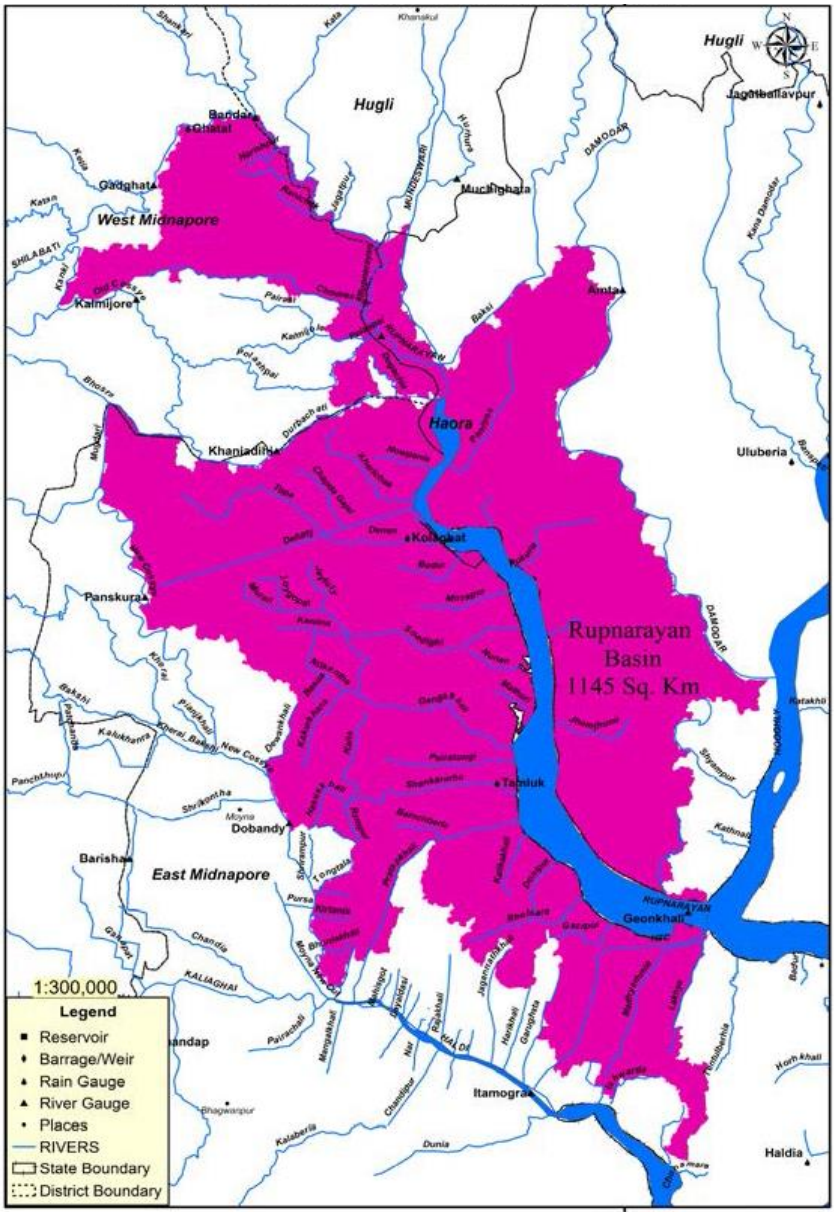
Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 86, Cluster-I: Rupnarayan River

FINAL FEASIBILTY REPORT



Inland Waterway Authority of India

Cluster – I : Rupnarayan River

Final Feasibility Report

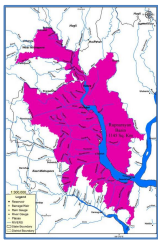
Revision - 0

November 2016

Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 86, Cluster-I: Rupnarayan River

FINAL FEASIBILITY REPORT

Project **IWAI Cluster-I, Rupnarayan River**
Owner **IWAI, Ministry of Shipping**
Consultant **Egis India Consulting Engineers**



Authors **Project Team :** Team Leader + 7-Experts **Technical Manager:** Ashish Khullar **Project Manager:** Akshat Singhal			**Project No:** PT/EIPTIWB003 **Report No:** PT/EIPTIWB003/2016/FR/005 **Approved by:** Dr. Jitendra K. Panigrahi		
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IWAI	Inland Waterways Authority of India
IWT	Inland Water Transportation
MOS	Ministry of Shipping
NW	National Waterway
DPR	Detailed Project Report
WW	Waterway
AtoN	Aid to Navigation
VC	Vertical Clearance
HC	Horizontal Clearance

ACKNOWLEDGEMENT

*Egis India Consulting Engineers Pvt Ltd (EIPL) express their gratitude to **Shri Amitabh Verma, IAS, Chairman,** for spending their valuable time and guidance for completing this Project of "Feasibility report of two stage detailed project report of National Waterway 86, Cluster – I, Rupnarayan River. EIPL would also like to thanks **Shri Pravir Pandey, Vice Chairman IA&AS**.*

*EIPL wishes to express their gratitude to **Cdr. P.K. Srivastava, Hydrographic Chief, IWAI** for his guidance and inspiration for this project. EIPL would also like to thank **Sh. Rajiv Singhal, A.H.S., IWAI** for their invaluable support and suggestions provided throughout the project duration. EIPL is pleased to place on record their sincere thanks to other staff and officers of IWAI for their excellent support and co-operation throughout the project duration.*

SALIENT FEATURES

<table>
<tr><th>S. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1.</td><td>Name of Consultant</td><td>Egis India Consulting Engineers Pvt. Ltd.</td></tr>
<tr><td>2.</td><td>Cluster number</td><td>Cluster I</td></tr>
<tr><td>3.</td><td>Waterway stretch
(from. To, total length)</td><td>Rupnarayan River (National Waterway No. 86)
(From confluence of Dwarakeswar and Silabati rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E to confluence with Hooghly river at Geonkhali Lat 22°12'41.58"N, Long 88° 3'13.99"E);
Total Length: 72 Km
(0.0 Km Chainage starts from Geonkhali)</td></tr>
<tr><td>4.</td><td>Navigability status</td><td></td></tr>
<tr><td>a)</td><td>Tidal & non tidal portions
(from ... to, length, average tidal variation)</td><td>Tidal portion: 0 – 72 Km
Non-tidal: Not Applicable
Tidal variation: 1.7 m</td></tr>
<tr><td>b)</td><td>LAD status w.r.t Chart Datum
Survey period (.. to ..)
< 1.0 m (km)
1.m to 1.5 m (km)
1.5 m to 2.0 m (km)
> 2.0 m (km)</td><td>
<table>
<tr><th></th><th>0 - 30 Km</th><th>30 – 60 Km</th><th>60 – 72 Km</th><th>Total (Km)</th></tr>
<tr><td>Survey Period</td><td colspan="4">7th Jan to 12th Jan 2016</td></tr>
<tr><td>< 1.0 m</td><td>11.42</td><td>12.40</td><td>1.49</td><td>25.30</td></tr>
<tr><td>1.m to 1.5 m (km)</td><td>6.01</td><td>6.27</td><td>2.02</td><td>14.31</td></tr>
<tr><td>1.5 m to 2.0 m (km)</td><td>6.87</td><td>4.17</td><td>3.08</td><td>14.12</td></tr>
<tr><td>> 2.0 m (km)</td><td>5.69</td><td>7.16</td><td>5.42</td><td>18.28</td></tr>
</table>
</td></tr>
</table>

S. No.	Particulars	Details
c)	**Cross structures** i) Dams, wires , barrages etc (number, with navigation locks or not). ii) Bridges, Power cables etc [number, HC (... to ...). VC (.. to ..)]	i) Dams, Weirs, Barrages, Locks = Not available ii) Bridges = 3 number, HC (80.0 m to 100 m), VC (8 m). iii) Power Cable = 3 number, VC (7 m to 15 m). *Vertical clearance is above MHWS on the basis of visual assessment.
d)	Avg. discharge and number of days in year	Not applicable. As the Rupnarayan waterway is tidal throughout its length.
e)	Slope (1 in ..)	Average slope of the waterway is 1 in 12,500
f)	Consultants inference	➢ The proposed national waterway of 72 km of Rupnarayan river is feasible for navigation ➢ The horizontal and vertical clearance of existing cross-structures is in the range of 8m – 10m and 8m respectively. ➢ Taking in to account the tide and discharge, the LAD of 1.5m is available for most of the sections of the River throughout the year. ➢ Considering the length of the river and availability of numerous minor and major industries 5km reach across the bank , the river has huge economic potential for Development of Waterway ➢ The waterway will be an alternated mode of connectivity to the existing Haldia Port. ➢ The waterway shall be used for coal transportation to Kolaghat thermal power plant. Kolaghat thermal plant is located about 2.5 Km from the waterway and thus the coal can be easily transported by conveyor belt directly from waterway to the site. ➢ Not only there is existing traffic but also the development of waterway will trigger new traffic. ➢ Connection with NW-1 gives an additional advantage to Rupnarayan waterway in terms of traffic potential and commercial benefits.

S. No.	Particulars	Details
5.	**Traffic potential**	
a)	Present IWT operations, ferry services, tourism, cargo, if any	Localised organised passenger ferry services are available for full length of the waterway. Small cargo vessels carrying fishes, vegetables, agricultural products, bricks, tiles etc, are also located along the waterway.
b)	Important industries within 50 km	Kolaghat Thermal Power Plant. (located about 2.5 Km from the waterway)
6.	Consultant's recommendation for going ahead with Stage-II (DPR preparation)	Rupnarayan waterway is recommended for Stage – II DPR preparation in view of the following potential advantages: a) Connectivity of Kolaghat Thermal Power Plant with Rupnarayan waterway. b) Connectivity with a Haldia Port and Kolkata Port. c) Connectivity with Indo Bangladesh Protocol Route d) Increasing cargo potential. e) Reduction in existing traffic load on rail and road infrastructure. In view of the above, it is recommended to develop the Rupnarayan waterway for large Cargo and Passenger ferry services.

1.0 CONTEXT

IWAI, Ministry of Shipping, Government of India is exploring the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. Upon completion of feasibility study, IWAI will select the stretches having potential for navigation to undertake a Detailed Project Report. The DPR stage would include detailed hydro-graphic surveys and investigation, traffic survey, proposed location for terminals and cost assessment etc.

There are 106 new waterways has been identified and declared as national waterways as per "The National Waterway Act, 2016", No. 17 of 2016, published in the Gazette of India, Part – II- Section 1 no. 18, New Delhi, Saturday, March 26/2016/Chaitra 6, 1938 (Saka), by Ministry of Law and Justice (Legislative Department).

Out of these 106 waterways, IWAI had invited international online bids for preparation of 2 stage Detailed Project Report (DPR) for National waterways, in a set of 8 Clusters from Cluster I to VIII through Tender No. IWAI/PR/40NW/2015. Egis Consulting Engineers was awarded the work for Cluster I and Cluster III respectively.

This feasibility report provides the technical viability of throughout the year inland navigation in the waterways, by taking into constraints and other functions of the rivers/canals such as water conveyance, tidal effects, floods, draughts, existing structures etc.

As stated above, 7 rivers out of 106 national waterways are clubbed in Cluster – I of two stages DPR studies for National waterways project. The detail descriptions of these 7 waterways are presented in **Table 1**. The total length of stretches of 7 rivers under Cluster – I is 820 km. Among these 7 waterways, 5 waterways are connected to the National Waterway 1 between Farakka to Haldia.

