DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
KAGAWARAN NG KAPALIGIRAN AT LIKAS YAMAN

BAGONG PILIPINAS

MEMORANDUM

TO : **THE REGIONAL EXECUTIVE DIRECTORS**
DENR – CAR, NCR and Regions I – VIII

FROM : **THE UNDERSECRETARY**
Field Operations and Supervising Undersecretary for EMB and MGB - Luzon and Visayas

SUBJECT : **MANUAL ON THE DELINEATION OF MEAN HIGH WATER LINE (MHWL)**

DATE : MAR 0 4 2024

Forwarding to your Office is the Memorandum dated 13 February 2024, from the Undersecretary for Policy, Planning, and International Affairs providing this Office with a copy of the National Mapping and Resources Information Authority's (NAMRIA) Administrative Order No. 2023-002 dated 01 December 2023 entitled, "Manual on the Delineation of Mean High Water Line (MHWL).

For your information and reference.

ATTY. JUAN MIGUEL T. CUNA, *CESO I*

MEMO NO. 2024-211

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

KAGAWARAN NG KAPALIGIRAN AT LIKAS YAMAN

BAGONG PILIPINAS

MEMORANDUM

FOR/TO : **The Undersecretary**
Field Operations – Luzon, Visayas, and Environment

The Undersecretary
Field Operations – Mindanao

The Assistant Secretary
International Affairs
Director, Biodiversity Management Bureau
in concurrent capacity

The OIC Assistant Secretary
Field Operations – Western Mindanao
Director, Forest Management Bureau
in concurrent capacity

FROM : **The Undersecretary**
Policy, Planning, and International Affairs

SUBJECT : **MANUAL ON THE DELINEATION OF MEAN HIGH WATER LINE (MHWL)**

DATE : FEB 13 2024

This is to respectfully provide your Office with a copy of the National Mapping and Resource Information Authority's (NAMRIA) Manual on the Delineation of Mean High Water Line (MHWL) dated 1 December 2023.

The said manual provides the procedures for delineating MHWL along applicable coastal areas nationwide as a reference to no-build zones, other legal easements, or foreshore areas. In addition, it provides the location of the reference line for the measurement of legal easements and foreshore areas along shorelines.

For your information and reference.

ATTY. JONAS R. LEONES

Republic of the Philippines
Department of Environment and Natural Resources
NATIONAL MAPPING AND RESOURCE INFORMATION AUTHORITY
www.namria.gov.ph

DEC 0 1 2023

ADMINISTRATIVE ORDER
NO. 2023 – 102

SUBJECT: Manual on the Delineation of Mean High Water Line (MHWL)

Pursuant to the mandates of the National Mapping and Resource Information Authority (NAMRIA), as provided for in Section 22(a) of Executive Order (EO) No. 192 or the Reorganization Act of the Department of Environment and Natural Resources (DENR) and in accordance with Article 51 of Presidential Decree (PD) 1067 or The Water Code of the Philippines, Sections 54 and 55, Article 11 of the DENR Administrative Order (DAO) 2007-29 on the Revised Regulation on Land Surveys, and Section 6 of DAO 2021-07 or the Guidelines on the Establishment of Legal Easements Along the Seas, Rivers, Lakes, Esteros, and Creeks, this manual is hereby issued for the guidance of all concerned.

SECTION 1. Basic Policy. In line with the NAMRIA's mandate to provide map-making services to the DENR and other government agencies and to act as the central mapping agency to support the conservation, management, development, and proper utilization of the country's environment and natural resources, the NAMRIA shall issue guidelines for locating the reference line for measuring legal easements and foreshore areas along shorelines.

SECTION 2. Objective. This manual shall provide guidelines on the delineation of the Mean High Water Line (MHWL) as a reference for no-build zones, legal easements, and foreshore areas along applicable coastal regions nationwide.

SECTION 3. Scope and Coverage. This manual covers the nationwide delineation of the MHWL for coastal areas affected by tides, such as shorelines facing oceans or seas. It shall not be applied under the following conditions:

a. Water areas such as lakes, rivers, streams, esteros, creeks, and other similar bodies of water;

b. Areas where the shoreline intersects a cliff such that the intersection is the natural boundary of the MHWL;

c. Coastal areas as defined under the Expanded National Integrated Protected Area System (ENIPAS); and

d. Where shorelines are altered due to natural processes or man-made activities.

