Installation of the Aids to Navigation in Stretch 1

Project Document for Force Account

Prepared By
Component 3 and Safeguard Unit
June, 2018
This document is prepared for the installation of modernized Aids to Navigation within the Stretch-1 (Mandalay-Nyaung U) to be carried out by the Directorate of Water Resource and Improvement of River Systems, Ministry of Transport and Communications of the Republic of the Union of Myanmar as one of activities under the Component-3 of Ayeyarwady Integrated River Basin Management Project.
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### Acronyms

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<th>Definition</th>
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<tr>
<td>AIRBM</td>
<td>Ayeyarwady Integrated River Basin Management Project</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
</tr>
<tr>
<td>AToN</td>
<td>Aids To Navigation</td>
</tr>
<tr>
<td>BoQ</td>
<td>Bills of Quantity</td>
</tr>
<tr>
<td>C3</td>
<td>Component 3</td>
</tr>
<tr>
<td>DG</td>
<td>Director General</td>
</tr>
<tr>
<td>DGPS</td>
<td>Dynamic Global Positioning System</td>
</tr>
<tr>
<td>DMH</td>
<td>Department of Meteorology and Hydrology</td>
</tr>
<tr>
<td>DWIR</td>
<td>Directorate of Water Resources and Improvement of River Systems</td>
</tr>
<tr>
<td>DWT</td>
<td>Deadweight ton</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>IALA</td>
<td>International Association of Lighthouse Authorities</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Conventions</td>
</tr>
<tr>
<td>IDA</td>
<td>International Development Association</td>
</tr>
<tr>
<td>IWT</td>
<td>Inland Waterway Transport</td>
</tr>
<tr>
<td>LAD</td>
<td>Least Available Depth (to determine the allowable vessel draft)</td>
</tr>
<tr>
<td>LAW</td>
<td>Least Available Width (to determine the maximum vessel beam)</td>
</tr>
<tr>
<td>LAR</td>
<td>Least Available Radius in bends (to determine maximum vessel length)</td>
</tr>
<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>NWRC</td>
<td>National Water Resources Committee</td>
</tr>
<tr>
<td>PMU</td>
<td>Project Management Unit</td>
</tr>
<tr>
<td>PSC</td>
<td>Project Steering Committee</td>
</tr>
<tr>
<td>RAP</td>
<td>Resettlement Assessment Plan</td>
</tr>
<tr>
<td>RVO</td>
<td>Enterprise Agency Netherlands</td>
</tr>
<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
</tr>
<tr>
<td>SWL</td>
<td>Safe Working Load</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities, Threats</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
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Executive Summary

To meet the anticipated growth in demand, Myanmar needs to ensure that its key transport infrastructure is adequate. In the age of global competition throughout supply chains, sustainable and green transport logistics have become a primary concern, the inland water transport (IWT) is recognized as the most low-cost, environmentally friendly way of transporting goods. Since Myanmar is endowed with inland rivers, the Ayeyarwady, the most critical, has played a vital role in the economic development of remote rural areas and in the welfare of the inhabitants. Regards to the Inland Waterborne Transportation, Myanmar has more than 6700 km of inland waterways not only extending to populated areas and industrial zones, but also to rural and remote area of difficulties for transportation. However, the sector has been lag behind for decades due to the political and economical constraints.

In view of the importance of inland waterways transportation to the economy and development of the nation, therefore, in 2015, with the credit from the World Bank, DWIR established the AIRBMP aiming to improve the river navigation facilities as a part of the river management. Component 3 of the AIRBM Project is acting as the operation team for making short term, medium and long term improvements of the navigability of the Ayeyarwady river, and to strenghten the capacity of the DWIR to plan and execute these tasks. AIRBM Project Component 3 aims at achieving safe, economical inland water transport along the Ayeyarwady River that will provide increased opportunities for trade, market access and mobility.

Currently there are only shore markers and water marks at shallow and danger area and only daytime navigation along the river. This lack of proper aids results in a loss of opportunities as investors see navigation as an exploration rather than a transport mode that can provide a reliable schedule for cargo forwarders. Modernized Aids to Navigation will help to introduce the night navigation that will halve the transport times and provide more safer route reducing the grounding incident as well as maintenance of river navigation will be more efficient – dredging can be limited and done in targeted areas. River regulating infrastructure together with operational services such as buoys and channel markers, and frequent hydrographic updates of the charts, are the main key factors in ensuring safe and efficient navigation. As the first attempt, the AIRBM-Component 3/DWIR has contracted two companies Sealite Co. Ltd and Tempest NV to manufacture and deliver aids to navigation for Stretch 1. Four different types of buoys will be installed including lateral buoy (Red color and Green color), danger buoy and mid fairway buoy. The detail technical information on the installation is described in Part 1.

This document is prepared for not only to guide the installation of Aids to Navigation along the stretch-1 but also provide the Environmental and Social Safeguard measure and management to ensure the project activities are carrying out with the least/no negative impacts to the environment. As all projects and activities under the project is following the environmental and social management framework of AIRBM according to the ESMF of AIRBMP, the Ato N installation is triggered to prepare the ESMP. Considering the provision of buoys and beacons to a river actually contribute vastly to the safety of people using the waterways by avoiding the risks of groundings, collisions, accidents and oil spillages. The safeguard unit of the PMU, therefore, made the screening process and prepared the ESMP and ECoP covering all activities include in the installation and operation of AtoN. It is anticipated that very minimal environmental impacts could be occurred during the installation of AtoN, somehow substantial risks to the river users and local boar operators at the initial phase of operation is being foreseen. Therefore, the safeguard unit developed the comprehensive public awareness program which is supposed to be engaged in parallel with the installation activities during the 2018-2019 dry seasons. The detail environmental and social baseline condition and potential impact has been assessed and described in Part 2.
Part 1: Installation of the Aids to Navigation in Stretch 1
1 Background and Rationale

1.1 The role of IWT in Myanmar

There are different transportation modes in Myanmar including roads, railways, inland waterways, ports, civil aviation, and urban transport within a diversified system. Among different transportation modes, the inland water transport (IWT) is recognized as the most low-cost, environmentally friendly way of transporting goods north of Yangon. In the age of global competition throughout supply chains, sustainable and green transport logistics have become a primary concern. Myanmar is endowed with inland rivers and the Ayeyarwady, the most critical, has played a vital role in the economic development of remote rural areas and in the welfare of the inhabitants. Having naturally blessed infrastructure and little development in other inland transport systems, without the Ayeyarwady, many communities in the remote areas of the country would have had difficulty accessing other modes of transport.

To meet the anticipated growth in demand, Myanmar needs to ensure that its key transport infrastructure is adequate. Investments will therefore focus in the medium term on restoring, modernizing and maintaining waterways and ports where demand is strong but deterioration poses serious bottlenecks. Once the network has been improved to a condition that can be maintained, long-term investments in regional road links, new ports and urban public transport could be considered. Such investments will require a deeper understanding of the evolving demand for transport.

More specifically regarding Inland Waterborne Transportation, Myanmar has more than 6700 km of inland waterways not only extending to populated areas and industrial zones, but also to rural and remote area of difficulties for transportation.

1.2 Role of the AIRBM in improving waterborne transportation along the Ayeyarwady River

In view of the importance of inland waterways transportation to the economy and development of the nation, Component 3 of the AIRBM Project aims at finding and implementing technical and operational schemes for making short term, medium and long term improvements of the navigability of the Ayeyarwady river, and to strengthen the capacity of the DWIR to plan and execute these tasks. AIRBM Project Component 3 aims at achieving safe, economical inland water transport along the Ayeyarwady River that will provide increased opportunities for trade, market access and mobility. Despite the very significant potential for transportation, the very high sediment loads and shallow river depths are compromising safe navigation on the river. Often river depths are less than 1.5m which seriously restricts long-haul navigation and results in safety issues of vessels using the river. The Ayeyarwady has the 5th highest sediment load of any major river in the world and many believe that the rate of sedimentation is increasing as a consequence of deforestation in the river’s fragile upstream landscape and widespread land use changes across the basin through the loss of sediment during rain events. Because of the extremely gentle slope of the river (approximately 6m over 100km) the river is constantly meandering and channels are braiding which means navigation channels can change location from year to year. Moreover, because of the gentle slope and its braiding characteristics, the river has become extremely wide in some places (often up to 5km wide) and this is where the river currents slow down and sedimentation takes place resulting in shoals, sandbanks and bottlenecks for navigation. Enhancing the navigability of the river through engineering approaches has been more challenging than expected because the sedimentation is much more significant than expected. In other words, establishing a static navigation channel is technically and financially difficult. This means that navigation should follow the natural channel with hot spot dredging where required. The precise location of the channel will need to be identified through yearly surveys and charting, and the channel markings should be repositioned according to the new alignment of the channel. That is why ‘Dynamic River Navigation Management’ is high on the agenda in the framework of improving waterborne transportation. That is why the DWIR needs to take full ownership and responsibility of making the channel fully operational. It should be mentioned in the triangle that the modern Aids to Navigation system has to be flexible and responsive to the morphological tendencies of the river.
The bathymetric surveys should provide regular updates of the vertical and horizontal changes in the channel and the charts have to be updated. This should be done at least every year just after the floods when most of the sedimentation and erosion take place. Based on these results the navigation channel should be revised and if required dredged at some hot spots. Finally the navigation buoys should be repositioned accordingly.

1.3 Role of the AIRBM in introducing Aids to Navigation along the Ayeyarwady River

Currently there are only shore markers and water marks at shallow and danger area and only daytime navigation. This lack of proper aids results in a loss of opportunities as investors see navigation as an exploration rather than a transport mode that can provide a reliable schedule for cargo forwarders. Without the need for major infrastructure works, indicating the deepest channel to the waterway users by beaconing and buoying can be considered as one of the most environmentally friendly exercises in the process of waterborne transport improvement. Pollution from spills is particularly important in Myanmar as millions of the people depend on the rivers and canals, and pollution accidents could be a serious threat to their livelihoods. Proper channel marking will reduce these risks significantly.

River regulating infrastructure together with operational services such as buoys and channel markers, and frequent hydrographic updates of the charts, are the main key factors in ensuring safe and efficient navigation. That is why Component 3 contracted two companies Sealite Co. Ltd and Tempest NV to manufacture and deliver aids to navigation for Stretch 1.

Importance of Introducing Aids to Navigation-

- Night navigation is made possible, halving the transport times;
- Makes navigation more efficient – dredging can be limited and done in targeted areas;
- Makes inland waterborne transportation much safer;
- The optimal approach to navigation in terms of minimal environmental impacts. Results in less accidents and groundings;
- Tankers will ground or collide much less minimizing the risk for pollution;
- The number of accidents, including loss of lives and cargo, will be greatly reduced. Insurance fees for the vessels, crew and passengers, and for cargo will be much less as river transportation will become a regulated and trustworthy mode of transport.
- Polyethylene buoys are very low maintenance and will limit the costs for DWIR;

1.4 Procurement of the Aids to Navigation for the Ayeyarwaddy River

Because of its very small slope of river bed over a long distance, the Ayeyarwady River is very wide and shallow. During the dry season, for about 5 months per year (November to May), the river levels are significantly low and so there are drought restriction in the Ayeyarwady river.

<table>
<thead>
<tr>
<th>Item no.</th>
<th>River / Stretch</th>
<th>Drought limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ft / inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meter</td>
</tr>
</tbody>
</table>
That called for a special type of buoys: for the period of low water levels the buoys that will mark the sides of the channel may ‘ground’ and actually become beacons as they are no longer floating. The buoys will need to remain absolutely upright so the light beams and angles stay within the permissible norms. The polyethylene river buoys are made of lightweight, buoyant and durable materials to minimize the personnel and equipment required for deployment, retrieval and servicing the buoys, and increase safety of handling. The buoys shall be capable of unattended operation throughout a 6-year service period, and have a total life expectancy in excess of 20 years. This excludes regular removal of debris which on a river like the Ayeyarwady is significant and requires manual removal of the debris, and of course relocation to follow the dynamic channel. The buoys shall require no preventive maintenance, other than periodic cleaning of external surfaces and re-applications of adhesives. They shall be resistant to all kinds of degradation in their operating and storage environments and to damage from vessel collisions and impact by large debris.

### 1.5 Installation of the Aids to Navigation for the Ayeyarwaddy River

The whole process in the project of Aids to Navigation consists of 3 main parts:

**Part A: Detailed Design (incl. establishing the System of AtoN)**

**Part B: Procurement of AtoN**

**Part C: Installation of AtoN**

Part A is mostly completed but still requires a fine-tuning on where exactly to install the buoys, based on the latest hydrographic maps. Part B is on the way as the buoys are being manufactured. It is expected that the buoys under Lot 2 (Tempest NV) will be delivered in June 2018 in Mandalay, and the buoys under Lot 1 (Sealite Co. Ltd.) will arrive in July 2018. The experts under both firms will assist in the installation of 10 buoys per lot.

Execution of the installation will go through DWIR. This Department is the owner of national inland waterways on behalf of the government and the implementing agency for inland waterway policies. It is responsible for the provision and maintenance of infrastructure along national rivers, lakes, and river ports and for the provision of aids to navigation on the waterways.

The project will be implemented in two phases:

**Phase 1:** Installation of the TEST buoys in July/August 2018. 10 buoys under Lot 1, and 10 buoys under Lot 2 will be installed primarily to inspect their performance during the high water season. All remaining buoys will be installed during the next dry season (probably October to November, 2018) but will form part of this Project Document. In July we will install 20 TEST buoys. These TEST buoys will be installed at locations following these parameters:

1) should be at locations with very high current and subject to much debris;
2) should be close to Mandalay so they can be monitored easily;
3) C3 has already mapped the approximate location of the buoys;

The distribution of buoys should be as follows:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Myitkyina – Sinbo</td>
<td>2’ 6”</td>
</tr>
<tr>
<td>2</td>
<td>Bhamo – Katha</td>
<td>3’ 6”</td>
</tr>
<tr>
<td>3</td>
<td>Katha – Mandalay</td>
<td>4’ 0”</td>
</tr>
<tr>
<td>4</td>
<td>Mandalay – Pyay</td>
<td>5’ 0”</td>
</tr>
<tr>
<td>5</td>
<td>Pyay – Hinzada</td>
<td>5’ 6”</td>
</tr>
</tbody>
</table>

Chindwin River

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Khamti – Homalin</td>
<td>2’ 6”</td>
</tr>
<tr>
<td>2</td>
<td>Homalin – Kalewa</td>
<td>3’ 0”</td>
</tr>
<tr>
<td>3</td>
<td>Kalewa – Monywa</td>
<td>3’ 3”</td>
</tr>
<tr>
<td>4</td>
<td>Monywa – Chindwinwa</td>
<td>3’ 0”</td>
</tr>
</tbody>
</table>
Phase 2: Installation of all remaining aids to navigation buoys in October and November 2018

1.6 Justification on the use of Force Account

Procuring, managing and maintaining aids to navigation on all navigable inland waterways in Myanmar is the full responsibility of DWIR (as reflected in their logo). This activity – especially the introduction of night navigation – is new to DWIR. Together with hydrographic surveying and charting, maintenance dredging this will remain the function by DWIR for some years to come, but the installation of the procured buoys is a new activity that for sure cannot be outsourced and must be done by DWIR. That of course requires additional assistance on human and financial resources. That is why in this case the procurement method of Force Account is the correct method for this pilot project.

1.7 Environmental and Social Safeguard Management

All projects and activities under the project is following the environmental and social management framework of AIRBM. and all possible environmental and social impacts will be taken into account in project implementation seriously and mitigated and/or solved if there are any. According to the ESMF of AIRBMP, the Ato N installation is triggered to prepare the ESMP. Considering the provision of buoys and beacons to a river actually contribute vastly to the safety of people using the waterways by avoiding the risks of groundings, collisions, accidents and oil spillages. The safeguard unit of the PMU, therefore, made the screening process and prepared the ECoP covering all activities include in the installation of AtoN. According to the screening result, it is anticipated that very minimal environmental impacts could be occurred during the installation of AtoN, somehow substantial risk to the river users at the initial phase of operation is being foreseen.