Table 1: National Waterways of Cluster – 1 (As per TOR)

S. No	River	National Waterway No.	Length (km)	Description
1.	Ajoy River	National Waterway 7	96	From Bridge on Morgram-Panagarh State Highway No 14 at Illambazar Lat 23°36'56.10"N, Long 87°31'58.07"E to confluence of river Ajay with river Bhagirathi at Katwa Lat 23°39'23.33"N, Long 88° 7'56.72"E
2.	Damodar River	National Waterway 29	130	From Krishak Setu, Bardhman on State Highway No 8 at Lat 23°12'39.83"N, Long 87°50'53.85"E to confluence with Hooghly river near Purbba Basudebpur at Lat 22°21'0.58"N, Long 88° 5'19.31"E
3.	Dwarekeswar River	National Waterway 35	113	From Bridge near Abantika Lat 23° 6'54.76"N, Long 87°18'46.99"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
4.	Ichamati River	National Waterway 44	64	From Bridge on Border Main Road at Gobra near Bangladesh Border at Lat 22°53'49.64"N, Long 88°53'48.87"E to near Bangladesh Border at Bansjhari Mallikpur Lat 22°39'6.71"N, Long 88°55'35.35"E.
5.	Rupnarayan River	National Waterway 86	72	From confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E to confluence with Hooghly river at Geonkhali Lat 22°12'41.58"N, Long 88° 3'13.99"E
6.	Silabati River	National Waterway 92	26	From Barrage near Shimulia village at Lat 22°34'53.20"N, Long 87°38'30.54"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
7.	Subarnrekha River	National Waterway 96	314	From Chandil Dam at Lat 22°58'29.39"N, Long 86° 1'14.03"E to confluence with Bay of Bengal at Lat 21°33'28.75"N, Long 87°22'58.60"E.

The detailed layout plan of the above waterways is shown in Drawing No. PT/EIPTIWB003/2016/FR/0001 and provided in **Figure 1**.

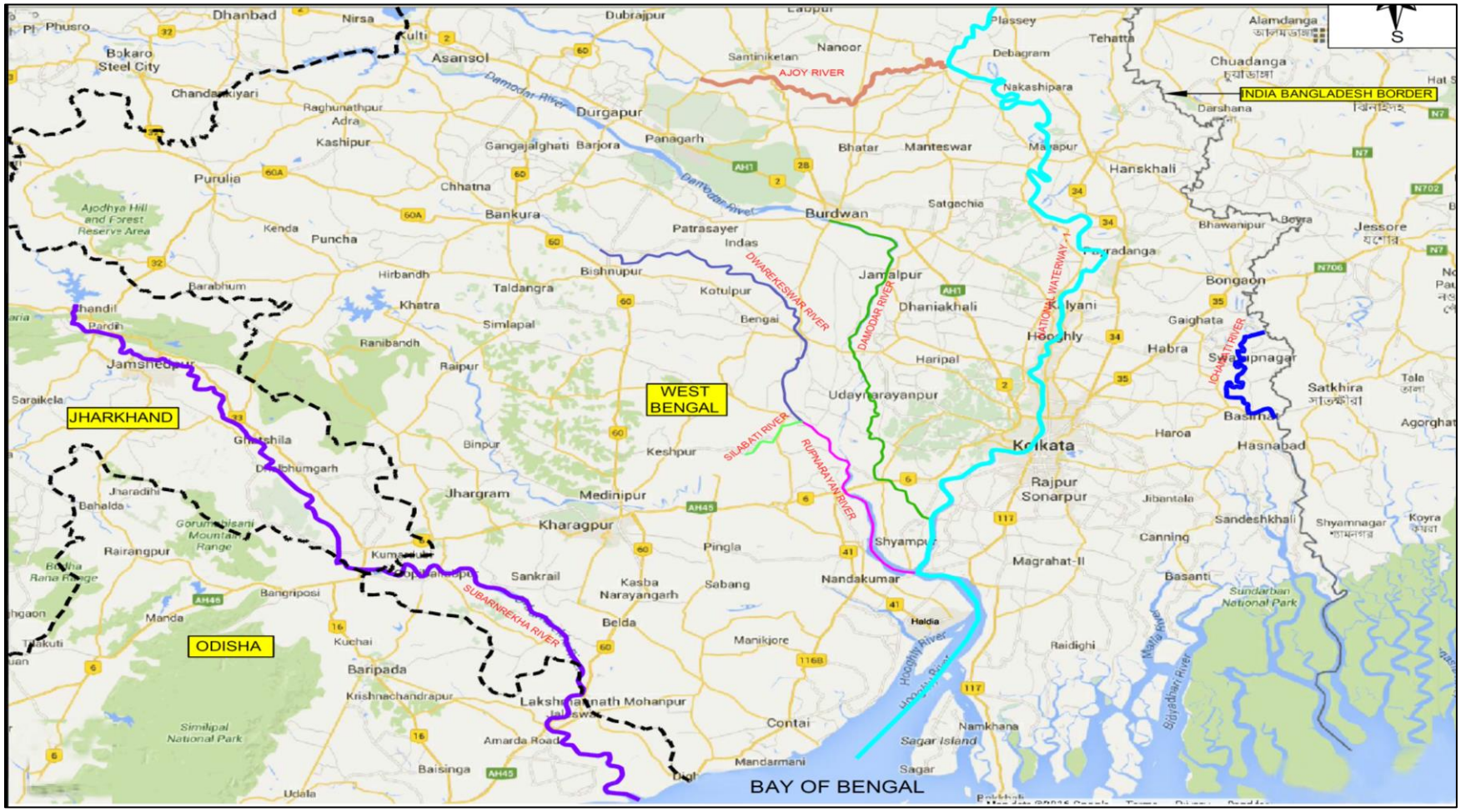


Figure 1: Layout Map of Cluster 1 National Waterways

2.0 OBJECTIVE

Government of India intends to explore the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. The whole of study comprises of two stages, feasibility and DPR as Stage-I and Stage-II as presented below:

Stage-1

1A. Reconnaissance Survey

1B. Collection and review of available data

1C. Feasibility Report

Stage-2

2A. Hydrographic Survey & hydro-morphological survey

2B. Traffic Survey & Techno economic feasibility

2C. Preparation of Detailed Project Report

The current scope for stage-I is executed as per following framework as per **Figure 2** .

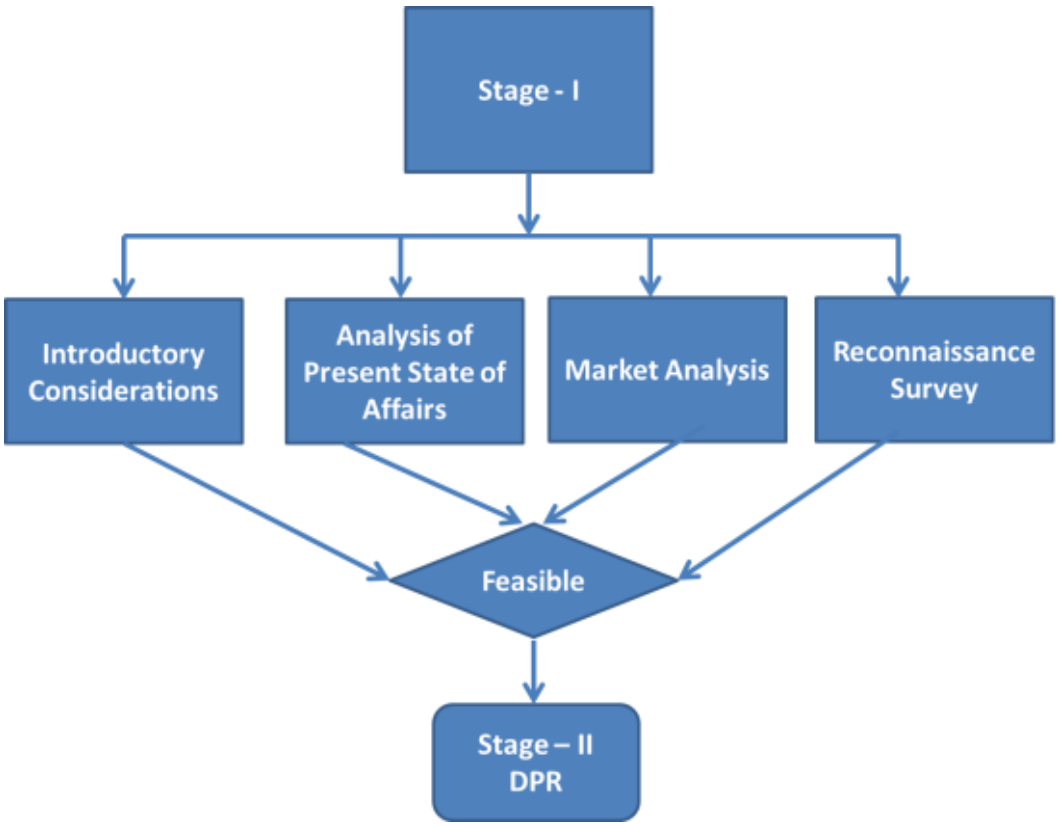


Figure 2: Framework of Studies

3.0 REPORT STRUCTURE

This report comprises of Feasibility Study for Rupnarayan River (Length- 72 Km). The report is arranged in following main chapters,

I. **Introductory Consideration**: This section comprises of,

1) Name of the river/canal;
2) Length of the river/canal;
3) State/ District through which river passes;
4) Map;
5) Characteristics of River;
   a. River Course: Background/Historical information, Origin, End
   b. Tributaries/ Network of Rivers/ Basin
6) Methodology Adopted to undertake the Study;
   a. Primary Data
   b. Secondary Data

II. **Analysis of Present State of Affairs**: This section comprises of,

1) Existing Dams, Barrages and Locks;
2) Existing Bridges and Crossings over River;
3) Other Cross structures, High Tension Lines, pipe-lines, cables;
4) Hindrances/ Encroachment to the Waterway;
5) Details of Protected Area- Wildlife, Defence;
6) NH/SH/MDR along and/or in vicinity;
7) Railway Line and Stations in the vicinity.

III. **Reconnaissance Survey**: This section provides the,

1) Methodology adopted including resources and equipment;
2) Description of Bench marks, reference levels, chart and sounding datum;
3) Details of collected water levels, discharge data, HFL and FSL;
4) Details and description of bathymetric and topographic survey including observations;
5) Detail about Soil, Water and Bank characteristics.

IV. **Market Analysis**: This section comprises of,

1) Land use pattern along Waterway;
2) Crop/Agriculture in the region;

3) Availability of Bulk/Construction Material;
4) Existing industries along waterway;
5) Details of existing Jetties and Terminals;
6) Preliminary traffic identified;
7) Existing cargo movement;
8) Prominent City/ Town/ Places of worship/ Historical places for tourism;
9) Availability of passenger ferry services;
10) Available and probable water sport/recreational facilities.

V. **Observation and Inferences**: This section comprises of,
1) Observation on Waterway, Length, LAD, Cross-Structures;
2) Water availability for different periods and depths;
3) Cargo/Passenger/Tourism/RO-RO facility;
4) Suitability of waterway for navigation;
5) Proposed alternative methods for making waterway feasible;
6) SWOT analysis;
7) Way forward for Stage – 2 DPR studies.