SECTION 4. Definition of Terms. The words, phrases, or terms used herein, unless the context otherwise indicates, shall have the following meanings:

4.1. Backwash Wave - a wave that forms when a mass of water (from swash) goes back to the ocean and encounters a regular wave (in a wet beach) in an opposite direction.

4.2. Cliff – a land mass that is vertically or nearly vertically sloped at the coast.

4.3. Comparison of Simultaneous Observations – a method of reducing tidal datums of subordinate tide stations into its equivalent National Tidal Datum Epoch (NTDE) values.

4.4. Control Tide Station a primary/standard tide station used as a reference station for the comparison of simultaneous observations.

4.5. Delineation the act of describing the limits or boundaries by drawing lines or outlines.

4.6. Elevation the vertical distance of a particular point with respect to a selected datum, e.g., mean sea level.

4.7. Geodetic Control Point (GCP) – a monumented or otherwise marked, survey point established for the purpose of providing geodetic reference for mapping and charting activities and for a wide variety of engineering and scientific applications. A control point is normally identified by a number, an alphanumeric symbol, or a concise, intelligible name which is usually stamped on the disk marker.

4.8. Global Navigation Satellite System (GNSS) a general term describing any satellite constellation that provides positioning, navigation, and timing services on a global or regional basis.

4.9. Harmonic Analysis – a method used to analyze tides and often used in software applications to derive harmonic constants, e.g., Tidal Analysis Software Kit (TASK) and ASEAN tidal analysis software.

4.10. Harmonic Constants – amplitudes and time lags of the harmonic constituents of the tide or tidal current at any place.

4.11. Legal Easement – an easement by necessity constituted by law which has for its object either for public use or the interest of private persons. For the purpose of recreation, navigation, floatage, fishing, and salvage, the bank of esteros, arroyos, creeks, and rivers throughout their entire lengths, situated in urban areas, agricultural areas, and forested areas shall be subject to the three (3) meters, 20 meters, 40 meters easement for public use, respectively.

4.12. Mean High Water (MHW) – a tidal datum; the average of the high-water heights at a tide station over a 19-year period.

4.13. Mean High Water Point (MHWP) point/s of the intersection between the shore and the MHW datum plane.

4.14. Mean High Water Line (MHWL) – a line derived from the connections of a series of MHWP.

4.15. National Tidal Datum Epoch (NTDE) the specific 19-year period adopted by the NAMRIA for which mean tidal values are obtained for tidal datums.

4.16. Primary/Standard Tide Station – a tide station where continuous observations have been made over a minimum of 19 years.

4.17. Salvage Zone - land measuring 20 meters from the shoreline for easement purposes.

4.18. Secondary Tide Station – a tide station where continuous observations have been made over a minimum period of one (1) year but less than 19 years.

4.19. Subordinate Tide Station – a tide station where continuous observations have been made over a minimum period of 30 days but less than one (1) year.

4.20. Table Hourly Values – tabulation of hourly mean values to produce a daily mean and monthly mean value.

4.21. Tidal Datum a base elevation used as a reference from which to reckon heights or depths.

4.22. Tide – the periodic rise and fall of a body of water due principally to the gravitational interactions between the sun, moon, and earth.

4.23. Tide and Current Tables an annual NAMRIA publication of predicted tides and currents.

4.24. Tide Gauge – a device for measuring the rise and fall of the tide; can either be analog or digital.

4.25. Tide Gauge Benchmark (TGBM) – a permanent, stable object containing a marked point of known elevation with respect to a datum used as a reference level for tidal observations.

4.26. Tide Staff – a tide gauge consisting of a vertical graduated pole from which the height of the tide at any time can be read directly.

SECTION 5. Establishment of Mean High Water (MHW) Datum. The following section shall describe the actual procedures in the establishment of the MHW datum.

5.1. Tidal Datum from Primary and Secondary Tide Stations

The MHW tidal datum can be obtained from primary and/or secondary tide stations that are established and maintained by the NAMRIA. The MHW tidal

datum obtained from the agency's primary and secondary tide stations shall be used as a reference for the survey area/s without any reduction of the mean tidal value.

5.2. Tidal Datum from Subordinate Tide Station

In coastal areas, the tidal datum serves as the reference local datum and is used to determine the height of the water as it relates to land. In cases where a local datum is not known, the NAMRIA shall establish a subordinate tide station and conduct tidal observations in accordance with the NAMRIA Quality Management and Operations Manual on Physical Oceanography (NQMOM-PO).