The detail environmental and social baseline condition and potential impact has been assessed and described in Part 2: Environmental and Social Safeguard Management for installation of Aids to Navigation in Stretch 1.
2 The Aids to Navigation under Lot 1 and Lot 2

2.1 LOT 1: SHALLOW DRAUGHT AIDS TO NAVIGATION

Inventory

<table>
<thead>
<tr>
<th>Line Item N°</th>
<th>Description of Goods</th>
<th>Quantity</th>
<th>Physical unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1.1</td>
<td>Shallow Draught Red (Portside) Lateral buoy</td>
<td>80</td>
<td>Unit (buoy)</td>
</tr>
<tr>
<td>L1.2</td>
<td>Shallow Draught Green (Starboard) Lateral buoy</td>
<td>79</td>
<td>Unit (buoy)</td>
</tr>
<tr>
<td>L1.3</td>
<td>Isolated Danger Mark Buoy</td>
<td>15</td>
<td>Unit (buoy)</td>
</tr>
<tr>
<td>L1.4</td>
<td>Self-contained Navigation lights/lantern(^1)</td>
<td>174</td>
<td>Unit (lantern)</td>
</tr>
<tr>
<td>L1.5</td>
<td>GSM/GPS Remote Monitoring Module</td>
<td>174</td>
<td>Unit (module)</td>
</tr>
<tr>
<td>L1.6</td>
<td>Base Station for the Monitoring Modules</td>
<td>2</td>
<td>Unit (Base station)</td>
</tr>
<tr>
<td>L1.7</td>
<td>Mooring chain set</td>
<td>174</td>
<td>Per set (^2)</td>
</tr>
<tr>
<td>L1.8</td>
<td>Anchor</td>
<td>174</td>
<td>Unit (anchor)</td>
</tr>
<tr>
<td>L1.9</td>
<td>Swivel</td>
<td>348</td>
<td>Unit (swivel)</td>
</tr>
<tr>
<td>L1.10</td>
<td>Shackle</td>
<td>522</td>
<td>Unit (shackle)</td>
</tr>
</tbody>
</table>

Aids to navigation system to be employed

L1.1 and L1.2 LATERAL BUOYS

Function:

Lateral marks, used in conjunction with a “conventional direction of buoyage” – in this case from the sea upstream - generally employed for well defined channels. Lateral marks indicate the port (right bank) and starboard (left bank) sides of the river to be followed. Where a channel divides, a modified lateral mark may be used to indicate the preferred route.

<table>
<thead>
<tr>
<th>Direction</th>
<th>Port Hand Buoys (Right Bank)</th>
<th>Starboard Hand Buoys (Left Bank)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buoyage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>Shape of buoy:</td>
<td>Cylindrical</td>
<td>Conical</td>
</tr>
<tr>
<td>Top sign:</td>
<td>Cylindrical, but not required</td>
<td>Conical, but not required</td>
</tr>
<tr>
<td>Light:</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>Rhythm:</td>
<td>Q.R or Fl. R or LFl. R or Fl(2) R(^3)</td>
<td>Q.G or Fl. G or LFl. G or Fl(2) G</td>
</tr>
<tr>
<td>Numbering:</td>
<td>Follow the ‘conventional direction of buoyage’ i.e. numbered from</td>
<td>Follow the ‘conventional direction of buoyage’ i.e. numbered from</td>
</tr>
</tbody>
</table>

\(^1\)Colors to fit the red and green lateral buoys, the isolated danger buoys and the bridge lights according to the inventory list

\(^2\)set of chain is 50m long

\(^3\)Q.R = Quick Red, Fl. R = Flash Red

LFl. R = Long Flash Red, Fl(2) R = Group Flash Red
L1.3 ISOLATED DANGER MARK

Function:
An isolated Danger mark is a mark erected on, or moored on or above, an isolated danger which has navigable water all around it.

| Color:   | Red and black vertical stripes |
| Shape of buoy: | Spherical |
| Top sign: | Two black spheres |
| Light:   | White |
| Rhythm:  | Group flashing (2) White |

MARKINGS AND IDENTIFICATION

Markings
a) All markings, unless otherwise specified, will be clearly and legibly printed in a permanent fashion. Markings will be in English, as applicable. Radar reflector notation and serial number markings shall be above the buoy’s design waterline.

b) MBL Markings. The Maximum Breaking Load (MBL) associated with all lifting and mooring points will be marked adjacent to each lifting point.

c) Each marking on a buoy must be accompanied by a separate control sheet

Identification
a) The words: “DIWR 2017” or other wording where “2017” is the year of manufacture, shall be inscribed in block digits on each buoy. The letters shall not be less than twenty-five (25) mm tall and shall be located as indicated on supplied drawings.

b) When radar reflectors are specified, the letter “R” shall be inscribed after the date above. This character is to be 25 mm tall.

c) Every buoy shall be fitted with a unique serial number and appropriate size of lettering. The numbering shall adhere to the following convention: DWIR-16-3456

OPERATIONS AND MAINTENANCE MANUALS

a) Operations Manual for each buoy type describe the following:

Operational Drawings;
Recommended / required deployment and retrieval procedures;
Recommended / required maintenance procedures;
Limitations of use;
Recommended / required storage requirements;
Fastener torques, if applicable;
Repair procedures, if applicable;
b) Technical Data Package for each buoy type was described the following:
Overall dimensions;
Buoy design drawings that show design waterline, centre of gravity, meta-centric height, centre of buoyancy, weight-in-air and height from water line to top of buoy;
Parts lists;
Any other information necessary for buoy use and maintenance;
Design analysis of lifting and mooring points, and other elements crucial to operator safety.

L1.4. NAVIGATION LIGHTS/LANTERNS
The lights are self-contained (SC), light emitting diode (LED) buoy lanterns, and provide an omnidirectional light signal, red, green or white in color, visible to the mariner at a nominal range of 3 nautical miles (nm).
The buoy lanterns consist of one or more rings of LEDs, electronic power/timer circuitry, solar power generation and energy storage devices (batteries), and a housing which incorporates the necessary light lenses.
The lanterns will communicate through GSM /GPS Monitoring Modules and Base Station with requirements which will be explained in Items L1.5 GSM/GPS Remote Monitoring Module and L1.6 Base Station for the Monitoring Modules.

L1.5. GSM/GPS REMOTE MONITORING MODULE
L1.6 BASE STATION FOR THE MONITORING MODULES
This concerns Remote Monitoring and Control of Aids to Navigation. Small and compact monitoring devices are integrated inside the marine lanterns. They incorporate the remote monitoring system based on sending-receiving signals through SMS or data connection technology. Communication with user and server shall be by means of SMS (short message service or serial devices).
The units are equipped with a high precision position monitoring based upon GPS.
The lantern GSM monitoring system needs to be logged in to the GSM network all the time, in order to enable fast replies if command messages are sent.

OPERATIONS AND MAINTENANCE MANUALS
Operational Drawings and electrical circuits;
Maintenance and renewal instructions
L1.7. MOORING CHAIN SET
L1.8 ANCHOR
L1.9 SWIVEL AND L1.10 SHACKLE
The mooring system for each buoy consists of an anchor, 50m length of adequate chain, swivel and shackles.
The shackle should be installed to join the mooring point of the buoy. After the shackle, a swivel will be connected and then another shackle. This second shackle connects to the mooring chain. A final shackle connects the mooring chain to the mooring at the lifting eye.
All swivels will be well lubricated with high-grade water resistant grease.
This specification describes the requirements for shackle assemblies, shackle pins, swivels, and split keys used as mooring fittings on aids to navigation buoys. Swivels shall be furnished assembled. Shackle assemblies shall consist of shackle components furnished assembled:
A rivet pin shackle assembly shall consist of the specified class of shackle body and the identical class of rivet pin, assembled. In addition, a retaining wire shall be inserted through the hole in the rivet pin, so that the pin will remain with the shackle body during shipment.

A split key shackle assembly shall consist of the specified class of shackle body, the identical class of split key pin, and the identical class of split key, assembled. The legs of the split key shall not be spread more than 5 degrees after the split key has been inserted in the pin.

A Modeer shackle assembly shall consist of the specified class of Modeer shackle body and the identical class of Modeer shackle pin, assembled.

2.2 LOT 2: MID-FAIRWAY BUOYS

Inventory

<table>
<thead>
<tr>
<th>Line Item N°</th>
<th>Description of Goods</th>
<th>Quantity</th>
<th>Physical unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2.1</td>
<td>Mid-Fairway buoy</td>
<td>42</td>
<td>Unit (Safe water buoy)</td>
</tr>
<tr>
<td>L2.2</td>
<td>Navigation lights/lanterns</td>
<td>42</td>
<td>Unit (lantern)</td>
</tr>
<tr>
<td>L2.3</td>
<td>Bridge lanterns⁴</td>
<td>12</td>
<td>Unit (lantern)</td>
</tr>
<tr>
<td>L2.4</td>
<td>GSM/GPS Remote Monitoring Modules</td>
<td>54</td>
<td>Unit (Monit. module)</td>
</tr>
<tr>
<td>L2.5</td>
<td>Base Station for the Monitoring Modules</td>
<td>2</td>
<td>Unit (Bases station)</td>
</tr>
<tr>
<td>L2.6</td>
<td>Mooring chain sets</td>
<td>42</td>
<td>Unit (Chain set)</td>
</tr>
<tr>
<td>L2.7</td>
<td>Anchors</td>
<td>42</td>
<td>Unit (anchor)</td>
</tr>
<tr>
<td>L2.8</td>
<td>Swivels</td>
<td>84</td>
<td>Unit (swivel)</td>
</tr>
<tr>
<td>L2.9</td>
<td>Shackles</td>
<td>126</td>
<td>Unit (shackle)</td>
</tr>
<tr>
<td>L2.10</td>
<td>High Intensity Retro Reflective Elastomeric Film – color yellow</td>
<td>400</td>
<td>meter</td>
</tr>
<tr>
<td>L2.11</td>
<td>High Intensity Retro Reflective Elastomeric Film – color white</td>
<td>200</td>
<td>meter</td>
</tr>
<tr>
<td>L2.12</td>
<td>High Intensity Retro Reflective Elastomeric Film – color red</td>
<td>200</td>
<td>meter</td>
</tr>
<tr>
<td>L2.13</td>
<td>High Intensity Retro Reflective Elastomeric Film – color green</td>
<td>200</td>
<td>meter</td>
</tr>
</tbody>
</table>

Aids to Navigation System to be employed

L2.1 MID FAIRWAY OR SAFE WATER BUOYS

Safe Water marks serve to indicate that there is navigable water all round the mark. These include centre line marks and mid-channel marks. Such a mark may also be used to indicate channel entrance, port or estuary approach, or landfall. The light rhythm may also be used to indicate best point of passage under a bridge.

⁴Colors to fit the red and green bridge lights according to the inventory list below
The Mid-Fairway river buoys are capable of displaying existing standard (IALA) International Association of Lighthouse Authority characteristics for marine aids-to-navigation. The objectives of these buoys are distinct from the shallow draught buoys. A Safe Water Mark, as defined by the International Association of Lighthouse Authorities, is a mark used to indicate the middle and deepest part of the channel. It usually implies that open, deep and safe water lies ahead, or a line of these marks can be used to mark a safe navigable route. The Mid-Fairway or Safe Water Marks may be used mid-channel, as a centreline or at the point where land is reached. These buoys indicate the presence of safe, navigable water all around the buoy. These buoys are coloured Red and White and will also be identified at night by a white light flashing. This buoy is also to be found at the start of a buoyed channel. The marker is also sometimes known as a Mid-Fairway Buoy.

These buoys will be positioned in the deepest part of the channel and usually in narrow stretches of the river which are the deepest. At night they will guide the skipper to follow the line marked by the Mid-Fairway buoys and as such stay in the deep water. The Mid-Fairway buoy can be passed on both sides, which is very different than the lateral marks. Because these buoys are placed in the middle of the navigation channel they are subject to higher currents and more debris.

<table>
<thead>
<tr>
<th>Color:</th>
<th>Red and white vertical stripes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of buoy:</td>
<td>Spherical</td>
</tr>
<tr>
<td>Top sign:</td>
<td>Single red sphere</td>
</tr>
<tr>
<td>Light:</td>
<td>White</td>
</tr>
<tr>
<td>Rhythm:</td>
<td>Isophase, occulting, one long flash every 10s or Morse “A”</td>
</tr>
<tr>
<td>Numbering:</td>
<td>follow the conventional direction of buoyage numbered from seaward.</td>
</tr>
</tbody>
</table>

**MARKINGS AND IDENTIFICATION**

**Markings**

a) All markings, unless otherwise specified, will be clearly and legibly printed in a permanent fashion. Markings will be in English, as applicable. Radar reflector notation and serial number markings shall be above the buoy’s design waterline.

b) MBL Markings. The Maximum Breaking Load (MBL) associated with all lifting and mooring points will be marked adjacent to each lifting point.

c) Each marking on a buoy must be accompanied by a separate control sheet

**Identification**
a) The words: “DWIR 2017” or other wording (to be consulted with Client first), where “2017” is the year of manufacture, shall be inscribed in block digits on each buoy. The letters shall not be less than twenty-five (25) mm tall and shall be located as indicated on supplied drawings.

b) When radar reflectors are specified, the letter “R” shall be inscribed after the date above. This character is to be 25 mm tall.

c) Every buoy shall be fitted with a unique serial number and appropriate size of lettering. The numbering shall adhere to the following convention: DWIR-16-3456

**OPERATIONS AND MAINTENANCE MANUALS**

a) Operations Manual for each buoy type describe the following:

- Operational Drawings;
- Recommended / required deployment and retrieval procedures;
- Recommended / required maintenance procedures;
- Limitations of use;
- Recommended / required storage requirements;
- Fastener torques, if applicable;
- Repair procedures, if applicable;

b) Technical Data Package for each buoy type describe the following:

- Overall dimensions;
- Buoy design drawings that show design waterline, centre of gravity, meta-centric height, centre of buoyancy, weight-in-air and height from water line to top of buoy;
- Parts lists;
- Location and details (i.e. size and area) of markings;
- Any other information necessary for buoy use and maintenance;
- Design analysis of lifting and mooring points, and other elements crucial to operator safety.

**L2.2. NAVIGATION LIGHTS/LANTERNS**

**L2.3. BRIDGE LIGHTS/LANTERNS**

Same as L1.4

There is also a need for 12 lanterns that mark the navigation opening of the bridge. These red (portside) and green (starboard) lights – of the same performance as above lights - must be easy to install above the highest high water location at the bridge pillars.

**Markings - manual**

The lanterns shall be clearly marked with the contents (example: “white LED lantern Model SC LED”), manufacturer, weight, unit quantity, stock number and bar code.

**Operations manual**

An operation and maintenance manual included The operations and maintenance manual shall provide general guidelines for setting the lantern characteristics and proper installation / mounting of the lantern. Troubleshooting instructions, if applicable, shall be included.

