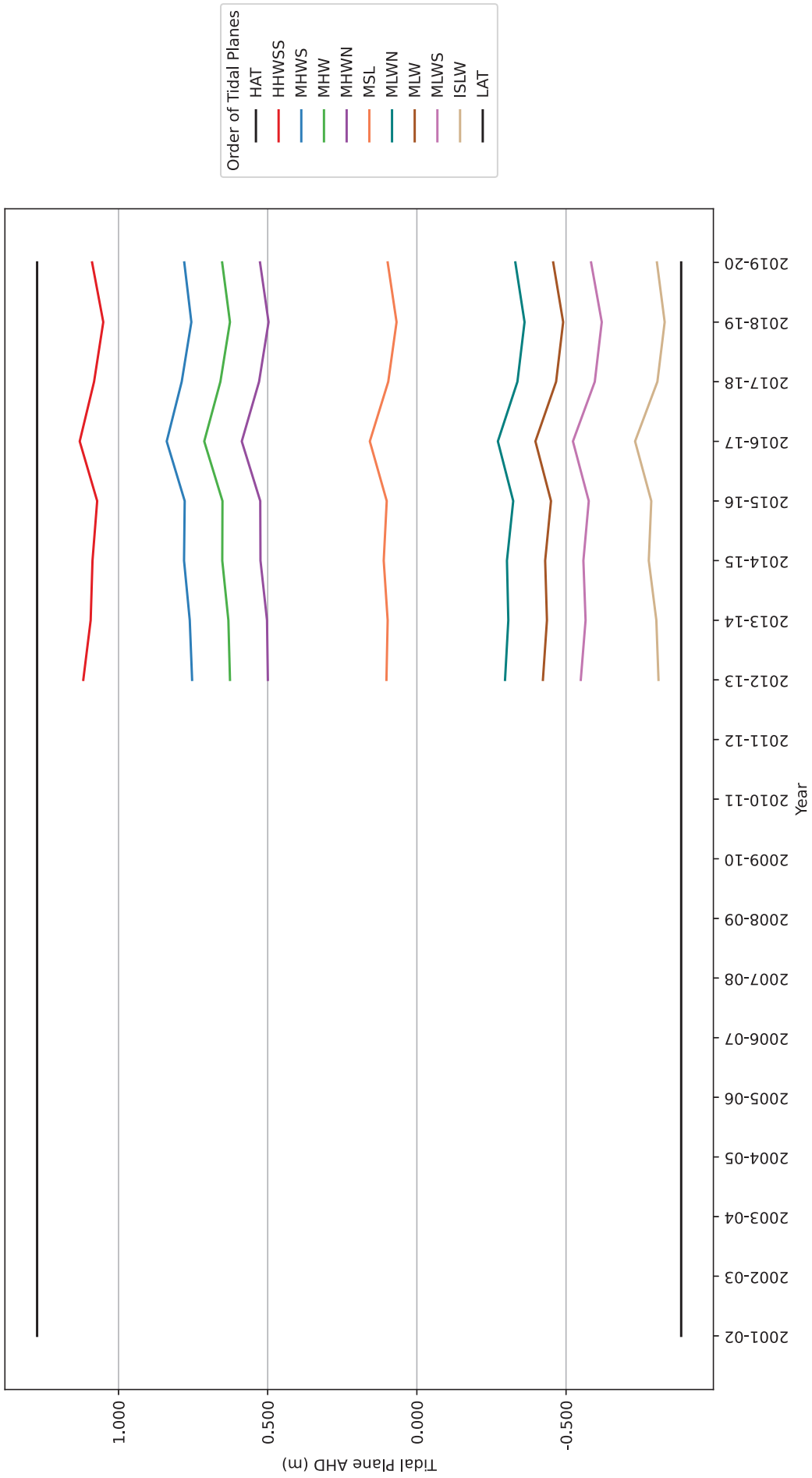

NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Parramatta River at Silverwater Bridge

MHL2786

Figure
A176

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cooks River at Canterbury Road

RECORDING STATION: **Cooks River at Canterbury Road**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213411

ZONE: 56
EASTING: 325944
NORTHING: 6245849

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.043	0.996	1.030	1.001	1.051	1.019	1.058	1.053	1.073	1.111	1.093	1.069	1.069	1.036	1.042	1.100	1.057	1.062	1.069	1.054	0.030
MHWS	0.718	0.667	0.691	0.647	0.677	0.632	0.648	0.646	0.659	0.695	0.688	0.688	0.719	0.714	0.730	0.789	0.749	0.755	0.748	0.698	0.043
MHW	0.614	0.565	0.584	0.543	0.570	0.528	0.540	0.541	0.553	0.588	0.574	0.575	0.607	0.602	0.618	0.675	0.632	0.642	0.634	0.589	0.040
MHWN	0.510	0.462	0.477	0.439	0.463	0.425	0.433	0.436	0.446	0.482	0.460	0.463	0.495	0.491	0.506	0.561	0.516	0.529	0.521	0.480	0.037
MSL	0.114	0.082	0.107	0.069	0.095	0.065	0.079	0.087	0.090	0.119	0.086	0.083	0.104	0.093	0.104	0.149	0.101	0.120	0.112	0.098	0.020
MLWN	-0.282	-0.298	-0.263	-0.301	-0.272	-0.294	-0.275	-0.261	-0.265	-0.243	-0.288	-0.297	-0.286	-0.305	-0.298	-0.263	-0.314	-0.289	-0.296	-0.284	0.019
MLW	-0.386	-0.401	-0.370	-0.405	-0.379	-0.397	-0.383	-0.366	-0.372	-0.349	-0.402	-0.409	-0.398	-0.417	-0.410	-0.377	-0.431	-0.402	-0.410	-0.393	0.020
MLWS	-0.489	-0.503	-0.477	-0.509	-0.486	-0.501	-0.490	-0.471	-0.478	-0.456	-0.516	-0.521	-0.510	-0.528	-0.522	-0.491	-0.548	-0.514	-0.523	-0.502	0.023
ISLW	-0.722	-0.738	-0.720	-0.761	-0.754	-0.778	-0.783	-0.762	-0.774	-0.753	-0.806	-0.793	-0.760	-0.758	-0.745	-0.713	-0.768	-0.734	-0.753	-0.756	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.792	0.761	0.740	0.740	0.734	0.719	0.708	0.697	0.711	0.725	0.748	0.760	0.780	0.796	0.804	0.824	0.830	0.818	0.817	0.763	0.043
MR	1.000	0.965	0.955	0.948	0.949	0.926	0.923	0.907	0.925	0.938	0.976	0.984	1.004	1.019	1.028	1.052	1.064	1.043	1.044	0.982	0.050
MSR	1.207	1.170	1.169	1.156	1.164	1.132	1.138	1.116	1.138	1.151	1.204	1.209	1.228	1.242	1.252	1.279	1.297	1.269	1.271	1.200	0.057
R	1.765	1.733	1.750	1.762	1.805	1.797	1.841	1.815	1.847	1.864	1.899	1.862	1.829	1.793	1.787	1.812	1.825	1.796	1.821	1.811	0.042
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.500	0.483	0.477	0.474	0.475	0.463	0.462	0.453	0.462	0.469	0.488	0.492	0.502	0.509	0.514	0.526	0.532	0.522	0.522	0.491	0.025
S2	0.104	0.102	0.107	0.104	0.107	0.103	0.107	0.105	0.107	0.107	0.114	0.112	0.112	0.111	0.112	0.114	0.117	0.113	0.113	0.109	0.004
K1	0.138	0.138	0.143	0.146	0.155	0.160	0.168	0.167	0.167	0.172	0.168	0.161	0.150	0.139	0.136	0.136	0.135	0.133	0.139	0.150	0.014
O1	0.095	0.096	0.099	0.106	0.112	0.117	0.125	0.124	0.128	0.125	0.122	0.111	0.100	0.091	0.087	0.086	0.085	0.087	0.091	0.105	0.015
MSF	0.021	0.029	0.035	0.018	0.016	0.007	0.022	0.007	0.016	0.008	0.023	0.009	0.006	0.008	0.016	0.014	0.021	0.009	0.013	0.016	0.008
z0	0.114	0.082	0.107	0.069	0.095	0.065	0.079	0.087	0.090	0.119	0.086	0.083	0.104	0.093	0.104	0.149	0.101	0.120	0.112	0.098	0.020
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	6.645	7.942	7.764	8.142	7.193	6.619	5.617	5.534	3.423	2.329	0.849	1.058	0.767	1.287	1.678	1.688	2.551	3.433	3.753	4.119	2.670
S2	283.152	283.335	281.523	282.390	283.059	282.284	282.327	284.177	282.010	283.736	280.179	281.475	281.552	281.350	282.044	279.261	280.405	280.005	279.392	281.771	1.426
K1	139.447	142.484	141.200	141.661	139.969	139.774	137.213	134.826	130.500	125.929	122.070	121.382	119.539	120.921	122.835	126.168	130.705	133.062	135.516	131.853	8.040
O1	198.099	196.540	194.804	196.366	195.477	197.535	197.930	200.646	205.872	210.719	213.005	216.059	215.697	215.566	210.622	204.841	201.689	197.616	194.919	203.369	7.843
MSF	289.402	286.727	280.880	270.846	310.895	288.416	285.000	40.638	269.145	262.168	273.919	6.726	271.739	334.823	262.652	309.784	287.153	337.096	251.443	258.918	86.171
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.081	0.078	0.078	0.087	0.095	0.074	0.086	0.079	0.075	0.072	0.080	0.074	0.083	0.072	0.058	0.078	0.074	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	86.3	95.2	90.4	97.1	95.6	94.8	96.2	89.5	96.1	94.7	95.9	88.7	86.9	93.0	88.7	84.3	93.4	85.3	91.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.24	04/06/2008 21:00	±0.19	6.2
Lowest Astronomical Tide (LAT)	-0.62	03/01/2014 17:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A177

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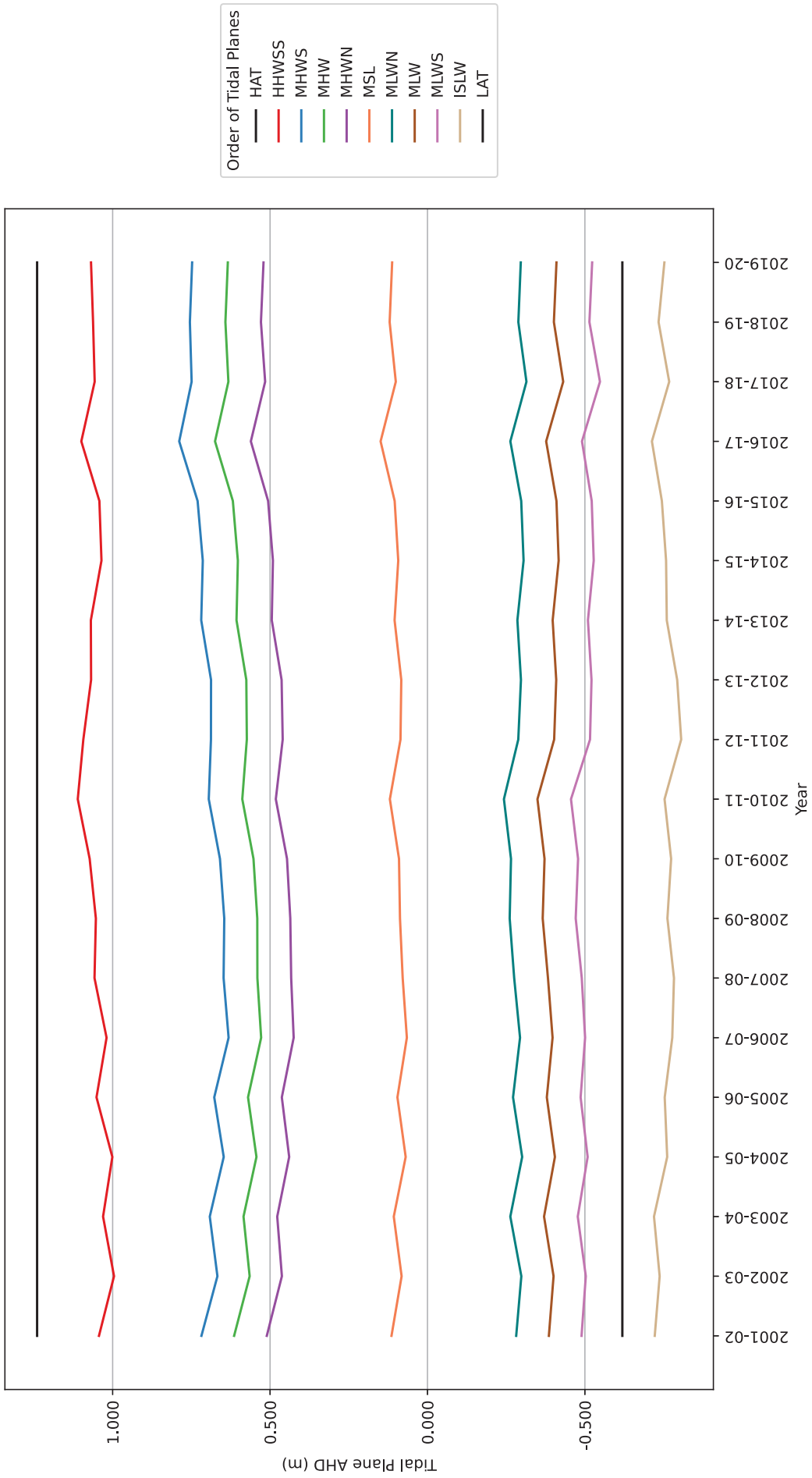


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cooks River at Canterbury Road

MHL2786

Figure A177

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cooks River at Illawarra Road Bridge

RECORDING STATION: **Cooks River at Illawarra Road Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213420

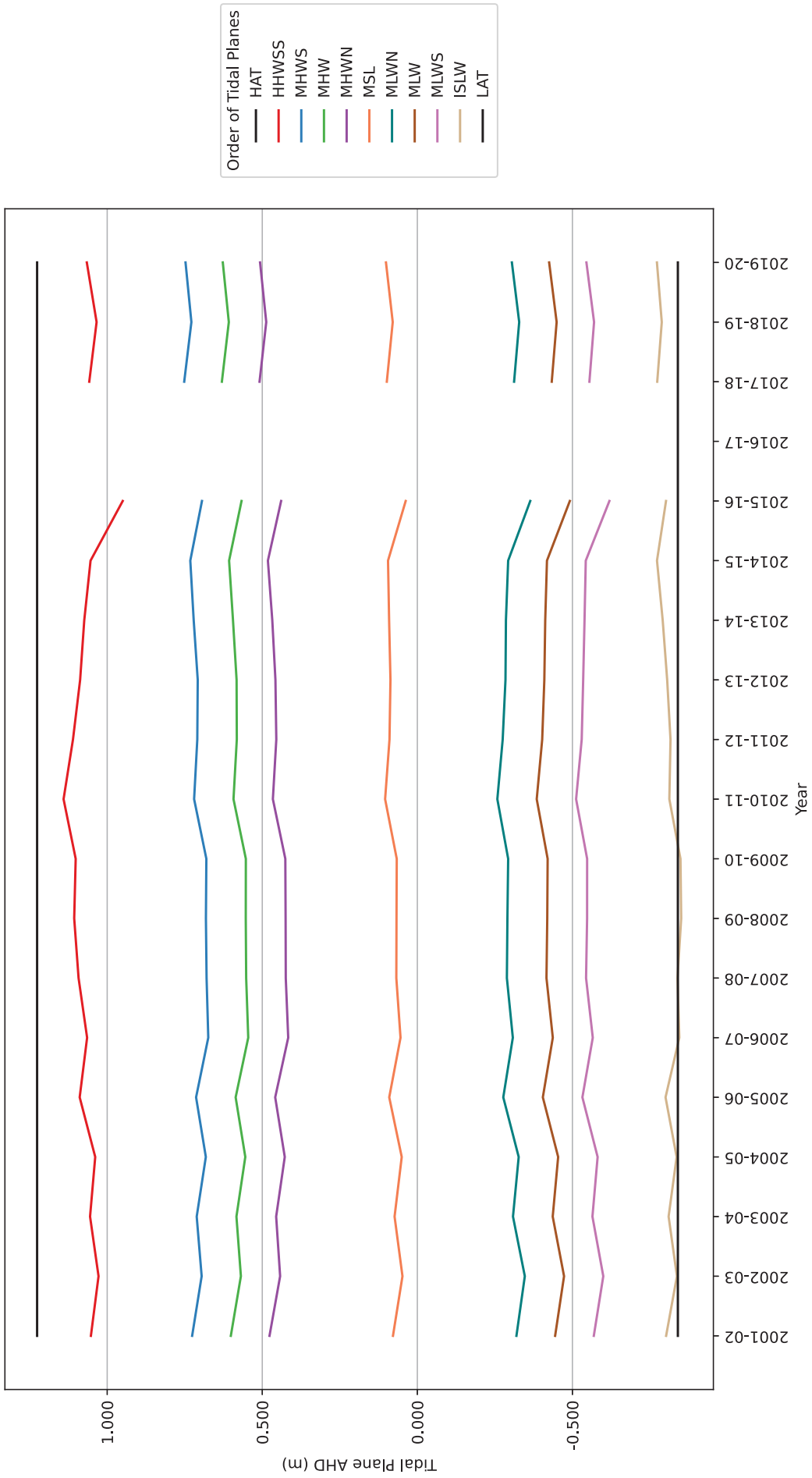
ZONE: 56
EASTING: 328303
NORTHING: 6244862

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17*	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.053	1.028	1.055	1.039	1.089	1.065	1.092	1.106	1.102	1.141	1.110	1.087	1.074	1.054	0.950		1.058	1.034	1.066	1.067	0.042
MHWS	0.726	0.695	0.711	0.682	0.713	0.674	0.680	0.682	0.680	0.720	0.710	0.708	0.721	0.732	0.694		0.752	0.729	0.747	0.709	0.024
MHW	0.601	0.569	0.583	0.555	0.586	0.545	0.552	0.553	0.553	0.593	0.582	0.583	0.594	0.607	0.567		0.630	0.608	0.627	0.583	0.026
MHWN	0.477	0.442	0.455	0.427	0.458	0.416	0.424	0.425	0.426	0.466	0.455	0.458	0.468	0.482	0.439		0.509	0.487	0.507	0.457	0.028
MSL	0.079	0.048	0.073	0.050	0.091	0.054	0.068	0.067	0.066	0.104	0.090	0.087	0.091	0.095	0.038		0.098	0.079	0.101	0.077	0.020
MLWN	-0.320	-0.347	-0.308	-0.327	-0.277	-0.308	-0.289	-0.290	-0.293	-0.258	-0.275	-0.284	-0.286	-0.293	-0.364		-0.312	-0.328	-0.305	-0.304	0.027
MLW	-0.444	-0.473	-0.436	-0.454	-0.405	-0.437	-0.416	-0.419	-0.420	-0.385	-0.403	-0.409	-0.412	-0.418	-0.492		-0.433	-0.449	-0.425	-0.429	0.026
MLWS	-0.569	-0.600	-0.565	-0.581	-0.532	-0.566	-0.544	-0.547	-0.547	-0.512	-0.530	-0.535	-0.539	-0.543	-0.619		-0.555	-0.570	-0.545	-0.555	0.026
ISLW	-0.802	-0.837	-0.810	-0.836	-0.800	-0.845	-0.839	-0.851	-0.848	-0.813	-0.816	-0.806	-0.791	-0.773	-0.802		-0.773	-0.788	-0.773	-0.811	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.796	0.789	0.764	0.754	0.735	0.724	0.713	0.715	0.719	0.724	0.730	0.742	0.753	0.775	0.803		0.821	0.816	0.812	0.760	0.038
MR	1.046	1.042	1.020	1.009	0.990	0.982	0.968	0.972	0.973	0.978	0.985	0.992	1.007	1.025	1.059		1.064	1.057	1.052	1.012	0.034
MSR	1.295	1.295	1.276	1.263	1.246	1.240	1.224	1.229	1.228	1.232	1.239	1.243	1.260	1.275	1.314		1.306	1.298	1.293	1.264	0.030
R	1.855	1.865	1.865	1.875	1.889	1.909	1.931	1.957	1.950	1.953	1.927	1.893	1.865	1.826	1.752		1.831	1.822	1.838	1.878	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.523	0.521	0.510	0.504	0.495	0.491	0.484	0.486	0.487	0.489	0.492	0.496	0.503	0.512	0.529		0.532	0.528	0.526	0.506	0.017
S2	0.125	0.126	0.128	0.127	0.128	0.129	0.128	0.128	0.127	0.127	0.127	0.125	0.127	0.125	0.128		0.121	0.121	0.120	0.126	0.003
K1	0.143	0.144	0.150	0.153	0.160	0.165	0.174	0.178	0.175	0.177	0.169	0.163	0.155	0.141	0.097		0.136	0.135	0.140	0.153	0.020
O1	0.090	0.093	0.096	0.102	0.108	0.114	0.121	0.126	0.125	0.124	0.117	0.107	0.097	0.089	0.085		0.083	0.083	0.088	0.103	0.015
MSF	0.011	0.010	0.023	0.002	0.011	0.013	0.011	0.021	0.004	0.008	0.017	0.017	0.003	0.010	0.022		0.017	0.008	0.009	0.012	0.006
z0	0.079	0.048	0.073	0.050	0.091	0.054	0.068	0.067	0.066	0.104	0.090	0.087	0.091	0.095	0.038		0.098	0.079	0.101	0.077	0.020
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	358.749	359.531	359.732	0.201	359.684	358.948	358.287	357.503	356.031	355.617	355.642	355.596	355.414	355.792	355.406		356.919	357.386	358.294	337.485	84.190
S2	273.087	272.051	270.944	270.692	271.269	271.400	271.998	272.306	271.321	272.605	271.991	272.231	272.861	272.465	272.468		271.113	270.038	271.283	271.784	0.818
K1	131.210	133.139	133.207	133.102	131.865	130.732	129.030	125.971	122.493	118.308	116.243	114.685	112.207	114.571	116.234		125.111	127.877	130.204	124.788	7.487
O1	189.285	187.308	186.073	186.991	187.562	188.202	190.233	192.957	197.603	203.646	207.334	210.189	209.417	209.838	207.438		195.962	191.968	189.759	196.209	9.147
MSF	304.468	306.343	294.629	153.594	13.174	106.724	288.864	65.646	274.446	98.814	264.682	59.353	67.436	26.354	236.138		299.453	21.305	211.135	171.809	113.579
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.085	0.074	0.077	0.082	0.093	0.074	0.071	0.079	0.085	0.071	0.089	0.079	0.078	0.063		0.073	0.090	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	76.0	99.1	96.8	98.6	90.9	92.1	98.5	99.4	97.5	96.6	95.8	93.7	99.3	92.9	52.1	40.3	94.0	96.7	92.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.23	04/06/2008 20:45	±0.18	4.3
Lowest Astronomical Tide (LAT)	-0.84	31/01/2010 15:45		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cooks River at Illawarra Road Bridge

MHL2786

Figure A178

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cooks River at Tempe Bridge

RECORDING STATION: **Cooks River at Tempe Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213415

ZONE: 56
EASTING: 329694
NORTHING: 6244231

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.071	1.009	1.021	1.013	1.044	1.042	1.073	1.104	1.093	1.123	1.114	1.086	1.079	1.053	1.037	1.064	1.040	1.018	1.051	1.060	0.034
MHWS	0.745	0.679	0.681	0.659	0.670	0.654	0.661	0.672	0.674	0.707	0.709	0.704	0.725	0.728	0.725	0.756	0.735	0.714	0.732	0.702	0.032
MHW	0.622	0.556	0.558	0.536	0.547	0.531	0.537	0.545	0.551	0.584	0.584	0.580	0.601	0.606	0.602	0.636	0.612	0.592	0.612	0.579	0.033
MHWN	0.499	0.433	0.435	0.413	0.424	0.407	0.414	0.418	0.427	0.461	0.458	0.457	0.477	0.484	0.478	0.515	0.490	0.471	0.491	0.455	0.033
MSL	0.089	0.036	0.048	0.031	0.054	0.044	0.052	0.048	0.065	0.095	0.082	0.074	0.088	0.084	0.074	0.109	0.082	0.065	0.086	0.069	0.022
MLWN	-0.322	-0.362	-0.338	-0.350	-0.317	-0.320	-0.310	-0.321	-0.297	-0.272	-0.293	-0.309	-0.302	-0.315	-0.331	-0.297	-0.326	-0.342	-0.319	-0.318	0.021
MLW	-0.445	-0.484	-0.461	-0.473	-0.440	-0.443	-0.434	-0.448	-0.421	-0.395	-0.419	-0.432	-0.425	-0.437	-0.454	-0.417	-0.449	-0.463	-0.439	-0.441	0.021
MLWS	-0.568	-0.607	-0.584	-0.596	-0.563	-0.566	-0.557	-0.576	-0.544	-0.518	-0.545	-0.555	-0.549	-0.559	-0.578	-0.538	-0.572	-0.584	-0.560	-0.564	0.021
ISLW	-0.800	-0.843	-0.827	-0.849	-0.830	-0.843	-0.852	-0.884	-0.843	-0.815	-0.834	-0.828	-0.802	-0.792	-0.800	-0.758	-0.789	-0.802	-0.787	-0.820	0.030
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.821	0.795	0.773	0.763	0.742	0.727	0.723	0.739	0.724	0.733	0.751	0.766	0.779	0.799	0.809	0.812	0.815	0.813	0.810	0.773	0.035
MR	1.067	1.040	1.019	1.009	0.988	0.974	0.971	0.993	0.971	0.979	1.003	1.012	1.026	1.043	1.056	1.053	1.061	1.055	1.051	1.020	0.034
MSR	1.313	1.286	1.265	1.255	1.233	1.221	1.219	1.248	1.218	1.225	1.255	1.259	1.274	1.288	1.303	1.294	1.307	1.297	1.292	1.266	0.032
R	1.871	1.852	1.849	1.862	1.874	1.885	1.925	1.988	1.936	1.939	1.949	1.915	1.881	1.845	1.838	1.822	1.829	1.820	1.838	1.880	0.049
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.534	0.520	0.510	0.505	0.494	0.487	0.486	0.497	0.486	0.490	0.501	0.506	0.513	0.522	0.528	0.527	0.531	0.528	0.525	0.510	0.017
S2	0.123	0.123	0.123	0.123	0.123	0.123	0.124	0.127	0.123	0.123	0.126	0.123	0.124	0.122	0.124	0.120	0.123	0.121	0.121	0.123	0.002
K1	0.143	0.144	0.149	0.152	0.159	0.165	0.174	0.180	0.175	0.175	0.171	0.165	0.155	0.144	0.139	0.137	0.135	0.135	0.140	0.155	0.015
O1	0.089	0.092	0.095	0.101	0.108	0.112	0.121	0.129	0.125	0.122	0.118	0.108	0.098	0.088	0.084	0.083	0.083	0.082	0.088	0.101	0.016
MSF	0.008	0.008	0.021	0.004	0.014	0.014	0.010	0.020	0.005	0.010	0.018	0.020	0.005	0.012	0.008	0.015	0.015	0.008	0.008	0.012	0.005
z0	0.089	0.036	0.048	0.031	0.054	0.044	0.052	0.048	0.065	0.095	0.082	0.074	0.088	0.084	0.074	0.109	0.082	0.065	0.086	0.069	0.022
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	354.923	355.380	355.612	356.158	355.802	355.158	354.620	353.758	352.121	351.572	351.713	351.459	351.253	351.493	351.695	352.405	353.223	353.631	354.585	353.503	1.736
S2	266.069	265.439	264.478	264.174	264.882	265.315	265.486	266.027	265.126	266.379	266.245	265.873	265.469	265.915	266.593	265.386	265.257	264.782	265.681	265.504	0.642
K1	129.808	131.236	131.138	130.644	130.384	128.791	127.201	124.112	120.602	116.591	114.442	113.133	112.133	113.157	115.153	118.595	122.704	125.292	127.999	122.796	7.027
O1	187.237	184.024	183.240	184.044	184.769	185.637	188.136	189.863	195.350	201.751	205.345	207.796	207.189	207.031	203.345	199.454	193.480	189.066	187.588	193.913	9.050
MSF	300.976	301.946	293.992	161.654	17.209	92.703	296.701	64.739	271.427	64.756	290.652	73.328	112.614	23.634	239.630	309.784	298.740	31.604	203.343	181.549	114.294
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.083	0.073	0.076	0.087	0.096	0.074	0.073	0.089	0.086	0.072	0.090	0.080	0.076	0.074	0.065	0.073	0.091	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	83.1	99.7	97.4	98.7	95.6	96.8	98.4	95.5	97.0	95.1	92.8	91.4	89.6	92.8	94.1	85.6	95.3	97.5	95.0		

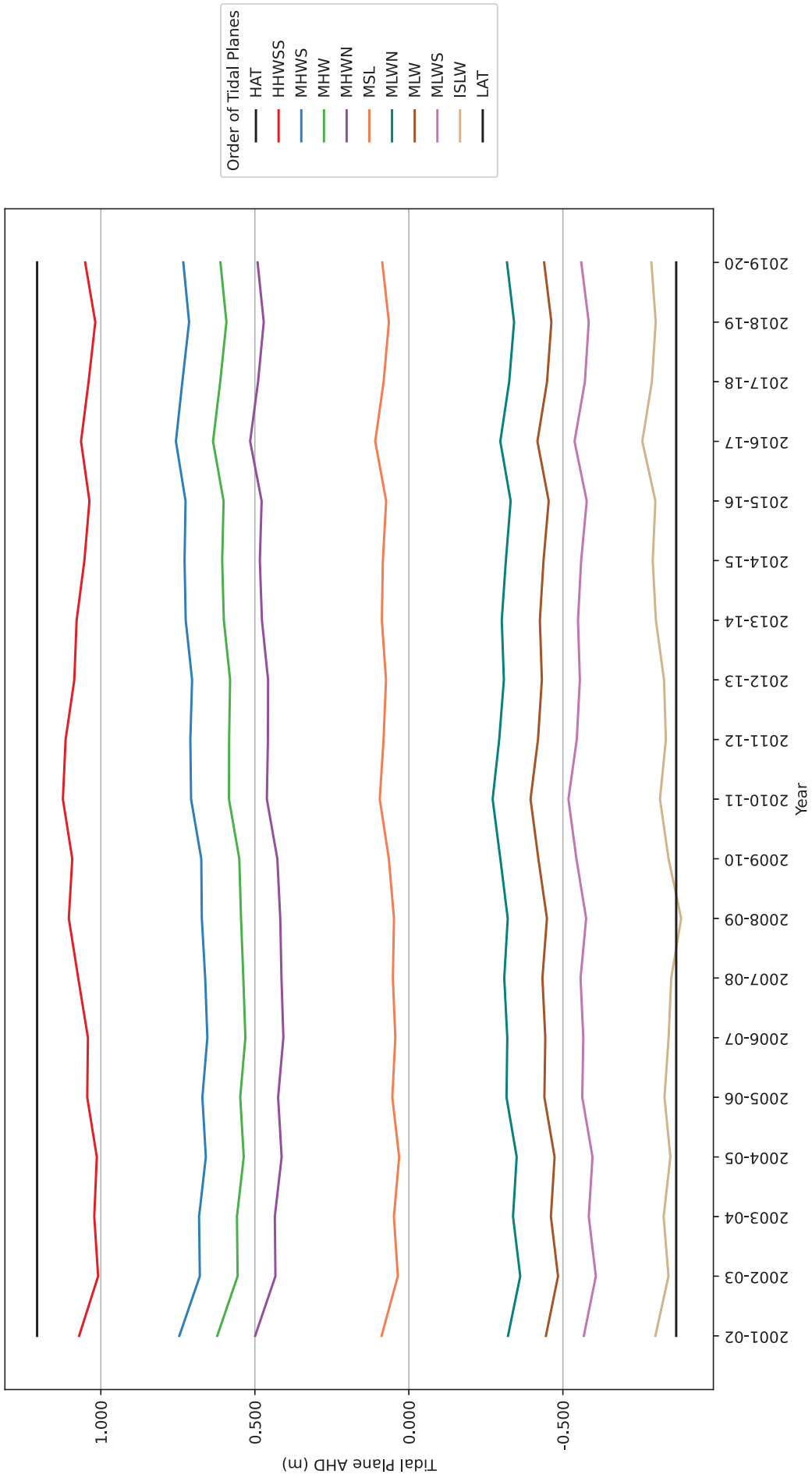
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.21	04/06/2008 20:45	±0.18	4.7
Lowest Astronomical Tide (LAT)	-0.87	09/09/2014 02:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A179

MHL2786

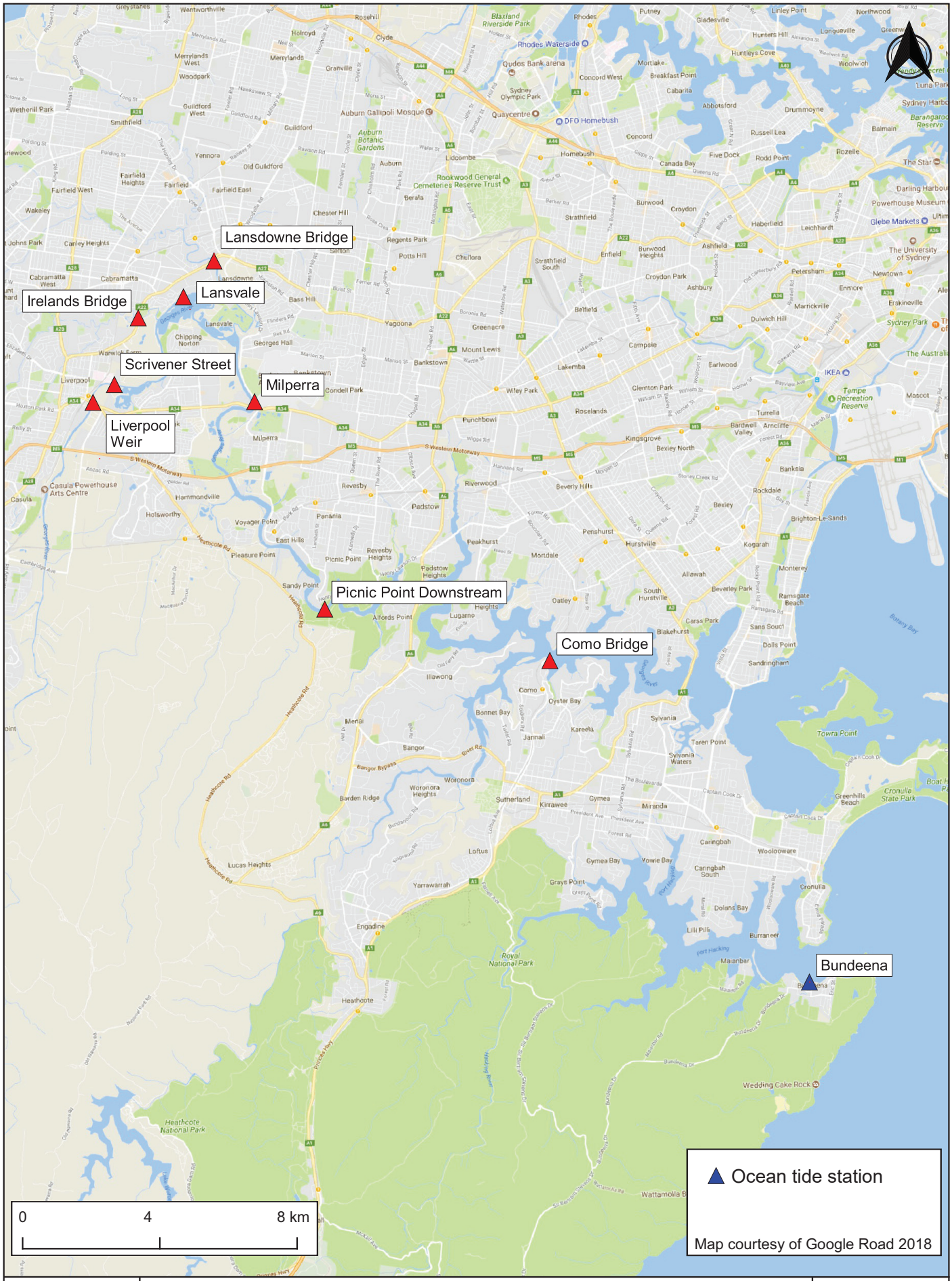


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cooks River at Tempe Bridge

MHL2786

Figure
A179



NSW GOVERNMENT

STATION LOCATIONS
GEORGES RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A180

DRAWING A180.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Georges River at Picnic Point Downstream

RECORDING STATION: **Georges River at Picnic Point Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213410D

ZONE: 56
EASTING: 315269
NORTHING: 6237999

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.036	0.974	1.013	1.010	1.050	1.022	1.072	1.059		1.098	1.087	1.063	1.032	1.013	0.993	1.064	1.033	1.002	1.040	1.037	0.033
MHWS	0.728	0.660	0.683	0.667	0.692	0.645	0.672	0.657		0.700	0.707	0.708	0.709	0.712	0.705	0.773	0.744	0.716	0.738	0.701	0.033
MHW	0.635	0.569	0.586	0.570	0.595	0.550	0.574	0.559		0.607	0.612	0.615	0.617	0.622	0.612	0.680	0.650	0.624	0.645	0.607	0.034
MHWN	0.543	0.478	0.489	0.473	0.499	0.454	0.475	0.460		0.515	0.518	0.522	0.524	0.532	0.520	0.586	0.556	0.533	0.551	0.513	0.036
MSL	0.166	0.108	0.123	0.107	0.148	0.108	0.129	0.118		0.174	0.171	0.170	0.169	0.167	0.147	0.201	0.179	0.158	0.171	0.151	0.028
MLWN	-0.211	-0.262	-0.242	-0.259	-0.204	-0.238	-0.216	-0.225		-0.167	-0.177	-0.182	-0.186	-0.198	-0.226	-0.184	-0.198	-0.217	-0.209	-0.211	0.027
MLW	-0.303	-0.353	-0.339	-0.355	-0.300	-0.333	-0.315	-0.324		-0.260	-0.271	-0.275	-0.278	-0.288	-0.319	-0.277	-0.292	-0.308	-0.303	-0.305	0.028
MLWS	-0.396	-0.443	-0.436	-0.452	-0.396	-0.429	-0.414	-0.422		-0.353	-0.365	-0.368	-0.370	-0.378	-0.411	-0.371	-0.386	-0.399	-0.397	-0.399	0.029
ISLW	-0.616	-0.667	-0.672	-0.698	-0.652	-0.698	-0.699	-0.709		-0.637	-0.637	-0.621	-0.601	-0.593	-0.618	-0.579	-0.592	-0.604	-0.612	-0.639	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.754	0.740	0.731	0.731	0.703	0.692	0.691	0.686		0.682	0.695	0.705	0.711	0.730	0.746	0.769	0.754	0.751	0.760	0.724	0.029
MR	0.939	0.922	0.925	0.925	0.895	0.883	0.889	0.883		0.867	0.883	0.890	0.895	0.910	0.931	0.957	0.942	0.933	0.948	0.912	0.027
MSR	1.123	1.103	1.118	1.119	1.088	1.074	1.086	1.079		1.053	1.072	1.075	1.079	1.090	1.116	1.145	1.129	1.115	1.135	1.100	0.026
R	1.652	1.641	1.684	1.707	1.702	1.720	1.771	1.769		1.735	1.724	1.684	1.633	1.606	1.611	1.643	1.625	1.607	1.652	1.676	0.054
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.469	0.461	0.462	0.463	0.448	0.442	0.444	0.441		0.434	0.442	0.445	0.447	0.455	0.465	0.478	0.471	0.466	0.474	0.456	0.013
S2	0.092	0.091	0.097	0.097	0.096	0.096	0.099	0.098		0.093	0.094	0.093	0.092	0.090	0.092	0.094	0.094	0.091	0.094	0.094	0.003
K1	0.131	0.133	0.141	0.143	0.149	0.156	0.164	0.164		0.161	0.156	0.150	0.137	0.129	0.125	0.125	0.125	0.124	0.129	0.141	0.014
O1	0.089	0.091	0.095	0.102	0.107	0.113	0.121	0.123		0.123	0.116	0.104	0.094	0.086	0.081	0.082	0.081	0.081	0.086	0.099	0.015
MSF	0.024	0.024	0.037	0.013	0.016	0.005	0.024	0.004		0.006	0.030	0.009	0.014	0.012	0.021	0.025	0.028	0.013	0.017	0.018	0.009
z0	0.166	0.108	0.123	0.107	0.148	0.108	0.129	0.118		0.174	0.171	0.170	0.169	0.167	0.147	0.201	0.179	0.158	0.171	0.151	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	31.812	32.763	32.385	32.427	32.101	31.285	29.668	29.421		27.674	26.833	26.619	27.277	27.769	27.279	26.881	29.048	29.702	29.192	29.452	2.192
S2	310.926	310.572	309.134	308.542	309.240	308.782	307.894	308.264		310.494	308.612	308.282	310.433	310.192	310.010	307.242	309.741	309.677	307.808	309.214	1.095
K1	157.223	159.454	158.707	158.004	156.953	156.176	153.097	152.441		143.643	140.896	140.152	138.822	141.171	141.722	145.176	150.440	153.173	154.823	150.115	7.403
O1	214.740	212.860	210.979	211.459	211.259	212.816	214.022	215.868		228.992	232.183	234.797	236.551	236.232	231.116	225.844	221.362	217.092	213.857	221.224	9.635
MSF	292.290	265.689	294.647	254.568	323.303	249.028	295.286	85.011		351.688	275.696	357.174	283.180	276.328	269.510	294.441	291.801	308.080	256.568	279.127	56.996
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.070	0.087	0.073	0.085	0.094	0.090	0.072	0.061		0.077	0.069	0.083	0.075	0.079	0.071	0.062	0.067	0.092	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	85.5	94.3	97.5	99.1	96.1	97.7	98.8	72.9	26.0	90.3	94.1	93.9	95.5	91.0	97.5	88.9	93.9	93.1	94.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.19	04/06/2008 22:00	±0.19	7.4
Lowest Astronomical Tide (LAT)	-0.61	09/09/2010 04:00		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

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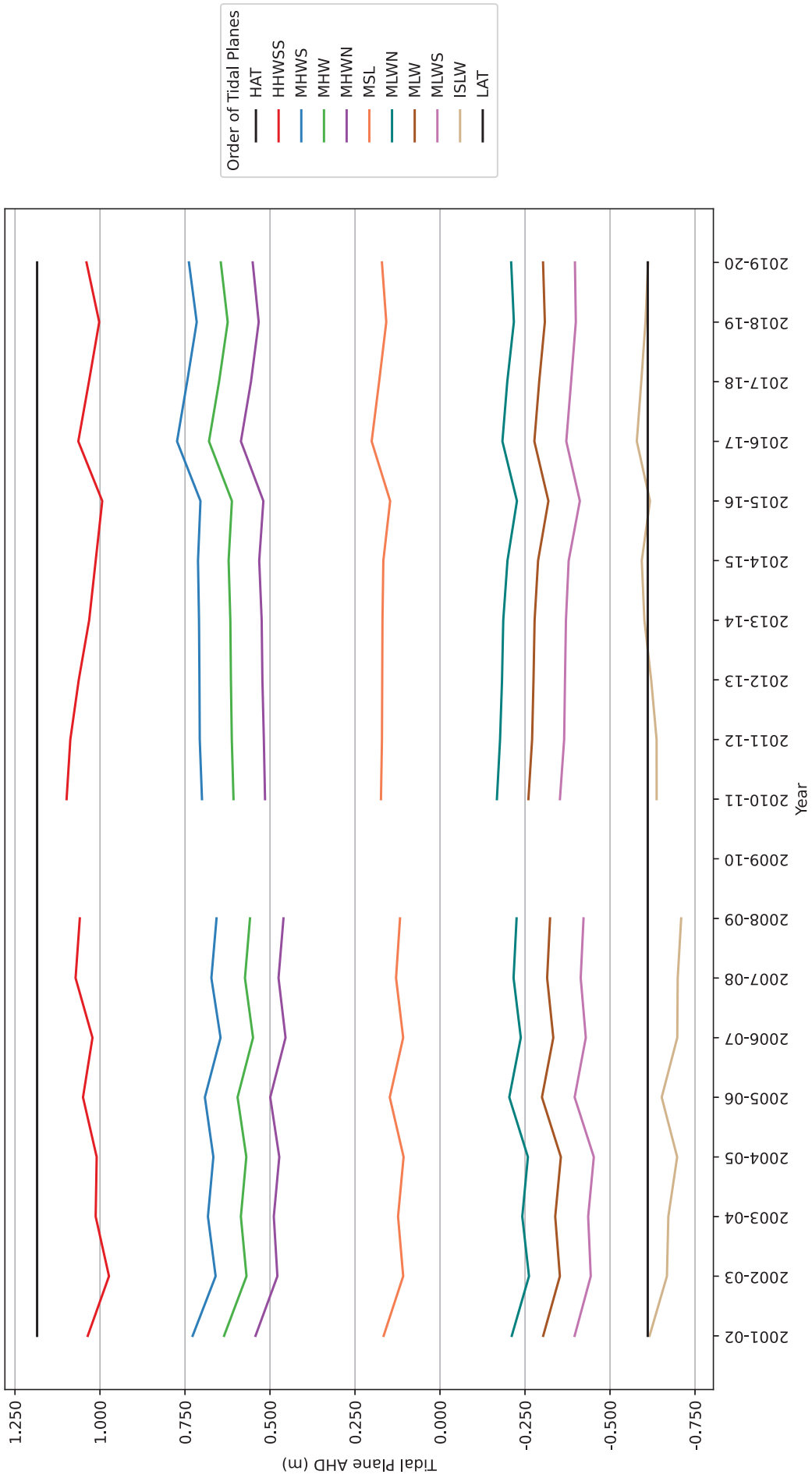


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Georges River at Picnic Point Downstream

MHL2786

Figure A181

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Georges River at Como Bridge

RECORDING STATION: **Georges River at Como Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213425

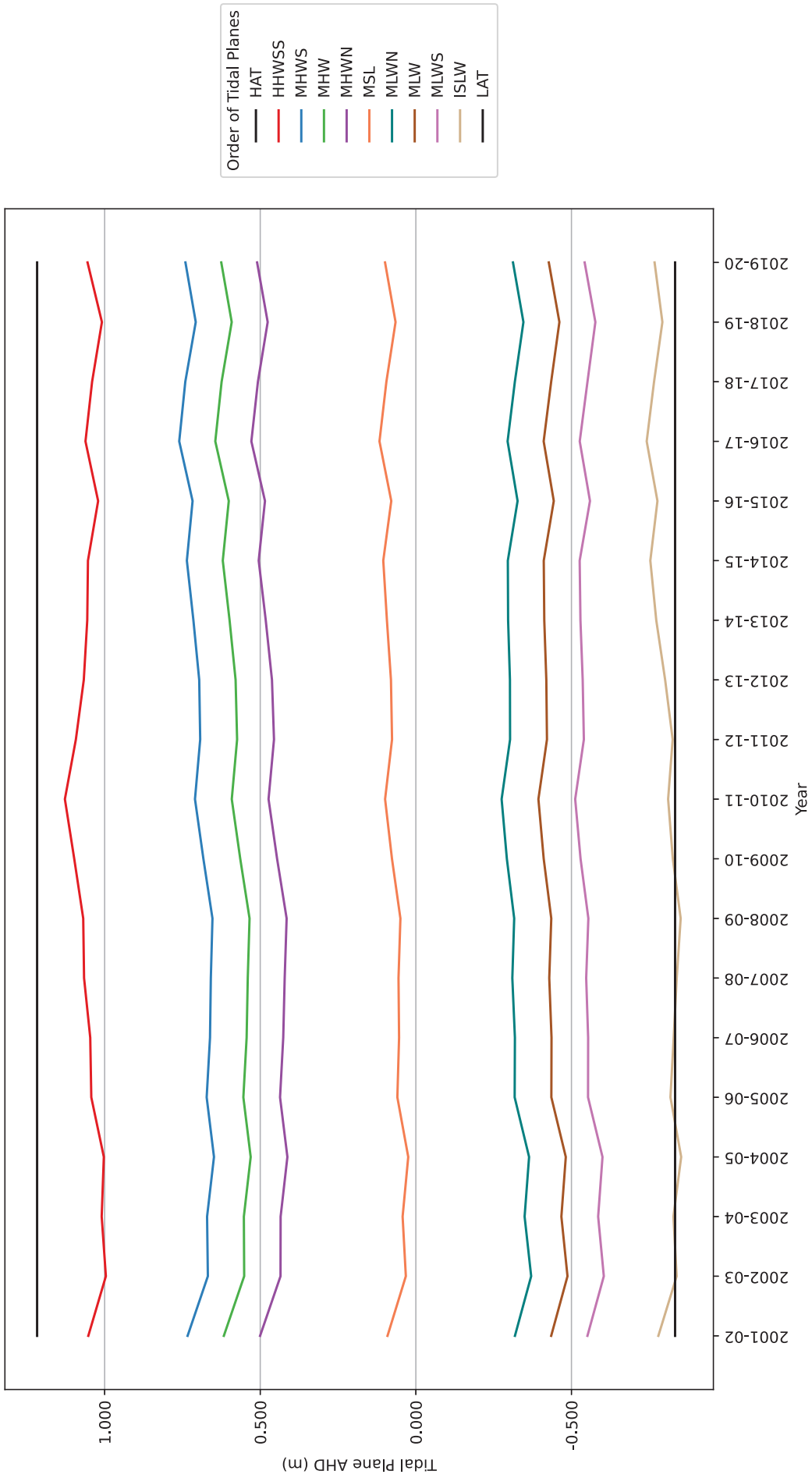
ZONE: 56
EASTING: 321829
NORTHING: 6236499

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.052	0.996	1.009	1.003	1.043	1.046	1.066	1.069	1.098	1.128	1.092	1.067	1.056	1.054	1.021	1.062	1.040	1.009	1.055	1.051	0.034
MHWS	0.733	0.668	0.671	0.649	0.672	0.661	0.659	0.654	0.683	0.710	0.693	0.696	0.715	0.736	0.717	0.760	0.741	0.707	0.740	0.698	0.034
MHW	0.617	0.552	0.553	0.531	0.554	0.544	0.540	0.534	0.564	0.592	0.574	0.579	0.599	0.620	0.601	0.644	0.624	0.592	0.625	0.581	0.035
MHWN	0.500	0.435	0.435	0.413	0.436	0.426	0.421	0.415	0.446	0.473	0.456	0.462	0.482	0.505	0.485	0.529	0.507	0.476	0.510	0.464	0.036
MSL	0.091	0.032	0.043	0.024	0.059	0.054	0.056	0.050	0.077	0.099	0.077	0.080	0.093	0.105	0.079	0.117	0.095	0.065	0.099	0.073	0.026
MLWN	-0.318	-0.371	-0.349	-0.364	-0.318	-0.318	-0.310	-0.316	-0.292	-0.276	-0.303	-0.302	-0.296	-0.296	-0.327	-0.295	-0.318	-0.346	-0.312	-0.317	0.025
MLW	-0.435	-0.487	-0.468	-0.482	-0.435	-0.436	-0.429	-0.435	-0.411	-0.394	-0.421	-0.419	-0.413	-0.411	-0.443	-0.411	-0.435	-0.461	-0.427	-0.434	0.025
MLWS	-0.551	-0.604	-0.586	-0.600	-0.553	-0.554	-0.547	-0.554	-0.529	-0.512	-0.540	-0.536	-0.529	-0.526	-0.560	-0.527	-0.552	-0.577	-0.542	-0.552	0.025
ISLW	-0.779	-0.838	-0.828	-0.853	-0.818	-0.828	-0.838	-0.851	-0.826	-0.811	-0.825	-0.801	-0.773	-0.753	-0.776	-0.742	-0.765	-0.792	-0.767	-0.803	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.819	0.805	0.784	0.777	0.754	0.744	0.731	0.731	0.738	0.749	0.759	0.765	0.779	0.801	0.812	0.823	0.826	0.822	0.822	0.781	0.034
MR	1.052	1.039	1.020	1.013	0.990	0.980	0.969	0.970	0.975	0.985	0.996	0.998	1.011	1.031	1.044	1.055	1.059	1.053	1.052	1.015	0.032
MSR	1.285	1.272	1.257	1.248	1.225	1.215	1.206	1.208	1.212	1.222	1.233	1.232	1.244	1.262	1.277	1.287	1.292	1.284	1.283	1.250	0.030
R	1.832	1.834	1.837	1.855	1.861	1.875	1.904	1.920	1.923	1.938	1.918	1.868	1.828	1.807	1.797	1.803	1.806	1.801	1.822	1.854	0.047
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.526	0.519	0.510	0.506	0.495	0.490	0.484	0.485	0.488	0.493	0.498	0.499	0.506	0.516	0.522	0.528	0.529	0.526	0.526	0.508	0.016
S2	0.116	0.117	0.118	0.118	0.118	0.118	0.119	0.119	0.118	0.118	0.119	0.117	0.116	0.115	0.116	0.116	0.117	0.116	0.115	0.117	0.001
K1	0.140	0.141	0.147	0.150	0.157	0.162	0.170	0.172	0.171	0.174	0.168	0.160	0.148	0.140	0.134	0.132	0.132	0.133	0.137	0.151	0.015
O1	0.088	0.093	0.095	0.102	0.108	0.112	0.121	0.124	0.125	0.125	0.118	0.105	0.095	0.087	0.083	0.083	0.082	0.083	0.087	0.101	0.016
MSF	0.009	0.013	0.023	0.006	0.011	0.002	0.014	0.015	0.007	0.007	0.020	0.016	0.004	0.009	0.011	0.012	0.018	0.006	0.006	0.011	0.006
z0	0.091	0.032	0.043	0.024	0.059	0.054	0.056	0.050	0.077	0.099	0.077	0.080	0.093	0.105	0.079	0.117	0.095	0.065	0.099	0.073	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	6.484	7.784	7.796	7.875	7.393	6.407	5.795	5.036	3.642	3.052	2.313	2.396	2.260	2.725	3.016	3.290	4.563	5.038	5.770	4.876	2.028
S2	280.387	280.409	279.269	278.748	279.121	279.118	279.636	280.057	279.291	280.676	278.886	278.977	279.618	279.559	280.079	278.184	279.534	279.171	279.595	279.490	0.629
K1	138.479	140.844	139.933	139.366	139.289	137.089	135.683	132.661	129.482	125.350	121.966	121.148	119.854	121.411	123.220	127.194	131.363	134.242	136.835	131.337	7.378
O1	196.096	193.469	192.051	192.248	192.753	194.193	195.976	198.174	203.349	209.455	213.558	215.964	215.551	215.575	212.621	207.203	201.260	198.020	195.723	202.276	8.967
MSF	345.936	283.879	291.637	209.967	359.226	228.452	302.964	64.008	280.725	53.580	281.557	55.752	286.015	357.517	268.969	323.468	298.104	15.498	210.744	237.789	109.636
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.076	0.080	0.072	0.075	0.085	0.091	0.070	0.073	0.080	0.079	0.068	0.085	0.077	0.072	0.070	0.059	0.072	0.093	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	74.3	99.9	98.3	99.7	96.2	87.8	92.6	98.6	97.7	97.8	97.6	95.4	94.8	89.2	95.8	91.4	96.2	97.6	94.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.22	04/06/2008 21:15	±0.16	4.5
Lowest Astronomical Tide (LAT)	-0.83	09/09/2014 02:45		

COMMENTS Staton installed in Mar 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Georges River at Como Bridge

MHL2786

Figure
A182

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Georges River at Milperra

RECORDING STATION: **Georges River at Milperra**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213405

ZONE: 56
EASTING: 313222
NORTHING: 6244042

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.996	0.934	0.964	0.952	1.001	0.974	1.034	1.003	1.025	1.056	1.026	1.005	1.012	1.002	0.971	1.026	0.979	0.940	0.993	0.994	0.033
MHWS	0.692	0.625	0.645	0.618	0.653	0.608	0.645	0.612	0.633	0.666	0.653	0.656	0.698	0.706	0.688	0.742	0.701	0.657	0.696	0.663	0.037
MHW	0.608	0.542	0.558	0.534	0.567	0.523	0.557	0.526	0.548	0.582	0.571	0.575	0.616	0.625	0.606	0.660	0.617	0.577	0.614	0.579	0.038
MHWN	0.525	0.458	0.471	0.449	0.482	0.438	0.469	0.439	0.463	0.498	0.489	0.494	0.534	0.544	0.524	0.578	0.532	0.496	0.532	0.496	0.039
MSL	0.151	0.092	0.113	0.095	0.136	0.098	0.129	0.103	0.127	0.162	0.150	0.150	0.183	0.185	0.156	0.205	0.163	0.129	0.163	0.142	0.032
MLWN	-0.223	-0.274	-0.244	-0.260	-0.209	-0.242	-0.211	-0.233	-0.208	-0.175	-0.189	-0.194	-0.167	-0.174	-0.213	-0.168	-0.206	-0.238	-0.207	-0.212	0.031
MLW	-0.307	-0.358	-0.331	-0.344	-0.295	-0.326	-0.299	-0.320	-0.293	-0.259	-0.271	-0.275	-0.249	-0.255	-0.295	-0.250	-0.290	-0.319	-0.289	-0.296	0.032
MLWS	-0.390	-0.441	-0.418	-0.428	-0.380	-0.411	-0.386	-0.406	-0.379	-0.343	-0.353	-0.355	-0.331	-0.335	-0.377	-0.332	-0.374	-0.400	-0.371	-0.379	0.033
ISLW	-0.607	-0.662	-0.646	-0.667	-0.629	-0.672	-0.665	-0.685	-0.659	-0.621	-0.619	-0.605	-0.555	-0.547	-0.579	-0.535	-0.573	-0.602	-0.582	-0.616	0.046
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.748	0.733	0.715	0.709	0.691	0.680	0.680	0.672	0.671	0.673	0.678	0.689	0.702	0.718	0.736	0.745	0.738	0.734	0.739	0.708	0.028
MR	0.915	0.899	0.889	0.878	0.862	0.849	0.856	0.845	0.841	0.841	0.842	0.850	0.865	0.880	0.900	0.909	0.907	0.896	0.903	0.875	0.027
MSR	1.082	1.066	1.063	1.046	1.033	1.018	1.031	1.018	1.012	1.009	1.006	1.011	1.028	1.041	1.065	1.073	1.075	1.058	1.067	1.042	0.026
R	1.603	1.596	1.611	1.618	1.630	1.646	1.699	1.689	1.684	1.677	1.644	1.610	1.567	1.549	1.550	1.560	1.552	1.542	1.575	1.611	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.457	0.450	0.444	0.439	0.431	0.425	0.428	0.423	0.421	0.420	0.421	0.425	0.433	0.440	0.450	0.455	0.453	0.448	0.451	0.438	0.013
S2	0.083	0.083	0.087	0.084	0.086	0.085	0.088	0.086	0.085	0.084	0.082	0.081	0.082	0.081	0.082	0.082	0.084	0.081	0.082	0.084	0.002
K1	0.130	0.131	0.135	0.137	0.144	0.151	0.159	0.158	0.157	0.158	0.150	0.147	0.135	0.126	0.123	0.122	0.119	0.121	0.125	0.138	0.014
O1	0.088	0.090	0.093	0.101	0.104	0.111	0.119	0.121	0.123	0.121	0.116	0.102	0.090	0.086	0.079	0.080	0.080	0.081	0.086	0.099	0.016
MSF	0.028	0.025	0.038	0.016	0.017	0.010	0.028	0.010	0.026	0.013	0.037	0.010	0.021	0.018	0.019	0.026	0.026	0.016	0.019	0.021	0.008
z0	0.151	0.092	0.113	0.095	0.136	0.098	0.129	0.103	0.127	0.162	0.150	0.150	0.183	0.185	0.156	0.205	0.163	0.129	0.163	0.142	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	57.489	59.060	58.701	59.114	58.508	57.782	55.607	55.495	54.788	54.810	54.443	53.678	53.868	54.191	53.636	54.221	56.650	56.834	56.327	56.063	1.927
S2	342.810	343.957	341.857	342.240	343.237	343.338	340.693	342.909	343.038	345.578	342.967	343.220	343.913	344.236	344.092	341.525	346.248	343.977	342.603	343.286	1.310
K1	172.198	174.832	174.708	173.918	172.574	171.719	168.784	166.856	163.793	160.270	157.869	156.927	155.909	157.837	158.157	162.781	167.355	169.324	171.997	166.200	6.724
O1	229.161	226.717	225.859	226.363	225.808	227.107	228.043	231.474	237.237	242.992	247.930	249.731	250.507	249.852	244.834	239.720	236.764	233.301	228.439	235.886	9.237
MSF	290.823	281.653	288.269	257.947	307.757	292.084	290.125	342.106	291.567	289.843	276.826	345.824	272.388	300.334	277.914	292.893	285.351	305.859	272.108	292.720	21.669
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.092	0.073	0.078	0.092	0.091	0.073	0.066	0.078	0.078	0.070	0.086	0.071	0.072	0.073	0.061	0.070	0.090	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.2	99.1	97.9	99.2	96.2	97.1	97.3	83.8	94.0	94.1	93.8	92.9	89.2	92.2	89.5	87.5	81.0	97.3	266.2		

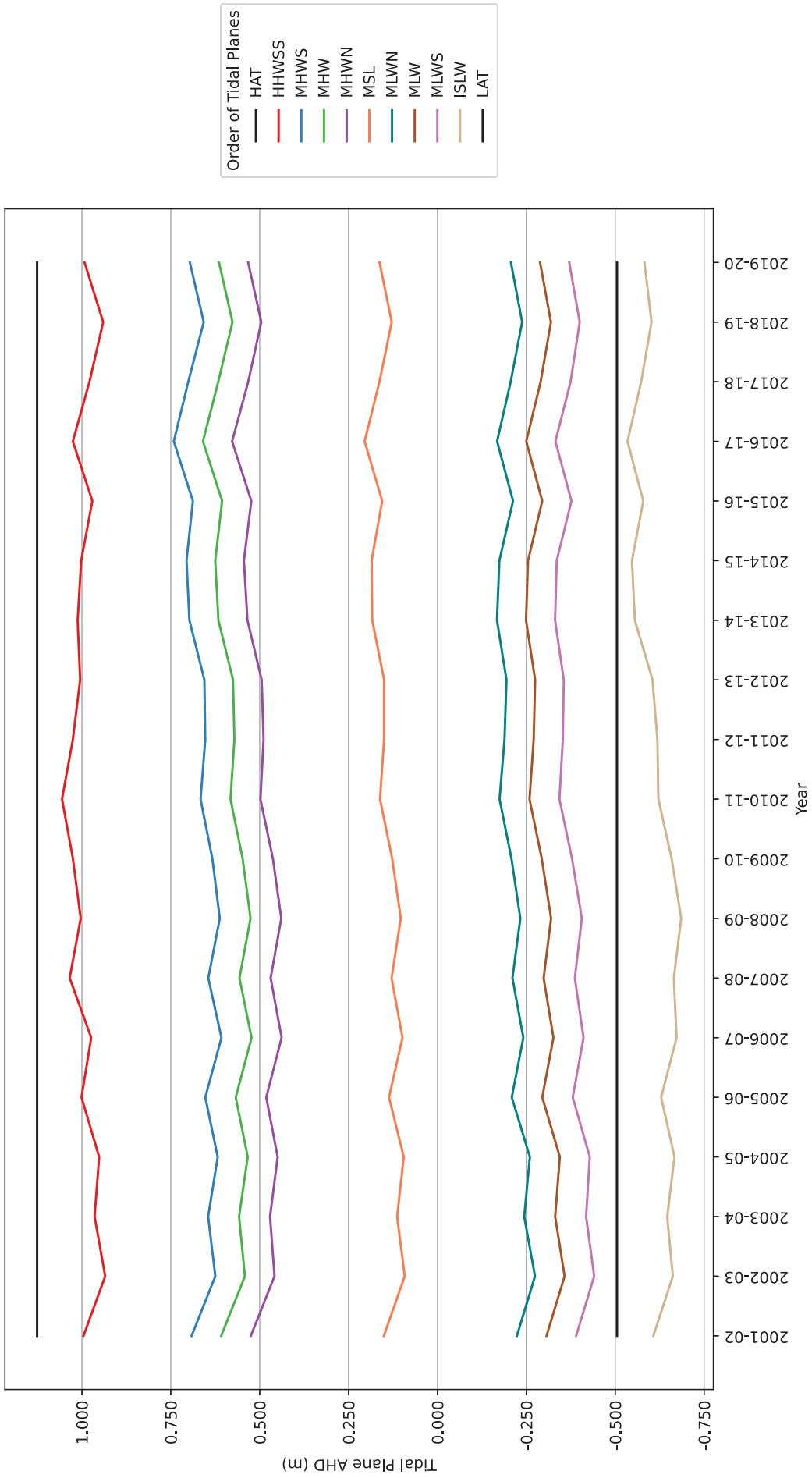
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.13	04/06/2004 23:30	±0.19	10.5
Lowest Astronomical Tide (LAT)	-0.51	09/09/2014 05:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A183

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Georges River at Milperra

MHL2786

Figure A183

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Prospect Creek at Lansdowne Bridge

RECORDING STATION: **Prospect Creek at Lansdowne Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213402