5.2.1. Tidal Observations

In general, tidal observation shall be conducted continuously for at least 30 days using a tide gauge recording/reading of 10-minute intervals and a tide staff for visual tide comparison. The observer shall conduct visual tide staff readings at least twice daily, morning and afternoon for the duration of the tidal observation and record these readings using the Check Sheet[1]. In conjunction with the tidal observation, at least five (5) TGBM shall be established to refer the tidal elevation to the ground. The Criteria for the establishment of TGBM shall be referred to the NAMRIA QMOM-PO.

5.2.2. Tidal data processing and analysis

In tidal data processing, it is important to check for errors. Ten (10)-minute recordings should be reduced to hourly values. To adjust hourly data for discrepancies between visual tide staff readings and recorded tidal data, use the Comparative Readings worksheet. Apply the difference to reduce the zero-tide staff (0TS).

Tidal analysis can be performed using harmonic analysis. Harmonic constants can be derived using various software applications, including Tidal Analysis Software Kit (TASK) and ASEAN tidal analysis software.

5.2.3 Comparison of Simultaneous Tidal Observations

To compute the local tidal datum, use the High and Low Waters worksheet. The computed local tidal datum obtained from tidal observations shall be reduced using the Comparison of Simultaneous Tidal Observation technique, which is provided in the Comparison of Simultaneous Observations worksheet.

This technique uses a primary tide station as a control station to reduce subordinate station tidal data to its equivalent National Tidal Datum Epoch

[1] All forms used in this Manual shall conform with the current templates uploaded in the NAMRIA Forms Portal.

(NTDE) 19-year mean values. In the conduct of this technique, it is important to select a suitable primary tide station with similar tidal characteristics to that of the subordinate station.

5.3. Tidal Data Validation

The surveyor shall submit the results of their tidal observation to the Physical Oceanography Division, Hydrography Branch for validation and certification.

SECTION 6. Delineation of MHW Line Using of Tidal Prediction. To determine the MHW points or lines at the coastline of a particular area, tidal prediction is the most common and practical method used. This method is suitable for project sites that are located within 10 kilometers from a tide station. If the project site is situated farther than this distance, tidal observation must be conducted in accordance with Section 5 of this manual.

The MHW points/line is the intersection between the planes of the coast and the MHW. The NAMRIA Tide and Current Tables only provides the times of high and low waters at a specific tide station; however, the MHW time can be interpolated from tidal predictions.

Determination of the MHW points on the shore shall be done only during calm sea conditions or with no prevailing local weather disturbance. Furthermore, the observation shall be done during the times of the MHW.

6.1. The following are the steps to actually determine the MHWL.

6.1.1. Generate tidal predictions of the tide station at 10-minute intervals of the intended survey period.

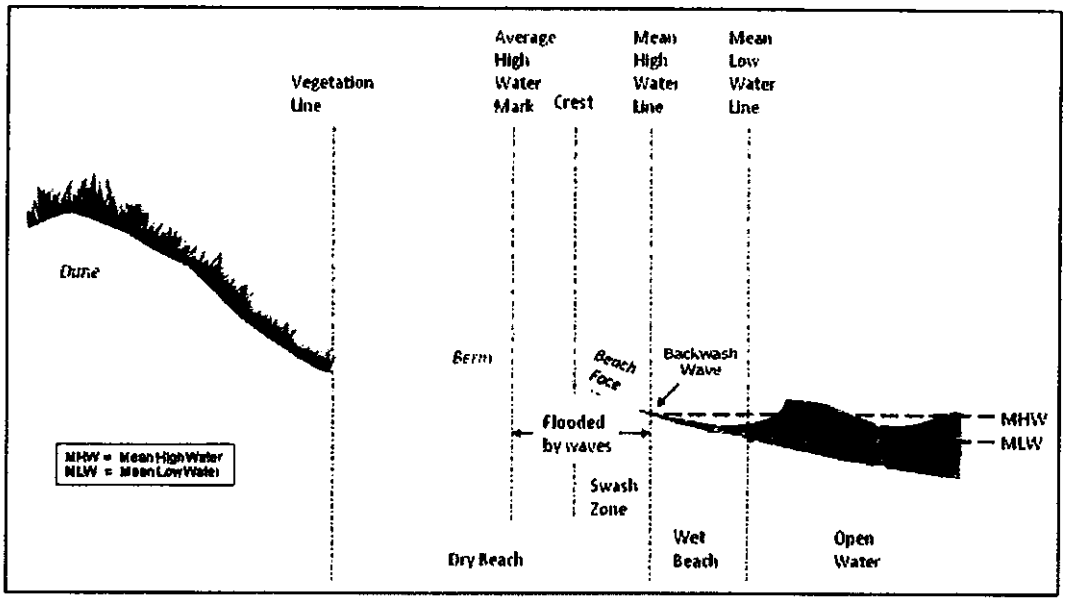
6.1.2. From the 10-minute interval tidal predictions, determine the dates and times of the MHW. In determining the time frame for actual identification, a +/- 5cm value of the MHW within the prediction table is still acceptable.