**L2.4. GSM/GPS REMOTE MONITORING MODULE**

**L2.5. BASE STATION FOR THE MONITORING MODULES**

Same as L1.4 and L1.5
L2.6. MOORING CHAIN SET
L2.7 ANCHOR
L2.8 SWIVEL
L2.9 SHACKLE
Same as L1.7 to L1.10
L2.10 HIGH INTENSITY RETRO REFLECTIVE ELASTOMERIC FILM – COLOR YELLOW
L2.11 HIGH INTENSITY RETRO REFLECTIVE ELASTOMERIC FILM – COLOR WHITE
L2.12 HIGH INTENSITY RETRO REFLECTIVE ELASTOMERIC FILM – COLOR RED
L2.13 HIGH INTENSITY RETRO REFLECTIVE ELASTOMERIC FILM – COLOR GREEN

These specifications describe the requirements for high intensity retroreflective, elastomeric films used as sign face materials on aids to navigation along the Ayeyarwaddy River to be fitted on the buoys and on the daymarks on the shore. The width of the film is between 60 and 80 mm.
3 Objective and General Scope of the Installation

3.1 Goals and Objectives

3.1.1 Development objective

The ultimate goal is to improve day and night, efficient, safe and sound waterborne transportation on Stretch 1 by ensuring they are fitted with low maintenance and high quality internationally standardized aids to navigation, thereby contributing to the enhancement of the domestic waterborne transport sector.

3.1.2 Immediate objectives

The immediate objectives are to:

Phase 1: The Test Buoys are installed and operational

1) Accessibility to DWIR compound is improved, and concrete slab on warehouse floor;
2) All AtoN are cleared for custom purposes;
3) Staff, workers and related personnel are assigned;
4) Logistics for receiving the goods are prepared;
5) All AtoN are delivered, checked, properly stored, and inventorized;
6) 20 Test buoys are assembled;
7) Awareness Campaign and Consultation
8) Test buoys are stored on board;
9) Test buoys are moored on site;
10) GPS/GSM Monitoring system is installed and operational
11) Relevant staff and technicians are trained
12) Calibration is done;
13) Monitoring period;

Phase 2: All remaining Aids to Navigation are installed and operational

1) Staff, workers and related personnel are informed about the next phase;
2) Logistics and plans for upcoming activities are discussed and finalized
3) All AtoN parts are checked for proper storage and ready for assembly
4) Awareness Campaign and Consultation
5) All AtoN are assembled;
6) New bathymetric data and charts are used for positioning of the AtoN
7) All AtoN are stored on board
8) All AtoN are moored on site;
9) GPS/GSM Monitoring system is installed and operational
10) Calibration, testing and inspection is done
11) Monitoring period;
12) Reconnaissance Survey and design of the AtoN between Nyaung U and Yangon
13) Transportation of Multipurpose Buoy Handling Vessel to Stretch 1
4 Outputs, Activities and Work Schedule

4.1 PHASE 1: THE TEST BUOYS ARE INSTALLED AND OPERATIONAL

Output 1: Prepare Store Area is prepared, and Accessibility to Mandalay DWIR compound is improved

Activities:

a) DWIR prepares accessibility detailed plans to allow 40 feet container trucks on the premises of the Mandalay DWIR compound close to the warehouse, and plans for the concrete slab;
b) DWIR executes the improvement works to the gate, entrance and slope. Concrete slab is poured and completed for storing of buoys. DWIR purchase modern tools. Install shelves;

Output 2: All AtoN are cleared for custom purposes

Activities:

a) PMU/DWIR receive the transport documents from Tempest;
b) PMU/DWIR receive the transport documents from Sealite;
c) PMU/DWIR start discussing the clearing process with the custom authority;
d) PMU/DWIR clear the consignment from the custom authority for Tempest;
e) PMU/DWIR clear the consignment from the custom authority for Sealite;

Output 3: Staff, workers and related personnel are assigned

Activities:

a) PMU/DWIR assign staff, workers and related personnel
   One (1) DWIR/PMU Project Manager
   One (1) Assistant DWIR/PMU Project Manager
   Ten (10) Mechanics from DWIR, including those from Magwe and Yangon
   Six (6) staffs from Navigation section
   One (1) Administrative Assistant from DWIR
   One (1) Project Officer from the PMU
   One (1) Civil Engineer from the PMU

b) Hire Eight (8) labors from outside
c) Contracts are prepared if required;
d) PPE equipment are measured, purchased and provided

Output 4: Logistics for receiving the goods are prepared

Activities:

a) DWIR Project manager, Assistant DWIR Project Manager and PMU Project Officer meet in Mandalay and discuss the logistics;
b) All preparations for the installation are made
c) Tempest and Sealite are contacted: their experts should come when the goods of Sealite are delivered at DWIR compound (expected end July 2018)

Output 5: All AtoN are delivered, checked, properly stored, and inventorized

Activities:

a) Goods Tempest arrive at DWIR Compound in Mandalay;
b) Goods Sealite arrive at DWIR Compound in Mandalay;
c) Goods Tempest are checked, stored and inventorized at DWIR Compound in Mandalay;
d) Goods Sealite are checked and stored and inventorized at DWIR Compound in Mandalay;
e) Experts Tempest and Sealite arrive in Mandalay
Output 6: 20 Test buoys are assembled
Activities:
10 TEST buoys from Tempest are assembled. Assembling the buoy structure, cable, chain, anchor or concrete sinker, swivel
10 X mid-fairway buoy
+ 2 bridge lanterns

10 TEST buoys from Sealite are assembled. Assembling the buoy structure, cable, chain, anchor or concrete sinker, swivel
4X red lateral buoy
4X green lateral buoy
2X isolated danger buoy

Output 7: Test buoys are stored on board;
Activities:
All 20 TEST buoys are transported and lifted on board by hiring car crane;

Output 8: Test buoys are moored and positioned on site
Activities:
a) Load the barges/boats. Buoys and moorings on the barge, ready to be dropped
b) Advice given by pilots during planning and buoy positioning
Includes Hydrographic survey around exact position by DWIR.
- Notify the skippers of all vessels, including drift-net fishermen that buoy installation is being carried out.
- Reserve sufficient maneuvering room to allow ships to pass safely
c) Moorings checked for correct length
d) Detailed list of positions, positions are mapped available
e) Prepare the concrete sinkers, chains and swivels, and assemble
f) Connect the chains and swivels to the Specialized anchor
g) Review and confirm river survey data, discuss with pilots to obtain the best and most suitable location for dropping the buoys
h) Pilot to exactly determine the location for drop
i) Use echo-sounding equipment and GPS to verify position. Some places may require more detailed surveys to find the best spot for dropping and positioning the anchor
j) Verify chain length according to location and river depth, then drop buoy and moorings and prepare for use
k) Monitor position and movement of the buoy;
l) Prepare database

Database format must include:
- Identification number
- Type of navaid
- Number on Navaid (buoy, beacon, shore mark, panel, signal, bridge light, or other)
- Principle dimensions
- Exact coordinates
- Nearest village or reference point
- Left Bank, right bank, middle channel?
- Name of channel, river or estuary?
- River Management Substation
- Year of Installation
- Kilometer number [km]
- Depth in meters (at Lowest Low water, and at Highest High water)
- Chain length in m - 1 or 2 chains?
- Structure buoy
- Color daymark
- Serial number main body
- Serial number lantern Material of the Navaid (steel, PE, plywood, ...)
- Condition of the Navaid structure?
- Structure bent? Other deficiencies?
- Any issues (nets get caught, fishermen tie up boats on buoys, etc.). Has buoy been hit by boat?
- Is reflective tape (3M) attached?
- If buoy, has it moved from original location?
- If buoy, when was it last lifted to maintain or repair?
- If buoy, moored by sinker of anchor
- If buoy, thickness chain in mm
- If concrete marker, dimensions and height
- Lantern range in Nautical Mile
- Height Lantern in m above the water
- Solar or battery?
- Lamp type and color
- Moisture in lantern? Lens discoloration?
- Radar reflector available?
- GPS/GSM monitoring module?
- Is GPS/GSM working?
- The weather record of installation period (windy, rainy, low tide, high tide etc.)
- On the spot photo documentation
- On site video documentation.

Output: GPS/GSM Monitoring system is installed and operational

Activities:

a) GPS/GSM Monitoring system is installed at DWIR office and in Yangon
b) Assure full time access of the SIM cards until September 2020
c) Configuring the system

Output: Relevant staff, technicians and skippers are trained

Activities:

TARGET GROUP A is being trained by the Tempest and Sealite Experts

TARGET GROUP A = DWIR Maintenance Staff, DWIR Navigation experts
Training is done so they can independently install and maintain the buoys, beacons. Training is estimated to be approximately 1 person-month input, and has to be completed within a period of 2 months after the date of delivery of the Goods to the Final Destination.
The chains, swivels and anchors come as one mooring set but must be attached to the buoy locally.
10 full sets of buoys will be assembled by the Supplier’s Aids to Navigation Specialist including configuring the lantern/GMS/GPS system. The Supplier’s Aids to Navigation Specialist works with the local team to ensure it is fully functional and meets the operational requirements. Testing of the reassembled system is done to ensure compliance with factory standards, bid requirements, and preparation for deployment.
In summary, Training Installation is estimated at about 1 man month, to be executed within two months after delivery of the Goods to the Final Destination (Project Site), and will include:

1. Assembling all buoy part components of 10 buoys;
2. Connecting the lanterns and moorings;
3. Programming the light characteristics and the GPS/GMS system;
4. Performance and Supervising the installation and positioning of 10 buoys in the river;
5. Relocation exercise of four buoys so that the DWIR staff is fully accustomed to the procedure;
6. Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;
7. Maintaining, quick repair, and operations procedures of the buoys;

Training and Installation will be done with participation of 8 DWIR Officers as part of the training. DWIR will be responsible to supply 6 labourers to provide manpower and to assist in the initial assembly. DWIR will provide adequate crane, forklift, slings and tools conduct assembly and bring the buoys and moorings from the warehouse to the barge. For installation, DWIR will also be responsible to provide the barge with crane, and crew.

The boat, its operation and crew will be supplied by DWIR.

All remaining buoys will be assembled and installed by DWIR. DWIR and the Supplier’s Aids to Navigation Specialist will need to certify in writing that after the initial assembly of the 10 buoys and training the DWIR officers are confident they can do the work themselves without supervision of the Supplier’s Aids to Navigation Specialist.

The International Expert or Team of Experts will remain one month in the country.

8. HSE training and emergency response orientation to the installation crew.

b) TARGET GROUP B is being trained by the Tempest and Sealite Experts

TARGET GROUP B = Pilots, skippers and other waterway users of commercial ships, the IWT Department, Ship Associations, Operators of Shipping and Cruise companies.

Training is done so the waterway users gain full understanding of the types and functions of the aids to navigation so they know how to navigate using the aids during the day time and during the night time.

This module describes the concept of a buoy as a floating platform for aids to navigation and the types of marine lanterns that can be fitted to them with an introduction to the concept of range.

Introduction to buoys and the light sources fitted to them.

Introduction to IALA/SIGNI
1. The IALA/SIGNI Navais system
2. The navais system on the Ayeyarwady River

Introduction to buoys:
1. The floating platform for aids to navigation.
2. The concepts of buoyancy, stability and moorings.
3. Sizes of buoys and their applications.
4. Superstructure, shape and topmarks.

Introduction to the lanterns and racons:
1. Types of marine lanterns.
2. Colours of light sources and their uses.
3. Light characteristics and ranges
4. The concept of light characters.
5. Introduction to the nominal and geographic range of marine lanterns.

Introduction to the reporting systems:
1. How to report on wrong-functioning of a buoy

Introduction to the repositioning of buoys
1. How repositioning of the buoys will affect the skipper

Output 11: Calibration and testing is done

Activities:

a) Testing of the reassembled system is done to ensure compliance with factory standards, bid requirements, and preparation for deployment;
b)  Calibration of the Remote Monitoring System is also done

c)  All equipment is inspected and tested as per contract:
**Inspections and Tests**

The following inspections and tests need to be done during the contract implementation (during manufacturing and upon installation). They include:

B. Product Inspections after Installation

<table>
<thead>
<tr>
<th>Test Nr.</th>
<th>Spec Ref.</th>
<th>Inspection/Test Name</th>
<th>Purpose and instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quality and Performance Tests</td>
<td>The Supplier will, in attendance of the PMU/DWIR Representative(s) and on the 10 demonstration buoys, demonstrate the correct working order of the following items and functions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a) Visual check of all connections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) Check flexibility of top sign</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c) Stability check (in an intact condition, buoys shall retain positive stability at all times. The buoy shall not have a list greater than 6 degrees)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>d) Visual check correct draught of the buoy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>e) Visual check correct connection of anodes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f) Check correct connection moorings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>g) Check proper stowage and stability on barge deck</td>
</tr>
</tbody>
</table>

A/ FOR THE BUOYS - For the items as listed in “1. List of Goods and Delivery Schedule”(L1.1, L1.2, L1.3):

B/ FOR THE LANTERNS - For the items as listed in “1. List of Goods and Delivery Schedule” (L1.4):

<table>
<thead>
<tr>
<th>Test Nr.</th>
<th>Spec Ref.</th>
<th>Inspection/Test Name</th>
<th>Purpose and instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT B-B1</td>
<td></td>
<td>Quality and Performance Tests</td>
<td>The Supplier will, in attendance of the PMU/DWIR Representative(s) and on the 10 demonstration buoys, demonstrate the correct working order of the following items and functions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a) Visual check of the self-contained lantern and connection to the buoy</td>
</tr>
</tbody>
</table>
### Quality and Performance Tests

<table>
<thead>
<tr>
<th>Quality and Performance Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Visual check of the optic head and solar power system</td>
</tr>
<tr>
<td>c) Autonomy of the battery (take to discharge from a fully-charged state [100% state of charge] to a 20% state of charge without any energy input from the solar panels.</td>
</tr>
<tr>
<td>d) Check of the fan beam</td>
</tr>
<tr>
<td>e) Check of the light characteristics – check against requirements for the AtoN system</td>
</tr>
<tr>
<td>f) Check of the nominal range</td>
</tr>
<tr>
<td>g) Check water tightness</td>
</tr>
</tbody>
</table>

---

### FOR THE GSM/GPS REMOTE MONITORING - For the items as listed in “1. List of Goods and Delivery Schedule” (L1.5, L1.6):

<table>
<thead>
<tr>
<th>IT B-C1</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Supplier will, in attendance of the PMU/DWIR Representative(s) and on the 10 demonstration buoys, demonstrate the correct working order of the following items and functions:</td>
</tr>
<tr>
<td>a) Visual check of the antennas (GSM + GPS) that are to be well integrated and mechanically protected;</td>
</tr>
<tr>
<td>b) The GPS system shall be capable of calculating its position with a maximum deviation of 10 meters from the fixed position;</td>
</tr>
<tr>
<td>c) Off location alarm, lantern status, solar panel charging in aH, battery voltage measurements, Flasher self-diagnostic status;</td>
</tr>
<tr>
<td>On-shore the GSM+GPS Communicator and Analysis must function:</td>
</tr>
<tr>
<td>a) Alarm log</td>
</tr>
<tr>
<td>b) Reporting</td>
</tr>
<tr>
<td>c) Battery graphs</td>
</tr>
<tr>
<td>d) Location indicator</td>
</tr>
<tr>
<td>e) Analysis</td>
</tr>
</tbody>
</table>

---

### FOR THE BUOY MOORINGSFor the items as listed in “1. List of Goods and Delivery Schedule” (L1.7, L1.8, L1.9, L1.10):
<table>
<thead>
<tr>
<th>IT B-D1</th>
<th>Visual quality and quantity checks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Count of all moorings</td>
</tr>
<tr>
<td></td>
<td>b) Visual check of all mooring components, including swivels and shackles</td>
</tr>
<tr>
<td></td>
<td>c) Visual check of required stamps</td>
</tr>
<tr>
<td></td>
<td>d) Visual check of connection between swivel and anchor</td>
</tr>
<tr>
<td></td>
<td>e) Visual check of rivet pin shackle assembly. Correct insertion of pin</td>
</tr>
<tr>
<td></td>
<td>f) Movement of anchor blades</td>
</tr>
<tr>
<td></td>
<td>g) Check length of the chain</td>
</tr>
</tbody>
</table>
Output 12: Monitoring Period

Activities:
Until the remaining aids to navigation are put in place careful monitoring of the aids to navigation is done

4.2 PHASE 2: THE REMAINING AIDS TO NAVIGATION ARE INSTALLED AND OPERATIONAL

Output 1: Staff, workers and related personnel are informed and hired

Activities:
a) PMU/DWIR inform project staff
   - One (1) DWIR Project Manager
   - One (1) Assistant DWIR Project Manager
   - Eight (8) Mechanics from DWIR
   - Six (6) staffs from Navigation session of DWIR
   - One (1) Administrative Assistant from DWIR
   - One (1) Project Officer from the PMU
   - One (1) Civil Engineer from the PMU
   - Hire Eight (8) labour from outside
b) Contracts are prepared if required;
c) PPE equipment are checked for proper order

Output 2: Logistics and plans for upcoming activities are discussed and finalized

Activities:
a) DWIR Project manager, Assistant DWIR Project Manager and PMU Project Officer meet in Mandalay and discuss the logistics;
b) All preparations for the installation are made

Output 3: All AtoN parts are checked for proper storage and ready for assembly

Activities:
Goods are checked, and selected for assembly

Output 4: Training

Activities:
Inform the skippers and shipping companies of the installation and functioning of the buoys.

