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Design of Shipping Lanes at Tanjung Ringgit Port Palopo City

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Abstract

One of the things that should not be left out in the port development process is the availability of shipping lanes. Shipping lanes are used to direct ships that will enter/leave the port. This study aims to design the exact and efficient location of the shipping lane and determine the characteristics of the shipping lane in accordance with the needs of ships at Tanjung Ringgit Port, Palopo City. The data used in the design are noise data, tidal data, grab sampler, sound velocity profiler data and the master plan for Tanjung Ringgit Port, Palopo City. Sounding data, tidal data and sound velocity profiler data are then processed using HYPACK software and then generate X, Y, and Z data. This data will later be visualized in thematic maps using QGyss software. The results of this study indicate that the entrance/exit port of Tanjung Ringgit Port, Palopo City, is 6,074 meters long, and 300 meters wide so a two-way route system is designed, and the depth starts from 9 meters - 23 meters. Based on the design of the channel, the size of the ship with a DWT of 8000 tons, a maximum draft of 8.1 meters with an LOA of 100 meters that can enter/leave the shipping lane. There is a water area for the activities of the main facilities for port services, namely, the Swivel Pool, the ship-to-ship Area, and the Freight Ship Harbor Area. And there are water areas for port service support facilities, namely, Dead Ship Area, Sea Trial Area, Emergency Area, and Reserve Area. As for the dangers of navigation in the Environmental Interest Area (DLKP), there are seaweed ponds for local residents, therefore the addition of Sailing Navigation Assistance Facilities in the form of 3 units of Red Flare Buoys and 1 unit of Upright Red and White Buoys (MPMT) as reference points for ships to enter the channel. enter/exit ship.

Keywords: Area; Shipping line

1. Introduction

A Port (harbour) is an area of water that is protected from waves and is used as a berth for ships and other water vehicles which functions to raise or lower passengers, goods and animals, repair, refuel and so on, which is equipped with a pier where ships moor. cranes for unloading goods, transit warehouses, as well as places for storing goods for a longer time, while waiting for delivery to the destination area or the next shipment. In addition, the port is a gateway as well as facilitating relations between regions, islands and even continents as well as between nations that can advance the region behind it or also known as a regional influence. This rear area is an area that has a relationship of economic, social and defence interests known as the Naval Military base. [28].

One of the things that should not be left behind in the port development process is the availability of cruise ship lanes. Shipping Channels are used to direct ships going in/out of the harbour pool. Shipping Channels must have sufficient depth and width or according to the ship's draft so that ships that will use the port can pass through.

Shipping conditions at the Port of Tanjung Ringgit, Palopo City, experienced problems where ships wanting to lean on the pier were often constrained by shallow sea depths and inadequate facilities and infrastructure in determining port entrances. Lack of awareness and understanding of port service users and the surrounding community is also an obstacle that occurs when ships want to dock. Where many fishing vessels are at the harbour entrance, making it difficult for ships wishing to dock to enter the port area and limitations in manoeuvring. These factors can cause accidents on ships.

As for the placement of the anchoring area, it is also very important where the location of the anchoring area avoids the coral reef area as much as possible to ensure the safety of underwater biota and seabed sediments in the form of muddy clay or mud which is one of the important factors when lego anchoring and facilitates anchoring. when you want to do the dredging. In this study, a survey was conducted to determine the right shipping channel area for ships using port services to avoid the risk of accidents.

1.1. *Tanjung Ringgit Port, Palopo City*

Tanjung Ringgit Port, Palopo City, was built by the Dutch East Indies government in 1920, initially only as a transportation route in the form of a small dock used by fishermen around the island. This pier can only be visited by small ships that support trade routes and passenger mobility with other ports, such as Soekarno-Hatta Port in Makassar and Nunukan Port in Kalimantan. This port is surrounded by islands and you can see the expanse of the Bone Bay coast surrounded by mountains and residential areas. The Port of Tanjung Ringgit is considered an important port in the Kingdom of Luwu because it used to anchor several ships (large boats or sailing ships), and Palopo as a very important port city in the archipelago can be seen from the various merchandise found in the area such as rice, coffee, chocolate, and so on. This provides an overview of Palopo's position on the international route, and a description of the commodities that existed in Palopo at that time, even in the early days of the existence of Tanjung Ringgit Port supporting inter-regional trade activities from 1920 to 1954. The government designated Tanjung Ringgit port as a special port, meaning a port, especially for ferry crossings. Tanjung Ringgit Port is expected to be the entry and exit point for goods in Tana Luwu and its surroundings in support of the sea highway program which has the potential to support the rapid economic growth in Tana Luwu. [23].

1.2. *Shipping Flow*

According to PM 129 of 2016 shipping lanes are waters which in terms of depth, and width and free from other shipping barriers are considered safe and safe to be navigable by sea transport ships. Shipping lanes are defined as waters that are in terms of depth, width, and free from other shipping barriers that are considered safe for ships to navigate in the sea, river or lake. The shipping lanes are included in the sea map and shipping manual and announced by the competent authority. Shipping lanes are used to direct ships into the harbour pool, therefore they must pass through calm waters against waves and currents that are not too strong. The port authorities are required to carry out maintenance and must ensure: sailing safety, environmental sustainability, water spatial planning and irrigation systems for river and lake work. Shipping lanes at sea consist of general shipping lanes and crossings and shipping lanes entering ports.

1.2.1. Depth of shipping lane

Recommends that the minimum depth of design should follow the draft plus 5 to 8 feet [2]. The depth of the shipping channel is required not to be less than the full load draft and it is necessary to take into account the shaking of the ship due to channel conditions such as wind, waves, tides and ship movement. Determination in the flow is as follows: [11].

$$d = 1{,}10 \times D \quad (1)$$

Each port has different shipping lane standards. The depth value must not be less than the size of the draft of the ship passing through the shipping lane so that each port has its classification of ships that will pass through the port shipping lane.

To obtain safe shipping lane conditions, the water depth in the shipping lane must be large enough to allow sailing at the lowest low water level (LLWL) with the largest maximum ship load limit passing through it.