In addition to the above, following digital data and charts shall also be submitted along with this report:

I. **Bathymetric Survey**: Hypack software output files with RAW, EDIT, SORT, TIDE extensions;
II. **Topographic Survey**: csv and xyz extension files;
III. **Survey Charts**: Geo-coded dxf and dwg files in scale as per width in AutoCAD formats;

4.0 INTRODUCTORY CONSIDERATIONS

The Consultant discussed here, the introductory considerations for feasibility and the scope of the assignment in subsequent phase of DPR for feasible stretches.

The present feasibility report provides the technical feasibility of Rupnarayan River, declared as National Waterway 86, clubbed under Cluster – I, as stated in earlier sections. The detail description of the waterway analysed in this feasibility report are described in subsequent paragraphs.

4.1 DETAILS OF NATIONAL WATERWAY 86 (RUPNARAYAN RIVER)

Details of the waterways are as follows:

Table 2: Description of Rivers/ Canals

Sl. No	Name of the River/Canal	Local Name	Length of waterway (km)	State/District through which river passes
1.	Rupnarayan River	Rupnarayan River	72	**State: West Bengal** *Hooghly District,* *Paschim Medinipur District,* *Purba Medinipur District,* *Howrah District*

4.2 CHARACTERISTICS OF RUPNARAYAN RIVER

Characteristics of Rupnarayan River considered for waterway is described in subsequent paragraph.

River Course: The Rupnarayan River begins at the Dhaleswari in the Chhota Nagpur plateau foothills northeast of the town of Purulia. It then follows a tortuous southeasterly course past the town of Bankura, where it is known as the Dwarakeswar River. Near the town of Ghatal it is joined by the Shilabati River, where it takes the name Rupnarayan. Finally, it joins the Hoogli River.

Catchment Area: The total catchments area of the Rupnarayan river system is 1145 Sq. Kms.

Tributaries: Shilabati, Dwarakeswar, Mundeswari, Durbachati and Jamuna are the main tributaries of Rupnarayan river system.

The section of the Rupnarayan River under feasibility study for inland waterway is presented in Drawing No. PT/EIPTIWB003/2016/FR/0006A and is also presented as **Figure 3**. The detail layout maps of the waterway are shown in Drawing No. PT/EIPTIWB003/2016/FR/0006.

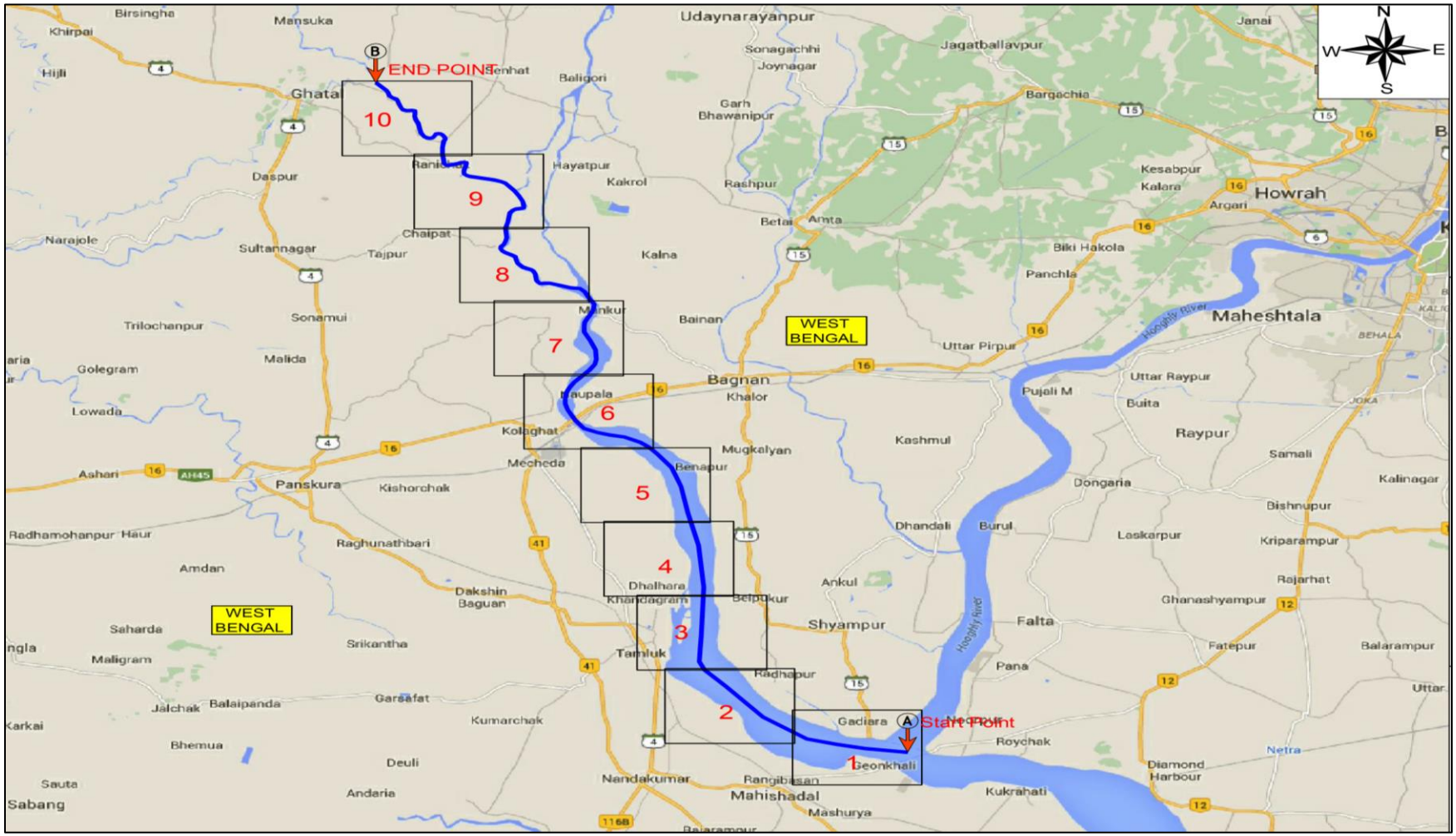


Figure 3: Layout Map of Rupnarayan River Waterway

4.3 METHODOLOGY ADOPTED TO UNDERTAKE STUDY

A detail description on Feasibility & DPR methodology and the expected outcome in fulfilling the assignment is presented.

The feasibility study shall be carried out in accordance with TOR in the following steps:

a) Conducting Reconnaissance survey as detailed in Chapter 5.
b) Collection and review of available primary and secondary data as detailed in Chapter 6 and 7.

On the basis of detailed analysis of collected primary and secondary data, throughout the year navigability potential of the waterway is assessed and submitted in the feasibility report.

4.3.1 Classification of Waterways

The classification of waterways by Inland Waterway Authority of India is discussed below and shall be adopted in the study.

1. The waterways shall be classified in the following categories for safe plying of self-propelled vessels up to 2000 tonne Dead Weight Tonnage (DWT) and tug-barge formation in push-tow units of carrying capacity up to 8000 tonne, namely:

a. **Class I** - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 1.2 meter depth, 30 meter bottom width, 300 meter bend radius, 4 meter vertical clearance and 30 meter horizontal clearance between piers, and

ii. Canals: Minimum of 1.5 meter depth, 20 meter bottom width, 300 meter bends radius, 4 meter vertical clearance and 20 meter horizontal clearance between piers.

b. **Class II -** Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 1.4 meter depth, 40 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 40 meter horizontal clearance between piers, and

ii. Canals: Minimum of 1.8 meter depth, 30 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 30 meter horizontal clearance between piers.

c. **Class III -** Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 1.7 meter depth, 50 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 50 meter horizontal clearance between piers, and

ii. Canals: Minimum of 2.2 meter depth, 40 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 40 meter horizontal clearance between piers.

d. **Class IV -** Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.0 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers, and

ii. Canals: Minimum of 2.5 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers.

e. **Class V** - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.0 meter depth, 80 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

f. **Class VI** - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.75 meter depth, 80 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers, and

ii. Canals: Minimum of 3.5 meter depth, 60 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 60 meter horizontal clearance between piers.

g. **Class VII** -Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.75 meter and above depth, 100 meter and above bottom width, 900 meter bends radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

2. Vertical clearance for power cables or telephone lines or cables for any transmission purpose for all the classes of waterways mentioned above shall be as follows:

a. Low voltage transmission lines including telephone lines - 16.5 meters

b. High voltage transmission lines, not exceeding 110 kilo volt - 19.0 meters

c. High voltage transmission line, exceeding 110 kilo volt - 19.0 meters

+1 cm extra for each additional kilovolt

3. In case of underwater pipelines, power cables and other cables, norms to be followed shall be decided as per the site conditions and navigational requirement.

Provided that this classification shall be effective for:

a. Minimum depth of channel should normally be available for about 330 days of the year.
b. Vertical clearance at cross structure over the waterway should be available at least in central 75% portion of each of the spans in entire width of the waterway.

Reference level for vertical clearance in different types of channel shall be:

a. For rivers, over Navigational High Flood Level (NHFL), this is the highest flood level at a frequency of 5% in any year over a period of last twenty years.
b. For tidal canals, over the highest high water level.
c. For other canals, over designed full supply level.

4.3.2 Measures to Improve the Depth

The basic parameters considered for the fairway design are:

- Depth
- Width
- Side slopes
- Bends

As explained above, as the classification of waterways in India is based on the experience gained in various waterways, the characteristic features of the design waterways based on studies carried out by IWAI are furnished below and the same shall be followed.

Fairway Design

The fairway depth should be good enough to ensure steerability of the vessel and to prevent bottom feel. To meet this requirement, the minimum depth that is needed in a channel would commonly be the sum of the draught (draft) of the vessel and other tolerance factors. The tolerance factors to be considered are listed as:

- Factor of keel clearance to avoid touching of the vessel to the ground and minimum free water below the keel for maintaining control on manoeuvring,
- Wave tolerance for the heaving and pitching of the vessel due to wave motion,
- Squat, increase of draft due to ship motion,
- Tolerance for siltation and dredging,
- Increase of draught due to trim and heaving due to unequal loading and steering manoeuvre respectively, and
- Tolerance for the change of draught during the transition from salt water to fresh water.

The keel clearance factor is the prime concern of the all tolerance factors considered. As per the standards laid down by German Code of practice (EAU 80), a 0.3 m layer of water column below the keel of the loaded ship is sufficient for free manoeuvrability of the vessel.

IWAI's experience in inland waterways in India and sub-continent (Bangladesh and Myanmar) shows that the under keel clearance for free manoeuvrability of the vessel varies between 0.2 and 0.5 m depending upon the soil characteristics of the channel bed and other parameters.

Width of a Channel

The total width of a navigation waterway (W) in general is expressed in terms of a beam of a vessel (B). The design width for the proposed two-way navigation can be obtained as:

$$W = BM + BM1 + C + 2C1$$

Where: W = Navigation channel width for two-way navigation.

BM = Maneuvering zone for the design vessel which takes into account the directional stability of vessel.

BM1 = Maneuvering zone for the upcoming vessel which takes into account the directional stability of vessel.

C = Width of separating zone.

C1 = Width of the security area, between the maneuvering zone and the channel side which is accounted for environmental and human factors including bank suction.