Output 5: All buoys are assembled

Activities:
All buoys - except the spares - are assembled;

Output 6: New bathymetric data and charts are used for precise positioning of the AtoN

Activities:
a) DWIR provides new bathymetric data and charts for precise positioning
b) AtoN Expert and Navigation Advisor conclude new positions together with DWIR staff. Charts are prepared.

Output 7: Buoys are stored on board;

Activities:
All buoys are transported and lifted on board;
Output 8: Buoys are moored and positioned on site

Activities:

a) Load the barges/boats. Buoys and moorings on the barge, ready to be dropped
b) Advice given by pilots during planning and buoy positioning

Includes Hydrographic survey around exact position by DWIR.
- Notify the skippers of all vessels, including drift-net fishermen that buoy installation is being carried out.
- Reserve sufficient maneuvering room to allow ships to pass safely

c) Moorings checked for correct length
d) Detailed list of positions, positions are mapped available
e) Prepare the concrete sinkers, chains and swivels, and assemble
f) Connect the chains and swivels to the concrete blocks
g) Review and confirm river survey data, discuss with pilots to obtain the best and most suitable location for dropping the buoys
h) Pilot to exactly determine the location for drop
i) Use echo-sounding equipment and GPS to verify position. Some places may require more detailed surveys to find the best spot for dropping and positioning the anchor
j) Verify chain length according to location and river depth, then drop buoy and moorings and prepare for use
k) Monitor position and movement of the buoy;
l) Prepare database

Database format must include:

- Identification number
- Type of navaid
- Number on Navaid (buoy, beacon, shore mark, panel, signal, bridge light, or other)
- Principle dimensions
- Exact coordinates
- Nearest village or reference point
- Left Bank, right bank, middle channel?
- Name of channel, river or estuary?
- River Management Substation
- Year of Installation
- Kilometer number [km]
- Depth in meters (at Lowest Low water, and at Highest High water)
- Chain length in m - 1 or 2 chains?
- Structure buoy
- Color daymark
- Serial number main body
- Serial number lantern Material of the Navaid (steel, PE, plywood, ...)
- Condition of the Navaid structure?
- Structure bent? Other deficiencies?
- Any issues (nets get caught, fishermen tie up boats on buoys, etc.). Has buoy been hit by boat?
- Is reflective tape (3M) attached?
- If buoy, has it moved from original location?
- If buoy, when was it last lifted to maintain or repair?
- If buoy, moored by sinker of anchor
- If buoy, thickness chain in mm
- If concrete marker, dimensions and height
- Lantern range in Nautical Mile
- Height Lantern in m above the water
- Solar or battery?
- Lamp type and color
- Moisture in lantern? Lens discoloration?
- Radar reflector available?
- GPS/GSM monitoring module?
- Is GPS/GSM working?
- The weather record of installation period (windy, rainy, low tide, high tide etc.)
- On the spot photo documentation (atmosphere, surrounding, near by lank mark etc.)
- On site video documentation (short clips).

**Output 9:** GPS/GSM Monitoring system is updated to fit the remaining buoys

Activities:

a) GPS/GSM Monitoring system is updated at DWIR office and in Yangon

b) Configuring the system

**Output 10:** Calibration and testing is done;

Activities:

a) Testing of the reassembled system is done to ensure compliance with factory standards, bid requirements, and preparation for deployment;

b) Calibration of the Remote Monitoring System is also done
c) All equipment is inspected and tested as per contract:
### Inspections and Tests

<table>
<thead>
<tr>
<th>Test Nr.</th>
<th>Spec Ref.</th>
<th>Inspection/Test Name</th>
<th>Purpose and instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A/ FOR THE BUOYS</strong> - For the items as listed in “1. List of Goods and Delivery Schedule” (L2.1):</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| IT B-A1 | | Quality and Performance Tests | a) Visual check of all connections  
b) Check flexibility of top sign  
c) Stability check (in an intact condition, buoys shall retain positive stability at all times. The buoy shall not have a list greater than 6 degrees)  
d) Visual check correct draught of the buoy  
e) Visual check correct connection of anodes  
f) Check correct connection moorings  
g) Check proper stowage and stability on barge deck |
| **B/ FOR THE LANTERNS** - For the items as listed in “1. List of Goods and Delivery Schedule” (L2.2): | | | |
| IT B-B1 | | Quality and Performance Tests | a) Visual check of the self-contained lantern and connection to the buoy  
b) Visual check of the optic head and solar power system  
c) Autonomy of the battery (take to discharge from a fully-charged state [100% state of charge] to a 20% state of charge without any energy input from the solar panels.  
d) Check of the fan beam  
e) Check of the light characteristics – check against requirements for the AtoN system  
f) Check of the nominal range  
g) Check water tightness |
**C/ FOR THE GSM/GPS REMOTE MONITORING** - For the items as listed in “1. List of Goods and Delivery Schedule” (L2.4, L2.5):

<table>
<thead>
<tr>
<th>IT B-C1</th>
<th>Quality and Performance Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Visual check of the antennas (GSM + GPS) that are to be well integrated and mechanically protected;</td>
</tr>
<tr>
<td></td>
<td>b) The GPS system shall be capable of calculating its position with a maximum deviation of 10 meters from the fixed position;</td>
</tr>
<tr>
<td></td>
<td>c) Off location alarm, <strong>lantern status, solar panel charging</strong> in aH, battery <strong>voltage measurements</strong>, Flasher <strong>self-diagnostic</strong> status;</td>
</tr>
<tr>
<td></td>
<td>On-shore the GSM+GPS Communicator and Analysis must function:</td>
</tr>
<tr>
<td></td>
<td>a) Alarm log</td>
</tr>
<tr>
<td></td>
<td>b) reporting</td>
</tr>
<tr>
<td></td>
<td>c) battery graphs</td>
</tr>
<tr>
<td></td>
<td>d) Location indicator</td>
</tr>
<tr>
<td></td>
<td>e) Analysis</td>
</tr>
</tbody>
</table>

**D/ FOR THE BUOY MOORINGS** For the items as listed in “1. List of Goods and Delivery Schedule” (L2.6-L2.9):

<table>
<thead>
<tr>
<th>IT B-D1</th>
<th>Visual quality and quantity checks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Count of all moorings</td>
</tr>
<tr>
<td></td>
<td>b) Visual check of all mooring components, swivels and shackles</td>
</tr>
<tr>
<td></td>
<td>c) Visual check of required stamps</td>
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</tr>
<tr>
<td></td>
<td>f) Movement of anchor blades</td>
</tr>
<tr>
<td></td>
<td>g) Check length of the chain</td>
</tr>
</tbody>
</table>

**E/ FOR THE RETRO REFLECTIVE ELASTOMERIC FILM** For the items as listed in “1. List of Goods and Delivery Schedule” (L2.10-L2.13):

<table>
<thead>
<tr>
<th>IT E1</th>
<th>Visual quality and quantity checks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Count of all tape units</td>
</tr>
<tr>
<td></td>
<td>b) Visual check of the full lengths of the tape</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IT E2</th>
<th>Check resistance to peeling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>apply random tests by attach a 0.50 kg weight to the free end and allow it to hang free for 5 minutes. At the end of the 5 minute period measure the distance of peeling. The distance of peeling must be smaller than 50mm.</td>
</tr>
</tbody>
</table>
Output 11: Monitoring

Activities:

a) All aids to navigation require careful monitoring for 7 months (including height of next wet season)
b) Update training to DWIR, the Skippers, Shipping Companies and other Stakeholders how to make use the buoys for navigation, by day and by night
c) Operational Equipment and Tools. Follow carefully the inventory that was prepared of the available Equipment, Vehicles and Buoy Handling Barges, Work Boats and other relevant equipment
d) Follow the maintenance Plan
e) Quality Control. At regular intervals – according to the needs – perform Quality Control of the whole system
4.3 Schedule (Phase 1 and 2)

Phase 1: THE TEST BUOYS ARE INSTALLED AND OPERATIONAL
Phase 2: ALL REMAINING AIDS TO NAVIGATION ARE INSTALLED AND OPERATIONAL

- **2018**
  - Oct
  - Nov
  - Dec

- **2019**
  - Jan
  - Feb
  - Mar
  - Apr
  - May
  - Jun
  - Jul
  - Aug

- **Oct 21 - Oct 30**: Finalize the logistic Plan
- **Oct 27 - Nov 6**: Assembling the buoys
- **Nov 6 - Nov 30**: All AtoN parts are checked for proper storage and ready for assembly
- **Nov 25 - Dec 5**: New bathymetric data and charts are used for positioning of the AtoN
- **Dec 7 - Dec 14**: Buoys are stored on board
- **Dec 17 - Jan 7**: Buoys are moored and positioned on site
- **Dec 15 - Jan 18**: Update GPS monitoring system
- **Nov 18 - Jan 25**: Calibration and Inspection Test
- **Jan 25 - Aug 30**: Monitoring and Evaluation
Part 2: Environmental and Social Safeguard Management for the Installation of Aids to Navigation on the Stretch 1
1 Background

Directorate of Water Resources and Improvement of River System (DWIR), Ministry of Transport and Communications (MOTC) is the responsible government agency, for providing the smooth and safety waterways navigation along rivers and creeks to enable to contribute to the development of State economy through improving water resources and river transportation system. Having the modernized navigation aids to assist the skippers and shippers is also one of the important infrastructures in promoting the inland waterway transportation. The current navigation aids are a temporary nature, such as bamboo rods, and need to be upgraded to more permanent equipment. In addition, the existing navigation aids in DWIR are applicable only for daytime navigation and need to be modernized to better meet the channel navigation demand and should be lighted to allow the night navigation.

Through the Ayeyarwady Integrated River Basin Management Project (AIRBMP) being implemented with the credit from the WorldBank, the Government of Myanmar (GOM) is upgrading the inland navigation infrastructures and operation system to promote the environmentally sustainable and economically viable transportation system on the Ayeyarwady river. As discussed in the chapter I, in view of the importance of inland waterways transportation to the economy growth of the nation, Component 3 of the AIRBM Project aims at achieving safe, economical inland water transport along the Ayeyarwady River that will provide increased opportunities for trade, market access and mobility by implementing the short term, medium and long term technical and operational schemes for making improvements of the navigability of the Ayeyarwady river and strengthening the capacity of the DWIR to carry out the strategic plan and execution of those plan. The ultimate goal is to improve day and night, efficient, safe and sound waterborne transportation on Stretch 1 by ensuring they are fitted with low maintenance and high quality internationally standardized aids to navigation, thereby contributing to the enhancement of the domestic waterborne transport sector.

1.1 Implementation Agency

Under the component of navigation enhancement on the river, the Directorate of Water Resources and Improvement of River Systems (DWIR) is acting as the implementation agency for installing the aids to navigation on the river. DWIR has been traditionally carrying out the provision of navigation aids, Promulgation of navigation warning, monitoring and marking of approach channels for the cross river bridges according to seasonal changes for the decades. Therefore, procuring, managing and maintaining aids to navigation on all navigable inland waterways in Myanmar is the full responsibility of DWIR (as reflected in their logo). This activity – especially the introduction of night navigation – is new to DWIR. Together with hydrographic surveying and charting, maintenance dredging this will remain the function by DWIR for some years to come.

Under the AIRBMP, Component 3 is taking care of procuring the modernized AtoN and install the modernized navigation aids for the whole river section from Mandalay to Yangon with the advice from DWIR. As the first phase of the installation of AtoN, the project will focus on the introduction of night navigation aids in Mandalay to Nyaung U section, the busiest stretch of Ayeyarwady river, to enhance income generating opportunities for both inland water transport and green/river tourism businesses.

The first installation of AtoN in stretch-1 will be carried out by the DWIR itself with the technical and operational supports from the International experts. In addition, the AIRBM financed AtoN installation will consider the environmental and social safeguards aspects since the design stage following the national legislations and WB’s safeguard Policies and ESMF of the project.

This section is prepared by AIRBMP Safeguard unit to cover the potential environmental and social safeguard issues that are likely to be occurred during the transporting, assembling and installation of AtoN financed under the Ayeyarwady Integrated River Basin Management (AIRBM) Project. The general information of potential impact and its significance analysis with the measures for mitigation and monitoring are provided with the code of practice.
2 Relevant Policy and legal framework

The main government agency responsible for administering environmental legislature in Myanmar is the Ministry of Natural Resource and Environmental Conservation (MONREC). It is the main body for environmental protection and managing the environmental and social impacts of projects. MONREC’s responsibilities include reviewing and approving a project developer, ESIA Project Proposal, ESIA Scoping Study, Environmental and Social Impact Assessment report and Environmental and Social Management and Monitoring Plan report by enacting the Environmental conservation law, regulation and environmental impact assessment procedure to prepare the appropriate instruments for obtaining the Environmental Clearance Certificate from MONREC. The EIA procedure describes the list of project type and their category. According to the Myanmar EIA procedure, the AtoN installation does not entitle to the category listed.

The main body for administering the improvement works on rivers is the Ministry of Transports and Communications (MOTC). It is responsible for all transport infrastructures in Myanmar. The Directorate of Water Resources and Improvement of River System (DWIR) is the main responsible agency for river training and bank stabilization, bank protection for the long-term existence of the river crossings, dredging in river constraints, bend cutting for improvement of waterways and erosion protection, provision of navigation aids and promulgation of navigation warning in Myanmar.

The installation of Aids to Navigation will follow the conservation of water resource and river law (2006) and rule (2013) enacted by the DWIR. The law gives the guidance to the directorate for prescribing the necessary terms and conditions relating to navigation of vessels in the rivers and creeks for conservation of water resources, rivers and creeks. This law is primarily concerned with river transportation, beneficial utilization of river by the public, protect the river from pollution. The law describes the definition of water resources, rivers and its authorities for directing to carry out waterways conservation works based on the suggestions of the Department and determining dangerous water levels for towns; cooperate with relevant government departments and organizations to solve related problems; and guide the use river water for domestic and agricultural use. The law prohibits destroying or cause collision of vessel with the river training structure, navigation aids, carrying out the activities that make channel shifting with the aim to ruin the water resources and rivers and creeks, river water pollution, extraction of river resources without approval.

This law is under the jurisdiction of the Ministry of Transport and Communications, puts its strength on transportation safety and its development.