ZONE: 56
EASTING: 312039
NORTHING: 6248143

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.001	0.960	0.991	0.974	1.021	0.992	1.063	1.060	1.048	1.080	1.061	1.020	0.998	1.013	0.973	1.028	0.998	0.967	1.017	1.014	0.036
MHWS	0.695	0.650	0.669	0.640	0.672	0.626	0.670	0.664	0.655	0.685	0.673	0.672	0.676	0.712	0.686	0.744	0.715	0.681	0.717	0.679	0.029
MHW	0.608	0.564	0.578	0.553	0.584	0.539	0.581	0.575	0.568	0.598	0.589	0.588	0.590	0.629	0.600	0.659	0.629	0.595	0.630	0.592	0.029
MHWN	0.522	0.478	0.487	0.465	0.495	0.452	0.491	0.486	0.481	0.512	0.506	0.504	0.504	0.545	0.515	0.573	0.542	0.510	0.544	0.506	0.030
MSL	0.138	0.103	0.122	0.103	0.143	0.104	0.143	0.139	0.138	0.166	0.155	0.148	0.141	0.174	0.134	0.189	0.161	0.131	0.162	0.142	0.023
MLWN	-0.247	-0.273	-0.244	-0.260	-0.209	-0.244	-0.206	-0.207	-0.206	-0.181	-0.197	-0.208	-0.222	-0.197	-0.247	-0.195	-0.220	-0.248	-0.220	-0.223	0.025
MLW	-0.333	-0.359	-0.334	-0.347	-0.298	-0.331	-0.295	-0.296	-0.293	-0.267	-0.280	-0.292	-0.309	-0.281	-0.333	-0.281	-0.307	-0.334	-0.306	-0.309	0.026
MLWS	-0.420	-0.444	-0.425	-0.434	-0.386	-0.418	-0.385	-0.386	-0.379	-0.354	-0.363	-0.375	-0.395	-0.364	-0.419	-0.367	-0.393	-0.419	-0.393	-0.396	0.026
ISLW	-0.638	-0.666	-0.655	-0.673	-0.636	-0.679	-0.666	-0.669	-0.660	-0.636	-0.641	-0.624	-0.625	-0.579	-0.623	-0.570	-0.595	-0.624	-0.607	-0.635	0.031
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.768	0.750	0.731	0.725	0.704	0.696	0.696	0.693	0.687	0.693	0.703	0.712	0.727	0.742	0.762	0.768	0.762	0.757	0.763	0.728	0.030
MR	0.941	0.922	0.912	0.900	0.881	0.870	0.876	0.871	0.861	0.866	0.869	0.880	0.899	0.909	0.933	0.940	0.935	0.929	0.937	0.902	0.029
MSR	1.114	1.094	1.093	1.074	1.059	1.044	1.055	1.049	1.034	1.039	1.036	1.047	1.071	1.077	1.105	1.111	1.109	1.101	1.110	1.075	0.029
R	1.639	1.626	1.646	1.648	1.657	1.671	1.729	1.729	1.708	1.716	1.701	1.644	1.623	1.592	1.596	1.598	1.593	1.591	1.624	1.649	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.471	0.461	0.456	0.450	0.441	0.435	0.438	0.436	0.430	0.433	0.435	0.440	0.449	0.455	0.467	0.470	0.468	0.464	0.468	0.451	0.015
S2	0.086	0.086	0.091	0.087	0.089	0.087	0.090	0.089	0.087	0.086	0.083	0.084	0.086	0.084	0.086	0.086	0.087	0.086	0.087	0.087	0.002
K1	0.130	0.131	0.136	0.137	0.145	0.151	0.160	0.160	0.157	0.160	0.161	0.144	0.137	0.128	0.124	0.123	0.122	0.122	0.126	0.140	0.014
O1	0.088	0.090	0.094	0.102	0.105	0.111	0.120	0.124	0.124	0.123	0.116	0.105	0.093	0.087	0.081	0.080	0.079	0.082	0.087	0.099	0.016
MSF	0.027	0.023	0.040	0.016	0.020	0.004	0.029	0.009	0.023	0.008	0.039	0.011	0.022	0.018	0.024	0.031	0.029	0.019	0.026	0.022	0.010
z0	0.138	0.103	0.122	0.103	0.143	0.104	0.143	0.139	0.138	0.166	0.155	0.148	0.141	0.174	0.134	0.189	0.161	0.131	0.162	0.142	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	62.529	64.496	64.106	64.636	63.770	63.296	61.595	61.541	60.228	60.617	61.104	60.035	59.775	60.607	59.945	60.387	62.434	63.142	63.143	61.968	1.655
S2	350.359	351.724	349.366	350.391	350.672	351.069	349.244	350.874	350.038	353.193	348.968	349.817	352.909	353.612	353.093	350.465	353.672	353.158	351.271	351.257	1.567
K1	175.093	178.379	177.712	177.487	175.698	175.418	172.485	169.428	167.052	163.754	161.409	163.463	158.540	161.280	161.420	166.081	170.873	173.138	175.472	169.694	6.580
O1	231.312	229.756	228.485	229.242	229.671	230.878	231.115	234.534	240.151	246.544	250.942	252.216	254.579	252.466	248.019	242.348	239.516	235.941	232.349	238.951	9.224
MSF	296.351	288.921	292.083	266.082	319.068	280.510	276.581	11.818	280.429	298.364	286.534	343.826	286.725	310.840	267.482	298.371	290.279	320.112	275.673	278.424	67.403
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.085	0.073	0.080	0.083	0.092	0.073	0.072	0.077	0.082	0.070	0.083	0.082	0.071	0.073	0.060	0.075	0.106	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	91.8	97.8	97.4	98.5	93.9	95.0	90.1	93.1	92.8	95.7	92.4	92.6	94.9	88.4	93.4	86.4	93.0	95.6	84.2		

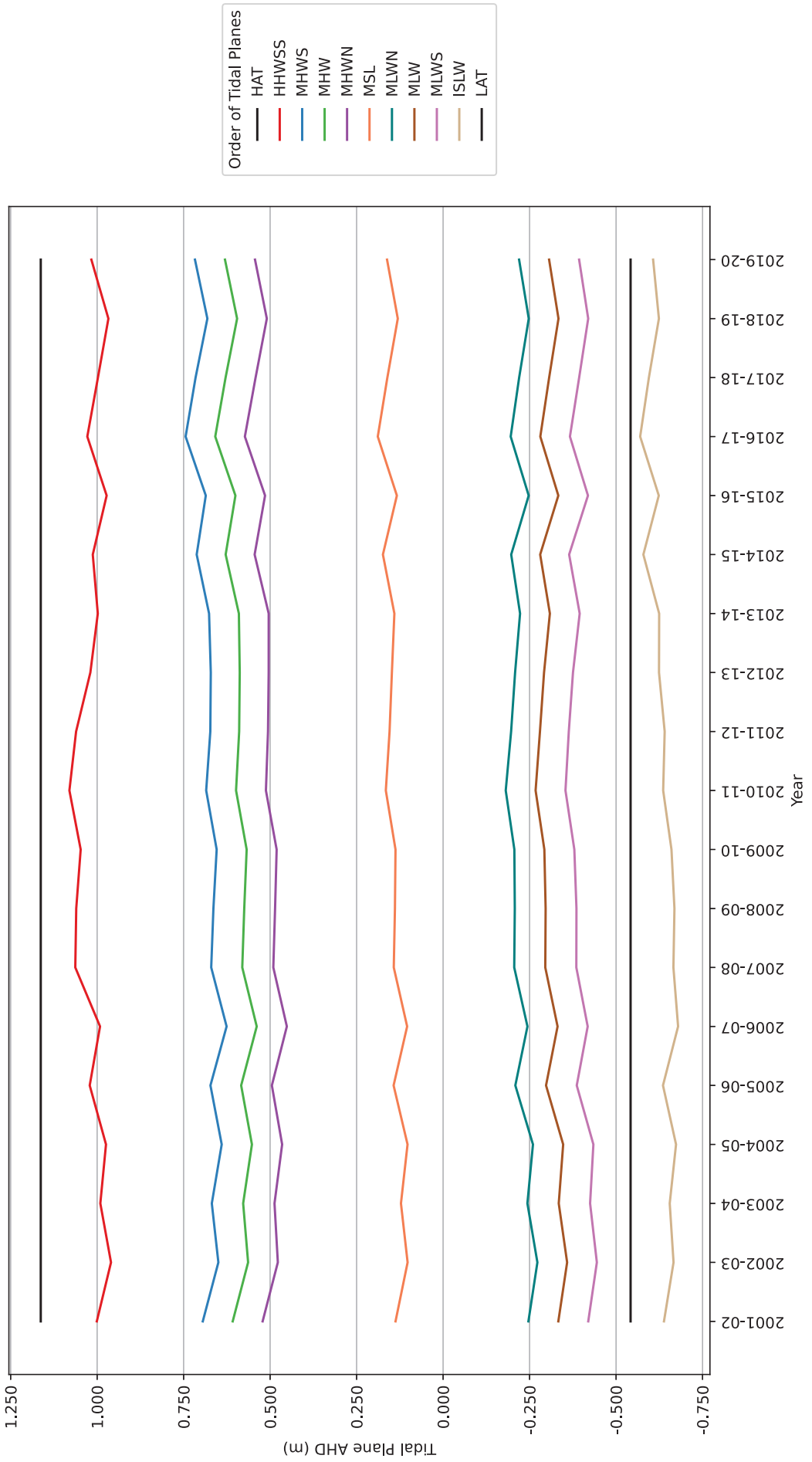
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.16	04/06/2004 23:45	±0.19	10.7
Lowest Astronomical Tide (LAT)	-0.54	08/10/2014 04:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A184

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Prospect Creek at Lansdowne Bridge

MHL2786

Figure A184

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Georges River at Lansvale

RECORDING STATION:	**Georges River at Lansvale**	ZONE:	56
DATUM:	AUSTRALIAN HEIGHT DATUM	EASTING:	311150
AWRC #:	213401	NORTHING:	6247099

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.981	0.943	0.957	0.946	0.999	0.977	1.039	1.047	1.053	1.062	1.065	1.046	1.024	1.025	0.964	1.007	0.955	0.956	0.991	1.002	0.042
MHWS	0.673	0.633	0.637	0.610	0.651	0.611	0.646	0.650	0.660	0.664	0.690	0.692	0.706	0.725	0.678	0.723	0.672	0.672	0.692	0.668	0.033
MHW	0.586	0.547	0.547	0.523	0.563	0.524	0.556	0.561	0.573	0.578	0.605	0.608	0.621	0.641	0.593	0.638	0.586	0.589	0.607	0.581	0.034
MHWN	0.500	0.462	0.457	0.437	0.475	0.437	0.466	0.472	0.486	0.492	0.520	0.524	0.537	0.558	0.508	0.553	0.499	0.505	0.523	0.495	0.036
MSL	0.117	0.088	0.093	0.075	0.126	0.091	0.119	0.128	0.145	0.147	0.174	0.172	0.177	0.192	0.130	0.171	0.124	0.129	0.144	0.134	0.033
MLWN	-0.265	-0.286	-0.272	-0.287	-0.223	-0.255	-0.228	-0.215	-0.196	-0.198	-0.173	-0.181	-0.184	-0.174	-0.248	-0.211	-0.251	-0.247	-0.234	-0.228	0.037
MLW	-0.352	-0.371	-0.362	-0.374	-0.311	-0.342	-0.318	-0.304	-0.284	-0.284	-0.258	-0.265	-0.268	-0.258	-0.333	-0.296	-0.338	-0.330	-0.319	-0.314	0.038
MLWS	-0.438	-0.456	-0.452	-0.461	-0.399	-0.429	-0.408	-0.393	-0.371	-0.370	-0.343	-0.349	-0.352	-0.342	-0.418	-0.381	-0.425	-0.414	-0.404	-0.400	0.039
ISLW	-0.658	-0.678	-0.681	-0.701	-0.647	-0.690	-0.689	-0.677	-0.652	-0.654	-0.611	-0.602	-0.580	-0.556	-0.622	-0.584	-0.627	-0.616	-0.617	-0.639	0.042
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.765	0.748	0.729	0.724	0.698	0.692	0.694	0.687	0.682	0.690	0.693	0.705	0.721	0.732	0.757	0.764	0.750	0.752	0.757	0.723	0.030
MR	0.938	0.918	0.909	0.898	0.874	0.865	0.874	0.865	0.857	0.862	0.863	0.873	0.890	0.900	0.926	0.934	0.924	0.919	0.927	0.895	0.028
MSR	1.111	1.089	1.089	1.071	1.050	1.039	1.055	1.043	1.031	1.034	1.033	1.040	1.058	1.067	1.096	1.104	1.097	1.085	1.096	1.068	0.027
R	1.639	1.621	1.638	1.647	1.646	1.668	1.728	1.725	1.705	1.716	1.677	1.648	1.603	1.582	1.585	1.591	1.582	1.572	1.608	1.641	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.469	0.459	0.454	0.449	0.437	0.433	0.437	0.433	0.428	0.431	0.431	0.436	0.445	0.450	0.463	0.467	0.462	0.459	0.463	0.448	0.014
S2	0.086	0.085	0.090	0.087	0.088	0.087	0.090	0.089	0.087	0.086	0.085	0.084	0.084	0.084	0.085	0.085	0.087	0.083	0.085	0.086	0.002
K1	0.131	0.132	0.135	0.138	0.143	0.151	0.160	0.160	0.158	0.161	0.153	0.149	0.136	0.128	0.123	0.122	0.123	0.122	0.126	0.140	0.014
O1	0.089	0.090	0.094	0.102	0.105	0.111	0.120	0.123	0.123	0.123	0.115	0.104	0.092	0.086	0.081	0.081	0.079	0.081	0.087	0.099	0.016
MSF	0.027	0.029	0.041	0.018	0.020	0.009	0.026	0.010	0.028	0.013	0.041	0.010	0.022	0.018	0.026	0.032	0.028	0.019	0.022	0.023	0.009
z0	0.117	0.088	0.093	0.075	0.126	0.091	0.119	0.128	0.145	0.147	0.174	0.172	0.177	0.192	0.130	0.171	0.124	0.129	0.144	0.134	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	64.104	65.840	65.487	65.927	64.974	64.548	62.975	62.743	62.300	61.968	62.492	61.781	61.393	61.984	61.164	61.430	64.993	64.913	64.583	63.453	1.656
S2	352.980	353.432	351.754	352.076	352.403	352.880	350.843	353.903	353.073	355.157	353.799	354.650	354.332	354.828	354.132	351.709	354.394	354.068	353.249	353.350	1.186
K1	176.395	179.016	178.549	177.983	177.384	176.542	173.394	170.722	168.203	165.110	163.190	162.474	160.053	162.301	162.169	166.860	172.162	174.312	176.045	170.677	6.579
O1	232.560	230.615	229.371	230.038	229.431	231.345	231.985	236.137	241.770	246.960	251.886	254.040	254.849	253.933	248.962	243.138	241.065	237.179	232.981	239.908	9.352
MSF	288.276	280.050	290.928	257.675	302.181	256.617	287.455	351.181	279.554	293.912	283.811	313.750	274.689	304.090	266.712	299.198	304.086	297.763	275.556	289.868	21.620
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.093	0.075	0.079	0.084	0.094	0.077	0.073	0.073	0.085	0.068	0.073	0.070	0.069	0.071	0.061	0.085	0.087	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.4	93.3	98.4	99.4	91.7	96.3	97.3	96.8	97.3	96.8	91.1	85.0	89.1	86.1	95.8	92.0	78.2	94.5	87.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.15	04/06/2008 23:15	±0.19	11.5
Lowest Astronomical Tide (LAT)	-0.55	08/10/2014 04:45		

COMMENTS

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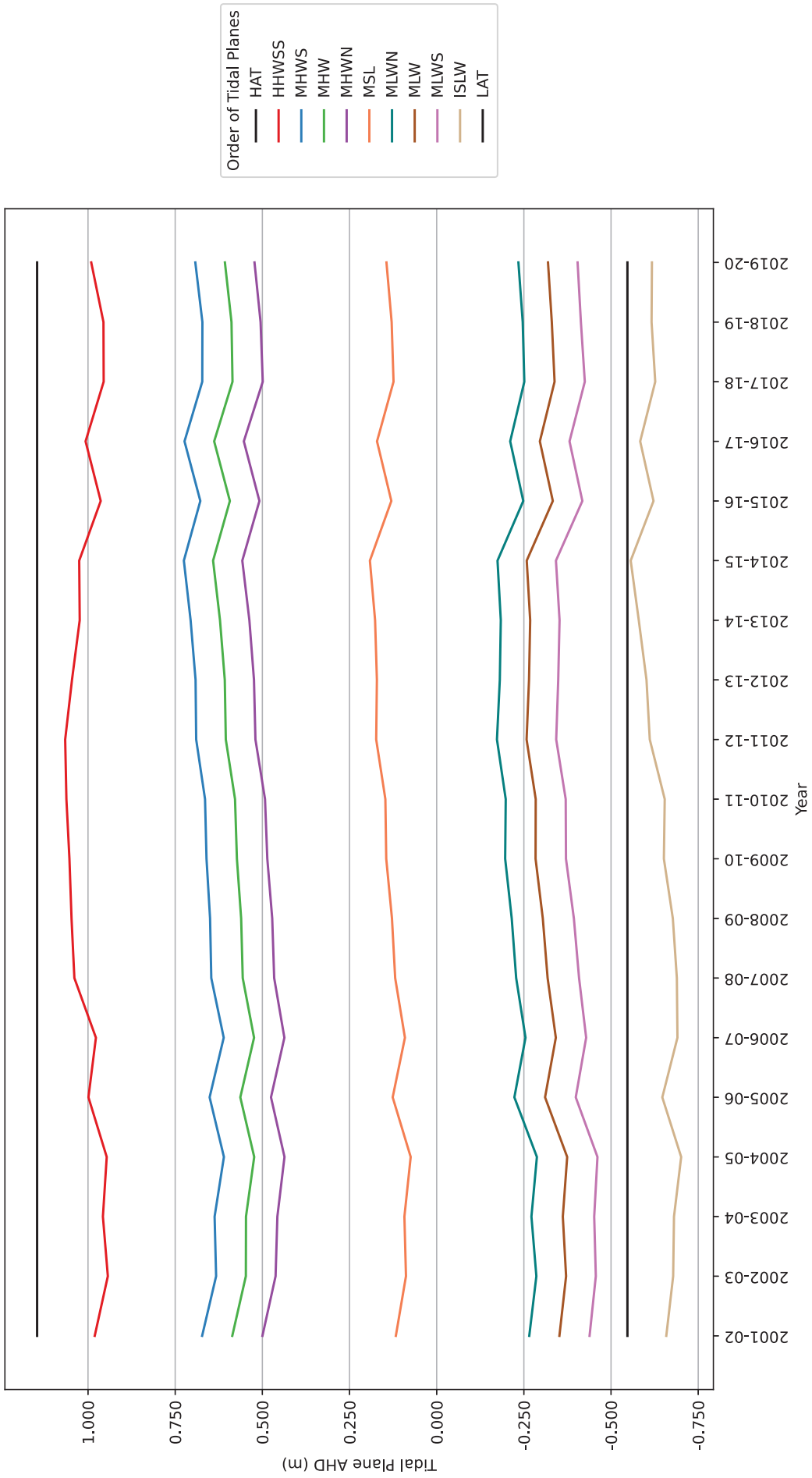


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Georges River at Lansvale

MHL2786

Figure A185

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Cabramatta Creek at Irelands Bridge

RECORDING STATION: **Cabramatta Creek at Irelands Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213407

ZONE: 56
EASTING: 309832
NORTHING: 6246486

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.002	0.945	0.968	0.961	1.007	0.979	1.038	1.036	1.047	1.064	1.036	1.005	0.994	0.999	0.966	1.046	1.000	0.954	0.998	1.002	0.035
MHWS	0.698	0.632	0.646	0.626	0.655	0.611	0.650	0.638	0.650	0.667	0.659	0.650	0.677	0.699	0.681	0.759	0.717	0.669	0.698	0.667	0.036
MHW	0.612	0.545	0.555	0.538	0.567	0.522	0.558	0.546	0.562	0.578	0.572	0.565	0.592	0.616	0.595	0.675	0.630	0.584	0.612	0.580	0.037
MHWN	0.526	0.457	0.463	0.450	0.478	0.434	0.467	0.455	0.473	0.490	0.484	0.481	0.507	0.533	0.509	0.590	0.544	0.500	0.525	0.493	0.038
MSL	0.146	0.083	0.098	0.087	0.124	0.086	0.121	0.111	0.130	0.146	0.138	0.127	0.145	0.163	0.131	0.208	0.168	0.124	0.145	0.131	0.031
MLWN	-0.233	-0.291	-0.266	-0.275	-0.229	-0.263	-0.225	-0.233	-0.213	-0.199	-0.208	-0.226	-0.216	-0.207	-0.247	-0.174	-0.208	-0.253	-0.235	-0.232	0.029
MLW	-0.319	-0.379	-0.358	-0.363	-0.318	-0.351	-0.317	-0.324	-0.301	-0.287	-0.295	-0.311	-0.301	-0.290	-0.333	-0.259	-0.295	-0.337	-0.321	-0.319	0.030
MLWS	-0.406	-0.466	-0.449	-0.451	-0.407	-0.440	-0.408	-0.415	-0.390	-0.376	-0.383	-0.395	-0.386	-0.374	-0.418	-0.343	-0.382	-0.422	-0.407	-0.406	0.031
ISLW	-0.622	-0.689	-0.679	-0.691	-0.658	-0.703	-0.685	-0.699	-0.673	-0.659	-0.652	-0.649	-0.613	-0.588	-0.622	-0.549	-0.584	-0.626	-0.621	-0.645	0.043
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.759	0.749	0.730	0.725	0.707	0.697	0.693	0.688	0.686	0.689	0.693	0.707	0.723	0.740	0.756	0.765	0.752	0.753	0.760	0.725	0.029
MR	0.931	0.923	0.912	0.901	0.884	0.874	0.875	0.870	0.863	0.866	0.867	0.876	0.893	0.906	0.928	0.934	0.926	0.922	0.932	0.899	0.026
MSR	1.104	1.098	1.095	1.077	1.062	1.051	1.057	1.053	1.040	1.043	1.042	1.045	1.063	1.072	1.099	1.102	1.099	1.091	1.104	1.074	0.024
R	1.624	1.634	1.646	1.652	1.665	1.681	1.723	1.735	1.721	1.723	1.687	1.654	1.608	1.586	1.588	1.595	1.584	1.580	1.619	1.648	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.466	0.462	0.456	0.450	0.442	0.437	0.437	0.435	0.432	0.433	0.434	0.438	0.447	0.453	0.464	0.467	0.463	0.461	0.466	0.450	0.013
S2	0.086	0.087	0.091	0.088	0.089	0.088	0.091	0.091	0.089	0.088	0.087	0.085	0.085	0.083	0.086	0.084	0.087	0.085	0.086	0.087	0.002
K1	0.129	0.132	0.136	0.138	0.146	0.152	0.158	0.162	0.160	0.160	0.152	0.149	0.136	0.128	0.124	0.124	0.122	0.122	0.127	0.140	0.014
O1	0.088	0.091	0.094	0.102	0.105	0.111	0.120	0.123	0.123	0.123	0.117	0.104	0.091	0.086	0.080	0.081	0.080	0.081	0.087	0.099	0.016
MSF	0.025	0.026	0.043	0.016	0.022	0.010	0.033	0.012	0.026	0.016	0.038	0.010	0.022	0.019	0.026	0.024	0.034	0.018	0.023	0.023	0.009
z0	0.146	0.083	0.098	0.087	0.124	0.086	0.121	0.111	0.130	0.146	0.138	0.127	0.145	0.163	0.131	0.208	0.168	0.124	0.145	0.131	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	64.414	66.140	65.890	66.270	65.468	65.170	63.330	63.330	62.542	62.239	62.818	61.824	61.653	62.112	61.528	61.987	63.993	64.468	64.313	63.657	1.609
S2	354.385	355.229	353.359	353.962	353.573	354.763	352.761	355.441	354.947	357.371	356.064	355.976	354.993	355.742	354.928	352.295	356.367	354.459	353.467	354.741	1.298
K1	176.323	179.483	178.634	178.249	177.070	177.151	173.517	171.611	168.190	165.402	162.293	160.981	159.984	161.888	162.864	167.468	171.826	173.991	176.144	170.688	6.771
O1	231.846	230.461	229.386	230.454	229.553	232.247	233.504	235.545	241.435	247.484	252.557	253.938	255.447	254.323	249.333	243.760	240.090	236.807	233.023	240.063	9.447
MSF	289.538	281.893	293.823	268.927	313.619	228.978	288.287	354.633	282.098	284.247	280.114	348.289	273.399	310.915	270.882	310.275	297.326	302.348	266.736	291.912	28.621
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.071	0.083	0.075	0.081	0.085	0.088	0.075	0.072	0.076	0.076	0.071	0.089	0.075	0.073	0.074	0.062	0.067	0.092	0.073		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	81.4	99.0	97.3	98.2	90.1	85.4	93.8	87.8	93.4	95.7	94.7	93.1	93.5	90.4	94.6	78.5	89.0	95.6	93.8		

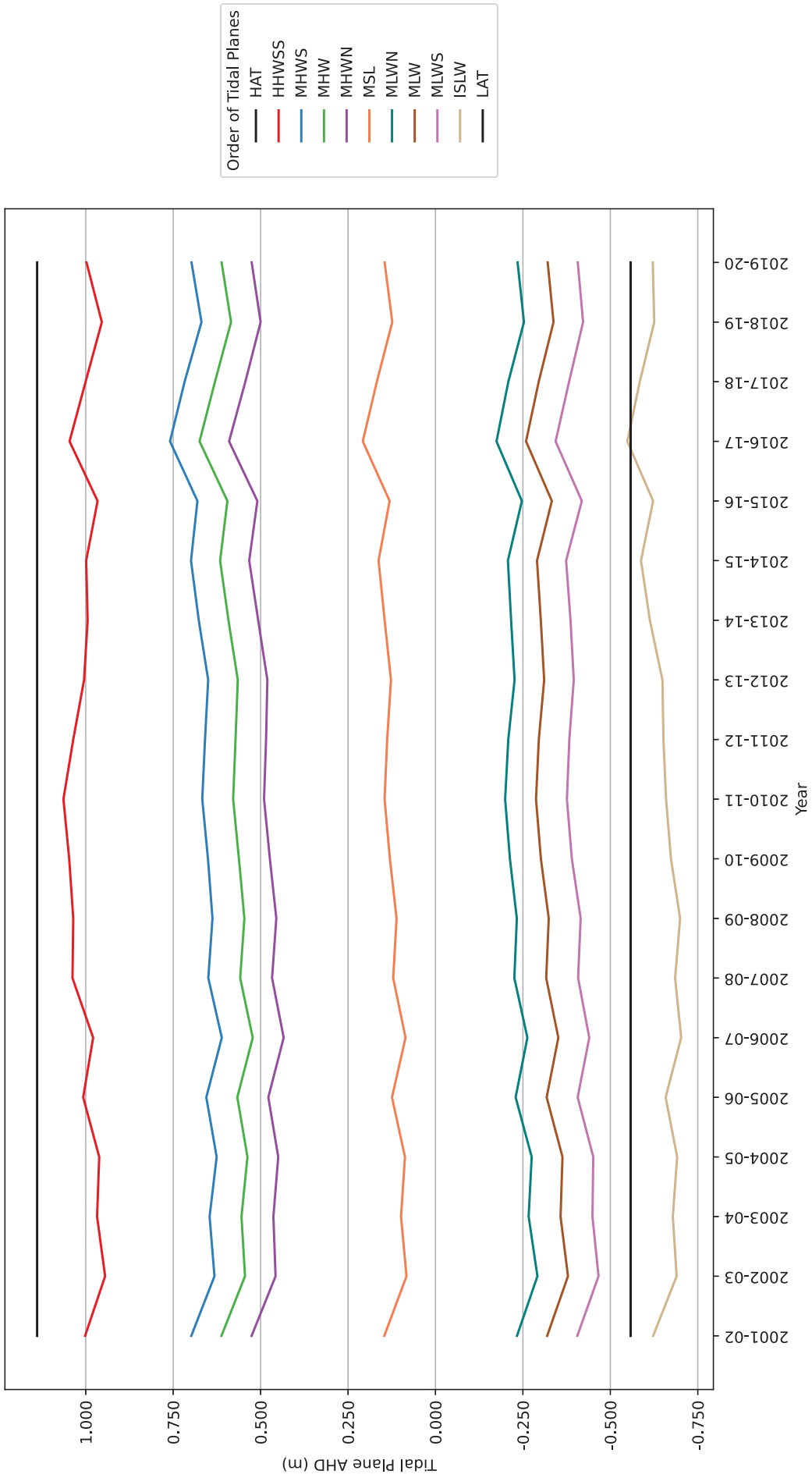
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.14	04/06/2004 23:45	±0.19	12.2
Lowest Astronomical Tide (LAT)	-0.56	09/09/2014 05:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A186

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Cabramatta Creek at Irelands Bridge

MHL2786

Figure A186

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Georges River at Scrivener Street

RECORDING STATION: **Georges River at Scrivener Street**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 213404

ZONE: 56
EASTING: 309137
NORTHING: 6244541

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.009	0.936	0.971	0.945	0.993	0.967	1.029	1.037	1.035	1.058	1.051	1.006	1.002	0.979	0.980	1.013	0.963	0.939	0.979	0.994	0.037
MHWS	0.701	0.623	0.647	0.608	0.640	0.600	0.636	0.637	0.638	0.662	0.672	0.650	0.680	0.679	0.693	0.729	0.682	0.653	0.679	0.658	0.033
MHW	0.615	0.535	0.555	0.520	0.550	0.512	0.544	0.547	0.550	0.574	0.585	0.565	0.593	0.595	0.607	0.643	0.594	0.568	0.593	0.571	0.034
MHWN	0.528	0.447	0.463	0.431	0.460	0.423	0.453	0.456	0.462	0.486	0.498	0.479	0.506	0.511	0.521	0.557	0.507	0.482	0.506	0.483	0.035
MSL	0.138	0.067	0.092	0.063	0.103	0.072	0.100	0.105	0.112	0.136	0.147	0.122	0.141	0.139	0.142	0.169	0.123	0.100	0.120	0.115	0.029
MLWN	-0.252	-0.314	-0.279	-0.305	-0.255	-0.280	-0.253	-0.246	-0.238	-0.215	-0.204	-0.235	-0.224	-0.233	-0.237	-0.219	-0.261	-0.282	-0.265	-0.252	0.030
MLW	-0.339	-0.401	-0.371	-0.394	-0.345	-0.369	-0.345	-0.336	-0.326	-0.302	-0.291	-0.321	-0.311	-0.318	-0.323	-0.305	-0.348	-0.367	-0.352	-0.340	0.030
MLWS	-0.425	-0.489	-0.463	-0.482	-0.434	-0.457	-0.436	-0.427	-0.414	-0.390	-0.377	-0.407	-0.398	-0.402	-0.409	-0.391	-0.435	-0.453	-0.439	-0.428	0.031
ISLW	-0.645	-0.713	-0.694	-0.723	-0.687	-0.719	-0.717	-0.713	-0.698	-0.674	-0.648	-0.661	-0.628	-0.616	-0.615	-0.593	-0.636	-0.656	-0.653	-0.668	0.040
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.781	0.761	0.742	0.737	0.715	0.703	0.706	0.701	0.700	0.701	0.702	0.715	0.730	0.744	0.758	0.776	0.768	0.764	0.770	0.735	0.029
MR	0.954	0.936	0.926	0.914	0.895	0.880	0.889	0.883	0.876	0.876	0.876	0.886	0.904	0.913	0.930	0.948	0.942	0.935	0.944	0.911	0.028
MSR	1.127	1.112	1.110	1.090	1.074	1.058	1.072	1.065	1.051	1.052	1.049	1.057	1.077	1.081	1.102	1.120	1.117	1.106	1.118	1.086	0.027
R	1.654	1.648	1.665	1.668	1.680	1.685	1.745	1.750	1.733	1.732	1.699	1.667	1.629	1.595	1.595	1.606	1.599	1.595	1.632	1.662	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.477	0.468	0.463	0.457	0.447	0.440	0.445	0.442	0.438	0.438	0.438	0.443	0.452	0.456	0.465	0.474	0.471	0.468	0.472	0.455	0.014
S2	0.086	0.088	0.092	0.088	0.090	0.089	0.091	0.091	0.088	0.088	0.087	0.086	0.087	0.084	0.086	0.086	0.087	0.086	0.087	0.088	0.002
K1	0.132	0.133	0.137	0.138	0.147	0.151	0.160	0.162	0.160	0.161	0.154	0.149	0.137	0.128	0.124	0.122	0.122	0.122	0.128	0.140	0.014
O1	0.088	0.090	0.094	0.102	0.106	0.110	0.121	0.124	0.124	0.122	0.117	0.105	0.093	0.086	0.081	0.080	0.079	0.081	0.086	0.099	0.016
MSF	0.028	0.023	0.040	0.017	0.013	0.006	0.029	0.005	0.020	0.010	0.039	0.008	0.023	0.018	0.027	0.030	0.030	0.015	0.019	0.021	0.010
z0	0.138	0.067	0.092	0.063	0.103	0.072	0.100	0.105	0.112	0.136	0.147	0.122	0.141	0.139	0.142	0.169	0.123	0.100	0.120	0.115	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	67.820	69.047	69.025	69.289	68.411	67.505	66.051	65.725	64.902	64.443	65.017	64.179	63.684	64.429	63.929	64.189	66.016	66.759	66.547	66.156	1.892
S2	356.617	357.940	355.888	356.698	356.516	356.540	354.641	357.658	357.421	358.910	356.755	357.925	357.702	358.797	357.493	355.718	357.899	357.573	356.033	357.091	1.082
K1	178.774	181.665	180.635	180.073	179.034	178.319	175.053	172.585	168.422	166.813	164.902	163.314	161.793	163.661	163.946	168.309	173.711	175.366	177.260	172.297	6.816
O1	234.408	231.725	230.736	231.786	230.726	232.546	233.610	237.459	242.909	247.700	253.252	255.159	256.090	255.313	248.816	244.922	241.391	238.109	233.305	241.051	9.249
MSF	296.293	290.036	293.513	263.989	302.851	270.221	288.910	352.499	280.386	298.725	278.905	342.569	277.577	300.654	271.841	302.699	291.881	305.937	270.302	293.673	22.846
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.071	0.083	0.073	0.081	0.086	0.091	0.077	0.073	0.074	0.087	0.071	0.083	0.073	0.075	0.070	0.058	0.073	0.089	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	83.3	98.1	96.8	98.5	97.9	94.7	96.6	96.0	77.8	94.7	91.7	91.8	91.7	91.2	89.6	84.9	96.7	97.3	92.7		

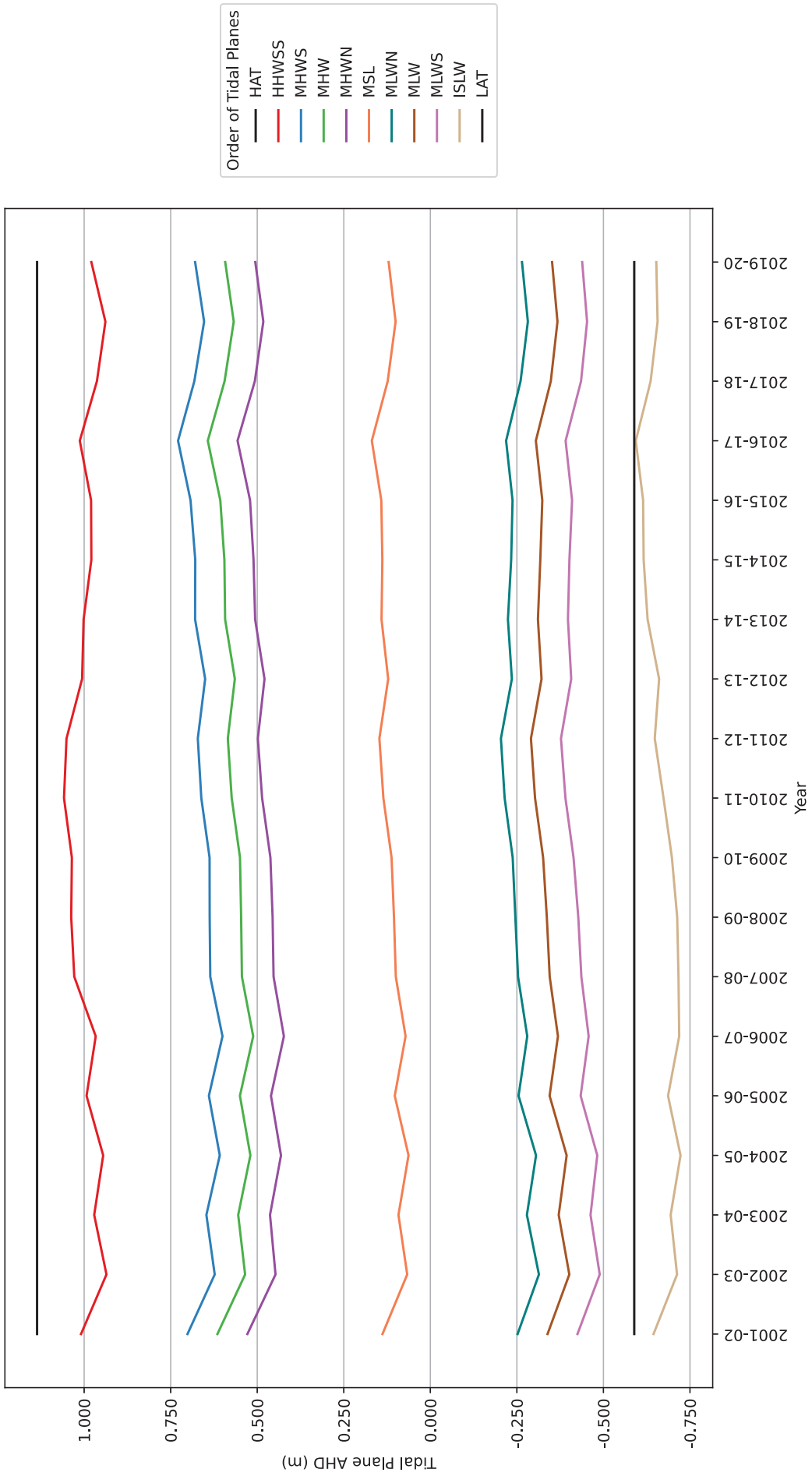
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.14	04/06/2008 23:15	±0.19	13.1
Lowest Astronomical Tide (LAT)	-0.59	29/09/2015 06:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A187

MHL2786

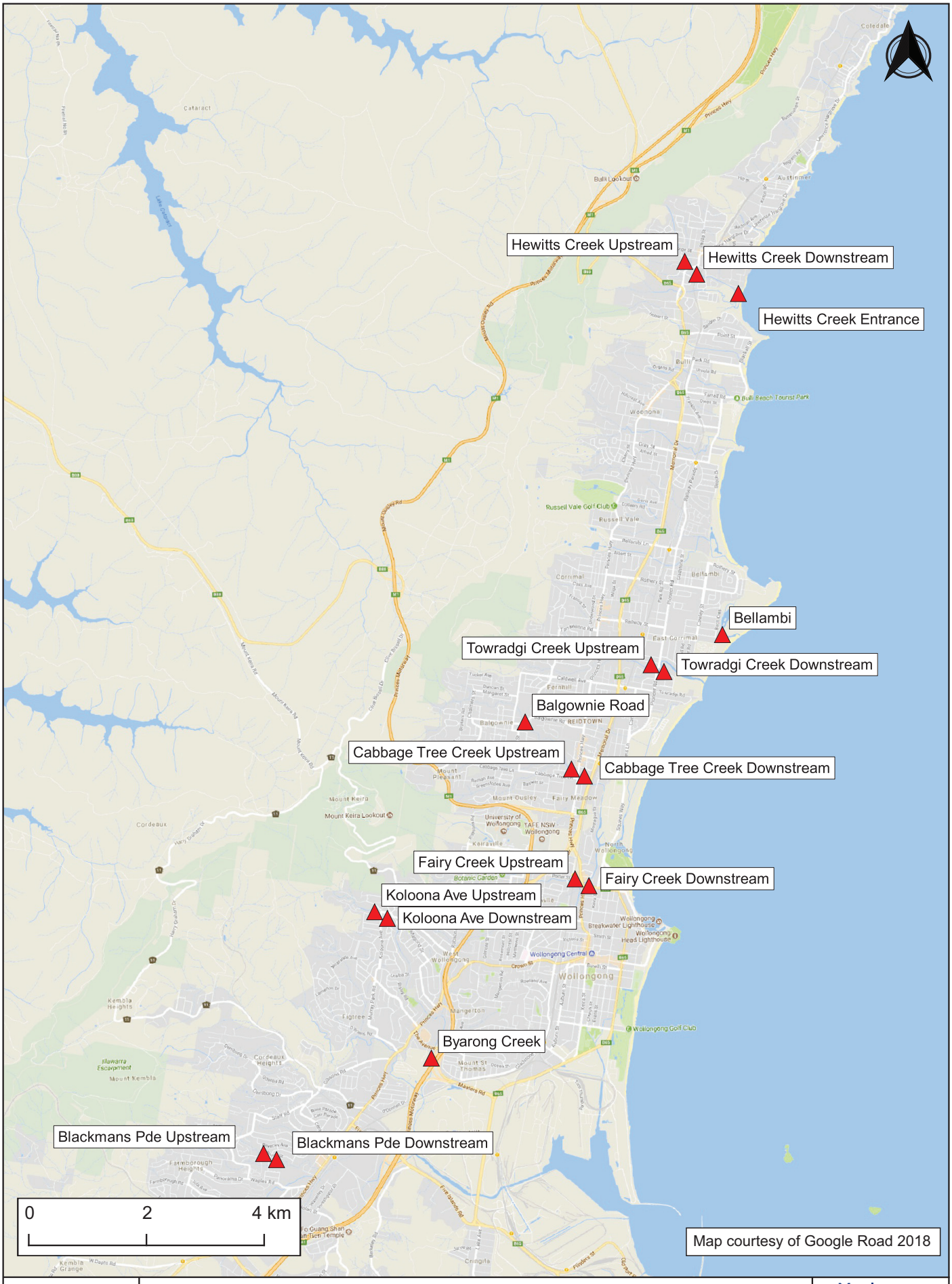


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Georges River at Scrivener Street

MHL2786

Figure A187



NSW GOVERNMENT

STATION LOCATIONS
WOLLONGONG REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A188

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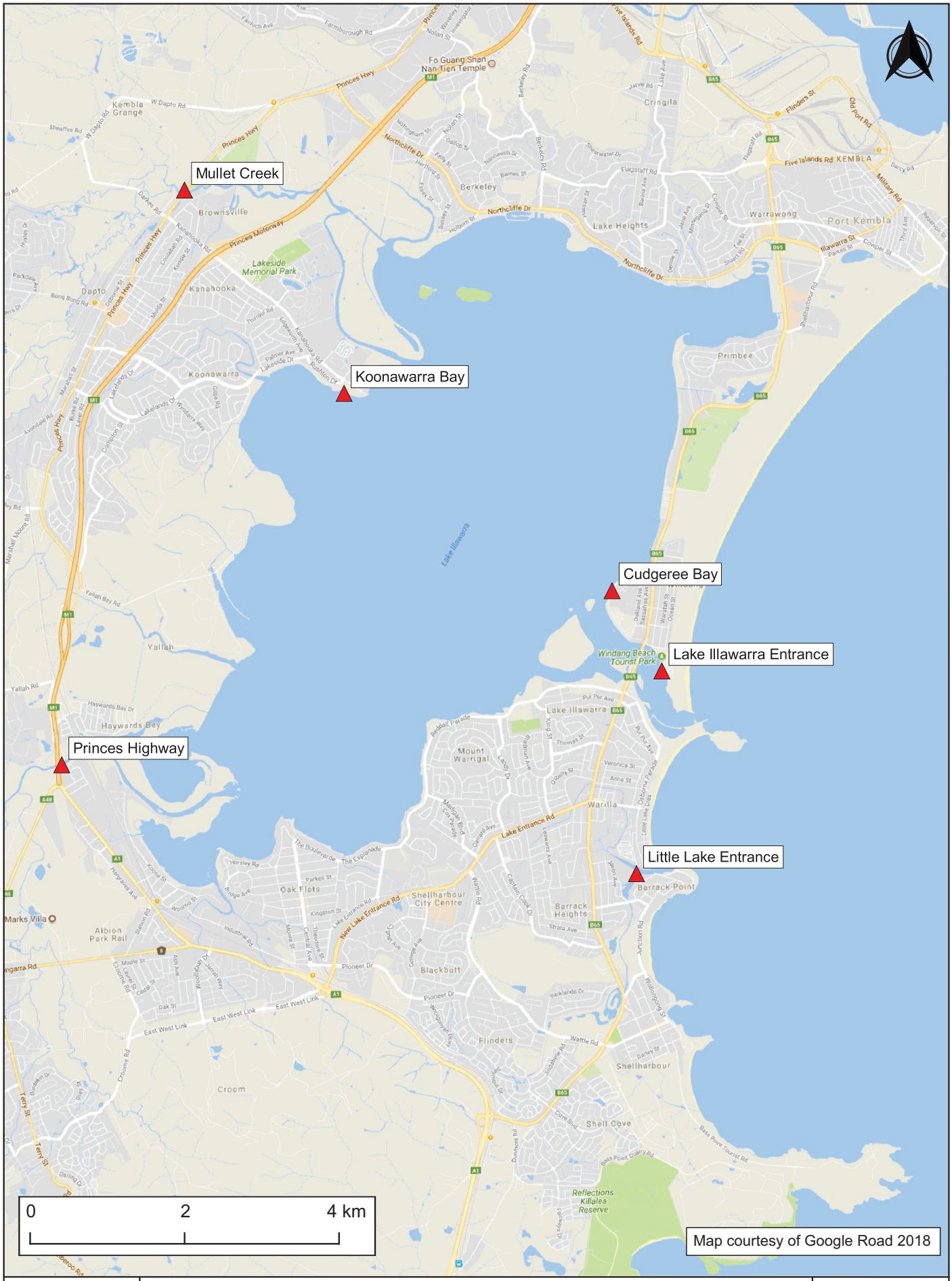


NSW GOVERNMENT

STATION LOCATIONS
LAKE ILLAWARRA REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A189

DRAWING A180.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Illawarra at Koonawarra Bay

RECORDING STATION: **Lake Illawarra at Koonawarra Bay**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214440

ZONE: 56
EASTING: 300464
NORTHING: 6179788

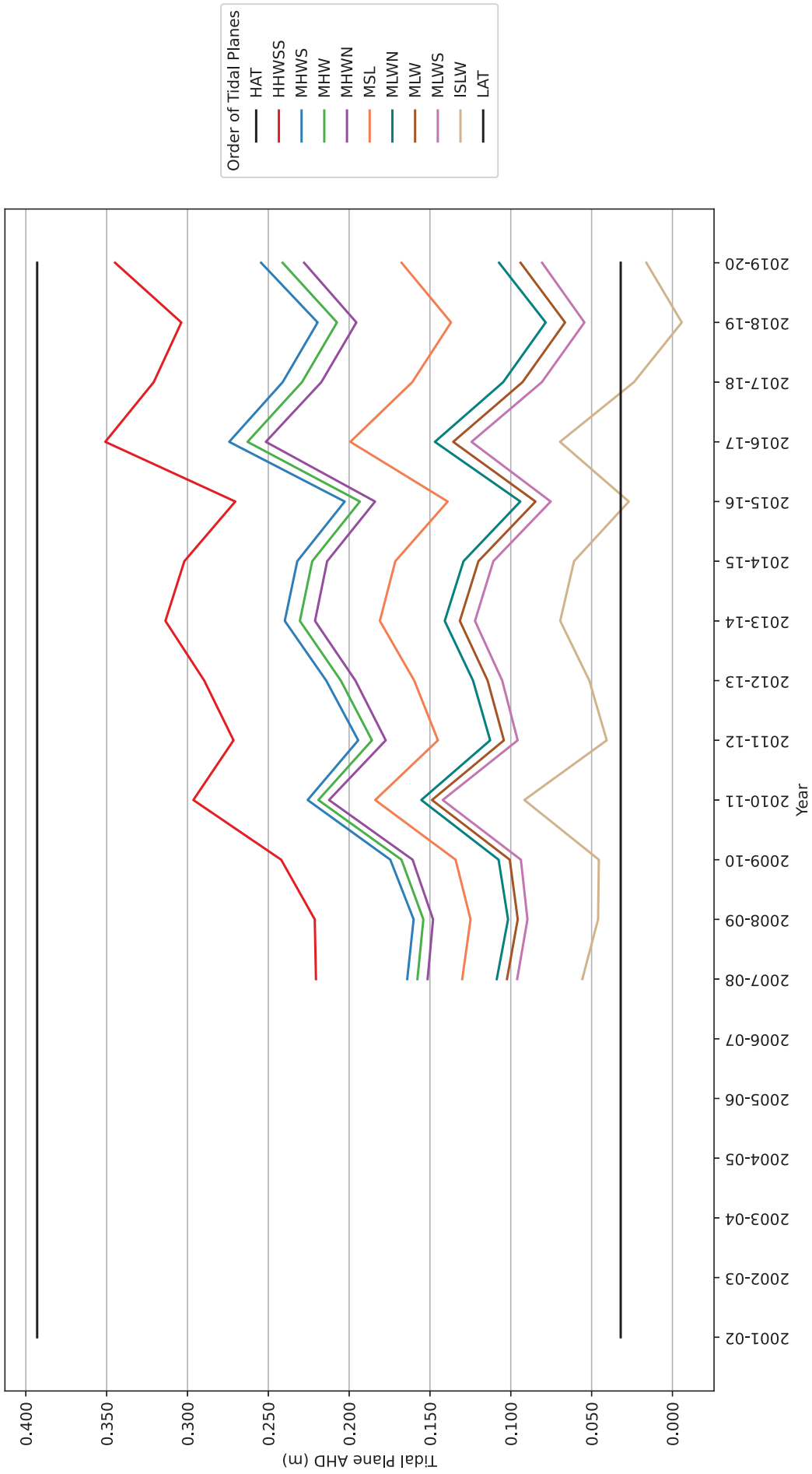
YEAR	2001-02^	2002-03^	2003-04^	2004-05^	2005-06^	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.221	0.221	0.242	0.296	0.272	0.290	0.314	0.302	0.270	0.351	0.321	0.304	0.345	0.288	0.042
MHWS							0.164	0.160	0.175	0.226	0.194	0.214	0.240	0.232	0.203	0.274	0.241	0.219	0.254	0.215	0.035
MHW							0.158	0.154	0.168	0.219	0.186	0.205	0.230	0.223	0.193	0.263	0.229	0.208	0.241	0.206	0.033
MHWN							0.151	0.148	0.161	0.212	0.177	0.196	0.221	0.214	0.184	0.252	0.217	0.196	0.228	0.197	0.031
MSL							0.130	0.125	0.134	0.184	0.145	0.160	0.181	0.171	0.139	0.199	0.161	0.137	0.168	0.156	0.023
MLWN							0.109	0.102	0.108	0.155	0.113	0.123	0.141	0.129	0.094	0.147	0.105	0.078	0.107	0.116	0.022
MLW							0.102	0.096	0.101	0.149	0.104	0.114	0.132	0.120	0.085	0.136	0.093	0.066	0.094	0.107	0.023
MLWS							0.096	0.090	0.094	0.142	0.096	0.105	0.122	0.111	0.075	0.124	0.081	0.054	0.081	0.098	0.023
ISLW							0.056	0.046	0.046	0.092	0.041	0.051	0.069	0.061	0.027	0.070	0.024	-0.006	0.016	0.046	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.043	0.046	0.053	0.057	0.065	0.073	0.080	0.084	0.090	0.105	0.112	0.117	0.121	0.080	0.027
MR							0.055	0.058	0.067	0.070	0.082	0.091	0.099	0.103	0.109	0.127	0.136	0.141	0.147	0.099	0.032
MSR							0.068	0.070	0.081	0.084	0.099	0.109	0.118	0.121	0.127	0.150	0.160	0.165	0.174	0.117	0.037
R							0.165	0.175	0.197	0.205	0.231	0.238	0.244	0.241	0.243	0.281	0.297	0.310	0.329	0.243	0.051
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.028	0.029	0.033	0.035	0.041	0.045	0.049	0.051	0.054	0.064	0.068	0.071	0.074	0.049	0.016
S2							0.006	0.006	0.007	0.007	0.009	0.009	0.009	0.009	0.009	0.011	0.012	0.012	0.013	0.009	0.002
K1							0.022	0.024	0.025	0.027	0.030	0.030	0.030	0.029	0.028	0.031	0.033	0.035	0.037	0.029	0.004
O1							0.019	0.020	0.023	0.024	0.025	0.024	0.023	0.021	0.021	0.023	0.024	0.025	0.028	0.023	0.002
MSF							0.044	0.025	0.040	0.027	0.051	0.021	0.034	0.029	0.035	0.044	0.045	0.025	0.032	0.035	0.009
z0							0.130	0.125	0.134	0.184	0.145	0.160	0.181	0.171	0.139	0.199	0.161	0.137	0.168	0.156	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							85.234	82.940	82.143	80.365	80.033	78.758	78.285	77.585	78.101	77.584	77.964	78.202	78.510	79.670	2.393
S2							359.725	359.598	357.735	359.073	352.192	351.156	354.674	356.874	348.767	351.921	351.990	351.625	349.332	354.205	3.942
K1							217.764	214.382	210.232	205.085	198.956	194.696	197.580	196.605	199.143	201.335	204.555	207.751	210.151	204.480	7.217
O1							285.355	285.375	289.207	294.093	296.999	304.370	300.886	296.828	294.610	284.759	280.317	275.727	271.388	289.224	9.856
MSF							312.185	322.612	303.586	307.437	300.038	337.893	293.921	308.391	292.891	309.156	291.328	295.687	272.086	303.632	16.091
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.061	0.053	0.075	0.066	0.063	0.095	0.073	0.072	0.067	0.056	0.069	0.085	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	82.5	95.4	98.4	89.8	68.1	30.6	98.9	98.6	99.2	98.9	99.0	97.1	98.8	97.1	96.5	99.3	99.5	99.2	96.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.39	05/06/2004 00:15	±0.20	60.9
Lowest Astronomical Tide (LAT)	0.03	10/02/2003 23:30		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Illawarra at Koonawarra Bay

MHL2786

Figure A190

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Illawarra at Cudgeree Bay

RECORDING STATION: **Lake Illawarra at Cudgeree Bay**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214416

ZONE: 56
EASTING: 303934
NORTHING: 6177233

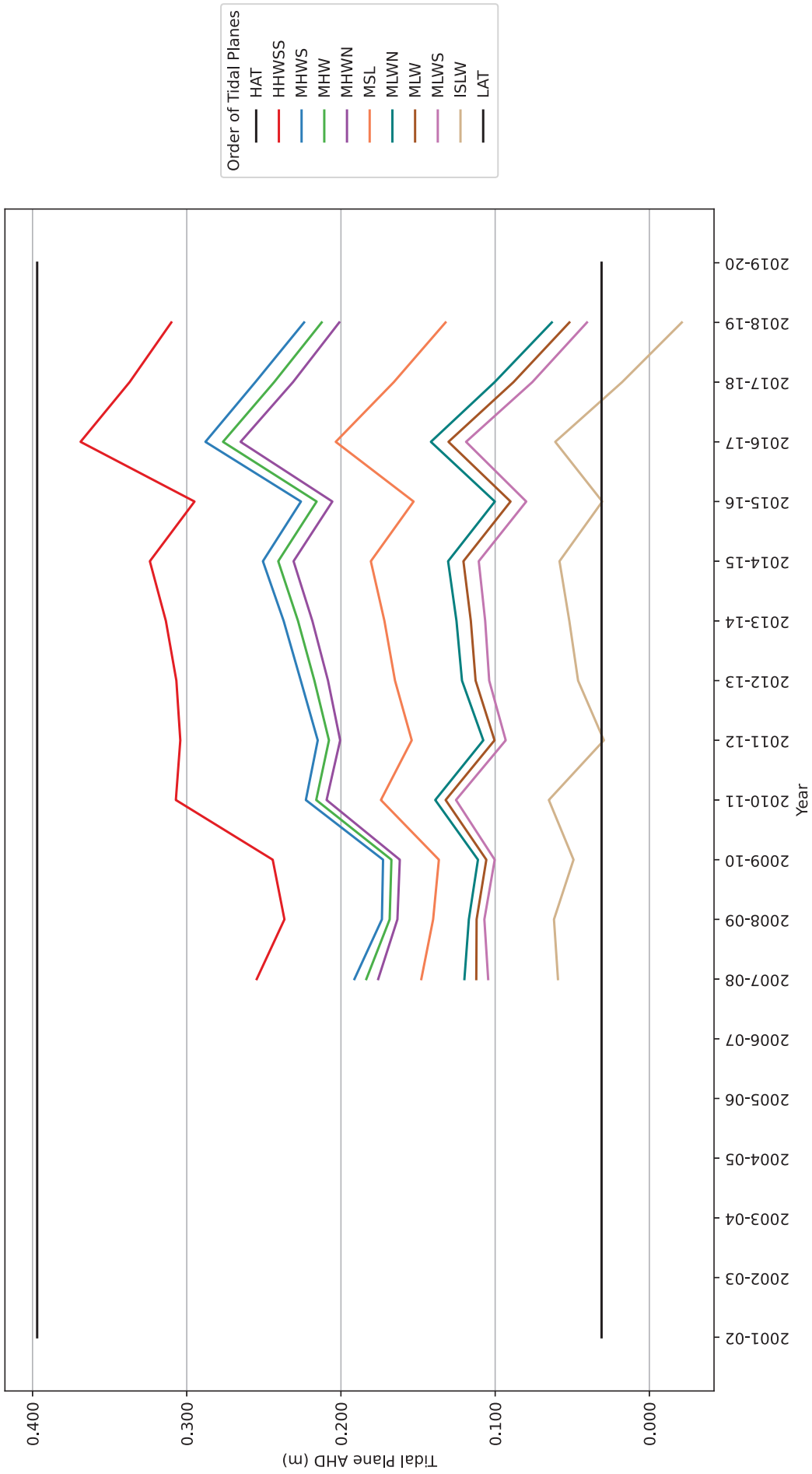
YEAR	2001-02^	2002-03^	2003-04^	2004-05^	2005-06^	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.255	0.237	0.244	0.307	0.304	0.307	0.314	0.324	0.295	0.369	0.337	0.310		0.300	0.038
MHWS							0.191	0.173	0.173	0.223	0.215	0.226	0.237	0.251	0.226	0.288	0.256	0.224		0.224	0.033
MHW							0.184	0.168	0.167	0.216	0.208	0.217	0.228	0.241	0.216	0.276	0.243	0.213		0.215	0.031
MHWN							0.176	0.163	0.162	0.209	0.201	0.208	0.219	0.231	0.206	0.265	0.231	0.201		0.206	0.030
MSL							0.148	0.140	0.136	0.174	0.154	0.165	0.172	0.181	0.153	0.203	0.166	0.132		0.160	0.021
MLWN							0.120	0.117	0.111	0.139	0.108	0.122	0.125	0.131	0.100	0.142	0.100	0.063		0.115	0.021
MLW							0.112	0.112	0.106	0.132	0.100	0.113	0.116	0.121	0.090	0.130	0.088	0.052		0.106	0.022
MLWS							0.105	0.107	0.100	0.125	0.093	0.104	0.106	0.111	0.080	0.119	0.076	0.040		0.097	0.023
ISLW							0.059	0.062	0.049	0.065	0.029	0.046	0.052	0.058	0.031	0.061	0.018	-0.021		0.042	0.025
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.056	0.046	0.051	0.070	0.093	0.087	0.093	0.100	0.105	0.123	0.131	0.138		0.091	0.031
MR							0.071	0.056	0.062	0.084	0.107	0.105	0.112	0.120	0.126	0.146	0.155	0.161		0.109	0.035
MSR							0.087	0.066	0.072	0.097	0.122	0.122	0.131	0.140	0.146	0.169	0.180	0.183		0.126	0.040
R							0.195	0.175	0.195	0.242	0.275	0.260	0.262	0.266	0.264	0.308	0.319	0.331		0.258	0.050
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.036	0.028	0.031	0.042	0.054	0.052	0.056	0.060	0.063	0.073	0.078	0.080		0.054	0.018
S2							0.008	0.005	0.005	0.007	0.007	0.009	0.009	0.010	0.010	0.011	0.012	0.011		0.009	0.002
K1							0.025	0.025	0.027	0.034	0.034	0.031	0.030	0.029	0.028	0.033	0.033	0.035		0.030	0.004
O1							0.021	0.020	0.024	0.026	0.029	0.027	0.024	0.023	0.022	0.025	0.025	0.026		0.024	0.003
MSF							0.040	0.030	0.037	0.030	0.050	0.023	0.033	0.029	0.036	0.042	0.045	0.024		0.035	0.008
z0							0.148	0.140	0.136	0.174	0.154	0.165	0.172	0.181	0.153	0.203	0.166	0.132		0.160	0.021
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							39.427	54.806	58.030	43.036	36.909	44.723	44.872	43.379	42.691	42.334	42.571	40.574		44.446	6.055
S2							314.601	341.720	339.329	332.204	307.284	305.069	314.772	306.477	308.605	305.435	310.171	302.252		315.660	13.967
K1							190.700	195.028	192.428	180.671	172.332	175.557	171.144	174.751	178.030	179.516	182.586	191.086		181.986	8.346
O1							254.144	267.930	272.763	273.098	270.341	280.869	279.071	276.733	274.274	267.144	260.459	256.701		269.461	8.579
MSF							310.972	313.154	302.279	311.848	300.202	346.011	288.958	310.578	289.137	308.932	288.627	281.096		304.316	17.191
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.062	0.059	0.072	0.071	0.063	0.084	0.077	0.076	0.066	0.057	0.067	0.076			
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.8	73.9	90.2	91.3	64.7	27.0	83.5	100.0	99.7	99.4	99.2	98.3	99.4	97.2	97.5	99.6	99.6	66.2	24.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.40	27/05/2017 23:45	±0.18	62.8
Lowest Astronomical Tide (LAT)	0.03	14/01/2003 00:00		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station decommissioned in Nov 2020. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Illawarra at Cudgeree Bay

MHL2786

Figure A191

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Lake Illawarra at Lake Illawarra Entrance

RECORDING STATION: **Lake Illawarra at Lake Illawarra Entrance**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214417

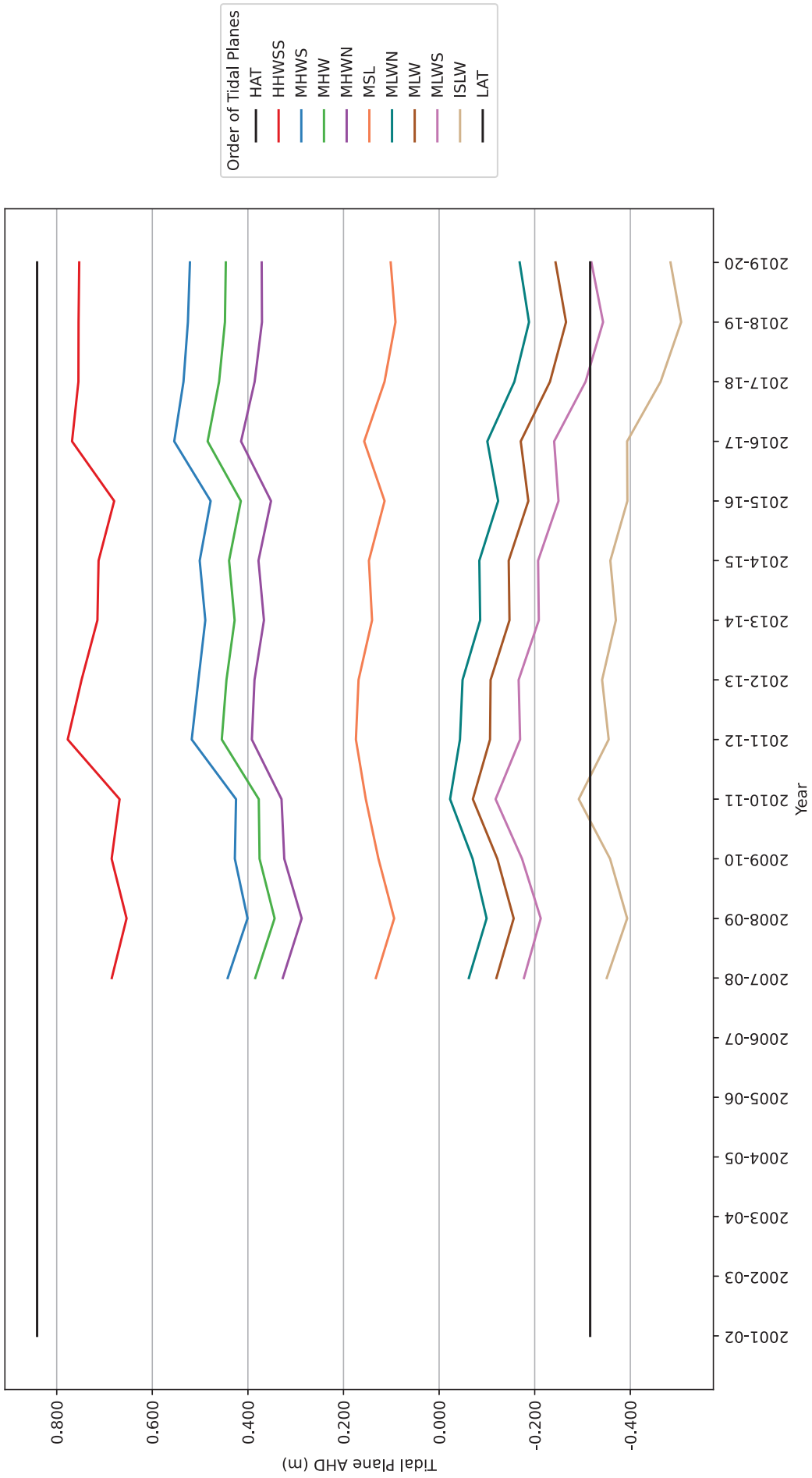
ZONE: 56
EASTING: 304579
NORTHING: 6176195

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.685	0.654	0.685	0.668	0.777	0.748	0.715	0.712	0.680	0.768	0.755	0.754	0.753	0.720	0.042
MHWS							0.442	0.401	0.427	0.425	0.518	0.504	0.489	0.501	0.478	0.554	0.535	0.526	0.521	0.486	0.048
MHW							0.385	0.344	0.376	0.377	0.455	0.445	0.428	0.439	0.415	0.484	0.460	0.448	0.446	0.423	0.041
MHWN							0.327	0.287	0.324	0.330	0.392	0.386	0.366	0.378	0.352	0.414	0.386	0.371	0.371	0.360	0.035
MSL							0.132	0.094	0.127	0.153	0.174	0.169	0.140	0.147	0.114	0.157	0.114	0.091	0.101	0.132	0.028
MLWN							-0.062	-0.099	-0.070	-0.023	-0.044	-0.049	-0.086	-0.084	-0.123	-0.101	-0.157	-0.188	-0.169	-0.097	0.051
MLW							-0.120	-0.156	-0.122	-0.071	-0.107	-0.108	-0.147	-0.146	-0.187	-0.171	-0.232	-0.266	-0.244	-0.160	0.059
MLWS							-0.177	-0.213	-0.173	-0.118	-0.169	-0.166	-0.209	-0.207	-0.250	-0.241	-0.306	-0.343	-0.319	-0.222	0.067
ISLW							-0.351	-0.393	-0.358	-0.292	-0.355	-0.341	-0.370	-0.358	-0.394	-0.393	-0.463	-0.506	-0.484	-0.389	0.061
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.389	0.387	0.394	0.353	0.435	0.435	0.452	0.462	0.475	0.515	0.543	0.559	0.540	0.457	0.067
MR							0.505	0.500	0.497	0.448	0.561	0.553	0.575	0.585	0.601	0.655	0.692	0.714	0.690	0.583	0.085
MSR							0.620	0.613	0.601	0.543	0.687	0.670	0.698	0.708	0.728	0.795	0.841	0.869	0.840	0.709	0.103
R							1.035	1.047	1.043	0.961	1.132	1.089	1.085	1.071	1.074	1.161	1.218	1.261	1.237	1.109	0.088
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.252	0.250	0.249	0.224	0.281	0.276	0.287	0.292	0.301	0.327	0.346	0.357	0.345	0.291	0.042
S2							0.058	0.057	0.052	0.048	0.063	0.059	0.061	0.061	0.063	0.070	0.074	0.077	0.075	0.063	0.009
K1							0.102	0.106	0.110	0.105	0.107	0.099	0.098	0.093	0.090	0.097	0.099	0.103	0.104	0.101	0.006
O1							0.071	0.075	0.074	0.069	0.078	0.075	0.063	0.058	0.054	0.056	0.058	0.061	0.062	0.066	0.008
MSF							0.034	0.011	0.017	0.012	0.042	0.030	0.023	0.022	0.027	0.028	0.031	0.008	0.012	0.023	0.010
z0							0.132	0.094	0.127	0.153	0.174	0.169	0.140	0.147	0.114	0.157	0.114	0.091	0.101	0.132	0.028
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							355.406	354.069	354.141	353.086	352.998	354.093	352.418	352.739	353.582	353.813	354.889	354.977	356.346	354.043	1.132
S2							260.898	262.096	262.297	266.935	264.177	263.831	264.035	263.833	263.918	262.629	264.107	263.641	265.118	263.655	1.488
K1							132.564	128.800	124.591	125.745	117.051	114.206	115.858	118.968	120.369	123.421	125.645	129.428	132.226	123.759	6.111
O1							195.538	200.519	203.645	214.461	214.303	219.624	219.948	217.533	213.593	205.084	197.909	194.350	190.614	206.702	10.363
MSF							306.906	308.576	308.661	348.426	289.377	308.526	278.253	318.754	273.380	311.174	291.546	336.303	254.058	302.611	25.489
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.069	0.068	0.100	0.082	0.061	0.073	0.084	0.079	0.073	0.063	0.073	0.092	0.076		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
					0.0	12.6	96.5	88.9	96.6	83.8	64.1	65.5	98.4	95.5	91.1	97.6	97.2	98.6	97.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.84	04/06/2008 20:45	±0.20	7.8
Lowest Astronomical Tide (LAT)	-0.32	07/10/2014 01:15		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Illawarra at Lake Illawarra Entrance