The depth of shipping lanes in general can be determined using the following formula: [25].

$$H = d + G + R + P \quad (2)$$

With groove depth (H), ship draft (d), vertical motion of the ship due to waves and squats (G), clear free space for grooves of 10%-15% of ship draft (R) and measurement accuracy (P).

Graphically the calculation of the depth of the shipping lane is depicted in the image below, Figure 1.

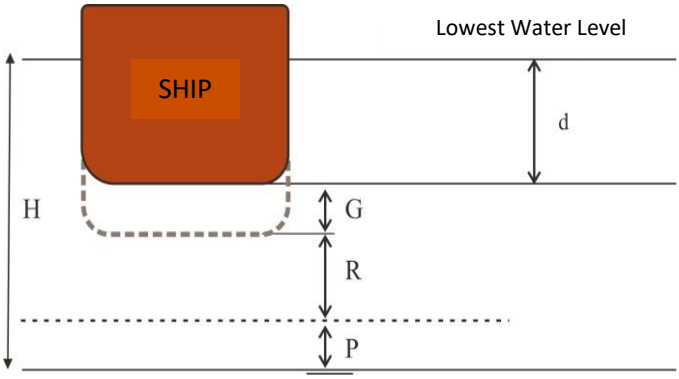

Figure 1. Schematic of determining the depth of the shipping channel.

2) Shipping lane width

According to [16], one-way routes are at least 5 times the width of the ship (B). Meanwhile, in two-way routes, at least 8 times the width of the ship (B) or 10 times the width of the ship plus current or wind deviations. The calculation of the width of the grooves [11] can be seen in Table 1.

Table 1. Groove width calculation.

No	Groove Length	Navigation Conditions	Groove Width
1	A relatively long path, straight groove	Ship with high frequency	7B + 30m
		Low-frequency ship	4B + 30m
2	The groove turns/bends	Ship with high frequency	9B + 30m
		Low-frequency ship	6B + 30m

In determining the size (measurement) of this channel, the planner must pay attention to the size of the ship to be served and the type of traffic lane, namely one-way or two-lane. If the width of the ship is B, then the width of the traffic lane (120%-150%)B and the security lane is 150%B [12]. Schematics of one-way and two-way shipping lanes as shown in Figure 2 and Figure 3.

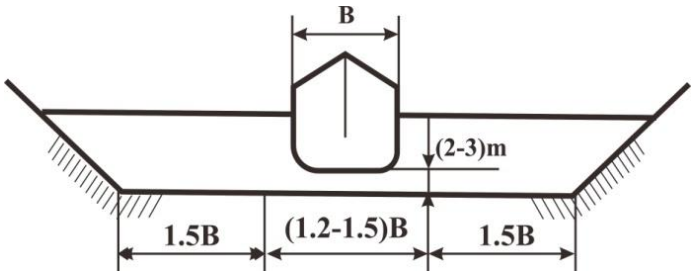

Figure 2. One-way shipping flow.

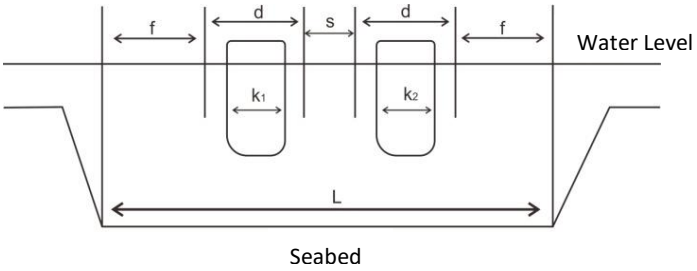

Figure 3. Two-way shipping.

Information:
b = The planned width of the ship through the shipping lane
d =Width for horizontal movement of ships caused by shipping lanes that are not in the direction of the water current, 1.2 – 1.5 ship width
s =Safety factor between two ships, equal to 1 times the width of the ship
f =The safety factor between the sides of the groove, equal to 1.5 ship width
l =The width of the shipping lane = 2d + 2f + s

2.1. *Hydrographic Survey*

The definition of hydrography according to the IHO is "That branch of applied sciences which deals with the measurement and description of the features of the seas and coastal areas for the primary purpose of navigation and all other marine purpose and activities, including – inter alia – offshore activities, research, protection of the environment, and prediction services [10]. From the above definition, a hydrographic survey is a survey conducted to map the bottom topography of the waters for further use in ship navigation, offshore construction, and protection of the environment.

Hydrographic surveys are measurement and observation activities carried out in water areas and around the coast to describe part or all of the earth's surface, especially those that are inundated by water, on a flat plane, with maps presented in the form of information on depth points, contour lines. the depth and high points and various variations above and below sea level.[16].

2. Methods

This research uses three methods, namely observation/survey, and document study. The object of this research is Tanjung Ringgit Port, Palopo City. The type of data that the author uses in this study are Primary Data and Secondary Data. Primary data includes Sound Velocity Proviller (SVP) Data, Grab Sampler Data, Bathymetry Survey, Coastline and Pier Side, and Tidal. Meanwhile, secondary data includes Port Data, Indonesian Sea Map, Zoning Plan Data for Coastal Areas and Small Islands, Port Master Plan Data, Ship Data, and Interviews with surrounding communities and port service users.

To complete this research, the authors perform data processing with the following steps: a). Grab sampler data, this data is used to ensure the safety of ships and the maritime environment where the placement of the anchoring area avoids protected areas such as coral reefs, and obtains the right area for

the anchoring area, such as sand or sandy mud. A grab sampler is lowered at sea at a certain point as an example of a material that represents certain areas. b). Ship data and ship specification data are used to analyze the width, length, and draft of ships that will pass. The main analysis is to determine the area that can be passed by ships that have been determined in the Tanjung Ringgit Port development plan, Palopo City. c). Ship traffic data, where this data will determine the number of trajectories in the channel that will be used, such as one-way or two-way and the size of the anchorage area required by the port. d). Ship type data. This data is used to determine the type of anchorage area. e). Bathymetry data, Bathymetry data is used to identify shallow hazards at sea that can threaten the safety of ships, and then from this data, the position of the Sailing Navigation Assistance Facility (SBNP) is designed. Then the data is analyzed for bathymetric conditions or the appropriate depth to be determined as grooves and anchorage areas as needed. The results of the analysis are then described and poured on a thematic map. f). Thematic maps (also known as statistical maps or special purpose maps) show shoreline, pier side and bathymetry conditions.