3 Project description

Four different type river buoys, 198 units with spare buoys 42 units in total, are planning to be installed in the Stretch-1 which has over 20 years life expectancy. The buoys are made of lightweight, buoyant and durable polyethylene materials to minimize the personnel and equipment required for handling. The detail technical information is described in the technical parts. Total actual number of each type to be installed is listed as below:

Table 1 : Types of buoys and its numbers to be installed in Stretch 1

<table>
<thead>
<tr>
<th>Description of Goods</th>
<th>Physical unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow Draught Red (Portside) Lateral buoy</td>
<td>Unit (buoy)</td>
<td>72</td>
</tr>
<tr>
<td>Shallow Draught Green (Starboard) Lateral buoy</td>
<td>Unit (buoy)</td>
<td>75</td>
</tr>
<tr>
<td>Isolated Danger Mark Buoy</td>
<td>Unit (buoy)</td>
<td>13</td>
</tr>
<tr>
<td>Midfairway buoy</td>
<td>Unit (buoy)</td>
<td>38</td>
</tr>
</tbody>
</table>

The major activities included in the installation of AtoN plan can be divided into two as follow:

Activities -1: Preparation of store area: As described in the technical section, the AtoN from the awarded two manufacturers will be delivered by ship to Yangon port and then by truck to the DWIR office in Mandalay. For the storage of all the buoy parts and storing of all auxiliary facilities before assemble, DWIR is planning to prepare the area (store area A1, A3 and A4) as shown in figure below. Total area to be prepared for the store area is about 6819 sq-ft.
Figure 1: Proposed Store area in the DWIR (Mandalay) Compound
The proposed area A2 could not available as it is using as the garage by Regional Office. It is more likely that the buoys to be stored at three different open space in the DWIR compound. No big tress will be cut down. The preparation works will include cleaning the sites and surface the ground with the sand to make more compact for truck accessibility and the buoys placing. As shown in figure 1, there will be a new gate at the north to be easily accessible by the truck and to reduce the risk of accidents without crossing through the office area.
Activities-2: Assembling and Installation of AtoN: Under the activities 2, DWIR is going to assemble the parts of the buoys at the open space nearby the store area A1. All the assembled complete set of buoys will be transported from the office to the river by the truck using the side road.

First, as the phase-1, DWIR will conduct the test running for two months by launching only 10 sets of buoys to see the function and resistance of the buoy during the peak flow condition. The test will start in August on the Mandalay waterway between Minkun and Sagaing right after the training from the manufacturer (see in figure 4). Then the remaining buoy will be launched into the river during November as the phase-2. It is notable that the buoy location at the remaining stretch is uncertain yet during the preparation of this document. DWIR will carry out the hydrographic survey in November to update the buoy location reflecting the river channel changes. The overall working period for the installation of AtoN will take four months. The work schedule is showed in detail in part 1 section 4.3. The total cost estimate for the installation of AtoN in Stretch -1 including environmental and social management cost is approximately USD 146,000.
Figure 4: Planned buoy location for the test running at the phase 1
4 Brief Existing Environmental and Social Setting

Out of the total length, the aids to navigation will be installed within the Mandalay – Nyaung U section in the length of 200 km which falls into the central part of the country. The influence area of the activities fall into three administrative regions namely Mandalay Region, Sagaing Region and Magway Region, however, 70% of the work is within the Mandalay Region.

Figure 5: Project Location (Ayeyarwady River Between Mandalay to Nyaung (Stretch 1)) (source:RHDHV,2015)

Out of the total 1534 km navigable length, as the first attempt for introducing the night navigation in the river, the AtoN will be installed within the Mandalay – NyaungOo section in the length of 200 km which falls into the central part of the country. The influence area defined for this AtoNs installation covers the entire stretch reach between the Project routes and extending 0.5 kilometer on each side of the river bank.

As the dry zone lies in the lowland, the landscape is flat. Generally, the area is dominated by thorny trees and shrubs with the distribution over the area of cinnamon soils, red-brown savanna soils, dark compact savanna soils and meadow soil. They consist of stone fragments with small residues of humus. Soil types in the regions include light forest soil (Nitosol), red brown savanna soil (Luvisol), dark compact soil (Vertisol), meadow soil (Gleysol) and meadow alluvial soil (Gleysol Fluvic) with relatively good fertility especially flood plain area in the river.

The climatic condition of the Central Dry Zone is variable from year to year. April is the hottest month and January the coldest with mean temperature difference is around 10º C. The Dry Zone of Central Myanmar experiences extreme heat differences while monthly temperatures range from a minimum of about 10º C in December, January and February to a maximum of about 43º C in March, April and May.

Therefore, the central zone of Myanmar does not have any rainfall contributing to the river flow during the dry season and the hydrological condition of the river is mainly influenced by the southwest monsoon between May to October. Flows and water depths in the main channel increase rapidly during the wet season (June-October) eventually over-topping levees to inundate adjacent and internal floodplains. Water level typically peaks during August and September and reach their minimum at the end of the dry season with large variations up to 10 meters. The annual flow of the river is approximately 400 km³ with 90% of the discharge in the monsoon season. About 70 % of the total annual discharge occurs between July and October with an annual average discharge of 410 km³/year. Although there are no major dams in the main flow of the Ayeyarwady, the water discharge can change rapidly from dams in the tributaries.
The central dry zone is vulnerable to droughts and floods caused by irregular and sparse rainfall. Estimated surface water storage in dry zone is about 8,780 Mm$^3$ and major surface water sources in dry zone region comprise Ayeyarwady River and its tributaries of Chindwin, Mu, Myitnge and, Zawgyi River. The surface water resource in dry zone is generally limited with low rainfall with average annual precipitation of 725 mm. River water is normally utilized for irrigation, drinking water purposes and other domestic usage.

The Stretch-1 is classified as a low slope and low elevation zone out of six geomorphic zones in Myanmar and referred to as an alluvial basin and also a temporary sediment storage area of the river. It can be said that the dry zone of the central river basin (including Stretch-1) is the major contributor of suspended sediment loads to the Ayeyarwady River helped by its landscape of low vegetation cover and intensive annual monsoon rainfalls which all lead to intense gullying and rapid land surface erosion. Due to the channel being unconstrained, having relatively low slopes and high sediment loads, the channel morphology of the stretch 1 is regarded as the highly complex mixing with braided area and meandering patterns with dynamic characteristics resulted from the large variations in seasonal water level and sediment transport. The variation in water levels and planform changes of the river with numerous sandbars create not only navigational problems in the river section but also floods and erosion potentials in the cities along river by disrupting the flow in the rainy season. The river is broad and open course along the Stretch-1 through the low land dry zone. During high discharge, the river is being shaped by morphodynamics process such as erosion and deposition. For the downstream section (from Pakkouku), discharge distribution and channel angle at the confluence also dominates in planform variation and bar migration apart from the magnitude and extent of morphodynamics process.
The Ayeyarwady carries large amounts of sediment discharge to the sea with more than 90% of the total suspended load discharged between Mid-June and Mid-November. The suspended sediment budget of river while passing thorough the dry zone or central basin was recorded as 229 million tons of suspended sediment with 32 million tons measured in Mandalay. Nearly half of the suspended load of these 229 million tons was contributed by non-perennial streams with dry sandy beds and the remaining was contributed by the Chindwin River (Stamp, 1940). However, the actual transport of suspended sediment still remains as unquantifiable so far. The Chindwin is the largest tributary and major sediment supplier of the Ayeyarwady and has influences on river morpho dynamics further downstream. At the time of preparing this report, DWIR and AIRBM could not conduct the sampling for sediment quality of Stretch-1 for the wet season. According to the dry season results, the river sediment quality is below the standards except chromium particularly at the downstream of Chindwin-Ayeyarwady confluence. The central zone of the river is an important wintering and staging area for migratory waterfowl from the northern ranges area. Also, the flood plains in the central dry zone are regarded as one of the Endemic Bird Areas (EBAs) where national endemic species: Hooded Tree pie; White throated Babbler; and Burmese Bush lark could be found. Near Mingun which is the upstream of Mandalay, the river provides crucial habitat to the critically endangered Ayeyarwady River Dolphin (Orcaella brevirostris) during monsoon.

The Stretch-1 of Ayeyarwady river is flowing through the central dry zone of Myanmar which have more than 54,000km², encompassing from the lower Sagaing region, to the western and central parts of the Mandalay region and most of the Magway region. Stretch-1 covers 16 townships in these three regions: Magway, Mandalay and Sagaing. The 6 townships are 1) Pakokku, and 2) Yasegyo townships of the Magway Division, 3) Myaung, 4) Myinmu and 5) Sagaing townships under the Sagaing region, 6) Amarapura, 7) Aungmyaythazan, 8) Chanayethazan, 9) Chanmyathazi, 10) Mahaaungmyau, 11) Myingyan, 12) Ngaizun, 13) Nyaung-U,14) Patheingyi, 15)Tada-U, and 16) Taungtha under the Mandalay Region.

Figure 7: Morpho dynamics at Ayeyarwady in the Stretch 1 prepared by ICEM (source: AIRBM-PMU)
The total population in the stretch 1 area is 3,883,281 and Bamar is the majority. The settlements of towns and villages are situated mainly on the river bank. The study area is mostly a mix of forests, agricultural and barren land. Agriculture is the primary economical source of livelihood covering 56% of total dry zone land area following by livestock and fisheries. Industry, including alcoholic breweries, textile factories, sugar mills, and gem mines and oil and gas blocks also exist. Tourism now forms a substantial part of the region's economy, as it contains many historical sites.
Main agricultural practices of central dry zone include paddy cultivation, and non-rice crops such as pulses, oil seeds, wheat, maize, peanut, sesame, cotton, tobacco, chili and legumes. Seasonal crops plantations are particularly found in floodplain area during the summer season had been practiced in Le (paddy land), Ya (dry land), and Kaing-Kyun (alluvial/island) of different land types. Major constraints for agricultural sector of Dry zone of central Myanmar contain Droughts, floods, and land degradation and poor agricultural practice. During the dry season, people are living at the temporary farming settlements on islands of Ayeyarwady River for farming on the floodplains.

The freshwater fisheries in Myanmar are significant and important in the national economy and for supporting livelihoods and rural incomes. The Ayeyarwady river is providing the largest share of fisheries production due to the presence of floodplains, wetland and swamps. Fishing is one of the few available livelihood opportunities for most of the landless people within the project area. Both capture and culture fisheries practices can be observed in the Stretch-1. The fisheries livelihoods that were identified in the Stretch-1 as 1) “Inn” Leasable fisheries; 2) Open Fisheries, 3) Tender fisheries and 4) Small scale aquaculture. The most common fishing techniques used in inland fisheries nowadays are “drift net, gillnet, traps and pots, pole-and-line, stationary traps in the near shore of rivers”. All fishing gears require a license from DOF, although in practical terms it is difficult to collect license fees from all the small gear holders.

According to the Environmental and Social Assessment conducted by ICEM in 2017, Mandalay and Magway region are highest in using the IWT while Sagaing is fairly access to the IWT (see in figure 9). Small-scale boat operators using the river include fishermen, small cross-river ferries and other small vessel operators while large scale are government-run operator of passenger and freight vessels and private run freight vessels.

![Figure 9: Map of Assess to IWT in Stretch-1 by ICEM (source: AIRBMP-PMU)](image)

5 Potential environmental and social impact assessment

Based on the baseline setting, the potential impact from the assembling phase and the installation of AtoN phase has been identified. The impact assessment takes account of potential impacts on a wide range of receptors including: physical and chemical environment, biological environment (e.g. plants, terrestrial animals and communities, social groups and individuals as part of the risk assessment process in line with the ESMF.
The VECs have a likelihood of being changes or impacted are i) Noise and Air quality; ii) Water; iii) Biodiversity and Ecosystem Services; iv) Waste; v) Social Livelihood; Local Commuting. Most of the impacts on the VECs are temporary, reversible, minimal and localized as the installation is merely on the main navigation channel of the river, does not include neither any contaminants, waste discharging and emission into the river environment nor land acquisition.

The assessment was carried out for each activity proposed in part 1 section 3 considering the magnitude, duration, spatial requirement of activities and sensitivity of receptor (i.e. habitats, species or communities) by professional experts. The assessment was qualitative and the significance of potential environmental and social impacts was then classified into 4 categories in overall on the basis of parameters such as: (a) duration of the residual impact; (b) spatial extent of the impact and (c) probability as showed in table 2.

The magnitude (M) of each impact has been determined into four tiered scale as below:

**Table 2: Determination of Magnitude Matrix**

<table>
<thead>
<tr>
<th>Degree of Change</th>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignificant</td>
<td>1</td>
<td>No loss or alteration of characteristics and features, no observable impact and no mitigation required</td>
</tr>
<tr>
<td>Small</td>
<td>2</td>
<td>Very minor loss or alteration to key characteristics and features. Minor change from baseline conditions and mitigation through good industrial practices (ECoPs) required</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
<td>Some measurable changes in quality or vulnerability, temporary loss of or alteration or restricted to key characteristics and features, conventional mitigation measures (ECoPs) for implementation with additional mitigation measures required</td>
</tr>
<tr>
<td>High</td>
<td>4</td>
<td>Partial loss of resource/significant damage to key characteristics and features, visible impacts to the users threatening the overall integrity of the resource, Mitigation measures that included in the design and in the good practices (ECoPs) with additional mitigation measures required</td>
</tr>
</tbody>
</table>

A goal of the ESMP process is to ensure the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area.

**Table 3: Impact Assessment Matrix**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Scale</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude (M)</td>
<td>Insignificant</td>
<td>small and will have minor effect on environment</td>
<td>Medium and will result in moderate changes on environment</td>
<td>High and will result in significant changes on environment</td>
<td></td>
</tr>
<tr>
<td>Duration (D)</td>
<td>0-2 months</td>
<td>3-9 months</td>
<td>10-24 months</td>
<td>24-36 months</td>
<td></td>
</tr>
<tr>
<td>Extent (E)</td>
<td>Limited to the site</td>
<td>Limited to the local area</td>
<td>Limited to the region</td>
<td>National</td>
<td></td>
</tr>
<tr>
<td>Probability (P)</td>
<td>Improbable</td>
<td>Probable</td>
<td>Highly probable</td>
<td>Definite</td>
<td></td>
</tr>
</tbody>
</table>

Then, the significant Point (SP) is calculated by following formula.

**Significant Point (SP) = (Magnitude + Duration + Extent)* Probability**

Once rating is determined by using the above formula for magnitude and likelihood, the following matrix was used to determine the impact significance.
### Significant Point (SP) Impact Significance

<table>
<thead>
<tr>
<th>SP</th>
<th>Impact Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>Very Low/Negligible</td>
</tr>
<tr>
<td>11-22</td>
<td>Minor</td>
</tr>
<tr>
<td>23-34</td>
<td>Moderate</td>
</tr>
<tr>
<td>35-48</td>
<td>Major</td>
</tr>
</tbody>
</table>

The impact significance was determined qualifying the degree of confidence expressing minor, moderate and/or major. Each degree can be defined as:

**Very Low/ Negligible** - An impact of negligible significance is defined as when a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be ‘negligible’ or is indistinguishable from natural background variations.

**Low/Minor** - An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

**Moderate** - An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level with the particular management plan. This does not necessarily mean that ‘moderate’ impacts have to be reduced to ‘minor’ impacts, but that moderate impacts are being managed effectively and efficiently.

**Major** - An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. Major alteration to key elements/features of watercourse such that post development nature and characteristics will be fundamentally changed.

5.1 Environmental and Social Impact from preparation of storage and assembling activities

All the AtoNs will be placed in the DWIR compound in Mandalay and the assembling is to also be carried out within the same vicinity.

(i) **Noise and Vibration**: The short term impact of noise and vibration are likely to be found during the said phase. The delivery of building materials by heavy truck and assembling work (i.e. cutting and wielding) will contribute noticeable levels of noise and vibration within the site. Elevated noise levels within the site can affect project workers and the nearby residents, passers-by and other persons within the vicinity of the project site as the working area is very close to the office residential area.

(ii) **Flora Biodiversity**: It is expected that two or three big trees will be cut down to prepare the sufficient space by the project. There are no endangered or rare species found in the DWIR compound. All trees around by the working area is common species and also the project will replant trees at the vacant area of the compound. Therefore, the impact is negligible.