MHL2786

Figure A192

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Macquarie Rivulet at Princes Highway

RECORDING STATION: **Macquarie Rivulet at Princes Highway**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214402

ZONE: 56
EASTING: 296808
NORTHING: 6174979

YEAR	2001-02^	2002-03*	2003-04^	2004-05^	2005-06^	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.256	0.238	0.273	0.300	0.298	0.306	0.317	0.318	0.300	0.359	0.330	0.304	0.335	0.303	0.033
MHWS							0.201	0.182	0.210	0.228	0.224	0.227	0.240	0.245	0.228	0.281	0.247	0.218	0.244	0.229	0.024
MHW							0.193	0.176	0.202	0.221	0.215	0.218	0.230	0.234	0.217	0.269	0.234	0.206	0.232	0.219	0.023
MHWN							0.185	0.170	0.195	0.214	0.205	0.209	0.221	0.224	0.206	0.258	0.221	0.194	0.220	0.209	0.022
MSL							0.169	0.152	0.174	0.187	0.175	0.173	0.180	0.183	0.162	0.205	0.165	0.135	0.158	0.171	0.017
MLWN							0.152	0.134	0.152	0.159	0.145	0.136	0.140	0.141	0.118	0.152	0.109	0.076	0.095	0.132	0.025
MLW							0.144	0.128	0.145	0.152	0.135	0.127	0.130	0.131	0.107	0.140	0.096	0.065	0.083	0.122	0.026
MLWS							0.136	0.122	0.138	0.145	0.126	0.118	0.121	0.120	0.096	0.129	0.084	0.053	0.071	0.112	0.028
ISLW							0.097	0.082	0.093	0.094	0.073	0.061	0.066	0.068	0.044	0.073	0.024	-0.008	0.006	0.059	0.034
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.033	0.035	0.043	0.055	0.060	0.073	0.081	0.083	0.089	0.106	0.113	0.118	0.125	0.078	0.031
MR							0.049	0.047	0.057	0.069	0.079	0.091	0.100	0.103	0.111	0.129	0.138	0.141	0.149	0.097	0.036
MSR							0.065	0.059	0.072	0.083	0.098	0.109	0.119	0.124	0.132	0.152	0.163	0.165	0.173	0.117	0.040
R							0.159	0.156	0.180	0.207	0.224	0.245	0.252	0.250	0.256	0.286	0.307	0.312	0.329	0.243	0.057
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.024	0.024	0.029	0.034	0.040	0.046	0.050	0.052	0.055	0.064	0.069	0.071	0.075	0.049	0.018
S2							0.008	0.006	0.007	0.007	0.010	0.009	0.010	0.010	0.011	0.012	0.013	0.012	0.012	0.010	0.002
K1							0.023	0.023	0.025	0.029	0.029	0.033	0.032	0.032	0.030	0.033	0.037	0.036	0.037	0.031	0.005
O1							0.016	0.017	0.020	0.022	0.023	0.024	0.024	0.021	0.021	0.023	0.023	0.025	0.028	0.022	0.003
MSF							0.038	0.023	0.035	0.026	0.045	0.025	0.034	0.029	0.038	0.041	0.043	0.024	0.032	0.033	0.007
z0							0.169	0.152	0.174	0.187	0.175	0.173	0.180	0.183	0.162	0.205	0.165	0.135	0.158	0.171	0.017
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							95.299	104.073	100.379	86.515	86.772	82.831	81.272	80.359	81.372	80.054	80.583	81.802	82.694	86.462	8.149
S2							34.261	34.442	27.134	16.092	16.889	13.895	8.068	13.372	2.576	4.527	2.947	359.072	355.503	68.367	128.668
K1							228.094	226.416	222.576	209.180	200.689	200.622	200.581	196.458	200.312	202.642	206.489	209.372	212.252	208.899	10.616
O1							284.051	297.577	301.325	295.887	300.229	301.341	304.315	299.867	294.452	286.239	282.136	277.455	272.869	292.134	10.323
MSF							312.171	321.849	306.143	308.356	299.054	335.132	292.840	299.078	291.285	308.334	288.639	291.372	274.212	302.190	15.737
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.049	0.049	0.057	0.071	0.059	0.085	0.071	0.069	0.067	0.059	0.065	0.083	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	75.5	48.4	80.9	81.3	57.7	0.0	78.0	97.8	76.9	98.3	97.9	94.3	98.9	96.1	97.3	97.8	99.5	99.7	98.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.41	28/05/2017 00:45	±0.16	62.3
Lowest Astronomical Tide (LAT)	0.05	19/09/2003 10:15		

COMMENTS
^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

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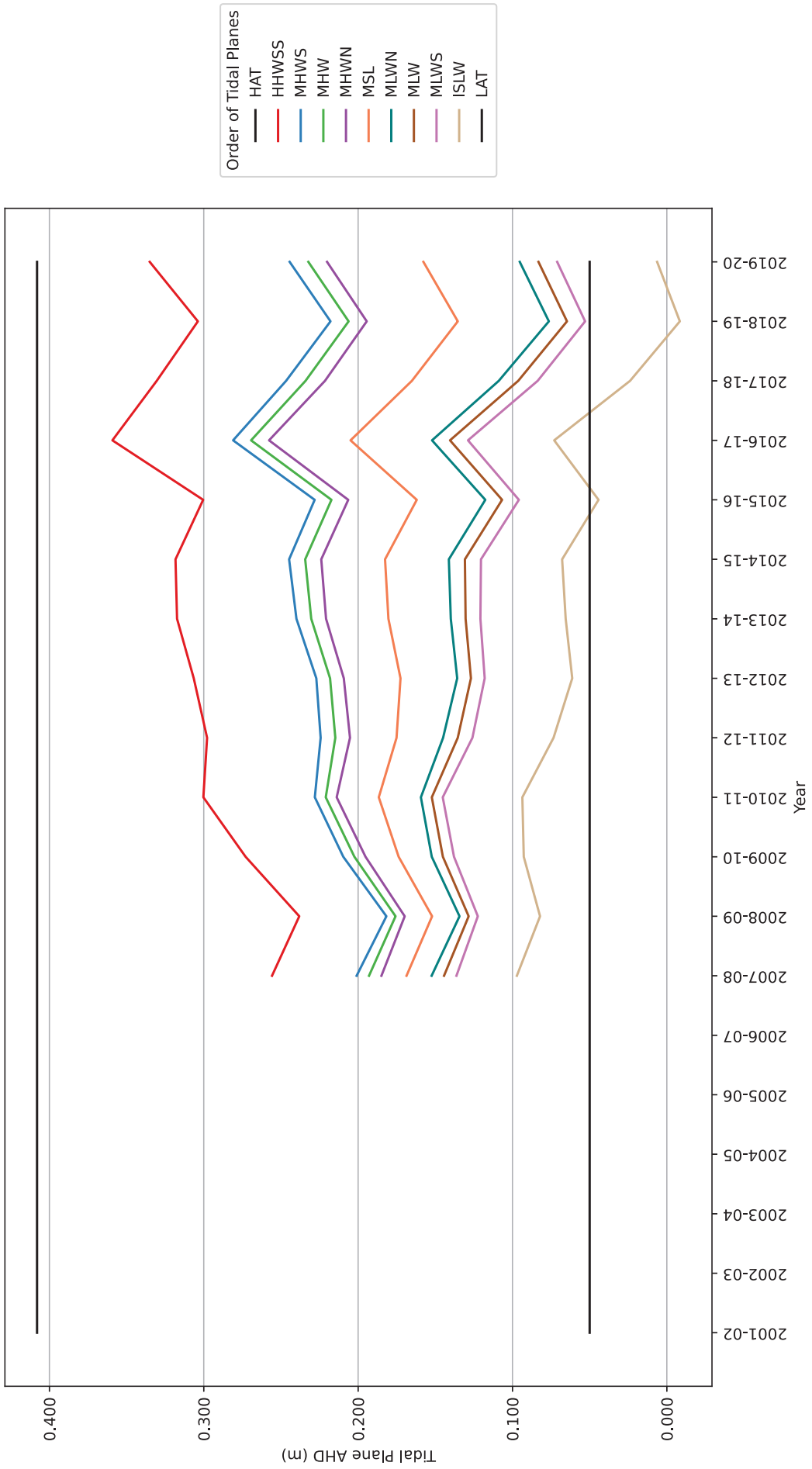


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Macquarie Rivulet at Princes Highway

MHL2786

Figure A193

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Little Lake at Little Lake Entrance

RECORDING STATION: **Little Lake at Little Lake Entrance**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214467

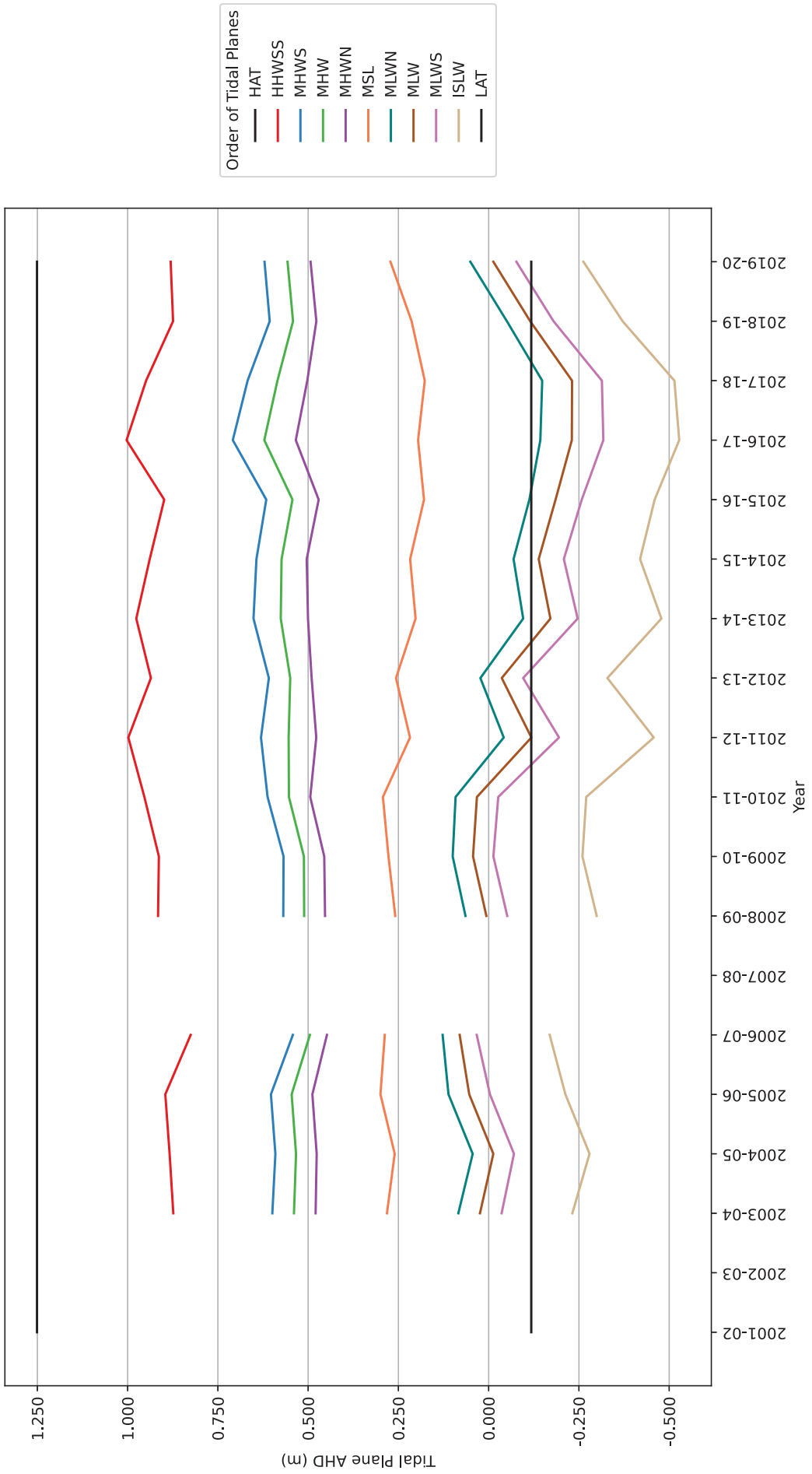
ZONE: 56
EASTING: 304250
NORTHING: 6173571

YEAR	2001-02*	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08*	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS			0.873	0.884	0.896	0.825		0.916	0.913	0.954	0.998	0.935	0.976	0.939	0.899	1.003	0.949	0.874	0.881	0.920	0.049
MHWS			0.599	0.591	0.603	0.542		0.569	0.568	0.612	0.631	0.609	0.651	0.643	0.616	0.709	0.668	0.606	0.621	0.615	0.041
MHW			0.539	0.534	0.546	0.495		0.511	0.512	0.553	0.554	0.550	0.576	0.574	0.543	0.621	0.585	0.542	0.557	0.549	0.031
MHWN			0.479	0.476	0.488	0.448		0.453	0.455	0.494	0.477	0.490	0.500	0.504	0.471	0.534	0.502	0.477	0.493	0.484	0.022
MSL			0.282	0.260	0.300	0.288		0.259	0.278	0.293	0.218	0.257	0.202	0.217	0.179	0.196	0.177	0.213	0.272	0.243	0.042
MLWN			0.084	0.044	0.111	0.128		0.064	0.100	0.092	-0.042	0.023	-0.096	-0.069	-0.113	-0.143	-0.148	-0.050	0.051	0.002	0.095
MLW			0.024	-0.013	0.054	0.080		0.006	0.043	0.033	-0.118	-0.036	-0.171	-0.139	-0.185	-0.230	-0.231	-0.115	-0.013	-0.063	0.106
MLWS			-0.036	-0.070	-0.004	0.033		-0.051	-0.013	-0.027	-0.195	-0.095	-0.247	-0.208	-0.258	-0.318	-0.314	-0.180	-0.077	-0.129	0.116
ISLW			-0.232	-0.279	-0.213	-0.169		-0.299	-0.260	-0.270	-0.457	-0.329	-0.478	-0.419	-0.460	-0.528	-0.514	-0.371	-0.262	-0.346	0.115
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR			0.395	0.432	0.377	0.320		0.389	0.356	0.403	0.519	0.467	0.596	0.573	0.584	0.677	0.651	0.528	0.443	0.482	0.110
MR			0.515	0.546	0.492	0.415		0.505	0.468	0.521	0.672	0.586	0.747	0.712	0.729	0.852	0.816	0.657	0.570	0.613	0.131
MSR			0.635	0.661	0.607	0.509		0.620	0.581	0.639	0.825	0.704	0.898	0.851	0.874	1.026	0.981	0.786	0.698	0.744	0.152
R			1.105	1.163	1.108	0.994		1.215	1.173	1.224	1.455	1.264	1.454	1.358	1.358	1.531	1.463	1.245	1.143	1.266	0.155
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2			0.258	0.273	0.246	0.207		0.252	0.234	0.260	0.336	0.293	0.373	0.356	0.364	0.426	0.408	0.328	0.285	0.306	0.065
S2			0.060	0.057	0.057	0.047		0.058	0.056	0.059	0.077	0.059	0.075	0.070	0.073	0.087	0.083	0.065	0.064	0.065	0.011
K1			0.109	0.115	0.114	0.107		0.132	0.128	0.127	0.142	0.126	0.131	0.120	0.116	0.126	0.120	0.109	0.103	0.120	0.011
O1			0.087	0.094	0.095	0.095		0.116	0.119	0.117	0.120	0.107	0.101	0.091	0.086	0.084	0.081	0.083	0.082	0.097	0.014
MSF			0.049	0.028	0.041	0.036		0.039	0.046	0.041	0.050	0.034	0.036	0.035	0.043	0.036	0.042	0.035	0.047	0.040	0.006
z0			0.282	0.260	0.300	0.288		0.259	0.278	0.293	0.218	0.257	0.202	0.217	0.179	0.196	0.177	0.213	0.272	0.243	0.042
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2			3.705	0.395	5.305	6.173		1.283	4.740	2.010	354.503	358.623	351.723	353.633	354.638	352.023	354.400	0.729	2.751	156.665	179.954
S2			271.610	268.581	272.428	276.212		275.020	273.845	273.681	267.109	272.009	265.725	268.524	264.300	261.636	268.421	272.045	270.067	270.076	4.037
K1			146.873	142.742	147.185	147.167		139.005	139.689	132.875	122.795	124.016	118.185	119.498	121.983	121.545	128.396	138.032	141.883	133.242	10.751
O1			207.193	202.314	205.339	210.860		209.228	217.893	222.870	218.255	225.133	221.512	221.082	216.867	204.756	204.653	209.206	207.716	212.805	7.544
MSF			268.664	262.834	273.973	274.592		272.393	279.808	274.188	271.631	274.705	269.184	282.023	267.151	288.841	271.322	275.013	269.075	273.462	6.210
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
			0.062	0.078	0.072	0.067		0.066	0.071	0.080	0.068	0.074	0.068	0.070	0.072	0.071	0.083	0.084	0.064		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	43.7	44.2	68.3	77.6	69.9	79.4	48.1	93.8	91.9	67.6	94.1	92.3	89.5	93.4	96.2	92.7	95.3	97.8	92.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.25	04/06/2004 21:15	±0.21	6.6
Lowest Astronomical Tide (LAT)	-0.12	06/10/2003 01:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Little Lake (AWRC: 214466) in May 2014. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

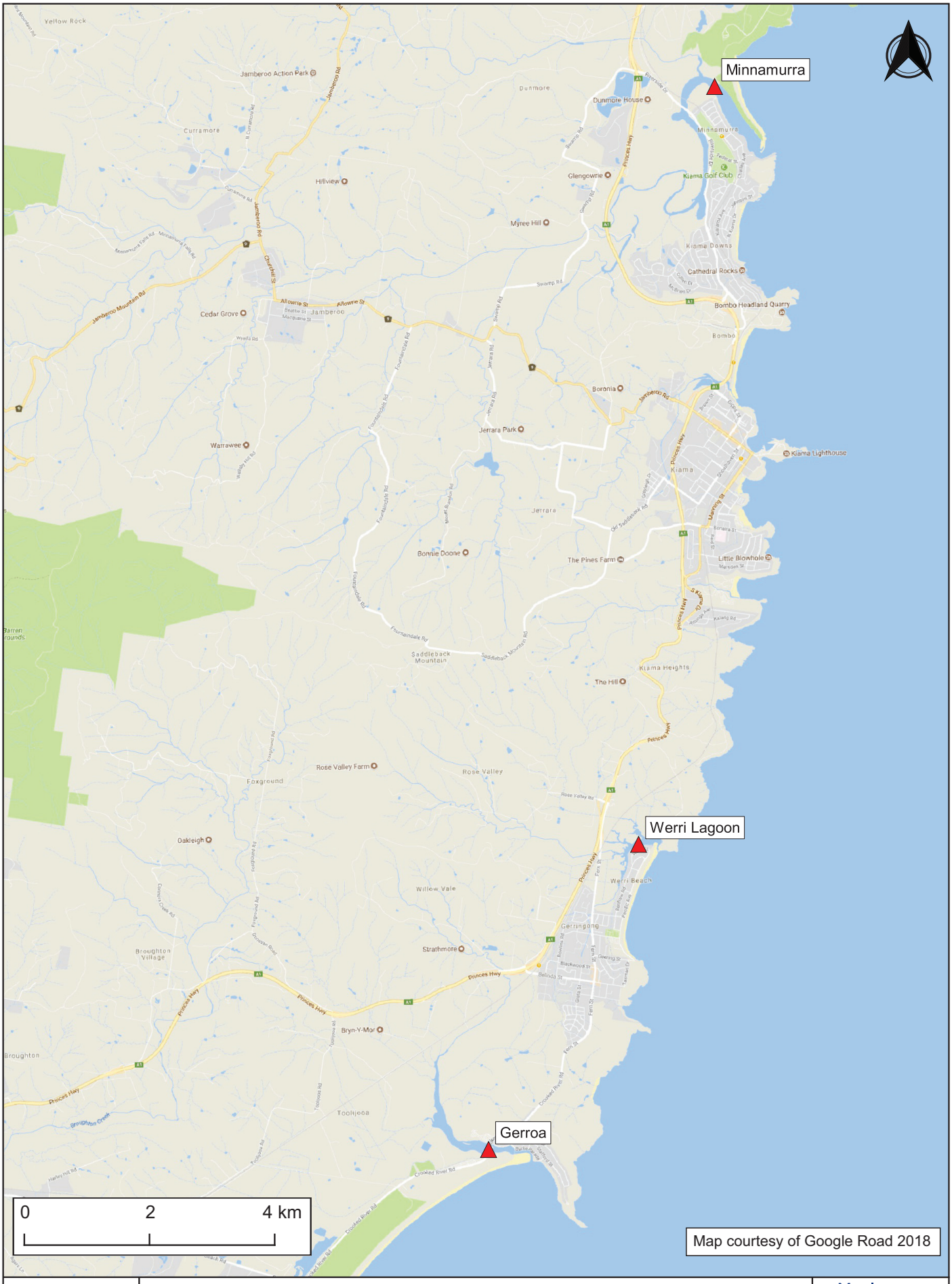


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Little Lake at Little Lake Entrance

MHL2786

Figure
A194



NSW GOVERNMENT

STATION LOCATIONS
KIAMA REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A195

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Minnamurra River at Minnamurra

RECORDING STATION: **Minnamurra River at Minnamurra**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 214442

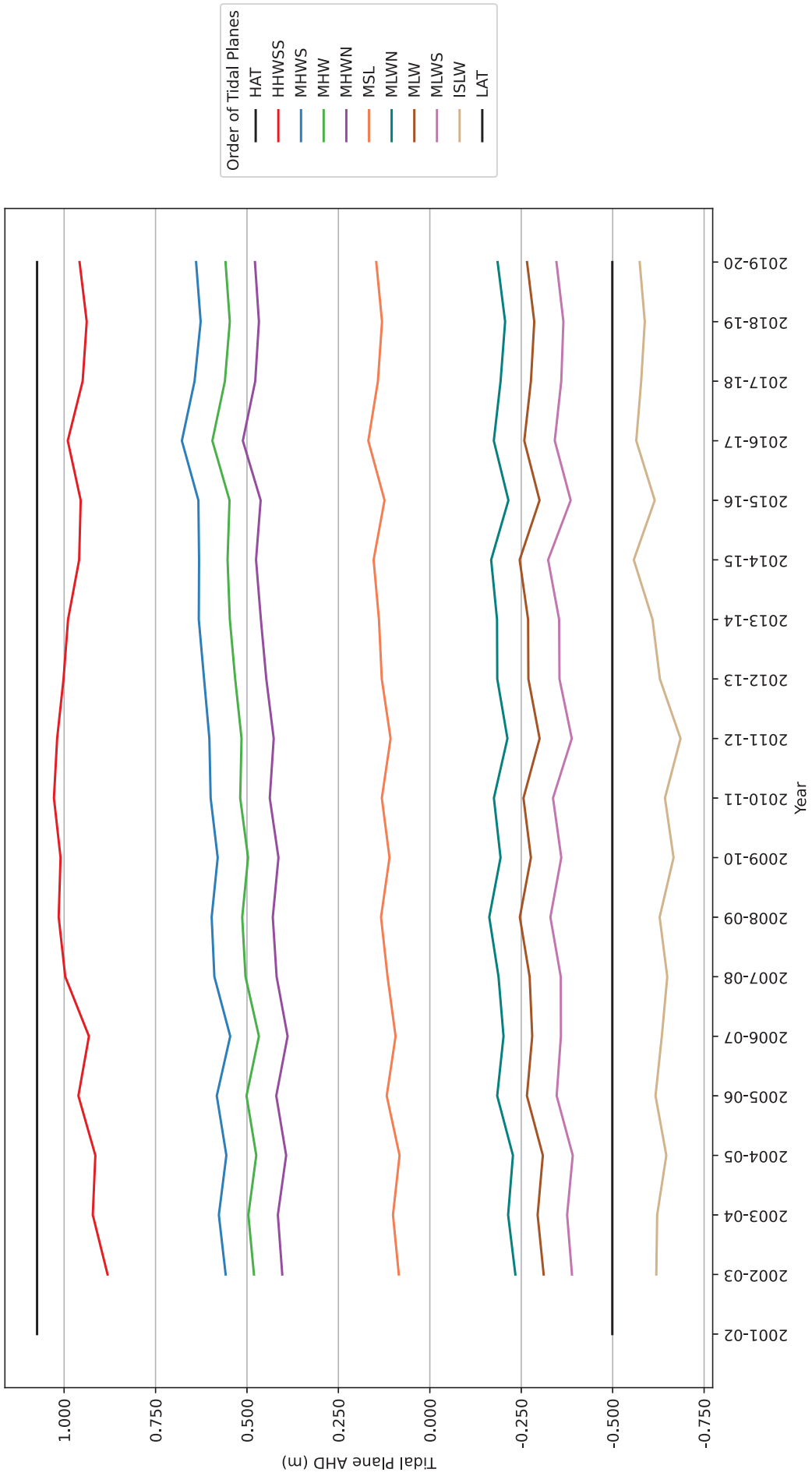
ZONE: 56
EASTING: 303031
NORTHING: 6167146

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.881	0.922	0.915	0.961	0.932	0.997	1.015	1.010	1.028	1.019	1.002	0.989	0.959	0.955	0.990	0.949	0.938	0.958	0.968	0.041
MHWS		0.558	0.577	0.556	0.583	0.546	0.589	0.597	0.580	0.599	0.603	0.617	0.632	0.631	0.633	0.678	0.643	0.627	0.639	0.605	0.035
MHW		0.481	0.496	0.475	0.501	0.467	0.504	0.513	0.497	0.519	0.515	0.532	0.547	0.553	0.548	0.595	0.560	0.547	0.559	0.523	0.034
MHWN		0.404	0.416	0.393	0.420	0.389	0.419	0.429	0.414	0.438	0.427	0.447	0.462	0.475	0.463	0.511	0.477	0.467	0.478	0.440	0.034
MSL		0.085	0.101	0.083	0.118	0.094	0.116	0.133	0.110	0.131	0.107	0.131	0.139	0.154	0.124	0.168	0.142	0.131	0.146	0.123	0.023
MLWN		-0.234	-0.214	-0.227	-0.184	-0.202	-0.188	-0.163	-0.193	-0.175	-0.212	-0.184	-0.184	-0.168	-0.215	-0.175	-0.193	-0.206	-0.185	-0.195	0.020
MLW		-0.311	-0.295	-0.309	-0.266	-0.280	-0.273	-0.246	-0.276	-0.256	-0.300	-0.269	-0.269	-0.246	-0.300	-0.258	-0.276	-0.286	-0.266	-0.277	0.020
MLWS		-0.389	-0.375	-0.391	-0.347	-0.358	-0.358	-0.330	-0.360	-0.337	-0.388	-0.355	-0.354	-0.323	-0.385	-0.342	-0.359	-0.365	-0.346	-0.359	0.020
ISLW		-0.619	-0.622	-0.647	-0.617	-0.634	-0.649	-0.628	-0.666	-0.643	-0.686	-0.629	-0.609	-0.558	-0.615	-0.564	-0.578	-0.588	-0.574	-0.618	0.035
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.637	0.630	0.620	0.604	0.590	0.607	0.592	0.607	0.613	0.639	0.632	0.646	0.643	0.678	0.686	0.671	0.673	0.664	0.635	0.030
MR		0.792	0.791	0.784	0.767	0.747	0.777	0.759	0.773	0.775	0.815	0.802	0.816	0.799	0.848	0.853	0.837	0.833	0.824	0.799	0.031
MSR		0.947	0.952	0.947	0.929	0.904	0.947	0.926	0.940	0.936	0.991	0.972	0.985	0.955	1.018	1.020	1.003	0.992	0.985	0.964	0.033
R		1.501	1.543	1.561	1.578	1.567	1.646	1.643	1.676	1.671	1.705	1.631	1.598	1.517	1.570	1.555	1.527	1.526	1.532	1.586	0.062
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.396	0.395	0.392	0.383	0.374	0.388	0.380	0.387	0.387	0.408	0.401	0.408	0.399	0.424	0.426	0.418	0.416	0.412	0.400	0.016
S2		0.077	0.081	0.082	0.081	0.078	0.085	0.084	0.083	0.081	0.088	0.085	0.085	0.078	0.085	0.083	0.083	0.080	0.080	0.082	0.003
K1		0.137	0.149	0.151	0.158	0.162	0.170	0.174	0.175	0.174	0.174	0.163	0.155	0.142	0.142	0.138	0.135	0.136	0.138	0.154	0.015
O1		0.093	0.098	0.105	0.112	0.114	0.121	0.125	0.132	0.132	0.123	0.112	0.101	0.092	0.088	0.085	0.084	0.087	0.089	0.105	0.017
MSF		0.043	0.054	0.023	0.032	0.019	0.034	0.021	0.030	0.023	0.042	0.020	0.031	0.028	0.036	0.038	0.042	0.025	0.039	0.032	0.010
z0		0.085	0.101	0.083	0.118	0.094	0.116	0.133	0.110	0.131	0.107	0.131	0.139	0.154	0.124	0.168	0.142	0.131	0.146	0.123	0.023
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		17.772	16.615	17.129	16.664	17.054	12.933	13.326	11.682	10.216	9.439	11.148	8.766	12.219	9.769	9.910	13.256	13.638	14.235	13.098	2.958
S2		297.038	293.995	292.741	291.520	294.834	290.937	292.902	291.499	293.464	291.294	293.481	290.987	296.552	291.816	289.919	293.707	293.066	293.657	292.967	1.898
K1		149.683	148.904	149.137	148.422	147.992	142.347	140.494	137.728	133.231	128.339	128.005	126.874	130.636	130.078	133.553	139.291	142.589	144.595	138.994	8.182
O1		205.363	203.224	204.268	203.578	206.721	205.025	210.108	212.489	219.485	221.606	226.186	225.562	230.328	221.646	214.953	212.813	209.464	205.766	213.255	8.815
MSF		286.190	283.828	265.891	300.945	283.179	282.410	302.073	280.847	283.213	278.020	298.931	275.054	294.742	267.739	285.628	278.400	291.979	268.143	283.734	10.919
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.090	0.073	0.083	0.087	0.091	0.078	0.071	0.086	0.080	0.073	0.089	0.081	0.080	0.075	0.065	0.078	0.093	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		87.7	96.8	98.3	93.1	95.1	97.2	90.4	97.4	87.2	96.4	91.9	91.7	91.3	93.5	89.2	92.3	96.7	93.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.07	04/06/2004 21:45	±0.19	5.8
Lowest Astronomical Tide (LAT)	-0.50	08/10/2014 03:00		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Mar 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Minnamurra River at Minnamurra

MHL2786

Figure A196

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Crooked River at Gerroa

RECORDING STATION: **Crooked River at Gerroa**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215410

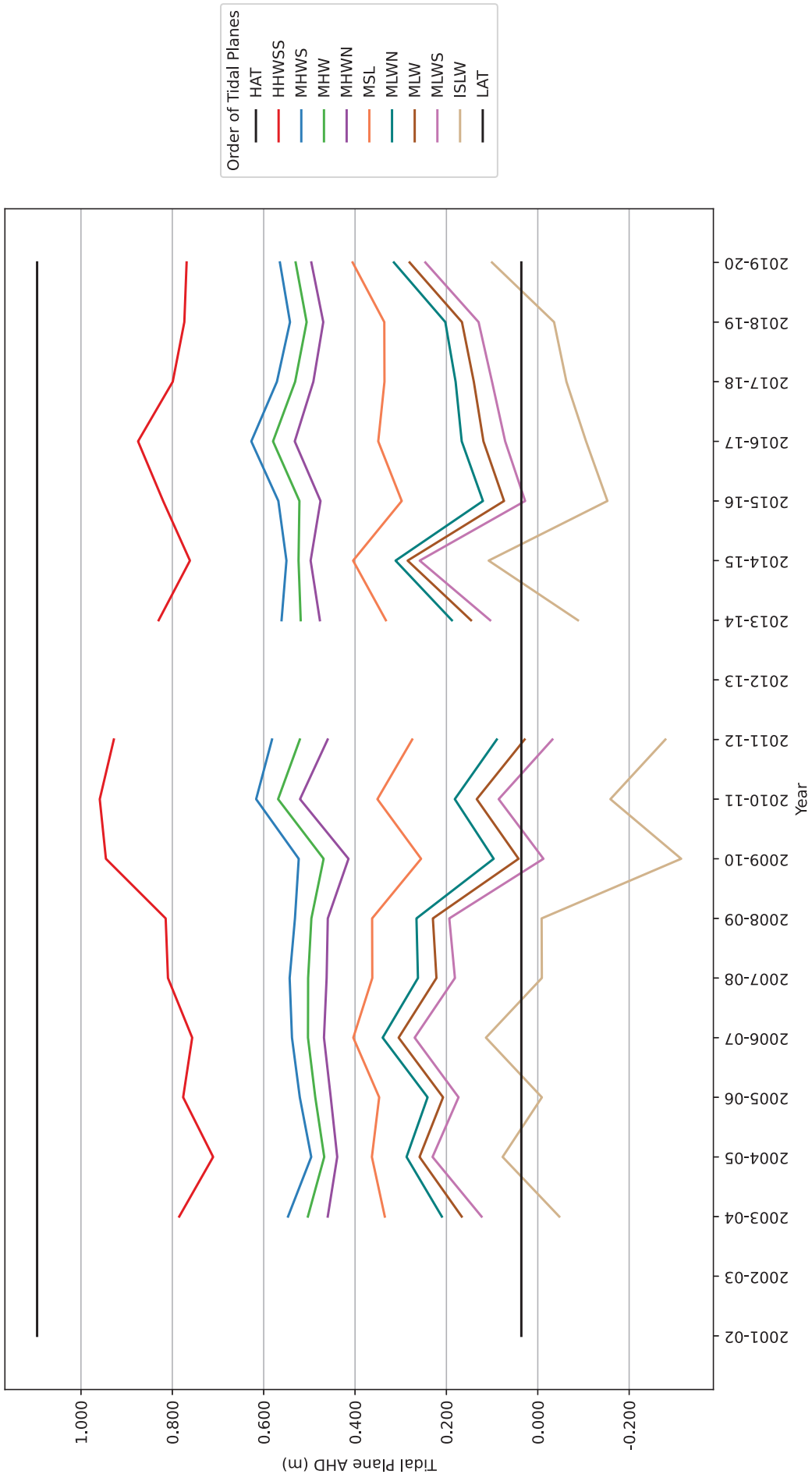
ZONE: 56
EASTING: 299419
NORTHING: 6150158

YEAR	2001-02	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.729		0.785	0.711	0.776	0.757	0.810	0.815	0.945	0.959	0.928		0.830	0.761	0.820	0.875	0.799	0.774	0.769	0.814	0.073
MHWS	0.549		0.547	0.496	0.521	0.538	0.543	0.532	0.523	0.617	0.582		0.561	0.550	0.568	0.627	0.571	0.542	0.565	0.555	0.033
MHW	0.516		0.503	0.467	0.487	0.503	0.503	0.496	0.469	0.568	0.521		0.519	0.524	0.522	0.580	0.531	0.506	0.530	0.514	0.029
MHWN	0.483		0.460	0.439	0.453	0.468	0.462	0.460	0.414	0.520	0.460		0.477	0.497	0.476	0.532	0.491	0.470	0.496	0.474	0.028
MSL	0.423		0.335	0.363	0.347	0.404	0.362	0.363	0.255	0.351	0.275		0.333	0.404	0.298	0.349	0.336	0.336	0.405	0.349	0.045
MLWN	0.363		0.210	0.287	0.241	0.340	0.262	0.266	0.097	0.182	0.090		0.188	0.311	0.120	0.166	0.180	0.202	0.315	0.225	0.083
MLW	0.331		0.167	0.259	0.207	0.305	0.222	0.230	0.042	0.134	0.029		0.146	0.285	0.074	0.119	0.140	0.166	0.281	0.184	0.091
MLWS	0.298		0.123	0.230	0.173	0.270	0.181	0.194	-0.012	0.086	-0.032		0.104	0.258	0.028	0.071	0.100	0.130	0.246	0.144	0.099
ISLW	0.169		-0.047	0.077	-0.009	0.114	-0.009	-0.008	-0.314	-0.159	-0.279		-0.088	0.108	-0.152	-0.106	-0.063	-0.036	0.100	-0.041	0.135
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.120		0.250	0.152	0.212	0.128	0.200	0.194	0.318	0.339	0.370		0.289	0.186	0.356	0.366	0.311	0.267	0.181	0.249	0.085
MR	0.186		0.337	0.209	0.280	0.198	0.281	0.266	0.427	0.435	0.492		0.373	0.239	0.448	0.461	0.391	0.340	0.250	0.330	0.100
MSR	0.251		0.424	0.266	0.347	0.269	0.362	0.338	0.536	0.531	0.614		0.457	0.292	0.540	0.556	0.471	0.413	0.318	0.411	0.116
R	0.560		0.832	0.634	0.785	0.643	0.818	0.823	1.259	1.118	1.207		0.918	0.654	0.973	0.981	0.862	0.809	0.668	0.856	0.203
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.093		0.168	0.104	0.140	0.099	0.140	0.133	0.213	0.217	0.246		0.186	0.119	0.224	0.230	0.196	0.170	0.125	0.165	0.050
S2	0.033		0.043	0.028	0.034	0.035	0.040	0.036	0.054	0.048	0.061		0.042	0.026	0.046	0.048	0.040	0.036	0.034	0.040	0.009
K1	0.069		0.090	0.081	0.096	0.081	0.096	0.105	0.154	0.126	0.130		0.105	0.080	0.099	0.099	0.092	0.090	0.078	0.098	0.021
O1	0.059		0.080	0.072	0.086	0.075	0.094	0.097	0.148	0.118	0.117		0.087	0.070	0.081	0.078	0.071	0.075	0.068	0.087	0.022
MSF	0.061		0.082	0.057	0.065	0.067	0.056	0.041	0.078	0.056	0.054		0.062	0.054	0.066	0.057	0.075	0.055	0.056	0.061	0.010
z0	0.423		0.335	0.363	0.347	0.404	0.362	0.363	0.255	0.351	0.275		0.333	0.404	0.298	0.349	0.336	0.336	0.405	0.349	0.045
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	41.182		23.579	37.685	30.622	37.698	22.948	27.679	24.642	14.784	11.569		26.940	34.910	18.312	21.977	25.491	31.578	37.904	27.618	8.527
S2	317.106		296.874	311.518	304.788	308.018	300.401	307.993	300.602	291.691	290.537		308.224	320.015	301.979	296.747	310.903	305.701	308.989	304.829	8.154
K1	183.332		176.324	184.087	178.646	177.965	163.047	163.992	159.410	148.563	139.634		147.909	161.532	145.218	149.983	162.426	168.503	174.232	163.812	13.995
O1	246.527		232.431	246.052	234.939	243.008	232.277	240.158	239.650	239.486	238.096		256.781	268.258	246.411	241.307	244.990	243.413	243.808	243.388	8.710
MSF	273.535		283.358	272.076	275.502	272.140	271.369	270.737	272.096	269.998	268.354		270.790	268.001	270.510	280.964	268.020	278.661	262.682	272.282	5.054
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077		0.087	0.076	0.077	0.074	0.073	0.085	0.120	0.101	0.081		0.088	0.079	0.086	0.075	0.101	0.088	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	57.9	12.2	69.2	89.1	80.0	62.7	97.4	86.9	91.5	80.1	95.8	44.1	94.0	88.1	91.3	66.7	95.4	98.5	87.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.10	04/06/2004 22:00	±0.24	22.6
Lowest Astronomical Tide (LAT)	0.04	17/02/2005 21:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

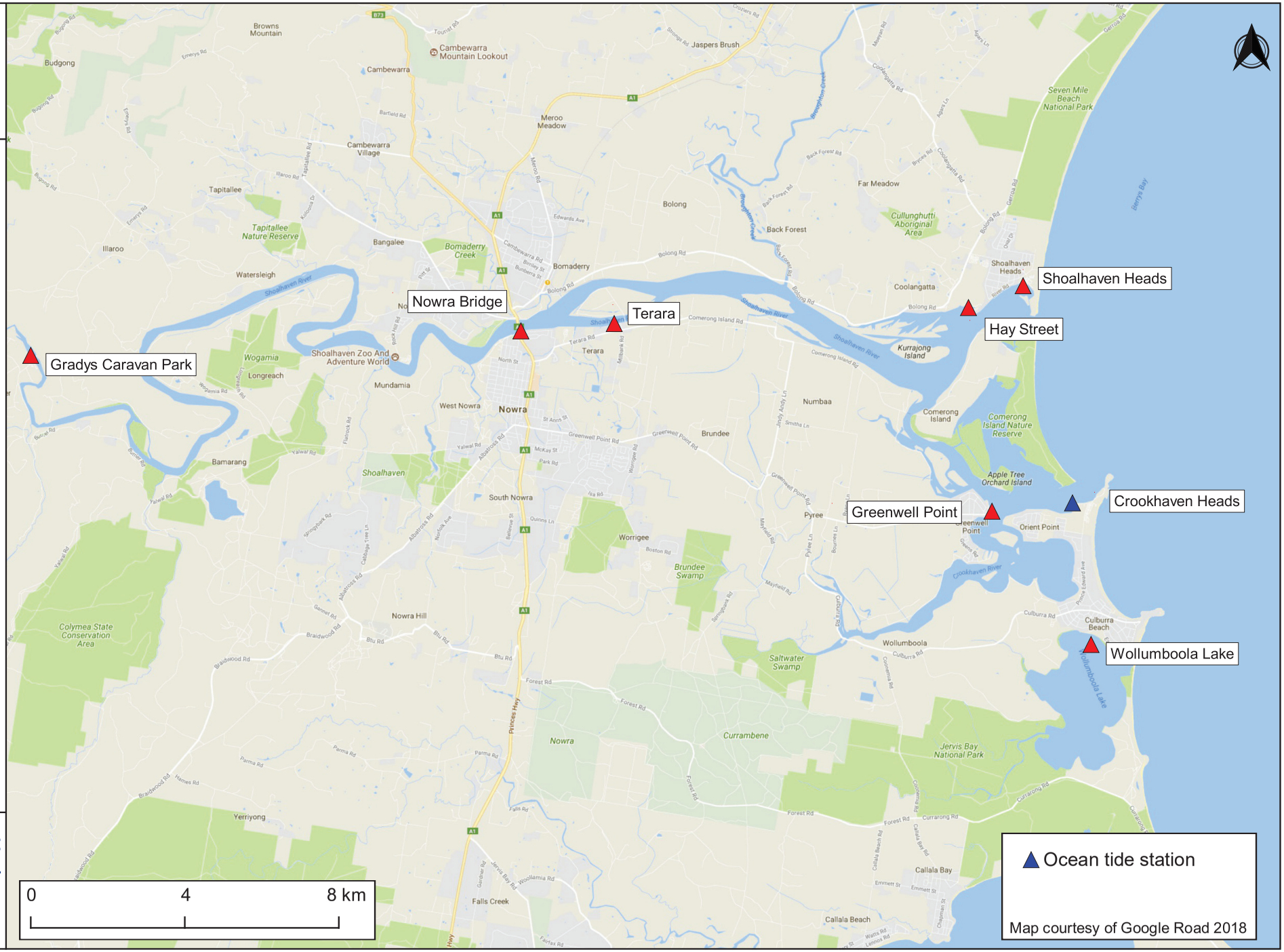
NSW TIDAL PLANE ANALYSIS
Crooked River at Gerroa

MHL2786

Figure A197

NSW GOVERNMENT

STATION LOCATIONS
SHOALHAVEN RIVER REGION



Manly Hydraulics Laboratory

Report MHL2786

Figure A198

DRAWING A198.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven River at Shoalhaven Heads

RECORDING STATION: **Shoalhaven River at Shoalhaven Heads**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215470

ZONE: 56
EASTING: 293877
NORTHING: 6140761

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.774	0.739	0.758	0.734	0.809	0.794	0.839	0.831	0.856	0.877	0.861	0.833	0.827	0.802	0.789	0.834	0.790	0.771	0.818	0.807	0.040
MHWS	0.496	0.452	0.460	0.418	0.478	0.451	0.475	0.456	0.481	0.507	0.508	0.502	0.519	0.514	0.506	0.556	0.524	0.501	0.536	0.491	0.034
MHW	0.437	0.389	0.397	0.354	0.414	0.385	0.409	0.389	0.414	0.442	0.443	0.437	0.453	0.453	0.443	0.491	0.458	0.437	0.468	0.427	0.034
MHWN	0.377	0.326	0.335	0.290	0.350	0.319	0.344	0.322	0.347	0.378	0.379	0.372	0.386	0.391	0.379	0.427	0.392	0.373	0.401	0.363	0.034
MSL	0.110	0.060	0.077	0.038	0.094	0.068	0.090	0.068	0.092	0.120	0.120	0.114	0.122	0.123	0.093	0.140	0.107	0.093	0.117	0.097	0.026
MLWN	-0.158	-0.207	-0.180	-0.215	-0.163	-0.184	-0.163	-0.187	-0.163	-0.139	-0.139	-0.145	-0.142	-0.146	-0.194	-0.146	-0.179	-0.186	-0.168	-0.169	0.023
MLW	-0.218	-0.270	-0.242	-0.279	-0.227	-0.250	-0.229	-0.254	-0.229	-0.203	-0.203	-0.210	-0.209	-0.208	-0.257	-0.211	-0.245	-0.250	-0.235	-0.233	0.023
MLWS	-0.277	-0.333	-0.305	-0.343	-0.291	-0.315	-0.294	-0.321	-0.296	-0.267	-0.267	-0.275	-0.275	-0.269	-0.320	-0.275	-0.310	-0.314	-0.302	-0.297	0.023
ISLW	-0.476	-0.538	-0.518	-0.568	-0.528	-0.561	-0.554	-0.589	-0.564	-0.532	-0.519	-0.512	-0.495	-0.474	-0.522	-0.474	-0.501	-0.507	-0.504	-0.523	0.033
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.535	0.533	0.515	0.505	0.513	0.503	0.507	0.509	0.510	0.517	0.518	0.517	0.529	0.538	0.573	0.573	0.571	0.559	0.569	0.531	0.025
MR	0.654	0.658	0.640	0.633	0.641	0.635	0.638	0.643	0.643	0.646	0.646	0.647	0.661	0.661	0.699	0.702	0.703	0.687	0.704	0.660	0.025
MSR	0.774	0.784	0.765	0.761	0.769	0.766	0.769	0.776	0.777	0.774	0.775	0.778	0.794	0.784	0.826	0.831	0.834	0.815	0.838	0.789	0.026
R	1.249	1.277	1.277	1.302	1.337	1.355	1.393	1.420	1.420	1.409	1.380	1.345	1.322	1.276	1.311	1.308	1.291	1.278	1.322	1.330	0.053
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.327	0.329	0.320	0.317	0.320	0.317	0.319	0.321	0.322	0.323	0.323	0.324	0.331	0.330	0.350	0.351	0.351	0.343	0.352	0.330	0.013
S2	0.060	0.063	0.063	0.064	0.064	0.066	0.065	0.067	0.067	0.064	0.064	0.065	0.066	0.061	0.063	0.064	0.066	0.064	0.067	0.064	0.002
K1	0.121	0.124	0.130	0.135	0.142	0.146	0.153	0.157	0.156	0.153	0.148	0.141	0.133	0.125	0.125	0.123	0.120	0.119	0.123	0.135	0.013
O1	0.078	0.081	0.083	0.090	0.095	0.099	0.107	0.111	0.112	0.112	0.104	0.095	0.087	0.080	0.078	0.075	0.070	0.074	0.079	0.090	0.014
MSF	0.033	0.028	0.038	0.019	0.025	0.008	0.027	0.013	0.019	0.010	0.036	0.011	0.015	0.015	0.029	0.029	0.036	0.012	0.023	0.022	0.010
z0	0.110	0.060	0.077	0.038	0.094	0.068	0.090	0.068	0.092	0.120	0.120	0.114	0.122	0.123	0.093	0.140	0.107	0.093	0.117	0.097	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	34.113	33.450	35.552	35.603	34.458	32.731	32.299	30.425	28.920	28.748	28.969	28.553	27.445	29.270	28.534	30.209	30.632	30.559	29.933	31.074	2.558
S2	305.475	304.647	305.889	304.497	304.398	303.116	304.522	303.968	303.598	305.413	305.722	304.211	305.025	306.151	304.649	304.124	303.606	302.988	302.111	304.427	1.059
K1	156.431	159.323	159.796	159.350	156.186	155.339	152.395	148.940	146.918	142.191	138.710	137.232	136.178	138.763	139.957	143.811	147.020	151.010	151.573	148.480	8.067
O1	216.896	213.999	213.817	214.255	213.320	214.805	216.155	219.392	222.853	228.707	232.229	234.553	235.096	236.132	232.342	224.623	222.206	217.512	212.988	222.204	8.428
MSF	283.955	280.359	276.296	252.030	348.435	253.523	293.653	318.242	281.429	326.127	282.802	326.645	279.921	312.605	272.842	300.700	286.941	300.323	270.151	291.946	25.329
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.074	0.081	0.072	0.080	0.092	0.093	0.076	0.069	0.093	0.088	0.067	0.083	0.077	0.081	0.072	0.065	0.080	0.094	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.8	92.7	97.3	97.3	66.0	96.4	98.0	98.4	97.9	97.0	94.1	92.1	85.4	92.9	90.8	93.0	97.4	98.5	91.2		

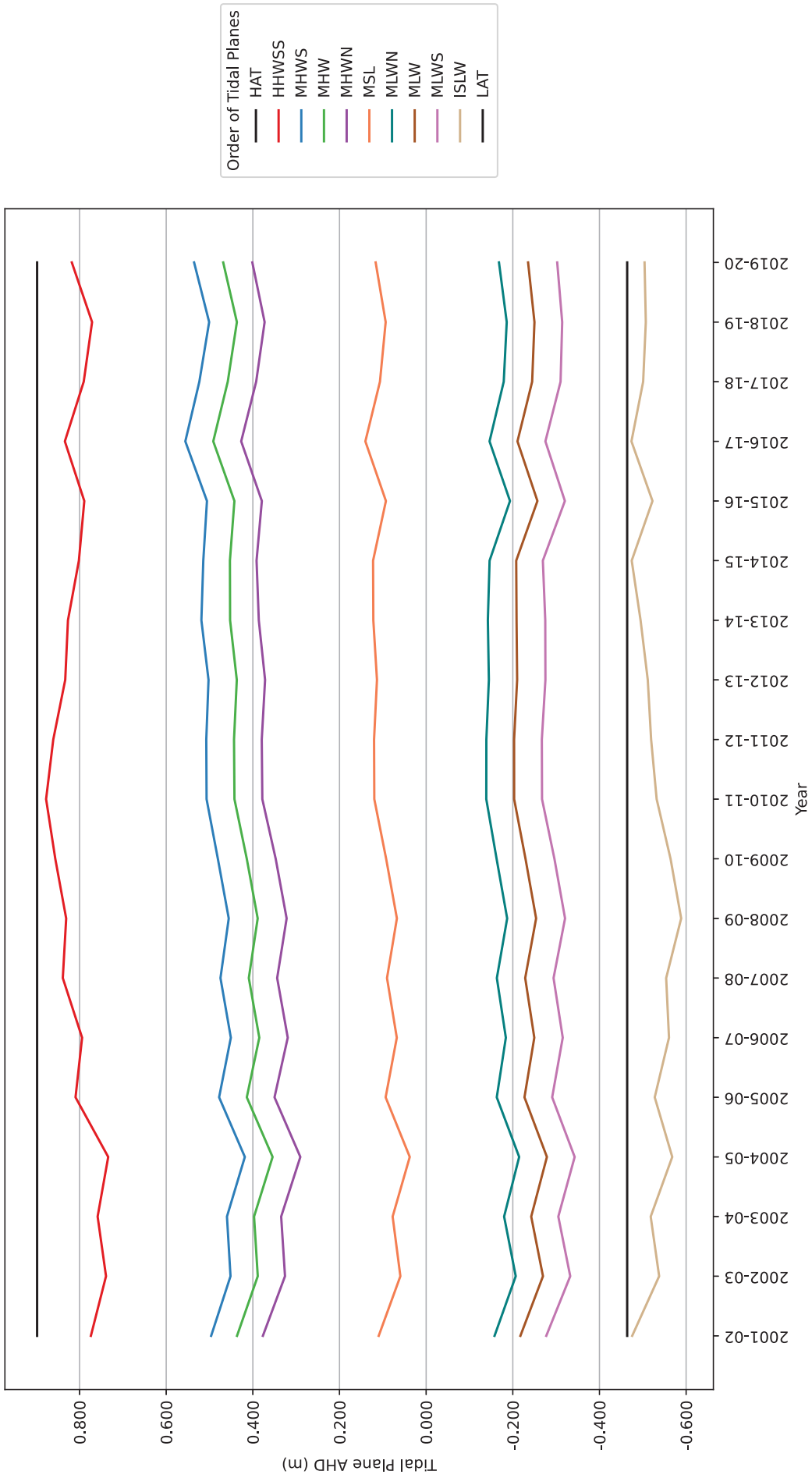
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.90	04/06/2004 22:30	±0.19	9.7
Lowest Astronomical Tide (LAT)	-0.46	10/09/2014 04:47		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A199

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven River at Shoalhaven Heads

MHL2786

Figure A199

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven River at Hay Street

RECORDING STATION: **Shoalhaven River at Hay Street**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215415

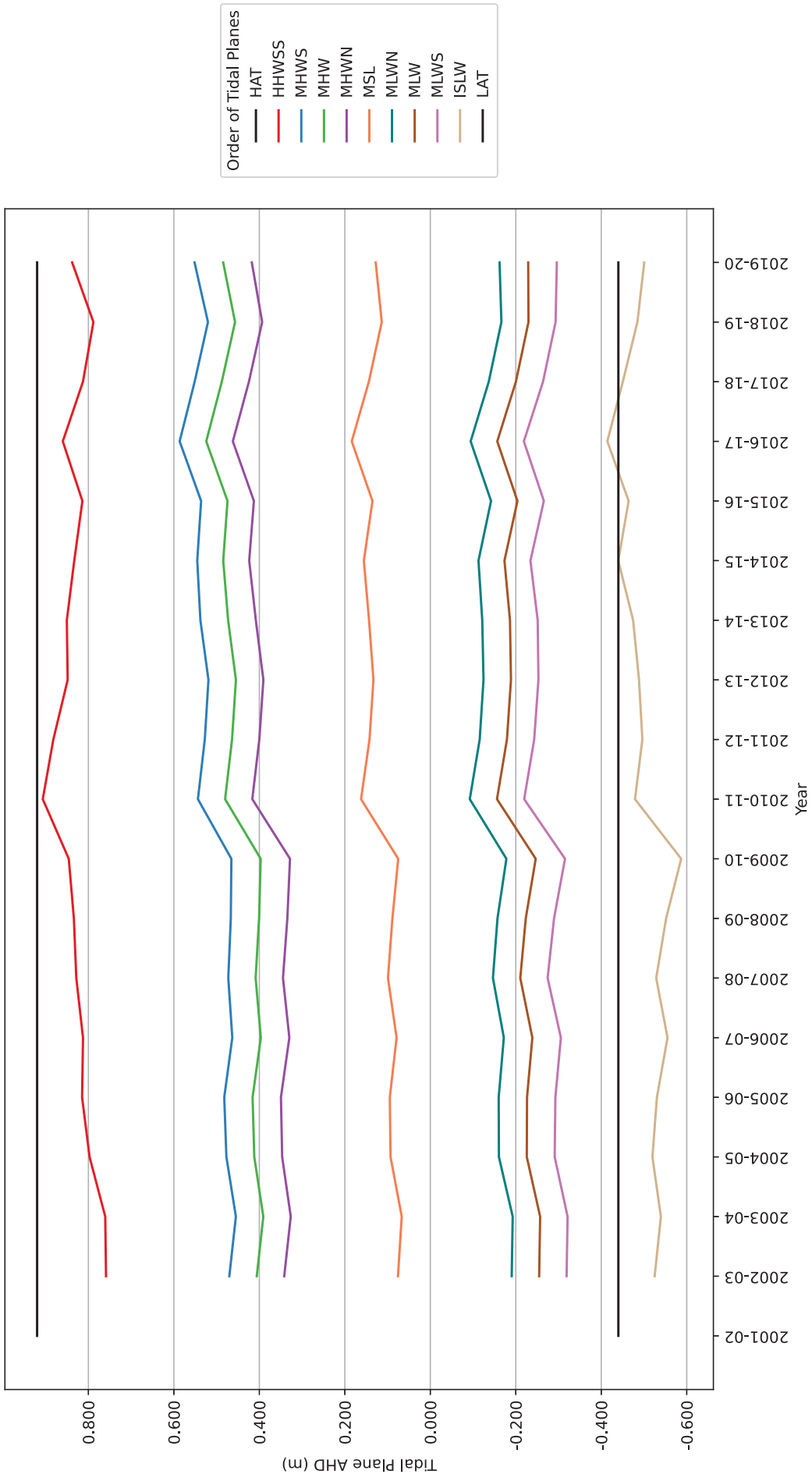
ZONE: 56
EASTING: 292468
NORTHING: 6140163

YEAR	2001-02*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS		0.759	0.761	0.797	0.815	0.813	0.828	0.834	0.846	0.907	0.882	0.849	0.850	0.833	0.814	0.860	0.813	0.788	0.838	0.827	0.038
MHWS		0.470	0.455	0.477	0.482	0.463	0.473	0.467	0.465	0.544	0.528	0.519	0.538	0.545	0.536	0.587	0.551	0.520	0.552	0.510	0.040
MHW		0.406	0.391	0.412	0.416	0.397	0.409	0.401	0.397	0.480	0.464	0.455	0.473	0.485	0.474	0.524	0.488	0.457	0.485	0.445	0.041
MHWN		0.342	0.327	0.347	0.349	0.330	0.345	0.335	0.328	0.416	0.400	0.391	0.408	0.424	0.413	0.462	0.424	0.393	0.418	0.381	0.043
MSL		0.076	0.067	0.093	0.095	0.079	0.099	0.089	0.075	0.162	0.142	0.133	0.143	0.156	0.135	0.184	0.144	0.114	0.128	0.117	0.035
MLWN		-0.190	-0.193	-0.161	-0.160	-0.172	-0.147	-0.157	-0.178	-0.092	-0.116	-0.124	-0.122	-0.113	-0.142	-0.094	-0.137	-0.166	-0.162	-0.146	0.030
MLW		-0.255	-0.257	-0.226	-0.226	-0.239	-0.211	-0.223	-0.247	-0.156	-0.179	-0.189	-0.186	-0.173	-0.204	-0.157	-0.200	-0.230	-0.229	-0.210	0.032
MLWS		-0.319	-0.321	-0.291	-0.293	-0.305	-0.275	-0.289	-0.315	-0.220	-0.243	-0.253	-0.251	-0.234	-0.266	-0.219	-0.264	-0.293	-0.296	-0.275	0.033
ISLW		-0.525	-0.539	-0.520	-0.530	-0.555	-0.529	-0.552	-0.587	-0.479	-0.496	-0.488	-0.475	-0.440	-0.464	-0.414	-0.450	-0.485	-0.501	-0.502	0.045
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR		0.532	0.519	0.507	0.510	0.502	0.491	0.492	0.506	0.509	0.516	0.515	0.530	0.536	0.555	0.556	0.561	0.560	0.580	0.526	0.026
MR		0.661	0.648	0.638	0.642	0.635	0.619	0.624	0.643	0.636	0.643	0.644	0.659	0.658	0.678	0.681	0.688	0.687	0.714	0.655	0.025
MSR		0.789	0.776	0.768	0.775	0.769	0.747	0.756	0.781	0.763	0.771	0.772	0.789	0.780	0.802	0.805	0.815	0.813	0.848	0.784	0.025
R		1.284	1.300	1.317	1.345	1.368	1.357	1.386	1.433	1.386	1.378	1.337	1.325	1.273	1.278	1.274	1.263	1.273	1.339	1.329	0.049
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2		0.330	0.324	0.319	0.321	0.318	0.310	0.312	0.322	0.318	0.322	0.322	0.330	0.329	0.339	0.340	0.344	0.343	0.357	0.328	0.013
S2		0.064	0.064	0.065	0.066	0.067	0.064	0.066	0.069	0.064	0.064	0.064	0.065	0.061	0.062	0.062	0.063	0.063	0.067	0.064	0.002
K1		0.125	0.133	0.137	0.142	0.148	0.150	0.154	0.158	0.150	0.148	0.141	0.136	0.126	0.122	0.121	0.117	0.118	0.125	0.136	0.013
O1		0.081	0.085	0.092	0.096	0.102	0.104	0.108	0.114	0.110	0.105	0.095	0.087	0.079	0.076	0.074	0.070	0.073	0.080	0.091	0.014
MSF		0.036	0.037	0.016	0.025	0.008	0.027	0.011	0.022	0.010	0.037	0.013	0.020	0.014	0.029	0.024	0.034	0.011	0.021	0.022	0.010
z0		0.076	0.067	0.093	0.095	0.079	0.099	0.089	0.075	0.162	0.142	0.133	0.143	0.156	0.135	0.184	0.144	0.114	0.128	0.117	0.035
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2		33.081	35.019	34.852	34.198	32.122	31.779	29.800	28.142	28.604	28.769	28.336	26.954	28.929	28.299	29.944	30.205	29.995	29.552	30.477	2.458
S2		306.118	307.396	305.825	305.599	304.525	305.829	305.204	305.529	306.716	305.728	304.503	304.261	305.511	304.108	303.227	303.002	302.512	303.279	304.937	1.346
K1		158.397	160.551	159.413	157.441	155.539	152.583	148.862	148.321	142.617	138.913	137.282	136.318	138.548	140.327	144.162	146.850	151.312	151.177	148.256	8.083
O1		213.923	214.349	214.617	212.918	214.409	216.111	219.061	222.306	229.001	232.329	235.914	233.360	236.444	232.513	224.272	221.389	217.607	212.627	222.397	8.640
MSF		282.974	298.062	259.042	320.078	242.634	297.623	322.414	285.350	308.008	284.239	345.524	276.871	311.383	273.564	295.807	285.939	300.740	263.943	291.900	24.818
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
		0.088	0.065	0.081	0.095	0.093	0.073	0.067	0.085	0.079	0.066	0.082	0.080	0.078	0.068	0.061	0.072	0.091	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
		89.8	61.7	97.2	95.0	96.8	99.0	98.8	79.3	89.1	93.2	94.2	91.2	92.3	90.7	89.6	96.5	95.6	92.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.92	04/06/2004 22:30	±0.19	8.0
Lowest Astronomical Tide (LAT)	-0.44	10/09/2014 04:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Jan 2002.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven River at Hay Street

MHL2786

Figure A200

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven River at Terara

RECORDING STATION: **Shoalhaven River at Terara**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215420

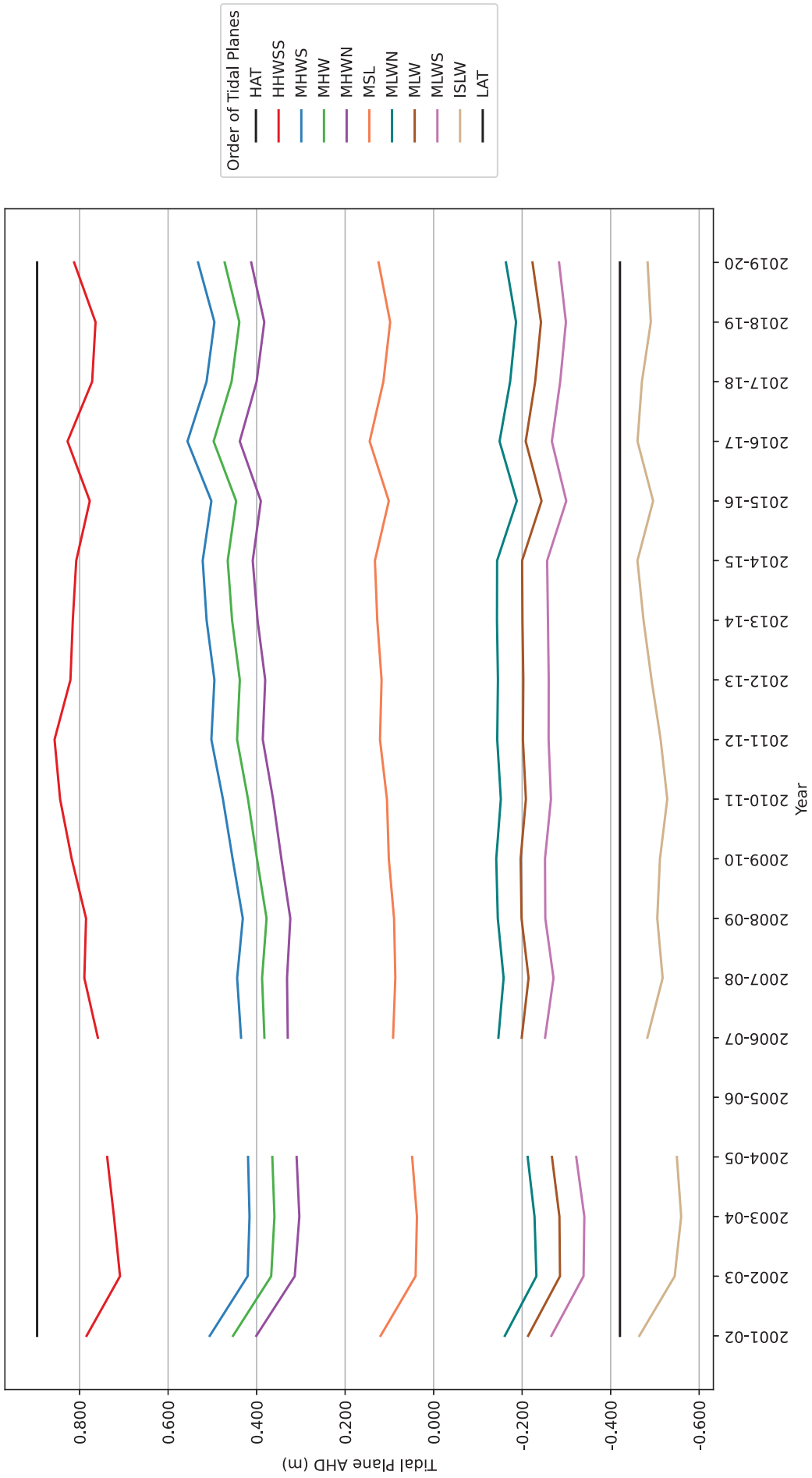
ZONE: 56
EASTING: 283258
NORTHING: 6139535