3. Resutls and Discussion

a. Tanjung Ringgit Port Master Plan, Palopo City

Referring to [23], the Tanjung Ringgit Port of Palopo City serves loading and unloading activities, especially agricultural goods, plantations besides that also serves passenger embarkation and debarkation activities to several well-known islands. in Kalimantan, be it in Balikpapan, Samarinda, Bentang, etc. This place has long been one of the economic sources of Palopo City in the marine and fisheries sector, it is also a tourist attraction that is quite popular with local and foreign tourists and continues to develop along with the development of the economic condition of this port area.

The Tanjung Ringgit Port of Palopo City is expected to be the entry and exit point for goods in Tana Luwu and its surroundings in support of the sea toll program which has the potential to support the rapid economic growth in Tana Luwu. Based on [18], the water area is 174.8 Ha or 1,748,000 m2.

The need for water areas for the activities of basic port service facilities consists of:

a) Swivel pool and berth area 1.3 Ha;
b) Transhipment area 2,2 Ha;
c) Intra-port shipping lane 4 Ha;
d) Freight ship docking area 8,1 Ha.

The need for water areas for port service support facilities consists of:

a) The dead ship area is 2,2 Ha;
b) The experimental sailing area is 9,9 Ha;
c) The emergency area is as wide as 9,9 Ha;
d) Reserve area of 147,2 Ha or 1.472.000 m2.

From the data that has been obtained and analyzed based on the results of the survey at the location, the position and area made on the map can be known. The map of the Port Working Environment Area (DLKR) and the Port Interest Environmental Area (DLKP) can be seen in Figure 4.

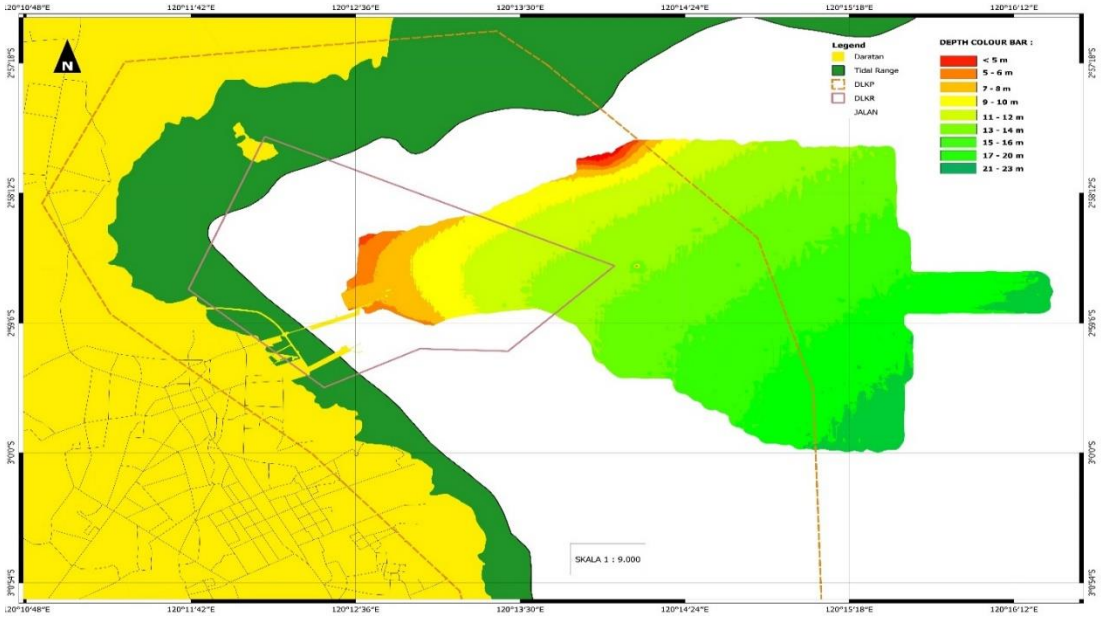

Figure 4. Map of DLKR and DLKP Tanjung Ringgit port, Palopo City.

b. Tidal

This tidal measurement is to get the tidal correction value for the resulting bathymetric data. The reference map uses a vertical datum in accordance with the Marine Map, namely the Chart Datum. The tides are carried out for 30 days which will be held on 09 March 2022 – 07 April 2022 with an interval of 1 hour. Tidal data was obtained from the Geospatial Information Agency.

c. Grab Sampler

The results of the seabed sampling survey carried out at 7 locations which are the groove plans and ship anchoring areas, where getting the results of seabed samples in the form of muddy clay and mud can be seen in Figure 5. The sampling points can be seen in Figure 6. The following coordinates taking the grab sampler can be seen in Table 1.

Table 2. Coordinates of grab sampler

Point	Coordinates		Description
	Longitude	Latitude	
1	120° 13' 59.99" E	2° 58' 39.27" S	Muddy clay
2	120° 13' 59.99" E	2° 58' 52.43" S	Muddy clay
3	120° 14' 05.05" E	2° 59' 09.89" S	Muddy clay
4	120° 14' 27.07" E	2° 58' 22.56" S	Mud
5	120° 14' 39.22" E	2° 58' 47.62" S	Mud
6	120° 14' 37.45" E	2° 59' 07.87" S	Mud
7	120° 13' 37.71" E	2° 58' 36.23" S	Muddy clay

Figure 5. Sample samples in flow planning and anchoring area.