6.1.3. On the ground, identify specific points along the relevant coastline during the MHW. The number of points to be marked should be determined based on the configuration of the coastline. For a curved coastline, the number of points shall be identified so as not to cut off a great portion of the coast.

6.1.4. The MHW point shall be identified by averaging at least three consecutive backwash waves observed during MHW, and marking or staking the identified MHW points. (Please see Figure 1 on the next page).

6.1.5. Use appropriate survey methods (e.g., GNSS, Total Station) to derive the geodetic position of MHW points, connecting them consecutively to derive the MHWL.

Figure I. Legal and Geological Zonation along the Beach (Backwash Wave)[2]



SECTION 7. Responsibilities.

The NAMRIA branches shall have the following responsibilities:

7.1. Hydrography Branch (HB)

7.1.1. Provides tidal predictions of the reference tide station

7.1.2. Conducts tidal observations to establish new local tidal datums

7.1.3. Processes and analyze tidal data

7.1.4. Conducts the actual field survey for the delineation of the MHWL

7.1.5. Conducts GNSS-RTK survey on the identified MHW points

7.2. Mapping and Geodesy Branch

7.2.1. Provides horizontal control points (i.e., GCPs)

7.2.2. Establishes new control points for the survey

[2] *Source: Titus, James G., Rolling Easements, Climate Ready Estuaries Program, U.S. Environmental Protection Agency, June 2010*

7.2.3. Conducts the actual field survey for the delineation of the MHWL

7.2.4. Conducts GNSS-RTK survey on the identified MHW points

7.3. Other branches may conduct the actual delineation of the MHW line with the supervision of the HB.

SECTION 8. Separability Clause. If any provision of this Order shall be held invalid or inconsistent with existing laws and regulations, the other portions or provisions hereof which are not affected shall continue in full force and effect.

SECTION 9. Repealing Clause. All Orders and other similar issuance inconsistent herewith are hereby revoked, amended, or modified accordingly.

SECTION 10. Effectivity. This Order shall take effect upon signing.

Usec. PETER N. TANGCO, PhD, *CESO I*
Administrator

APPENDIX 1. NAMRIA-PO-Form06 Rev01

CHECK SHEET

NAMRIA PO Form06

Station Name												
Operated by									Year			
Date	Hr.	Min	AM/PM	Tide Staff	Analogue		Digital		Sensor 1		Remarks	Signature
				Height	Time	Height	Time	Height	Time	Height		

APPENDIX 2. NAMRIA-PO-Form08 Rev01

COMPARATIVE READINGS

NAMRIA - Form08 -

Station				Latitude	
Chief of Party				Longitude	
Obs. Begin		Obs. End		Time Meridian	
Tide Gage No.		Scale		Preliminary scale setting of datum line	meter

Date Year Month Day	Time of Staff Reading h m	Staff A meter	Scale B meter	Difference A - B meter	Phase of Tide H/L/F	Remarks
						Scale setting for
						to
						Sum of differences
						Mean differences
						Preliminary setting
						Setting for reduction to tide staff
						Constant for fixed datum
						Setting or reduction to fixed datum

Tabulated by:				
	Name	Signature	Designation	Date
Checked by:				
	Name	Signature	Designation	Date

NAMRIA -

APPENDIX 3. NAMRIA-PO-Form10 Rev01

HIGH AND LOW WATERS

NAMRIA [illegible] Rev.01

Station				**Latitude**	
Observations Begin		**End**		**Longitude**	
Time Meridian				**Distance below Bench Mark**	
Height Datum					