Values recommended by various authorities for the above equation vary within wide limits. Some of the recommended values are presented here:

BM = 1.3 B to 3.0 B

BM = BM1

C = 0.5 B to 1.0 B

C1 = 0.3 B to 1.5 B

Where, B = Beam of a design vessel.

Based on the experience and recommendations of experts on Inland Waterways, the factors considered for the present design are:

BM = 1.8 B

BM = BM1

C = 0.5 B

C1 = 0.5 B

The designed channel width = 1.8B+1.8B+0.5B+2x0.5B for two way navigation at draft level = 5.1B. The bottom width of the channel for two-way navigation for the design vessel can generally be considered as 5 x B.

Slopes

The selection of slope is in accordance with the soil characteristics of the bed and banks, width of the waterway etc. The adopted channel slope shall be 1:5

Width Allowance at Bends

In bends, the width of the fairway should be more than the width of the canal that is designed for a straight reach to allow for a drift of the vessel in a curved portion of the waterway. It means that the vessel occupies a greater width in bends than in a straight stretch of the waterway. The drift of the vessel depends on the radius of the bend, the speed of the vessel, wind forces, the flow pattern and the loading of the vessel. The drift angle is larger for vessels traveling in the downstream than the upstream direction. The drift angle is inversely proportional to the bend radius 'R', that is, the larger the radius the smaller the value of drift angle. Unloaded ships normally subjected to more drift and consequently take up a greater width in bends than loaded ships and therefore the proposed allowance at the keel level of the unloaded ships is larger than the loaded ships.

Dredging of Navigational Channel

The dredging quantities for the above design channel shall be worked out based on the bathymetric surveys carried out. The system and different type of navigation marks shall be proposed in the DPR are given as follows:

- Lateral marks, to mark the left and right sides of the navigation route to be followed by navigator;
- Bifurcation marks, to mark the middle ground between the navigation channel, bifurcated channel and isolated dangers in the middle of the navigational channel;
- Shore marks;
- Bank wise marks, to indicate the channel at point where it approaches a bank;
- Crossing marks, to indicated crossing and alignment of the channel from one bank to another;
- Marks of prohibited areas, to indicate no permission of entry;
- Sound signal marks, to indicate use of horning or other sound signals;
- Marks for traffic control, to control up bound or down bound vessel in one way or sequence passage or to prohibit navigation;
- Marks on bridges, to indicate the passage through bridges;
- Depth indicator marks, to indicate shallow areas ahead in the navigation channel;
- Width indicator marks, to indicate the narrow stretches ahead in the navigational channel;
- River training marks, to indicate the ongoing river training works in the river to the navigators.

4.3.3 IWT Terminal Planning

The terminal planning and design includes selection of suitable sites in the vicinity of cargo potential considering all the relevant technical variables such as choosing the type of berthing facility and providing of covered/open storage facility, cargo handling systems and other ancillary facilities required for efficient terminal operation. Based on the projected traffic, the selection of various facilities shall be planned. The cost estimate including capital and operating costs shall be estimated for each of the proposed system considering the design. These above aspects are briefly explained in the following subsequent sections.

Planning Considerations

The terminal facilities proposed for this project shall include the following:

i) Berthing Facilities for vessels;
ii) Cargo Storage Facilities;
iii) Cargo Handling Facilities;
iv) Other ancillary Facilities.

Terminal Facilities

The type of cargo handling system required at the terminal is generally dependent on the type of cargo, the annual volume required to be handled and the size of the vessels.

The various type of cargo foreseen to be handled at the proposed IWT Terminals are primarily grouped into:

i) Incoming Cargo, and
ii) Outgoing Cargo.

These above two groups are further subdivided into bulk, bagged and other miscellaneous general cargo for the purpose of planning the cargo handling equipment. The quantum and other cargo compositions shall be based on the traffic study. The same may be classified as below:

- Bulk Cargo - Construction materials such as Sand, stone, bricks, Marble, Iron steel, Machinery – Light, Heavy and ODC, Mineral Ore such as coal, lime stone, iron, fly ash, copper ore etc., bamboo, etc.
- Bagged Cargo - Cement, Fertilizer, wine and beverages, acids, cereals, cash crops, wheat, rice, Bajra, gram, pulses, cotton, etc.
- Misc. General Cargo – Consumer goods, animals, oil cake, edible oil, refined oil, paper products, jute products, etc
- Ferry – Passenger vessels for Tourists

4.3.4 Identification of IWT Terminals

Site selection is the most important as it decides the investment for establishing the terminal facilities. Hence, proper consideration has to be given to select the most optimum location which will minimise the capital investment and other recurring cost during operation. The selection of suitable site shall be carried out with the view of following considerations:

- Water availability near the terminal land throughout the year especially during lean season;
- Stable river channel with sufficient depth;
- Favourable hydraulic conditions for berthing and cargo handling;
- Availability of terminal land for infrastructure, cargo storage and handling;
- Traffic potential and cargo characteristics; and
- Navigational safety.

The proposed IWT Terminals shall be planned with the following infrastructure facilities for operation:

i) Steel Gangway resting on a floating pontoon. The detailed engineering & design of gangway arrangement shall be carried out during the construction stage. The preliminary layout drawing shall be proposed in the DPR;
ii) Administration Building and Bank protection arrangement;
iii) Covered Storage Shed/Transit Shed;
iv) Open storage area;
v) Security Shed;
vi) Forklift Trucks, Pay loaders & Dumper tracks; and
vii) Weigh Bridge, Watch and ward, Compound wall, Firefighting arrangement, Electrical & PH Facilities including DG.

The terminal shall be proposed with suitable mooring facilities, firefighting water line, water supply pipeline, power line for shore connection to barges, fenders etc. Preliminary planning and master plan shall be prepared in the DPR stage as per the relevant IS codes. It is envisaged and proposed that to the extent possible, all shore/river bank based buildings / godown are prefabricated, pre-engineered type conforming to the best standards in vogue in logistic / supply chain industry.

Other Alternatives to Improve for Navigation

Based on our earlier study for Ganga River between the reach from Allahabad to Ghazipur, there are many methods available to improve river navigation. Bandalling work – it has to follow closely falling stage of river, closing minor channels and diverting river flow in single channel to increase depth in the navigable channel in mainly due done by bandalling. In some reaches this method becomes successful but some river stretches remain shallow and need other training measures including dredging. Channelization of river and Construction of barrages at suitable locations, creating ponding conditions with required depth and navigational locks for ships and vessel movement shall be studied. The examination of various options/measures to improve the water depth shall be studied. The most suitable method for development shall be identified with consideration on the likely morphological, sediment transport, and dredging aspects of different options. This task is expected to be fed back into from the financial and economic analysis providing refinement to the proposed development until a recommended solution is reached. The most appropriate type of river development including drudging option along the river shall be identified and likely impacts of these developments on river flow depths as well as sedimentation and morphology shall be investigated. This analysis will constitute an iterative process in which problems relating to LAD will be addressed to find more successful solutions where necessary. This will however, not be an open-ended process as the

assessment of techno-economic feasibility updation only requires an indication of the likely costs of building and maintaining the structures which are shown to support achievement of LAD as intended.

4.3.5 Rapid EIA

Suitable Rapid Environmental Impact Assessment shall be performed and report shall be included in final DPR. The Rapid EIA Studies can be broadly divided in to three phases.

- The first phase involves identification of significant environmental components in the area where the project is located and assessing their baseline (pre-project or existing) status within the study zone. In case of existing projects, environmental performance of existing manufacturing / pollution control plants is also required to be covered.
- The second phase involves prediction of impacts on various identified significant environmental parameters due to proposed project.
- The third phase includes the evaluation of final impacts and delineation of an Environmental Management Plan to mitigate adverse impacts on the quality of surrounding environment.

4.3.6 Concept Design and Cost Estimates

Preliminary Design shall be performed for all the structures /developmental works proposed as per the above analysis and mathematical model studies carried out conforming to relevant IS Codes. Design drawings shall be prepared and submitted based on the preliminary design. Bill of quantities and cost estimates shall be prepared for all the proposed structures / developmental works. Based on the cargo potential and other considerations necessary for locating an IWT terminal, extent of land required for setting up of IWT terminals and other suitable locations shall be identified. Preliminary topographic survey shall be carried out and layout plan for all suggested locations shall be prepared clearly indicating all facilities e.g. jetty, approach to jetty, bank protection, covered and open storage, roads, office, sentry hut, boundary wall, bank protection, bunkering facility, water facility, turning circle for IWT vessels location of depth contours of 2m and 2.5m in the river near the terminal sites. Preliminary engineering design and drawings for setting up of terminals with related facilities including mechanical loading/ unloading at the proposed sites shall be prepared. Also inter modal cargo transfer facilities required at these terminals shall be indicated.

4.3.7 Financial and Economic Analysis

Financial and economic analysis through FIRR and EIRR of the project including SWOT analysis shall be carried out for the project. For the Financial Internal Rate of Return shall be computed as follows:

- Costs shall be calculated as total capital investment for the Project components, net rate of interest charges during construction and operations & maintenance costs for the Project;
- Income flows shall be calculated based on gross revenues of projected goods to be transported through private operators with permissible assumptions such as project life etc.;
- Economic Internal Rate of Return shall be computed taking into account the following factors;
- The assumed life of the project as per norms;
- Costs shall be calculated as Government contribution and other sources. A standard conversion factor shall be used to reduce financial costs to economic costs;
- Benefits shall be estimated as Government revenues, calculated as net profit share, royalties and tax;
- Social Benefits like fuel saving, reduction in environment pollution and carbon emission, accident reduction, decongestion of rail and roads, etc.

The financial viability and sustainability of this project depend upon the adaptation to the prevailing context in which they operate. In working out the Financial Viability and sustainability, the following factors shall be considered.

- budgeting and cost accounting systems,
- resource mobilization for capital investments,
- cost recovery and operational financing,
- cost reduction and control.

The Profitability projections and financial analysis for each of the project components shall be worked out in detail and presented in the report. The financial statements shall be prepared on the basis of the suitable assumptions. The cost benefit analysis for the proposed project shall be calculated. The Net Present Value (NPV) with interest and depreciation, IRR and preliminary expenses shall be suitably considered and estimated. Break-even analysis shall be performed and presented in the report.

4.3.8 Implementation & Monitoring Mechanism

Project financial structuring shall be worked out in detail which will examine the sources and composition of funding for the project. The Project financial structuring can involve a combination of equity, grant, debt and finance from private participation (and in some cases, contribution from user communities). The scope and options for possible debt and private sector financing shall be reviewed elaborately and presented in the report. The suitable monitoring mechanism shall be evolved.

5.0 COLLECTION AND REVIEW OF DATA

5.1 PRIMARY DATA

In order to collect primary data and to access the latest hydro-morphological condition of the waterways, reconnaissance survey was done. Following aspects had been covered in the reconnaissance survey as per TOR:

a) Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System. Bathymetric surveys in the waterways are to be carried out in the deepest route. Deepest route can be accessed by taking two or three longitudinal line soundings at equal interval. Topographic survey, if required, is to be taken up at lowest ground levels, which can be decided on visual assessment.

b) Details (horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be collected and indicated on the chart and also included in the report along with their co-ordinates and location. Details about Barrages, Dams, Locks en-route are also to be collected horizontal and vertical clearance is to be given as approximate on visual assessment.

c) Photographs are required to be submitted in the report.

d) Topographical features of the Inland Waterways.

e) Typical physical features along the alignment i.e. land use pattern:

f) Preliminary identification of stretches having year round flow and critical depth for navigational purpose.

g) Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location), urban areas (location extent). Geologically sensitive areas environmental features. Hydrological features

h) Critical areas requiring detailed investigations and

i) Requirements for carrying out supplementary investigations

j) Soil (textural classifications) (only visual inspection at every 10km) and drainage conditions.

k) Type and extent of existing utility services along the alignment.