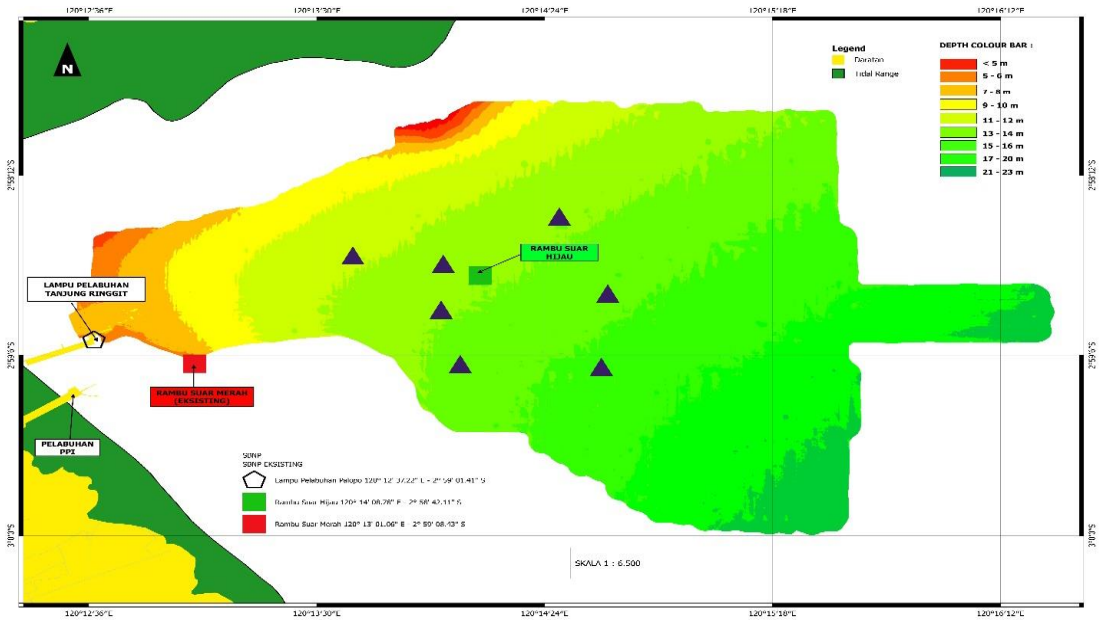

Figure 6. Sampling location points.

d. Voiceover

The data from the bathymetry survey are presented in the form of a careful painting sheet/bathymetric map in the form of a CD depth value display (Chart Datum) and depth contours. Important objects such as Shipping Navigation Aids and shipping hazards are shown in meticulously painted sheets. The depth contour is displayed at each depth change. Data processing begins by entering the patch test correction values, tides and sound velocity on the Raw Data (raw data) Multibeam Echosounder. The raw data is then verified to eliminate incorrect depth data such as spikes, noise, and so on. The next step is to export the depth data in XYZ format for further processing to become a bathymetric map. The depth survey data processing (Multibeam Echosounder) was carried out using the Hypack and Geoswath Plus (GS+) software version 4.0. The results obtained from the Bathymetry map in the area around Tanjung Ringgit Port, Palopo City, ranged from 1 to 23 meters. Meanwhile, based on the bathymetric data for the area along the port side, it can be seen that the depth ranges from 5 meters to 8 meters. The depiction of the depth contour can be seen in Figure 7 and Figure 8.

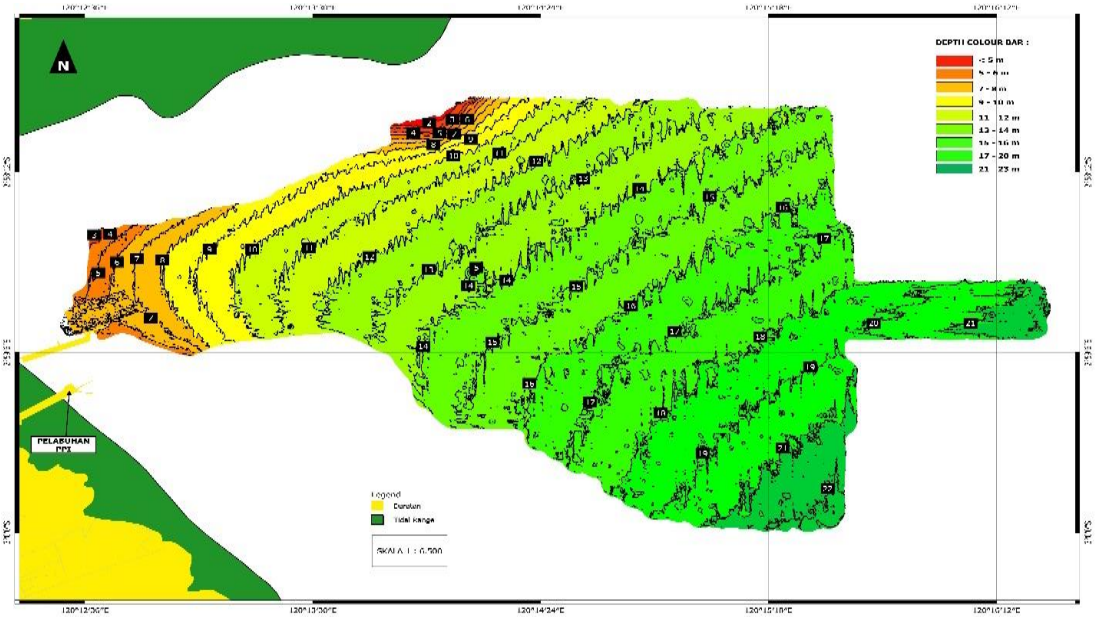

Figure 7. Bathymetric contour map.