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06*	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.784	0.709	0.722	0.738		0.759	0.789	0.785	0.818	0.844	0.857	0.821	0.815	0.808	0.777	0.827	0.772	0.764	0.812	0.789	0.041
MHWS	0.506	0.420	0.416	0.419		0.435	0.444	0.431	0.454	0.476	0.502	0.495	0.513	0.522	0.502	0.556	0.513	0.495	0.532	0.480	0.044
MHW	0.453	0.367	0.360	0.364		0.382	0.388	0.378	0.399	0.419	0.444	0.438	0.455	0.465	0.446	0.497	0.457	0.439	0.472	0.424	0.042
MHWN	0.401	0.314	0.303	0.310		0.330	0.331	0.324	0.344	0.363	0.386	0.381	0.398	0.409	0.390	0.438	0.400	0.383	0.412	0.368	0.041
MSL	0.120	0.041	0.038	0.049		0.092	0.087	0.089	0.101	0.105	0.121	0.118	0.127	0.133	0.101	0.145	0.114	0.098	0.124	0.100	0.031
MLWN	-0.161	-0.232	-0.228	-0.212		-0.146	-0.158	-0.145	-0.141	-0.152	-0.144	-0.145	-0.143	-0.143	-0.188	-0.149	-0.173	-0.186	-0.163	-0.167	0.030
MLW	-0.213	-0.285	-0.284	-0.267		-0.199	-0.215	-0.199	-0.197	-0.208	-0.202	-0.203	-0.201	-0.200	-0.244	-0.208	-0.229	-0.243	-0.223	-0.223	0.030
MLWS	-0.266	-0.339	-0.341	-0.322		-0.252	-0.271	-0.252	-0.252	-0.265	-0.260	-0.260	-0.258	-0.256	-0.300	-0.267	-0.286	-0.299	-0.283	-0.279	0.029
ISLW	-0.465	-0.545	-0.559	-0.550		-0.483	-0.517	-0.505	-0.511	-0.528	-0.513	-0.492	-0.474	-0.461	-0.496	-0.461	-0.471	-0.491	-0.484	-0.500	0.031
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.562	0.546	0.531	0.522		0.476	0.489	0.469	0.486	0.515	0.530	0.526	0.541	0.552	0.578	0.587	0.573	0.569	0.576	0.535	0.037
MR	0.667	0.653	0.644	0.632		0.581	0.602	0.576	0.596	0.628	0.646	0.641	0.656	0.665	0.690	0.705	0.686	0.682	0.696	0.647	0.039
MSR	0.772	0.759	0.757	0.742		0.687	0.715	0.684	0.706	0.741	0.762	0.755	0.771	0.778	0.802	0.823	0.799	0.794	0.816	0.759	0.041
R	1.249	1.253	1.282	1.287		1.242	1.307	1.291	1.329	1.372	1.370	1.313	1.290	1.268	1.273	1.288	1.242	1.255	1.296	1.289	0.038
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.333	0.326	0.322	0.316		0.291	0.301	0.288	0.298	0.314	0.323	0.320	0.328	0.333	0.345	0.353	0.343	0.341	0.348	0.323	0.019
S2	0.053	0.053	0.056	0.055		0.053	0.056	0.054	0.055	0.057	0.058	0.057	0.058	0.057	0.056	0.059	0.057	0.056	0.060	0.056	0.002
K1	0.122	0.124	0.133	0.134		0.135	0.144	0.148	0.149	0.151	0.149	0.139	0.132	0.126	0.121	0.120	0.115	0.119	0.123	0.132	0.012
O1	0.077	0.082	0.086	0.093		0.096	0.102	0.105	0.111	0.112	0.104	0.093	0.084	0.078	0.075	0.073	0.069	0.073	0.077	0.088	0.014
MSF	0.037	0.030	0.036	0.017		0.010	0.026	0.008	0.022	0.011	0.035	0.016	0.024	0.016	0.028	0.027	0.031	0.012	0.025	0.023	0.009
z0	0.120	0.041	0.038	0.049		0.092	0.087	0.089	0.101	0.105	0.121	0.118	0.127	0.133	0.101	0.145	0.114	0.098	0.124	0.100	0.031
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	52.663	53.463	55.288	55.845		54.716	53.084	53.936	52.546	49.635	49.581	50.500	48.910	49.927	48.524	49.076	52.718	53.153	52.461	52.001	2.314
S2	328.676	328.333	329.450	328.749		334.093	332.774	333.649	334.211	333.952	333.445	332.577	332.559	333.515	331.802	330.483	334.405	333.900	332.250	332.157	2.091
K1	167.880	173.522	173.126	172.874		169.641	165.889	164.884	162.707	156.674	152.869	152.529	151.224	152.502	153.163	156.193	162.244	165.267	166.355	162.197	7.823
O1	229.016	224.943	224.214	224.789		227.960	226.997	231.945	236.474	240.757	244.389	246.699	245.832	246.719	243.019	233.046	233.636	228.941	223.768	234.064	8.445
MSF	294.218	275.712	288.526	270.424		107.279	299.195	315.843	292.914	307.151	277.631	345.273	280.290	299.225	279.605	296.872	284.933	299.008	267.891	282.333	47.360
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.078	0.083	0.077	0.084		0.088	0.072	0.067	0.091	0.084	0.067	0.082	0.079	0.075	0.069	0.062	0.074	0.085	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	78.2	99.6	99.1	95.8	21.8	64.1	98.2	95.7	96.9	97.1	91.6	93.9	90.3	90.3	91.1	91.7	98.6	97.9	91.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.90	04/06/2004 23:30	±0.18	12.3
Lowest Astronomical Tide (LAT)	-0.42	07/10/2014 03:15		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Aug 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven River at Terara

MHL2786

Figure A201

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven River at Nowra Bridge

RECORDING STATION: **Shoalhaven River at Nowra Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215411

ZONE: 56
EASTING: 280834
NORTHING: 6139287

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.837	0.764	0.823	0.792	0.847	0.773	0.857	0.815	0.830	0.873	0.875	0.829	0.837	0.835	0.805	0.858	0.794	0.785	0.818	0.824	0.032
MHWS	0.564	0.490	0.525	0.472	0.512	0.446	0.505	0.461	0.468	0.502	0.527	0.508	0.536	0.549	0.531	0.587	0.536	0.516	0.539	0.514	0.036
MHW	0.514	0.440	0.472	0.416	0.455	0.397	0.450	0.409	0.416	0.447	0.472	0.454	0.479	0.494	0.477	0.530	0.480	0.461	0.479	0.460	0.035
MHWN	0.465	0.390	0.418	0.360	0.398	0.347	0.395	0.358	0.363	0.393	0.417	0.400	0.423	0.438	0.422	0.472	0.424	0.405	0.420	0.406	0.034
MSL	0.201	0.139	0.152	0.098	0.133	0.110	0.142	0.120	0.124	0.132	0.157	0.138	0.153	0.163	0.133	0.177	0.136	0.120	0.132	0.140	0.024
MLWN	-0.063	-0.111	-0.115	-0.165	-0.133	-0.128	-0.111	-0.118	-0.115	-0.129	-0.103	-0.123	-0.117	-0.113	-0.156	-0.117	-0.151	-0.165	-0.155	-0.126	0.025
MLW	-0.113	-0.161	-0.168	-0.221	-0.190	-0.177	-0.166	-0.169	-0.167	-0.183	-0.158	-0.177	-0.173	-0.168	-0.211	-0.175	-0.207	-0.220	-0.215	-0.180	0.026
MLWS	-0.163	-0.211	-0.222	-0.276	-0.247	-0.227	-0.221	-0.221	-0.220	-0.238	-0.214	-0.232	-0.229	-0.223	-0.265	-0.233	-0.263	-0.276	-0.275	-0.234	0.028
ISLW	-0.358	-0.407	-0.434	-0.506	-0.486	-0.460	-0.472	-0.474	-0.478	-0.503	-0.463	-0.461	-0.444	-0.428	-0.461	-0.425	-0.448	-0.468	-0.474	-0.455	0.035
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.528	0.501	0.533	0.525	0.531	0.475	0.505	0.476	0.478	0.521	0.520	0.523	0.540	0.551	0.578	0.589	0.575	0.570	0.575	0.531	0.035
MR	0.627	0.601	0.640	0.636	0.645	0.574	0.616	0.579	0.583	0.630	0.630	0.631	0.652	0.662	0.687	0.704	0.687	0.681	0.694	0.640	0.039
MSR	0.727	0.701	0.747	0.748	0.759	0.673	0.726	0.681	0.688	0.739	0.741	0.739	0.765	0.773	0.796	0.820	0.800	0.792	0.813	0.749	0.044
R	1.194	1.171	1.257	1.298	1.333	1.233	1.329	1.289	1.309	1.377	1.338	1.290	1.281	1.263	1.267	1.283	1.242	1.252	1.292	1.279	0.049
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.314	0.301	0.320	0.318	0.323	0.287	0.308	0.289	0.291	0.315	0.315	0.316	0.326	0.331	0.344	0.352	0.344	0.340	0.347	0.320	0.020
S2	0.050	0.050	0.054	0.056	0.057	0.049	0.055	0.051	0.052	0.055	0.055	0.054	0.056	0.055	0.055	0.058	0.056	0.055	0.060	0.054	0.003
K1	0.119	0.118	0.129	0.136	0.141	0.138	0.146	0.148	0.147	0.153	0.146	0.137	0.130	0.125	0.121	0.120	0.116	0.119	0.121	0.132	0.012
O1	0.076	0.078	0.084	0.093	0.098	0.096	0.105	0.106	0.111	0.113	0.103	0.092	0.085	0.079	0.075	0.073	0.069	0.073	0.078	0.089	0.014
MSF	0.033	0.025	0.031	0.015	0.022	0.010	0.024	0.009	0.021	0.015	0.033	0.020	0.022	0.016	0.027	0.028	0.032	0.012	0.024	0.022	0.008
z0	0.201	0.139	0.152	0.098	0.133	0.110	0.142	0.120	0.124	0.132	0.157	0.138	0.153	0.163	0.133	0.177	0.136	0.120	0.132	0.140	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	64.239	65.905	65.040	66.295	65.315	65.240	61.650	63.418	63.209	59.715	57.588	57.965	55.326	56.083	54.224	54.173	58.119	58.698	57.599	60.516	4.208
S2	343.623	345.229	344.249	343.372	344.507	346.510	343.334	347.160	348.274	345.796	341.927	342.143	340.368	341.036	338.748	336.799	340.888	340.788	338.432	342.799	3.103
K1	176.676	181.097	178.403	177.767	175.312	176.290	171.472	169.898	168.555	161.885	157.145	156.136	154.408	155.609	156.555	158.921	165.032	168.152	169.638	167.313	8.941
O1	233.138	230.782	225.917	228.668	228.677	232.522	230.308	235.775	241.332	244.491	247.774	250.516	249.618	248.620	244.857	234.617	235.549	231.311	225.614	236.847	8.434
MSF	292.384	296.556	291.962	254.375	312.806	266.996	298.281	313.312	289.203	305.232	285.710	346.344	285.166	302.295	280.236	300.280	284.134	302.110	264.030	293.232	20.332
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.062	0.084	0.081	0.086	0.090	0.084	0.072	0.066	0.081	0.087	0.064	0.084	0.079	0.078	0.070	0.062	0.074	0.088	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	73.6	80.4	82.8	92.3	91.2	95.1	97.3	98.8	93.8	93.2	91.8	95.5	91.8	90.9	91.2	92.0	99.4	99.1	94.3		

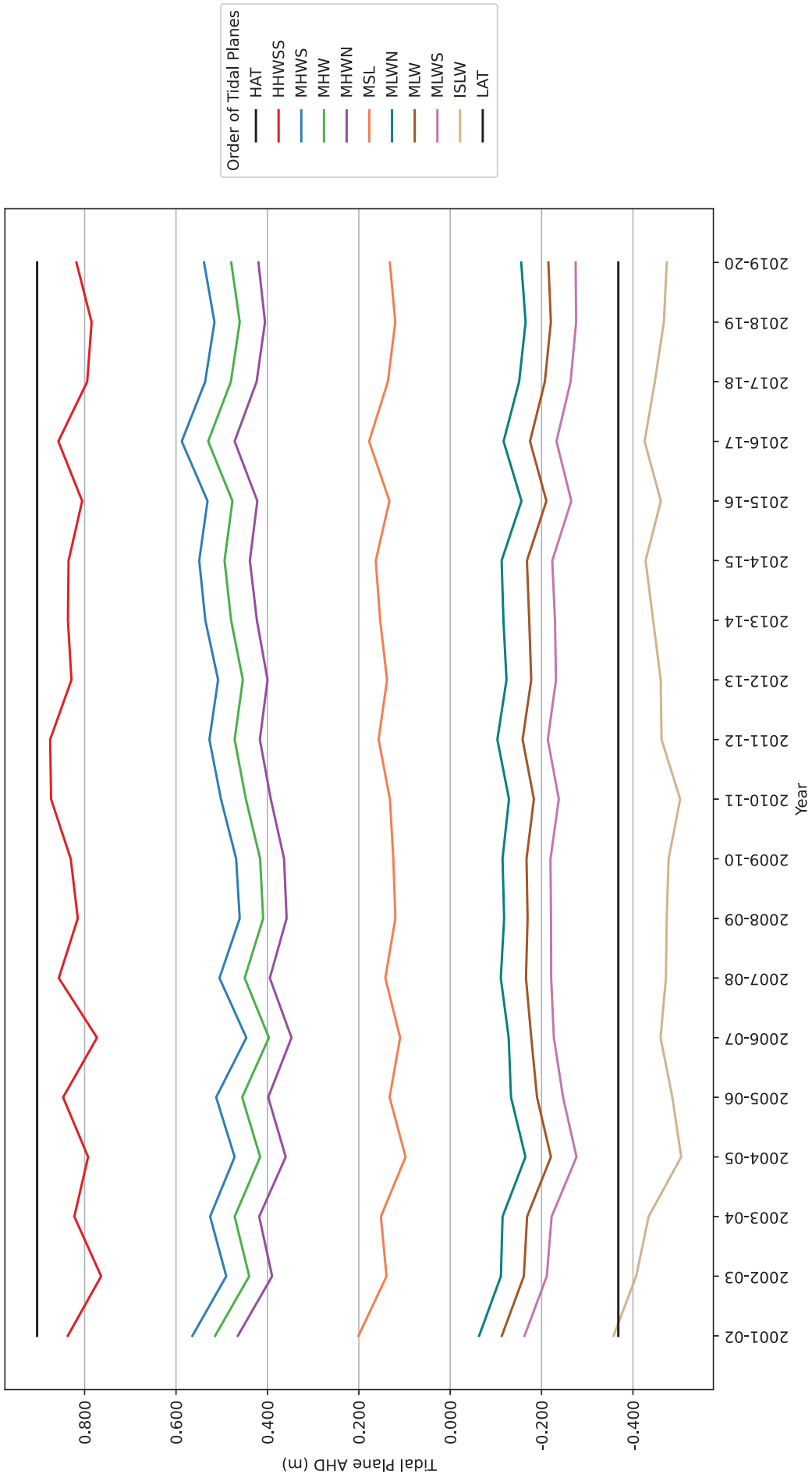
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.90	04/06/2004 23:30	±0.19	18.5
Lowest Astronomical Tide (LAT)	-0.37	07/10/2014 03:45		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A202

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven River at Nowra Bridge

MHL2786

Figure A202

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Shoalhaven River at Gradys Caravan Park

RECORDING STATION: **Shoalhaven River at Gradys Caravan Park**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215430

ZONE: 56
EASTING: 268094
NORTHING: 6138339

YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS						0.750	0.798	0.801	0.808	0.878	0.860	0.840	0.834	0.839	0.771	0.867	0.802	0.791	0.824	0.819	0.037
MHWS						0.424	0.444	0.441	0.427	0.532	0.528	0.518	0.540	0.557	0.504	0.602	0.537	0.515	0.541	0.508	0.054
MHW						0.366	0.385	0.381	0.367	0.476	0.472	0.460	0.478	0.498	0.449	0.539	0.473	0.451	0.474	0.448	0.053
MHWN						0.308	0.326	0.322	0.306	0.421	0.417	0.403	0.417	0.440	0.395	0.476	0.409	0.387	0.408	0.388	0.052
MSL						0.032	0.040	0.045	0.025	0.156	0.153	0.110	0.120	0.145	0.091	0.161	0.074	0.055	0.082	0.092	0.049
MLWN						-0.244	-0.245	-0.232	-0.256	-0.110	-0.111	-0.182	-0.177	-0.151	-0.213	-0.154	-0.260	-0.278	-0.245	-0.204	0.056
MLW						-0.302	-0.304	-0.291	-0.316	-0.165	-0.166	-0.240	-0.238	-0.209	-0.268	-0.217	-0.324	-0.342	-0.311	-0.264	0.058
MLWS						-0.360	-0.363	-0.350	-0.377	-0.221	-0.221	-0.297	-0.299	-0.267	-0.322	-0.279	-0.388	-0.405	-0.377	-0.323	0.061
ISLW						-0.594	-0.616	-0.608	-0.649	-0.468	-0.459	-0.527	-0.509	-0.469	-0.513	-0.469	-0.578	-0.603	-0.580	-0.546	0.065
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR						0.552	0.570	0.554	0.562	0.531	0.527	0.585	0.594	0.591	0.608	0.630	0.669	0.665	0.652	0.592	0.047
MR						0.668	0.689	0.672	0.683	0.642	0.638	0.700	0.716	0.707	0.717	0.756	0.797	0.792	0.785	0.712	0.053
MSR						0.784	0.807	0.791	0.805	0.752	0.749	0.815	0.839	0.824	0.826	0.881	0.925	0.920	0.918	0.831	0.059
R						1.344	1.415	1.408	1.456	1.347	1.318	1.367	1.343	1.308	1.285	1.336	1.381	1.394	1.404	1.365	0.048
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2						0.334	0.344	0.336	0.342	0.321	0.319	0.350	0.358	0.354	0.358	0.378	0.399	0.396	0.393	0.356	0.026
S2						0.058	0.059	0.059	0.061	0.055	0.055	0.057	0.061	0.058	0.055	0.063	0.064	0.064	0.066	0.060	0.004
K1						0.136	0.147	0.150	0.159	0.141	0.134	0.134	0.125	0.123	0.116	0.115	0.120	0.122	0.124	0.132	0.014
O1						0.097	0.107	0.107	0.112	0.106	0.103	0.097	0.085	0.078	0.075	0.075	0.070	0.075	0.078	0.090	0.015
MSF						0.011	0.024	0.012	0.025	0.017	0.033	0.024	0.028	0.026	0.033	0.030	0.030	0.015	0.029	0.024	0.007
z0						0.032	0.040	0.045	0.025	0.156	0.153	0.110	0.120	0.145	0.091	0.161	0.074	0.055	0.082	0.092	0.049
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2						92.939	90.615	90.113	91.242	88.913	89.858	88.409	88.852	87.550	88.511	86.755	88.025	88.725	93.495	89.571	1.952
S2						20.800	16.868	20.033	18.088	22.771	18.541	21.922	19.273	18.323	17.646	14.304	17.985	17.591	19.175	18.808	2.141
K1						192.197	185.703	183.134	187.155	174.959	174.958	172.929	172.318	171.122	174.004	177.173	181.577	183.383	189.264	179.991	6.932
O1						244.117	242.249	247.919	252.719	258.906	264.076	265.263	267.080	263.608	260.285	251.612	248.349	244.510	243.213	253.850	9.087
MSF						220.323	289.539	326.032	271.203	286.182	274.949	312.382	300.736	289.252	276.348	303.298	279.869	292.002	272.635	285.339	24.545
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
						0.101	0.075	0.074	0.072	0.084	0.078	0.095	0.090	0.087	0.089	0.068	0.079	0.092	0.077		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
						87.4	83.1	93.5	52.2	59.4	75.5	90.4	81.5	75.2	87.4	84.9	98.0	97.1	92.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.96	05/06/2008 00:00	±0.20	20.6
Lowest Astronomical Tide (LAT)	-0.50	17/10/2013 04:45		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from Gradys (AWRC: 215452) in Oct 2010.

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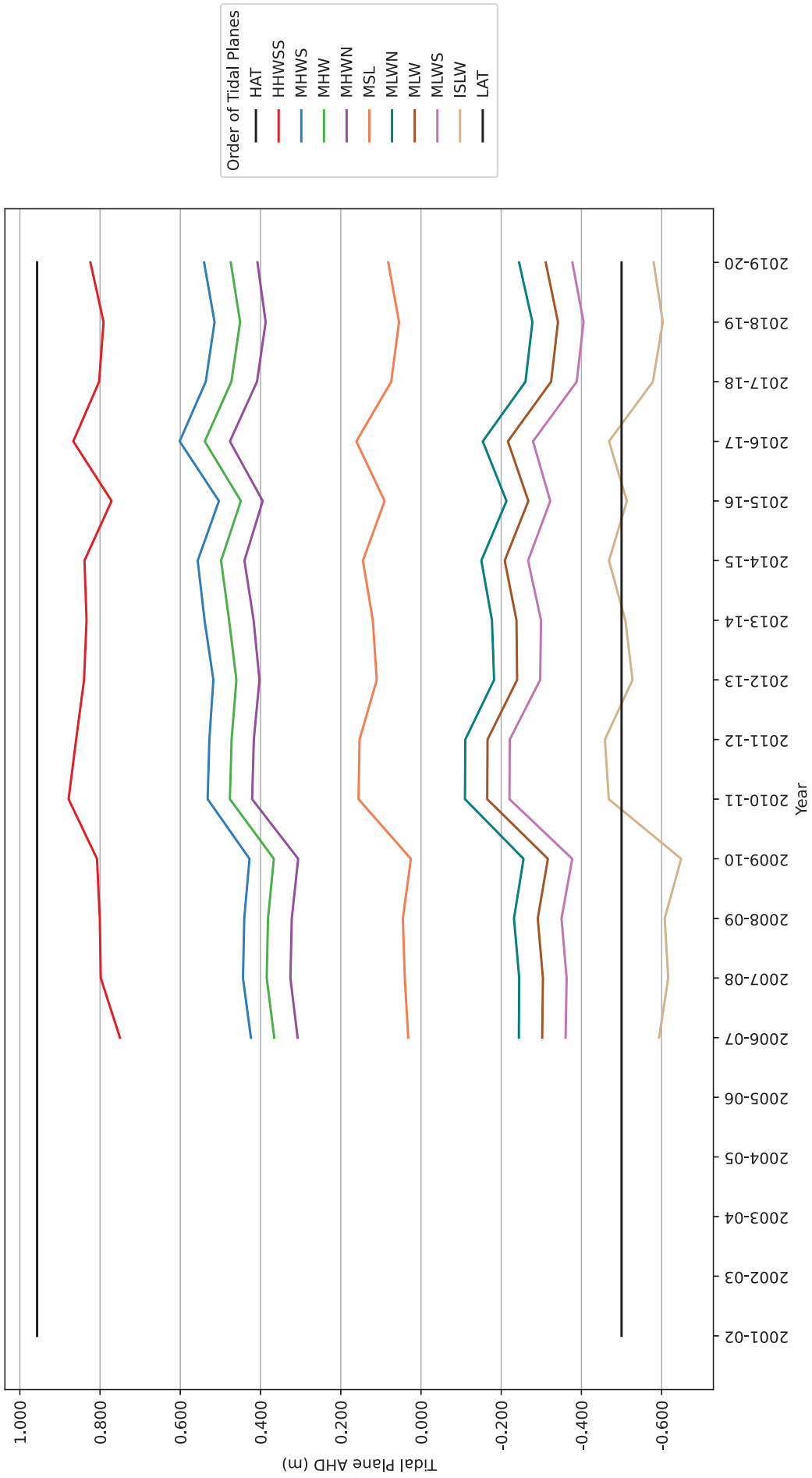


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Shoalhaven River at Gradys Caravan Park

MHL2786

Figure A203

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Crookhaven River at Greenwell Point

RECORDING STATION: **Crookhaven River at Greenwell Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 215417

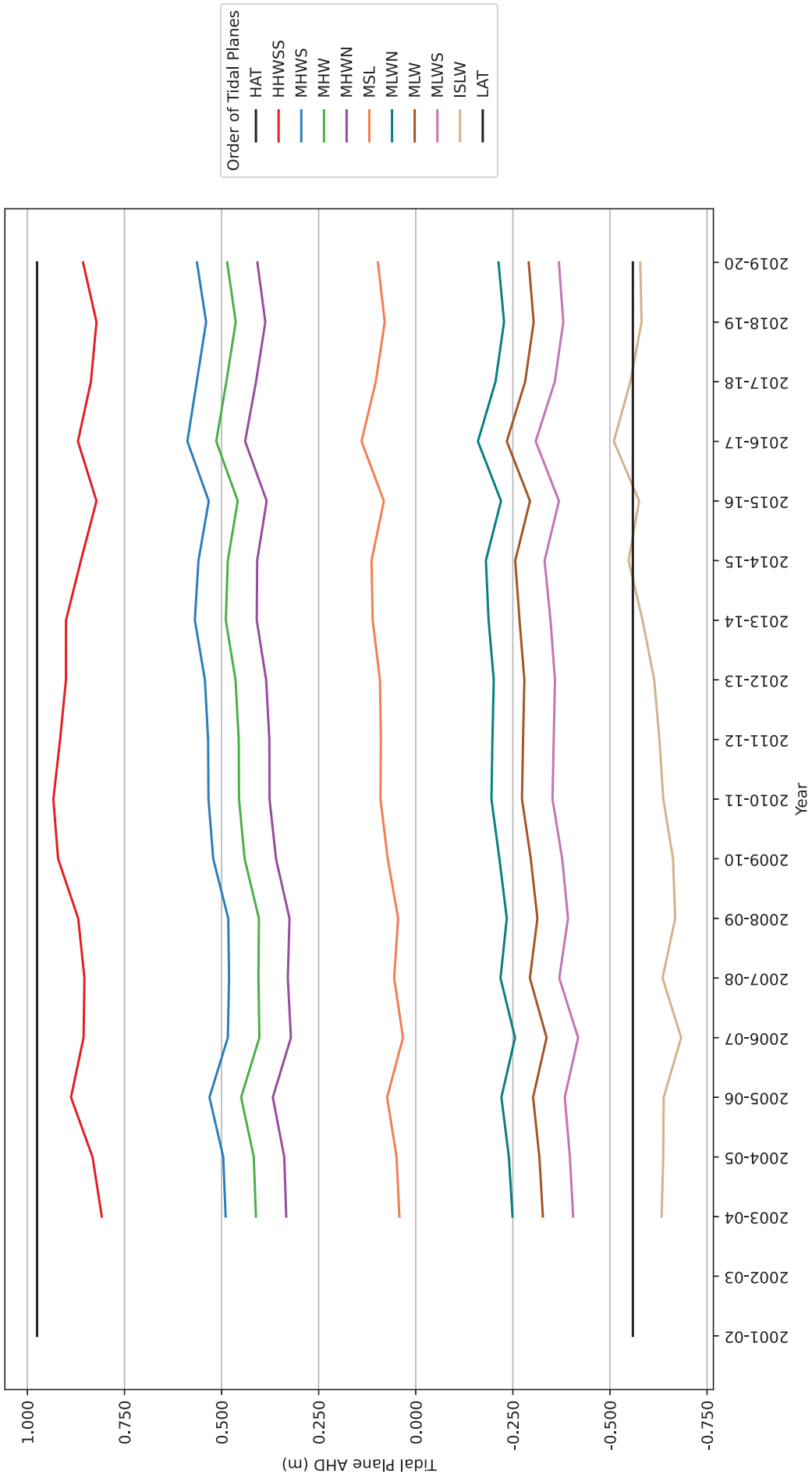
ZONE: 56
EASTING: 293199
NORTHING: 6134901

YEAR	2001-02	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.857		0.808	0.832	0.888	0.855	0.853	0.869	0.921	0.933	0.916	0.901	0.901	0.862	0.822	0.870	0.837	0.822	0.857	0.867	0.036
MHWS	0.561		0.490	0.496	0.531	0.484	0.481	0.483	0.522	0.534	0.535	0.543	0.569	0.560	0.533	0.588	0.564	0.540	0.563	0.532	0.033
MHW	0.488		0.412	0.417	0.450	0.403	0.405	0.404	0.441	0.455	0.456	0.464	0.489	0.484	0.458	0.514	0.488	0.464	0.486	0.454	0.034
MHWN	0.415		0.334	0.339	0.368	0.321	0.329	0.325	0.360	0.376	0.377	0.385	0.409	0.408	0.384	0.439	0.411	0.387	0.408	0.377	0.036
MSL	0.117		0.042	0.049	0.074	0.033	0.056	0.045	0.072	0.091	0.090	0.092	0.111	0.114	0.082	0.140	0.103	0.080	0.097	0.083	0.029
MLWN	-0.182		-0.249	-0.240	-0.221	-0.256	-0.218	-0.234	-0.215	-0.195	-0.197	-0.201	-0.188	-0.181	-0.220	-0.160	-0.205	-0.227	-0.213	-0.211	0.025
MLW	-0.255		-0.327	-0.318	-0.302	-0.337	-0.294	-0.313	-0.296	-0.274	-0.276	-0.280	-0.267	-0.256	-0.294	-0.234	-0.282	-0.304	-0.291	-0.289	0.027
MLWS	-0.328		-0.405	-0.397	-0.384	-0.418	-0.370	-0.392	-0.377	-0.352	-0.355	-0.358	-0.347	-0.332	-0.369	-0.309	-0.358	-0.380	-0.369	-0.367	0.028
ISLW	-0.539		-0.633	-0.637	-0.638	-0.683	-0.636	-0.668	-0.662	-0.637	-0.627	-0.614	-0.584	-0.548	-0.575	-0.510	-0.553	-0.582	-0.578	-0.606	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.597		0.583	0.578	0.589	0.577	0.548	0.560	0.575	0.571	0.574	0.586	0.597	0.589	0.603	0.599	0.617	0.615	0.621	0.588	0.019
MR	0.743		0.739	0.735	0.752	0.740	0.699	0.717	0.737	0.729	0.732	0.744	0.756	0.740	0.753	0.748	0.769	0.767	0.776	0.743	0.019
MSR	0.889		0.895	0.893	0.915	0.902	0.850	0.875	0.899	0.886	0.890	0.901	0.916	0.891	0.902	0.897	0.922	0.920	0.932	0.899	0.019
R	1.396		1.441	1.470	1.526	1.539	1.489	1.537	1.583	1.571	1.543	1.515	1.485	1.410	1.397	1.380	1.389	1.404	1.435	1.473	0.068
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.372		0.369	0.368	0.376	0.370	0.350	0.359	0.368	0.364	0.366	0.372	0.378	0.370	0.376	0.374	0.385	0.384	0.388	0.372	0.009
S2	0.073		0.078	0.079	0.082	0.081	0.076	0.079	0.081	0.079	0.079	0.079	0.080	0.076	0.075	0.074	0.076	0.076	0.078	0.078	0.002
K1	0.132		0.140	0.146	0.155	0.160	0.158	0.166	0.168	0.168	0.163	0.156	0.146	0.135	0.130	0.127	0.124	0.127	0.130	0.146	0.016
O1	0.079		0.088	0.094	0.100	0.105	0.108	0.110	0.117	0.117	0.109	0.100	0.091	0.081	0.077	0.075	0.071	0.075	0.079	0.093	0.016
MSF	0.026		0.030	0.012	0.017	0.004	0.022	0.008	0.017	0.010	0.033	0.014	0.018	0.013	0.025	0.023	0.029	0.007	0.019	0.018	0.008
z0	0.117		0.042	0.049	0.074	0.033	0.056	0.045	0.072	0.091	0.090	0.092	0.111	0.114	0.082	0.140	0.103	0.080	0.097	0.083	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	10.739		11.741	11.323	10.945	9.785	8.991	7.693	6.452	6.253	6.566	6.373	6.172	6.673	7.471	8.631	8.701	8.707	9.406	8.479	1.883
S2	280.532		281.840	280.124	279.998	279.462	280.220	280.820	280.609	281.870	281.450	280.204	282.060	282.205	281.407	281.506	281.439	280.553	280.998	280.961	0.797
K1	140.792		143.363	142.496	140.608	140.086	136.770	132.842	131.187	126.934	123.510	121.699	122.960	123.445	125.610	129.908	131.959	135.858	137.552	132.643	7.366
O1	200.354		196.122	197.170	196.507	197.813	200.183	202.363	206.003	212.706	217.118	219.093	219.070	220.896	217.211	210.288	205.616	201.638	198.804	206.609	8.920
MSF	277.287		289.473	243.953	334.065	268.610	298.765	328.772	277.604	348.648	279.706	2.264	265.638	317.739	273.040	301.587	283.547	313.675	267.333	276.206	73.656
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.070		0.088	0.084	0.091	0.098	0.079	0.077	0.089	0.081	0.068	0.084	0.079	0.077	0.069	0.061	0.073	0.089	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.5	40.9	78.1	98.8	93.8	96.7	98.4	99.3	98.4	98.6	97.0	95.8	91.4	93.4	94.2	94.1	97.5	98.3	93.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.97	04/06/2004 21:45	±0.19	5.9
Lowest Astronomical Tide (LAT)	-0.56	09/09/2014 03:15		

COMMENTS *No data collected for the period or insufficient data for meaningful analysis.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

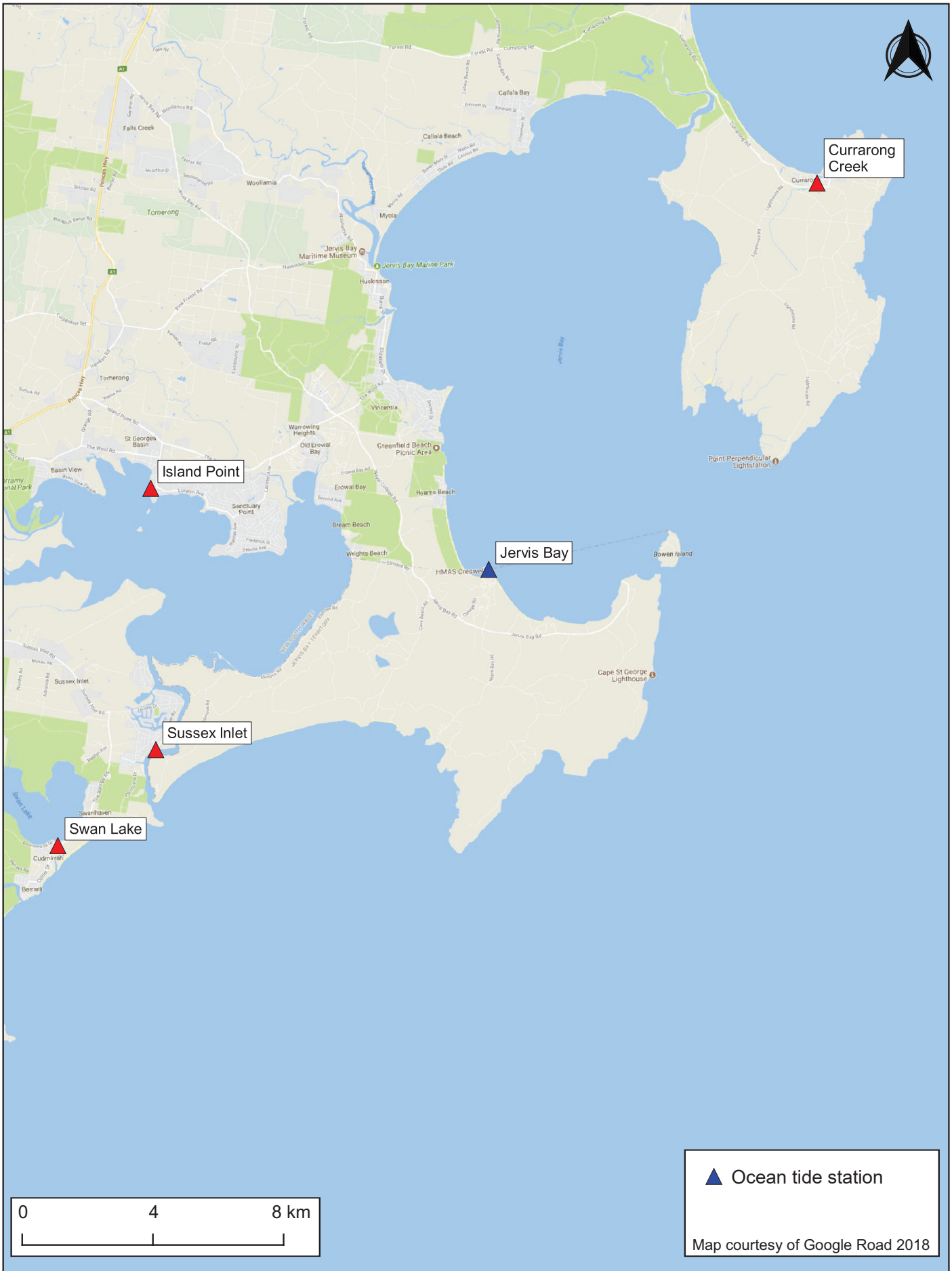


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Crookhaven River at Greenwell Point

MHL2786

Figure A204



NSW GOVERNMENT

STATION LOCATIONS
JERVIS BAY REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A205

DRAWING A205.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Currarong Creek at Currarong Creek

RECORDING STATION: **Currarong Creek at Currarong Creek**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216405

ZONE: 56
EASTING: 301142
NORTHING: 6122850

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.865	0.816	0.825	0.805	0.834	0.802	0.845	0.853	0.870	0.868	0.839	0.843	0.835	0.812	0.776	0.830	0.818	0.786	0.812	0.828	0.026
MHWS	0.589	0.531	0.541	0.512	0.529	0.496	0.517	0.491	0.522	0.539	0.526	0.539	0.550	0.547	0.530	0.586	0.573	0.538	0.558	0.538	0.026
MHW	0.519	0.463	0.471	0.447	0.465	0.435	0.453	0.427	0.458	0.487	0.465	0.482	0.490	0.488	0.473	0.525	0.506	0.475	0.493	0.475	0.026
MHWN	0.449	0.395	0.402	0.383	0.401	0.374	0.390	0.363	0.394	0.434	0.405	0.424	0.430	0.429	0.415	0.463	0.439	0.413	0.428	0.412	0.026
MSL	0.209	0.152	0.181	0.171	0.184	0.178	0.191	0.151	0.191	0.248	0.232	0.214	0.222	0.212	0.210	0.242	0.195	0.174	0.195	0.197	0.027
MLWN	-0.032	-0.091	-0.039	-0.041	-0.034	-0.019	-0.007	-0.062	-0.013	0.062	0.060	0.004	0.013	-0.006	0.006	0.020	-0.049	-0.065	-0.037	-0.017	0.040
MLW	-0.102	-0.160	-0.109	-0.106	-0.098	-0.080	-0.070	-0.126	-0.076	0.009	-0.000	-0.053	-0.047	-0.065	-0.052	-0.041	-0.116	-0.127	-0.102	-0.080	0.043
MLWS	-0.172	-0.228	-0.179	-0.170	-0.162	-0.141	-0.134	-0.190	-0.140	-0.044	-0.061	-0.111	-0.107	-0.124	-0.109	-0.102	-0.183	-0.190	-0.167	-0.143	0.047
ISLW	-0.369	-0.431	-0.381	-0.380	-0.379	-0.360	-0.368	-0.448	-0.388	-0.279	-0.285	-0.328	-0.310	-0.313	-0.285	-0.277	-0.358	-0.367	-0.349	-0.350	0.049
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.481	0.486	0.441	0.424	0.435	0.393	0.396	0.424	0.407	0.372	0.344	0.420	0.416	0.435	0.410	0.443	0.489	0.478	0.465	0.429	0.039
MR	0.621	0.622	0.580	0.553	0.563	0.515	0.523	0.552	0.534	0.478	0.465	0.535	0.537	0.553	0.525	0.565	0.622	0.603	0.595	0.555	0.045
MSR	0.762	0.758	0.720	0.682	0.691	0.637	0.651	0.680	0.662	0.583	0.586	0.650	0.657	0.671	0.639	0.688	0.756	0.727	0.725	0.680	0.052
R	1.234	1.247	1.206	1.184	1.213	1.162	1.213	1.301	1.258	1.147	1.124	1.172	1.145	1.125	1.061	1.107	1.177	1.152	1.161	1.178	0.058
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.311	0.311	0.290	0.277	0.281	0.258	0.262	0.276	0.267	0.239	0.233	0.268	0.268	0.277	0.262	0.283	0.311	0.301	0.298	0.277	0.023
S2	0.070	0.068	0.070	0.065	0.064	0.061	0.064	0.064	0.064	0.053	0.061	0.057	0.060	0.059	0.057	0.061	0.067	0.062	0.065	0.063	0.004
K1	0.112	0.115	0.114	0.117	0.120	0.119	0.126	0.140	0.132	0.124	0.118	0.117	0.111	0.105	0.097	0.099	0.100	0.101	0.102	0.114	0.012
O1	0.085	0.088	0.088	0.092	0.097	0.100	0.108	0.119	0.116	0.111	0.106	0.100	0.093	0.084	0.078	0.076	0.075	0.076	0.079	0.093	0.014
MSF	0.047	0.051	0.055	0.036	0.041	0.036	0.048	0.042	0.049	0.038	0.056	0.034	0.048	0.038	0.050	0.045	0.052	0.035	0.044	0.045	0.007
z0	0.209	0.152	0.181	0.171	0.184	0.178	0.191	0.151	0.191	0.248	0.232	0.214	0.222	0.212	0.210	0.242	0.195	0.174	0.195	0.197	0.027
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	0.712	359.936	0.018	0.879	2.514	359.564	359.394	2.344	357.808	357.354	356.994	355.472	355.310	355.005	354.102	355.826	357.271	357.466	359.383	263.545	161.029
S2	269.634	270.206	267.631	266.253	272.788	268.945	270.767	271.720	269.792	271.603	268.544	269.955	266.958	267.988	266.087	267.202	269.630	268.839	269.223	269.146	1.851
K1	139.775	141.939	142.010	141.658	141.857	140.304	138.026	135.025	131.579	129.122	125.810	121.014	121.125	120.517	123.665	127.505	130.594	135.514	139.368	132.969	7.896
O1	208.111	204.198	205.196	204.715	205.093	207.143	208.888	212.272	215.586	222.201	228.210	228.526	228.914	228.982	226.154	219.656	215.453	212.467	210.437	215.379	9.250
MSF	275.923	274.841	274.634	261.502	280.246	269.125	276.197	273.878	275.646	281.183	274.506	282.828	265.338	279.789	273.356	280.502	275.964	281.735	271.680	275.204	5.547
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.063	0.070	0.062	0.067	0.076	0.075	0.062	0.069	0.072	0.061	0.055	0.067	0.064	0.063	0.057	0.054	0.063	0.074	0.061		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	82.3	97.6	96.5	99.3	95.9	98.2	99.2	86.8	93.6	91.0	95.1	92.3	88.0	94.6	93.7	93.5	96.3	97.6	94.4		

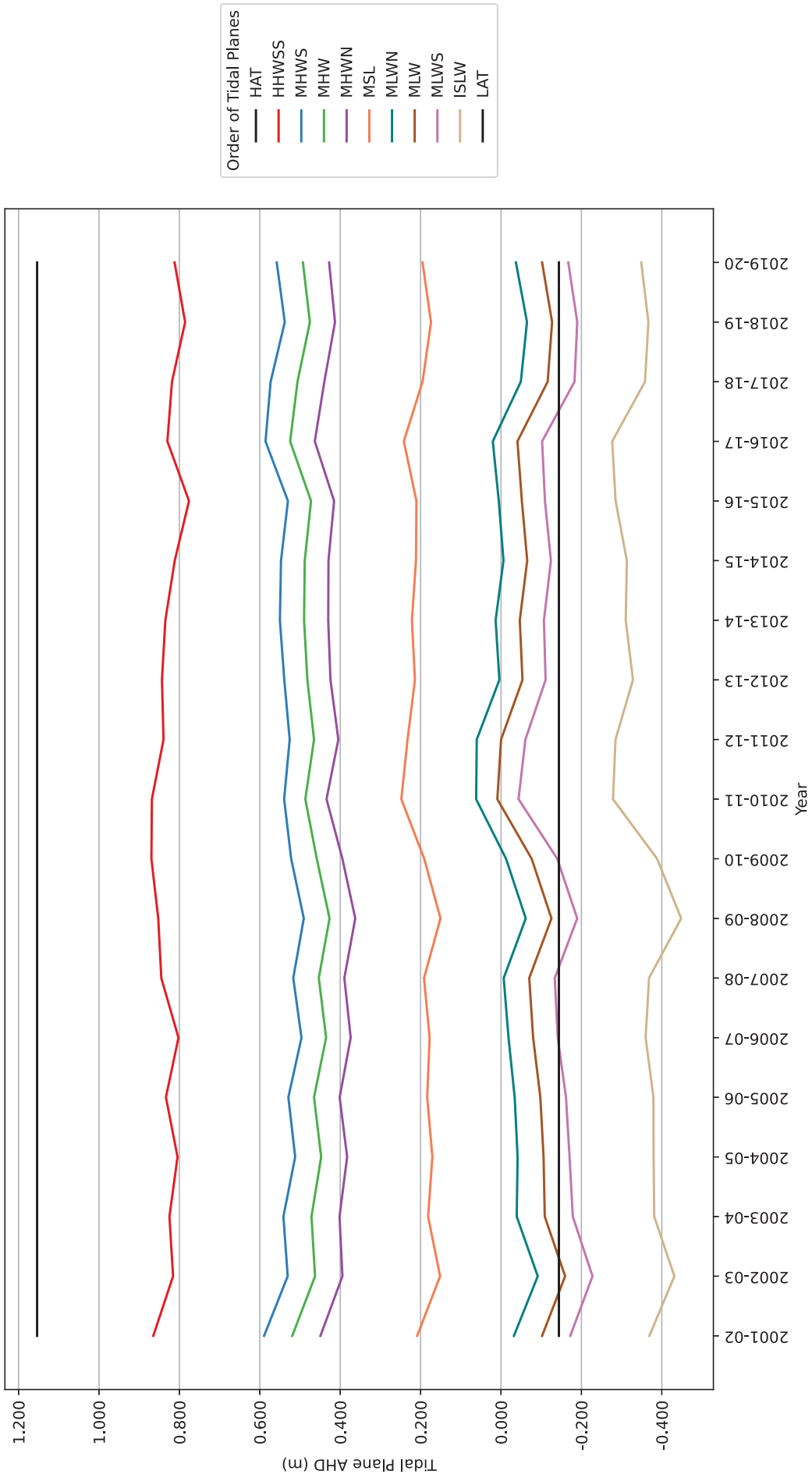
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.15	04/06/2004 21:15	±0.17	3.1
Lowest Astronomical Tide (LAT)	-0.14	06/10/2003 01:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A206

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Currarong Creek at Currarong Creek

MHL2786

Figure A206

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Sussex Inlet at Sussex Inlet

RECORDING STATION: **Sussex Inlet at Sussex Inlet**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216412

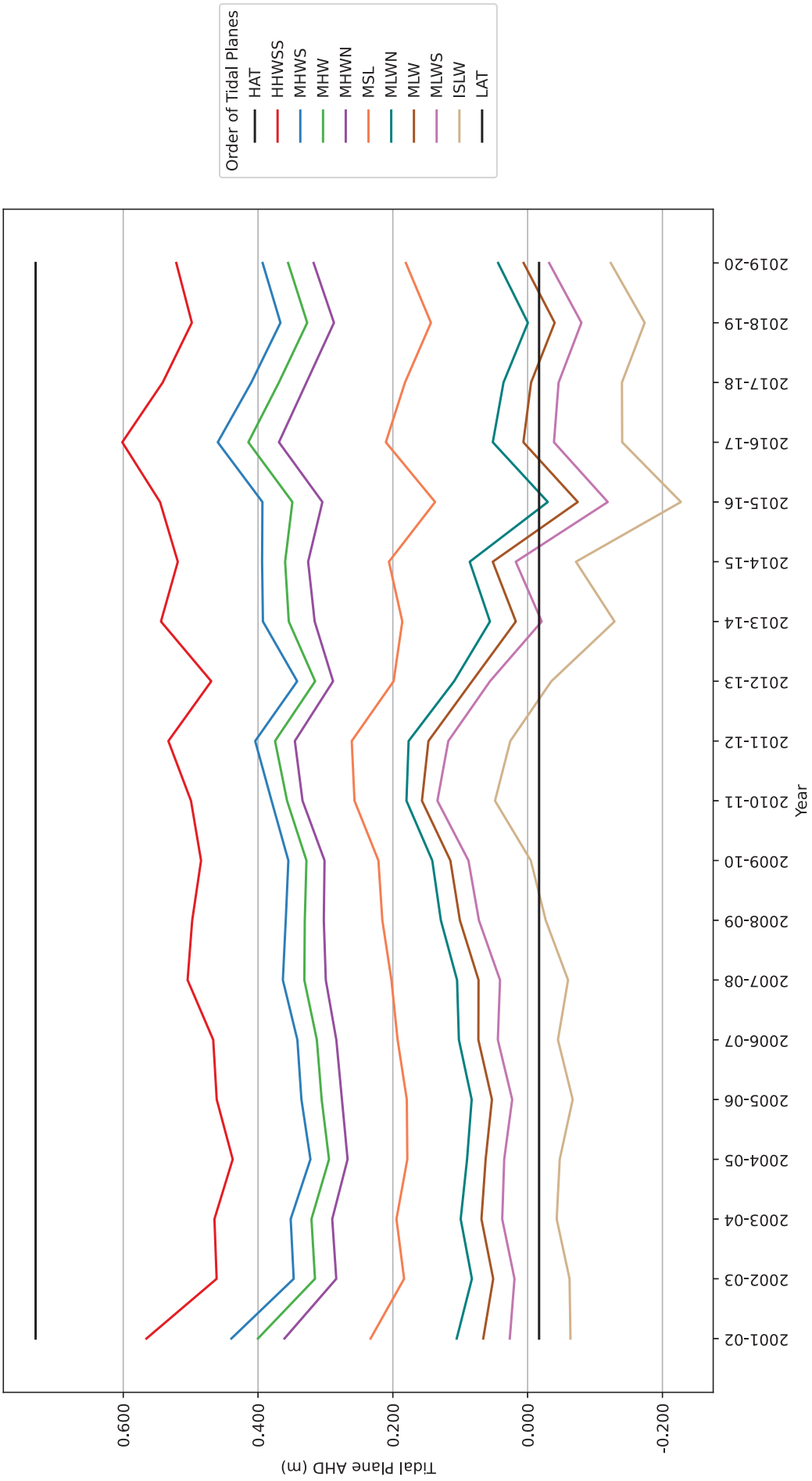
ZONE: 56
EASTING: 280903
NORTHING: 6105512

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.566	0.461	0.465	0.438	0.461	0.466	0.505	0.498	0.485	0.500	0.533	0.469	0.544	0.519	0.545	0.601	0.541	0.498	0.521	0.506	0.042
MHWS	0.440	0.347	0.352	0.322	0.336	0.342	0.363	0.359	0.355	0.380	0.404	0.342	0.393	0.394	0.393	0.460	0.410	0.367	0.393	0.376	0.036
MHW	0.400	0.315	0.321	0.295	0.306	0.313	0.331	0.331	0.328	0.357	0.375	0.315	0.354	0.360	0.349	0.414	0.369	0.327	0.355	0.343	0.032
MHWN	0.361	0.284	0.290	0.267	0.275	0.284	0.299	0.302	0.301	0.334	0.345	0.289	0.316	0.326	0.305	0.369	0.328	0.287	0.317	0.309	0.028
MSL	0.233	0.183	0.195	0.178	0.179	0.193	0.202	0.216	0.221	0.257	0.261	0.199	0.186	0.206	0.137	0.210	0.182	0.143	0.181	0.198	0.032
MLWN	0.105	0.083	0.099	0.090	0.083	0.102	0.105	0.129	0.141	0.180	0.177	0.109	0.056	0.086	-0.030	0.052	0.036	-0.000	0.044	0.087	0.053
MLW	0.066	0.051	0.069	0.062	0.053	0.073	0.073	0.101	0.115	0.157	0.147	0.082	0.017	0.052	-0.074	0.006	-0.005	-0.040	0.006	0.053	0.059
MLWS	0.026	0.019	0.038	0.035	0.023	0.044	0.041	0.072	0.088	0.134	0.118	0.056	-0.021	0.018	-0.119	-0.039	-0.046	-0.080	-0.032	0.020	0.064
ISLW	-0.064	-0.062	-0.043	-0.048	-0.067	-0.045	-0.060	-0.027	-0.005	0.048	0.026	-0.035	-0.129	-0.072	-0.227	-0.140	-0.140	-0.174	-0.123	-0.073	0.068
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.256	0.201	0.191	0.177	0.192	0.182	0.195	0.174	0.160	0.154	0.169	0.180	0.260	0.240	0.334	0.317	0.292	0.288	0.274	0.223	0.057
MR	0.334	0.264	0.252	0.232	0.253	0.240	0.258	0.230	0.214	0.200	0.228	0.233	0.337	0.308	0.423	0.408	0.374	0.367	0.349	0.290	0.070
MSR	0.413	0.328	0.314	0.287	0.313	0.297	0.322	0.287	0.267	0.246	0.287	0.286	0.414	0.376	0.512	0.499	0.456	0.447	0.425	0.357	0.083
R	0.629	0.524	0.508	0.485	0.528	0.511	0.564	0.525	0.489	0.451	0.507	0.505	0.673	0.591	0.773	0.742	0.681	0.672	0.645	0.579	0.095
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.167	0.132	0.126	0.116	0.126	0.120	0.129	0.115	0.107	0.100	0.114	0.116	0.168	0.154	0.212	0.204	0.187	0.184	0.175	0.145	0.035
S2	0.039	0.032	0.031	0.028	0.030	0.029	0.032	0.028	0.027	0.023	0.029	0.027	0.038	0.034	0.044	0.045	0.041	0.040	0.038	0.033	0.007
K1	0.052	0.047	0.046	0.046	0.050	0.050	0.056	0.054	0.050	0.047	0.050	0.050	0.062	0.052	0.066	0.061	0.055	0.056	0.053	0.053	0.006
O1	0.038	0.035	0.035	0.036	0.039	0.039	0.045	0.045	0.042	0.039	0.042	0.041	0.046	0.038	0.043	0.040	0.039	0.038	0.038	0.040	0.003
MSF	0.040	0.034	0.046	0.029	0.026	0.015	0.033	0.024	0.032	0.020	0.036	0.026	0.034	0.021	0.032	0.028	0.039	0.023	0.023	0.030	0.008
z0	0.233	0.183	0.195	0.178	0.179	0.193	0.202	0.216	0.221	0.257	0.261	0.199	0.186	0.206	0.137	0.210	0.182	0.143	0.181	0.198	0.032
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	357.925	357.297	357.527	357.664	357.332	356.688	356.370	355.060	353.993	353.412	353.598	352.815	354.732	355.495	355.568	356.802	356.440	356.864	358.111	355.984	1.641
S2	264.734	267.282	264.712	263.584	264.927	267.234	264.188	267.403	264.989	265.887	263.029	269.855	268.444	269.398	265.132	267.127	266.004	267.609	265.130	266.140	1.914
K1	132.065	139.917	138.689	140.358	137.635	138.690	132.617	130.869	128.077	126.113	121.267	117.299	114.472	114.995	114.500	119.892	123.996	127.777	129.687	127.838	8.957
O1	205.650	206.427	208.153	206.260	206.071	206.186	209.330	211.929	216.320	222.651	229.353	233.443	227.449	230.160	221.379	215.791	213.804	209.105	204.452	214.943	9.612
MSF	312.459	309.714	303.580	295.822	316.319	261.322	309.069	314.237	307.619	322.352	304.116	339.933	280.828	309.142	305.117	315.105	299.854	295.115	279.905	304.295	17.125
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.068	0.069	0.062	0.064	0.070	0.078	0.060	0.049	0.070	0.064	0.050	0.076	0.078	0.073	0.069	0.060	0.070	0.098	0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.5	97.4	94.9	98.1	92.4	95.2	99.2	98.4	91.6	87.0	84.2	91.6	97.5	93.4	96.3	95.2	95.9	94.2	92.5		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.73	04/06/2004 21:30	±0.16	17.8
Lowest Astronomical Tide (LAT)	-0.02	30/09/2013 23:00		

COMMENTS Station installed in Jan 2001.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

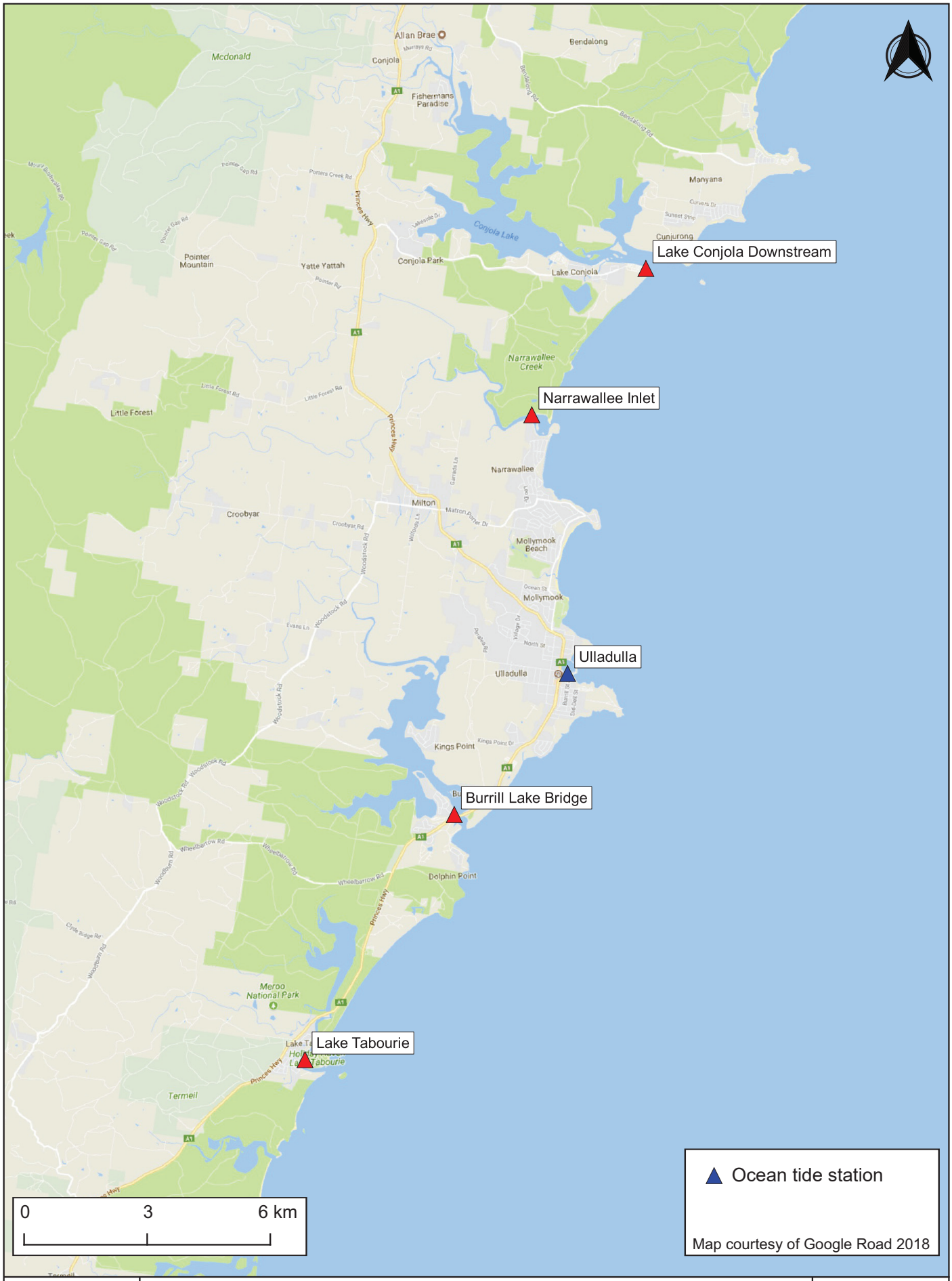


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Sussex Inlet at Sussex Inlet

MHL2786

Figure A207



NSW GOVERNMENT

STATION LOCATIONS
ULLADULLA REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A208

DRAWING A208.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Lake Conjola at Lake Conjola Downstream

RECORDING STATION: **Lake Conjola at Lake Conjola Downstream**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216420D

ZONE: 56
EASTING: 272620
NORTHING: 6094240

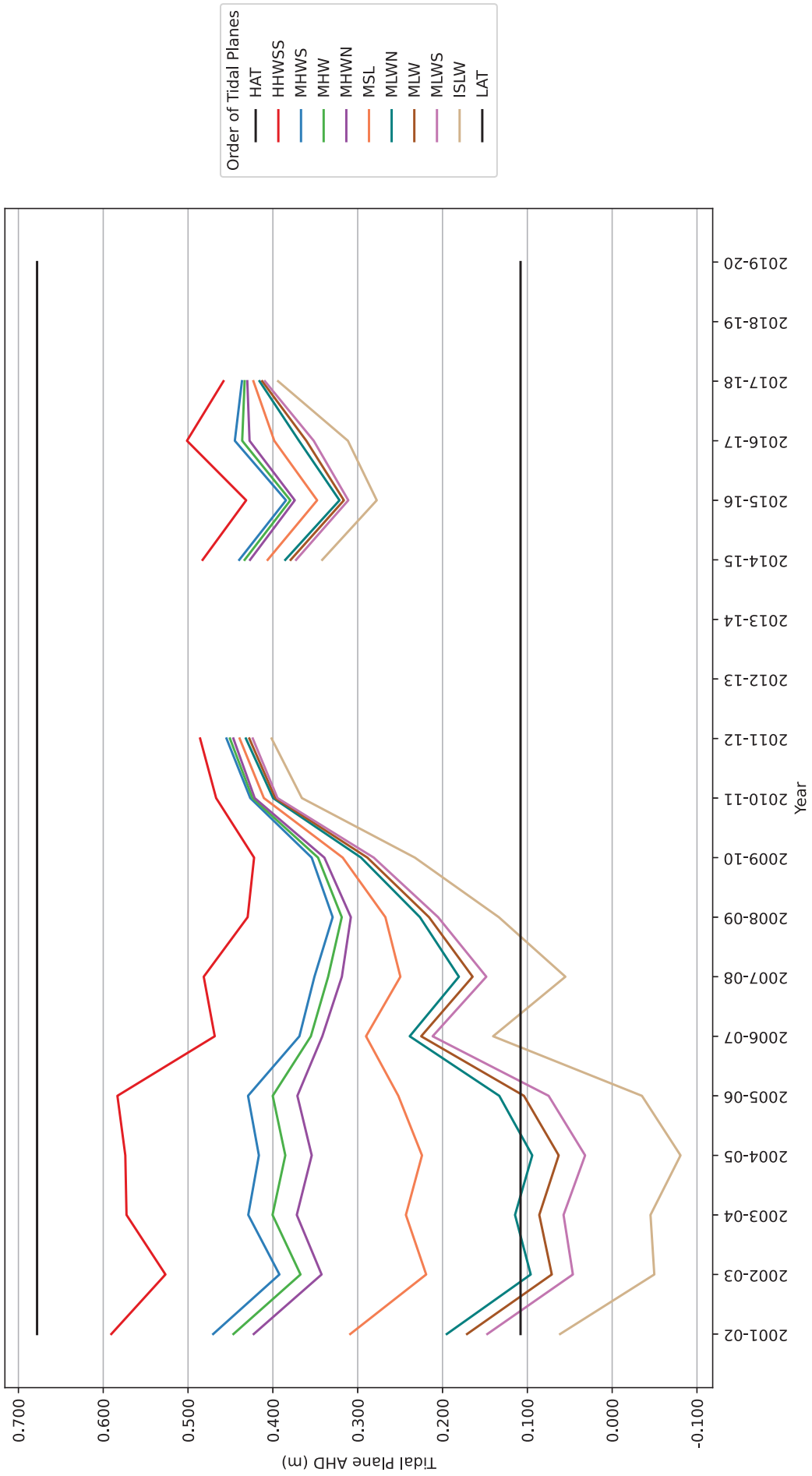
YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13^	2013-14^	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.590	0.527	0.573	0.574	0.583	0.469	0.482	0.430	0.422	0.467	0.486			0.483	0.431	0.501	0.458		0.478	0.497	0.056
MHWS	0.470	0.392	0.429	0.416	0.429	0.369	0.351	0.329	0.354	0.427	0.455			0.440	0.385	0.445	0.436		0.432	0.410	0.041
MHW	0.446	0.367	0.400	0.385	0.400	0.355	0.335	0.319	0.347	0.424	0.451			0.433	0.379	0.436	0.433		0.424	0.396	0.042
MHWN	0.423	0.343	0.372	0.354	0.371	0.342	0.319	0.308	0.339	0.421	0.447			0.427	0.374	0.427	0.430		0.415	0.382	0.045
MSL	0.309	0.219	0.243	0.224	0.252	0.290	0.250	0.267	0.318	0.411	0.439			0.406	0.348	0.398	0.423		0.398	0.325	0.078
MLWN	0.195	0.096	0.115	0.094	0.133	0.239	0.181	0.227	0.296	0.400	0.432			0.385	0.321	0.369	0.416		0.381	0.267	0.122
MLW	0.171	0.071	0.086	0.063	0.104	0.225	0.165	0.216	0.289	0.397	0.428			0.379	0.316	0.361	0.413		0.373	0.253	0.132
MLWS	0.147	0.046	0.057	0.032	0.075	0.212	0.148	0.205	0.281	0.395	0.424			0.373	0.311	0.352	0.409		0.364	0.239	0.141
ISLW	0.061	-0.050	-0.045	-0.081	-0.035	0.140	0.055	0.134	0.233	0.366	0.401			0.342	0.278	0.312	0.394		0.332	0.177	0.175
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.228	0.247	0.257	0.260	0.238	0.103	0.138	0.081	0.043	0.022	0.015			0.042	0.053	0.058	0.014		0.034	0.115	0.097
MR	0.275	0.296	0.314	0.322	0.296	0.130	0.170	0.103	0.058	0.027	0.023			0.054	0.063	0.076	0.021		0.051	0.143	0.117
MSR	0.323	0.346	0.372	0.385	0.354	0.157	0.203	0.124	0.073	0.032	0.031			0.067	0.073	0.093	0.027		0.068	0.171	0.137
R	0.529	0.576	0.618	0.655	0.618	0.328	0.426	0.296	0.190	0.101	0.084			0.141	0.154	0.190	0.064		0.146	0.320	0.217
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.138	0.148	0.157	0.161	0.148	0.065	0.085	0.051	0.029	0.013	0.011			0.027	0.032	0.038	0.010		0.025	0.071	0.059
S2	0.024	0.025	0.029	0.031	0.029	0.014	0.016	0.011	0.007	0.003	0.004			0.006	0.005	0.009	0.003		0.008	0.014	0.010
K1	0.052	0.057	0.060	0.065	0.064	0.039	0.049	0.036	0.024	0.014	0.012			0.015	0.018	0.022	0.008		0.015	0.034	0.021
O1	0.034	0.039	0.043	0.048	0.046	0.032	0.045	0.036	0.025	0.015	0.010			0.016	0.016	0.019	0.007		0.017	0.028	0.014
MSF	0.062	0.057	0.063	0.039	0.037	0.033	0.058	0.042	0.068	0.038	0.038			0.030	0.057	0.062	0.058		0.057	0.050	0.013
z0	0.309	0.219	0.243	0.224	0.252	0.290	0.250	0.267	0.318	0.411	0.439			0.406	0.348	0.398	0.423		0.398	0.325	0.078
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	13.779	11.199	11.472	10.591	11.657	24.957	18.032	22.766	30.861	53.220	50.301			37.748	30.104	32.617	46.796		1.737	25.490	15.638
S2	287.509	280.947	283.434	279.760	280.796	291.868	289.863	287.631	290.834	314.522	297.317			301.610	298.199	290.570	264.105		291.030	289.375	11.115
K1	158.477	154.544	156.141	154.722	155.112	172.345	165.978	168.576	177.846	190.271	192.185			170.192	168.143	168.571	191.622		133.902	167.414	15.655
O1	235.793	227.094	225.638	226.154	223.944	247.737	245.398	255.522	267.503	291.493	299.055			285.972	283.250	277.590	278.462		254.048	257.791	25.916
MSF	293.707	300.539	290.108	277.320	295.505	277.834	290.640	308.794	303.269	309.949	318.525			279.418	294.543	303.179	320.081		288.133	296.971	13.272
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.089	0.096	0.085	0.093	0.108	0.104	0.098	0.086	0.089	0.060	0.063			0.090	0.071	0.074	0.088		0.070		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.0	99.3	98.0	98.2	96.0	98.2	99.0	99.1	95.8	75.1	63.3	50.7	78.8	75.3	88.1	93.1	82.2	11.5	64.6		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.68	04/06/2004 22:00	±0.22	29.2
Lowest Astronomical Tide (LAT)	0.11	09/09/2004 10:15		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station relocated from middle of Lake Conjola (AWRC: 216420) to the bank in Oct 2010. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Conjola at Lake Conjola Downstream