All the above details are collected during field survey as well as by interaction with the concerned authorities from 7th January 2016 to 12th January 2016 by the consultant.

5.2 REVIEW OF SECONDARY DATA

Location and its Catchment: The Rupnarayan river and its tributaries lie within the latitude of 23.49 N and 22.29 N and longitudes of 86.69 E and 87.92 E. The Rupnarayan River is a river in eastern India. It begins as the Dhaleswari (Dhalkisor) in the Chhota Nagpur Plateau foothills northeast of the town of Purulia. It then follows as a tortuous south-easterly course past the town of Bankura, where it is known as Dwarkeshwar River. Near the town of Ghatsila, the Silai join it, where it takes the name of Rupnarayan and finally it joins the River Hooghly. The Rupnarayan is famous for the Hilsa fish that breed in it and used widely in Bengali cuisine. It is also distinguished for the West Bengal Power Development Corporation Limited (WBPDCL) thermal power plant located at Kolkaghat.

The Rupnarayan river network are bordered by Hooghly district in the East, Purulia and Bankura in the West and East, West Midnapore district in the south and Bardhaman district in the North. The detail of its catchment is follows:

Sl. No.	Name of River	Catchment Area (Sq. Km)	
		Total	West Bengal
1	Rupnarayan	1145	1145

Source: Annual Flood Report 2014

Rupnarayan River is a combination of number of streams. The tidal reach below confluence of Dwarakeswar and Shilabati Rivers is known as Rupnarayan. It outfalls into Hooghly near Geonkhali of Purba Medinipur (Gadiara of Howrah) after receiving main flow of Damodar through Mundeswari and that of Kangsabati though Durbachaty and Polashpai rivers. Apart from those, there are various local drainage channels and khals which directly outfall into Rupnarayan from its both banks in the district of Purba Medinipur (Chandreswar, Dehaty, Soadighi, Shankrara, Pratapkhali etc.) and Howrah (Bakshi khal). The river is tidal throughout its entire course. The catchment area of this Sub-basin is 9,525 sq.km (catchment area of Silabati 4088 sq.km + Dwarakeswar 4292 sq.km + Rupnarayan 1145 sq.km). Two gauge station are located on Rupnarayan River in Paschim Medinipur district as given below:

Sl. No.	Gauge Station	District	Danger Level (DL) (m amsl)	Extreme Danger Level (EDL) (m amsl)
1	Bandar	Paschim Medinipur	6.850	7.460
2	Gopiganj		5.030	5.650

Source: Annual Flood Report 2014
DL is considered as HFL for assessing the Minimum Vertical Clearance

Significance of the River: Rupnarayan River is an important source of fishing in West Bengal and is one of the major sources of the famous Hilsa fish which is used as a delicacy in Bengali cuisine. The West Bengal Power Development Corporation also hosts a thermal power plant on the banks of this river in Kolaghat. Most of the people inhabiting this river basin depend on agriculture for their source of livelihood. At the confluence of the Rupnarayan River with the Hoogly River, several industries like chemical and oil factories are located on the banks of this river.

Geography, Habitat and Eco-system: The Rupnarayan River flows through primarily three types of topography the Purulia High Plains in its upper reaches, the Rarh Upland in its middle reaches and finally the riverine deltaic region in its lower course. The Rupnarayan River basin usually receives regular and heavy rainfall over a large section of its course with the exception of the Dwarakeswar River which receives scanty rainfall even during the monsoons. The Rupnarayan River flows through large areas of densely populated lands and agricultural fields with very little surviving native vegetation.

Geomorphological Features: The Physiographic zones through which Rupnarayan and its tributaries has flowed includes the Purulia High Plains, The Rarh Upland and the Riverine Delta.

Meteorological Characteristics: The entire basins of Rupnarayan fall within the sub humid west. Heavy and regular rainfall is observed in the Rupnarayan basin though in the banks of Dwarakeswar, the climate is dry and occasional rainfall is received even during the monsoon season.

Industrial Status: In Bankura and Purulia, due top presence of fireclay, pottery industry makes the livelihood of the people. Haldia is centre of industrial activities with its chemical and oil factories are situated on the banks of River Hooghly near the confluence point of the Rupnarayan and Damodar with Hooghly. Midnapur district is also popular for its textile and paper and in Ghatal, the controlling centre of East Midnapur and the junction point of River Salai and Rupnarayan is famous for tin and bronze industries. Arambagh, the head office of the Hooghly is famous for poultries and paper industries. Besides these, rubber industry is found in some pockets of the catchment.

Agricultural Status: Most of the people living in the banks of Rupnarayan basin depend upon agriculture for their livelihood. Kharif and Rabi, both types of crops are cultivated along with the bittle tree cultivation. The East and West Midnapur are famous for their Bittle Industries.

6.0 ANALYSIS OF PRESENT STATE OF AFFAIRS

6.1 EXISTING DAMS, BARRAGE & LOCKS

There are no dams, barrage and locks exist along the study area of Rupnarayan River

6.2 EXISTING BRIDGES OVER RUPNARAYAN RIVER

The existing bridges and crossings encountered during survey are listed in **Table 3.**

Table 3: Details of existing Major Road and Rail bridges over Rupnarayan River

Sl. No	Location	Chainage (km)	Easting	Northing	Vertical Clearance w.r.t. MHWS	Horizontal Clearance b/w piers
Major Road Bridges						
1	Kolaghat	34.7	590811.40	2481820.00	8.00 M	100.00 M
Rail Bridges						
1	Kolaghat	34.4	591046.20	2481643.00	8.00 M	80.00 M
2	Kolaghat	34.3	591202.30	2481523.00	8.00 M	80.00 M

Vertical Clearances are on the basis of visual assessment s per Ref No. 2, page 2 of 27, replies to Pre-bid queries raised by Prospective bidders in Pre-bid meeting held on 23.04.2015, wherein it was clarified by IWAI that, "In Stage –I, horizontal and vertical clearance is to be given as approximate on visual assessment."

It can be inferred from the above table that the vertical clearance for all the bridges is **8.0 m**. Similarly the maximum and minimum Horizontal clearance is in the range of **10.0 m to 8.0 m**.

6.3 EXISTING HIGH TENSION LINES AND OTHER CROSS STRUCTURES

During the survey high tension lines are observed at certain chainages and the same is presented in the following **Table 4**.

Table 4: Details of Existing High Tension Lines

Sl. No	Location	Chainage	Easting	Northing	Vertical Clearance w.r.t. MHWS
1	Jamitya	29.5	591710.80	2480731.00	15.00 M
2	Mankur	40.5	591942.60	2489923.00	7.00 M

Sl. No	Location	Chainage	Easting	Northing	Vertical Clearance w.r.t. MHWS
3	Bakshi	41.0	591822.20	2490945.00	7.00 M

Vertical Clearances are on the basis of visual assessment s per Ref No. 2, page 2 of 27, replies to Pre-bid queries raised by Prospective bidders in Pre-bid meeting held on 23.04.2015, wherein it was clarified by IWAI that, "In Stage –I, horizontal and vertical clearance is to be given as approximate on visual assessment."

6.4 HINDRANCES/ ENCROACHMENT ALONG THE WATERWAY

Hindrances/encroachments for waterway are defined as any natural or manmade structure, which can cause obstruction or danger to navigation. In order to start navigation in the waterway, these structures are either to be removed or taken care adequately. These hindrances/encroachments are may be rock outcrop from the river bed, wooden or sand bridges, etc. No major hindrances/encroachments identified en-route the Rupnarayan Waterway during the reconnaissance survey.

6.5 FOREST AREA / PROTECTED AREA / DEFENCE AREA

There are no forests, protected or defence area exists along the study area of Rupnarayan River.

6.6 ROAD AND RAIL INFRASTRUCTURE

Rupnarayan waterway is well connected with rail and road network. The details of Railway station located within 5.0 Km radius of the proposed waterway are presented in **Table 5**.

Table 5: Railway station within 5.0 Km radius of Rupnarayan River

Sl. No.	Railway Station (within 5.0 km radius)	Sl. No.	Railway Station (within 5.0 km radius)
1.	Mahisadal Railway Station	5.	Matangini Railway Station
2.	Satish Samanta halt Railway Station	6.	Mecheda Railway Station
3.	Keshabpur Railway Station	7.	Kolaghat Railway Station
4.	Tamluk Railway Station	8.	Deulti Railway Station

Detail of major roads connecting to the Rupnarayan waterway is provided in **Table 6**.

Table 6: Major Roads crossing or within 5.0 km Radius of Rupnarayan

National/State Highway	Other Major Roads
a) National Highway 6 **b) National Highway 41** **c) State Highway 4** **d) State Highway 15**	a) Mahishadal Geonkhali Road b) Bagnan Shyampur Road c) Haldia Tamluk Mechada Road

7.0 RECONNAISSANCE SURVEY

The consultant done the reconnaissance survey as required for the feasibility studies and detailed as per TOR, as follows

- Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System.
- Horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be charted.
- Details about Barrages and Dams en-route are also to be reported.
- Topographical features of the Inland Waterways are to be reported.
- Typical physical features along the alignment i.e. land use pattern are to be reported
- Stretches having year round flow and critical depth for navigational purpose are to be reported.
- Preliminary Traffic on the Inland Waterways are to be identified.
- Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location) will be reported.
- Urban areas (location extent) are to be reported.
- Geologically sensitive areas environmental features are to be reported
- Hydrological features are to be reported.
- Critical areas requiring detailed investigations are to be reported.
- Requirements for carrying out supplementary investigations are to be reported.
- Visual inspection of Soil (textural classifications) are to be reported
- Major Drainage conditions are to be reported.
- Type and extent of existing utility services along the alignment are to be identified.
- Identification of various agencies of the govt. from whom the concerned project clearances for implementation are to be sought.

7.1 DETAIL METHODOLOGY FOR SURVEY

The surveyor deployed a team of personnel to carry out the reconnaissance survey; the detailed methodology is described in following sub sections.

7.1.1 Resource for Survey Work

Off shore Key Personal:

- Project in-charge: 1 no.

- Senior Surveyor: 4 nos.
- Survey Engineer: 3 nos.

On shore Key Personal:

- Project manager: 1 no.
- Survey manager: 2 nos.
- Reports Coordinator: 1 no.

Survey Equipment and Software:

Table 7: List of Equipment Mobilised for Survey

Survey Equipment/Systems Used for the Data Acquisition	
Equipment/System	**Description/Make/Model**
Software / Navigation	HYPACK 2015 computer acquisition and data logging Software
Positioning System	Trimble SPS 351(DGPS) & 855 RTK DGPS (One Base & Two Rover)
Single beam Echo Sounder	Sonar Mite
Tidal Observation	Valeport Automatic Tide Gauge/ Manual Tide Gauge
Levelling	Sokkia B40 Auto Level
Total Station	Trimble TS 635
Data Acquisition System	Dell laptop/ HP laptop

Survey Vessel

Considering the geographical and topographical feature, length of river, shallow and dry patch, inaccessibility to survey area, due to insufficient water for regular boat, inflatable Zodiac Boat "Aqua Marina-1", "Aqua Marina 2" were used to carry out bathymetric survey. The names and specifications of the survey boats are provided in **Table 8**.