(iii) **Waste Generation and Disposal**

- **Construction waste**: Certain quantities of solid waste will be generated at the site by cutting trees and site clearing and civil works such as metal cuttings, rejected materials. However, the proposed activity would not generate any hazardous toxic waste to the environment.
- **Kitchen waste**: Daily solid waste will be mainly from the kitchen of from the working camp. Most of the waste will be bio-degradable.

(iv) **Onsite Occupational Health and Safety**

- **Physical Hazards**: Because of the civil works including, metal grinding and cutting, concrete work, and welding among others, construction workers will be exposed to risks of accidents and injuries. However, it is expected that most of the potential injuries will be minors and can be mitigated.
Exposure to Noise and Vibration: Levels of noise and vibrations typical to those of works will be generated at the project site. Noise will be generated from vehicles and other assembling activities, will not exceed the applicable standards. This noise impact is expected to be negative in the short-term. The major sources of noises and vibration will be vehicles movement. The major receptors exposed to the noise are expected to be at a minimum and localized as the scope of the construction work is relatively small and simple in terms of work scope.

(v) Land Utilization: As the assembling area is planning to be prepared in the DWIR compound, no land used changes will be occurred.

(vi) Communicable Diseases: The assembling is very short term work. In addition, the PMU is constructing the new sanitation facilities and office for the consultants. Therefore, by sharing the new facilities with the consultant, it will not cause significant changes to the health of nearby community.

(vii) Safety: During this phase, the traffic to and from the DWIR premise will be busy transporting materials to the site. In such a case it is probable that accidents may occur due to carelessness. As the premise is primarily existed in the DWIR compound and hence it is expected that the vehicles movements from and to the site during construction phase would slightly disturb the local traffic in the short term.

(viii) Livelihood: It is expected that the changes to the local livelihood by the assembling work is positive as the nearby shop vendors will generate more income by selling food to the construction worker during the construction phase.

5.2 Environmental and Social Impacts from the assembling and installation of AtoNs

(i) Sediment Quality and Composition: The launching buoys and its anchor and the operation of vessels are expected to disturb the bed level sediment and cause the resuspension of sediment that increase the turbidity at the very specific location. However, the magnitude of changes will not be sufficiently high to change the sediment characteristics as the activity does not generate the harmful contaminants into the environment. Therefore, impacts from sediment disturbance during these operations are expected to be temporary, minimal.

(ii) Hydrology and river morphology: The proposed activity will have little to no impacts to flow regime and sedimentation process is anticipated as the footprint of buoy at each location is limited that would not able to disrupt the river flow and its natural process.

(iii) River Water Quality: As the results of sediment disturbance, very short-term impacts would involve increased, localized turbidity, however, suspended particles will settle out within a short time frame, with no measurable effects on water quality are expected.

(iv) Aquatic and benthic habitats: The impact of proposed activity on benthos considered minor and temporary as the main channel does not feature any sites significant for fisheries such as deep pools, spawning areas, or significant vegetation.

(v) Ambient Noise generation: The noise and gas emission from the operation of vessels is negligible when compare to the shipping traffic in the river and the scope of river area. In addition, the proposed activities will be carried out within two months along Stretch-1. Hence, it is unlikely that project activities would increase the emission and impact on the ambient air quality outside the project boundary.
(vi) **Waste Generation:** Solid and liquid waste effluents will be generated from the vessels. The solid waste will be mainly from the kitchen and liquid waste is mainly bilge water. The solid waste and bilge water should be collected and properly disposed. Hazardous waste includes used oil and grease generated from the vessels. Improper handling with the storage facilities for fuel and oil are the potential sources of river water pollution. Leakage and spills of those waste may occur due to accidents (e.g. collisions, groundings, fires), equipment failure (e.g. pipelines, hoses, flanges), or improper operating procedures during fueling. However, the impact will be mitigated having the standard procedures for hazardous material and waste handling and storage by implementing the ECOPs during the operation and monitored by the project management unit.

(vii) **Water Usage:** The Ayeyarwady River along the stretch-1 is being heavily utilized for irrigation, fishing, transportation, household usage and drinking water at some places. It is expected that certain parts of the project in the river somewhat negatively affect on the local residents daily lifestyle particularly in water usage, river transportation and livelihoods. The increased of turbidity near the shoreline by installation activities may disturb their daily usage temporary. At this stage the extent of the impact is unknown yet.

(viii) **Local Transport Access:** It is anticipated that the installation of AtoN would have temporary disrupt of local boats access between the living place and their farming land. In addition, it could also have the difficulty to adapt and understand the system for both skippers of the cargo ship and local boat operator. The project will address it through the public awareness training and consultation.

(ix) **Livelihood:** It is expected that no major changes to the local livelihood will be occurred but there would be some limitation to the local fishermen for fishing in the navigation channel. The impact will be managed through the consultation.

(x) **Occupational Health and Safety:** Potential issues associated with OHS are physical hazards and noise. The main sources of physical hazards are associated with the handling of AtoN and maintenance of machinery and vehicles without wearing appropriate PPE.

(xi) **Land Use:** No private and public land would be acquired for this proposed activity.

(xii) **Community Health and Safety:** The potential community safety issues are risk of accidents when local boats are passing through the project vicinity. If installation is to be carried out along the busy stretch particularly at the ports area where boat traffic are intense within very limited space, then there is the substantial risk of accidents. Moreover, the community nearby the assembling area will face the noise and vibration generation from the truck movement and assembling activities, but it will be short term impacts. DWIR/AIRBMP would prepare the ECOPs to prevent the incidents and reduce the level of impacts. Therefore, the probability of the impacts is considered to be low.

5.3 **Environmental and Social Impacts from operation of AtoNs**

(i) **Noise:** The long term impact of noise is likely to be found at the night during the operation phase. The engine noise of the fleets will contribute noticeable levels of noise. Elevated noise levels at night can affect the river bank community. However, the extent of impact is uncertain at this phase. Therefore, long term monitoring program will be developed to address the issues.

(ii) **River Water Quality:** As the results of increasing the ship movements that disturb the sediment, very short-term impacts would involve increased, localized turbidity, however, suspended particles will settle out within a short time frame, with no measurable effects on water quality are expected. However, there is still the risk of oil and grease spill from using old and obsolete ships which needs to be monitored in long term.

(iii) **Community Health and Safety:** The potential community safety issues are risk of accidents when local boats are passing through the system at the initial phase in particular while the mariners and local boat operators do not familiar to the system. PMU will engage comprehensive awareness training and consultation along the stretch 1 as described in Chapter-6.
(iv) Occupational Health and Safety: Repositioning of buoy may be required time to time during the dry season. There is the substantial risk of physical hazards for DWIR staffs while carrying out the task. DWIR/AIRBMP would prepare the ECoPs to prevent the incidents and reduce the level of impacts with the follow up actions. Therefore, the probability of the impacts is considered to be low.

(v) Livelihood and income generation: According to the ESA consultation results, the bank erosion caused by the vessel wave during the low flow is substantial case. It is expected that having the fixed navigation fairway which will distance from the bank will reduce the erosion to bank by the wave induced from the vessels to some extent and provide benefits such as maintaining the farmland and residential area.

5.4 Summary of Potential Impact and its Significance

With the credit from World Bank, DWIR is improving the navigation between Mandalay and Nyaung U. The proposed activity is aiming to introduce the night navigation along the river based on the dynamic river management concept. The valued environmental components that have likelihood to be affected by the proposed actions are identified as below:

Table 3: Summary and Impact and Significance

<table>
<thead>
<tr>
<th>VEC</th>
<th>Activities</th>
<th>M</th>
<th>D</th>
<th>E</th>
<th>P</th>
<th>SP</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>Noise from the assembling work</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>Negligible</td>
</tr>
<tr>
<td>Soil Quality</td>
<td>Generation of hazardous waste and disposal of such wastes</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>Negligible</td>
</tr>
<tr>
<td>Flora &amp; Fauna</td>
<td>Loss of big trees and natural vegetation</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>18</td>
<td>Minor</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>Risk of physical hazard during construction</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>21</td>
<td>Minor</td>
</tr>
<tr>
<td>Livelihood and Income generation</td>
<td>Temporary increase of income generation by selling food and goods to the workers</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>18</td>
<td>Minor</td>
</tr>
<tr>
<td>Community Health and Safety</td>
<td>Risk of road accident, traffic congestion</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>16</td>
<td>Minor</td>
</tr>
<tr>
<td><strong>Installation Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic and Benthic community</td>
<td>Impact of installation of anchor and chain in the river bed</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>18</td>
<td>Minor</td>
</tr>
<tr>
<td>River water quality</td>
<td>Increase turbidity of river from instream buoy launching on the river</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>16</td>
<td>Minor</td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td>Boats/Vessel Operation</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>Negligible</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>Risk of physical hazard during working with buoy and boat</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>21</td>
<td>Minor</td>
</tr>
<tr>
<td>Local River Usage</td>
<td>Temporary disruption of local boat access to the bank and farmlands by the activities</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>28</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Temporary loss of local boat access to the bank by the installation of chain on the bank</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>21</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Temporary disturbance to local water usage for drinking, bathing, washing and irrigation</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>15</td>
<td>Minor</td>
</tr>
</tbody>
</table>
With the fact of the small footprint of each buoy compared to the length of extremely dynamics river, the combined negative effect of project activities on the said valued environmental components are likely to be negligible. Impacts on the physical environmental are considered to be temporary, minor and easily reversible and are not anticipated to result in unprecedented, significance and permanent loss to natural and social environment. The proposed activity could temporarily impact on the local boat operator to access to livelihood and the skipper to adapt to the new system. Mostly fishermen; however alternate sites that are regularly used by fishers are not in the main navigation channel, therefore the projects are unlikely to have a major impact on the fisher’s livelihoods. Upon the result of analysis, it is obvious that there are no major negative environmental and social changes by the project except the health and safety aspects.

The impacts related to the occupational health and safety aspects will be addressed and mitigated through the code of practice (Annex-1) while community health and safety issue will be addressed by engaging the comprehensive public awareness campaign, training and consultations. It is clearly visible that the project will increase the ship movement during dry season that have influence on the economy growth of the region in very near future due to the improvement of safety in access within the Stretch-1.

### 5.5 Implementation Arrangements

1. **Directorate of Water Resources and Improvement of River Systems**

DWIR will be the implementing agency for this AtoN installation and would be the overall responsible for all aspects of project implementation including technical, operational and financial management and quality assurance as well as the compliance of ECoPs. The regional heads of navigation section of DWIR are the main responsible person for the implementation of mitigation measures, regular monitoring at the project site and communication with local communities whenever it necessary. DWIR will be obliged to perform on the following activities: 1) conducting installation works complying with the ECoPs; 2) ensuring the availability of proper PPE, waste management plan, site management plan 3) preparing monthly reports covering technical, environmental and social aspects on the works performed; 4) reporting to the Project Management for any special incident; 7) Engaging with the local community for their awareness on new system. Together with Environmental and Social Specialists of PMU, they will ensure the environmental awareness of project personnel is maintained through appropriate training. In addition, DWIR is responsible for the entire coordination between its own relevant departments and PMU for the project implementation including administration supports and ESMP implementation.

2. **Project Management Unit (PMU), AIRBM**
The AIRBM-PMU will supervise the implementation according to the project proposal. PMU-Safeguard Unit will fulfill the following activities: 1) supervising the proper application of ECoPs and the conformity of its implementation with the design; 2) engaging with local community throughout all phases of project; 3) provide the proper remediation or corrective action for any unexpected significance impacts of the project; 4) preparing required reports; 5) ongoing cooperation with the World Bank, including preparing reports for Project implementation (i.e. progress reports, completion reports).

Management System framework was developed for the proposed activity. The management system is the means by which environmental and social (amongst other) performance requirements are established as below:

**5.6 Environmental and Social Monitoring Plan**

From early on, in the design phase DWIR consider the design with the least impacts on the natural and social environment. This monitoring program will be fed as the overall general management plan into both phase 1 and phase 2 activities along with ECoPs for all the impacts covered in here. A summary of these impacts and mitigation measures and onsite monitoring are presented in table 8.

Given the small size of the works, no cumulative adverse impacts outside of the immediate vicinities of the sites are likely to occur. A Code of Practice has been prepared covering occupational and community health and safety, as well as public awareness program to manage all related impacts of the Project.

The DWIR will be responsible for operations and ensuring compliance with the ECoPs. The PMU safeguard unit will provide continuous supervision and support the effective management of the project by the DWIR engineers.
5.7 Grievance Redress Mechanism

DWIR established a project level Grievance Redress Mechanism (GRM) which will be implemented under the leadership of PMU to oversee the grievance management. GRM will cover three issues i) safeguards implementation ii) overall project implementation and iii) Public awareness program implementation. The project level protocol envisages the role of the head of Regional DWIR and site supervisor to function the GRM process with the support from DWIR head office and PMU.

In order to hear any concerns raised by the communities during the project implementation, the contact phone numbers will be advertised to the local communities at the public notice board for complaints. Site supervisor (or) engineer will be responsible for handling the complaint with assist of PMU C-3 and Safeguard team. GRM for Public awareness program implementation will be carried out by establishing a technical team to address complaints and grievances pertaining to the adaptation of AtoN system safely. The team will include Component 3 director, Component 3 navigation specialists, Safeguard officer, Regional Director of DWIR and representatives from the local communities. A grievance/complaint can be submitted either via a written form or verbally by phone calls as of the below options:

1) By communicating to the local Authority/ regional DWIR office (using the official grievance form, via letter/note or verbally) who will be responsible for reporting the issue to PMU
2) By submitting the grievance directly to PMU (either verbally or via the grievance form)
3) By submitting the grievance to the site engineer or supervisor who will then be responsible for informing PMU

When a complaint/grievance is received, it will be registered using the template in Annex-2 and solved within 24 hours after receiving the complaint by site engineer with the support of regional DWIR office. If the complaint/grievance is directly involve the current project implementation activities, for an immediate action to satisfy the complaint, the complainant will be informed of corrective action plan including the tentative timeline. Any complaints relates to a significant incident (eg. Fatality or morbidity) which needs further investigation will be referred to PMU C-3 team. Then PMU C-3 team will investigate and find the corrective solution within 7 days after receiving the complaint and implement the solution. It will be subsequently reported to DWIR management and World Bank for the commentary and/or advisory purpose.