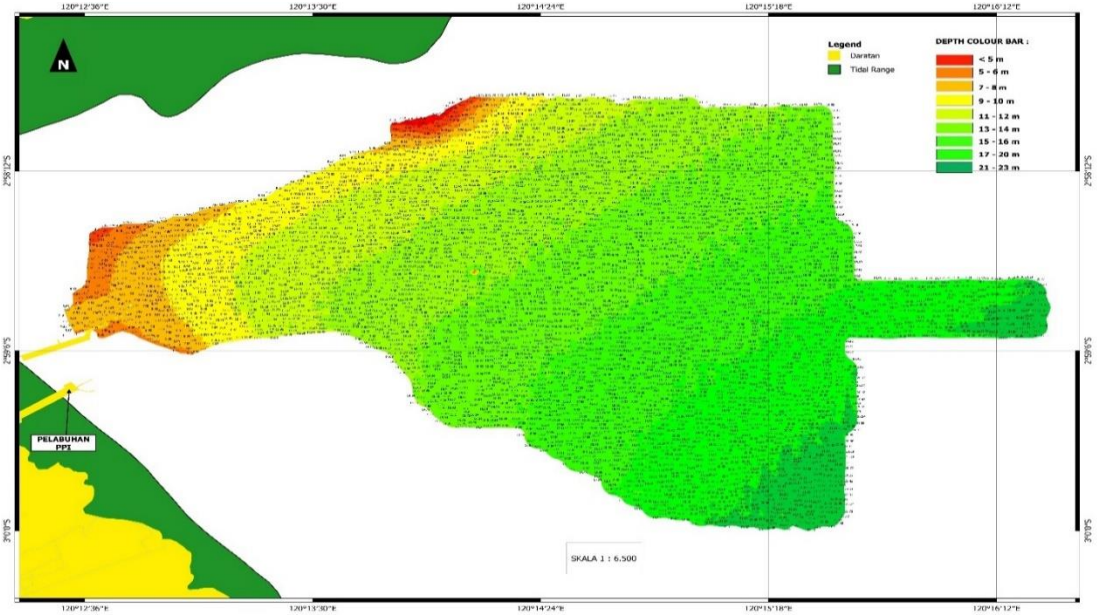

Figure 8. Bathymetry map.

e. Aids to Navigation Guide

Based [19], navigation-assisted facilities are equipment or systems outside the ship which are designed and operated to improve the safety and efficiency of navigating ships and/or ship traffic. Beacon signs are fixed navigational aids that have flares and have a visible distance equal to or more than 10 nautical miles that can assist navigators in determining the position and/or bow of the ship, indicating the direction of the mainland and the presence of a port and can be used as a sign of state boundaries.

As for the survey results, it is known that there are two units of sailing-navigation aids, namely the Red Beacon and the Green Beacon, which can be seen in Table 3 and a map depiction of navigation-assisted facilities can be seen in Figure 9.

Table 3. Coordinates of Existing SBNP

No	Name	Coordinates	
		Longitude	Latitude
1	Red Beacon	120° 13' 01.16" E	2° 59' 07.89" S
2	Green Beacon	120° 14’ 08.35” E	2° 58’ 41.76” S

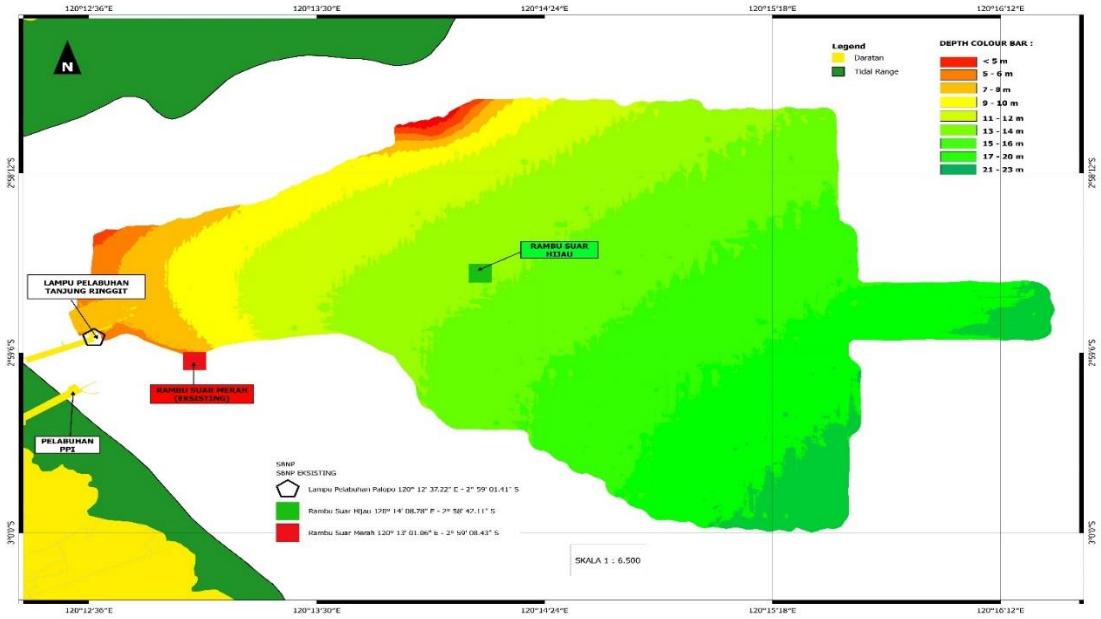

Figure 9. Map of existing SBNP.

In the Environmental Interest Area (DLKP) of Tanjung Ringgit Port, there are seaweed ponds for local residents as a livelihood, so additional navigation-sailing aids are needed so that ships that will carry out activities at the port do not interfere with the livelihood activities of local residents. The seaweed pond area can be seen in Figure 10.

Figure 10. Seaweed pond area.

Beacon buoys are floating navigational aids that have flares and have a visible distance of 4 nautical miles or more that can assist navigators in the presence of navigational hazards/obstacles, including coral, shallow water, scorched, ship hulls and/or to indicate safe waters and channel separator, and can be used as a sign of state boundaries. As for the addition of 3 red flare buoys as a marker for the anchorage area and seaweed pond area so that ships that want to dock do not enter the seaweed pond area and 1 red and white buoy goes straight (Foam 0) which serves as a reference point for ships to enter the channel. in and out of the ship. The following coordinates and a description of the placement of navigation-sailing aids can be seen in Table 4 and Figure 11.