Table 8: Details of Survey Boats Used

Sl. No.	Name of the Boat	Length (m)	Width (m)	Draft (m)
1	Aqua Marina - 1	3.0	1.5	0.020
2	Aqua Marina – 2	2.5	1.29	0.020

7.1.2 Geodetic Parameters

The geodetic parameters used for survey were as follows:-

Global Positioning System Geodetic Parameters	
Datum:	World Geodetic System 1984 (WGS84)
Spheroid:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$^1/_f$ = 298.257 223 563

Local Datum Geodetic Parameters	
Datum:	World Geodetic System 1984 (WGS84)
Spheroid:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$^1/_f$ = 298.257 223 563

Datum Transformation Parameters from WGS84 to WGS84						
Shift dX:	0.0 m	Rotation rX:	0.000	arcsec	Delta Scale :	0.0000 ppm
Shift dY:	0.0 m	Rotation rY:	0.000	arcsec		
Shift dZ:	0.0 m	Rotation rZ:	0.000	arcsec		

Local Projection and Grid Parameters [2)]	
Map Projection:	Universal Transverse Mercator
Grid System:	UTM Zone 45 N
Central Meridian:	087° 00’ 00” West
Latitude of Origin:	0° 00’ 00” North
False Easting:	500 000 m
False Northing:	0.0000
Scale factor on Central Meridian:	0.9996
Units:	metres

Notes:

1) Hypack navigation software always uses WGS84 geodetic parameters as a primary datum for any geodetic calculations.
2) This is the right-handed coordinate frame rotation convention used by the Hypack navigation software.

7.1.3 Survey Data Processing

General

The survey data was logged in HYPACK On-line Survey Software, and was processed using the HYPACK Processing, AUTOCAD and Spectra Precision Survey Office. The data was processed, checked and verified to ensure good quality data. Single Beam (SB) Editor was used for the automated and manual processing of logged data sets.

Navigation and Positioning

The DGPS Receiver Antenna was mounted exactly above the echo sounder transducer. The echo sounder transducer was mounted on the side of the boat, without any offset to ensure accuracy in the position of soundings. The bar-checks were carried out before/after each sounding session. Transducer draft was measured and recorded, and the same was used while processing. On all such occasions the error observed was zero or near zero. Therefore, no corrections were necessary.

Bathymetry

HYPACK Processing suite was used to import quality check and process the navigation, bathymetry and tidal data. The data was filtered, cleaned, and combined to create geographically positioned bathymetric data set.

7.2 DESCRIPTION OF BENCH MARKS/ REFERENCE LEVELS

During the execution of Survey work, temporary bench marks were established using static DGPS observation. This temporary bench mark was transferred using RTK Method. Details of the temporary bench marks, established by the surveyor at various locations along the Rupnarayan River (National Waterways 86) are provided as shown in **Table 9**.

Table 9 : Temporary Benchmark Rupnarayan River

Sl. No.		WGS84 Datum , UTM Projection, CM 087° East, Zone 45 North						
	TBM	Latitude	Longitude	Easting	Northing	Chainage (Km)	CD w.r.t MSL (m)	Ht (m) above MSL
1.	Gadhiada (TBM 5)	22°13'10.82"N	88°02'44.61"E	607777.96	2457513.59	0.0	-2.82	3.936

Sl. No.		WGS84 Datum , UTM Projection, CM 087° East, Zone 45 North						
	TBM	Latitude	Longitude	Easting	Northing	Chainage (Km)	CD w.r.t MSL (m)	Ht (m) above MSL
2.	Sashati (TBM 4)	22°21'03.56"N	87°57'29.08"E	598651.76	2471990.74	21.187	-1.423	2.366
3.	Kolaghat (TBM 3)	22°26'28.21"N	87°53'00.65"E	590914.99	2481927.17	34.815	-0.808	5.10
4.	Ranichok (TBM 2)	22°33'26.34"N	87°50'36.26"E	586715.08	2494761.39	52.527	0.234	5.09
5.	Bondar (TBM 1)	22°40'15.53"N	87°46'45.15"E	580048.36	2507307.57	71.961	1.000	1.932

7.3 LEVELLING OF TEMPORARY TIDE POLES

Five Temporary Bench Marks were established in between the course of survey at different places by using Trimble RTK SPS 855. Auto level SOKIA B-30 was used to establish the zero of the tide gauge with reference the TBMs. The observed readings in Auto Level are provided in **Annexure 1**. The water levels observed on the tide poles during reconnaissance survey are provided in **Annexure 2**. The CD/SD adopted for obtaining reduced depth along the waterway is given in Chart datum established at Sagar Island is used for establishing CD along the waterway.

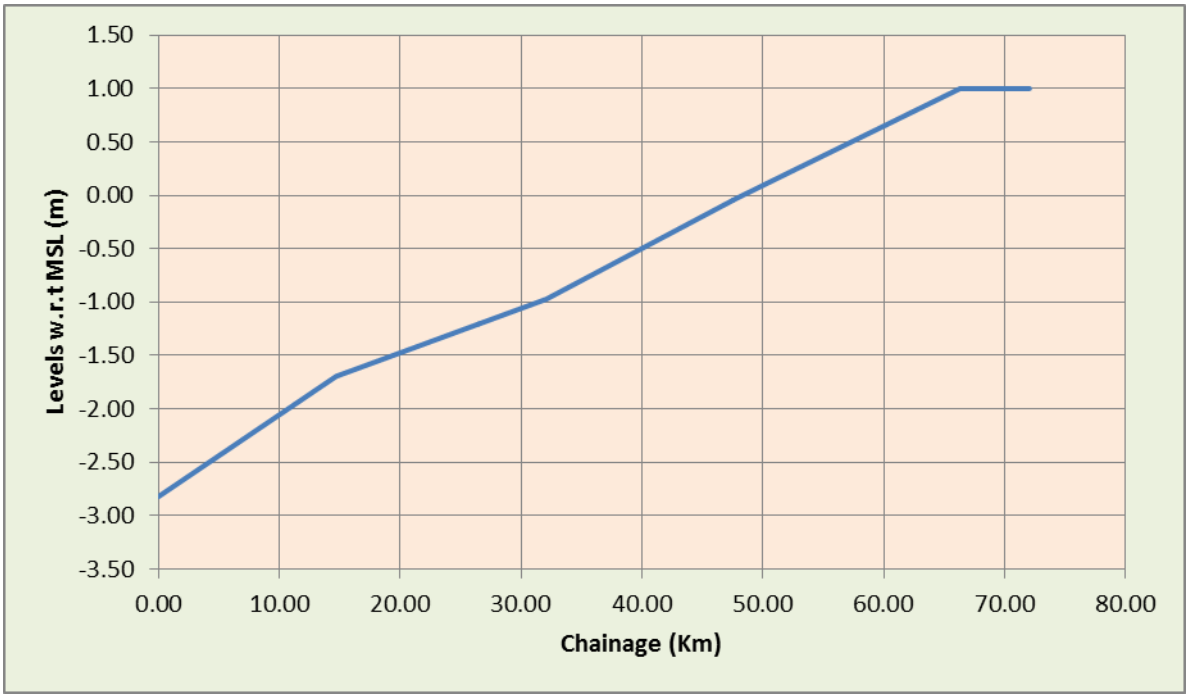


Figure 4: Graph showing Chart Datum/Sounding Datum w.r.t. MSL

7.4 HYDROGRAPIC SURVEY

Single line longitudinal Bathymetric survey along the deepest depths with the help of DGPS using Automatic Hydrographic Survey System has been carried out for the full length of 72.0 km of Rupnarayan waterway.

Water levels observed on the 5 tide poles installed during reconnaissance survey are provided in Annexure 2.

7.5 WATER DEPTH

Water depths along the waterway have been observed during Reconnaissance survey as per the scope of works and requirement for feasibility studies. Single line longitudinal bathymetric survey has been carried out for obtaining the water depth along the deepest route of waterway. The observed depth at every 10 km interval is presented in **Table 10**. The kilometre and stretch wise minimum and maximum water depths are also furnished along with Digital Data and Charts respectively. Detailed observed and Water depths along the Rupnarayan River is also presented in Annexure 3.

Table 10: Water Depth along the Waterway

Sl No.	Chainage (Km)	Draft Variation		Length of River (Km) with following draft w.r.t CD			
		Max. Available (m)	Min. Available (m)	<1m	1.0 - 1.5m	1.5 - 2.0 m	>2.0m
1.	0 – 10	5.30	0.00	5.33	0.50	0.50	3.67
2.	10 – 20	2.72	0.00	2.67	2.22	4.22	0.89
3.	20 – 30	3.18	0.00	3.42	3.29	2.15	1.14
4.	30 – 40	4.29	0.00	4.66	2.37	1.22	1.76
5.	40 – 50	4.18	0.00	3.55	2.11	1.84	2.50
6.	50 – 60	8.05	0.00	4.19	1.80	1.10	2.91
7.	60 – 70	5.78	0.16	1.02	1.75	2.41	4.82
8.	70 – 72	2.36	0.76	0.47	0.27	0.67	0.60
Total				**25.30**	**14.31**	**14.12**	**18.28**

It can be inferred from the above table that **18.28 km stretch of waterway have draft of more than 2.0 m, 14.12 km stretch have draft of 1.50 m to 2.0 m, 14.31 km have draft of 1.0 m to 1.50m and remaining 25.30 km stretch of waterway have less than 1.0 m draft** respectively.

Considering the tidal variation of about 1.7 m throughout the stretch of waterway, it can be said that the river will get >2.0 m of navigable draft throughout the stretch all-round the year.

7.6 DETAILS OF WATERWAY SURVEY

The survey work was done between the confluence of Silabati and Dwarakeswar River at Pratappur (00 Km Chainage) upto the waterway confluence with Hoogly River at Geonkhali (72 km Chainage). The details of structures, hindrances/encroachments, auxiliary or any additional features located along the waterway for every 10km stretch are provided as under. Tidal influence is located along the full stretch of the river. Detailed variation of tides in this stretch shall be worked out during DPR stage of the studies.

7.6.1 Chainage 0 km to 10 km

This stretch of the river starts with the confluence of Silabati and Dwarakeswar River. The villages located along this stretch are Dhanyaghari, Harishpur, Ghoradaha, Shyamsundarpur, Jot Kanusamgar, Ranichak and Jagatpur. Major district road passes all along the right bank of the river. A ferry ghat, namely Garer Ghat is also located in this stretch with ferry route for river crossing. Width of the river in this stretch varies from 90 m to 100 m.

No bridges and any hindrance/encroachment are located along the waterway.

7.6.2 Chainage 10 km to 20 km

Villages located along this stretch are Chand Kundu, Marokhana, Manikdwip, Dakshin Bhatora and Uttar Bar. Major district roads are connected to the right bank of the river. Two ferry ghats are also located in this stretch with ferry route for river crossing. Width of the river in this stretch varies from 100 m to 300 m.