MHL2786

Figure A209

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Narrawallee Inlet at Narrawallee

RECORDING STATION: **Narrawallee Inlet at Narrawallee**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216430

ZONE: 56
EASTING: 269839
NORTHING: 6090673

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.879	0.813	0.856	0.855	0.878	0.831	0.926	0.929	0.927	0.959	0.926	0.892	0.910	0.870	0.850	0.914	0.876	0.870	0.888	0.887	0.038
MHWS	0.587	0.513	0.545	0.526	0.545	0.496	0.553	0.553	0.547	0.575	0.566	0.565	0.595	0.590	0.572	0.643	0.610	0.598	0.612	0.568	0.036
MHW	0.504	0.433	0.463	0.445	0.465	0.427	0.467	0.468	0.464	0.490	0.480	0.482	0.509	0.513	0.489	0.556	0.526	0.513	0.526	0.485	0.034
MHWN	0.421	0.353	0.381	0.364	0.385	0.358	0.381	0.382	0.381	0.405	0.394	0.400	0.423	0.436	0.405	0.470	0.442	0.428	0.441	0.403	0.032
MSL	0.095	0.044	0.067	0.064	0.094	0.094	0.075	0.090	0.082	0.107	0.099	0.103	0.112	0.135	0.076	0.140	0.121	0.107	0.126	0.096	0.025
MLWN	-0.231	-0.266	-0.247	-0.237	-0.197	-0.170	-0.232	-0.202	-0.216	-0.192	-0.196	-0.194	-0.198	-0.167	-0.252	-0.190	-0.199	-0.213	-0.189	-0.210	0.028
MLW	-0.314	-0.346	-0.329	-0.318	-0.277	-0.239	-0.318	-0.287	-0.299	-0.277	-0.282	-0.277	-0.285	-0.244	-0.336	-0.277	-0.283	-0.298	-0.274	-0.293	0.029
MLWS	-0.397	-0.426	-0.411	-0.399	-0.358	-0.307	-0.403	-0.373	-0.382	-0.361	-0.368	-0.359	-0.371	-0.320	-0.420	-0.363	-0.367	-0.383	-0.359	-0.375	0.030
ISLW	-0.606	-0.640	-0.633	-0.634	-0.595	-0.547	-0.670	-0.641	-0.654	-0.636	-0.625	-0.593	-0.596	-0.520	-0.618	-0.556	-0.557	-0.578	-0.557	-0.603	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.652	0.619	0.628	0.601	0.582	0.527	0.613	0.584	0.596	0.597	0.590	0.594	0.621	0.603	0.657	0.660	0.642	0.641	0.630	0.613	0.032
MR	0.819	0.779	0.792	0.763	0.743	0.665	0.784	0.755	0.763	0.766	0.762	0.759	0.793	0.757	0.825	0.833	0.809	0.811	0.800	0.778	0.038
MSR	0.985	0.939	0.956	0.926	0.903	0.803	0.956	0.926	0.929	0.936	0.934	0.924	0.966	0.910	0.992	1.006	0.977	0.981	0.971	0.943	0.045
R	1.485	1.453	1.490	1.489	1.473	1.379	1.595	1.570	1.581	1.595	1.550	1.485	1.506	1.390	1.469	1.470	1.433	1.448	1.445	1.490	0.064
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.409	0.390	0.396	0.382	0.371	0.333	0.392	0.378	0.381	0.383	0.381	0.379	0.397	0.378	0.412	0.416	0.405	0.405	0.400	0.389	0.019
S2	0.083	0.080	0.082	0.081	0.080	0.069	0.086	0.085	0.083	0.085	0.086	0.082	0.086	0.077	0.084	0.086	0.084	0.085	0.085	0.083	0.004
K1	0.129	0.131	0.138	0.144	0.142	0.140	0.160	0.159	0.161	0.162	0.152	0.142	0.140	0.124	0.127	0.125	0.120	0.123	0.124	0.139	0.014
O1	0.079	0.083	0.085	0.091	0.096	0.099	0.107	0.110	0.111	0.112	0.105	0.092	0.085	0.076	0.072	0.069	0.070	0.072	0.074	0.089	0.015
MSF	0.046	0.042	0.054	0.021	0.030	0.023	0.037	0.016	0.023	0.015	0.035	0.014	0.023	0.027	0.032	0.031	0.035	0.016	0.031	0.029	0.011
z0	0.095	0.044	0.067	0.064	0.094	0.094	0.075	0.090	0.082	0.107	0.099	0.103	0.112	0.135	0.076	0.140	0.121	0.107	0.126	0.096	0.025
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	13.129	14.313	13.723	15.259	14.721	19.331	10.104	10.525	8.266	8.547	8.386	8.795	6.524	10.888	7.344	8.570	10.494	11.356	12.669	11.208	3.268
S2	289.388	291.275	289.232	291.128	290.490	295.859	287.609	290.882	288.778	291.979	289.358	291.616	288.651	293.651	285.827	288.352	290.624	288.879	290.078	290.192	2.231
K1	134.606	138.504	138.282	138.552	137.891	142.628	130.237	129.332	124.591	121.835	118.739	117.543	115.875	120.497	118.269	121.740	128.085	130.188	132.993	128.441	8.491
O1	200.985	198.466	198.000	201.074	200.957	210.925	200.913	204.649	206.867	213.166	217.948	223.760	219.577	226.944	215.918	209.189	208.709	203.699	201.359	208.585	8.809
MSF	286.872	279.655	272.645	260.010	296.993	268.946	278.796	296.508	283.556	279.439	267.038	295.757	263.022	293.460	268.151	283.359	268.296	282.543	264.832	278.415	11.930
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.082	0.091	0.077	0.089	0.088	0.088	0.084	0.080	0.088	0.082	0.074	0.081	0.082	0.081	0.076	0.064	0.083	0.096	0.068		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	92.1	96.4	85.1	97.2	88.5	86.7	98.0	97.1	97.3	96.3	94.6	94.6	92.5	89.1	88.4	84.3	92.9	96.4	91.3		

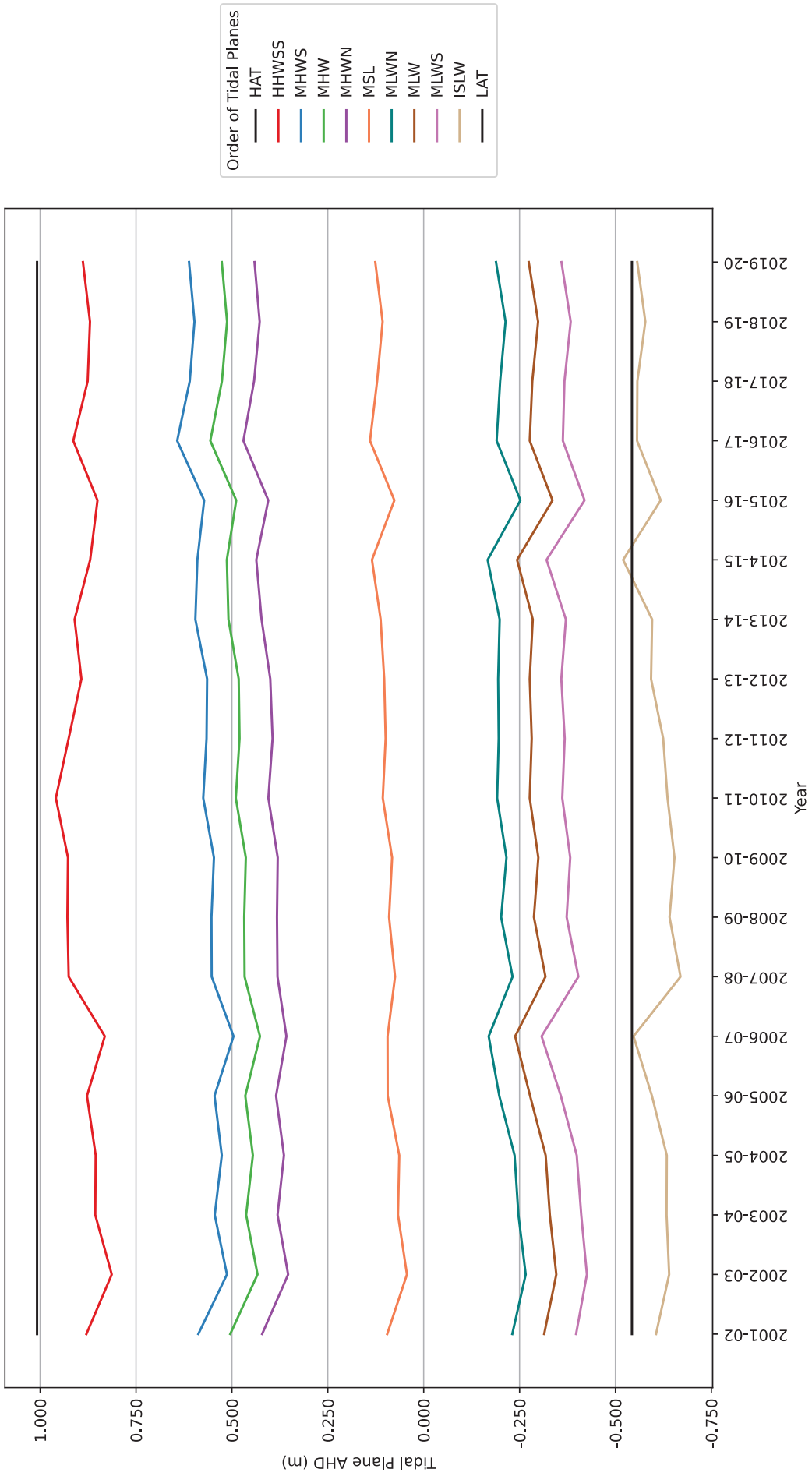
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.01	04/06/2004 21:45	±0.19	8.4
Lowest Astronomical Tide (LAT)	-0.54	10/09/2014 04:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A210

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Narrawallee Inlet at Narrawallee

MHL2786

Figure A210

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Burrill Lake at Burrill Lake Bridge

RECORDING STATION: **Burrill Lake at Burrill Lake Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216435

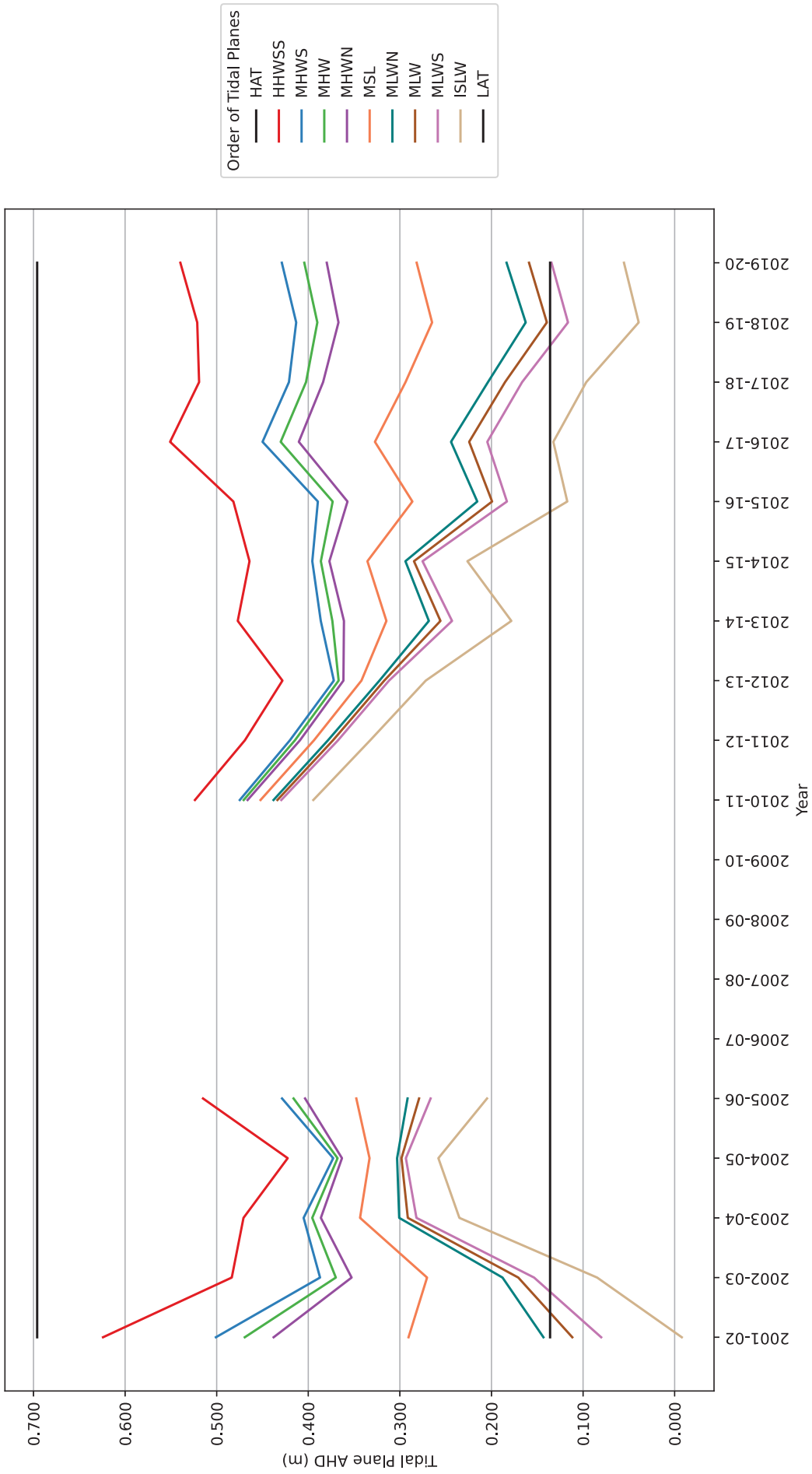
ZONE: 56
EASTING: 267949
NORTHING: 6080931

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07*	2007-08	2008-09*	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.624	0.484	0.471	0.422	0.515		0.434			0.524	0.469	0.428	0.477	0.464	0.482	0.551	0.519	0.521	0.540	0.495	0.052
MHWS	0.501	0.387	0.405	0.373	0.429		0.381			0.475	0.420	0.372	0.386	0.396	0.390	0.450	0.421	0.413	0.429	0.414	0.037
MHW	0.469	0.370	0.396	0.368	0.416		0.375			0.471	0.415	0.367	0.374	0.386	0.373	0.430	0.402	0.390	0.404	0.400	0.033
MHWN	0.438	0.353	0.386	0.363	0.403		0.368			0.466	0.409	0.362	0.361	0.377	0.357	0.410	0.384	0.367	0.380	0.387	0.032
MSL	0.291	0.270	0.343	0.333	0.348		0.347			0.452	0.394	0.342	0.315	0.335	0.286	0.327	0.294	0.265	0.282	0.326	0.048
MLWN	0.143	0.188	0.301	0.303	0.292		0.326			0.438	0.379	0.322	0.268	0.294	0.215	0.244	0.204	0.163	0.184	0.266	0.081
MLW	0.112	0.171	0.291	0.298	0.279		0.319			0.434	0.373	0.317	0.256	0.285	0.199	0.224	0.185	0.140	0.159	0.253	0.089
MLWS	0.080	0.153	0.282	0.293	0.266		0.313			0.429	0.368	0.312	0.243	0.275	0.183	0.205	0.167	0.116	0.134	0.239	0.096
ISLW	-0.008	0.085	0.235	0.258	0.205		0.275			0.394	0.332	0.272	0.178	0.226	0.117	0.132	0.096	0.039	0.055	0.181	0.113
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.295	0.165	0.086	0.060	0.112		0.042			0.028	0.031	0.039	0.093	0.083	0.142	0.166	0.180	0.204	0.196	0.120	0.076
MR	0.358	0.199	0.104	0.070	0.137		0.055			0.037	0.042	0.050	0.118	0.102	0.174	0.206	0.217	0.251	0.245	0.148	0.093
MSR	0.421	0.234	0.123	0.079	0.162		0.068			0.045	0.053	0.060	0.143	0.120	0.206	0.245	0.255	0.297	0.294	0.175	0.109
R	0.632	0.399	0.236	0.165	0.310		0.159			0.129	0.137	0.156	0.299	0.238	0.365	0.418	0.423	0.482	0.484	0.314	0.150
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.179	0.100	0.052	0.035	0.069		0.028			0.018	0.021	0.025	0.059	0.051	0.087	0.103	0.109	0.125	0.123	0.074	0.046
S2	0.032	0.017	0.009	0.005	0.013		0.007			0.004	0.005	0.005	0.013	0.009	0.016	0.020	0.019	0.023	0.025	0.014	0.008
K1	0.053	0.039	0.026	0.019	0.034		0.019			0.018	0.017	0.020	0.035	0.027	0.036	0.041	0.040	0.045	0.045	0.032	0.012
O1	0.035	0.030	0.021	0.017	0.028		0.019			0.017	0.018	0.020	0.030	0.022	0.030	0.031	0.030	0.033	0.034	0.026	0.006
MSF	0.057	0.066	0.061	0.057	0.051		0.057			0.067	0.062	0.034	0.050	0.037	0.055	0.043	0.061	0.037	0.059	0.053	0.010
z0	0.291	0.270	0.343	0.333	0.348		0.347			0.452	0.394	0.342	0.315	0.335	0.286	0.327	0.294	0.265	0.282	0.326	0.048
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	9.840	12.749	16.165	19.443	12.678		16.761			31.837	36.423	41.666	26.554	30.782	19.728	19.529	17.687	14.674	16.069	21.412	9.277
S2	280.169	270.846	277.800	272.141	271.545		285.678			300.226	296.690	314.250	300.933	300.868	289.988	294.379	293.618	288.655	294.890	289.542	12.437
K1	145.736	156.658	167.622	175.432	160.682		170.720			165.095	168.767	172.373	157.875	161.401	151.502	154.527	156.446	155.699	158.824	161.210	8.164
O1	221.001	231.968	242.974	247.788	231.982		252.487			289.425	281.617	291.542	273.367	276.326	264.380	255.456	250.552	240.848	238.517	255.639	21.623
MSF	297.246	300.577	308.908	323.323	309.771		303.883			300.311	308.591	302.167	285.573	301.235	282.198	295.395	284.947	284.563	256.817	296.594	15.302
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.104	0.094	0.073	0.079	0.097		0.070			0.063	0.064	0.082	0.086	0.090	0.083	0.079	0.090	0.095	0.083		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	95.7	85.8	91.4	65.0	95.1	36.9	96.3	35.4	2.5	55.8	93.6	95.7	98.7	95.6	97.7	98.9	97.1	99.3	91.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.70	04/06/2004 21:45	±0.22	79.3
Lowest Astronomical Tide (LAT)	0.14	03/01/2012 23:30		

COMMENTS
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Burrill Lake at Burrill Lake Bridge

MHL2786

Figure
A211

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tabourie Lake at Lake Tabourie

RECORDING STATION: **Tabourie Lake at Lake Tabourie**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216440

ZONE: 56
EASTING: 264310
NORTHING: 6074957

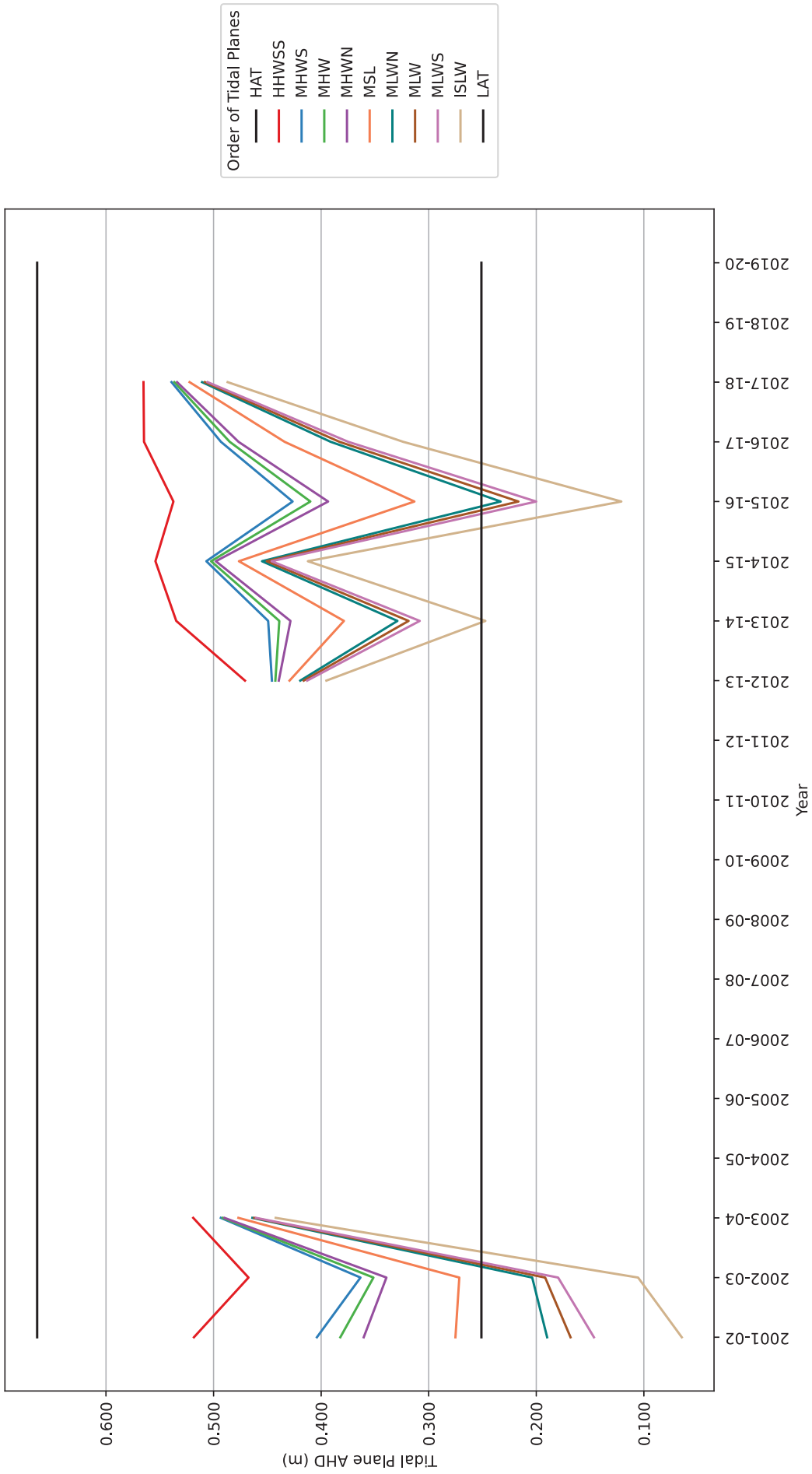
YEAR	2001-02	2002-03	2003-04	2004-05^	2005-06^	2006-07	2007-08^	2008-09^	2009-10^	2010-11*	2011-12*	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19^	2019-20^	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.518	0.467	0.519			0.280						0.471	0.535	0.554	0.537	0.565	0.565			0.501	0.085
MHWS	0.404	0.363	0.493			0.259						0.446	0.449	0.507	0.426	0.493	0.539			0.438	0.082
MHW	0.382	0.351	0.492			0.256						0.443	0.439	0.502	0.410	0.485	0.537			0.430	0.084
MHWN	0.360	0.339	0.490			0.253						0.439	0.429	0.498	0.393	0.477	0.534			0.421	0.086
MSL	0.275	0.272	0.477			0.246						0.429	0.379	0.476	0.313	0.434	0.522			0.382	0.100
MLWN	0.190	0.204	0.464			0.239						0.419	0.329	0.455	0.233	0.391	0.511			0.343	0.120
MLW	0.168	0.192	0.462			0.235						0.416	0.319	0.451	0.217	0.383	0.508			0.335	0.125
MLWS	0.146	0.180	0.461			0.232						0.413	0.308	0.446	0.200	0.375	0.506			0.327	0.131
ISLW	0.065	0.105	0.442			0.217						0.395	0.247	0.412	0.121	0.324	0.487			0.282	0.152
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.171	0.136	0.026			0.014						0.020	0.099	0.043	0.160	0.086	0.023			0.078	0.061
MR	0.214	0.160	0.029			0.021						0.026	0.120	0.052	0.193	0.102	0.028			0.095	0.074
MSR	0.258	0.184	0.033			0.028						0.033	0.141	0.061	0.226	0.118	0.034			0.111	0.087
R	0.454	0.362	0.077			0.063						0.076	0.287	0.142	0.416	0.241	0.078			0.220	0.153
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.107	0.080	0.015			0.010						0.013	0.060	0.026	0.097	0.051	0.014			0.047	0.037
S2	0.022	0.012	0.002			0.003						0.003	0.010	0.004	0.017	0.008	0.003			0.008	0.007
K1	0.046	0.040	0.009			0.007						0.009	0.030	0.018	0.044	0.027	0.010			0.024	0.015
O1	0.036	0.034	0.009			0.007						0.009	0.031	0.016	0.035	0.024	0.008			0.021	0.012
MSF	0.067	0.080	0.022			0.023						0.012	0.052	0.026	0.054	0.056	0.028			0.042	0.023
z0	0.275	0.272	0.477			0.246						0.429	0.379	0.476	0.313	0.434	0.522			0.382	0.100
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	17.374	19.670	25.218			23.586						36.577	20.657	31.366	17.490	27.511	31.480			25.093	6.554
S2	287.738	282.022	283.649			275.201						334.081	287.739	314.815	300.677	296.772	291.250			295.394	17.520
K1	163.569	165.520	189.769			175.702						162.291	155.306	173.864	153.629	166.669	189.581			169.590	12.631
O1	241.523	243.783	246.093			230.487						280.367	273.017	281.102	261.070	275.184	263.568			259.619	18.078
MSF	290.715	271.392	289.987			272.983						283.092	271.921	306.192	280.814	287.713	296.625			285.143	11.405
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.145	0.134	0.084			0.095						0.114	0.112	0.122	0.130	0.120	0.127				
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	79.6	89.9	93.3	89.6	65.4	87.8	90.7	98.8	92.1	29.6	39.3	89.2	75.0	79.6	92.7	88.1	80.1	50.9	63.8		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.66	04/06/2004 21:45	±0.31	82.3
Lowest Astronomical Tide (LAT)	0.25	31/08/2013 11:15		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

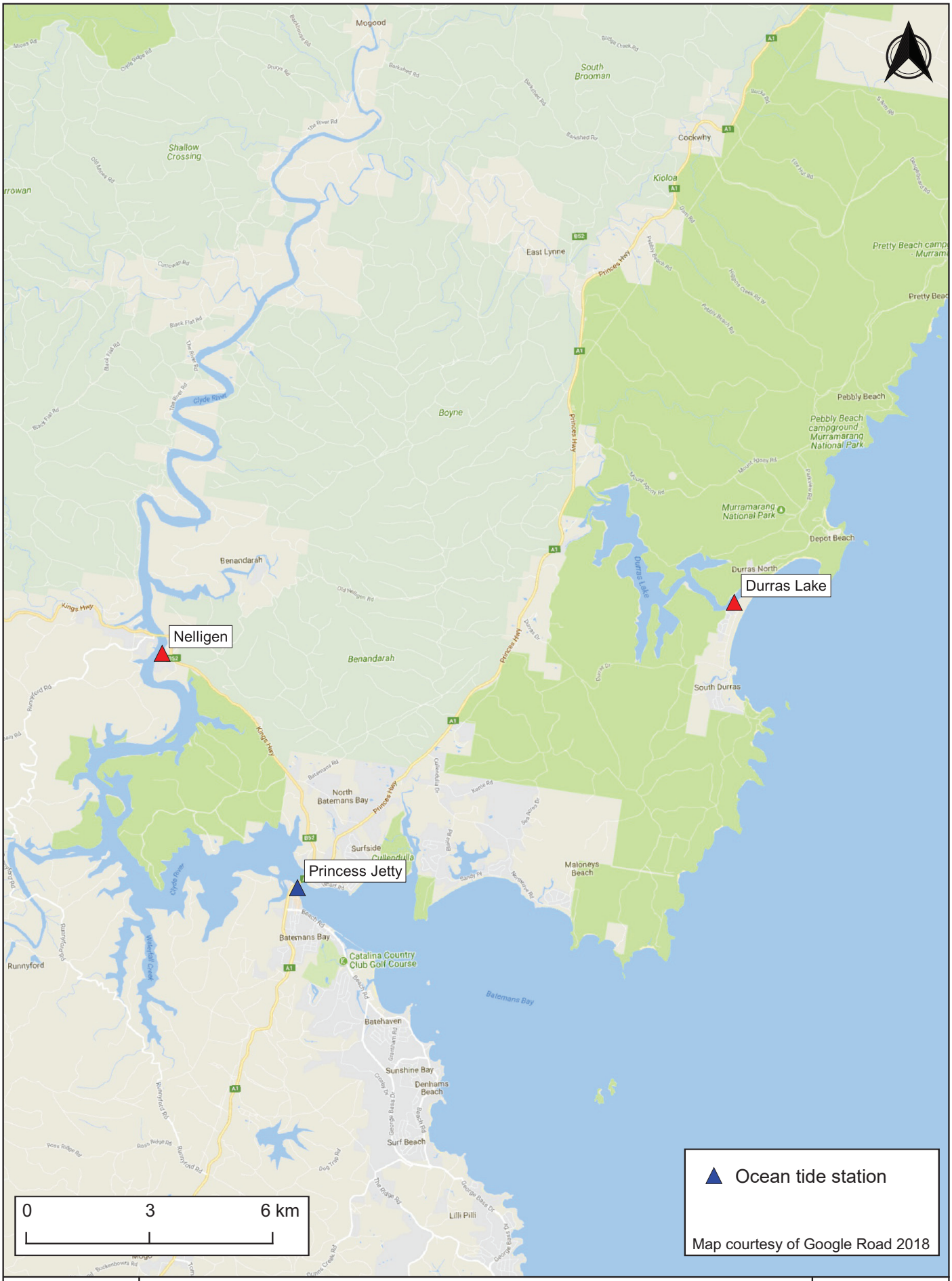


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tabourie Lake at Lake Tabourie

MHL2786

Figure A212



NSW GOVERNMENT

STATION LOCATIONS
BATEMANS BAY REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A213

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Durras Lake at Durras Lake

RECORDING STATION: **Durras Lake at Durras Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216445

ZONE: 56
EASTING: 255304
NORTHING: 6052185

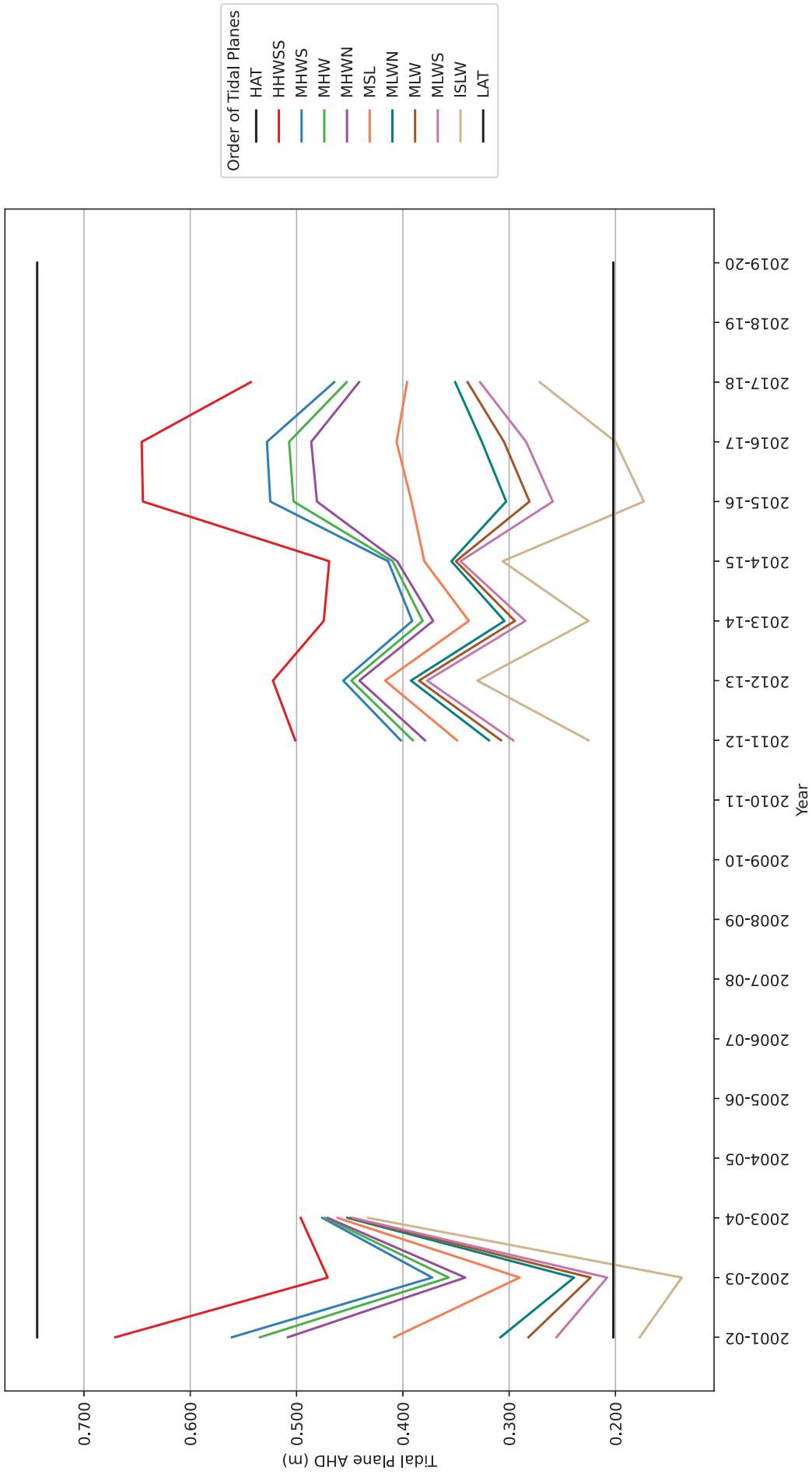
YEAR	2001-02	2002-03	2003-04	2004-05*	2005-06	2006-07*	2007-08	2008-09^	2009-10^	2010-11*	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19^	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.670	0.471	0.496		0.477		0.506				0.501	0.522	0.474	0.469	0.645	0.646	0.543			0.535	0.075
MHWS	0.561	0.372	0.476		0.386		0.396				0.402	0.456	0.391	0.414	0.525	0.528	0.465			0.448	0.064
MHW	0.534	0.357	0.473		0.373		0.382				0.391	0.449	0.381	0.410	0.503	0.507	0.453			0.434	0.060
MHWN	0.508	0.341	0.471		0.361		0.369				0.379	0.441	0.372	0.405	0.481	0.486	0.441			0.421	0.057
MSL	0.408	0.290	0.461		0.320		0.324				0.349	0.417	0.338	0.380	0.392	0.406	0.396			0.373	0.049
MLWN	0.308	0.239	0.452		0.279		0.279				0.319	0.392	0.304	0.354	0.303	0.326	0.351			0.326	0.056
MLW	0.282	0.223	0.450		0.266		0.266				0.308	0.385	0.295	0.350	0.281	0.305	0.339			0.312	0.061
MLWS	0.256	0.208	0.447		0.254		0.252				0.296	0.377	0.285	0.346	0.259	0.284	0.327			0.299	0.066
ISLW	0.177	0.138	0.433		0.189		0.173				0.225	0.330	0.225	0.306	0.173	0.200	0.271			0.237	0.084
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.200	0.102	0.018		0.082		0.090				0.060	0.049	0.067	0.051	0.178	0.161	0.090			0.096	0.056
MR	0.253	0.133	0.024		0.107		0.117				0.083	0.064	0.087	0.060	0.222	0.202	0.114			0.122	0.070
MSR	0.305	0.165	0.029		0.132		0.143				0.106	0.079	0.106	0.068	0.266	0.244	0.137			0.148	0.084
R	0.493	0.333	0.063		0.288		0.333				0.276	0.192	0.249	0.163	0.471	0.446	0.272			0.298	0.128
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.126	0.067	0.012		0.054		0.058				0.041	0.032	0.043	0.030	0.111	0.101	0.057			0.061	0.035
S2	0.026	0.016	0.003		0.013		0.013				0.011	0.008	0.010	0.004	0.022	0.021	0.012			0.013	0.007
K1	0.043	0.038	0.007		0.033		0.041				0.035	0.022	0.030	0.019	0.046	0.045	0.030			0.032	0.012
O1	0.035	0.033	0.007		0.031		0.038				0.036	0.025	0.029	0.021	0.039	0.039	0.027			0.030	0.009
MSF	0.043	0.071	0.016		0.065		0.067				0.083	0.042	0.065	0.047	0.063	0.056	0.086			0.059	0.019
z0	0.408	0.290	0.461		0.320		0.324				0.349	0.417	0.338	0.380	0.392	0.406	0.396			0.373	0.049
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	12.884	23.386	26.479		26.322		22.342				38.865	36.545	38.128	45.759	17.361	22.182	29.878			28.344	9.747
S2	280.388	294.901	282.378		291.445		294.220				305.838	309.409	302.996	299.642	291.714	295.485	299.784			295.683	8.660
K1	155.716	175.653	189.140		177.649		172.249				171.733	170.668	166.649	174.037	151.407	157.470	171.649			169.502	10.442
O1	231.701	246.795	245.520		248.961		250.499				282.514	285.740	282.832	291.747	259.180	259.990	267.027			262.709	19.206
MSF	310.369	293.220	292.254		303.039		290.748				295.238	289.505	284.258	285.953	283.022	290.876	285.007			291.957	8.014
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.156	0.082	0.059		0.091		0.082				0.084	0.155	0.080	0.123	0.092	0.076	0.101				
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	50.5	92.3	97.0	45.0	75.5	1.2	99.5	98.4	77.5	2.5	99.6	85.0	77.6	66.2	81.0	99.4	96.9	99.2	39.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.74	04/06/2004 22:00	±0.30	101.6
Lowest Astronomical Tide (LAT)	0.20	31/01/2004 23:45		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2000. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Durras Lake at Durras Lake

MHL2786

Figure
A214

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Clyde River at Nelligen

RECORDING STATION: **Clyde River at Nelligen**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216453

ZONE: 56
EASTING: 241369
NORTHING: 6050944

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	1.007	0.956	0.966	0.971	0.984	0.965	1.013	0.993	1.014	1.027	1.025	1.009	0.999	0.997	0.975	0.995	0.988	0.964	0.999	0.992	0.021
MHWS	0.713	0.643	0.649	0.639	0.646	0.604	0.646	0.610	0.621	0.640	0.667	0.664	0.681	0.706	0.692	0.716	0.711	0.680	0.707	0.665	0.036
MHW	0.607	0.535	0.541	0.532	0.538	0.498	0.540	0.501	0.512	0.532	0.556	0.558	0.574	0.600	0.585	0.611	0.605	0.576	0.600	0.558	0.036
MHWN	0.501	0.426	0.432	0.426	0.430	0.393	0.434	0.393	0.403	0.425	0.446	0.452	0.467	0.493	0.479	0.506	0.499	0.471	0.494	0.451	0.037
MSL	0.075	0.002	0.025	0.030	0.043	0.010	0.055	0.016	0.018	0.035	0.055	0.052	0.063	0.080	0.056	0.078	0.070	0.044	0.067	0.046	0.024
MLWN	-0.351	-0.423	-0.382	-0.366	-0.345	-0.373	-0.324	-0.361	-0.367	-0.356	-0.336	-0.348	-0.341	-0.333	-0.368	-0.350	-0.358	-0.382	-0.360	-0.359	0.022
MLW	-0.457	-0.531	-0.491	-0.473	-0.452	-0.478	-0.431	-0.470	-0.477	-0.463	-0.447	-0.454	-0.448	-0.439	-0.474	-0.455	-0.465	-0.487	-0.466	-0.466	0.022
MLWS	-0.563	-0.640	-0.600	-0.580	-0.560	-0.583	-0.537	-0.578	-0.586	-0.570	-0.558	-0.560	-0.555	-0.545	-0.581	-0.561	-0.571	-0.591	-0.573	-0.573	0.023
ISLW	-0.773	-0.863	-0.826	-0.817	-0.802	-0.841	-0.799	-0.852	-0.866	-0.847	-0.813	-0.806	-0.782	-0.753	-0.783	-0.760	-0.769	-0.794	-0.782	-0.807	0.035
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.852	0.849	0.814	0.792	0.775	0.766	0.758	0.754	0.771	0.781	0.782	0.801	0.808	0.826	0.846	0.855	0.857	0.853	0.854	0.810	0.038
MR	1.065	1.066	1.031	1.006	0.990	0.977	0.971	0.971	0.989	0.995	1.003	1.012	1.022	1.039	1.060	1.066	1.069	1.062	1.067	1.024	0.037
MSR	1.277	1.283	1.249	1.219	1.206	1.187	1.183	1.188	1.207	1.209	1.224	1.223	1.236	1.251	1.273	1.277	1.282	1.272	1.280	1.238	0.036
R	1.780	1.819	1.792	1.789	1.786	1.806	1.812	1.844	1.880	1.874	1.838	1.815	1.781	1.751	1.759	1.754	1.757	1.758	1.781	1.799	0.039
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.532	0.533	0.516	0.503	0.495	0.488	0.485	0.486	0.494	0.498	0.502	0.506	0.511	0.519	0.530	0.533	0.535	0.531	0.533	0.512	0.018
S2	0.106	0.108	0.109	0.107	0.108	0.105	0.106	0.108	0.109	0.107	0.111	0.106	0.107	0.106	0.107	0.105	0.106	0.105	0.106	0.107	0.002
K1	0.130	0.140	0.141	0.144	0.147	0.155	0.156	0.160	0.165	0.165	0.151	0.150	0.141	0.131	0.128	0.126	0.124	0.127	0.129	0.143	0.014
O1	0.080	0.084	0.085	0.093	0.095	0.103	0.106	0.113	0.116	0.112	0.105	0.096	0.087	0.077	0.074	0.073	0.074	0.075	0.080	0.091	0.015
MSF	0.022	0.019	0.031	0.002	0.014	0.005	0.017	0.011	0.009	0.020	0.021	0.017	0.013	0.007	0.017	0.011	0.026	0.007	0.010	0.015	0.007
z0	0.075	0.002	0.025	0.030	0.043	0.010	0.055	0.016	0.018	0.035	0.055	0.052	0.063	0.080	0.056	0.078	0.070	0.044	0.067	0.046	0.024
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	18.174	18.203	17.898	18.706	18.356	17.512	17.035	16.468	15.007	14.637	15.165	14.258	14.814	15.727	14.833	16.527	17.920	18.156	18.202	16.716	1.542
S2	297.142	298.106	297.791	296.344	296.561	297.323	297.267	299.411	298.594	298.609	298.381	298.352	298.304	298.097	297.041	296.698	300.154	299.976	298.156	298.016	1.077
K1	130.742	133.100	133.109	132.392	131.404	131.650	128.595	126.434	122.646	118.759	117.971	115.326	114.508	116.163	117.469	121.682	126.869	128.035	130.372	125.117	6.683
O1	192.953	190.186	188.256	190.266	190.414	191.181	194.100	197.706	200.301	206.472	212.307	212.969	214.443	213.650	209.928	204.646	203.115	196.263	194.927	200.215	9.170
MSF	282.373	282.022	254.757	133.663	346.079	332.534	308.665	348.379	266.428	46.802	277.173	15.407	259.542	330.830	279.841	309.865	293.582	337.127	289.342	262.864	94.610
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.087	0.077	0.085	0.088	0.097	0.079	0.072	0.087	0.101	0.073	0.085	0.082	0.078	0.069	0.071	0.083	0.091	0.075		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	81.7	96.9	95.4	95.5	92.6	97.0	98.3	97.6	94.4	96.6	66.8	94.2	91.8	79.2	89.9	91.6	95.0	96.4	85.4		

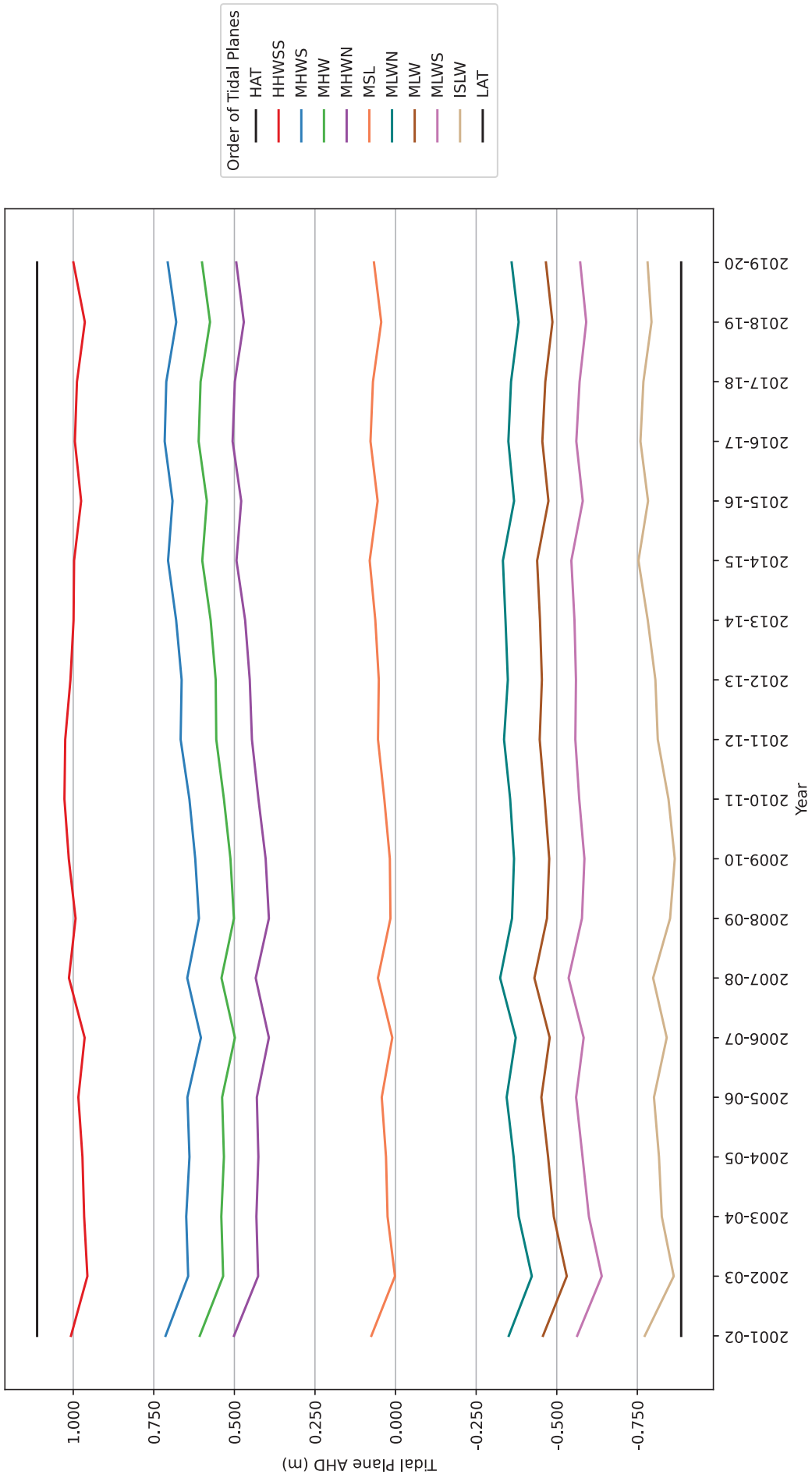
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.11	04/06/2008 21:45	±0.21	8.9
Lowest Astronomical Tide (LAT)	-0.89	09/09/2014 03:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A215

MHL2786

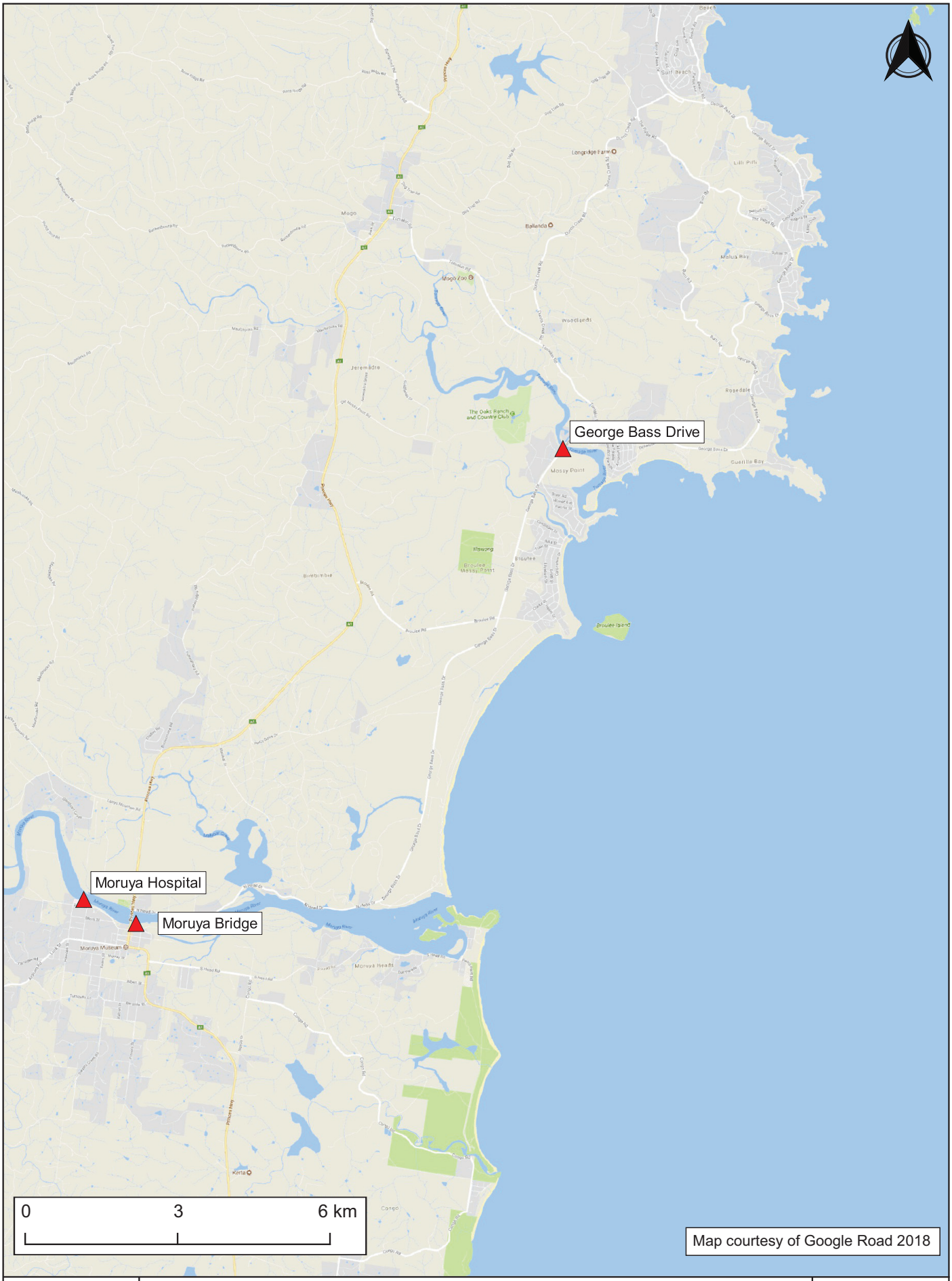


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Clyde River at Nelligen

MHL2786

Figure A215



NSW GOVERNMENT

STATION LOCATIONS
MORUYA RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A216

DRAWING A216.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Tomaga River at George Bass Drive

RECORDING STATION: **Tomaga River at George Bass Drive**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 216455

ZONE: 56
EASTING: 245110
NORTHING: 6031671

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.705	0.659	0.689	0.676	0.721	0.704	0.738	0.765	0.804	0.798	0.764	0.754	0.742	0.751	0.730	0.778	0.757	0.725	0.748	0.737	0.039
MHWS	0.477	0.418	0.442	0.416	0.449	0.419	0.443	0.461	0.495	0.485	0.467	0.473	0.486	0.515	0.507	0.557	0.537	0.498	0.521	0.477	0.040
MHW	0.432	0.371	0.394	0.368	0.398	0.371	0.395	0.415	0.448	0.438	0.419	0.427	0.438	0.470	0.461	0.509	0.490	0.450	0.474	0.430	0.041
MHWN	0.386	0.324	0.346	0.319	0.347	0.323	0.348	0.369	0.401	0.391	0.372	0.381	0.391	0.425	0.416	0.461	0.443	0.403	0.426	0.383	0.041
MSL	0.166	0.103	0.132	0.107	0.131	0.121	0.146	0.169	0.194	0.187	0.165	0.167	0.173	0.207	0.190	0.226	0.209	0.169	0.201	0.166	0.035
MLWN	-0.054	-0.118	-0.083	-0.105	-0.085	-0.081	-0.056	-0.030	-0.014	-0.018	-0.043	-0.047	-0.045	-0.010	-0.036	-0.008	-0.025	-0.064	-0.024	-0.050	0.032
MLW	-0.100	-0.165	-0.131	-0.153	-0.136	-0.129	-0.103	-0.076	-0.061	-0.065	-0.090	-0.093	-0.093	-0.055	-0.082	-0.056	-0.072	-0.112	-0.071	-0.097	0.033
MLWS	-0.145	-0.212	-0.179	-0.201	-0.186	-0.178	-0.150	-0.122	-0.108	-0.112	-0.138	-0.139	-0.140	-0.100	-0.127	-0.104	-0.119	-0.159	-0.119	-0.144	0.034
ISLW	-0.308	-0.384	-0.355	-0.387	-0.381	-0.382	-0.362	-0.339	-0.329	-0.335	-0.350	-0.339	-0.323	-0.269	-0.287	-0.263	-0.276	-0.321	-0.280	-0.330	0.041
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.441	0.442	0.428	0.424	0.432	0.404	0.404	0.399	0.415	0.410	0.415	0.428	0.436	0.434	0.452	0.469	0.468	0.466	0.450	0.432	0.022
MR	0.531	0.536	0.524	0.521	0.534	0.500	0.498	0.491	0.509	0.503	0.510	0.520	0.531	0.525	0.543	0.565	0.561	0.562	0.545	0.527	0.022
MSR	0.622	0.631	0.620	0.618	0.635	0.597	0.593	0.583	0.603	0.597	0.605	0.612	0.626	0.615	0.634	0.661	0.655	0.658	0.640	0.621	0.022
R	1.013	1.043	1.044	1.062	1.102	1.086	1.100	1.104	1.133	1.132	1.114	1.093	1.065	1.019	1.017	1.041	1.033	1.046	1.028	1.067	0.039
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.266	0.268	0.262	0.260	0.267	0.250	0.249	0.245	0.254	0.252	0.255	0.260	0.266	0.262	0.271	0.283	0.281	0.281	0.273	0.263	0.011
S2	0.045	0.047	0.048	0.048	0.051	0.048	0.047	0.046	0.047	0.047	0.048	0.046	0.047	0.045	0.045	0.048	0.047	0.048	0.048	0.047	0.001
K1	0.095	0.100	0.103	0.106	0.111	0.115	0.118	0.119	0.121	0.123	0.116	0.112	0.105	0.097	0.093	0.094	0.093	0.096	0.095	0.106	0.011
O1	0.068	0.072	0.074	0.079	0.084	0.089	0.093	0.098	0.099	0.101	0.096	0.088	0.078	0.072	0.066	0.064	0.065	0.066	0.067	0.080	0.013
MSF	0.061	0.056	0.066	0.036	0.033	0.039	0.053	0.041	0.044	0.029	0.063	0.032	0.050	0.038	0.053	0.044	0.062	0.050	0.047	0.047	0.011
z0	0.166	0.103	0.132	0.107	0.131	0.121	0.146	0.169	0.194	0.187	0.165	0.167	0.173	0.207	0.190	0.226	0.209	0.169	0.201	0.166	0.035
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	37.611	36.275	37.177	37.062	35.249	35.716	35.608	36.207	33.528	33.290	33.022	32.916	32.784	35.606	33.728	34.097	35.137	34.256	35.812	35.004	1.530
S2	311.592	310.666	311.321	310.898	310.114	311.984	312.213	314.301	312.908	315.474	314.384	315.348	314.285	316.924	315.935	311.251	314.499	313.156	313.277	313.186	1.976
K1	162.736	162.762	163.865	162.343	161.261	161.276	159.183	157.842	153.845	150.100	147.209	144.877	143.132	148.658	148.078	151.336	155.852	157.201	159.917	155.341	6.730
O1	232.074	227.618	228.131	226.804	225.917	228.905	231.911	235.613	239.752	245.592	250.228	254.125	254.859	256.984	250.900	242.985	240.330	235.491	233.594	239.043	10.418
MSF	279.150	276.172	266.590	260.912	275.759	272.231	283.374	287.840	277.177	302.091	282.746	303.092	264.538	285.711	276.923	283.662	283.309	284.129	271.966	279.862	10.889
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.077	0.097	0.077	0.084	0.076	0.097	0.083	0.086	0.087	0.090	0.074	0.086	0.086	0.082	0.070	0.066	0.077	0.102	0.071		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	85.2	95.6	98.1	98.4	68.3	96.1	99.5	80.5	94.1	96.4	95.9	96.8	95.0	90.3	90.0	90.5	93.5	90.5	91.6		

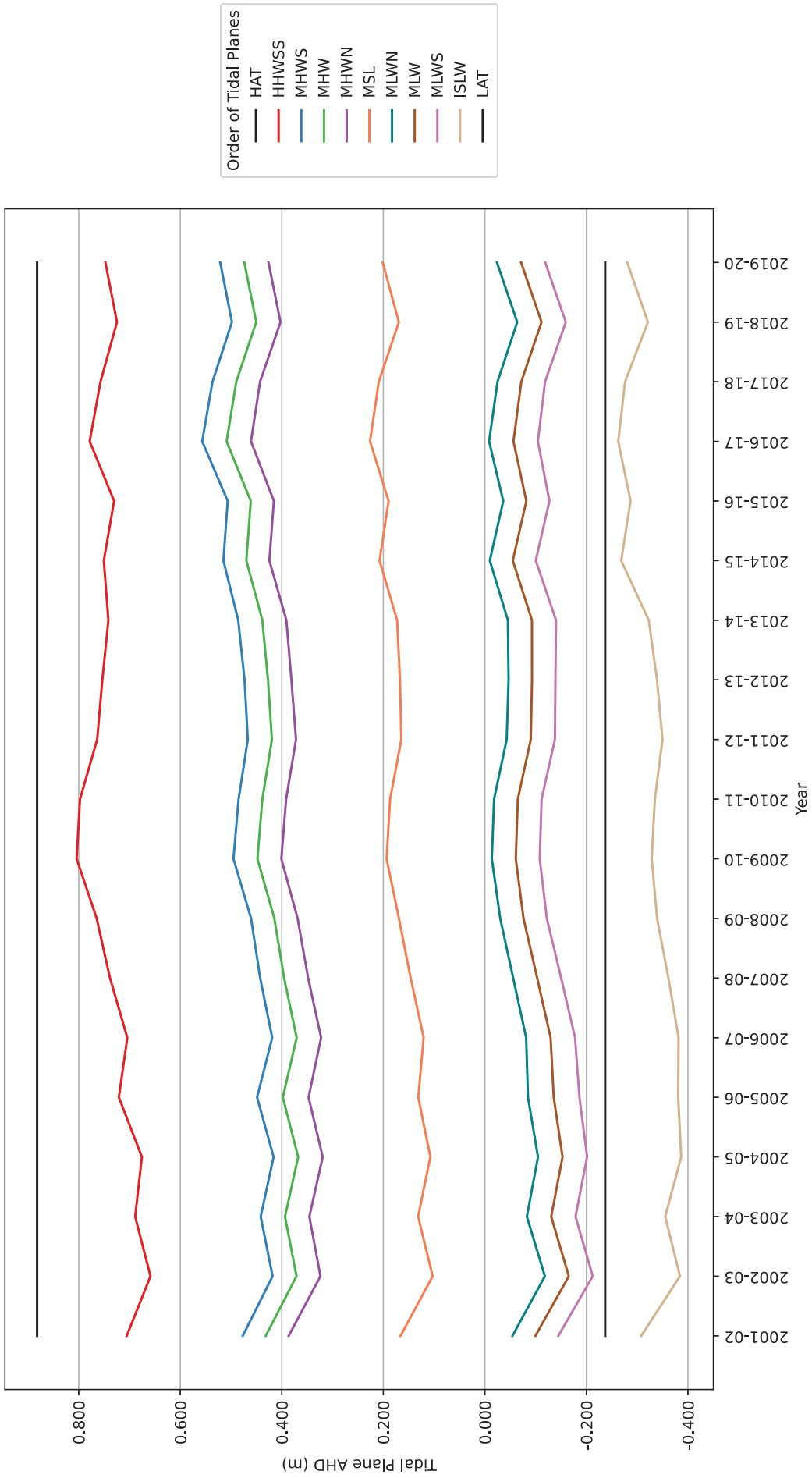
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.88	04/06/2004 22:30	±0.18	10.6
Lowest Astronomical Tide (LAT)	-0.24	25/10/2012 00:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A217

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tomaga River at George Bass Drive

MHL2786

Figure A217

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Moruya River at Moruya Bridge

RECORDING STATION: **Moruya River at Moruya Bridge**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 217410