Table 4. Coordinates of Addition of SBNP

No	Name	Coordinates	
		Longitude	Latitude
1	MPMT Beacon Buoy	120° 16' 24.89" E	2° 58' 53.13" S
2	Red Flare Buoy 1	120° 14' 06.05" E	2° 59' 56.74" S
3	Red Flare Buoy 2	120° 13' 42.99" E	2° 58' 59.26" S
4	Red Flare Buoy 3	120° 13' 19.04" E	2° 58' 59.29" S

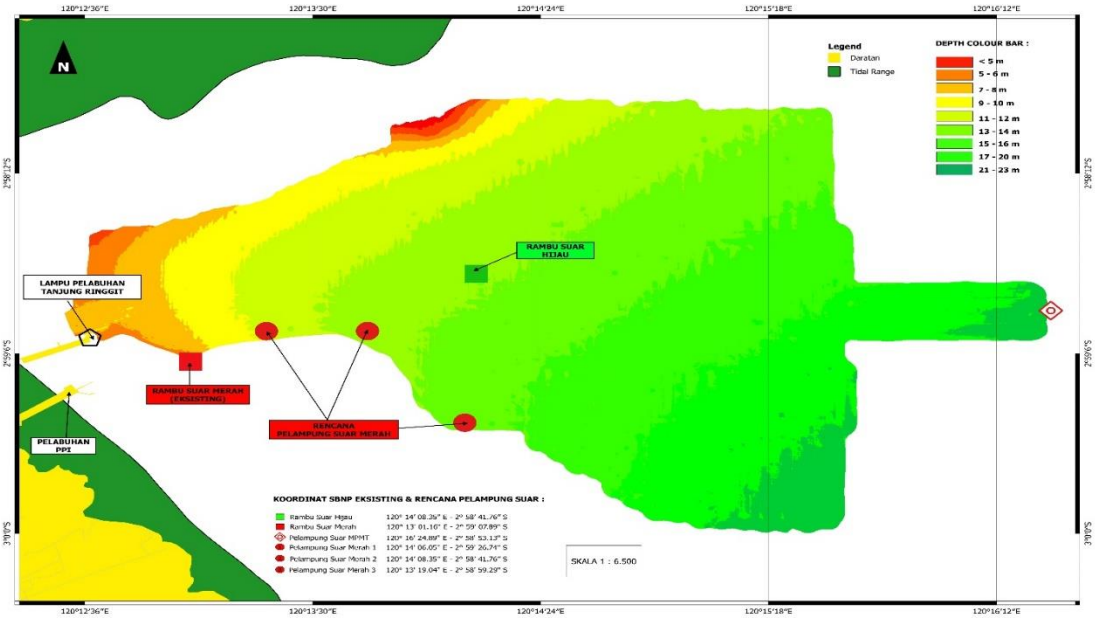

Figure 11. Map of the flow design plan, existing SBNP and plan for the addition of SBNP.

f. Flow and Zoning of Shipyard Area

Regulation [16], shipping lanes are waters which in terms of depth, and width and are free from other shipping barriers are considered safe and safe to be navigable by sea transport ships.

Referring to [18], there are 8 areas of interest in the Tanjung Ringgit Port of Palopo City. In designing the channel and zoning of the ship's anchorage area at the Port of Tanjung Ringgit, Palopo City, several factors are considered, as follows:

a) The anchorage area must be within the Environmental Interest Port Area (DLKP);
b) The anchorage area is as close to the port as possible and does not interfere with shipping lanes so that shipping activities can be effective and efficient;
c) In the context of determining the channel and anchorage area at Tanjung Ringgit Port, Palopo City, it is adjusted to the seaweed ponds of local residents located within the Port Environmental Interest Area (DLKP);

d) The anchorage area is adjusted to the depth of the waters.
e) The channel is designed based on the width and draft of the largest ship both planned and those that have carried out activities at Tanjung Ringgit Port, Palopo City.

1). Ship In and Out Flow

Based on the survey results, it is known that the ships that will dock at the Palopo port come from the north and south. In addition, from the data obtained by the last 3 ships that want to enter the Tanjung Ringgit Port, Palopo City, these ships tend to pass through almost the same route. The size of the largest ship planned and has entered the Port of Tanjung Ringgit Palopo, namely LOA 100 m, B 16 m, draft 8 m. The depiction, it can be seen in Figure 12 and the coordinates can be seen in Table 5.

Table 5. Coordinates of existing ship routes

SHIP A		
POINT	**Coordinates**	
	Longitude	**Latitude**
1	120° 12' 48.39" E	2° 58' 54.90" S
2	120° 13' 16.15" E	2° 58' 51.57" S
3	120° 13' 43.17" E	2° 58' 51.57" S
4	120° 14' 16.11" E	2° 58' 52.68" S
5	120° 14' 33.13" E	2° 58' 50.83" S
6	120° 15' 01.26" E	2° 58' 53.05" S
7	120° 15' 28.65" E	2° 58' 57.87" S
8	120° 15' 54.93" E	2° 59' 04.53" S
SHIP B		
POINT	**Coordinates**	
	Longitude	**Latitude**
1	120° 16' 51.55" E	2° 58' 54.53" S
2	120° 16' 28.61" E	2° 58' 59.35" S
3	120° 16' 03.44" E	2° 58' 58.61" S
4	120° 15' 22.51" E	2° 58' 56.79" S
5	120° 14' 35.35" E	2° 58' 58.24" S
6	120° 13' 59.33" E	2° 58' 57.00" S
7	120° 13' 24.05" E	2° 58' 51.57" S
8	120° 12' 54.19" E	2° 58' 51.33" S
SHIP C		
POINT	**Coordinates**	
	Longitude	**Latitude**
1	120° 16' 34.28" E	2° 58' 51.33" S
2	120° 16' 14.79" E	2° 58' 54.53" S
3	120° 15' 46.61" E	2° 58' 54.18" S
4	120° 14' 32.15" E	2° 58' 55.82" S
5	120° 14' 14.86" E	2° 58' 55.38" S
6	120° 13' 49.42" E	2° 58' 53.78" S
7	120° 13' 19.30" E	2° 58' 50.12" S