No bridges and any hindrance/encroachment are located along the waterway.

7.6.3 Chainage 20 km to 30 km

Villages located along this stretch are Dakshin Bar, Sribara, Mankur and Kalyanpur. Both banks of the river are connected with Major district roads. Width of the river in this stretch varies from 300 m to 1000 m.

No bridges and any hindrance/encroachment are located along the waterway.

7.6.4 Chainage 30 km to 40 km

Villages/cities located along this stretch are Machhinan, Birampur, Sabsit, Panitras, Mellak, Gopal Nagar, Naupala, Chak Kamala, Babua P, Kolaghat and Amalhara. Both banks of the river are connected with Major district roads. National Highway 6 also crosses the river near Kolaghat. Width of the river in this stretch varies from 500 m to 1200 m.

Bridges at 37.3 Km, 37.6 Km and 37.7 Km of chainage are located along the waterway. Kolaghat Thermal Power Station which is the largest power sector in the state and managed by West Bengal Power Development Corporation Limited (WBPDCL), a department of the State Government of West Bengal is located on the right bank of river in this stretch.

7.6.5 Chainage 40 km to 50 km

Villages/cities located along this stretch are Benapur, Hurinan, Katagachhi, Shyampur, Baikunthapur, Osmanpur and Shyampur. Both banks of the river are connected with Major district roads and state highways. Width of the river in this stretch varies from 2.0 Km to 2.2 Km.

No bridges and any hindrance/encroachment are located along the waterway.

7.6.6 Chainage 50 km to 60 km

Villages/cities located along this stretch are Belpukur, Kalidaha, Srikol, Deuli, Radhapur, Dhalhara and Tamluk. Both banks of the river are connected with Major district roads and state highways. Width of the river in this stretch varies from 2.0 Km to 3.5 Km. Ambaria-Tamluk ferry line is located in this stretch for river crossing.

No bridges and any hindrance/encroachment are located along the waterway.

7.6.7 Chainage 60 km to 72 km

Villages/cities located along this stretch are Nadaria, Kamalpur, Gadiara, Geonkhali and Pahlanpur. Both banks of the river are connected with Major district roads and state highways. Width of the river in this stretch varies from 2.0 Km to 3.5 Km.

No bridges and any hindrance/encroachment are located along the waterway.

7.7 SOIL CHARACTERISTICS

On the basis of visual assessment done during longitudinal survey, the characteristics of soil on both banks of the waterway are provided in **Table 11**.

Table 11: Soil Characteristics along Rupnarayan River

S. No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
1	0	22^0 40'15.92"N	087^0 46'43.25"E	579994.13	2507319.73	Muddy
2	10	$22^0$37'41.32"N	$087^0$48'49.44"E	583621.24	2502584.99	Muddy
3	20	$22^0$34'11.16"N	$087^0$50'52.03"E	587157.64	2496141.70	Muddy
4	30	$22^0$30'35.02"N	$087^0$53'29.30"E	591688.84	2489521.61	Muddy

S. No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
5	40	$22^0$26'05.86"N	$087^0$53'15.05"E	591322.36	2482626.09	Muddy
6	50	$22^0$22'27.44"N	$087^0$56'50.45"E	597530.43	2474563.45	Muddy sand
7	60	$22^0$17'05.73"N	$087^0$56'40.19"E	597288.78	2466298.61	Muddy sand
8	70	$22^0$12'58.90"N	$088^0$00'09.62"E	605661.90	2457132.96	Muddy sand

7.8 TIDAL WATERWAY SECTION

It is seen from the data collected during Reconnaissance survey that out of 72 Km of the Rupnarayan River, complete 72.0 Km stretch of waterway is having tidal influence.

8.0 MARKET ANALYSIS

Preliminary market analysis has been done on the basis of reconnaissance survey, Consultants site visit, available secondary informations and published literature at the feasibility stage of the project.

8.1 LAND USE PATTERN

Land use pattern along the Rupnarayan River can be characterized as Agricultural and Residential as presented in **Table 12**.

Table 12: Land Use Pattern along Waterway

Length (km)	Agricultural		Residential		Industrial	
	Length (km)	%	Length (km)	%	Length (km)	%
72	38.2	53%	25.2	35%	8.6	12%

8.2 CROPS /AGRICULTURE PRODUCTS

The study stretch passes through the following districts:

- Hooghly
- Paschim Medinipur
- Purba Medinipur
- Howrah

Hooghly: Hooghly is an agriculturally prosperous district of West Bengal. The land use pattern of the district demonstrates a high proportion of net sown area as percentage of total reported area. About 70% of its population depend on agriculture and represents an important and remarkable place in the field of agriculture in West Bengal.

Due to massive population explosion and continuous increase of pressure on land, the farmers of this district are engaged in cultivation of all the major crops utilising the fullest potentiality of land and natural resources. Though rice is the prime crop of the district, the agricultural economy largely depends on potato, jute, vegetables and orchard and the cropping intensity of the district has been escalated to 220%.

Vegetable is a price crop in the blocks of Haripal, Singur, Chanditala, Polba and Dhaniakhali being grown in a relay system throughout the year. Though potato is cultivated in all the blocks of this district

in Dhaniakhali, Arambagh, Goghat, Pursurah, Haripal, Polba-Dadpur, Tarakeswar, Pandua and Singur contributed much of its production of this district.

Table 13: Hooghly district-Average Production and Productivity of major crops (2004-09)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	19.24	2665	16.83	2712	304.72	2953	340.79	8330
Potato	-	-	1960.34	20889	-	-	1960.34	20889
Wheat	-	-	1.38	2110	-	-	1.38	2110
Oilseeds	-	-	40.86	1127	-	-	40.86	1127
Pulses	-	-	1.278	758	-	-	1.278	758
Maize	0.46	2531	-	-	-	-	0.46	2531

Source: Agriculture Contingency Plan

Paschim Medinipur: The district is primarily agricultural in nature, with cultivation being the chief livelihood of a majority of the people. Paddy occupies the first place in production. The district has a suitable agro-climatic condition for cultivation of mulberry and horticulture crops such as mango, banana, guava, lemon, mousambi, papaya, cashew and jackfruit. The district is well known for the production of mulberry and tussar silks, and Silk saris from Midnapur are much in demand.

Table 14: Paschim Medinipur district-Average Production and Productivity of major crops (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	84.33	2063	1205.30	2505	452.29	3156	1742.42	7724
Wheat	-	-	17.68	2141	-	-	17.68	2141
Jute	66.29	2845	-	-	-	-	66.29	2845
Pulses	-	-	4.33	659	-	-	4.33	659
Oilseeds	-	-	102.47	1055	-	-	102.47	1055
Potato	-	-	1412.56	19484	-	-	1412.56	19484

Source: Agriculture Contingency Plan

Purba Medinipur: In Purba Medinipur district about more than 73% of the total reported area is under cultivation. Out of which nearly 78 % cultivation land has been occupied by food crops. Among food crops paddy is the most widespread crop being grown throughout the arable belt. Paddy more importantly aman dominates in cropping pattern. The performance of other two types of paddy like *aus*

and *rabi* is unsatisfactory. A very small agricultural land is devoted to pulses and oilseeds. Among oilseeds, mustard dominates in cropping pattern though in a very limited extent. Due to heavy clay texture, poor susceptibility to water logging and lack of irrigation crops like potato are unsuitable here. In recent years a very limited area has been devoted to sunflower and vegetables.

Table 15: Purba Medinipur district-Average Production and Productivity of major crops (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	118	1937	439.45	1709	461.86	3161	1019.31	6807
Wheat	-	-	-	-	1.2	2314	1.2	2314
Pulses	-	-	-	-	-	-	11.0	1074
Oilseeds	-	-	-	-	-	-	33.9	1669
Jute	16.93	2798	-	-	-	-	16.93	2798
Potato	-	-	59.45	152.73	-	-	59.45	152.73

Source: Agriculture Contingency Plan

Howrah: Topographically, there are three land situations namely up, medium and low and different farming systems are adopted accordingly. Frequent inundation of low lying areas result in stagnation of water for certain times of the year affecting some parts of the district. The soils of this sub-region have high nutrient content and mineral resource with a high potential for a large variety of agricultural and horticultural crops. Paddy (Aus, Aman and Boro), jute and potato are the major crops while pulses like gram, lentil etc., oilseeds like mustard, sesame, groundnut etc. and various kinds of vegetables are grown under varying physiographic situations of the district. Water chest nut, madur kathi, water lilly and lotus are also cultivated in some low lying marshy land areas of the district.

Table 16: Howrah district: Average Production and Productivity of major crops (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	2.509	1749	124.05	1700	139.79	1767	263.349	2187
Wheat	-	-	0.69	1823	-	-	0.69	1823
Jute	64.98	4006	-	-	-	-	64.98	4006
Pulses	-	-	1.28	758	-	-	1.28	758
Oilseeds	-	-	40.87	1127	-	-	40.87	1127
Potato	-	-	1960.32	20839	-	-	1960.32	20839

8.3 AVAILABILITY OF PASSENGER FERRY SERVICES

Local ferry services are operational across and along the river for throughout the waterway length for the whole year as observed during Reconnaissance survey. The ferry services locations on Rupnarayan River are given in **Table 17**.

Table 17: Existing Ferry locations along Rupnarayan River

S. No	Location	Chainage (Km)	Easting	Northing
1	Pratappur	0	579974.58	2507350.94
2	Garer Ghat	9.0	583822.26	2503156.02
3	Pansuili	14.0	587348.35	2499330.75
4	Gopiganj	19.5	586698.06	2494769.93
5	Bakshi Ferry Ghat	36.0	591670.95	2491535.43
6	Tamluk-Amberia ferry	54.5	596031.99	2464459.18
7	Ghadiada	72.0	607777.00	2457514.00

8.4 EXISTING JETTIES AND TERMINALS

The ferry services operational on Rupnarayan river is locally operated and used for passenger and small cargo transports like fish, vegetables, agricultural goods and bricks only, at the designated locations.

As observed during the survey, temporary structures made of wooden planks, stones are used for loading/unloading purposes. And no permanent structural RCC jetty is located along the waterway. Photographs of existing jetty structures are provided in **Annexure 4**.

8.5 PROMINENT PLACES ALONG THE RUPNARAYAN RIVER

Rupnarayan River is in West Bengal state, north-eastern India. It rises as the Dhaleshwari (Dhalkisor) in the Chota Nagpur plateau foothills northeast of the city of Purulia and follows a tortuous southeasterly course past the city of Bankura, where it is known as the Dwarkeswar. It is joined by the Silai River near the town of Ghatal, where it takes the name Rupnarayan. The river then joins the Hugli (Hooghly) after completing a 150-mile (240-km) course. The Rupnarayan, which originally formed a western exit of the Ganges (Ganga) River, is important for its irrigation potential. It is tidal through its entire course and constitutes a principal danger to navigation of the Hugli River because it

forces the Hugli to deposit silt upon dangerous shoals. Study stretches comprises of 72 km starting from Dwarkeshwar and Silai rivers at Pratappur to confluence with Hoogly Ricer at Geonkhali. The following prominent City /Town falls along the Rupnarayan River:

Kolaghat: Kolaghat is a census town situated on the banks of the Rupnarayan River in the Midnapore East district of West Bengal. It is located in the Panskura–II community development block of the Tamluk subdivision. It is also the headquarters of the outback panskura. (Panskura II block).