ZONE: 56
EASTING: 236703
NORTHING: 6022317

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.878	0.822	0.856	0.842	0.856	0.832	0.895	0.901	0.901	0.929	0.916	0.895	0.878	0.879	0.842	0.906	0.881	0.849	0.865	0.875	0.030
MHWS	0.604	0.542	0.564	0.537	0.542	0.500	0.536	0.525	0.535	0.565	0.565	0.570	0.582	0.602	0.580	0.642	0.618	0.591	0.595	0.568	0.036
MHW	0.517	0.455	0.475	0.451	0.454	0.415	0.445	0.435	0.449	0.478	0.476	0.483	0.496	0.514	0.496	0.552	0.529	0.505	0.510	0.481	0.035
MHWN	0.430	0.368	0.386	0.364	0.366	0.331	0.353	0.346	0.364	0.390	0.387	0.396	0.409	0.426	0.411	0.461	0.439	0.419	0.425	0.393	0.035
MSL	0.078	0.028	0.051	0.039	0.050	0.016	0.035	0.037	0.046	0.066	0.061	0.066	0.075	0.083	0.058	0.094	0.074	0.064	0.074	0.058	0.020
MLWN	-0.274	-0.312	-0.283	-0.287	-0.266	-0.298	-0.284	-0.272	-0.273	-0.259	-0.264	-0.264	-0.260	-0.259	-0.296	-0.274	-0.291	-0.290	-0.276	-0.278	0.015
MLW	-0.361	-0.399	-0.372	-0.374	-0.354	-0.383	-0.375	-0.362	-0.358	-0.346	-0.353	-0.351	-0.347	-0.348	-0.381	-0.364	-0.380	-0.376	-0.362	-0.366	0.015
MLWS	-0.448	-0.486	-0.461	-0.460	-0.441	-0.468	-0.466	-0.452	-0.443	-0.433	-0.442	-0.438	-0.433	-0.436	-0.465	-0.455	-0.470	-0.462	-0.447	-0.453	0.015
ISLW	-0.644	-0.686	-0.669	-0.678	-0.666	-0.705	-0.723	-0.720	-0.705	-0.693	-0.693	-0.670	-0.644	-0.634	-0.652	-0.643	-0.657	-0.647	-0.639	-0.672	0.028
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.703	0.680	0.669	0.651	0.633	0.629	0.637	0.618	0.637	0.649	0.652	0.661	0.670	0.685	0.707	0.735	0.730	0.709	0.701	0.671	0.035
MR	0.877	0.854	0.846	0.824	0.808	0.798	0.820	0.797	0.807	0.824	0.830	0.835	0.842	0.862	0.877	0.916	0.909	0.881	0.871	0.846	0.035
MSR	1.052	1.028	1.024	0.997	0.983	0.967	1.002	0.977	0.978	0.998	1.007	1.009	1.015	1.039	1.046	1.097	1.088	1.053	1.042	1.021	0.036
R	1.522	1.508	1.525	1.520	1.521	1.537	1.618	1.620	1.605	1.622	1.608	1.566	1.522	1.513	1.494	1.549	1.538	1.497	1.504	1.547	0.045
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.439	0.427	0.423	0.412	0.404	0.399	0.410	0.399	0.404	0.412	0.415	0.417	0.421	0.431	0.438	0.458	0.454	0.441	0.436	0.423	0.018
S2	0.087	0.087	0.089	0.086	0.088	0.085	0.091	0.090	0.085	0.087	0.089	0.087	0.086	0.088	0.085	0.090	0.089	0.086	0.085	0.087	0.002
K1	0.119	0.123	0.128	0.130	0.134	0.141	0.151	0.157	0.151	0.152	0.146	0.138	0.129	0.122	0.116	0.118	0.116	0.114	0.118	0.132	0.014
O1	0.077	0.078	0.081	0.087	0.091	0.096	0.106	0.111	0.111	0.108	0.104	0.094	0.083	0.076	0.070	0.070	0.071	0.071	0.074	0.087	0.015
MSF	0.034	0.026	0.033	0.001	0.018	0.010	0.027	0.014	0.010	0.012	0.029	0.009	0.020	0.015	0.025	0.015	0.028	0.009	0.016	0.018	0.009
z0	0.078	0.028	0.051	0.039	0.050	0.016	0.035	0.037	0.046	0.066	0.061	0.066	0.075	0.083	0.058	0.094	0.074	0.064	0.074	0.058	0.020
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	14.276	14.890	15.379	17.489	16.852	17.577	16.813	17.697	15.349	13.796	14.015	13.997	14.585	14.939	14.362	13.145	15.051	16.796	18.248	15.540	1.551
S2	291.324	291.147	291.718	293.416	294.216	294.499	299.493	299.602	296.286	296.616	295.980	296.898	296.978	295.964	297.149	292.108	294.726	298.022	296.369	295.395	2.567
K1	132.538	135.114	135.685	135.861	135.965	134.861	132.701	131.844	127.887	123.172	120.887	119.234	119.019	119.781	121.464	124.210	128.943	131.791	135.428	128.757	6.477
O1	196.159	192.792	192.008	194.060	194.305	196.880	199.322	202.876	206.991	211.265	215.411	219.446	219.139	219.017	215.152	205.839	203.872	200.518	199.311	204.440	9.548
MSF	297.305	283.242	264.627	159.423	316.118	256.985	306.998	306.359	285.435	16.855	280.490	10.657	251.932	328.961	267.677	290.119	286.803	291.600	270.011	251.137	90.693
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.084	0.075	0.085	0.085	0.093	0.086	0.078	0.091	0.087	0.072	0.083	0.082	0.078	0.071	0.068	0.077	0.088	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	84.3	98.8	96.7	95.5	89.7	85.1	98.5	97.3	96.1	96.7	94.5	93.9	93.1	91.1	89.5	91.2	94.3	76.5	88.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.02	04/06/2008 21:30	±0.19	10.2
Lowest Astronomical Tide (LAT)	-0.69	09/09/2014 03:15		

COMMENTS

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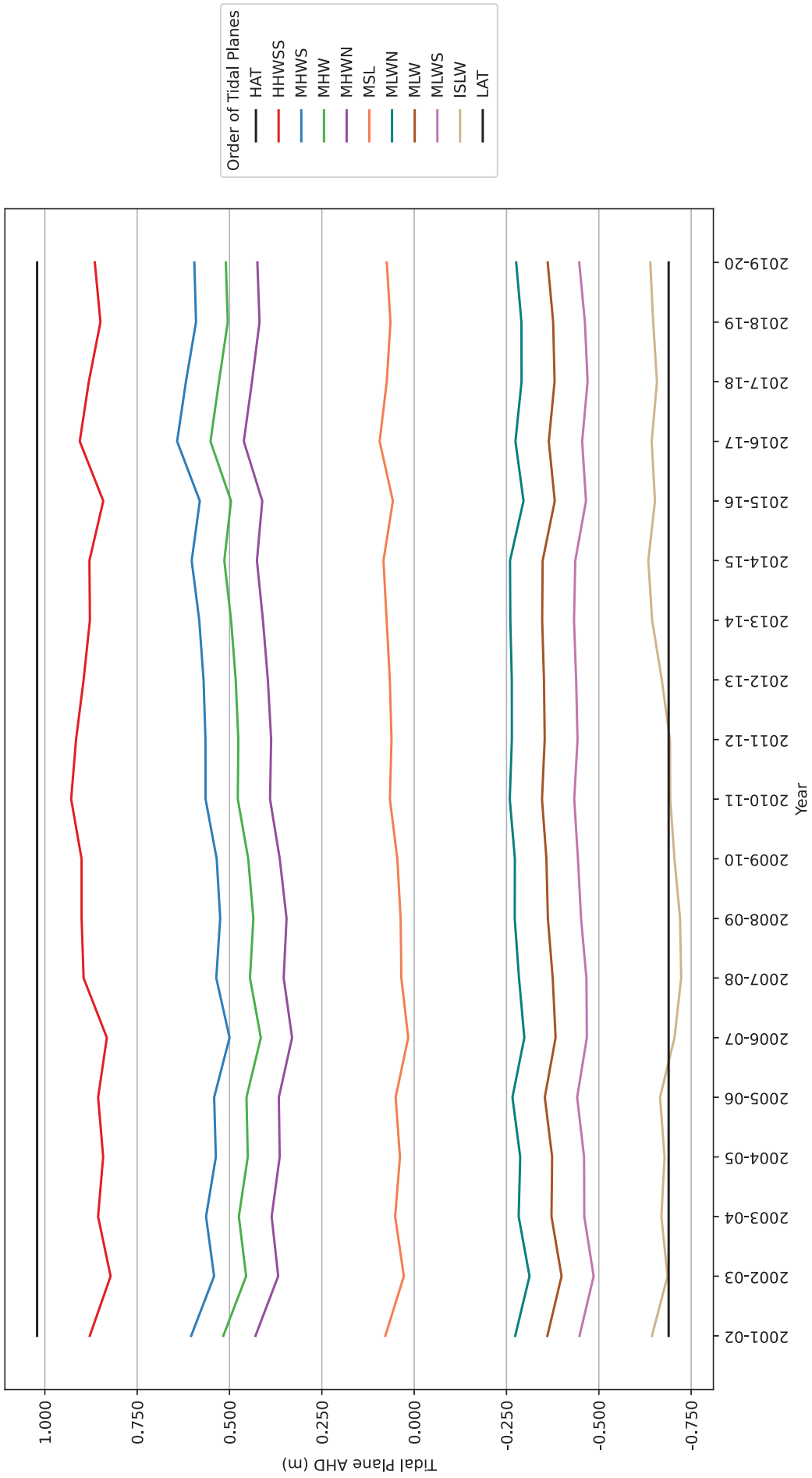
Table A218

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Moruya River at Moruya Bridge

MHL2786

Figure A218

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Moruya River at Moruya Hospital

RECORDING STATION: **Moruya River at Moruya Hospital**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 217402

ZONE: 56
EASTING: 235673
NORTHING: 6022790

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.867	0.806	0.830	0.811	0.839	0.830	0.896	0.885	0.871	0.910	0.919	0.893	0.873	0.879	0.844	0.898	0.885	0.832	0.861	0.865	0.033
MHWS	0.594	0.527	0.537	0.508	0.528	0.498	0.539	0.530	0.519	0.561	0.579	0.571	0.579	0.606	0.584	0.637	0.625	0.572	0.590	0.562	0.039
MHW	0.509	0.442	0.452	0.424	0.444	0.415	0.453	0.444	0.437	0.477	0.494	0.486	0.495	0.521	0.502	0.549	0.537	0.488	0.508	0.478	0.039
MHWN	0.424	0.357	0.366	0.339	0.360	0.332	0.367	0.358	0.355	0.393	0.408	0.402	0.411	0.435	0.421	0.462	0.449	0.404	0.425	0.393	0.038
MSL	0.074	0.020	0.034	0.018	0.046	0.027	0.048	0.053	0.049	0.081	0.088	0.077	0.080	0.097	0.072	0.098	0.090	0.055	0.077	0.062	0.026
MLWN	-0.277	-0.317	-0.298	-0.303	-0.269	-0.277	-0.270	-0.253	-0.257	-0.230	-0.231	-0.248	-0.251	-0.241	-0.276	-0.265	-0.270	-0.293	-0.272	-0.268	0.024
MLW	-0.362	-0.402	-0.384	-0.387	-0.353	-0.361	-0.356	-0.338	-0.340	-0.314	-0.317	-0.333	-0.335	-0.327	-0.357	-0.353	-0.357	-0.377	-0.354	-0.353	0.024
MLWS	-0.447	-0.487	-0.470	-0.472	-0.437	-0.444	-0.443	-0.424	-0.422	-0.398	-0.403	-0.418	-0.419	-0.412	-0.439	-0.440	-0.445	-0.461	-0.436	-0.438	0.024
ISLW	-0.642	-0.686	-0.679	-0.688	-0.659	-0.681	-0.697	-0.678	-0.673	-0.648	-0.645	-0.648	-0.629	-0.607	-0.625	-0.627	-0.630	-0.647	-0.630	-0.654	0.026
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.700	0.674	0.664	0.643	0.629	0.609	0.637	0.611	0.612	0.623	0.639	0.650	0.662	0.676	0.697	0.727	0.719	0.698	0.697	0.661	0.037
MR	0.871	0.844	0.836	0.811	0.797	0.775	0.810	0.782	0.777	0.791	0.811	0.819	0.830	0.848	0.860	0.902	0.894	0.865	0.862	0.831	0.038
MSR	1.042	1.014	1.007	0.979	0.966	0.942	0.982	0.953	0.942	0.959	0.982	0.988	0.998	1.019	1.023	1.077	1.070	1.033	1.026	1.000	0.040
R	1.510	1.492	1.510	1.499	1.498	1.511	1.593	1.563	1.544	1.558	1.564	1.540	1.502	1.486	1.469	1.525	1.515	1.480	1.490	1.518	0.034
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.436	0.422	0.418	0.406	0.399	0.388	0.405	0.391	0.388	0.395	0.405	0.410	0.415	0.424	0.430	0.451	0.447	0.433	0.431	0.415	0.019
S2	0.085	0.085	0.086	0.084	0.084	0.083	0.086	0.086	0.082	0.084	0.086	0.085	0.084	0.086	0.081	0.087	0.088	0.084	0.082	0.085	0.002
K1	0.119	0.121	0.129	0.129	0.132	0.140	0.148	0.145	0.143	0.144	0.142	0.136	0.128	0.119	0.116	0.117	0.114	0.115	0.118	0.129	0.012
O1	0.076	0.078	0.081	0.088	0.090	0.097	0.107	0.109	0.108	0.106	0.101	0.094	0.082	0.075	0.070	0.070	0.071	0.071	0.075	0.087	0.014
MSF	0.032	0.028	0.031	0.005	0.019	0.008	0.029	0.014	0.013	0.009	0.033	0.011	0.022	0.017	0.027	0.016	0.029	0.009	0.020	0.020	0.009
z0	0.074	0.020	0.034	0.018	0.046	0.027	0.048	0.053	0.049	0.081	0.088	0.077	0.080	0.097	0.072	0.098	0.090	0.055	0.077	0.062	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	17.390	18.631	19.179	21.216	20.145	21.078	19.960	20.921	18.873	16.820	16.986	17.232	17.802	18.112	17.654	16.098	18.344	20.645	21.578	18.877	1.697
S2	294.591	295.857	296.051	298.148	298.843	300.466	298.712	300.766	299.028	299.457	299.855	301.262	301.261	299.835	301.430	295.817	299.330	300.692	301.292	299.089	2.109
K1	135.020	138.283	138.600	138.958	138.521	139.338	135.326	134.467	130.481	125.576	123.187	121.541	121.375	122.344	123.655	125.734	131.479	135.304	138.012	131.432	6.835
O1	197.377	195.196	194.331	196.708	196.527	199.683	202.131	205.812	209.753	213.590	218.003	221.527	220.998	220.616	217.432	208.118	206.413	204.096	201.884	206.852	9.416
MSF	280.726	282.693	266.658	225.972	329.657	269.672	296.361	314.306	292.947	17.223	278.002	0.226	255.759	330.285	269.122	300.500	290.904	297.232	277.744	256.631	90.774
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.071	0.089	0.077	0.084	0.086	0.094	0.081	0.073	0.095	0.090	0.068	0.078	0.082	0.077	0.070	0.065	0.077	0.090	0.078		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	90.2	94.4	78.4	99.6	96.5	86.4	99.3	97.0	91.4	95.7	87.2	93.2	92.5	89.6	88.2	91.3	92.6	90.5	91.7		

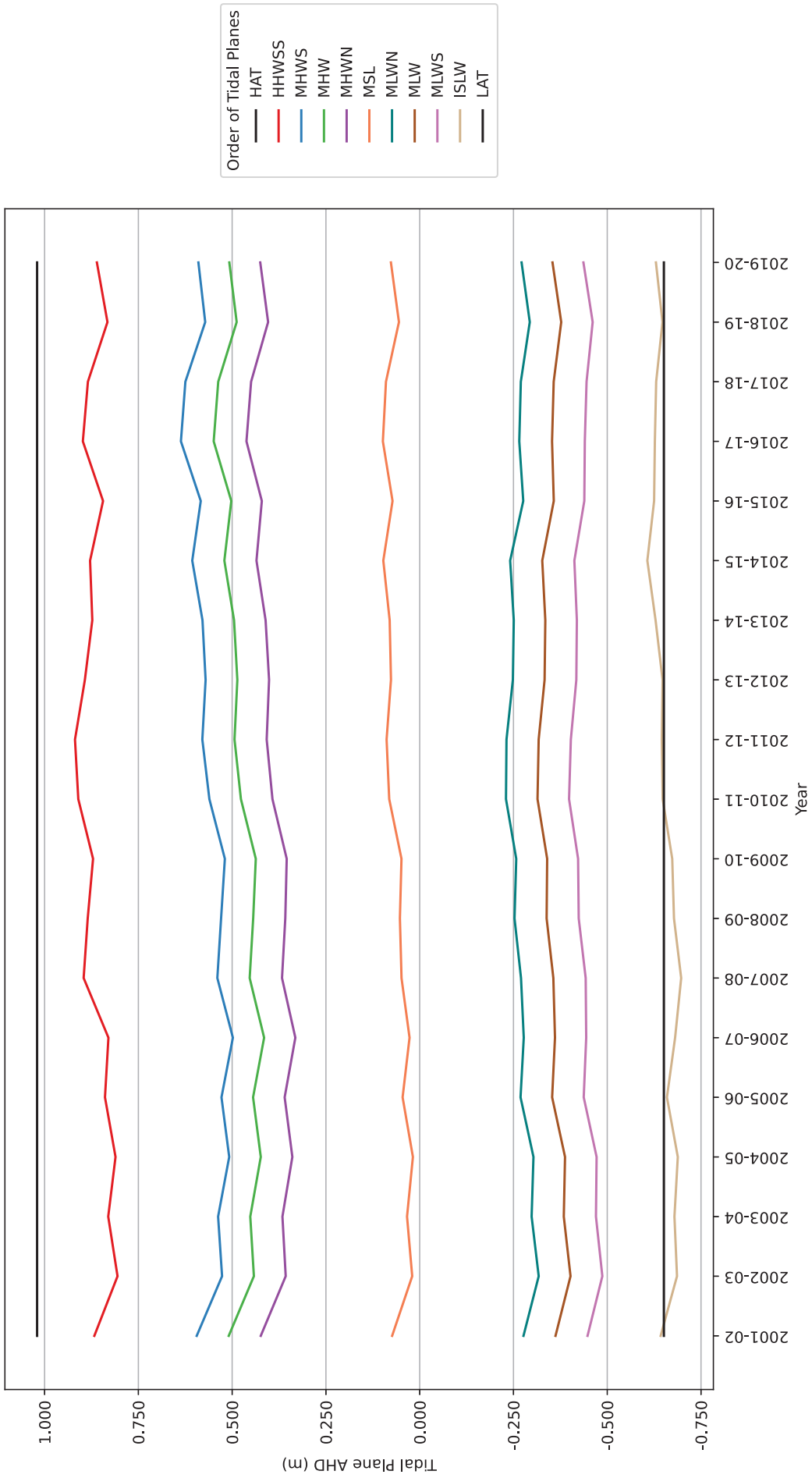
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	1.02	04/06/2008 21:30	±0.19	10.4
Lowest Astronomical Tide (LAT)	-0.65	09/09/2014 03:30		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A219

MHL2786

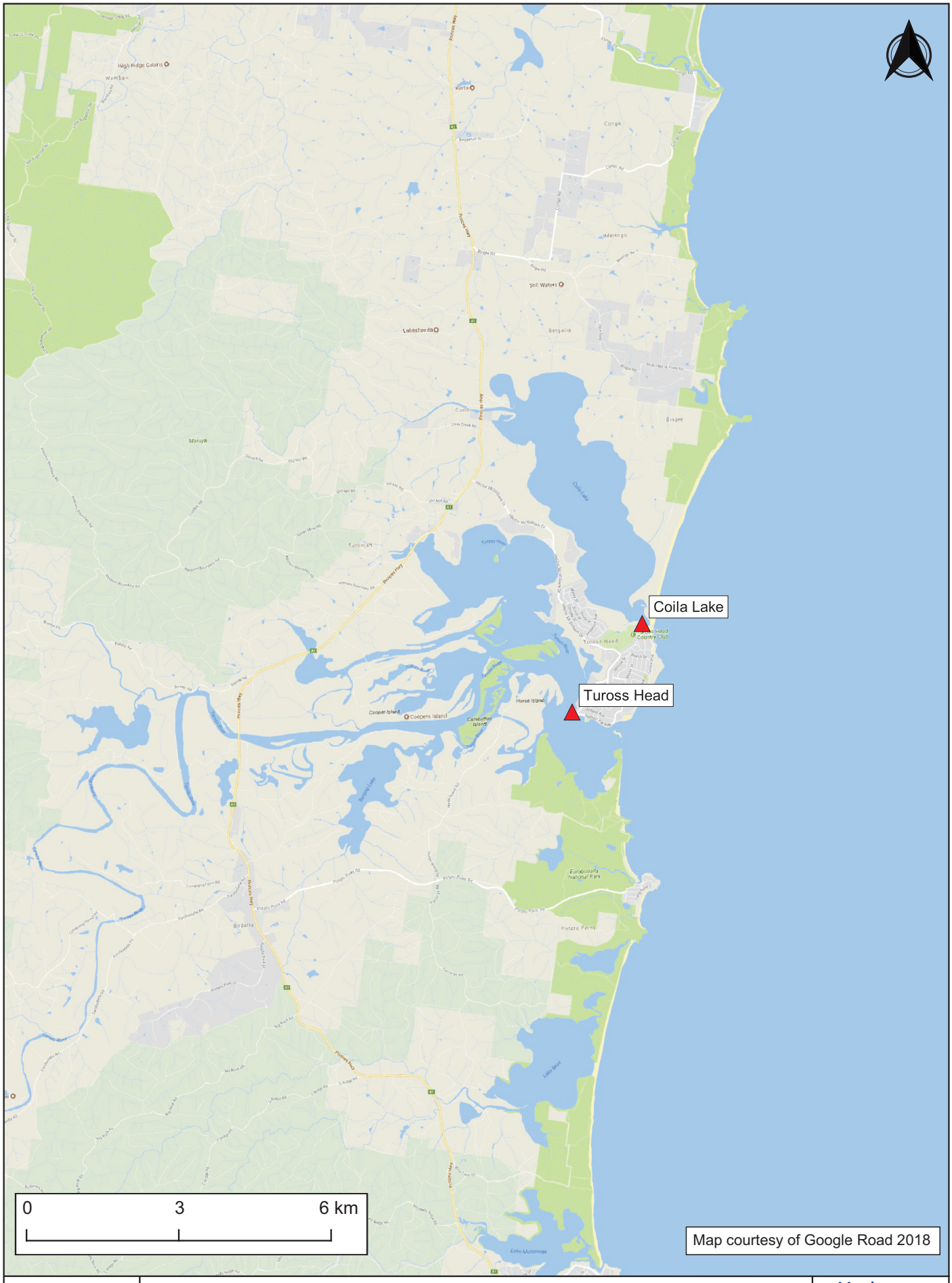


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Moruya River at Moruya Hospital

MHL2786

Figure A219



NSW GOVERNMENT

STATION LOCATIONS
COILA AND TUROSS LAKES

Manly Hydraulics Laboratory

Report MHL2786

Figure

A220

DRAWING A220.PDF

RECORDING STATION: **Tuross River at Tuross Head**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 218410

ZONE: 56
EASTING: 240898
NORTHING: 6005120

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09^	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.390	0.327	0.337	0.304	0.299	0.225	0.314		0.429	0.526	0.448	0.424	0.391	0.409	0.430	0.547	0.469	0.381	0.371	0.390	0.082
MHWS	0.335	0.289	0.290	0.264	0.263	0.204	0.259		0.344	0.377	0.293	0.298	0.302	0.314	0.326	0.401	0.349	0.294	0.318	0.307	0.046
MHW	0.327	0.284	0.284	0.260	0.259	0.202	0.254		0.336	0.360	0.274	0.283	0.291	0.300	0.310	0.373	0.326	0.281	0.311	0.295	0.041
MHWN	0.318	0.280	0.278	0.256	0.256	0.199	0.248		0.327	0.344	0.256	0.268	0.280	0.287	0.294	0.344	0.304	0.268	0.304	0.284	0.037
MSL	0.286	0.261	0.257	0.239	0.240	0.190	0.227		0.284	0.263	0.172	0.203	0.229	0.220	0.206	0.205	0.201	0.206	0.268	0.231	0.033
MLWN	0.254	0.242	0.235	0.222	0.224	0.181	0.205		0.242	0.183	0.088	0.139	0.178	0.154	0.118	0.065	0.098	0.143	0.231	0.178	0.059
MLW	0.246	0.238	0.229	0.218	0.220	0.178	0.200		0.233	0.166	0.069	0.124	0.166	0.140	0.102	0.037	0.076	0.130	0.225	0.167	0.065
MLWS	0.238	0.234	0.224	0.214	0.217	0.176	0.194		0.224	0.150	0.051	0.108	0.155	0.127	0.085	0.009	0.053	0.117	0.218	0.155	0.072
ISLW	0.199	0.206	0.190	0.185	0.191	0.161	0.155		0.164	0.043	-0.060	0.019	0.092	0.059	0.011	-0.096	-0.033	0.055	0.180	0.096	0.098
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.064	0.038	0.043	0.034	0.032	0.018	0.043		0.086	0.161	0.168	0.129	0.102	0.133	0.176	0.279	0.206	0.125	0.073	0.106	0.072
MR	0.080	0.046	0.054	0.042	0.039	0.023	0.054		0.103	0.194	0.205	0.159	0.124	0.160	0.209	0.336	0.251	0.151	0.086	0.129	0.086
MSR	0.097	0.055	0.066	0.050	0.046	0.029	0.065		0.120	0.228	0.242	0.189	0.147	0.187	0.241	0.392	0.295	0.176	0.100	0.151	0.100
R	0.191	0.120	0.148	0.120	0.108	0.065	0.158		0.266	0.483	0.507	0.405	0.299	0.350	0.419	0.643	0.502	0.326	0.191	0.294	0.169
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.040	0.023	0.027	0.021	0.019	0.012	0.027		0.051	0.097	0.102	0.080	0.062	0.080	0.104	0.168	0.125	0.075	0.043	0.064	0.043
S2	0.008	0.004	0.006	0.004	0.004	0.003	0.005		0.009	0.017	0.019	0.015	0.011	0.013	0.016	0.028	0.022	0.013	0.007	0.011	0.007
K1	0.021	0.014	0.018	0.015	0.013	0.008	0.019		0.032	0.057	0.059	0.047	0.035	0.037	0.041	0.060	0.049	0.035	0.019	0.032	0.017
O1	0.019	0.013	0.016	0.014	0.013	0.007	0.020		0.029	0.049	0.052	0.043	0.029	0.031	0.033	0.045	0.037	0.027	0.019	0.028	0.013
MSF	0.069	0.050	0.070	0.035	0.045	0.028	0.045		0.031	0.028	0.054	0.027	0.045	0.031	0.054	0.038	0.057	0.038	0.040	0.044	0.013
z0	0.286	0.261	0.257	0.239	0.240	0.190	0.227		0.284	0.263	0.172	0.203	0.229	0.220	0.206	0.205	0.201	0.206	0.268	0.231	0.033
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	61.687	65.874	66.358	67.039	64.728	61.310	61.481		52.934	46.920	48.791	51.544	55.241	52.816	47.358	40.798	48.311	56.895	59.729	56.101	7.849
S2	326.585	327.273	327.217	315.962	318.823	299.386	325.385		312.843	323.862	321.554	325.407	324.942	326.099	321.714	314.213	320.758	324.589	320.081	320.927	6.953
K1	203.871	209.529	212.503	214.272	209.945	207.066	205.754		175.351	173.689	168.940	175.374	176.808	175.496	170.185	163.127	177.302	192.834	199.049	189.505	17.971
O1	274.658	278.746	279.216	284.963	278.686	290.646	279.637		273.747	270.198	273.070	283.180	288.715	284.378	274.930	256.773	261.546	268.747	273.986	276.435	8.740
MSF	308.470	305.358	296.941	299.913	310.795	284.840	298.379		270.770	304.879	290.891	301.779	284.338	309.700	279.856	290.084	288.511	290.082	280.785	294.243	11.555
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066	0.086	0.065	0.072	0.059	0.110	0.070		0.067	0.082	0.076	0.087	0.084	0.101	0.075	0.064	0.085	0.091	0.067		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	87.6	93.3	97.3	94.6	76.0	94.8	94.8	87.7	51.2	84.1	95.3	96.7	96.9	92.6	91.0	88.8	96.6	99.7	91.9		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.53	04/06/2004 23:00	±0.20	60.6
Lowest Astronomical Tide (LAT)	0.06	08/09/2004 10:15		

COMMENTS ^Estuary entrance was closed for this period resulting in non-tidal data.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Tuross River at Tuross Head

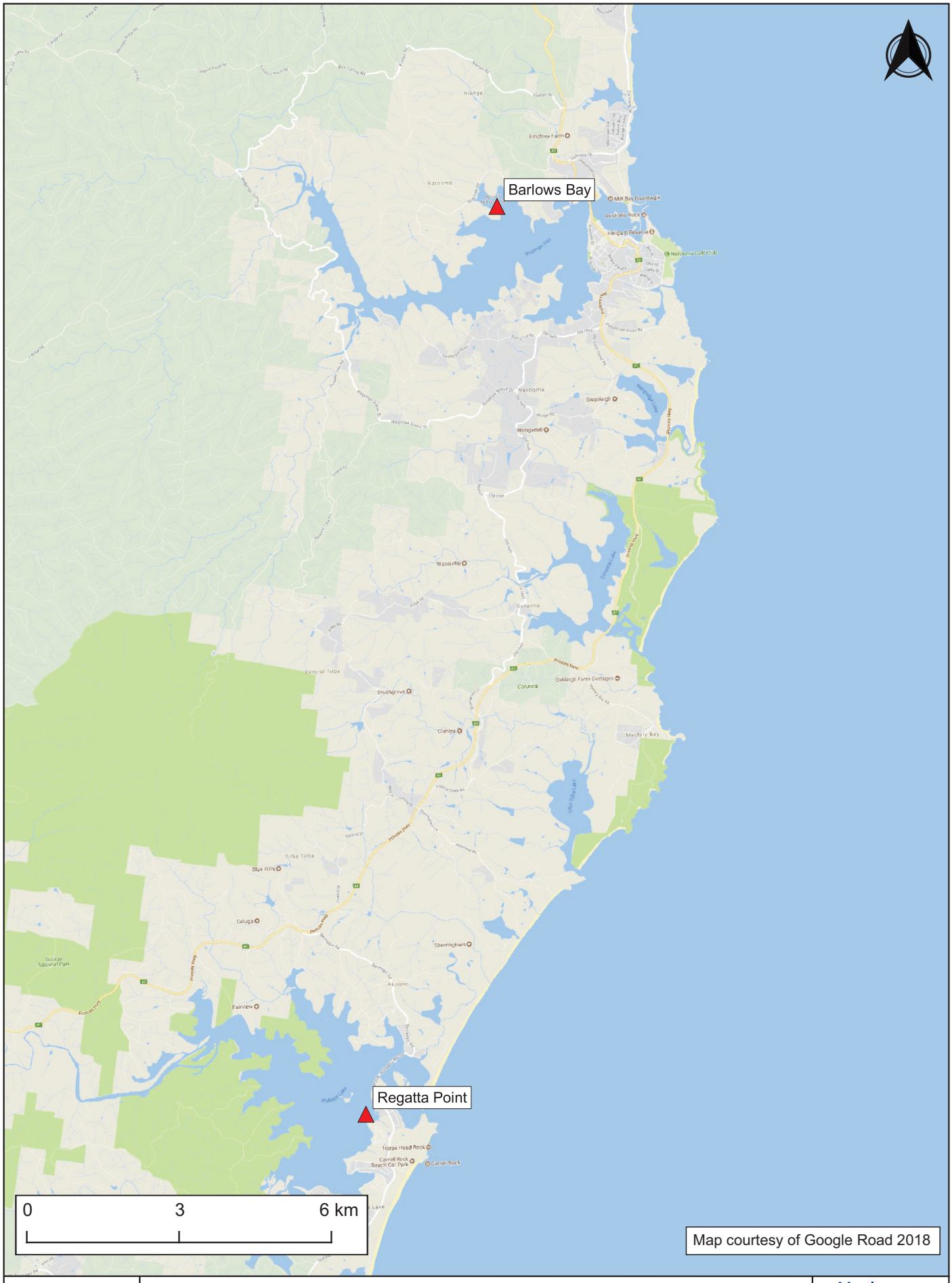
Table A221

NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Tuross River at Tuross Head

MHL2786

Figure
A221



NSW GOVERNMENT

STATION LOCATIONS
WAGONGA INLET AND WALLAGA LAKE

Manly Hydraulics Laboratory

Report MHL2786

Figure

A222

DRAWING A222.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Wagonga Inlet at Barlows Bay

RECORDING STATION: **Wagonga Inlet at Barlows Bay**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 218415

ZONE: 56
EASTING: 239464
NORTHING: 5988955

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.643	0.593	0.629	0.620	0.653	0.630	0.674	0.684	0.666	0.692	0.694	0.673	0.664	0.656	0.617	0.674	0.657	0.634	0.660	0.653	0.027
MHWS	0.404	0.349	0.373	0.352	0.375	0.339	0.370	0.369	0.348	0.373	0.393	0.388	0.401	0.414	0.387	0.446	0.428	0.405	0.421	0.386	0.029
MHW	0.353	0.297	0.321	0.299	0.321	0.286	0.316	0.315	0.295	0.319	0.338	0.335	0.347	0.361	0.334	0.391	0.373	0.350	0.366	0.332	0.029
MHWN	0.302	0.245	0.268	0.246	0.266	0.233	0.261	0.260	0.242	0.265	0.283	0.281	0.294	0.308	0.281	0.337	0.318	0.295	0.311	0.279	0.029
MSL	0.062	0.012	0.033	0.017	0.041	0.013	0.038	0.037	0.017	0.035	0.051	0.047	0.055	0.062	0.037	0.084	0.061	0.040	0.057	0.042	0.019
MLWN	-0.177	-0.221	-0.203	-0.211	-0.185	-0.208	-0.184	-0.187	-0.209	-0.195	-0.180	-0.187	-0.184	-0.184	-0.208	-0.169	-0.197	-0.215	-0.197	-0.195	0.014
MLW	-0.229	-0.273	-0.255	-0.265	-0.239	-0.261	-0.239	-0.241	-0.262	-0.249	-0.235	-0.240	-0.238	-0.237	-0.261	-0.223	-0.252	-0.270	-0.252	-0.248	0.014
MLWS	-0.280	-0.324	-0.308	-0.318	-0.293	-0.313	-0.293	-0.296	-0.315	-0.304	-0.290	-0.293	-0.291	-0.290	-0.314	-0.277	-0.307	-0.325	-0.307	-0.302	0.014
ISLW	-0.450	-0.499	-0.490	-0.509	-0.492	-0.522	-0.510	-0.521	-0.542	-0.531	-0.505	-0.497	-0.479	-0.463	-0.478	-0.440	-0.471	-0.489	-0.478	-0.493	0.027
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.479	0.466	0.471	0.457	0.451	0.441	0.446	0.447	0.451	0.460	0.463	0.468	0.478	0.492	0.489	0.507	0.514	0.510	0.508	0.474	0.024
MR	0.582	0.570	0.576	0.563	0.560	0.547	0.554	0.556	0.557	0.568	0.573	0.575	0.585	0.598	0.595	0.615	0.625	0.620	0.619	0.581	0.024
MSR	0.684	0.673	0.681	0.670	0.668	0.652	0.663	0.666	0.664	0.677	0.682	0.681	0.692	0.705	0.701	0.723	0.735	0.729	0.729	0.688	0.025
R	1.093	1.092	1.119	1.130	1.144	1.152	1.185	1.204	1.208	1.224	1.199	1.170	1.144	1.119	1.095	1.114	1.128	1.123	1.138	1.146	0.041
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.291	0.285	0.288	0.282	0.280	0.273	0.277	0.278	0.279	0.284	0.286	0.287	0.292	0.299	0.298	0.307	0.312	0.310	0.309	0.290	0.012
S2	0.051	0.052	0.053	0.053	0.054	0.053	0.054	0.055	0.053	0.054	0.055	0.053	0.053	0.053	0.053	0.054	0.055	0.055	0.055	0.054	0.001
K1	0.100	0.104	0.108	0.112	0.115	0.121	0.123	0.127	0.127	0.130	0.123	0.117	0.112	0.103	0.099	0.098	0.098	0.100	0.102	0.111	0.011
O1	0.070	0.071	0.075	0.080	0.084	0.088	0.094	0.098	0.100	0.098	0.093	0.087	0.077	0.070	0.065	0.065	0.065	0.064	0.069	0.079	0.013
MSF	0.038	0.032	0.039	0.007	0.020	0.014	0.027	0.019	0.016	0.014	0.035	0.016	0.022	0.012	0.025	0.020	0.036	0.014	0.022	0.023	0.009
z0	0.062	0.012	0.033	0.017	0.041	0.013	0.038	0.037	0.017	0.035	0.051	0.047	0.055	0.062	0.037	0.084	0.061	0.040	0.057	0.042	0.019
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	48.910	49.414	49.730	49.931	50.254	48.749	47.795	45.667	44.333	43.351	42.855	42.944	43.232	44.007	43.827	43.917	43.764	44.852	45.435	45.946	2.736
S2	327.259	327.596	327.711	328.786	329.374	328.221	327.962	328.069	327.361	329.462	325.601	329.313	327.031	327.900	328.419	325.558	324.552	324.165	324.209	327.292	1.698
K1	164.626	166.487	166.526	165.398	165.659	163.675	160.140	157.805	154.978	149.415	147.225	145.674	144.937	146.434	148.410	151.956	155.192	158.067	160.083	156.457	7.780
O1	226.212	224.300	222.759	222.587	222.458	223.142	225.766	227.262	232.210	235.754	242.367	245.127	244.252	244.441	242.552	234.497	229.545	225.884	224.038	231.324	8.538
MSF	268.730	279.855	262.477	243.527	333.600	296.820	300.648	302.605	269.799	355.475	283.399	343.030	261.841	302.360	285.222	293.621	283.520	298.575	278.273	291.757	28.303
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.072	0.086	0.076	0.084	0.088	0.094	0.080	0.073	0.088	0.092	0.071	0.082	0.081	0.077	0.069	0.066	0.076	0.092	0.072		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	89.2	97.7	96.7	97.8	97.2	97.8	97.0	97.6	98.2	97.2	96.3	97.1	92.9	94.0	92.5	94.7	97.2	95.7	92.2		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.79	04/06/2004 23:00	±0.19	15.3
Lowest Astronomical Tide (LAT)	-0.40	07/10/2014 03:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A223

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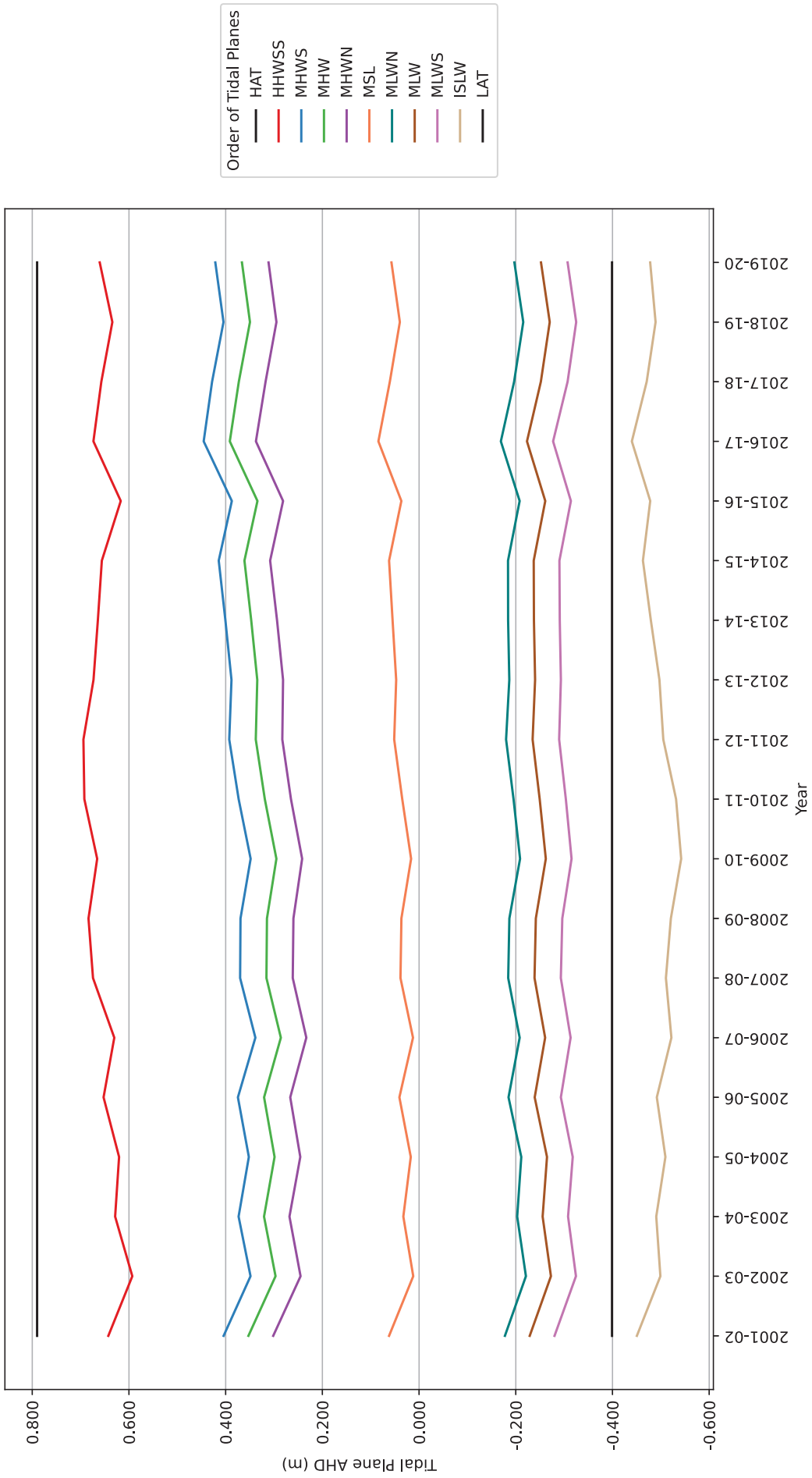


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wagonga Inlet at Barlows Bay

MHL2786

Figure A223

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wallaga Lake at Regatta Point

RECORDING STATION: **Wallaga Lake at Regatta Point**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 219405

ZONE: 56
EASTING: 236881
NORTHING: 5971060

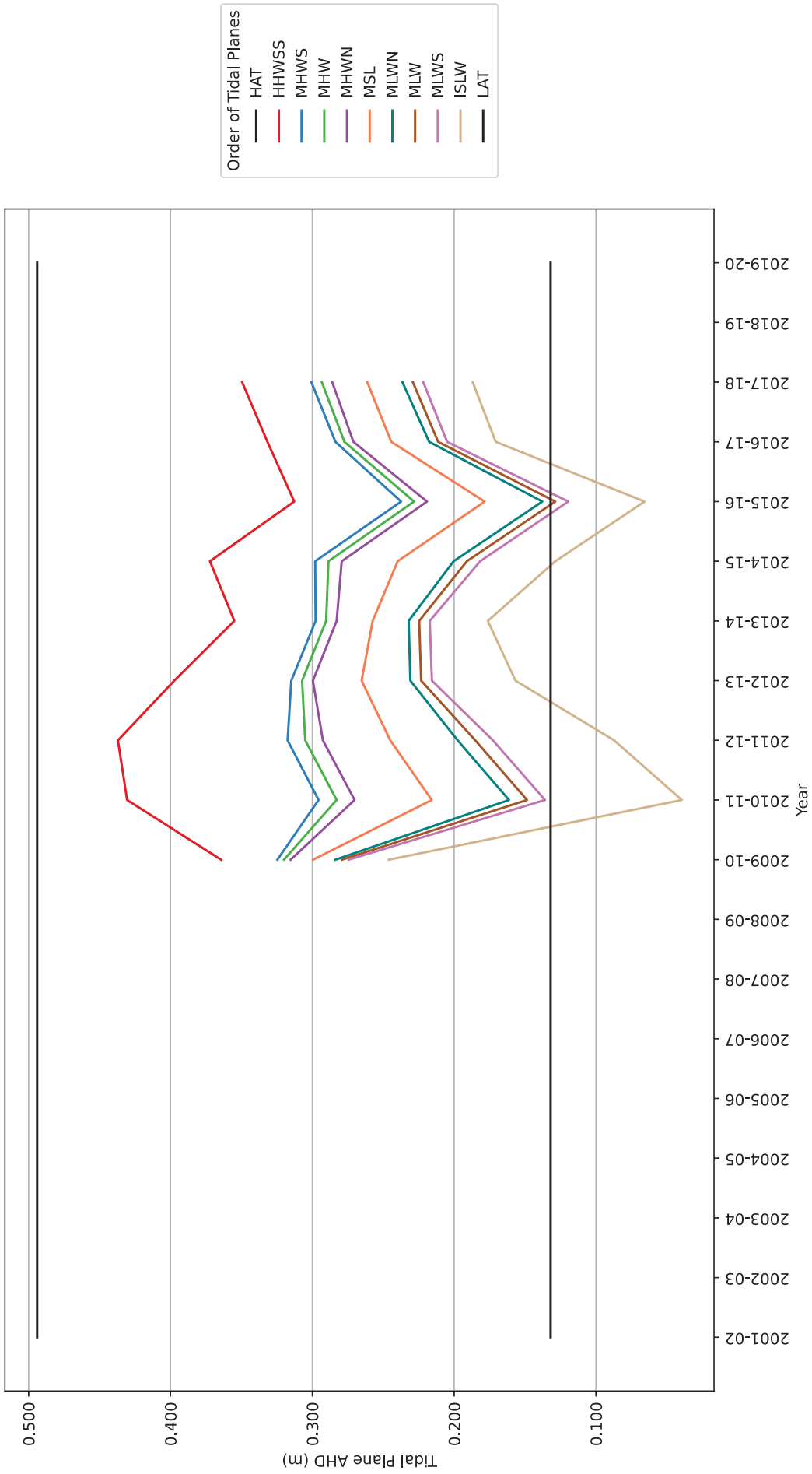
YEAR	2001-02	2002-03^	2003-04^	2004-05^	2005-06^	2006-07*	2007-08	2008-09*	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20^	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.387						0.355		0.364	0.431	0.437	0.397	0.355	0.372	0.313	0.332	0.349			0.372	0.038
MHWS	0.357						0.307		0.325	0.296	0.317	0.315	0.298	0.298	0.237	0.284	0.301			0.303	0.029
MHW	0.353						0.304		0.320	0.283	0.305	0.307	0.290	0.289	0.228	0.277	0.293			0.295	0.031
MHWN	0.349						0.302		0.315	0.270	0.293	0.300	0.283	0.279	0.219	0.271	0.286			0.288	0.032
MSL	0.336						0.288		0.300	0.216	0.245	0.265	0.257	0.240	0.178	0.244	0.261			0.257	0.042
MLWN	0.324						0.275		0.284	0.161	0.198	0.231	0.232	0.200	0.138	0.218	0.236			0.227	0.054
MLW	0.320						0.272		0.279	0.149	0.185	0.223	0.225	0.191	0.129	0.211	0.229			0.219	0.056
MLWS	0.315						0.269		0.274	0.136	0.173	0.216	0.217	0.182	0.120	0.205	0.222			0.212	0.059
ISLW	0.294						0.235		0.246	0.040	0.087	0.157	0.176	0.129	0.066	0.171	0.187			0.162	0.079
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.024						0.027		0.032	0.109	0.095	0.069	0.051	0.079	0.081	0.053	0.050			0.061	0.028
MR	0.033						0.032		0.041	0.134	0.120	0.084	0.066	0.098	0.100	0.066	0.064			0.076	0.034
MSR	0.042						0.037		0.050	0.160	0.145	0.099	0.080	0.116	0.118	0.079	0.079			0.091	0.040
R	0.093						0.120		0.118	0.391	0.350	0.241	0.179	0.244	0.247	0.161	0.163			0.210	0.096
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.017						0.016		0.020	0.067	0.060	0.042	0.033	0.049	0.050	0.033	0.032			0.038	0.017
S2	0.004						0.003		0.005	0.013	0.012	0.008	0.007	0.009	0.009	0.006	0.007			0.008	0.003
K1	0.010						0.025		0.015	0.049	0.043	0.030	0.021	0.028	0.029	0.018	0.018			0.026	0.012
O1	0.011						0.009		0.014	0.047	0.042	0.029	0.020	0.025	0.025	0.016	0.017			0.023	0.012
MSF	0.045						0.032		0.027	0.033	0.066	0.027	0.044	0.032	0.065	0.031	0.087			0.044	0.020
z0	0.336						0.288		0.300	0.216	0.245	0.265	0.257	0.240	0.178	0.244	0.261			0.257	0.042
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	81.920						84.593		73.371	70.286	68.927	71.243	73.290	68.961	72.300	76.808	75.757			74.314	5.110
S2	355.259						41.358		329.903	347.576	343.822	343.701	347.301	349.759	350.307	345.100	346.363			318.223	92.039
K1	225.386						236.545		184.768	197.487	189.768	196.080	189.903	196.465	199.588	205.584	209.563			202.831	15.772
O1	291.234						280.490		274.556	283.435	293.502	294.403	304.305	295.010	297.895	294.757	288.390			290.725	8.466
MSF	325.438						313.926		256.614	289.814	291.801	296.355	307.546	307.342	282.357	307.108	292.273			297.325	18.334
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.066						0.053		0.132	0.088	0.082	0.122	0.100	0.117	0.084	0.072	0.082				
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	80.6	86.6	86.1	92.9	72.5	35.9	57.4	35.8	92.3	98.8	98.6	97.7	77.5	98.3	84.0	88.6	57.9	45.4	70.3		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.49	05/06/2004 00:00	±0.26	108.4
Lowest Astronomical Tide (LAT)	0.13	10/02/2003 23:00		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

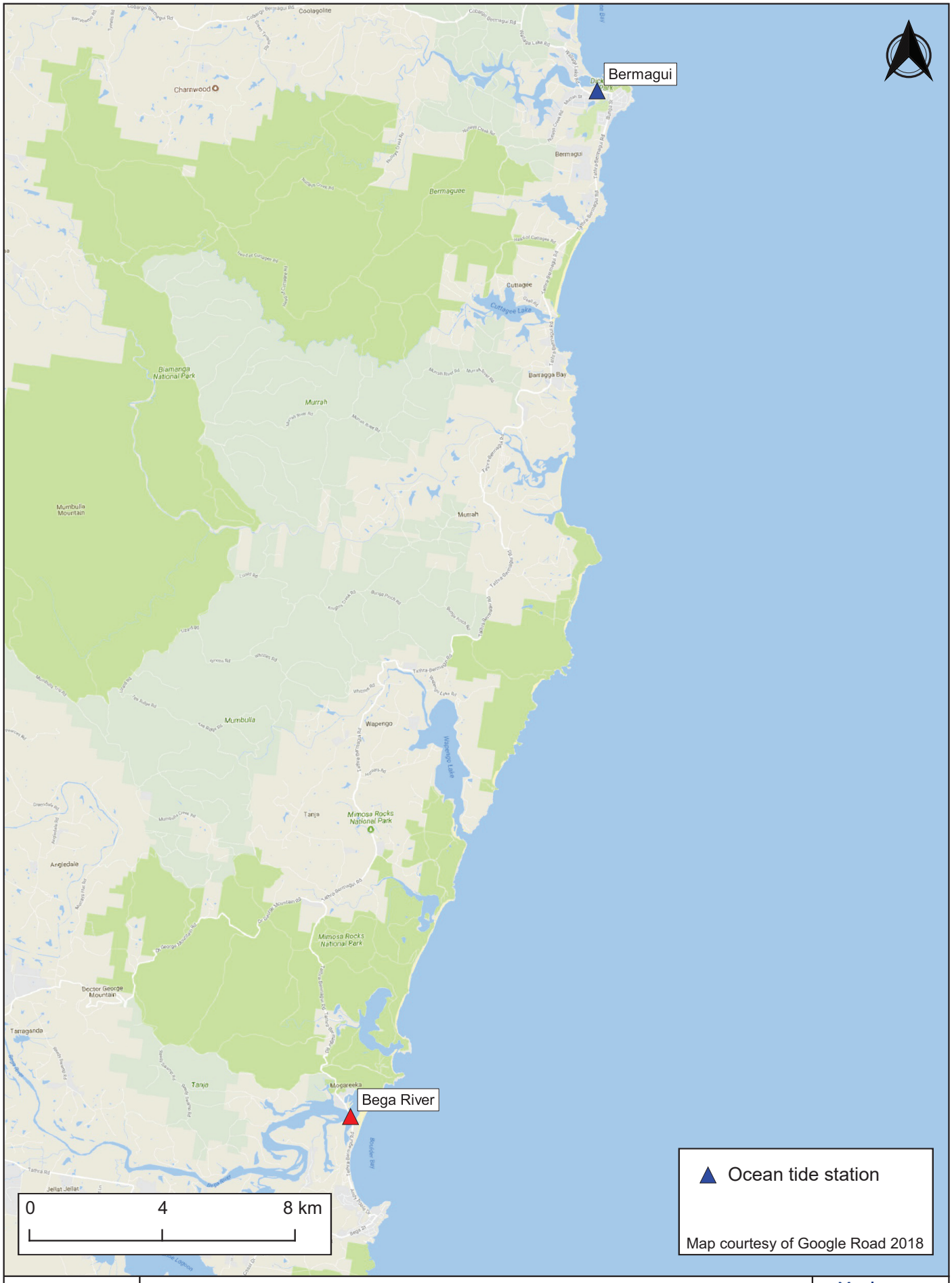


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wallaga Lake at Regatta Point

MHL2786

Figure A224



NSW GOVERNMENT

STATION LOCATIONS
BERMAGUI AND BEGA RIVER REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A225

DRAWING A225.PDF

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Bega River at Bega River

RECORDING STATION: **Bega River at Bega River**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 219410

ZONE: 55
EASTING: 766021
NORTHING: 5933983

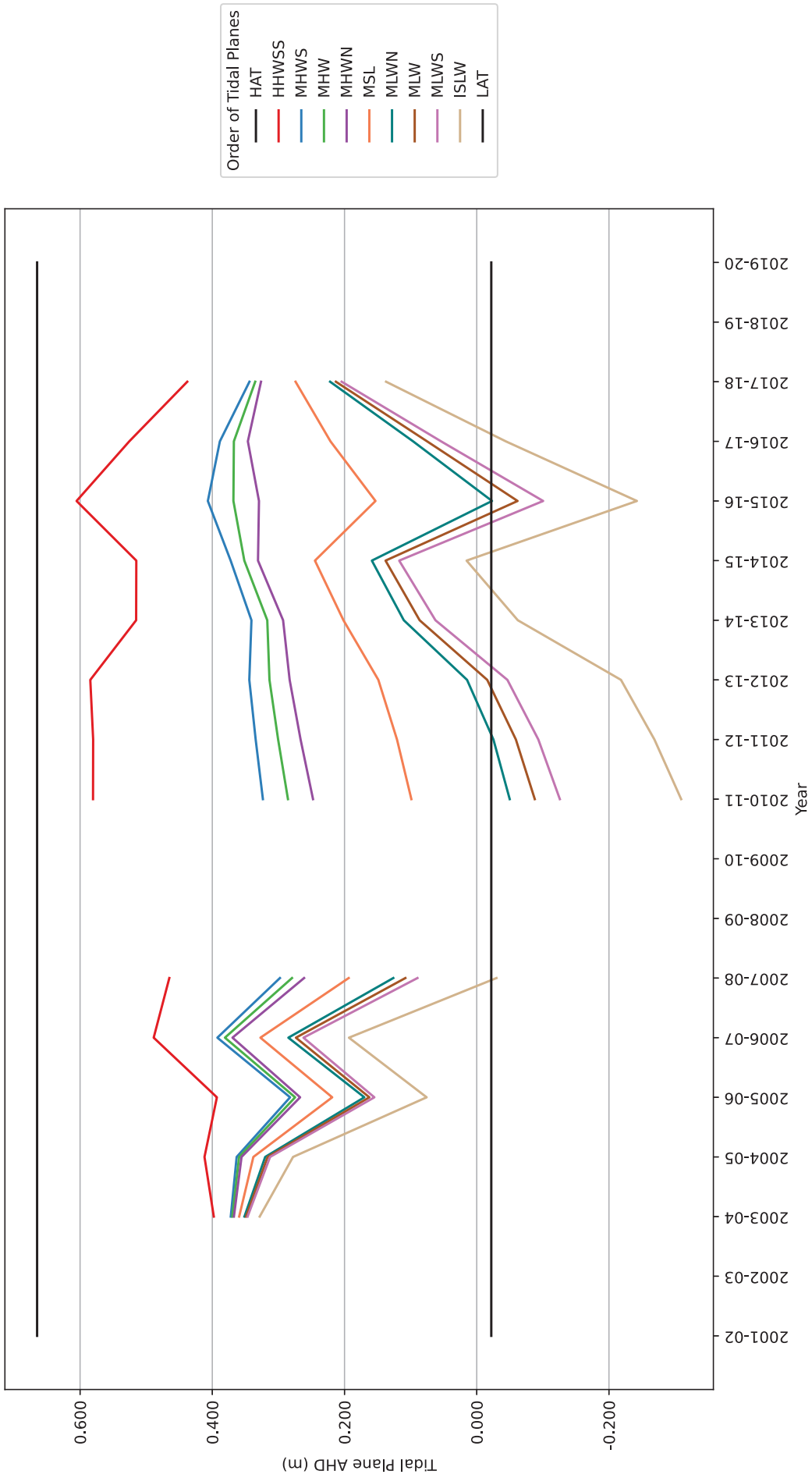
YEAR	2001-02	2002-03*	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09^	2009-10*	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.476		0.398	0.412	0.393	0.489	0.465			0.580	0.580	0.585	0.515	0.515	0.605	0.526	0.438			0.498	0.072
MHWS	0.353		0.372	0.363	0.282	0.392	0.298			0.323	0.334	0.344	0.341	0.372	0.407	0.389	0.344			0.351	0.035
MHW	0.337		0.370	0.359	0.275	0.381	0.279			0.286	0.300	0.314	0.317	0.352	0.368	0.367	0.335			0.331	0.036
MHWN	0.321		0.367	0.356	0.267	0.369	0.261			0.248	0.266	0.283	0.293	0.331	0.329	0.346	0.326			0.312	0.042
MSL	0.254		0.359	0.338	0.219	0.327	0.194			0.099	0.121	0.149	0.202	0.245	0.153	0.221	0.274			0.225	0.080
MLWN	0.187		0.351	0.320	0.170	0.285	0.126			-0.050	-0.025	0.015	0.110	0.159	-0.023	0.096	0.222			0.139	0.129
MLW	0.171		0.349	0.316	0.162	0.274	0.108			-0.088	-0.059	-0.016	0.086	0.138	-0.062	0.075	0.213			0.119	0.141
MLWS	0.155		0.347	0.313	0.155	0.262	0.090			-0.126	-0.093	-0.046	0.062	0.117	-0.100	0.054	0.204			0.099	0.153
ISLW	0.067		0.328	0.278	0.076	0.193	-0.030			-0.309	-0.269	-0.218	-0.062	0.015	-0.242	-0.044	0.137			-0.006	0.202
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.134		0.016	0.036	0.097	0.085	0.135			0.298	0.292	0.268	0.183	0.172	0.353	0.250	0.105			0.173	0.104
MR	0.166		0.021	0.043	0.112	0.107	0.171			0.373	0.360	0.329	0.230	0.214	0.430	0.292	0.122			0.212	0.128
MSR	0.198		0.025	0.051	0.127	0.130	0.208			0.449	0.428	0.390	0.278	0.255	0.507	0.335	0.140			0.252	0.152
R	0.409		0.069	0.134	0.317	0.295	0.495			0.890	0.849	0.803	0.577	0.500	0.848	0.570	0.301			0.504	0.269
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.083		0.010	0.022	0.056	0.054	0.086			0.187	0.180	0.165	0.115	0.107	0.215	0.146	0.061			0.106	0.064
S2	0.016		0.002	0.004	0.008	0.011	0.018			0.038	0.034	0.031	0.024	0.021	0.039	0.021	0.009			0.020	0.012
K1	0.047		0.010	0.020	0.044	0.039	0.061			0.097	0.094	0.095	0.068	0.059	0.085	0.056	0.033			0.058	0.028
O1	0.041		0.009	0.015	0.035	0.030	0.058			0.087	0.082	0.077	0.057	0.043	0.057	0.042	0.034			0.048	0.024
MSF	0.050		0.023	0.039	0.041	0.043	0.044			0.020	0.041	0.035	0.034	0.017	0.048	0.030	0.095			0.040	0.019
z0	0.254		0.359	0.338	0.219	0.327	0.194			0.099	0.121	0.149	0.202	0.245	0.153	0.221	0.274			0.225	0.080
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	60.034		64.361	59.394	62.456	54.598	54.009			30.489	28.677	39.349	49.036	41.732	29.210	32.722	70.798			48.347	14.493
S2	331.238		326.914	345.461	337.587	316.102	324.523			308.722	316.036	320.499	325.810	332.836	317.329	302.625	338.590			324.591	11.989
K1	197.617		235.186	203.707	194.818	189.810	184.613			152.353	148.910	160.965	165.189	167.501	149.153	158.912	202.382			179.365	25.743
O1	262.814		276.084	273.841	261.269	264.017	255.301			240.503	247.313	260.991	273.786	271.874	247.811	258.412	279.125			262.367	11.798
MSF	282.102		290.089	271.167	290.330	289.486	289.756			282.815	285.485	313.108	273.531	297.456	270.337	288.678	279.155			285.964	11.191
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.097		0.081	0.143	0.096	0.107	0.087			0.136	0.109	0.128	0.113	0.137	0.134	0.142	0.079				
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	81.1	24.4	72.6	68.1	73.7	73.4	84.2	86.5	37.7	95.6	75.2	89.7	97.8	95.6	94.9	68.4	56.0	45.0	35.7		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.67	23/06/2005 22:45	±0.36	94.4
Lowest Astronomical Tide (LAT)	-0.02	08/09/2008 09:00		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in Nov 2000. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

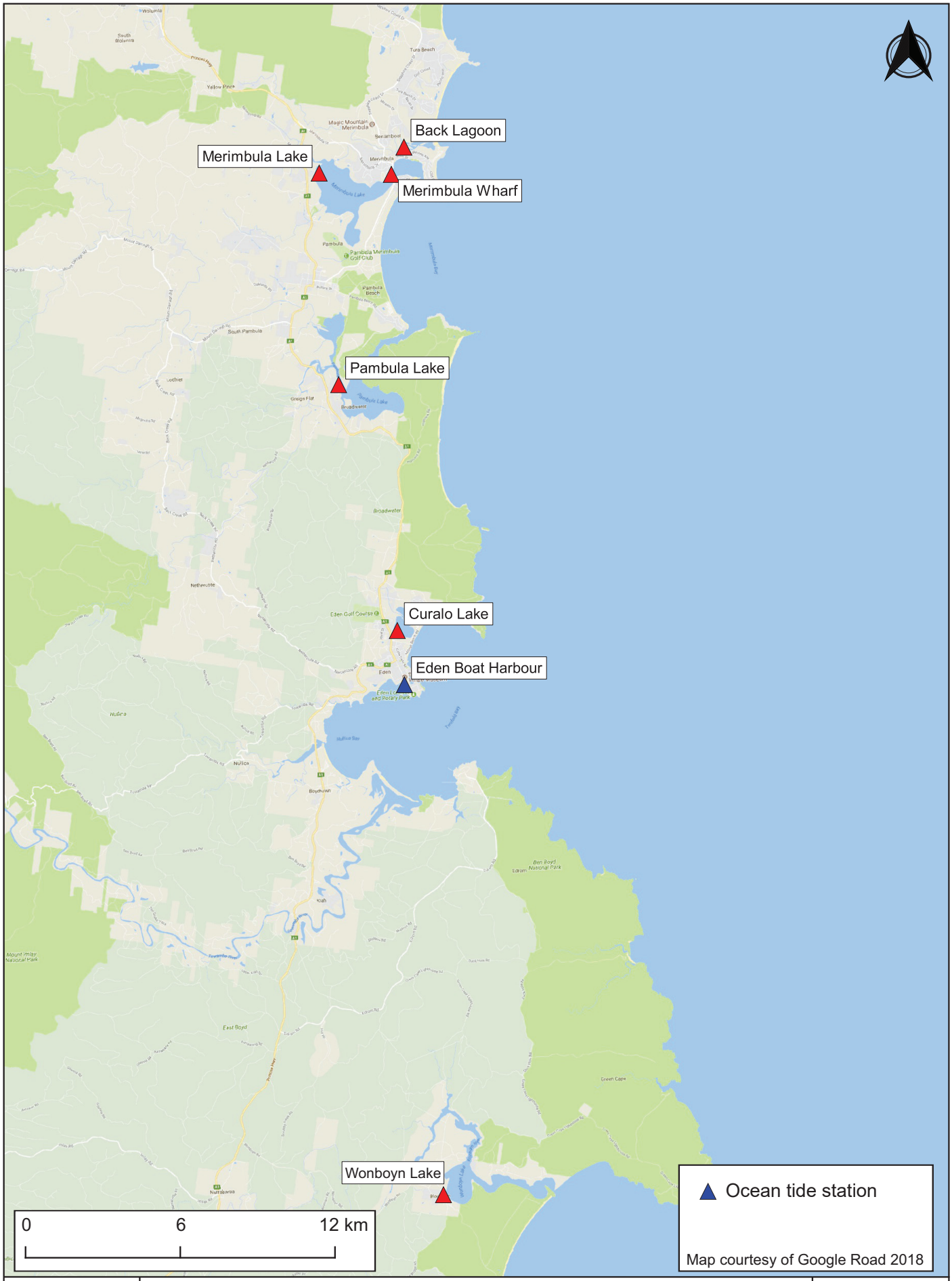


NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Bega River at Bega River

MHL2786

Figure A226



NSW GOVERNMENT

STATION LOCATIONS
EDEN REGION

Manly Hydraulics Laboratory

Report MHL2786

Figure

A227

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NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS
Merimbula Lake at Merimbula Wharf

RECORDING STATION: **Merimbula Lake at Merimbula Wharf**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220410

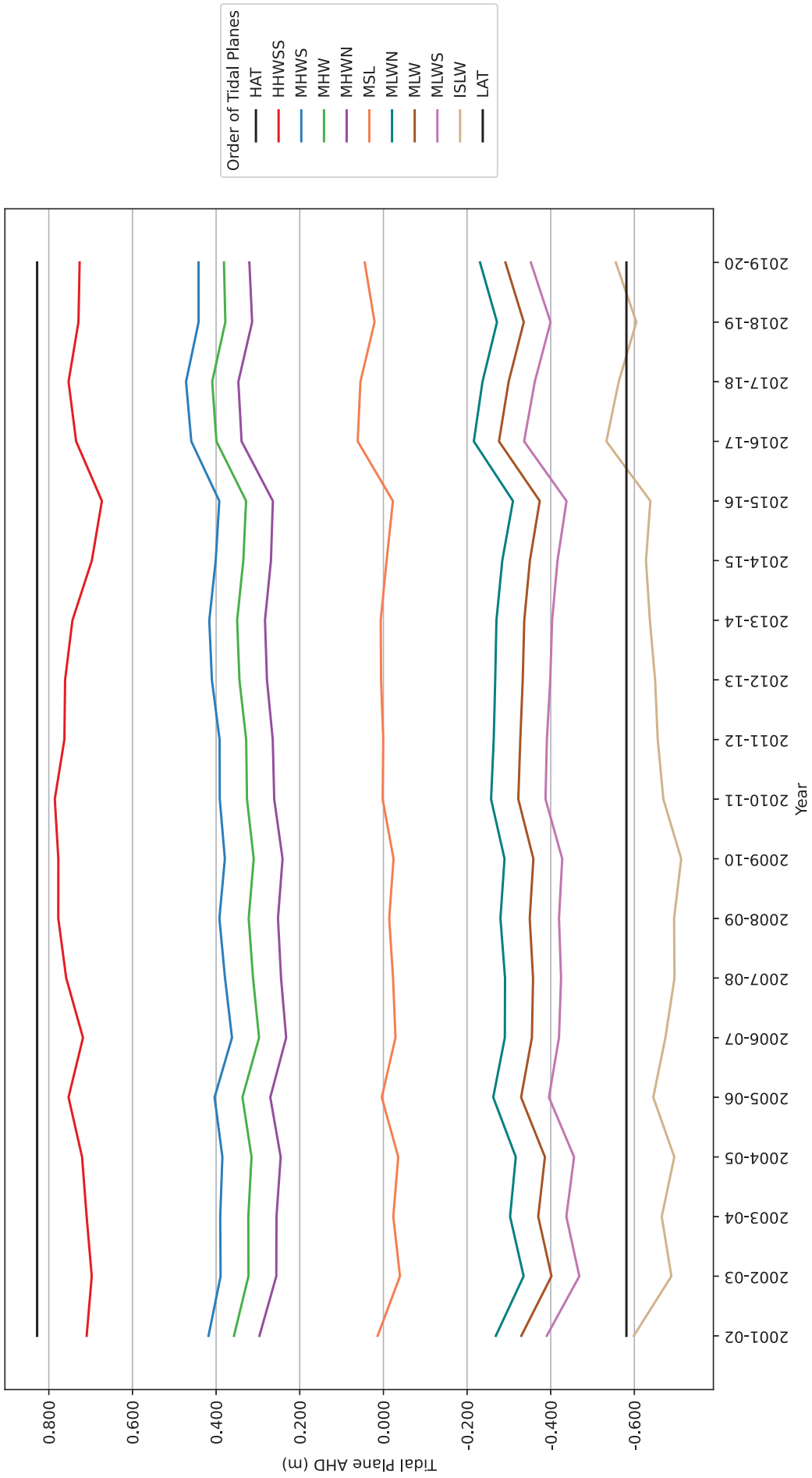
ZONE: 55
EASTING: 759297
NORTHING: 5913048