Date Year month day	Moon's Transit (Greenwich mean civil)	Time of		Lunidial Interval		Height of		Remarks
		High Water	Low Water	High Water	Low Water	High Water	Low Water	
	h.dec	h.dec	h.dec	h.dec	h.dec	meter	meter	
1								
2								
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16								

APPENDIX 3. NAMRIA-PO-Form10 Rev01

HIGH AND LOW WATERS

NAMRIA - Form10

17	.	.	.	.	.	.	.	
	.	.	.	.	.	.	.	
Sum Carried Forward								

Station				Latitude	
Date of Highest Tide		Height		Longitude	
Date of Lowest Tide		Height			
(k1+Q1)±M2 OR 2(DHO+DLO)/Hn		F(Hn)		FI	

Date Year month day	Moon's Transits (Greenwich mean civil)	Time of High Water	Time of Low Water	Height of High Water	Height of Low Water	Height of High Water	Height of Low Water	Remarks
		h.dm	h.dm	h.dm	h.dm	meter	meter	
Sought Forward								
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	.	.	.	.	.	.	.	HHW / LLW
Sums	.	.	.	.	.	.	.	Sums

HIGH AND LOW WATERS

NAMIBIA PO

										Means
Correction to Intervals →								Mn	DHQ	DLQ
Local Intervals →							Mn	Observed		
Greenwich Intervals →							HTL	Factor		
								Corrected		

Tabulated by:		
	Name	Signature
Reduced by:		
	Name	Signature

Checked by:		
	Name	Signature
Checked by:		
	Name	Signature

APPENDIX 4. NAMRIA-PO-Form 11 Rev01

COMPARISON OF SIMULTANEOUS OBSERVATIONS

NAMRIA

Page of

(A) Subordinate Station		(B) Standard Station	
Latitude		Latitude	
Longitude		Longitude	
Time Meridian		Time Meridian	

Date Year		TIME						HEIGHT					
		Subordinate Station (A)		Standard (B)		Difference (A) – (B)		Subordinate Station (A)		Standard (B)		Difference (A) – (B)	
mo.	d	hour	hour	hour	hour	hour	hour	meter	meter	meter	meter	meter	meter
								HHW	HLW	HHW	HLW	HHW	HLW
Sums													
Means													
								LHW	LLW	LHW	LLW	LHW	LLW
Sums													
Means													

		LW	HW
[1]	Mean difference in time of high and low water		
[2]	Correction for difference in longitude		
[3]	[1] + [2]; Mean difference in high and low water intervals		

[4]	Mean HHW height at (A)		[16]	Mean LHW difference	
[5]	Mean HLW at (A)		[17]	Mean LLW difference	
[6]	Mean LHW height at (A)		[18]	[14] – [16]; 2DHQ difference.	
[7]	Mean LLW at (A)		[19]	[15] – [17]; 2DLQ difference.	
[8]	[4] – [6]; 2DHQ at (A)		[20]	½ * {[14] + [16]}; Mean HW diff	
[9]	[5] – [7]; 2DLQ at (A)		[21]	½ * {[15] + [17]}; Mean LW diff	
[10]	½ * {[4] + [6]}; Mean HW heights at (A)		[22]	[20] – [21]; Mean difference	
[11]	½ * {[5] + [7]; Mean LW height at (A)		[23]	½ * {[20] + [21]}; MTL difference	
[12]	[10] – [11]; Mean at (A)		[24]	[12] / {[12] – [22]} = Mean ratio	
[13]	½ * {[10] + [11]}; MTL at (A)		[25]	[8] / {[8] – [18]}; DHQ ratio	
[14]	Mean HHW difference		[26]	[9] / {[9] – [19]; DLQ ratio	
[15]	Mean HLW difference				

Results from comparison of Stations A and B	HWI hour	LWI hour	MTL meter	HN meter	DHQ meter	DLQ meter
Accepted values for standard station, from						

COMPARISON OF SIMULTANEOUS OBSERVATIONS

NAMRIA FO Form11 . . .

Differences and ratios: (3), (23), (24), (25), (26)						
Corrected values for subordinate station						
Mean LW on staff at subordinate station = MTL - 1/2MN =						
Mean LLW on staff at subordinate station = MTL -1/2MN- DLQ =						
Mean HW on staff at subordinate station = MTL + 1/2MN =						
Mean HHW on staff at subordinate station = MTL +1/2MN+ DHQ =						

Computed by:				
	Name	**Signature**	**Designation**	**Date**
Checked by:				
	Name	**Signature**	**Designation**	**Date**