![Grievance Mechanism Process Chart](image)

Figure 11: Grievance Mechanism Process Chart
<table>
<thead>
<tr>
<th>Source</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation Measures</th>
<th>Implementing By</th>
<th>Monitoring Frequency</th>
<th>Monitoring By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of store area</td>
<td>Onsite occupational safety</td>
<td>DWIR will provide the proper PPE and first aid kits for the worker and will follow the ECOPs. To provide healthcare services to the workers and local communities</td>
<td>DWIR Implementation team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Site preparation and Transportation of buoys</td>
<td>Possible damages to the road, Increased traffic load on the road</td>
<td>DWIR will avoid the truck movement in and out to the site during the rush hour and install visible and clear warning signs and boards prohibiting access to the site and notify/inform to the nearby community</td>
<td>DWIR Implementation team PMU C3 team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Site preparation</td>
<td>Community safety in accessing the area</td>
<td>Proper construction management plan will be established to shorten the duration of construction activities.</td>
<td>DWIR Implementation team &amp; PMU C3 team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Site preparation</td>
<td>Impacts associated with population influx</td>
<td>To hire the local people for construction workforce with involvement of local community leaders, To give priority for job opportunities to members of project-affected households</td>
<td>DWIR Implementation team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Site preparation</td>
<td>Employment opportunity for local people</td>
<td>To encourage procurement of construction materials from local suppliers</td>
<td>DWIR Implementation team &amp; PMU C3 team</td>
<td>One time during implementation phase</td>
<td>PMU-C3, PMU-Safeguard Team</td>
</tr>
<tr>
<td>Installation of buoy</td>
<td>Temporary increase of turbidity interfere local river water usage</td>
<td>DWIR will inform/notify the installation period and location to the nearby river bank community before the implementation</td>
<td>DWIR Implementation Team</td>
<td>Three times before, during and closing phase</td>
<td>PMU-Safeguard Team</td>
</tr>
<tr>
<td></td>
<td>Disrupt transport accessibility of cargo</td>
<td>DWIR will install visible clear warning sign along</td>
<td>DWIR Implementation</td>
<td>Three times before, during and closing phase</td>
<td>PMU-Safeguard</td>
</tr>
<tr>
<td>Source</td>
<td>Potential Impacts</td>
<td>Proposed Mitigation Measures</td>
<td>Implementing By</td>
<td>Monitoring Frequency</td>
<td>Monitoring By</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>shipping along the project area</td>
<td>the working area</td>
<td>Notify/inform to local cruising association, local community and Department of Marine Aviation. Carry out public awareness consultation for the AtoN system</td>
<td>Team</td>
<td>phase</td>
<td>Team</td>
</tr>
<tr>
<td>Installation of chain and mooring anchor</td>
<td>Temporary loss of boat access by the installation of chain</td>
<td>Notify/inform to local community about the installation period. If there is any unavoidable case, DWIR and PMU will select the location consulting with the nearby local community for their most convenience.</td>
<td>DWIR Implementation Team and PMU-Safeguard Team</td>
<td>Three times before, during and closing phase</td>
<td>PMU-Safeguard Team</td>
</tr>
<tr>
<td>Installation of chain and mooring anchor</td>
<td>Risk to community safety when local boats are passing through the site</td>
<td>Notify/inform to local community, local community through Local General Administration Department and Department of Marine Aviation about the installation period to avoid the area as a precaution measure before installation</td>
<td>DWIR Implementation Team and PMU-Safeguard Team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Installation of chain and mooring anchor</td>
<td>Risk to community safety when local boats are passing through the site</td>
<td>Notify/inform to local community, local community through Local General Administration Department and Department of Marine Aviation about the installation period to avoid the area as a precaution measure before installation</td>
<td>DWIR Implementation Team and PMU-Safeguard Team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Disposal of Waste</td>
<td>Water Pollution, Land Contamination</td>
<td>DWIR will dispose all the hazardous waste and solid waste using separate containment on land in accordance with ECOPs</td>
<td>DWIR Implementation Team</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Installation of buoys</td>
<td>Occupational injuries and accidents</td>
<td>Proper PPE will be provided to the workers. DWIR will establish the on board record of accident. Standard COP will be applied</td>
<td>DWIR Implementation team, PMU-C3</td>
<td>Three times before, during and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
</tbody>
</table>

Operation Phase
<table>
<thead>
<tr>
<th>Source</th>
<th>Potential Impacts</th>
<th>Proposed Mitigation Measures</th>
<th>Implementing By</th>
<th>Monitoring Frequency</th>
<th>Monitoring By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of buoy</td>
<td>Risk to community safety when local boats are unfamiliar to the new system</td>
<td>To provide focus group awareness programs to local people on how to adopt to the changes</td>
<td>DWIR Implementation team, PMU-C3, PMU-Safeguard Team</td>
<td>During and closing phase</td>
<td>PMU- Safeguard Team</td>
</tr>
<tr>
<td>Operation of buoy</td>
<td>Increase of number of boats and cargo, increase of trading activities</td>
<td>To provide public awareness programs to local people on how to adopt to the changes</td>
<td>DWIR Implementation team, PMU-C3, PMU-Safeguard Team</td>
<td></td>
<td>DWIR Implementation team, PMU-Safeguard Team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improvement of navigation in the river by the project activities will be monitored as part of the monitoring and evaluation program for public awareness program</td>
<td>PMU-C3, PMU-Safeguard Team</td>
<td>Intermittence survey in long run</td>
<td>DWIR (Head Office)</td>
</tr>
<tr>
<td>Oil and Grease water pollution</td>
<td>DWIR will conduct the water quality monitoring as part of their routine water quality and sediment monitoring program</td>
<td>DWIR (Head Office)</td>
<td>Seasonal Survey in long run</td>
<td>DWIR (Head Office)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DWIR and PMU will introduce the new fleet design to replace the obsolete fleet as part of the navigation strategy</td>
<td>DWIR Implementation team, PMU-C3</td>
<td>Intermittence survey in long run</td>
<td>DWIR (Head Office)</td>
</tr>
<tr>
<td>Risk of Occupational Health and Safety during the repositioning of buoys along the stretch 1</td>
<td>Provide PPE and First aid kits adequately, Provide safety training to the staffs</td>
<td>DWIR Implementation team, PMU-C3, PMU-Safeguard Team</td>
<td>DWIR (Head Office)</td>
<td>DWIR (Head Office)</td>
<td></td>
</tr>
</tbody>
</table>
6 Stakeholder engagement and public awareness plan

6.1 Introduction

The plan and process for stakeholder consultation and public awareness campaign activities to be undertaken for the AtoN installation and its associated activities in Stretch-1 is designed to meet the Myanmar legal requirements for public consultation and disclosure and international practice. Public awareness and understanding of the jurisdictional AtoNs operation system among the public and key river users are vital important to introduce the new navigation system safely in Myanmar successfully. The public consultation plan is developed aiming not only to fulfill the regulatory requirement but also to provide the information necessary to help the public understand that AtoNs operation and establish the communication between the stakeholder and the project.

6.2 Objectives

The series of consultation will be carried out during the training and awareness campaign period aiming to achieve the following objectives:

a) Informing the skippers and shipping companies of the installation and functioning of the buoys.

b) Posting the news/announcement about the installation of AtoN in newspapers

c) Distributing the pamphlets, related documents and specimens to all major cities and ports along the stretch 1.

d) Organizing the public events to inform, discuss the purpose of AtoN and demonstrate the use of AtoN at major cities and ports along the stretch 1.

e) Producing the extension or educational materials (short movies, illustrative clips etc.) to be broadcasted from mass media.

As in the case of operational activities on the water, like dredging, there are risks for the operators involved: even though the buoys are made of lightweight polyethylene, their weight is still important and the use of chain and anchors always requires preventive measures against accidents.

6.3 Methodology and Approach

The consultations effort for the proposed activities aims to achieve a consistent, comprehensive, coordinated and culturally appropriate approach to sustainable project. Principles employed for consultation are i) Stakeholder identification ii) Engagement Strategy and Planning iii) Implementation and iv) Monitoring and Evaluation. According to the result of the stakeholder identification, DWIR and PMU plans to carry out the consultations with the stakeholders on the basis of phase approach aiming to inform the project plan and new system to the people along the river. The monitoring program will be engaged after each level of consultation to evaluate the effectiveness of public awareness program and to hear the feedback communities on the system for further improvement. The program is long term and flexible to provide quick action adapting the situation covering both installation and operation. PMU will carry out the quick monitoring action in parallel with the installation activity to prevent the unforeseen risks.

<table>
<thead>
<tr>
<th>Level</th>
<th>Objective</th>
<th>Outcome</th>
<th>Proposed Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level-1</td>
<td>Gather early inputs for project design process and obtain feedback from stakeholders</td>
<td>Early inputs and feedback obtained and used in early stages of project development.</td>
<td>Dialogue Panel meetings</td>
</tr>
<tr>
<td>Level-2</td>
<td>Raising stakeholder awareness and educate the installation and functioning of the buoys.</td>
<td>Stakeholders understand the project and gain motivation to be involved in the upgrading the operation system</td>
<td>Focus group discussion and workshop</td>
</tr>
<tr>
<td>Level-3</td>
<td>Stakeholder awareness</td>
<td>Public understand the AtoN</td>
<td>Focus group discussion and workshop</td>
</tr>
</tbody>
</table>

Table 5: Level of Public Awareness Program and expected outcomes
Campaign to understand about the project benefits and outcomes and to identify their concerns and address the issues to achieve the long term maintenance with the community participation. Along the river and involve in maintenance of equipment and prevent damages to the Aids to Navigation. Workshop, Distribute the pamphlets, related documents and specimens to all major cities and ports. Organize the public events to inform, discuss the purpose of AtoN and demonstrate the use of AtoN at major cities and ports along the stretch 1.

| Level-4 | Public awareness Campaign to understand about the project benefits and outcomes | Public understand the AtoN along the river and involve in maintenance of equipment and prevent damages | Produce the extension or educational materials (short movies, illustrative clips etc.) to be broadcasted from mass media. |

6.4 Project Stakeholder

The stakeholder has been identified through the internal technical team meeting, review of previous similar projects. The process includes identify the stakeholder groups, identify the representative or individuals of each group and generate the stakeholder list. The stakeholder is identified in terms of their level of influence and interest to the project and directly or indirectly affected by the project and prioritized the stakeholders. The tentative stakeholders are divided into four subgroups and the list for each phase is shown in figure 12. The project stakeholders in further detail, including the organizations identified as stakeholders in the project will be prepared later.

6.5 Tentative Location for Consultation and Awareness Program

The key criterion for selecting the village tracts is: 1) spatial distribution along the stretch-1, and 2) proximity to riverbank (within 500m) 3) other criteria related to the degree of relying on the river for the livelihoods and changes in river environment. The participants include (i) communities and population living nearby the proposed constraint areas, (ii) farmers, fishing community, and passengers using boat transports, day labor, women (iii) village tract level government officials of relevant departments. The detail program for the focused group consultation and awareness campaign could not able to prepare during writing this report. Tentatively, PMU is planning to conduct the 3 regional level consultations, 6 District level consultations and 10 township/village tract level consultations. At the same time, the awareness campaign through media will be carried out for the general audience.

6.6 Content of the Stakeholder Consultation and Public Awareness Program

The following aspects will be covered at each public awareness consultations for AtoN introducing along the Stretch 1.

1) Technical Information: Information of AtoN system and its benefits to the inland water transport and local community will be shared with the stakeholder. The skippers will be consulted in detail how to use the system.

2) Safeguard Information: The potential risks and issues from AtoNs installation phase and operation phase will be presented and identified the sustainable solution with the participation of local community. The information of ESMP (Section 5.5) and GRM system (Section 5.6) will be explained and then, appoint the local contact (or) representative of the communities at the event to make a complaint or suggestion easier and faster.

3) Legal Information: The existing law and regulation relevant to the Aids to Navigation and river conservation will be shared with the stakeholders to enhance their knowledge and awareness emphasizing the benefits that are relevant and important to the community welfare and the legal framework for long term sustainability of AtoN system.
6.7 Operation Team

Project Director of AIRBMP/DWIR will serve as the responsible administrator for the overall implementation of this Public Awareness Campaign and Consultation Program to ensure that:

- Target groups are identified,
- Message(s) appropriate to each level of audience are identified
- Appropriate media are selected to transmit each message to each audience,
- Appropriate message delivery frequencies are identified for each message and audience,
- Messages are delivered as specified in the plan,
- The effectiveness of the program is periodically evaluated, and
- The plan is modified to reflect the findings of the effectiveness evaluation

To support the program, the following team (see in figure 13) is going to take care of the technical and communication tasks of program implementation effectively. The component 3 director will lead the team serving as the coordinator between DWIR and AIRBMP-PMU. The Safeguard unit is to support the team leader in all aspects for carrying out the consultation and campaign events. The plan for focus group consultation and public awareness campaign will be prepared in detail and proposed in the separate document.
**Figure 13: Implementation Team for Stakeholder Consultation and Awareness Campaign**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Win Hlaing</td>
<td>Project Director, AIRMBP</td>
<td>Overall Supervision and leadership</td>
</tr>
<tr>
<td>Aung Myo Khaing</td>
<td>Director, Component 3 of AIRBMP</td>
<td>Lead in Coordination between DWIR, AIRBMP and Other Government Agencies, Monitoring and Implementation of the Public Awareness Program and installation of AtoN</td>
</tr>
<tr>
<td>Lieven Geerinck</td>
<td>Navigation Advisor, Component 3 of AIRBMP</td>
<td>Lead in Technical Support Team and Monitoring and Implementation of the Public Awareness Program and installation of AtoN, Preparation of supporting materials</td>
</tr>
<tr>
<td>Nan Kham Syne</td>
<td>National Environment Officer, Safeguard Unit of AIRBM</td>
<td>Lead in Safeguard Support, Communication, Monitoring and Implementation of the Public Awareness Program and installation of AtoN, preparation of supporting materials</td>
</tr>
<tr>
<td>Ye Win Ko</td>
<td>National Project Officer</td>
<td>Coordination between technical support team and DWIR, Facilitating the AtoN training program</td>
</tr>
<tr>
<td>Toe Aung Lin</td>
<td>Director, Mandalay Region of DWIR</td>
<td>Facilitating the AtoN installation, Communication and Monitoring for Public Awareness Program Regional Coordination between Government agencies and DWIR/AIRMB for Mandalay Region</td>
</tr>
</tbody>
</table>
6.8 Tentative Schedule for the consultation and awareness campaign

The tentative timeline for each level of consultation/campaign is prepared (see in figure 14). The program will start in July once PMU receive the approval from the Bank. The level 1 consultation will be carried out before and during the test running period and the level 2 activities will be carried out right after the test running installation. The level 3 will be carried out in parallel with the level 2 activities and keep continuing until the installation of all AtoNs is accomplished.

![Figure 14: Working Schedule for Stakeholder Consultation](image)

6.9 Information Disclosure

Draft version of this report will be publicly disclosed in AIRBM project website for two weeks at least before the consultation program is commenced. Once the phase-2 level consultation is completed, the report will be finalized incorporating the feedbacks and disclosed on the website.

7 Cost Estimate for the Installation of AtoN

<table>
<thead>
<tr>
<th>No.</th>
<th>Activities</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit</th>
<th>Amount in</th>
<th>Amount in</th>
</tr>
</thead>
</table>

57
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td><strong>Preparation of Store area for buoys in DWIR compound</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Site cleaning and concrete flooring</td>
<td>sqm</td>
</tr>
<tr>
<td></td>
<td>Purchasing and Installation of shelves</td>
<td>sqm</td>
</tr>
<tr>
<td></td>
<td>Purchase 2 set of modern tools to be used in assembling work (Steel cutter, welding gun....)</td>
<td>Lumsump</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td><strong>Rental of vessel and equipment</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Vessel rental cost for phase 1</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Crane rental cost for phase 1</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Vessel rental cost for phase 2</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Crane rental cost for phase 2</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Forklift rental + Operator cost for phase 1</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Forklift rental + Operator cost for phase 2</td>
<td>day</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td><strong>Hydrographic Survey</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Hydrographic Survey for exact positioning at phase 1</td>
<td>day</td>
</tr>
<tr>
<td></td>
<td>Hydrographic Survey for exact positioning at phase 2</td>
<td>day</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td><strong>Labour Cost</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Labour Cost for deliver, check and inventory the goods to DWIR compound</td>
<td>days</td>
</tr>
<tr>
<td></td>
<td>Labour cost for assembling the buoys for phase 1</td>
<td>days</td>
</tr>
<tr>
<td></td>
<td>Labour cost for assembling the buoys for phase 2</td>
<td>days</td>
</tr>
<tr>
<td></td>
<td>Installation of monitoring system</td>
<td>days</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td><strong>GPS/GSM Monitoring system is installed and operational</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Purchase the sim card</td>
<td>nos</td>
</tr>
<tr>
<td></td>
<td>Deposit for sim card</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Bill + Services charges for 240 pcs of sim cards</td>
<td>months</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td><strong>Training and Capacity Building</strong></td>
<td><strong>Price</strong></td>
</tr>
<tr>
<td></td>
<td>Travelling for trainees</td>
<td>Round Trip</td>
</tr>
<tr>
<td></td>
<td>Training for 16 DWIR staff (Allowance + Accomodation for trainees)</td>
<td>days</td>
</tr>
<tr>
<td>Description</td>
<td>Cost Type</td>
<td>Cost</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>Training for skippers (room rental+ meal &amp; travel allowance)</td>
<td>lumpsum</td>
<td>7920000</td>
</tr>
<tr>
<td>Expense for PMU Staff (C3 PO, Safeguard)</td>
<td>lumpsum</td>
<td>14852800</td>
</tr>
<tr>
<td>Airfare for 4 pax for phase 1</td>
<td>Round trip</td>
<td>739200</td>
</tr>
<tr>
<td>Accomodation and Allowance for 4 pax for phase 1</td>
<td>Day</td>
<td>200000</td>
</tr>
<tr>
<td>Airfare for 4 pax for phase 2</td>
<td>Round trip</td>
<td>1108800</td>
</tr>
<tr>
<td>Accomodation and Allowance for 4 pax for phase 2</td>
<td>Day</td>
<td>200000</td>
</tr>
<tr>
<td>Environmental and Social Management</td>
<td>lumpsum</td>
<td>4294000</td>
</tr>
<tr>
<td>Purchasing the PPE (glove, glass, helmet and boots)</td>
<td>Set</td>
<td>52800</td>
</tr>
<tr>
<td>Drinking water supply + Water Supply</td>
<td>lumpsum</td>
<td>400000</td>
</tr>
<tr>
<td>First Aid kit supply</td>
<td>lumpsum</td>
<td>66000</td>
</tr>
<tr>
<td>Preparing the warning signs and safety measures on board and onsite</td>
<td>lumpsum</td>
<td>330000</td>
</tr>
<tr>
<td>Contingency &amp; Miscellaneous cost</td>
<td>lumpsum</td>
<td>1570800</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>193205960</td>
</tr>
<tr>
<td>Round Cost</td>
<td></td>
<td>193,200,000</td>
</tr>
</tbody>
</table>

8  Conclusions
In view of the importance of inland waterways transportation to the economy and development of the nation, The Government of Myanmar aims at achieving safe, economical inland water transport along the Ayeyarwady River that will provide increased opportunities for trade, market access and mobility through DWIR and Component 3 of the AIRBM Project to find and implement the technical and operational schemes for making short term, medium and long term improvements of the navigability of the Ayeyarwady river, and to strengthen the capacity of the DWIR to plan and execute these tasks.