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.710	0.697	0.710	0.721	0.753	0.718	0.758	0.777	0.777	0.786	0.763	0.761	0.743	0.697	0.673	0.735	0.753	0.729	0.726	0.736	0.031
MHWS	0.418	0.389	0.390	0.385	0.404	0.362	0.379	0.392	0.379	0.391	0.392	0.410	0.416	0.401	0.392	0.459	0.472	0.442	0.442	0.406	0.029
MHW	0.357	0.323	0.323	0.315	0.337	0.297	0.312	0.322	0.310	0.326	0.328	0.344	0.350	0.335	0.328	0.399	0.409	0.378	0.381	0.341	0.031
MHWN	0.296	0.256	0.256	0.246	0.270	0.233	0.245	0.252	0.241	0.261	0.265	0.278	0.283	0.269	0.264	0.339	0.347	0.314	0.320	0.276	0.033
MSL	0.014	-0.040	-0.024	-0.035	0.004	-0.029	-0.023	-0.014	-0.024	0.002	0.000	0.006	0.006	-0.008	-0.023	0.061	0.055	0.021	0.045	-0.000	0.029
MLWN	-0.269	-0.335	-0.303	-0.316	-0.263	-0.290	-0.291	-0.280	-0.290	-0.257	-0.264	-0.267	-0.270	-0.284	-0.310	-0.216	-0.237	-0.272	-0.231	-0.276	0.030
MLW	-0.330	-0.402	-0.370	-0.386	-0.329	-0.355	-0.358	-0.350	-0.359	-0.322	-0.327	-0.333	-0.337	-0.350	-0.374	-0.276	-0.299	-0.336	-0.292	-0.341	0.032
MLWS	-0.391	-0.468	-0.437	-0.456	-0.396	-0.420	-0.425	-0.420	-0.428	-0.388	-0.391	-0.399	-0.403	-0.416	-0.438	-0.336	-0.362	-0.400	-0.353	-0.407	0.034
ISLW	-0.599	-0.688	-0.665	-0.695	-0.645	-0.674	-0.696	-0.695	-0.712	-0.669	-0.656	-0.650	-0.637	-0.628	-0.638	-0.533	-0.563	-0.605	-0.556	-0.642	0.051
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.565	0.591	0.559	0.562	0.533	0.523	0.536	0.532	0.531	0.518	0.528	0.546	0.553	0.553	0.574	0.555	0.584	0.585	0.551	0.552	0.022
MR	0.687	0.724	0.693	0.701	0.666	0.652	0.670	0.672	0.669	0.649	0.655	0.677	0.687	0.685	0.702	0.675	0.709	0.714	0.673	0.682	0.021
MSR	0.809	0.858	0.828	0.841	0.799	0.782	0.803	0.812	0.807	0.779	0.783	0.809	0.820	0.817	0.830	0.796	0.834	0.842	0.795	0.813	0.022
R	1.308	1.386	1.375	1.416	1.398	1.392	1.454	1.472	1.489	1.455	1.419	1.411	1.381	1.325	1.311	1.268	1.315	1.334	1.282	1.378	0.066
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.343	0.362	0.347	0.351	0.333	0.326	0.335	0.336	0.334	0.324	0.328	0.339	0.343	0.343	0.351	0.338	0.354	0.357	0.336	0.341	0.011
S2	0.061	0.067	0.067	0.070	0.067	0.065	0.067	0.070	0.069	0.065	0.064	0.066	0.067	0.066	0.064	0.060	0.063	0.064	0.061	0.065	0.003
K1	0.128	0.134	0.140	0.145	0.150	0.150	0.160	0.162	0.165	0.163	0.154	0.149	0.142	0.132	0.125	0.122	0.126	0.128	0.123	0.142	0.015
O1	0.081	0.086	0.088	0.095	0.099	0.105	0.111	0.113	0.119	0.118	0.111	0.101	0.091	0.080	0.075	0.074	0.075	0.077	0.080	0.094	0.016
MSF	0.044	0.045	0.043	0.018	0.023	0.023	0.031	0.026	0.029	0.021	0.043	0.019	0.027	0.014	0.027	0.032	0.047	0.035	0.030	0.030	0.010
z0	0.014	-0.040	-0.024	-0.035	0.004	-0.029	-0.023	-0.014	-0.024	0.002	0.000	0.006	0.006	-0.008	-0.023	0.061	0.055	0.021	0.045	-0.000	0.029
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	12.440	9.989	11.423	10.894	11.562	10.659	8.819	8.414	8.350	8.216	8.179	7.164	7.060	7.858	8.168	10.133	9.806	9.129	12.160	9.496	1.668
S2	284.656	280.753	282.161	280.115	281.620	282.149	280.372	282.082	282.050	284.755	285.105	282.138	284.247	282.538	284.622	283.758	283.923	282.079	282.758	282.731	1.522
K1	143.868	142.216	143.542	142.662	142.989	143.028	137.445	134.934	133.376	130.363	127.448	124.302	124.328	125.683	128.112	132.748	135.221	137.441	144.842	135.503	7.240
O1	206.703	199.421	200.154	199.128	202.196	203.404	202.303	206.683	212.276	217.874	224.336	224.712	226.085	227.827	223.815	218.564	211.911	208.342	208.451	211.799	9.971
MSF	261.006	280.066	252.704	285.119	278.363	327.422	304.850	298.339	268.137	336.118	288.171	317.189	275.113	332.999	289.249	288.072	285.049	300.585	286.581	292.375	23.146
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.091	0.101	0.091	0.090	0.096	0.099	0.093	0.092	0.097	0.101	0.080	0.098	0.102	0.094	0.085	0.073	0.093	0.100	0.074		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	86.3	96.9	96.3	90.9	86.1	96.5	98.0	93.8	95.5	91.1	92.7	94.5	91.8	93.3	92.8	83.9	89.1	87.6	81.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.83	04/06/2004 21:30	±0.20	9.4
Lowest Astronomical Tide (LAT)	-0.58	01/02/2014 17:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Merimbula Lake at Merimbula Wharf

MHL2786

Figure A228

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Merimbula Lake at Merimbula Lake

RECORDING STATION: **Merimbula Lake at Merimbula Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220405

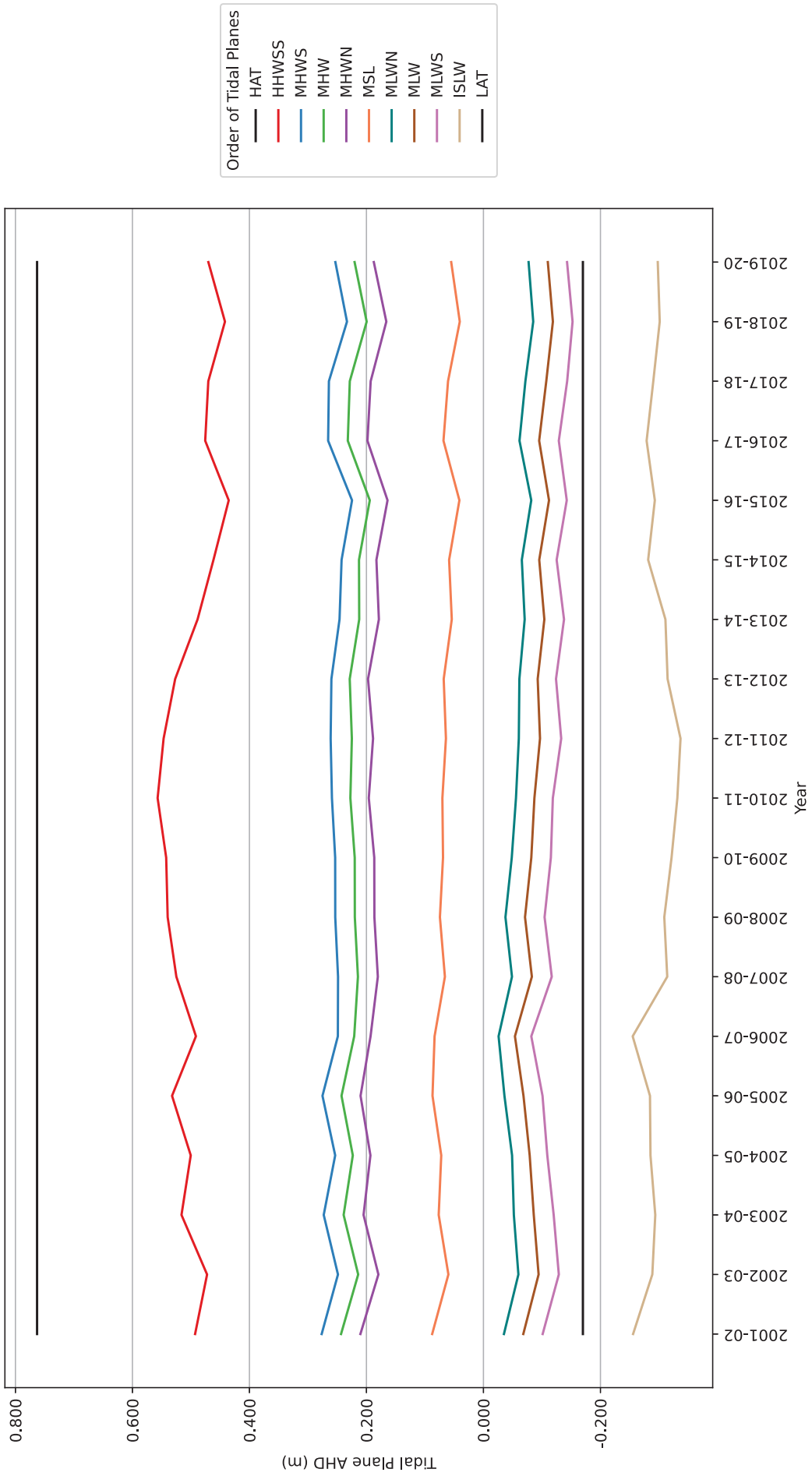
ZONE: 55
EASTING: 756506
NORTHING: 5913274

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.493	0.472	0.516	0.500	0.532	0.491	0.525	0.540	0.542	0.557	0.547	0.527	0.489	0.461	0.435	0.476	0.470	0.442	0.470	0.499	0.036
MHWS	0.277	0.249	0.273	0.253	0.275	0.249	0.249	0.253	0.253	0.259	0.261	0.260	0.246	0.242	0.225	0.265	0.264	0.233	0.253	0.255	0.013
MHW	0.243	0.214	0.239	0.223	0.243	0.221	0.215	0.220	0.220	0.227	0.225	0.229	0.212	0.213	0.194	0.232	0.228	0.200	0.220	0.222	0.013
MHWN	0.210	0.180	0.205	0.193	0.210	0.193	0.181	0.186	0.187	0.196	0.189	0.197	0.179	0.183	0.164	0.198	0.193	0.166	0.187	0.189	0.013
MSL	0.088	0.060	0.076	0.072	0.087	0.084	0.066	0.074	0.069	0.070	0.064	0.068	0.054	0.059	0.041	0.068	0.061	0.040	0.055	0.066	0.013
MLWN	-0.035	-0.060	-0.052	-0.049	-0.036	-0.026	-0.049	-0.038	-0.048	-0.056	-0.060	-0.061	-0.070	-0.066	-0.082	-0.062	-0.072	-0.085	-0.077	-0.057	0.016
MLW	-0.068	-0.094	-0.086	-0.079	-0.068	-0.054	-0.083	-0.071	-0.082	-0.087	-0.097	-0.093	-0.104	-0.095	-0.112	-0.095	-0.107	-0.119	-0.110	-0.090	0.017
MLWS	-0.101	-0.129	-0.120	-0.109	-0.101	-0.082	-0.117	-0.105	-0.115	-0.119	-0.133	-0.124	-0.138	-0.125	-0.142	-0.129	-0.143	-0.152	-0.143	-0.122	0.018
ISLW	-0.256	-0.289	-0.294	-0.286	-0.285	-0.255	-0.314	-0.309	-0.322	-0.331	-0.337	-0.315	-0.311	-0.282	-0.293	-0.279	-0.290	-0.301	-0.298	-0.297	0.022
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.245	0.239	0.257	0.242	0.246	0.219	0.229	0.224	0.235	0.252	0.249	0.259	0.249	0.249	0.246	0.260	0.264	0.251	0.265	0.246	0.013
MR	0.312	0.308	0.325	0.302	0.311	0.275	0.297	0.291	0.302	0.315	0.322	0.321	0.316	0.308	0.306	0.327	0.336	0.318	0.330	0.312	0.015
MSR	0.378	0.378	0.393	0.363	0.376	0.331	0.365	0.358	0.369	0.378	0.394	0.384	0.384	0.368	0.367	0.394	0.407	0.386	0.396	0.377	0.017
R	0.749	0.761	0.810	0.786	0.817	0.747	0.839	0.849	0.864	0.888	0.884	0.842	0.800	0.743	0.728	0.755	0.761	0.743	0.768	0.796	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.156	0.154	0.162	0.151	0.156	0.137	0.149	0.145	0.151	0.157	0.161	0.161	0.158	0.154	0.153	0.164	0.168	0.159	0.165	0.156	0.007
S2	0.033	0.035	0.034	0.030	0.033	0.028	0.034	0.033	0.033	0.032	0.036	0.031	0.034	0.030	0.030	0.034	0.036	0.034	0.033	0.033	0.002
K1	0.085	0.089	0.095	0.097	0.101	0.095	0.105	0.110	0.109	0.114	0.109	0.103	0.095	0.086	0.084	0.084	0.083	0.084	0.087	0.096	0.010
O1	0.069	0.071	0.079	0.080	0.083	0.078	0.093	0.094	0.097	0.098	0.095	0.087	0.078	0.070	0.067	0.066	0.064	0.065	0.068	0.079	0.012
MSF	0.053	0.055	0.052	0.037	0.036	0.034	0.045	0.046	0.046	0.032	0.055	0.033	0.044	0.028	0.044	0.047	0.056	0.040	0.041	0.043	0.009
z0	0.088	0.060	0.076	0.072	0.087	0.084	0.066	0.074	0.069	0.070	0.064	0.068	0.054	0.059	0.041	0.068	0.061	0.040	0.055	0.066	0.013
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	64.285	62.383	62.421	62.635	62.335	62.888	59.840	61.334	59.282	59.321	59.024	58.055	58.834	60.654	61.767	61.627	60.742	60.938	62.336	61.089	1.667
S2	326.186	328.356	327.313	327.927	330.117	335.176	331.509	337.382	328.859	335.756	329.628	335.356	331.043	338.152	334.855	332.631	331.154	334.587	327.496	331.762	3.676
K1	184.867	184.979	183.913	184.679	184.360	187.132	180.465	177.616	175.483	168.774	166.353	163.519	163.779	166.208	169.279	172.381	175.110	178.218	181.783	176.258	8.015
O1	248.723	243.090	242.478	243.236	242.837	246.482	245.394	247.916	253.207	257.735	262.229	264.640	266.783	266.960	266.569	258.063	251.539	249.743	247.908	252.923	8.908
MSF	267.585	278.154	261.556	270.546	289.137	291.810	290.493	287.514	274.200	303.160	281.133	297.342	277.693	289.454	280.705	282.602	277.400	288.274	268.717	281.972	10.748
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.067	0.070	0.066	0.068	0.071	0.075	0.070	0.068	0.074	0.078	0.065	0.071	0.077	0.073	0.065	0.065	0.072	0.082	0.069		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.7	93.2	81.3	98.3	85.7	96.0	98.2	95.9	95.3	93.0	95.3	96.7	94.9	82.4	94.0	96.2	97.8	96.6	95.0		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.76	04/06/2004 23:00	±0.20	11.2
Lowest Astronomical Tide (LAT)	-0.17	11/08/2008 12:15		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Merimbula Lake at Merimbula Lake

MHL2786

Figure A229

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Pambula Lake at Pambula Lake

RECORDING STATION: **Pambula Lake at Pambula Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220415

ZONE: 55
EASTING: 756743
NORTHING: 5905036

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.778	0.751	0.777	0.767	0.810	0.766	0.821	0.820	0.830	0.832	0.821	0.796	0.767	0.745	0.715	0.768	0.763	0.736	0.763	0.780	0.034
MHWS	0.444	0.407	0.416	0.395	0.424	0.368	0.406	0.396	0.406	0.416	0.420	0.420	0.422	0.420	0.404	0.459	0.456	0.427	0.443	0.418	0.022
MHW	0.373	0.335	0.344	0.324	0.352	0.299	0.335	0.324	0.339	0.348	0.351	0.351	0.354	0.352	0.337	0.387	0.383	0.357	0.375	0.348	0.022
MHWN	0.302	0.262	0.272	0.253	0.281	0.229	0.265	0.252	0.273	0.280	0.281	0.282	0.286	0.284	0.270	0.315	0.310	0.287	0.306	0.278	0.021
MSL	-0.019	-0.052	-0.032	-0.044	-0.013	-0.055	-0.016	-0.026	-0.009	-0.003	-0.005	-0.009	-0.009	-0.012	-0.037	0.002	-0.005	-0.016	-0.004	-0.019	0.017
MLWN	-0.339	-0.365	-0.336	-0.341	-0.306	-0.339	-0.297	-0.303	-0.290	-0.287	-0.292	-0.300	-0.303	-0.308	-0.344	-0.312	-0.320	-0.320	-0.314	-0.317	0.022
MLW	-0.410	-0.438	-0.408	-0.412	-0.378	-0.409	-0.367	-0.375	-0.356	-0.355	-0.362	-0.368	-0.371	-0.376	-0.412	-0.384	-0.393	-0.389	-0.382	-0.387	0.023
MLWS	-0.481	-0.510	-0.480	-0.483	-0.449	-0.478	-0.437	-0.447	-0.423	-0.423	-0.431	-0.437	-0.440	-0.443	-0.479	-0.455	-0.465	-0.459	-0.450	-0.456	0.024
ISLW	-0.720	-0.756	-0.738	-0.748	-0.725	-0.763	-0.734	-0.750	-0.726	-0.720	-0.717	-0.706	-0.686	-0.676	-0.701	-0.676	-0.685	-0.680	-0.679	-0.715	0.029
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.641	0.628	0.607	0.594	0.587	0.569	0.562	0.555	0.563	0.566	0.573	0.582	0.590	0.592	0.614	0.627	0.630	0.607	0.621	0.595	0.027
MR	0.783	0.773	0.752	0.736	0.730	0.707	0.702	0.699	0.695	0.703	0.712	0.720	0.726	0.727	0.748	0.771	0.776	0.746	0.757	0.735	0.028
MSR	0.925	0.918	0.896	0.878	0.873	0.846	0.843	0.843	0.828	0.839	0.852	0.857	0.862	0.863	0.883	0.914	0.921	0.885	0.893	0.875	0.030
R	1.497	1.507	1.515	1.515	1.536	1.529	1.556	1.570	1.556	1.552	1.538	1.501	1.453	1.421	1.415	1.444	1.449	1.415	1.442	1.495	0.052
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.391	0.386	0.376	0.368	0.365	0.354	0.351	0.349	0.348	0.351	0.356	0.360	0.363	0.364	0.374	0.385	0.388	0.373	0.378	0.367	0.014
S2	0.071	0.073	0.072	0.071	0.072	0.069	0.070	0.072	0.066	0.068	0.070	0.069	0.068	0.068	0.067	0.072	0.073	0.070	0.068	0.070	0.002
K1	0.143	0.147	0.155	0.157	0.163	0.167	0.171	0.175	0.174	0.173	0.167	0.159	0.149	0.142	0.136	0.136	0.136	0.135	0.138	0.154	0.015
O1	0.095	0.098	0.103	0.109	0.113	0.117	0.126	0.128	0.129	0.125	0.119	0.109	0.097	0.090	0.086	0.085	0.084	0.085	0.091	0.105	0.016
MSF	0.034	0.041	0.035	0.010	0.015	0.019	0.031	0.026	0.017	0.016	0.034	0.016	0.023	0.014	0.024	0.025	0.035	0.021	0.021	0.024	0.009
z0	-0.019	-0.052	-0.032	-0.044	-0.013	-0.055	-0.016	-0.026	-0.009	-0.003	-0.005	-0.009	-0.009	-0.012	-0.037	0.002	-0.005	-0.016	-0.004	-0.019	0.017
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	29.604	29.853	30.646	31.408	31.112	30.885	30.593	29.967	28.565	26.431	25.810	26.501	26.661	26.733	26.594	25.370	27.059	29.155	30.256	28.590	2.055
S2	304.874	306.476	306.668	308.292	308.189	310.198	309.851	312.214	309.251	310.132	307.617	310.821	310.660	310.723	309.305	304.855	307.625	309.441	307.425	308.664	2.034
K1	146.708	149.111	150.000	149.725	148.590	149.540	147.067	143.394	141.559	135.236	133.239	131.549	131.377	132.717	133.455	135.785	140.392	144.237	147.549	141.644	7.082
O1	204.830	201.712	201.728	202.999	202.759	205.152	207.640	210.541	214.365	218.642	223.418	225.640	226.504	224.687	222.589	213.533	209.960	209.484	208.188	212.335	8.731
MSF	252.633	273.259	246.089	245.812	307.289	318.319	298.866	291.328	260.209	347.074	278.155	332.400	271.554	337.218	289.093	286.358	276.511	294.799	276.063	288.580	29.596
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.079	0.091	0.084	0.089	0.089	0.094	0.087	0.085	0.094	0.086	0.074	0.086	0.088	0.083	0.080	0.071	0.085	0.095	0.079		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	88.3	96.2	96.4	98.7	94.8	97.1	97.1	95.6	77.8	91.2	91.2	95.6	91.8	92.4	92.9	93.0	95.4	93.8	91.7		

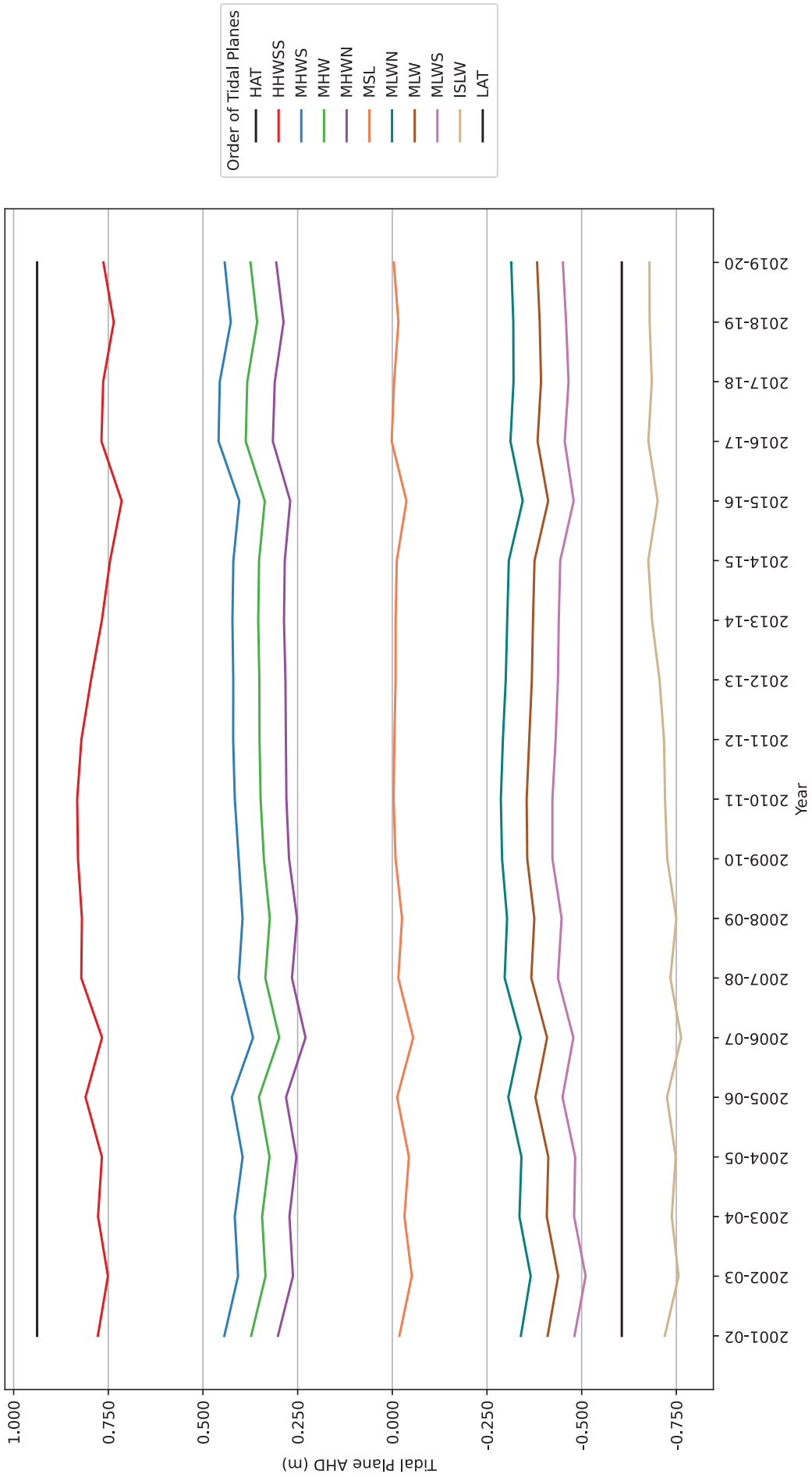
HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.94	04/06/2004 22:15	±0.23	9.5
Lowest Astronomical Tide (LAT)	-0.61	10/09/2014 05:00		

COMMENTS

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.

Table A230

MHL2786



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Pambula Lake at Pambula Lake

MHL2786

Figure A230

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Lake Curalo at Lake Curalo

RECORDING STATION: **Lake Curalo at Lake Curalo**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220420

ZONE: 55
EASTING: 758413
NORTHING: 5895378

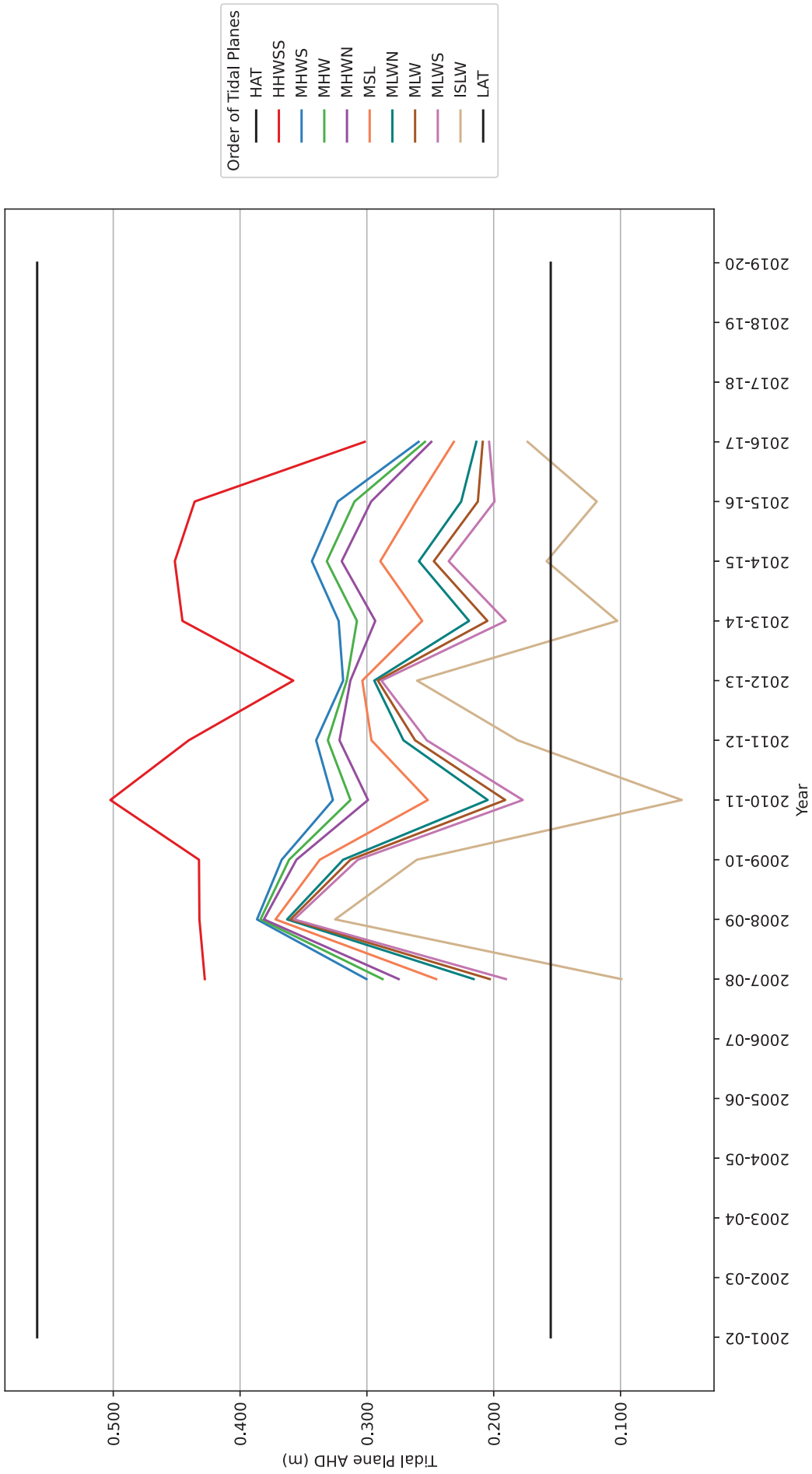
YEAR	2001-02*	2002-03*	2003-04*	2004-05*	2005-06*	2006-07*	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18^	2018-19^	2019-20*	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS							0.428	0.432	0.432	0.502	0.440	0.358	0.445	0.451	0.436	0.302				0.423	0.055
MHWS							0.300	0.387	0.367	0.327	0.340	0.319	0.322	0.343	0.323	0.259				0.329	0.035
MHW							0.288	0.384	0.361	0.313	0.331	0.316	0.308	0.332	0.310	0.254				0.320	0.036
MHWN							0.275	0.381	0.356	0.299	0.322	0.313	0.293	0.320	0.297	0.249				0.310	0.038
MSL							0.245	0.372	0.337	0.252	0.296	0.304	0.256	0.289	0.261	0.231				0.284	0.044
MLWN							0.216	0.363	0.319	0.205	0.271	0.294	0.219	0.259	0.226	0.214				0.259	0.053
MLW							0.203	0.360	0.313	0.191	0.262	0.291	0.205	0.247	0.212	0.209				0.249	0.057
MLWS							0.190	0.357	0.307	0.177	0.253	0.289	0.190	0.235	0.199	0.204				0.240	0.060
ISLW							0.099	0.325	0.260	0.052	0.181	0.260	0.102	0.158	0.119	0.173				0.173	0.086
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR							0.059	0.018	0.037	0.094	0.050	0.019	0.074	0.061	0.071	0.036				0.052	0.025
MR							0.085	0.024	0.048	0.122	0.069	0.025	0.103	0.084	0.097	0.046				0.070	0.034
MSR							0.110	0.029	0.060	0.150	0.087	0.030	0.132	0.108	0.124	0.056				0.089	0.043
R							0.329	0.107	0.172	0.451	0.259	0.098	0.343	0.293	0.317	0.129				0.250	0.118
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2							0.042	0.012	0.024	0.061	0.034	0.012	0.051	0.042	0.049	0.023				0.035	0.017
S2							0.013	0.003	0.006	0.014	0.009	0.003	0.014	0.012	0.013	0.005				0.009	0.005
K1							0.046	0.018	0.023	0.064	0.033	0.016	0.045	0.039	0.042	0.016				0.034	0.016
O1							0.045	0.014	0.024	0.061	0.039	0.012	0.043	0.038	0.039	0.014				0.033	0.016
MSF							0.052	0.021	0.027	0.043	0.033	0.009	0.054	0.045	0.057	0.017				0.036	0.017
z0							0.245	0.372	0.337	0.252	0.296	0.304	0.256	0.289	0.261	0.231				0.284	0.044
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2							67.342	71.061	59.706	63.099	60.732	65.332	64.756	64.655	61.911	63.230				64.182	3.306
S2							345.346	336.210	322.978	347.293	338.954	301.559	347.924	354.310	339.932	336.679				337.118	15.130
K1							201.336	212.240	179.562	189.308	180.528	198.180	183.451	183.545	183.036	188.554				189.974	10.668
O1							273.609	278.176	281.766	279.896	282.053	294.799	289.410	294.985	284.635	278.633				283.796	7.172
MSF							292.961	270.773	250.654	289.871	290.718	218.475	291.381	306.105	278.206	284.822				277.397	25.564
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
							0.081	0.093	0.142	0.073	0.069	0.058	0.085	0.072	0.064	0.092					
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
							98.5	92.9	89.3	98.0	81.5	97.6	70.5	73.2	97.9	99.7	97.4	58.6	43.4		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.56	15/06/2018 23:45	±0.22	55.6
Lowest Astronomical Tide (LAT)	0.15	29/02/2008 23:15		

COMMENTS

^Estuary entrance was closed for this period resulting in non-tidal data.
*No data collected for the period or insufficient data for meaningful analysis.
Station installed in July 2007. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Lake Curalo at Lake Curalo

MHL2786

Figure A231

NSW GOVERNMENT

NSW TIDAL PLANE AND TIDAL PHASE ANALYSIS

Wonboyn Lake at Wonboyn Lake

RECORDING STATION: **Wonboyn Lake at Wonboyn Lake**
DATUM: AUSTRALIAN HEIGHT DATUM
AWRC #: 220452

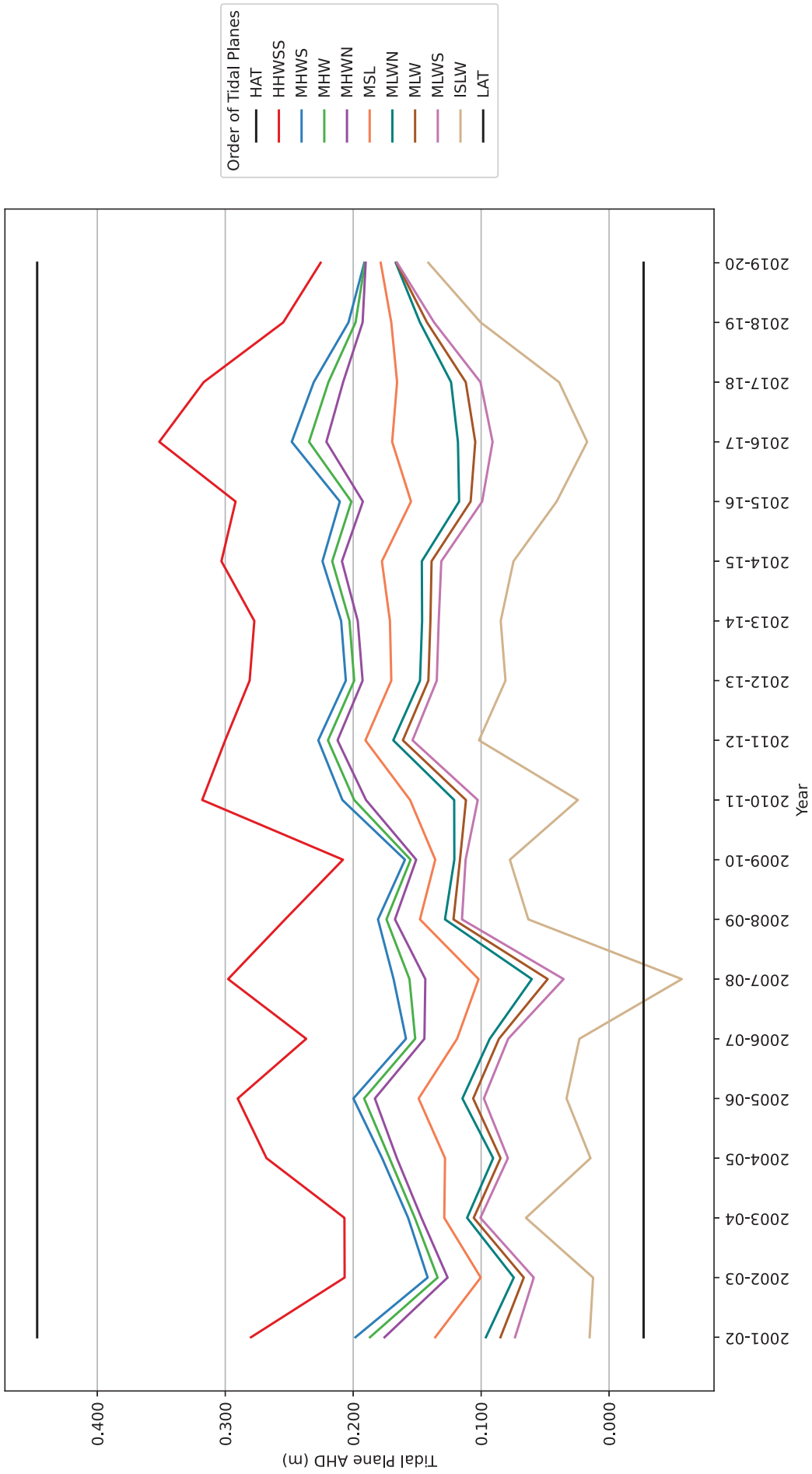
ZONE: 56
EASTING: 226665
NORTHING: 5873012

YEAR	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Annual Average	Std Deviation (+/-)
TIDAL PLANES	**AMPLITUDE (metres)**																				
HHWSS	0.280	0.207	0.207	0.268	0.290	0.237	0.298	0.253	0.208	0.318	0.300	0.281	0.277	0.303	0.292	0.352	0.317	0.255	0.225	0.272	0.041
MHWS	0.198	0.142	0.157	0.177	0.200	0.159	0.168	0.181	0.160	0.208	0.227	0.206	0.209	0.224	0.210	0.248	0.231	0.204	0.191	0.195	0.029
MHW	0.187	0.134	0.152	0.172	0.191	0.152	0.156	0.174	0.155	0.199	0.220	0.199	0.203	0.216	0.201	0.235	0.219	0.198	0.191	0.187	0.028
MHWN	0.175	0.126	0.147	0.166	0.183	0.144	0.144	0.167	0.151	0.190	0.212	0.193	0.196	0.209	0.192	0.221	0.208	0.193	0.190	0.179	0.027
MSL	0.136	0.100	0.129	0.128	0.149	0.119	0.102	0.148	0.136	0.156	0.190	0.170	0.171	0.178	0.155	0.170	0.166	0.170	0.178	0.150	0.026
MLWN	0.096	0.074	0.111	0.091	0.115	0.093	0.060	0.128	0.121	0.121	0.169	0.148	0.146	0.146	0.117	0.118	0.124	0.148	0.167	0.121	0.029
MLW	0.085	0.067	0.106	0.085	0.106	0.086	0.048	0.122	0.117	0.112	0.161	0.141	0.140	0.139	0.108	0.105	0.112	0.142	0.166	0.113	0.031
MLWS	0.073	0.059	0.101	0.079	0.098	0.079	0.036	0.115	0.112	0.103	0.154	0.135	0.133	0.131	0.099	0.091	0.101	0.137	0.166	0.105	0.033
ISLW	0.015	0.013	0.065	0.015	0.033	0.023	-0.057	0.063	0.078	0.024	0.102	0.081	0.085	0.075	0.041	0.017	0.039	0.100	0.141	0.050	0.045
TIDAL PLANE RANGES	**AMPLITUDE (metres)**																				
MNR	0.079	0.052	0.036	0.075	0.068	0.051	0.083	0.039	0.030	0.069	0.044	0.045	0.050	0.062	0.075	0.103	0.084	0.045	0.024	0.059	0.021
MR	0.102	0.067	0.046	0.087	0.085	0.065	0.108	0.052	0.039	0.087	0.059	0.058	0.063	0.078	0.093	0.130	0.107	0.056	0.025	0.074	0.027
MSR	0.125	0.083	0.056	0.098	0.102	0.080	0.133	0.066	0.047	0.106	0.074	0.071	0.076	0.093	0.111	0.157	0.130	0.067	0.026	0.090	0.033
R	0.265	0.194	0.142	0.253	0.257	0.214	0.355	0.190	0.130	0.294	0.198	0.200	0.193	0.228	0.251	0.334	0.278	0.154	0.084	0.222	0.069
TIDAL CONSTITUENTS	**AMPLITUDE (metres)**																				
M2	0.051	0.034	0.023	0.043	0.043	0.033	0.054	0.026	0.019	0.044	0.029	0.029	0.032	0.039	0.047	0.065	0.054	0.028	0.012	0.037	0.013
S2	0.011	0.008	0.005	0.006	0.008	0.007	0.012	0.007	0.004	0.009	0.008	0.007	0.006	0.008	0.009	0.014	0.011	0.006	0.001	0.008	0.003
K1	0.031	0.025	0.019	0.036	0.036	0.030	0.049	0.027	0.017	0.042	0.027	0.028	0.026	0.031	0.032	0.041	0.035	0.020	0.016	0.030	0.009
O1	0.027	0.021	0.016	0.028	0.029	0.026	0.043	0.025	0.017	0.036	0.025	0.026	0.022	0.026	0.026	0.032	0.026	0.016	0.008	0.025	0.008
MSF	0.060	0.060	0.058	0.044	0.046	0.038	0.045	0.045	0.035	0.038	0.054	0.041	0.038	0.027	0.058	0.048	0.059	0.039	0.039	0.046	0.010
z0	0.136	0.100	0.129	0.128	0.149	0.119	0.102	0.148	0.136	0.156	0.190	0.170	0.171	0.178	0.155	0.170	0.166	0.170	0.178	0.150	0.026
TIDAL CONSTITUENTS	**PHASE (degrees)**																				
M2	75.577	78.818	78.510	77.806	78.163	79.775	76.037	77.724	75.294	75.206	72.073	74.360	75.367	73.748	72.940	71.936	73.520	76.664	64.088	75.137	3.532
S2	343.751	351.743	354.398	343.520	356.691	353.409	353.957	356.259	319.420	351.218	348.943	356.355	349.211	347.109	347.509	345.238	347.475	349.819	333.489	347.869	8.893
K1	202.851	211.287	217.479	208.003	208.901	211.490	200.494	207.007	197.275	192.683	189.676	192.998	186.840	186.454	188.511	189.288	195.607	203.434	239.231	201.553	13.144
O1	281.344	282.345	283.361	279.945	276.349	279.893	275.988	283.411	296.199	292.280	298.064	303.199	306.492	304.257	299.693	285.488	283.120	287.167	288.807	288.811	9.745
MSF	288.727	298.496	298.783	286.494	308.107	291.793	295.591	310.070	278.819	300.592	305.479	312.096	287.150	296.405	287.013	291.147	286.805	306.158	281.181	295.311	9.905
RESIDUAL ERROR	**ROOT MEAN SQUARE (metres)**																				
	0.087	0.088	0.074	0.098	0.095	0.096	0.078	0.069	0.089	0.078	0.061	0.073	0.077	0.070	0.063	0.065	0.076	0.080	0.066		
DATA ANALYSED	**YEARLY PERCENTAGE (%)**																				
	93.0	99.5	99.3	79.9	96.5	96.1	98.7	98.1	91.5	96.0	91.9	95.7	95.9	91.4	92.6	94.6	95.7	76.7	61.1		

HAT/LAT	Value (m)	Date and time from prediction	Uncertainty at 95% CI (m)	Average number of days per year that HAT was exceeded (2001-2020)
Highest Astronomical Tide (HAT)	0.45	04/06/2004 23:45	±0.20	39.3
Lowest Astronomical Tide (LAT)	-0.03	01/02/2004 00:30		

COMMENTS Station relocated from Agnew Wharf (AWRC: 220425) in Oct 2018. Station is classified as an ICOLL.

The information supplied has been collected for use by the Department of Planning and Environment and the tidal plane heights only approximately relate to Australian Height Datum (AHD) or other specified datum. Other users should independently verify the suitability of this data for their particular use.



NSW GOVERNMENT

NSW TIDAL PLANE ANALYSIS
Wonboyn Lake at Wonboyn Lake

MHL2786

Figure A232

Appendix B Flood removal sensitivity analysis results

Table B-2 provides a listing of the stations that were used for the sensitivity analysis. These stations represent a range of catchment and estuary sizes to provide a cross section of stations analysed in this report.

Table B-2 Stations selected for flood removal analysis

Station name	Catchment	Catchment area (km^2)	Estuary area (km^2)
Billinudgel	Brunswick River	226	4
Belmore Bridge	Hunter River	21367	47
Belmont	Lake Macquarie	604	114
Sackville	Hawkesbury-Nepean	21624	114
Koonawarra Bay	Lake Illawarra	238	36

B.1. Data removal

Table B-3 provides the average percentage of the remaining data for each flood removal method for three to four flood events experienced at each station. The 0.1m hindcast residual method has the least remaining data, whereas the 0.3m hindcast residual has the most remaining data for analysis.

Table B-3 Remaining data (%) for each flood removal method

Station	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
Billinudgel	91.7%	96.3%	94.3%	88.2%	95.5%	82.6%
Belmont	93.2%	99.9%	98.8%	91.2%	96.1%	100.0%
Belmore Bridge	88.0%	91.8%	89.4%	85.2%	91.2%	88.7%
Sackville	97.4%	98.6%	96.5%	87.2%	98.0%	90.7%
Koonawarra Bay	93.1%	97.5%	94.6%	84.7%	73.4%	87.7%

Figure B-1 to Figure B-17 provides a graphical representation of the data removal results for each selected flood event. In the plot legend, *Level* is the monitored data , *0.3m*, *0.2m* and *0.1m* is the hindcast residual result for each threshold, *Thresh* is the threshold and rate of rise method result, *Rain_Removed* is the rainfall totals method and the *Forecast* is the astronomical prediction using the 0.2m threshold hindcast floods removed for the 19-year (2001 – 2020) epoch. Please note the control results are tabulated but are not plotted in the figures.

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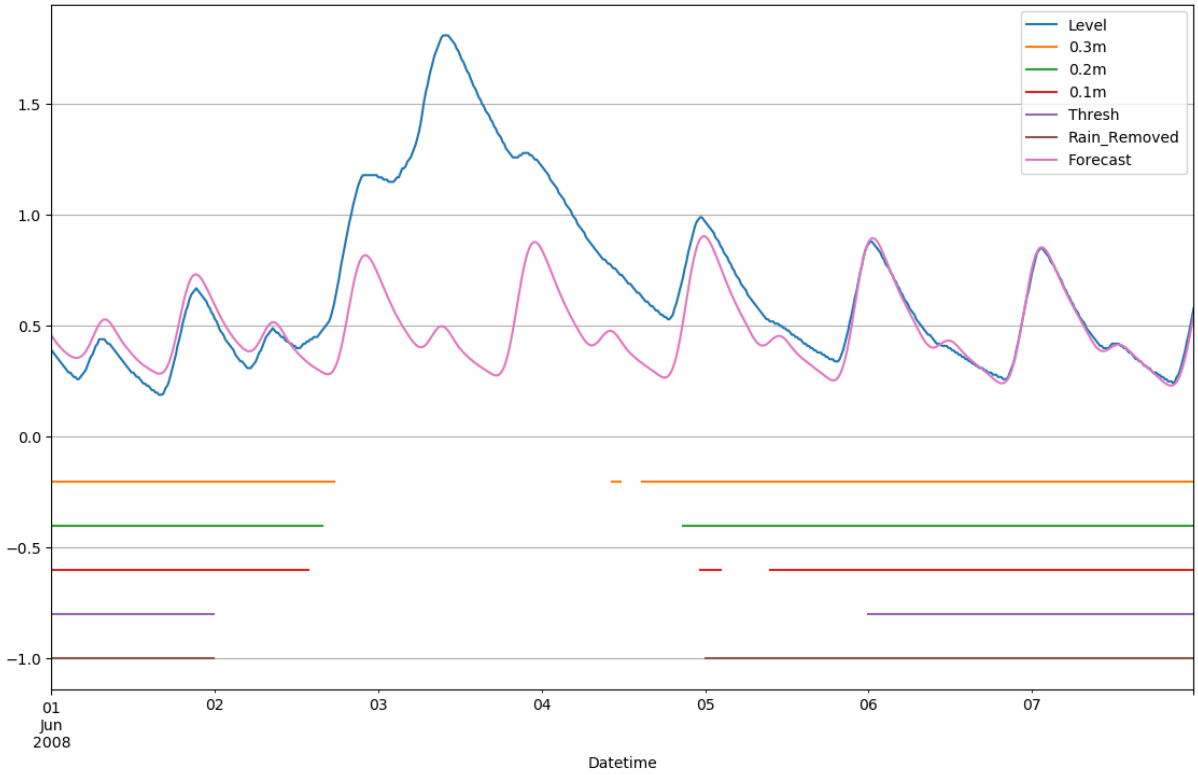

Figure B-1 Billinudgel, June 2008

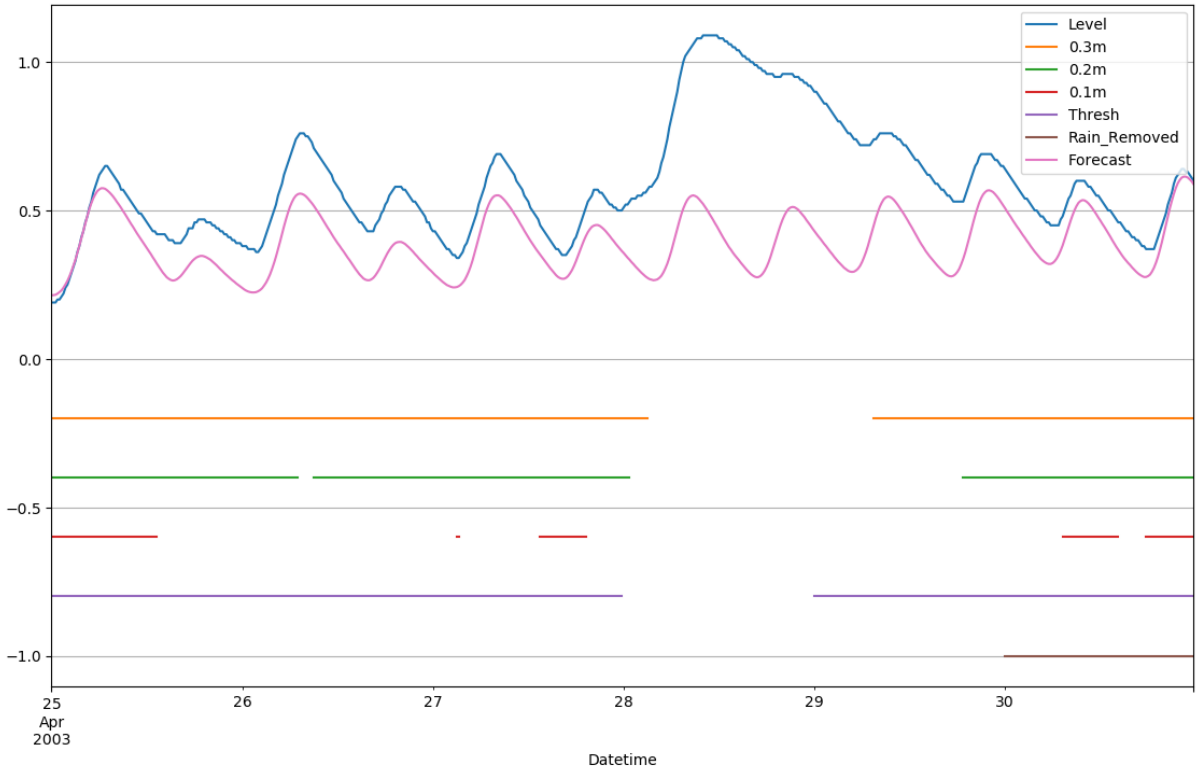

Figure B-2 Billinudgel, April 2003

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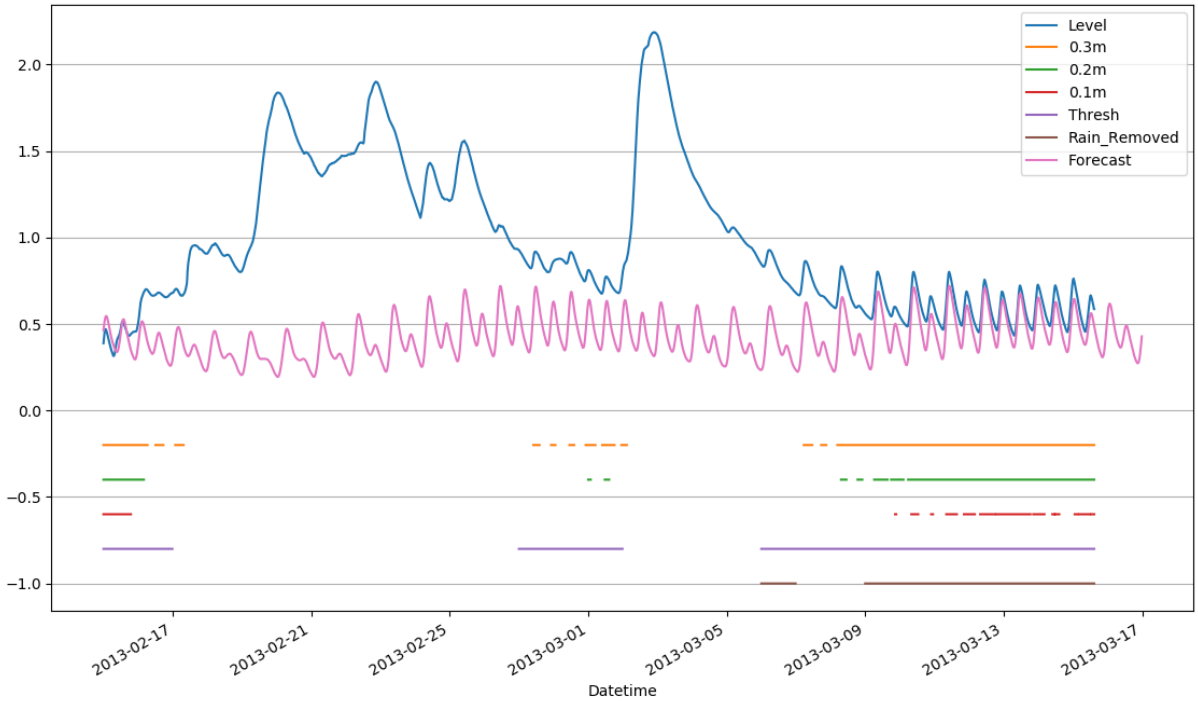

Figure B-3 Billinudgel, February 2013

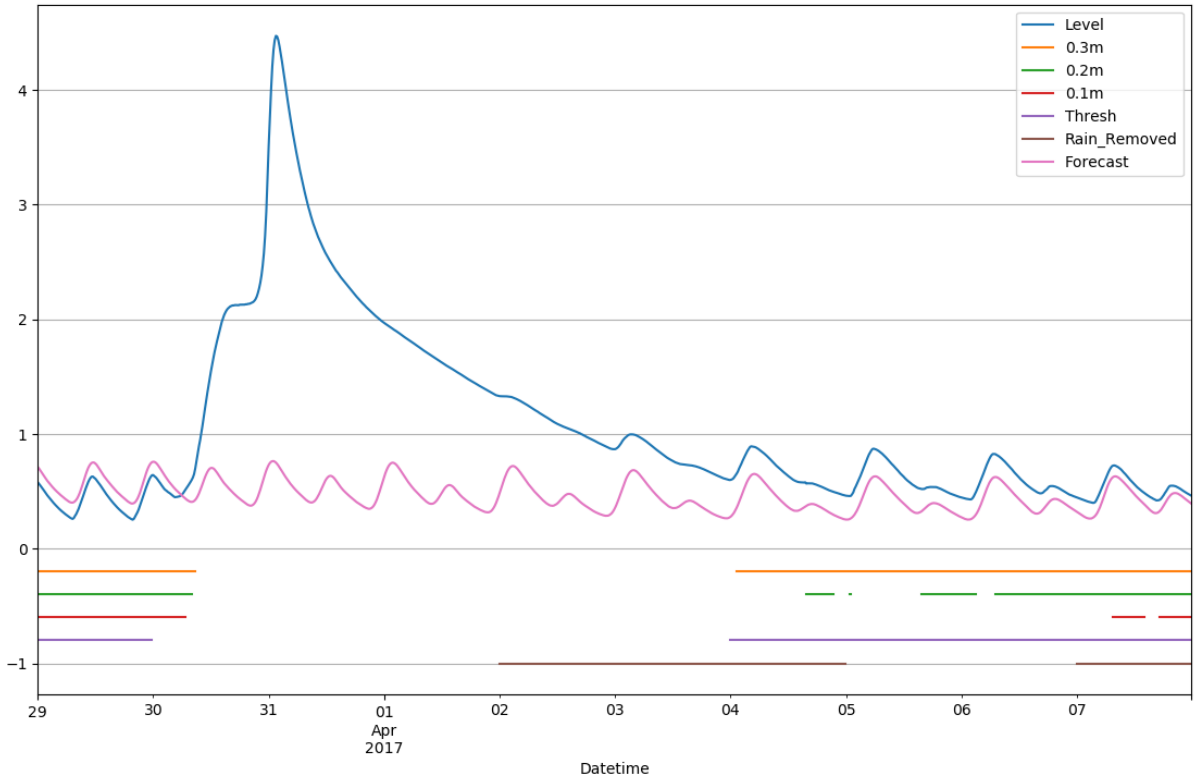

Figure B-4 Billinudgel, March 2017

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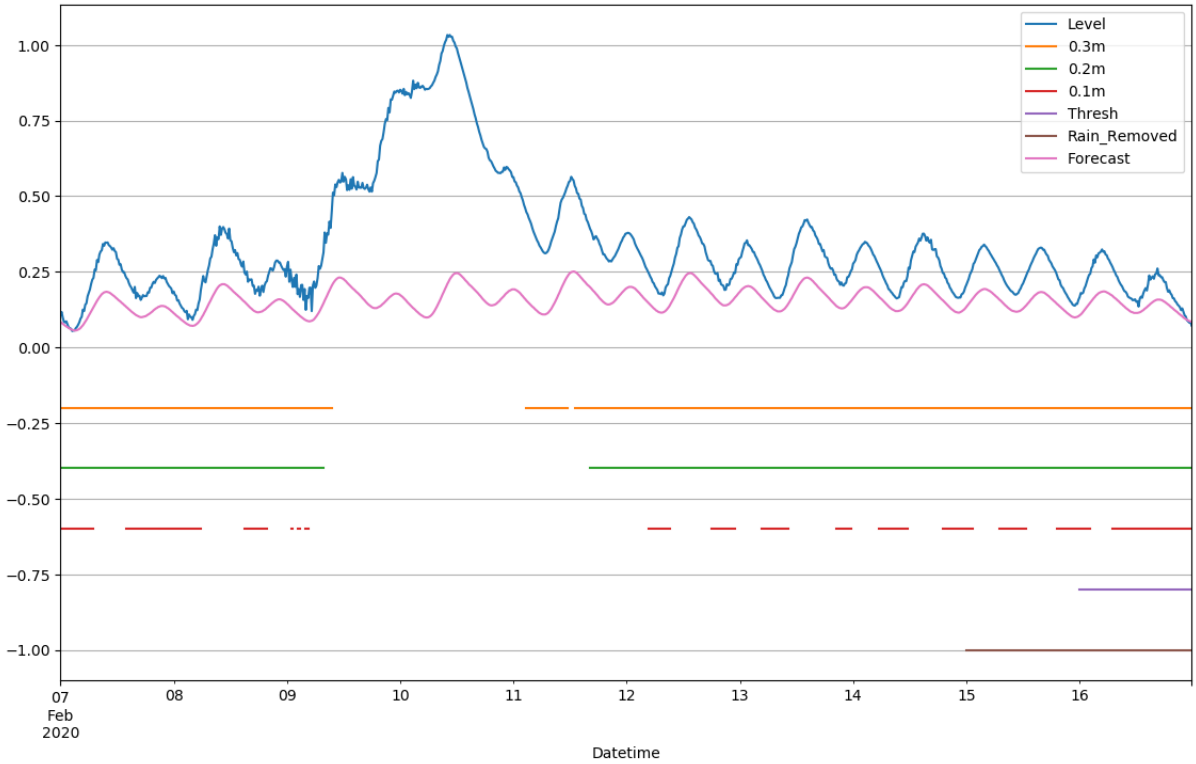

Figure B-5 Koonawarra Bay, February 2020

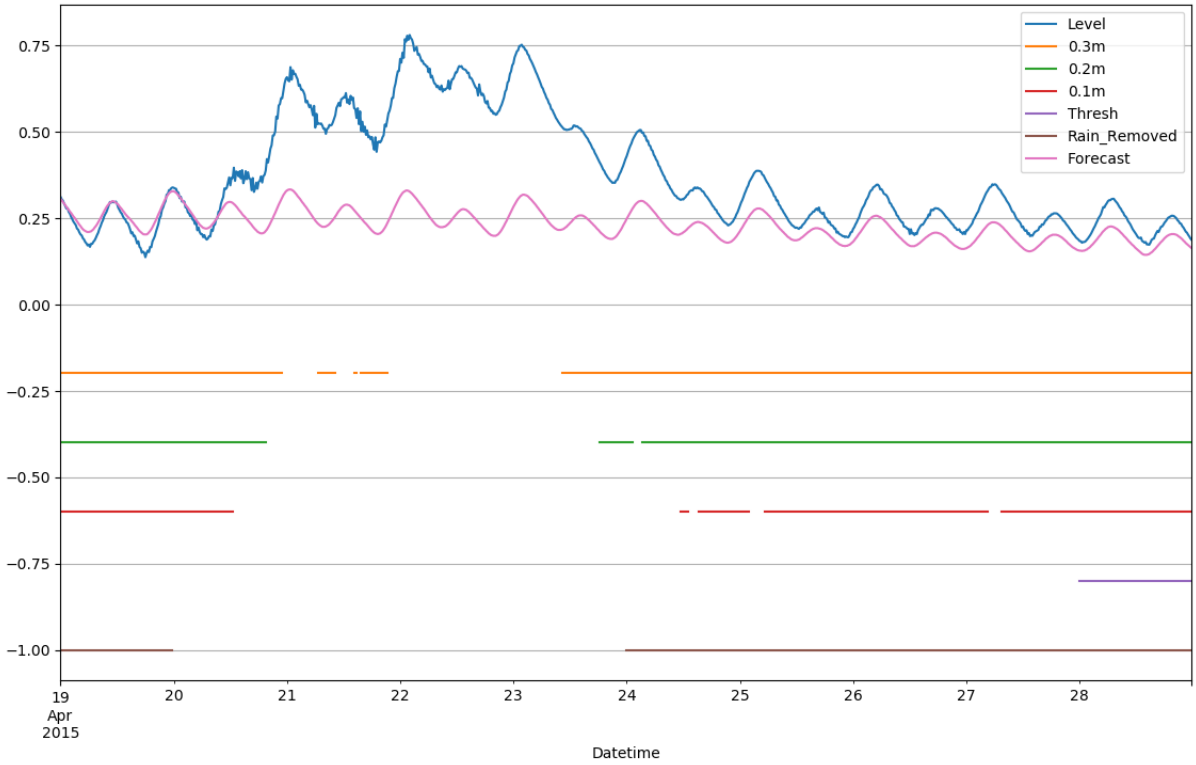

Figure B-6 Koonawarra Bay, April 2015

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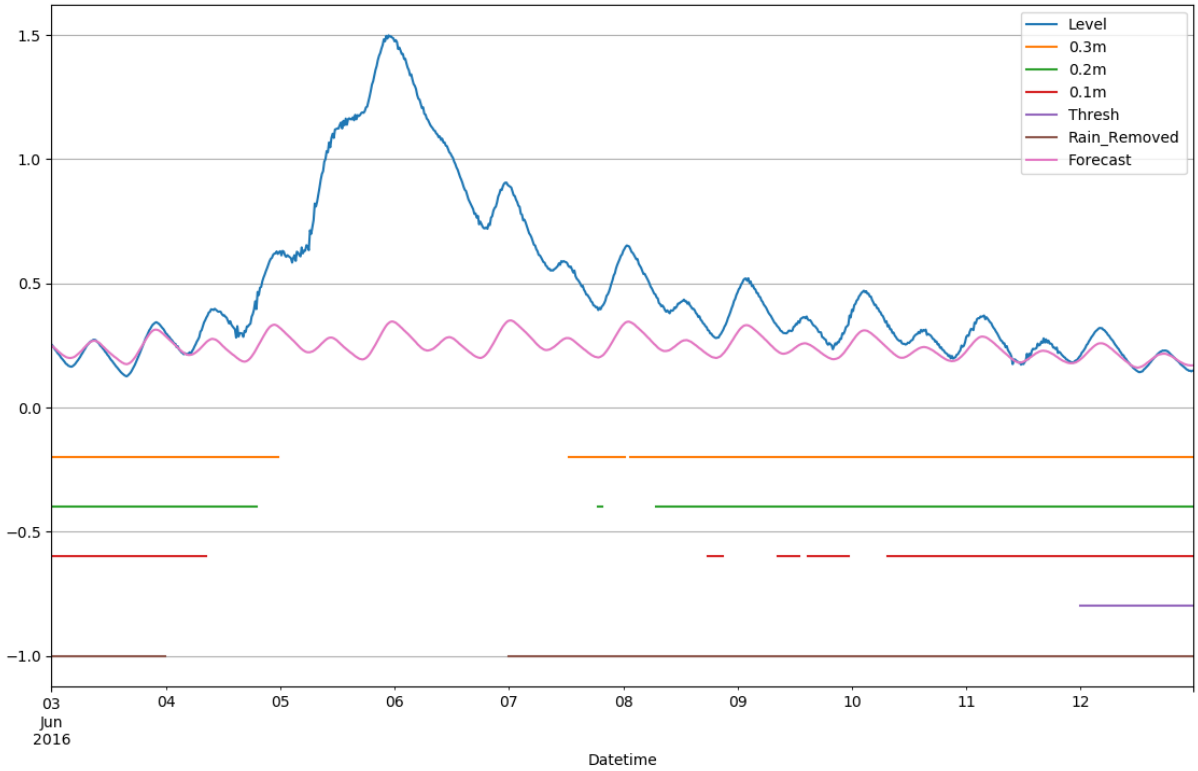