SHIP A		
POINT	Coordinates	
	Longitude	Latitude
8	120° 12' 47.64" E	2° 58' 53.34" S

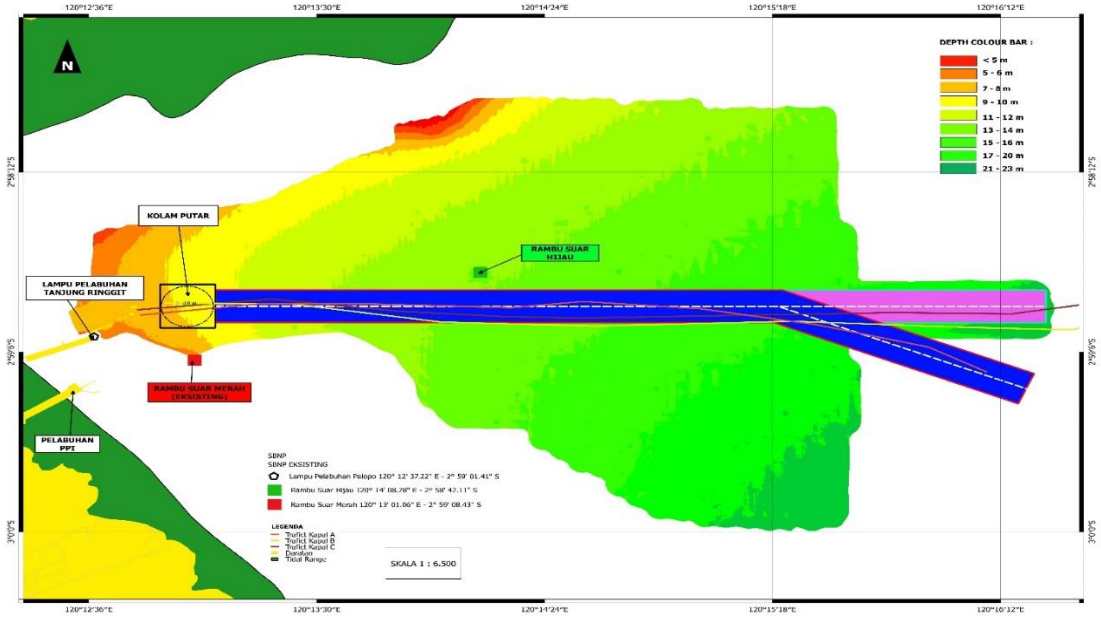

Figure 12. Ship route map and existing SBNP.

Department of Ship Transportation, Routeing of the Directorate General of Sea Transportation, Directorate of Navigation, a good channel is a channel that has straight, long, wide, and has a depth that is in accordance with the required draft of the ship, where the channel is free from other shipping obstacles that are considered safe and safe for shipping navigable by sea freight [4]. Therefore, the most efficient and effective route for ships to enter Tanjung Ringgit Palopo Port can be drawn from the descriptions of the three ships. The design and coordinates of the shipping lanes can be seen in Table 6, Table 7 and Figure 13.

Table 6. AS coordinates flow.

No	Coordinates		Length	Bow	
	Longitude	Latitude	(km)	Enter	Exit
1	120° 13' 06.05" E	2° 58' 52.23" S	6	270°	90°
2	120° 16' 22.77" E	2° 58' 52.32" S			

Table 7. Coordinates of left boundary and right boundary.

No	Left Limit	
	Longitude	Latitude
1.	120° 16' 22.77" E	2° 58' 57.21" S
2.	120° 13' 06.05" E	2° 58' 57.12" S

	Right Limit	
1.	120° 16' 22.77" E	2° 58' 47.44" S
2.	120° 13' 06.05" E	2° 58' 47.35" S

2) Swivel Pool Zone

A roundabout is a certain lane consisting of a dividing point or a circular separation chart and a traffic lane circular within the specified limits. Traffic in a roundabout is restricted by movement in a counterclockwise direction around a dividing point or area boundary. At Tanjung Ringgit Port, Palopo City, the largest ships planned and that have entered the Tanjung Ringgit Palopo Port are LOA 100 m, B 16 m, draft 8 m. The design and coordinates of the rotary pool can be seen in Table 8 and Figure 13.

Table 8. Coordinates of swivel pool zone.

Swivel Pool Zone					
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**	**Diameter (m)**
	Longitude	**Latitude**			
1	120° 12' 52.93" E	2° 58' 45.71" S	1,3	5 – 8	400
2	120° 13' 05.99" E	2° 58' 45.71" S			
3	120° 13' 05.99" E	2° 58' 58.77" S			
4	120° 12' 52.93" E	2° 58' 58.77" S			

3) Ship-to-ship zone

The ship-to-ship area is placed at a deeper depth than the depth of the berth area, where ships that will be loading and unloading cannot dock at the port due to the draft of the ship exceeding the depth at the dock so loading and unloading are carried out in the ship to ship area. The design and coordinates of the rotary pool can be seen in Table 9 and Figure 13.

Table 9. Coordinates the ship-to-ship zone.

Ship to Ship Zone				
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 14' 39.69" E	2° 58' 29.33" S	2,2	13 – 16
2	120° 14' 44.54" E	2° 58' 29.33" S		
3	120° 14' 44.54" E	2° 58' 35.84" S		
4	120° 14' 39.68" E	2° 58' 35.84" S		

4) Freight Ship Docking Zone

The cargo ship docking area is placed in waters with the available depth and area of the Port Environmental Interest Area (DLKP). The design and coordinates of the rotary pool can be seen in Table 10 and Figure 13.

Table 10. Coordinates the freight ship anchoring zone.

Freight Ship Docking Zone				
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 13' 52.61" E	2° 58' 22.97" S	8,1	13 – 16
2	120° 14' 00.75" E	2° 58' 22.95" S		
3	120° 14' 00.78" E	2° 58' 35.91" S		
4	120° 13' 52.64" E	2° 58' 35.93" S		

5) Dead / Damage Ship Zone

A dead ship zone is used for ships that are no longer used. Then it is placed in an area far enough from the channel and anchorage zone so as not to become a hazard to navigational navigation. The design and coordinates of the rotary pool can be seen in Table 11 and Figure 13.