Despite the very significant potential for transportation, the very high sediment loads and shallow river depths are compromising safe navigation on the river. Often river depths are less than 1.5m which seriously restricts long-haul navigation and results in safety issues of vessels using the river. Because of the extremely gentle slope of the river (approximately 6m over 100km) the river is constantly meandering and channels are braiding, the river has become extremely wide in some places (often up to 5km wide).

Under such condition, the navigation in the river currently use only shore markers and water marks at shallow and danger area and only daytime navigation. Pollution from spills is particularly important in Myanmar as millions of the people depend on the rivers and canals, and pollution accidents could be a serious threat to their livelihoods. In the process of waterborne transport improvement, the deepest channel to the waterway users by beaconing and buoying can be considered as one of the most environmentally friendly cost effective exercises. Proper channel marking will reduce these risks significantly. River regulating infrastructure together with operational services such as buoys and channel markers, and frequent hydrographic updates of the charts, are the main key factors in ensuring safe and efficient navigation.

Through AIRBMP project, Myanmar is improving the basic infrastructure for inland waterway navigation and expanding to the night navigation to reduce the transport times and minimize the risk of grounding and collision and maximize the safe and trustworthy mode of transport.

From the point of safeguard perspective, from early on, DWIR consider the design with the least impacts on the natural and social environment sustainability in long term. In addition, Given the small size of the works, the nature of installation work and associated activity would not cause significant and unprecedented impacts on the natural environment. As discussed in the part 2 under the section 5, the potential impacts are localized, minor and temporary, no cumulative adverse impacts outside of the immediate vicinities of the sites are likely to occur. Only occupation and community health and safety are the major concern for the whole process of implementation. Therefore, PMU prepare the Code of Practice covering occupational and community health and safety, as well as public awareness campaign program to manage all related impacts of the Project.
Annex 1: Environmental, Social, Health and Safety Code of Practice

Best practice involves minimizing the impacts at and near the working. DWIR has adopted the Environmental Code of Practice for Installation of AtoNs and will be committed to continuous improvement through a quality management approach. The persons directly in charge of the proposed project will be the Site supervisor of DWIR Navigation Section.

- **Noise Reduction**

Noise can cause physical and psychological stress in both employees and riparian population. Noise may also disturb animals, but the extent of disturbance is difficult to estimate.

DWIR shall:

- ensure to locate noisy equipment away from the residential area
- ensure to use enclosed generators
- Limit operations to between 7 am and 6 pm if other noise mitigation measures are inadequate, and if the riparian community is complaining.

- **Occupational Health and Safety Control**

- During the installation, accident can happen and workers who are not trained, do not wear protective clothing or who are not prepared well are more vulnerable, and can become victims of accidents.

- **Directly related to the Work Force**

DWIR shall:

- Ensure that the engineers and assistants must be present in the project area at all times;
- Provide information and training session about labor risks to the workers;
- Prohibit use of illegal drugs/alcohol on board and onsite
- Assign the site engineer for any HSE problem that occurs must be solved and record;
- Provide personal protective equipment (PPE) to protect worker health and safety such as hardhat, goggles, gloves, insulated shoes, steel-toed boots, eyes protection glasses (for welders), toxic/dust face mask and enforce their use.
- Ensure the workers wear the adapted protection equipment and know how to use them.
- Place the safety rules on board clearly and explained to the workers. Regularly training session must be organized;
- Ensure that all equipment, vehicles operating in the site should be registered and have operational permits.
- Electricity plugs used outdoor need to be water-resistant and splash-proof;
- In case of heavy rain, difficult working conditions, bad visibility or an emergency situation, the operators will suspend all work.
• Related to the Vessel and Equipment

DWIR shall:

- Set up regular maintenance and repair schedules for equipment and implement as required;
- Regularly check technical and operational specifications of all machinery, both directly and indirectly taking part in activities;
- Ensure that any lifting equipment and cranes should be located on the ground with solid structure or on a floating system with sufficient pressure bearing capability, be stable and be anchored by a firm anchoring system.
- Ensure that transferring, handling and storage of equipment and supplies should be conducted carefully during assembling phase
- Use waterproof/outdoor plugs and lights;
- National certificates (safety construction, safety equipment, load lines, ship safety, safe manning, etc.) for inland waterway vessels for class, tonnage, construction and equipment must be on board and must be valid;
- Crew certificates must be on board and must be valid;
- Life-saving appliances (life buoys, life jackets, etc.) must be in a good state, sufficient quantity and accessible according to national regulations;
- Complete system of life-saving appliances must be fully checked before the operations;
- Fire-fighting equipment (fixed and portable fire extinguishers, fire hoses, fire hydrants, fire boxes, fire alarms, fire pumps, muster list, etc.) must be in a good state, sufficient quantity and accessible according to national regulations;
- Complete system of fire-fighting equipment must be fully checked before the operations;
- Where applicable have smoking requirements, "No smoking" signs, are posted and well known by crew.
- Ensure no slippery surfaces on deck and in the engine room;
- The lights on deck and in the engine room provide sufficient light for safely working on deck and in the engine room;
- Stairs, handrails or walkways are in satisfactory conditions;
- All manholes are fully bolted;
- Bilge in the engine room is not full and contains no or only small amounts of oil or sludge;
- There is evidence that bilges are **NOT** pumped overboard;
- There is a main fuel emergency stop;
- Emergency exits are clearly marked;
- The engine room alarm is available and in good working order
- Main and auxiliary machinery are satisfactory. Propulsion engines and generators are well maintained;
- Ensure Anchor winches and mooring ropes in good condition;
- Ensure general alarm of vessel is available and works properly;
- Ensure the vessel is equipped with an emergency steering device and instructions how to switch over from normal to emergency steering;
- Emergency Preparedness is there: musters, exercises, equipment ready in case of man-over board, fire, grounding, pollution, collision, abandon ship, etc.

- **Workers Safety Management**

  DWIR shall:

  - Executing hot works (like welding) must be planned in advance, with permission;
  - Ensure that electricity cables serving store area, assemble area and residential quarters must be located in appropriate locations, unaffected by working equipment. At working locations, ground wire and automatic circuit breakers must be installed. Electric cables must be sized to provide sufficient handling capacity. Joints of electric cables must be appropriately joined and sealed with insulated waterproof materials. Electric equipment must have signs, ground wire and appropriately shielded;
  - Ensure executing the hot work in enclosed spaces with special attention and proper PPE
  - Fire-fighting equipment (fixed and portable fire extinguishers, fire hoses, fire hydrants, fire boxes, fire alarms, fire pumps, muster list, etc.) must be in a good state, sufficient quantity and accessible according to national regulations;
  - Electricity plugs used outdoor need to be water-resistant and splash-proof;
  - Provide appropriate security personnel (police/home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area
  - Executing hot works (like welding) must be planned in advance, with permission;
  - Ensure executing the hot work in enclosed spaces with special attention and proper PPE
  - Ensure "No smoking" signs, are posted in the working area and store area and well known by worker

- **Workers Health Management**

  - Provide appropriate information and education to the workforce on basic personal hygiene;
  - Provide periodical health check to construction workers to ensure their health and well-being, and avoid possible transfer of disease including respiratory diseases such as tuberculosis, or STDs such as HIV/AIDS;
  - Before the operations, identify the local clinics to evacuate the victims to when accidents happen. Ensure a speedboat is close at hand to bring the victim to the shore.
  - Provide first aid facility round the clock. Maintain stock of medicines in the facility.
- Provide basic first aid services to the workers as well as emergency facilities for emergencies for work related accidents;
- Replace expired medicines and supplement new ones;
- Ensure there is plenty of drinking water, and of good quality, check every 2 days;
- Provide adequate sanitary facilities including bathrooms, toilets (with septic tank) for the workers at the working site and on board the dredgers;
- Include a Pest Control for the construction areas, including work site;

**Work Force and Workers Camp**

DWIR shall:

- Be encouraged to hire local labor to carry out simple manual works
- Not hire children of less than 15 years of age and ensure that identity verification mechanisms are in place to screen for children under age 15.
- Ensure that children working at the site between age 15 and 18 do not work on hazardous tasks.
- Register the temporary residence of the engineer and workers with the local authority;
- Whenever possible, rent houses nearby or suitable accommodations will be provided for the workforce. Workers' camps will be located at appropriate areas away from villages, and schools;
- Working site/areas shall be located to allow effective natural drainage;
- Provide potable water safe for human consumption at camps, site offices, and other areas;
- Provide a medical and first aid facilities and first aid boxes on boat;
- Not allow cutting of trees for any reason outside the site;
- Not allow hunting, fishing, wildlife capture;
- Not allow use of firearms (except authorized security guards);
- Not allow use of illegal drugs
- Not allow doing maintenance (change of oils and filters) of cars and equipment outside authorized areas:
- Not allow driving in an unsafe manner in local roads;

**Waste Management**

DWIR shall:

- Not allow disposing trash in unauthorized places;
- Encourage to segregate waste on site
- Ensure oil and grease waste such as diesel oil and gasoline are stored with the enclosed container properly and have warning signs;
- Post prohibition signs for waste disposal into the river;
- Provide enough garbage bins at various relevant locations on board and on site.
- Put oil drums to collect used oil and other harmful liquids and make provisions to limit the impact of (small) oil spills resulting from leaks;
- Dispose hazardous wastes in authorized disposal facilities;
- Domestic waste shall be transported to the approved refuse disposal site in covered containers or trucks;
- Metal waste could be collected by a contract buyer;
- Prohibit burning of solid waste and disposal to the river.
- Collect and transport wastes to the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route.
- Train and instruct all personnel in waste management practices and procedures.

- **Public Health and Safety Management**

  DWIR shall:

  - Dredgers shall be off-limits to non-workers, warning signs shall be conspicuously posted along the site periphery;
  - Disposal sites of dredged material shall be off-limits to people.
  - Provide the clear visible warning signs around the working area
  - Inform the working plan to the nearby community in advance
  - Provide the contact person and number to the nearby community for any complaints and suggestion
  - Avoid the access of heavy truck to the site during the rush hour.

- **Interaction with public and other river users**

  DWIR shall:

  - Maintain open communications with the local communities;
  - Disseminate project information to the communities (for example local authority, enterprises and affected households, etc.) through community meetings before the commencement;
  - Inform local residents about AtoNs installation, legal framework, ESMP including GRM and work schedules, interruption of services, traffic management routes as appropriate;
  - Provide a community relations contact from whom interested parties can receive information on the site activities;
  - Provide all information, especially technical findings, in a language that is understandable to the general public;
- Monitor community concerns and information requirements as the project progresses, and respond in a timely and accurate manner;

- Limit the working activities at night;

- Inform the community at least a week before the works starts if the installation work could cause disruption to existing infrastructure, resources or public services.

- Notify the users of river water for drinking, agriculture and aquaculture activities of the land surrounding the project site at least a week before installation and address any concerns to satisfy the requirements of supervision;

- **Interaction with Ongoing Shipping Activities**

  DWIR shall:

  - Place warning signs for speed limit, before and after the location and traffic adjustment;
  
  - Installation of signage for operations;
  
  - Carefully check the anchor system of floating equipment and vessels and signal systems such as floating beacons, signs, and signal lights both on the river and on shore;
  
  - Ensure that other vessels do not moor alongside the site works during the course of installation;
  
  - On the river side, appropriate signs and navigation aids should be placed to define the navigation channel area and ensure navigation safety. It is critical to keep vehicles or shipping from entering the working area, interfering with the activities.
  
  - Coordinate with the Inland Waterways Administration, provincial Ministries of Transport and relevant River Management Stations to ensure navigation safety in relevant areas of the river;
  
  - Ensure that shipping is not inadvertently diverted to non-navigable areas or involved in accidents;
  
  - Ensure that river traffic is controlled using buoys and lights to ensure vessels can operate safely;
  
  - Ensure that anchored vessels and other equipment do not impede passing vessels;
  
  - Ensure that the vessels must be located, with appropriate safety equipment according to current regulations and instructions.
  
  - Ensure that all barges to transport buoy, tug boats and other vessels related to the installation will be equipped with signal light while anchoring and moving on the river, pursuant to the rules and regulations;
  
  - Coordinate with Waterways police and River management stations to regulate traffic properly during the construction process. All vessels should strictly follow river traffic laws and regulations.
Annex-2: Complaints Record Form

Directorate of Water Resource and Improvement of River System
Ayeyarwady Integrated River Basin Management Project

Complaints Record Form

Reg No._______________________

Date of Complaint:________________________________________________________________

Complaint received by:____________________________________________________________

Complaint made via: □ Telephone
                      □ Letter (attached)
                      □ In person
                      □ Other (please specify)_____________________________

1. Description of concerns and unsatisfactory performance by the Project activities or executing team
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

2. Description of the harm that is, or may be resulting from the Project and/or the executing agency
(Provide any supporting evidence, documents and attachments, as appropriate)
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. List (if known) the relevant ESMP measures, standards, regulation and law or procedures the
Project failed to follow(Provide any supporting evidence, documents and attachments, as appropriate)
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

4. If the type of complaint is not valid in the above mention type
(please go to next page)
Subject of Complaint: ____________________________________________________________________

Name of Complainant: ____________________________________________________________________

Address: _______________________________________________________________________________
______________________________________________________________________________________

Phone number: _____________________

Detail of Complaint:

Comments by Complaint Receive Officer:

5 (Details of the complaint should be written on the next page. If there is insufficient space, attach extra sheets.)

6 if complaint is filled by a representative, please request the proof of representation
To be filled by DWIR Implementation and PMU C-3 Team

Outcome

Signed by____________________________   Date:_______________________________

If the complaint is pending for more than 14 working days or requiring the follow up measures, it shall be referred to Project Director:

List of Follow up Measures and Date of Action taken :
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Signed by___________________________________
Position:____________________________________
Closing Date:________________________________