Figure B-7 Koonawarra Bay, June 2016

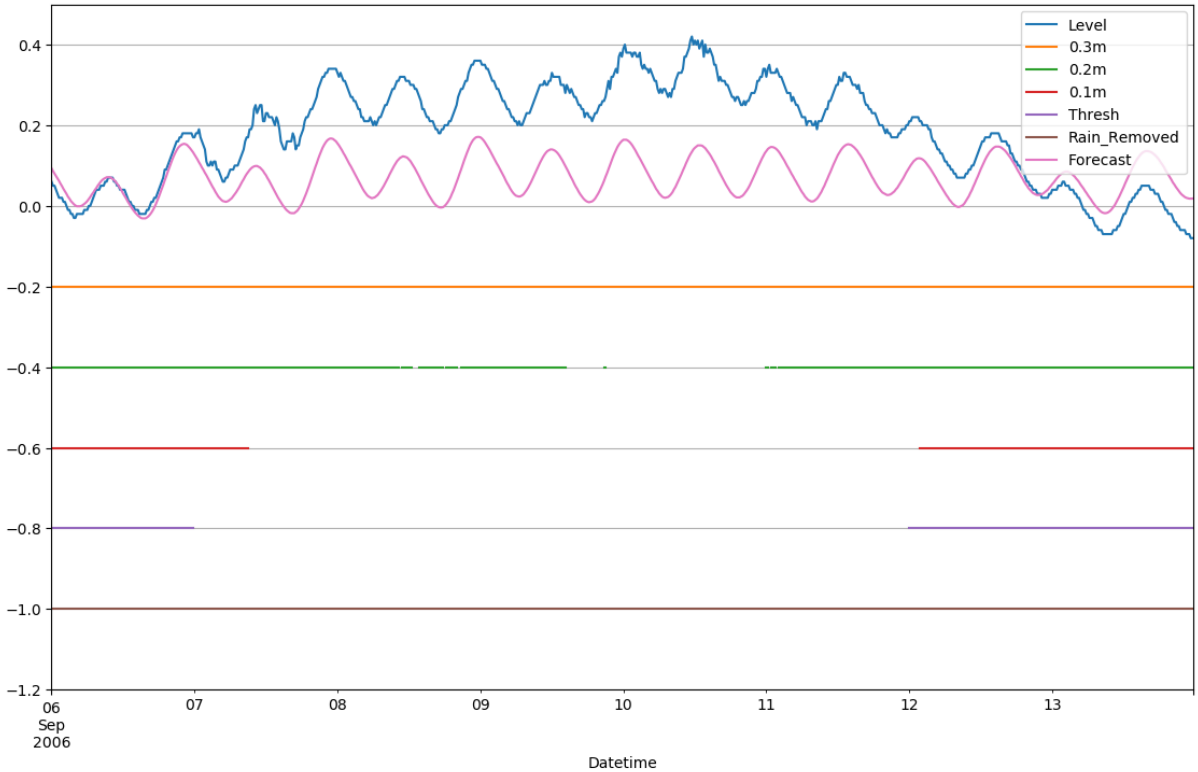

Figure B-8 Belmont, September 2006

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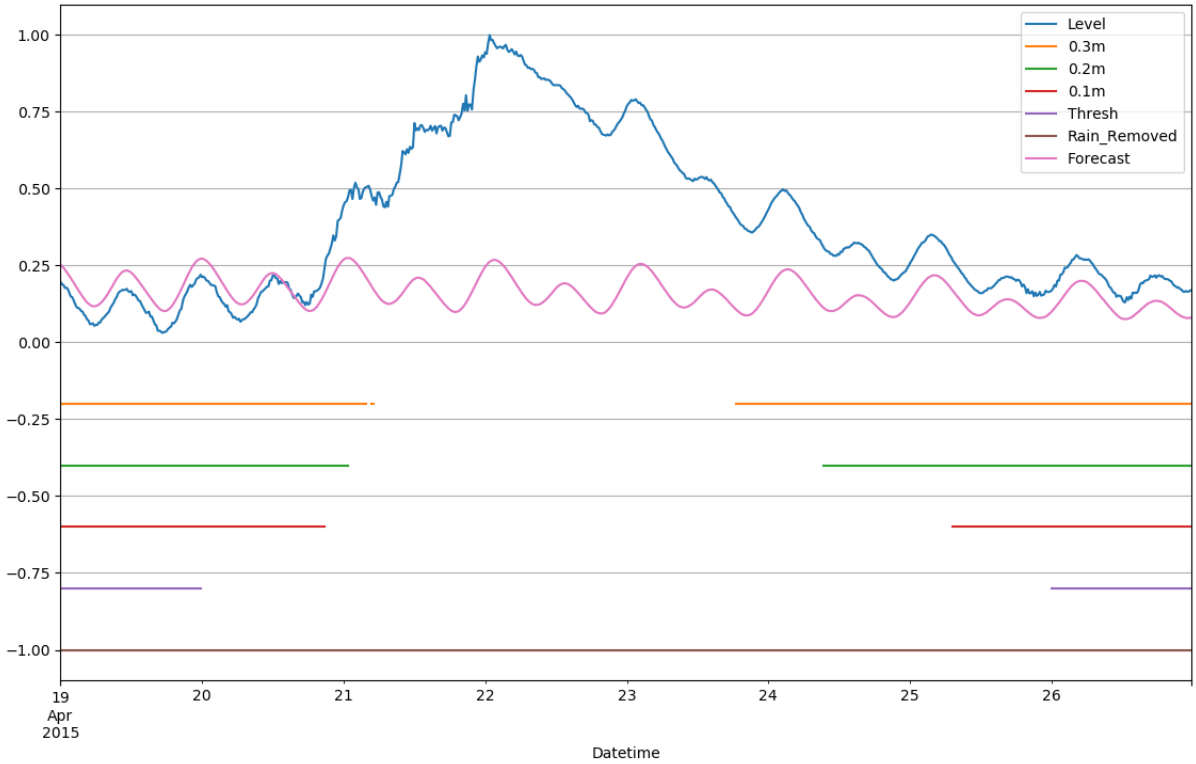

Figure B-9 Belmont, April 2015

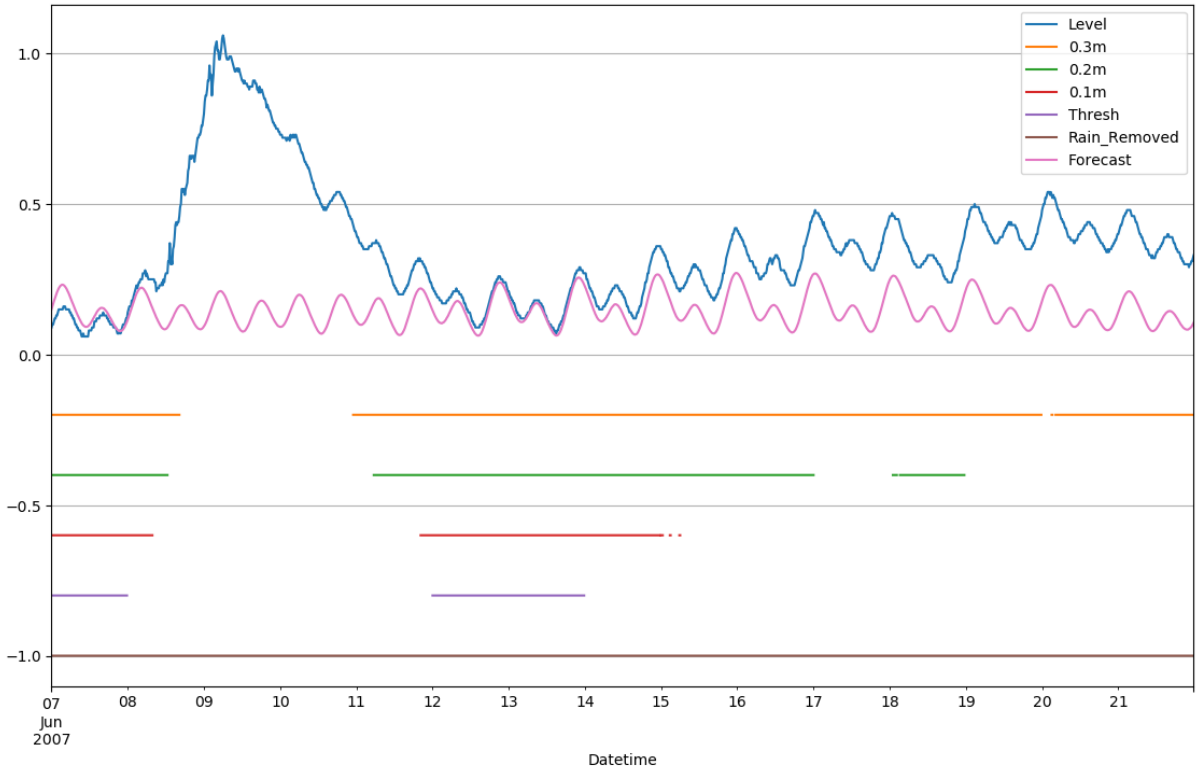

Figure B-10 Belmont, June 2007

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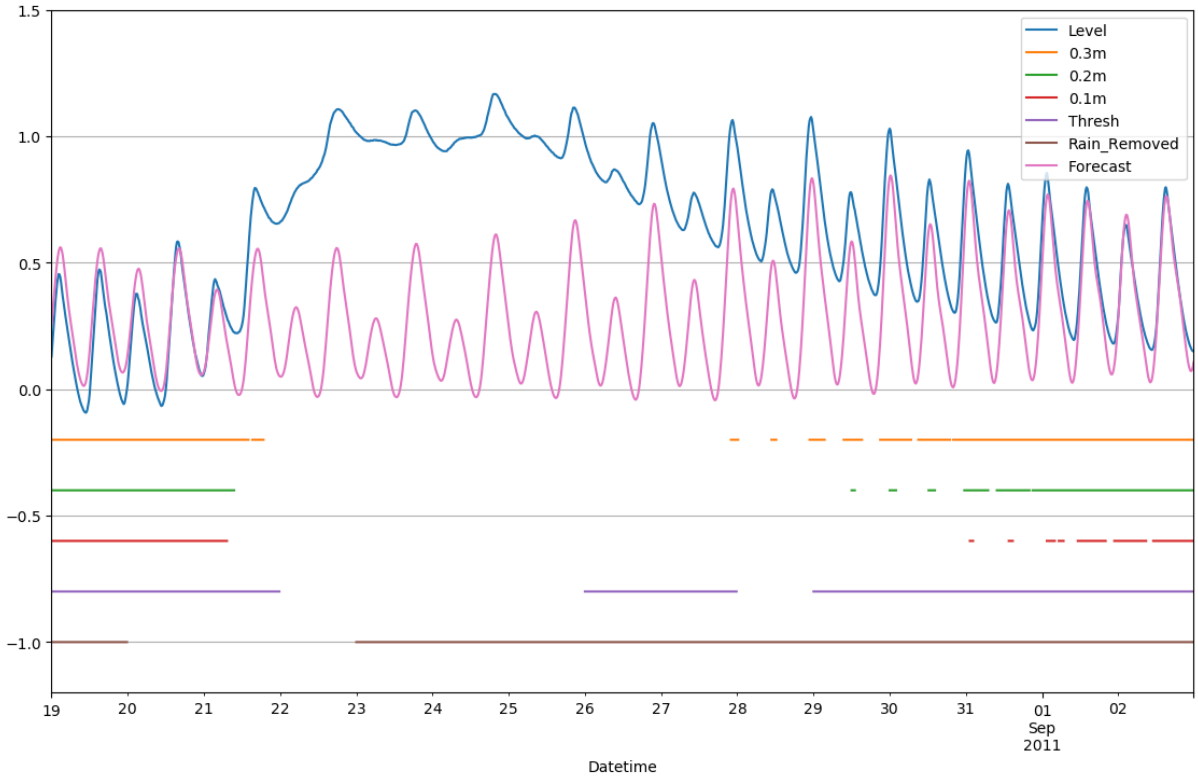

Figure B-11 Belmore Bridge, August 2011

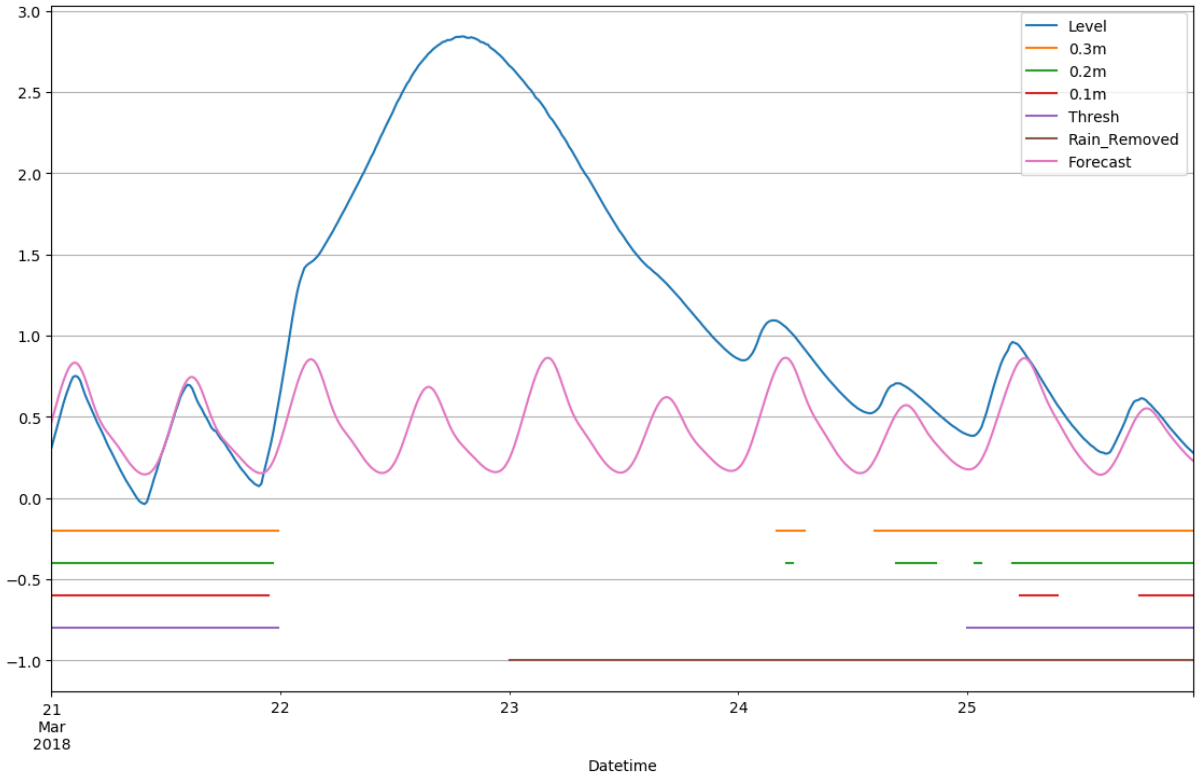

Figure B-12 Belmore Bridge, March 2018

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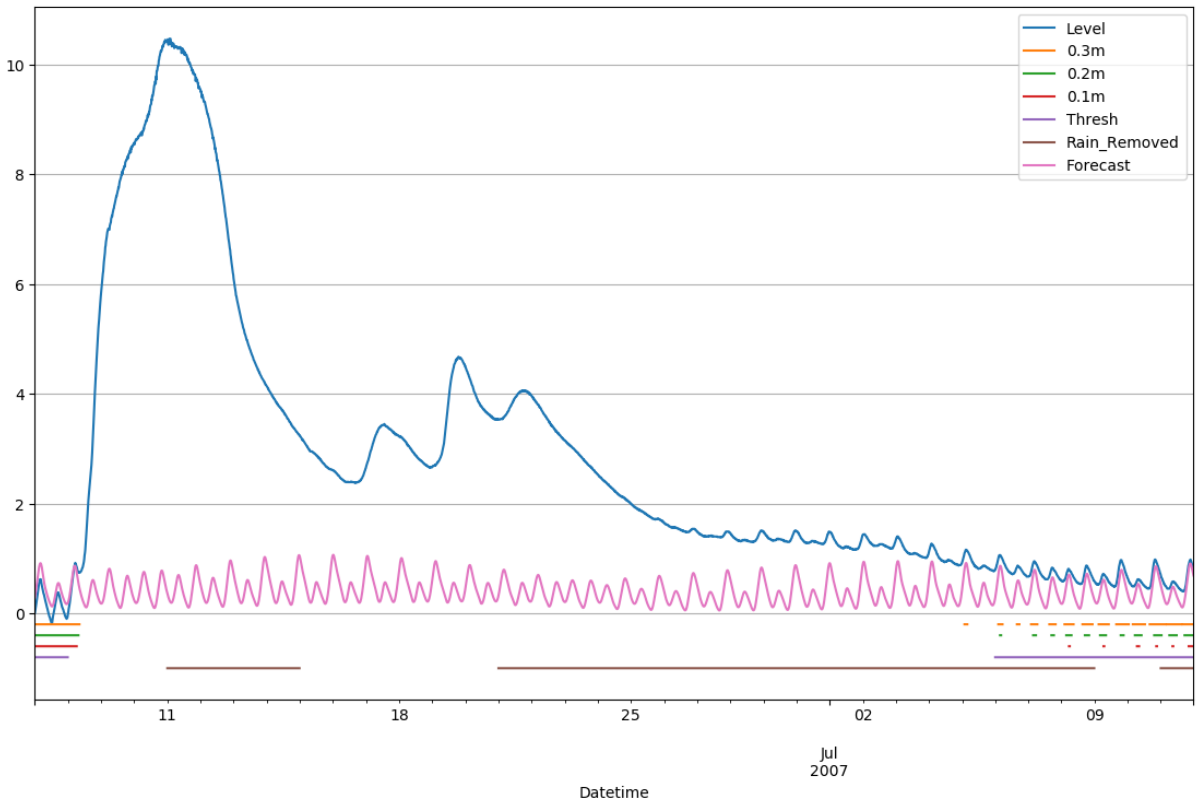

Figure B-13 Belmore Bridge, June 2007

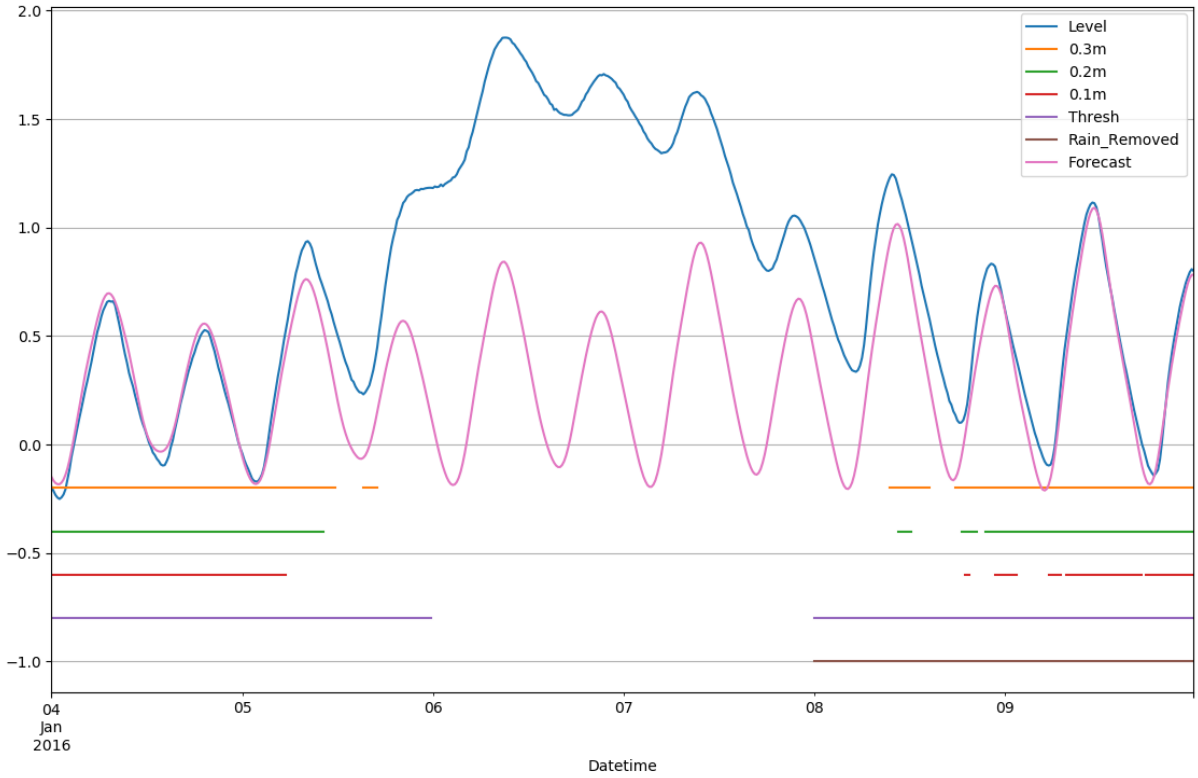

Figure B-14 Sackville, January 2016

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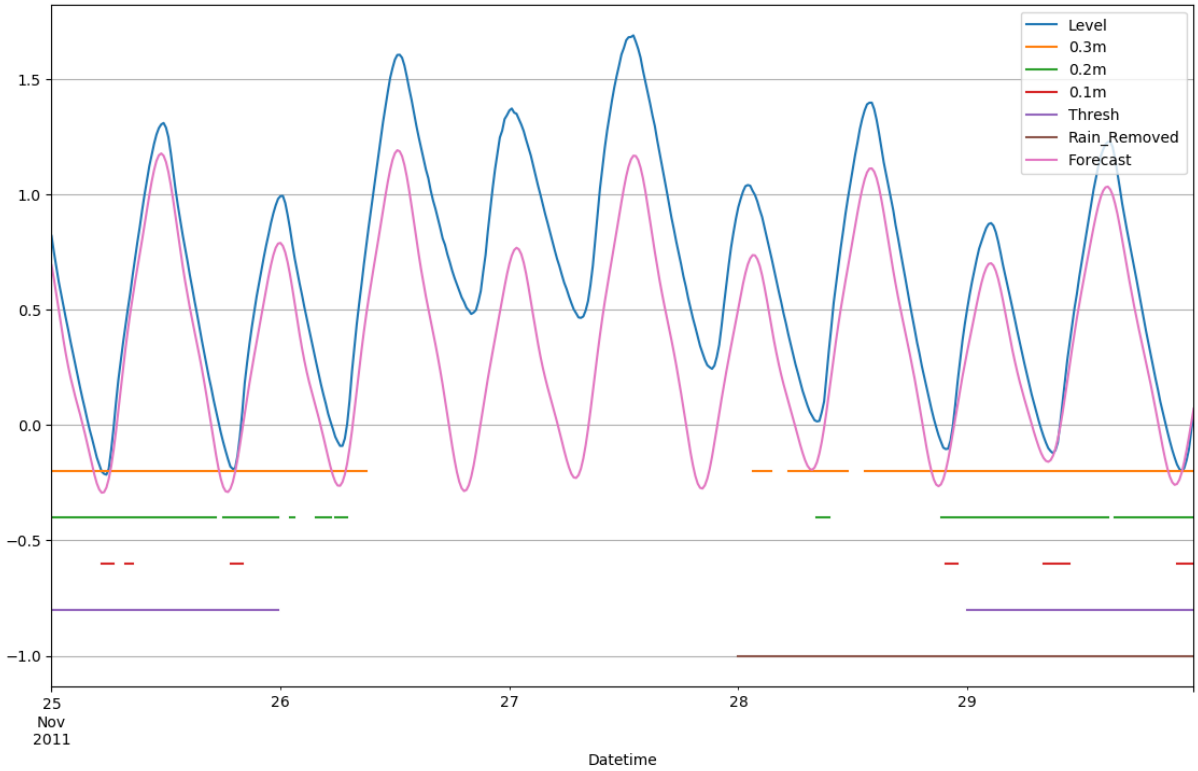

Figure B-15 Sackville, November 2011

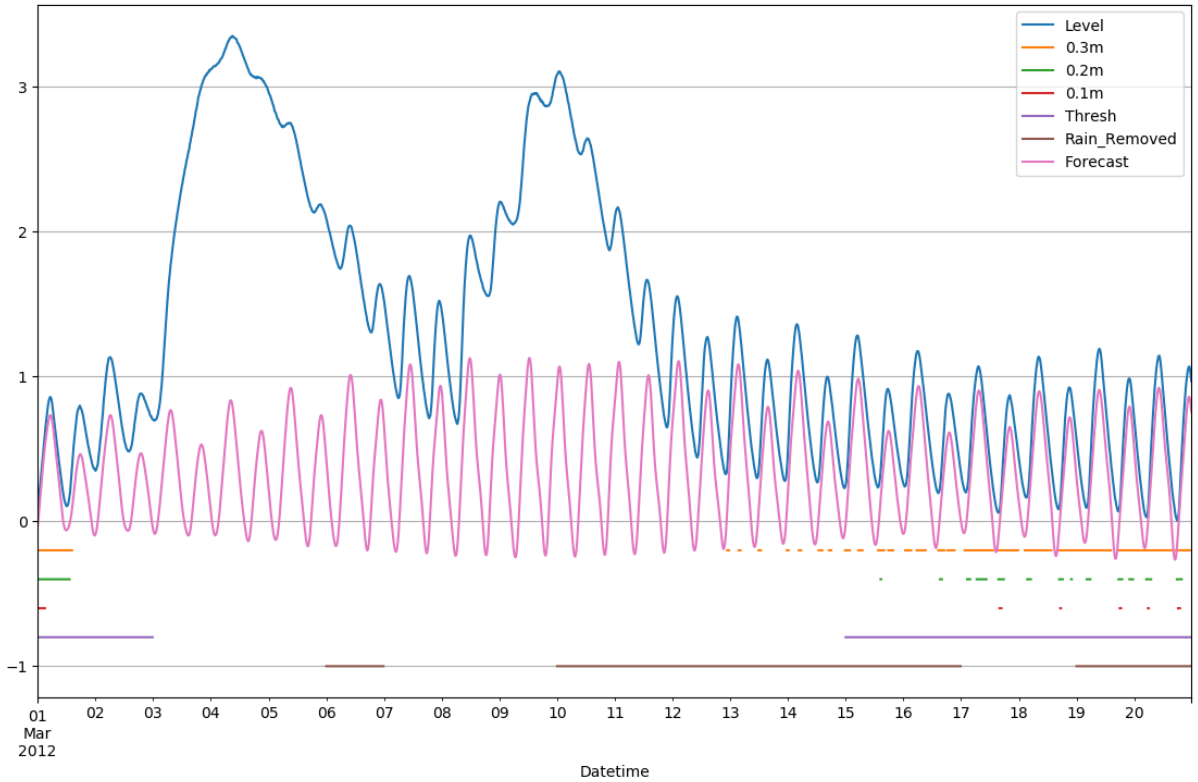

Figure B-16 Sackville, March 2012

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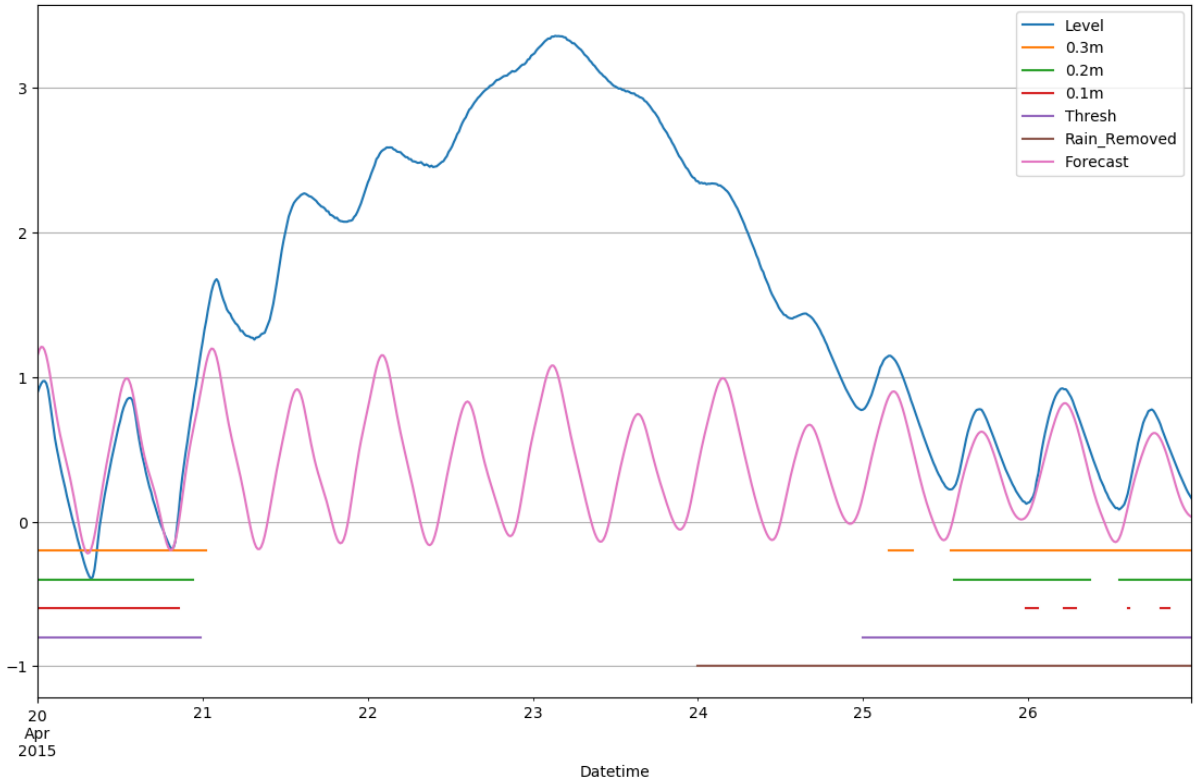

Figure B-17 Sackville, April 2015

B.2. Tidal planes

Table B-4 to Table B-8 provides the amount (metres) of change from the control tidal planes results for the selected stations. Belmore Bridge displays the most variation from the control (manual flood removal) due to significant variation in water levels during flood events.

Table B-4 Change in tidal planes with flood removal techniques, Billinudgel

	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
HHWSS	0.671	-0.010	-0.001	0.021	-0.004	-0.003
MHWS	0.452	-0.010	-0.003	0.014	-0.007	-0.005
MHW	0.424	-0.010	-0.003	0.014	-0.007	-0.005
MHWN	0.396	-0.010	-0.002	0.015	-0.007	-0.005
MSL	0.315	-0.009	-0.003	0.011	-0.008	-0.006
MLWN	0.233	-0.009	-0.004	0.007	-0.010	-0.008
MLW	0.205	-0.009	-0.004	0.007	-0.010	-0.008
MLWS	0.177	-0.009	-0.003	0.007	-0.010	-0.008
ISLW	0.021	-0.008	-0.004	0.003	-0.011	-0.009

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Table B-5 Change in tidal planes with flood removal techniques, Belmore Bridge

	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
HHWSS	0.805	-0.020	-0.011	0.007	-0.007	-0.075
MHWS	0.545	-0.018	-0.010	0.006	-0.009	-0.081
MHW	0.496	-0.017	-0.009	0.007	-0.008	-0.08
MHWN	0.448	-0.016	-0.007	0.009	-0.007	-0.079
MSL	0.215	-0.013	-0.003	0.012	-0.012	-0.097
MLWN	-0.019	-0.011	0.000	0.014	-0.018	-0.115
MLW	-0.067	-0.009	0.002	0.016	-0.017	-0.114
MLWS	-0.116	-0.008	0.003	0.017	-0.016	-0.113
ISLW	-0.302	-0.007	0.003	0.016	-0.018	-0.117

Table B-6 Change in tidal planes with flood removal techniques, Belmont

	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
HHWSS	0.183	-0.007	-0.004	0.008	0.001	-0.008
MHWS	0.118	-0.006	-0.004	0.009	0.002	-0.007
MHW	0.108	-0.007	-0.004	0.008	0.001	-0.008
MHWN	0.099	-0.007	-0.004	0.008	0.001	-0.008
MSL	0.061	-0.007	-0.004	0.008	0.001	-0.008
MLWN	0.023	-0.007	-0.004	0.007	0.001	-0.008
MLW	0.014	-0.007	-0.004	0.008	0.001	-0.007
MLWS	0.005	-0.007	-0.004	0.008	0.001	-0.007
ISLW	-0.042	-0.007	-0.004	0.008	0.001	-0.007

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Table B-7 Change in tidal planes with flood removal techniques, Sackville

	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
HHWSS	1.108	-0.002	0.005	0.025	-0.001	-0.003
MHWS	0.844	-0.002	0.005	0.024	-0.001	-0.003
MHW	0.756	-0.002	0.004	0.024	-0.001	-0.003
MHWN	0.668	-0.002	0.004	0.023	-0.001	-0.003
MSL	0.292	-0.002	0.004	0.021	-0.002	-0.004
MLWN	-0.083	-0.001	0.004	0.021	-0.001	-0.003
MLW	-0.171	-0.001	0.004	0.020	-0.001	-0.003
MLWS	-0.259	-0.002	0.004	0.020	-0.001	-0.004
ISLW	-0.448	-0.002	0.003	0.019	-0.002	-0.004

Table B-8 Change in tidal planes with flood removal techniques, Koonawarra Bay

	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
HHWSS	0.279	-0.005	0.002	0.027	0.044	-0.007
MHWS	0.230	-0.003	0.005	0.027	0.043	-0.007
MHW	0.223	-0.003	0.005	0.025	0.042	-0.007
MHWN	0.216	-0.003	0.005	0.024	0.041	-0.007
MSL	0.187	-0.002	0.006	0.025	0.041	-0.008
MLWN	0.158	0.000	0.008	0.026	0.042	-0.008
MLW	0.152	0.001	0.009	0.025	0.041	-0.007
MLWS	0.145	0.000	0.009	0.024	0.040	-0.008
ISLW	0.110	0.002	0.010	0.024	0.040	-0.008

B.3. HAT and LAT variations

Table B-9 provides the HAT value for each flood removal method. The threshold method shows the greatest variation in the HAT result from the control.

Table B-9 HAT for each flood removal method

Station	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
Billinudgel	0.917	0.922	0.919	0.901	0.897	0.913
Belmont	0.298	0.325	0.326	0.327	0.293	0.326
Belmore Bridge	0.984	1.000	0.994	0.985	0.966	1.093
Sackville	1.302	1.305	1.301	1.288	1.295	1.316
Koonawarra Bay	0.326	0.338	0.339	0.317	0.251	0.326

Table B-10 provides the LAT value for each flood removed method. Belmont displays the greatest variation in LAT values from the control for all flood removal methods. These differences can be attributed to the relatively small tidal range and therefore difficulty in isolating flooding using automated means.

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Table B-10 LAT for each flood removal method

Station	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
Billinudgel	0.061	0.063	0.058	0.053	0.071	0.054
Belmont	-0.043	-0.034	-0.03	-0.032	-0.032	-0.034
Belmore Bridge	-0.198	-0.191	-0.203	-0.208	-0.162	-0.097
Sackville	-0.326	-0.328	-0.333	-0.353	-0.330	-0.322
Koonawarra Bay	-0.011	-0.009	-0.012	-0.039	-0.018	-0.017

B.4. Root mean square error (RMSE)

Table B-11 provides the hindcast RMSE compared to the manual flood removed dataset (Control) for each flood removal method. The results show relative consistency across the board with all removal methods performing similarly to the control.

Table B-11 Hindcast RMSE to 0.1m dataset for each flood removal method

Station	Control	0.3m	0.2m	0.1m	Threshold	Rainfall
Billinudgel	0.082	0.083	0.082	0.083	0.083	0.083
Belmont	0.072	0.072	0.072	0.073	0.072	0.072
Belmore Bridge	0.127	0.128	0.128	0.129	0.129	0.165
Sackville	0.094	0.094	0.094	0.096	0.094	0.094
Koonawarra Bay	0.110	0.110	0.111	0.114	0.117	0.110

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Appendix C HAT/LAT uncertainty calculation

From the draft ISO standard (ISO 4373:2021(E)) the estimation of uncertainty of a value derived from a primary measurement may be due to:

- Unsteadiness of the measurement value (noisy fluctuation due; waves, or noise of electronic systems). Incorporated in the uncertainty of the 'level measurement'.
- Resolution of the measurement process (resolution of the sensor and/or of the human eye). Incorporated in the uncertainty of the 'level measurement'.
- Uncertainty of the original calibration and gradual drift due to sensitivity to, and/or variability in environmental conditions. Incorporated in the uncertainty of the 'level measurement'.
- Uncertainty of the original calibration and gradual drift due to sensitivity to, and/or variability in electrical conditions. Incorporated in the uncertainty of the 'level measurement'.
- Gradual shift in the vertical position of the gauge structure and consequent drift from the last datum check. Incorporated in the uncertainty of the 'level datum'.

Further discussion on each of these points is below.

C.1. Uncertainty model

The basic model for the HAT and LAT value uncertainty is as below:

Standard uncertainty (u)

$$u = \sqrt{u(level\ datum)^2 + u(level\ measurement)^2 + u(analysis)^2}$$

Where:

$\boldsymbol{u(level\ datum)}$ = standard uncertainty in datum
representing uncertainty components for:

- adopted datum level
- Instrument resolution
- survey levelling from datum (mis-close).

$\boldsymbol{u(level\ measurement)}$ = standard uncertainty in level measurement
representing uncertainty components for:

- resolution error
- calibration error
- changes in water density – applicable for some sensor types
- field observation resolution/readability.

$\boldsymbol{u(analysis)}$ = standard uncertainty in HAT/LAT tidal analysis
representing uncertainty components for:

- level data preparation and pre-analysis to allow for tidal anomalies
- tidal analysis model fit (Foreman).

The effective degrees of freedom for the analysis combining the uncertainty components are calculated by the Welch Satterthwaite equation (ISO, 2008). This is then used to calculate the combined coverage factor to convert the calculated combined standard uncertainty into

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uncertainty at the 95% confidence interval (U95). The coverage factor is calculated from the t-statistic and ideally approximates 2 (i.e., 60 degrees of freedom).

C.2. Uncertainty in datum

Level measurement is not an absolute measurement and is always relative to a datum. This datum is usually to a local benchmark, or flow structure (such as weir crest). The uncertainty in the datum should be reflected in the overall uncertainty of the level measurement.

Generally, water level measurements are related to a geodic or gravitational equipotential frame of reference to enable comparison between measurement points. For most of MHL's station this is Australian Height Datum 1971 derived from a benchmark.

The components for uncertainty in datum are:

- cited benchmark accuracy
- length of survey run and mis-close.
- resolution of survey equipment.

C.2.1. Cited benchmark accuracy

Benchmarks have potential uncertainties as the value of one mark is transferred to another, and the vertical stability of the area in which the benchmark is placed. The uncertainty of the gauge plate survey is a function of the local uncertainty (of the reference benchmark) and relative uncertainty (levelling run from the benchmark to the gauge plate).

NSW Government Spatial Services provide a typical application definition for each Class of survey mark to calculate the amount of acceptable mis-close on survey runs. For the expected uncertainty for the benchmark, MHL has relied on the height accuracy as provided by the Class as defined by NSW Government Spatial Services (NSW Government Spatial Services, 2021) to calculate the uncertainty of the benchmark. MHL has assumed a level run of 2 km as survey runs are usually no more than 1 to 2 km each way. If a reference survey is longer than this distance, then Department of Customer Service Spatial Services is engaged to establish new State Survey Marks (SSM) nearby to the water level monitoring station. Refer to Table B-1 for an estimation of uncertainty for each class of survey mark based on a 2km survey run.

Table C-1 Survey mark class calculation of uncertainty

Class	Typical applications	Uncertainty (m) (survey run distance (d) = 2km)
L2A	Precise levelling (Forward and backrun mis-close < 2√d mm)	0.003
LA	1st Order levelling (Forward and backrun mis-close < 4√d mm)	0.006
LB	2nd Order levelling (Forward and backrun mis-close < 8√d mm)	0.011
LC	3rd Order levelling (Forward and backrun mis-close < 12√d mm)	0.017
LD	Levelling (Forward and backrun mis-close < 18√d mm)	0.025

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LE	Levelling (Forward and backrun mis-close < 36√d mm)	0.051
2A	Precise trigonometric or GNSS heighting (Standard deviations of observations < 3(d+0.2) mm)	0.007
A	Trigonometric or GNSS heighting for state survey control (Standard deviations of observations < 7.5(d+0.2) mm)	0.017
B	Trigonometric or GNSS heighting for cadastral control (Standard deviations of observations <15(d+0.2)mm)	0.033
C	Trigonometric or GNSS heighting (Standard deviations of observations < 30 (d+0.2) mm)	0.066
D	Trigonometric or GNSS heighting (Standard deviations of observations < 50 (d+0.2) mm)	0.110
E	Trigonometric or GNSS heighting (Standard deviations of observations < 100 (d+0.2) mm)	0.220
U	Unknown or unreliable	Not used for gauge plate survey

Levelling - the process of determining the height of one level relative to another. It is used in surveying to establish the elevation of a point relative to a datum, or to establish a point at a given elevation relative to a datum.

Global Navigation Satellite System (GNSS) – uses GPS and a range of existing and emerging satellite-positioning constellations.

C.2.2. Length of run and mis-close

When undertaking a levelling run it is important to close the run. This is done by either returning to the benchmark at the start of the run, or levelling to another benchmark. The difference in the two levels obtained for the same mark are known as a mis-close.

C.3. Uncertainty in level

The level uncertainty component assesses the accuracy of the field readings based on the level measurement system including the logger and instrument.

C.3.1. Instrumentation

MHL currently uses a number of level sensing technologies, each with their own advantages and disadvantages. Uncertainties that are common to all instrument types are:

- Uncertainty in field readings, this includes wave action, which may impact all types of instruments. Some instruments have the ability to both perform average and multiple sampling and damping. Generally, wave action is compensated for at the time of the reading by the operator by taking an average over multiple waves. For stations classed as ocean tide the method for taking field observations is to strap a stilling tube to the gauge plate or dip point fixture and measure down from the surveyed reference level to the base of the laser leveller. At the 1 minute mark before the 15 min logged point begin measurements at 15 second intervals until 1 minute after the 15 minute logged point (9 measurements all up). Average the 9 measurements then subtract this from the relative level. For river and estuary stations the field operator takes an observed average at the 15 minute point.
- Resolution of the field readings, generally MHL uses staff gauges with a 0.01m increment, and in this uncertainty calculator we have adopted 1/3 of the increment as

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the resolution, based on the readability of the staff gauge in the water. It is suggested from NMI 1/3 between the resolution marks on a rule or instrument dial is the best approximation of readability. Resolution of the measuring system, this includes both the logger and the sensor. See below for a more detailed explanation of each type of measuring system. At present for stations in this report MHL uses the following sensors:

  - floatwells
  - gas purge / dry pressure sensors
  - radar
  - downward looking ultrasonic
  - submersible pressure sensors.

- Sensor calibration and linearity. A value of ± 0.004m has been adopted as most of MHL's calibration equipment is within this range or better.
- Flow velocities past any orifice type gauge, including gas purge, float-wells, submersible transducers can cause a Bernoulli effect either lowering or raising apparent relative errors at the sensor. For this uncertainty calculator the Bernoulli effect has been excluded until further investigation is completed to be able to quantify its impacts.
- Drift of the sensor. MHL recalibrates submersible and dry pressure sensors every two years, and drift is considered to be included in the calibration uncertainty and hence is not included in these estimations of uncertainty. Drift is also corrected during quality control of the data.
- Variation between quality controlled data and field observations. To estimate the uncertainty of the quality controlled data, the field readings over the 2001-2020 period are compared to the edited data in the database and the mean difference and standard deviation are used to define this uncertainty.

Radar

A downward looking radar unit determines the relative water level via a microwave transmitter and receiver. The radar transmits a form of modulated signal and the time elapsed between the transmission and receipt of the reflected signal is converted to a distance using the speed of light as a constant.

Float wells

A float well uses a float and counter-weight connected by a wire over a pulley. This type of set-up is installed in a stilling well which both protects the system from the environment and can be used to dampen wave/wind chop effects. There is a small uncertainty caused with the differing water density as it will change slightly the buoyancy of the float and counter-weight. This uncertainty is different depending on the system being monitored and if there are changes in water density between fresh and salt waters through the tidal cycle.

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Gas purge/dry pressure transducers

The gas purge/dry pressure transducer systems consist of a pressure regulator, a gas-flow regulation valve and a pressure sensor unit, this is connected to a gas-line submerged below the water level. The principal of the measurement system is the pressure that is required to form a bubble under water is proportional to the height of the water above the gas line orifice. The main uncertainty of this measurement system is water density, with a difference between oceanic waters and fresh water approximately ±2.5 %. Sensors are calibrated to either fresh or salt water, and in estuarine and intermittently closed and open lakes and lagoons (ICOLLs), there can be large changes in salinity over the measurement range.

Submersible pressure transducers

A sensor that measures electrical properties such as capacitance or resistance of a probe penetrating the water to a sufficient depth to measure the lowest water levels. Such probes can be either vented to the atmosphere or measure absolute pressure. When measuring the absolute pressure, the atmospheric pressure must be compensated for. The main uncertainty of this measurement system is water density, with a difference between oceanic waters and fresh water approximately ±2.5 %. Sensors are calibrated to either fresh or salt water, and in estuarine and intermittently closed and open lakes and lagoons (ICOLLs), there can be large changes in salinity over measurement range. If an absolute sensor is being used, the uncertainty of the atmospheric correction must be considered. This is not considered relevant for this report as the submersible pressure transducers used for monitoring are all vented to the atmosphere.

Downward looking ultrasonic

A downward looking ultrasonic unit determines the relative water level via an ultrasonic transmitter and receiver. The sensor transmits a form of modulated signal and the time elapsed between the transmission and receipt of the signal is converted to a distance using the speed of sound as a constant. This introduces a small uncertainty as the speed of sound through air varies with density which is a function of air pressure, temperature and humidity. The speed of sound is temperature-dependent and changes by approximately 0.17% with each degree Celsius, but as most sensors have an in-built temperature compensation it is assumed this uncertainty is small and not included in uncertainty calculations in this report.

C.3.2. Water density

Differing water densities affects submerged sensing technologies as previously mentioned. Table C-12 provides the adopted percentage of uncertainty to account for changes in water density based on the UNESCO formula and extrapolated for assumed salinity levels for five categories of location and technology type (UNESCO, 1981). The percentage is applied to the tidal range for the station. The tidal range value is taken from the 2001-2020 tidal planes analysis and the locations are entrance, estuary, fresh water, full ocean and intermittently closed and open lakes and lagoons (ICOLL).

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Table C-12 Density of water uncertainty (%) by location and instrumentation

	Entrance	Estuary	Fresh water	Full ocean	ICOLL
Floatwell	0.00%	0.03%	0.04%	0.00%	0.25%
Submersible pressure transducer	0.01%	2.40%	0.41%	0.01%	2.40%
Gas line	0.01%	2.40%	0.41%	2.40%	2.50%
Down looking ultrasonic	0.00%	0.00%	0.00%	0.00%	0.00%
Radar	0.00%	0.00%	0.00%	0.00%	0.00%

C.4. Uncertainty in analysis

C.4.1. Flood removal technique

Flood removal based on harmonic analysis was performed by creating a hindcast of the 19-years of recorded data based on the calculated harmonic constituents. This hindcast is then subtracted from the control data to produce a timeseries of residual values (or anomalies). Floods and other anomalies are identified by periods where residual values exceed a given threshold. The threshold of 0.2m was selected for analysis in this report as it strikes a balance between of a high data retention for analysis and removal of hydrologic inputs.

To understand the uncertainty associated with the selection of this hydrologic input removal technique, it was compared with a control (no anomaly removal) and three different thresholds for the hindcast subtraction (0.3m, 0.2m and 0.1m). Table C-13 and Table C-14 display the results of this comparison for stations that represent a range of river and estuary locations. The maximum difference between the 0.1m and 0.3m anomaly threshold removal is 0.033m, which has been adopted as the standard uncertainty for hydrologic input removal.

Table C-13 HAT for the control and hindcast anomaly removal method

Station	River (R)/Estuary (E)	Control (m)	0.3 (m)	0.2 (m)	0.1 (m)	Range in hindcast (m)	Tidal range (m)	Hindcast range vs tidal range
Billinudgel	R	0.931	0.915	0.912	0.895	0.020	0.594	3.37%
Belmont	E	0.336	0.332	0.328	0.317	0.015	0.202	7.43%
Belmore Bridge	R	1.064	0.989	0.984	0.968	0.021	1.090	1.93%
Sackville	R	1.317	1.287	1.284	1.269	0.018	1.555	1.16%
Koonawarra Bay	E	0.335	0.333	0.334	0.309	0.024	0.167	14.37%

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Table C-14 LAT for the control and hindcast anomaly removal method

Station	River (R) /Estuary (E)	Control	0.3m	0.2m	0.1m	Range in hindcast method (m)
Billinudgel	R	0.055	0.061	0.056	0.050	0.011
Belmont	E	-0.033	-0.033	-0.033	-0.045	0.012
Belmore Bridge	R	-0.150	-0.223	-0.228	-0.233	0.010
Sackville	R	-0.345	-0.345	-0.350	-0.370	0.025
Koonawarra Bay	E	-0.011	-0.012	-0.016	-0.045	0.033

C.4.2. Foreman analysis

The uncertainty of the Foreman analysis technique is calculated as the standard deviation of the difference between the predicted and actual monitored values (anomalies removed) over the 2001 – 2020 analysis period.

C.5. Other potential errors

Timing

Tidal analysis relies on the phases change of each individual component against the Universal Time Clock (UTC) and reported timing is a critical element in the calculations and a potential error source. Since the mid 1990's MHL has telemetered the majority of its gauges and the server has performed time corrections when the logger clock was showing a discrepancy of greater than 15 seconds when downloaded (typically daily). The server itself was corrected by checking against a second order time-server. With changes in telemetry and most loggers using internet technology to send data to MHL's servers, the logger now self-synchronises to a time-server. As these processes have been in place during the period of data used is this report, timing as an uncertainty component is considered insignificant and not included in the uncertainty calculation. The data analysed in this report has been collected at 15 min intervals, hence the error could be 15 seconds while the smallest major constituent is in the order of 3 hours and most over 14 hours.

Seiches

A seiche is a standing wave in an enclosed or partially enclosed body of water. Seiches and seiche-related phenomena have been observed on lakes, reservoirs, swimming pools, bays, harbours and seas. MHL has undertaken studies on seiching in Coffs Harbour (MHL, 1990) (MHL, 2016), Crowdy Head (MHL, 1994), Sydney Harbour and Ulladulla (MHL, 2007) (MHL, 2018).

The seiche signal is normally initial set-up (usually by barometric effects) and then decays over time. We do not believe the harmonic analysis picks up the seiche, unless seiche is persistent enough and the period of the seiche matches one of the defined harmonic constituents. Due to the random nature of a seiche and the small period (under 60 min) and the extended data set we have undertaken the tidal analysis over, we have assumed that the seiche signal is ignored in the analysis, and hence has not been considered in the uncertainty analysis.

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C.6. Component assumptions and contributions

Table C-15 provides a summary of the elemental uncertainty sources associated with the water level measurement and analysis method.

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Table C-15 Summary of uncertainty components and assumptions

Source	Probability distribution	k value[1]	Raw uncertainty	Estimation source
Survey reference Benchmark	Normal	2	Assumed survey distance of 2km, refer to Table B-1	(NSW Government Spatial Services, 2021)
Survey resolution	Rectangular	1.73	Assumed read on survey staff of ±0.001m	Scale resolution
Survey mis-close	Normal	2	From most recent survey result	MHL survey books
Instrument resolution	Normal	1.73	Assumed ±0.010m for all instrumentation types	Lowest resolution of the environmental database – resolution varies from 0.010 (pre 2010) to 0.001m.
Instrument calibration uncertainty	Normal	2	Assumed ±0.004m for all instrumentation types and tidal ranges.	DPI 610 IS Portable pressure calibrator calibration certificate from manufacturer.
Water density uncertainty	Normal	2	Refer to Table B-2	(UNESCO, 1981) Salinity is not being measured so we are making an assumption based on a classification.
Variation between quality controlled data and field observations	Normal	2	MHL quality controlled database for each station.	MHL field observations

[1] Value is the divisor used to convert the raw uncertainty to a standard uncertainty based an adopted error probability distribution.

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Source	Probability distribution	k value[1]	Raw uncertainty	Estimation source
Gauge post reading resolution	Triangular	$\frac{1}{\sqrt{6}}$	$\pm$0.003m	Scale resolution (1/3 of the gauge plate 10mm marks)
Sea level change – Not included.	Normal	2	Based on the Fort Denison tide record 1914 – 2004 there is a linear trend of sea level rise of 0.94mm/year.	(MHL, 2011) – Not included in the calculation.
Hydrologic input removal technique	Normal	2	Assumed $\pm$0.033m for all station locations	Refer to Table C-13 and Table C-14
Foreman analysis uncertainty	Normal	2	Station specific	Assumption is that for the tidal constituents their associated uncertainty is the same as the mean value (prediction) i.e., the standard deviation.

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Appendix D Glossary of terms

Amplitude (H)	One-half the range of a constituent tide. By analogy, it may be applied also to the maximum speed of a constituent current.
Automatic Tide Gauge	An instrument that automatically registers the rise and fall of the tide. In some instruments, the registration is accomplished by recording the heights at regular time intervals in digital format.
Australian Height Datum (AHD)	The Australian Height Datum is a geodetic datum for altitude measurement in Australia. According to Geoscience Australia, "In 1971 the mean sea level for 1966-1968 was assigned the value of zero on the Australian Height Datum at thirty tide gauges around the coast of the Australian continent. The resulting datum surface, with minor modifications in two metropolitan areas, has been termed the Australian Height Datum (AHD) and was adopted by the National Mapping Council as the datum to which all vertical control for mapping (and other surveying functions) is to be referred.
Benchmark (BM)	A fixed physical object or mark used as reference for a vertical datum. A tidal benchmark is one near a tide station to which the tide staff and tidal datums are referred. A primary benchmark is the principal (or only) mark of a group of tidal benchmarks to which the tide staff and tidal datums are referred.
Chart Datum	The datum to which soundings on a chart are referred. It is usually taken to correspond to a low-water elevation, and its depression below mean sea level is represented by the symbol Z.
Coastal Boundary	The Mean High Water Line (MHWL) or Mean Higher High Water Line (MHHWL) when tidal lines are used as the coastal boundary. Also, lines used as boundaries inland of and measured from (or points thereon) the MHWL or MHHWL.
Constituent	One of the harmonic elements in a mathematical expression for the tide-producing force and in corresponding formulas for the tide or tidal current. Each constituent represents a periodic change or variation in the relative positions of the earth, moon and sun. A single constituent is usually written in the form y = A cos (at + á), in which y is a function of time as expressed by the symbol t and is reckoned from a specific origin. The coefficient A is called the amplitude of the constituent and is a measure of its relative importance. The angle (at + á) changes uniformly and its value at any time is called the phase of the constituent. The speed of the constituent is the rate of change in its phase and is represented by the symbol a in the formula. The quantity a is the phase of the constituent at the initial instant from which the time is reckoned. The period of the constituent is the time required for the phase to change through 360° and is the cycle of the astronomical condition represented by the constituent.
Digital Recorder (or logger)	An electronic recorder system which stores the information in accessible form, for example, on tape or solid state memory.
Digitise	To translate analog information into digital form i.e. a series of numeric data readable by, and stored within, a digital computer.
Diurnal	Having a period or cycle of approximately one tidal day. Thus, the tide is said to be diurnal when only one high water and one low water occur during a tidal day, and the tidal current is said to be diurnal when there is a single flood and a single ebb period of a reversing current in the tidal day. A rotary current is diurnal if it changes its

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	direction through all points of the compass once each tidal day. A diurnal constituent is one which has a single period in the constituent day. The symbol for such a constituent is the subscript 1.
Encoder	A device that translates tidal movement into computer readable data.
Estuary	An embayment of the coast in which fresh river water entering at its head mixes with the relatively saline ocean water. When tidal action is the dominant mixing agent it is usually termed a tidal estuary. Also, the lower reaches and mouth of a river emptying directly into the sea where tidal mixing takes place. The latter is sometimes called a river estuary.
Extreme High Water	The highest elevation reached by the sea as recorded by a tide gauge during a given period.
Extreme Low Water	The lowest elevation reached by the sea as recorded by a tide gauge during a given period.
Floatwell	A stilling well in which the float of a float-actuated gauge operates.
Gas Purged Pressure Gauge	A type of analog tide gauge in which gas, usually nitrogen, is emitted from a submerged tube at a constant rate. Fluctuations in hydrostatic pressure due to changes in tidal height modify the emission rate for recording.
Harmonic Analysis	Process of measuring or calculating the relative amplitudes and frequencies of all the significant harmonic components present in a given wave form.
Harmonic Prediction	Method of predicting tides by combining the harmonic constituents into a single tidal curve. The work is usually performed by electronic digital computer.
Head	The difference in water level at either end of a strait, channel, inlet, etc.
High Water (HW)	The maximum height reached by a rising tide. The high water is due to the periodic tidal forces and the effects of meteorological, hydrologic, and/or oceanographic conditions. For tidal datum computational purposes, the maximum height is not considered a high water unless it contains a tidal high water.
High Water Mark	A line or mark left upon tide flats, beach, or alongshore objects indicating the elevation of the intrusion of high water. The mark may be a line of oil or scum on alongshore objects, or a more or less continuous deposit of fine shell or debris on the foreshore or berm. This mark is physical evidence of the general height reached by wave runup at recent high waters. It should not be confused with the Mean High Water Line or Mean Higher High Water Line.
Higher High Water (HHW)	The highest of the high waters (or single high water) of any specified tidal day due to the declination A_l effects of the moon and sun.
Higher Low Water (HLW)	The highest of the low waters of any specified tidal day due to the declination A_l effects of the moon and sun.
Highest Astronomical Tide (HAT)	The highest level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions; this level will not be reached every year. HAT is not the extreme level which can be reached as storm surges may cause considerably higher levels to occur.

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Hydrographic Datum	A datum used for referencing depths of water and the heights of predicted tides or water level observations. Same as Chart Datum. See Datum.
ICOLL	Intermittently closed or open (coastal) lakes and lagoons
Indian Spring Low Water	A datum originated by Professor G. H. Darwin when investigating the tides of India. It is an elevation depressed below mean sea level by an amount equal to the sum of the amplitudes of the harmonic constituents M_2, S_2, K_1, and O_1.
Inverse Barometer Effect	The inverse response of sea level to changes in atmospheric pressure. A static reduction of 1.005 mb in atmospheric pressure will cause a stationary rise of 1 cm in sea level.
K_1	Lunisolar diurnal constituent. This constituent, with O_1, expresses the effect of the moon's declination. They account for diurnal inequality and, at extremes, diurnal tides. With P_1, it expresses the effect of the sun's declination. Speed = T + h = 15.041,068,6° per solar hour.
Lambda	Smaller lunar evectional constituent. This constituent, with V_2, U_2, and (S_2), modulates the amplitude and frequency of M_2 for the effects of variation in solar attraction of the moon. This attraction results in a slight pear-shaped lunar ellipse and a difference in lunar orbital speed between motion toward and away from the sun. Although (S_2) has the same speed as S_2, its amplitude is extremely small. Speed = 2T - s + p = 29.455,625,3° per solar hour.
Low Water (LW)	The minimum height reached by a falling tide. The low water is due to the periodic tidal forces and the effects of meteorological, hydrologic, and/or oceanographic conditions. For tidal datum computational purposes, the minimum height is not considered a low water unless it contains a tidal low water.
Lower High Water (LHW)	The lowest of the high waters of any specified tidal day due to the declination A_l effects of the moon and sun.
Lower Low Water (LLW)	The lowest of the low waters (or single low water) of any specified tidal day due to the declination A_l effects of the moon and sun.
Lowest Astronomical Tide (LAT)	The lowest level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions; this level will not be reached every year. LAT is not the extreme level which can be reached as storm surges may cause considerably lower levels to occur.
Lunar Tide	That part of the tide on the earth due solely to the moon as distinguished from that part due to the sun.
Magnetic Tape	Recording tape on which (numeric) data may be stored.
M_2	Principal lunar semi-diurnal constituent. This constituent represents the rotation of the Earth with respect to the Moon. Speed = 2T - 2s + 2h = 28.984,104,2° per solar hour.
M_{sf}	Lunisolar synodic fortnightly constituent. Speed = 2s - 2h = 1.015,895,8° per solar hour.

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Mean High Water (MHW)	A tidal datum. The average of all the high water heights observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum.
Mean High Water Neaps (MHWN)	The average of high water heights occurring at the time of neap tides.
Mean High Water Springs (MHWS)	The average of high water heights occurring at the time of spring tides.
Mean Low Water (MLW)	The average of all low water heights observed over a period.
Mean Low Water Neaps (MLWN)	The average of the low water heights occurring at the time of neap tides.
Mean Low Water Springs (MLWS)	A tidal datum. Frequently abbreviated spring low water. The arithmetic mean of the low water heights occurring at the time of spring tides observed over the National Tidal Datum Epoch. It is usually derived by taking an elevation depressed below the half-tide level by an amount equal to one-half the spring range of tide, necessary corrections being applied to reduce the result to a mean value.
Mean Range of Tide (Mn)	The difference in height between Mean High Water and Mean Low Water.
Modem	A device allowing a computer to be accessed over a telephone line.
Neap Tides	Tides of decreased range or tidal currents of decreased speed occurring semi-monthly as the result of the moon being in quadrature. The neap range (Np) of the tide is the average range occurring at the time of neap tides and is most conveniently computed from the harmonic constants. It is smaller than the mean range where the type of tide is either semi-diurnal or mixed and is of no practical significance where the type of tide is predominantly diurnal. The average height of the high waters of the neap tide is called Neap High Water or High Water Neaps (MHWN) and the average height of the corresponding low waters is called Neap Low Water or Low Water Neaps (MLWN).
O_1	Lunar diurnal constituent. See K_1. Speed = T - 2s + h = 13.943,035,6° per solar hour.
Phase	1. Any recurring aspect of a periodic phenomenon, such as new moon, high water, flood strength, etc. 2. A particular instant of a periodic function expressed in angular measure and reckoned from the time of its maximum value, the entire period of the function being taken as 360°. The maximum and minimum of a harmonic constituent have phase values of 0° and 180°, respectively.

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Pressure Sensor	A pressure transducer sensing device for water level measurement. A relative transducer is vented to the atmosphere and pressure readings are made relative to atmospheric pressure. An absolute transducer measures the pressure at its location. The readings are then corrected for barometric pressure taken at the surface.
Range of Tide	The difference in height between consecutive high and low waters. The mean range is the difference in height between mean high water and mean low water. The great diurnal range or diurnal range is the difference in height between mean higher high water and mean lower low water.
Relative Mean Sea Level Change	A local change in mean sea level relative to a network of benchmarks established in the most stable and permanent material available (bedrock, if possible) on the land adjacent to the tide station location. A change in relative mean sea level may be composed of both an absolute mean sea level change component and a vertical land movement change component, together.
S_2	Principal solar semi-diurnal constituent. This constituent represents the rotation of the Earth with respect to the Sun. Speed = 2T = 30.000,000,0° per solar hour.
Seiche	A stationary wave usually caused by strong winds and/or changes in barometric pressure. It is found in lakes, semi-enclosed bodies of water, and in areas of the open ocean. The period of a seiche in an enclosed rectangular body of water is usually represented by the formula : Period (T) = 2L / square root (gd) in which L is the length, d the average depth of the body of water, and g the acceleration of gravity.
Semi-Diurnal	Having a period or cycle of approximately one-half of a tidal day. The predominant type of tide throughout the world is semi-diurnal, with two high waters and two low waters each tidal day. The tidal current is said to be semi-diurnal when there are two flood and two ebb periods each day. A semi-diurnal constituent has two maxima and two minima each constituent day, and its symbol is the subscript 2.
Shallow Water Constituent	A short-period harmonic term introduced into the formula of tidal (or tidal current) constituents to take account of the change in the form of a tide wave resulting from shallow water conditions. Shallow water constituents include the overtides and compound tides.
Slack Water (Slack)	The state of a tidal current when its speed is near zero, especially the moment when a reversing current changes direction and its speed is zero. The term also is applied to the entire period of low speed near the time of turning of the current when it is too weak to be of any practical importance in navigation. The relation of the time of slack water to the tidal phases varies in different localities. For a perfect standing tidal wave, slack water occurs at the time of high and of low water, while for a perfect progressive tidal wave, slack occurs midway between high and low water.
Solar Tide	1. The part of the tide that is due to the tide-producing force of the sun. 2. The observed tide in areas where the solar tide is dominant. This condition provides for phase repetition at about the same time each solar day.

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Solid State	An electronic device composed of components with no moving parts - in this instance, using the electronic properties of solids, as in transistors, semi-conductors and integrated circuits.
Spring High Water	Same as Mean High Water Springs (MHWS). See Spring Tides.
Spring Low Water	Same as Mean Low Water Springs (MLWS). See Spring Tides and Mean Low Water Springs.
Spring Tides	Tides of increased range or tidal currents of increased speed occurring semi-monthly as the result of the moon being new or full. The spring range (Sg) of tide is the average range occurring at the time of spring tides and is most conveniently computed from the harmonic constants. It is larger than the mean range where the type of tide is either semi-diurnal or mixed, and is of no practical significance where the type of tide is predominantly diurnal. The average height of the high waters of the spring tides is called Spring High Water or Mean High Water Springs (MHWS) and the average height of the corresponding low waters is called Spring Low Water or Mean Low Water Springs (MLWS).
Storm Surge	The local change in the elevation of the ocean along a shore due to a storm. The storm surge is measured by subtracting the astronomic tidal elevation from the total elevation. It typically has a duration of a few hours. Since wind generated waves ride on top of the storm surge (and are not included in the definition), the total instantaneous elevation may greatly exceed the predicted storm surge plus astronomic tide. It is potentially catastrophic, especially on low-lying coasts with gently sloping offshore topography.
Telemeter	Transmit data to a distant receiving station via a telephone line or by telegraphic means.
Tidal Anomaly	The difference between the recorded and predicted tide level generally representative of the non-astronomical factors influencing coastal water levels such as storm surge.
Tidal Characteristics	Principally, those features relating to the time, range, and type of tide.
Tidal Constants	Tidal relations that remain practically constant for any particular locality. Tidal constants are classified as harmonic and non-harmonic. The harmonic constants consist of the amplitudes and epochs of the harmonic constituents, and the non-harmonic constants include the ranges and intervals derived directly from the high and low water observations.
Tidal Current	A horizontal movement of the water caused by gravitational interactions between the Sun, Moon and Earth. The horizontal component of the particulate motion of a tidal wave. Part of the same general movement of the sea that is manifested in the vertical rise and fall called tide.
Tidal Limit	That point along a tidal estuary above which there is no tidal influence.
Tide	The periodic rise and fall of the water resulting from gravitational interactions between Sun, Moon and Earth. The vertical component of the particulate motion of a tidal wave. Although the accompanying horizontal movement of the water is part of the same phenomenon, it is preferable to designate this motion as tidal current.

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Tide Curve	A graphic representation of the rise and fall of the tide in which time is usually represented by the abscissa and height by the ordinate. For a semi-diurnal tide with little diurnal inequality, the graphic representation approximates a cosine curve.
Tide (Water Level) Gauge	An instrument for measuring the rise and fall of the tide (Water Level).
Tide Tables	Tables which give daily predictions of the times and heights of high and low waters. These predictions are usually supplemented by tidal differences and constants through which predictions can be obtained for numerous other locations.
Tsunami	A shallow water progressive wave, potentially catastrophic, caused by an underwater earthquake or volcano.
Universal Time (UTC)	Same as Greenwich Mean Time (GMT).
Z_0	Symbol recommended by the International Hydrographic Organisation to represent the elevation of mean sea level above chart datum.

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