Table 11. Coordinates of damaged / dead ship zone.

Damaged / Dead Ship Zone				
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 13' 48.80" E	2° 57' 58.87" S	2,2	>5 – 6
2	120° 13' 55.28" E	2° 57' 58.79" S		
3	120° 13' 55.31" E	2° 58' 02.05" S		
4	120° 13' 48.84" E	2° 58' 02.13" S		

6) Sailing Trial Zone (Sea Trial)

The sea trial area is placed in an area that does not interfere with the channel and anchorage area because the sea trial requires extensive ship movement. The design and coordinates of the rotary pool can be seen in Table 12 and Figure 13.

Table 12. Coordinates of the sea trial zone.

Sailing Trial Zone (Sea Trial)				
Point	**Coordinates**		**Area (m^2)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 14' 20.56" E	2° 59' 22.38" S	99.000	17 – 20
2	120° 14' 52.96" E	2° 59' 22.44" S		
3	120° 14' 52.95" E	2° 59' 25.70" S		
4	120° 14' 20.56" E	2° 59' 25.63" S		

7) Emergency Zone

The emergency area is placed in the area closest to the port while taking into account the depth of the waters. The design and coordinates of the rotary pool can be seen in Table 13 and Figure 13.

Table 13. Emergency zone coordinates.

Emergency Zone				
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 13' 34.21" E	2° 58' 29.53" S	9,9	13 - 16
2	120° 13' 50.41" E	2° 58' 29.42" S		
3	120° 13' 50.45" E	2° 58' 35.93" S		
4	120° 13' 34.26" E	2° 58' 36.04" S		

8) Reserve Zone

The reserve area is placed in the available area in the Environmental Interest Port Area (DLKP) with consideration of the required area in the Tanjung Ringgit Port Master Plan, Palopo City. The design and coordinates of the rotary pool can be seen in Table 14, Table 15 and Figure 13.

Table 14. Coordinates of A reserve zone.

A Reserve Anchoring Zone				
Point	**Coordinates**		**Area (m^2)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 14' 04.06" E	2° 58' 03.99" S	75	09 - 16
2	120° 14' 20.33" E	2° 58' 03.95" S		
3	120° 14' 20.32" E	2° 58' 19.19" S		
4	120° 14' 36.60" E	2° 58' 19.15" S		
5	120° 14' 36.70" E	2° 58' 35.84" S		
6	120° 14' 04.14" E	2° 58' 35.91" S		

Table 15. Coordinates of B reserve zone.

B Reserve Anchoring Zone				
Point	**Coordinates**		**Area (Ha)**	**Depth (m)**
	Longitude	**Latitude**		
1	120° 14' 04.03" E	2° 59' 02.24" S	75	15 - 20
2	120° 14' 52.85" E	2° 59' 02.31" S		
3	120° 14' 52.83" E	2° 59' 18.59" S		
4	120° 14' 04.00" E	2° 59' 18.51" S		

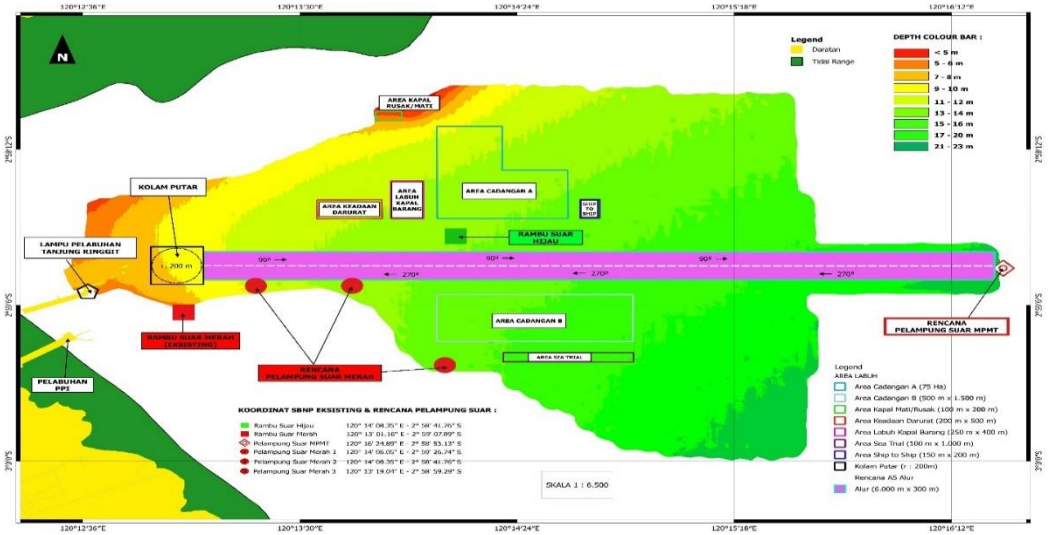

Figure 13. Map of the design plan for shipping routes, anchoring areas and SBNP.

4. Conclusion

From the results of the discussion regarding "DESIGN OF TANJUNG RINGGIT PORT SHIP FLOW, PALOPO CITY" it can be concluded as follows:

a) Based on the results of a survey on the flow of cruise ships at Tanjung Ringgit Port, Palopo City, namely following the existing ship entry and exit routes as an initial reference. Meanwhile, there are waters for basic port service facility activities, namely, Turning Pools, Ship to Ship Areas, and Freight Ship Berthing Areas. And there are water areas for port service support activities, namely the Damaged/Dead Ship Area, the Sea Trial Area, the Emergency Area, and the Reserve Area.

b) The specifications of the Tanjung Ringgit Port shipping lane, Palopo City, namely having a two-way route for entering and leaving ships. Where the two channels have a length of 6,000 m or 6 km, a width of 150 m in one direction and a depth of 9 m – 23 m. Based on these results, the size of a ship with a DWT of 8000 tons, a maximum draft of 8.1 meters with an LOA of 100 meters can enter the shipping channel.

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