Tamluk: Tamluk is the district headquarters of Purba Medinipur district of West Bengal, India. Though there is some controversy, scholars have generally agreed that present day Tamluk is the site of the ancient city variously known as Tamralipta or Tamralipti. The present town is located on the banks of the Rupnarayan River close to the Bay of Bengal.

The people of Tamluk are primarily Bengali speaking. There are some lingering effects of successive migrations and invasions from both the west, east, and especially from northern India . Its history shows the complex combination of indigenous, Muslim, Buddhist, Jain and Hindu cultures, through trade, travel, and migration.
Unlike other parts of Bengal, Tamluk was always well connected with the Gangetic plains. In fact, there is evidence to suggest that the culture of Aryavarta influenced life in early Tamluk. The worship of Bheema is a sign of the socio-religious acceptance of Aryan culture in this area

As a seaport, Tamluk was once famous as a centre for trade. Currently it also a place of affluent people

8.6 HISTORICAL AND TOURIST PLACE ALONG THE WATERWAYS

Following important historical and tourist place are located along the Rupnarayan River waterway:

Kolaghat: Kolaghat is a census town situated on the banks of the Rupnarayan River in the Midnapore East district of West Bengal. It is located in the Panskura–II community development block of the Tamluk subdivision. It is also the headquarters of the outback panskura. (Panskura II block). Kolaghat Thermal Power Station is located here, which is the largest power sector in the state and managed by West Bengal Power Development Corporation Limited (WBPDCL), a department of the State Government of West Bengal,

The riverside has become a popular picnic spot and is often crowded with people, particularly during the Christmas and New Year holidays. The town is notable for its Hilsa fish. The flower market is one of the biggest in the state.

Tamluk: Tamluk is the district headquarters of Purba Medinipur district of West Bengal, India. Though there is some controversy, scholars have generally agreed that present day Tamluk is the site of the ancient city variously known as Tamralipta or Tamralipti. The present town is located on the banks of the Rupnarayan River close to the Bay of Bengal.

Archaeological remains show continuous settlement from about the 3rd century BC. It was known as Tramralipti (in the Puranas and the Mahabharata), Tamralipta (in the Mahabharata), Tamalika (in historical documents), Tamalitti (in foreigners' descriptions), or Tamoluk (in the British Raj). It was a seaport, now buried under river silt. For this reason, Tamluk has many ponds and lakes remaining today.

In the Mahabharata (Bhishma Parba/Nabam Adhyay), while describing the names of the holiest rivers and kingdoms of India, Sanjay took the name of "Tramralipta" to Dhritarashtra.

Tamluk was also known as Bhivas, in religious texts, and Madhya Desh, as the Middle State of Utkal/Kalinga and Banga.

According to Jain sources, Tamralipti was the capital of the kingdom of Venga and was long known as a port.

8.7 AVAILABILITY OF CONSTRUCTION MATERIAL

Major construction material available along the Rupnarayan River is Bricks. Numerous brick kilns are located along the waterways which uses clay deposits along the banks for this.

8.8 INDUSTRIES ALONG THE WATERWAY

There are number of Industries exists along the bank of Rupnarayan River study area, mainly in Purba Medinipur district. Kolaghat Thermal Power Station, which is the largest power sector in the state and managed by West Bengal Power Development Corporation Limited (WBPDCL), a department of the State Government of West Bengal, The district has an excellent transport and communication network of national highways and railways. A major existing industrial base at Kolaghat, due to availability of skilled man power at comparative low rates, abundance of electric power and a business environment conducive for industrial growth both from the labour and political fronts are few plus points for promotion and development of Micro & Small Medium Enterprises (MSME) in this district. Aquaculture and shrimp farming has been taken up in a big way in the coastal belt of this district and floriculture and horticultural activities are concentrated in a major portion of Tamluk Sub-division. There are several number of Brick kiln are also present along the Rupnarayan River.

8.9 EXISTING WATER SPORT AND RECREATIONAL ACTIVITIES AND FUTURE PROBABILITY

There are no existing water sports and recreational activities available in the study stretch of Rupnarayan River.

8.10 ESTIMATED CARGO MOVEMENT THROUGH PROPOSED WATERWAY, ROAD AND RAIL

Existing passengers and cargo movements are located along Rupnarayan River. Inland waterways mode of transport has immense potential for domestic cargo transportation as well as for cruise, tourism and passenger traffic. A short traffic survey was also carried out over the bridges on Rupnarayan in Kolaghat bridge as provided in **Table 18**.

Table 18: Traffic Density over Kolaghat Bridge in Kolaghat

Sl.no.	Vehicle Type	No. of Vehicles	
		From Kolaghat to Kolkata Date 17/03/2016 Time :12:00 hrs to 13:00 hrs	From Kolkata to Kolaghat Date 17/03/2016 Time :13:00 hrs to 14:00 hrs
1	Bike	132	96
2	Auto	60	48
3	Car	192	180
4	Truck	180	228
5	Chotta hathi	144	96
6	Mini Truck	96	60
7	Bus	36	24
Total		**840**	**732**

Rupnarayan waterway has huge potential for economic development considering its connectivity with various industrial and commercial places along its way. Though currently the waterway is used only for local transportation of passengers and small cargos like vegetables, agricultural products, fish, bricks, tiles etc.

The waterway shall be used for coal transportation to Kolaghat thermal power plant. Kolaghat thermal plant is located about 2.5 Km from the waterway and thus the coal can be easily transported by conveyor belt directly from waterway to the site.

Forecasted cargo potential has been estimated on the basis of last 13 year growth pattern of Cargo movement from 2002-2003 to 2014 – 2015 for National waterway-1, as provided in the IWAI Annual reports. Linear correlation between existing and declared National Waterways has been done, to estimate the forecasted cargo potential. In Stage-I of the study a base figure of 0.0 tonnes cargo movement is assumed for estimating the forecasted figures as shown in **Figure 5**.

Table 19: Cargo Movement in National Waterway – 1 from 2002 – 2015

Sl. No.	Year	Cargo Movement for NW-1 (tonnes)
1.	2002-03	632,037
2.	2003-04	786,159
3.	2004-05	887,328
4.	2005-06	1,001,450
5.	2006-07	1,317,387
6.	2007-08	1,497,964
7.	2008-09	1,348,385
8.	2009-10	1,811,070
9.	2010-11	1,871,178
10.	2011-12	3,309,839
11.	2012-13	2,716,437
12.	2013-14	3,349,138
13.	2014-15	5,050,209

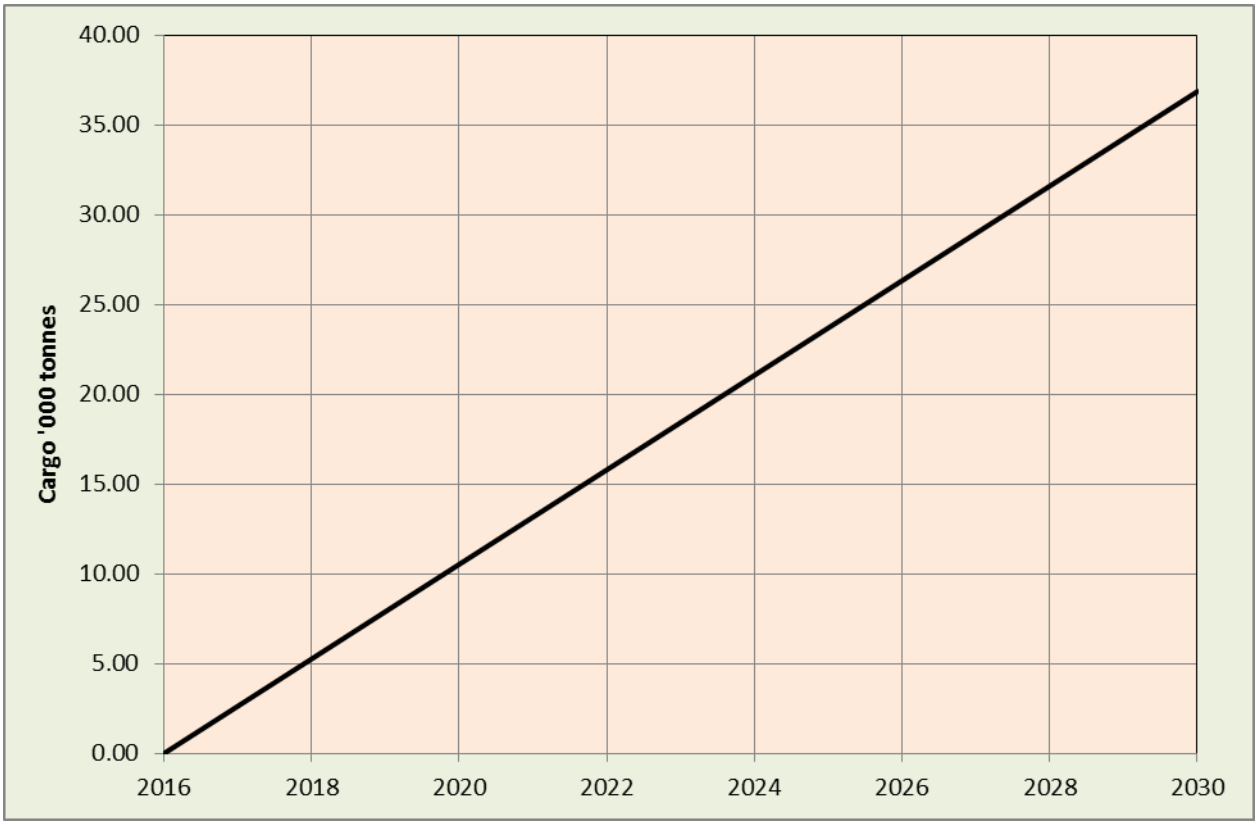


Figure 5: Forecasted Cargo Potential

Prima facie Rupnarayan waterway has huge economical potential for development of Inland waterway. Not only there is existing traffic but also the development of waterway will trigger new traffic. Extent of development and prioritisation of inland waterways will be prepared in subsequent phase of the DPR study.

9.0 OBSERVATION AND INFERENCE

On the basis of reconnaissance survey as well as primary and secondary data collected from IWAI, central and state government departments and other stakeholders, following observations and inferences are made on the Rupnarayan River (National Waterway 86).

9.1 WATERWAY

Rupnarayan River flows through the Indian states of West Bengal. The Rupnarayan river and its tributaries lie within the latitude of 23.49 N and 22.29 N and longitudes of 86.69 E and 87.92 E. The Rupnarayan River is a river in eastern India. It begins as the Dhaleswari (Dhalkisor) in the Chota Nagpur Plateau foothills northeast of the town of Purulia. It then follows as a tortuous south easterly course past the town of Bankura, where it is khown as Dwarkeshwar river. Near the town of Ghatsila, the Silai join it, where it takes the name of Rupnarayan and finally it joins the River Hooghly.

9.2 LEAST AVAILABLE DEPTH (LAD)

LAD of the Rupnarayan waterway is estimated on the basis of applying exceedance probability approach on the reduced water depth. Reduced water depth is evaluated after applying corrections on the water depths observed during single line hydrographic survey with reference to Chart Datums. Navigable stretch available for least available depth (LAD) of <1.0 m, 1.0 m to 1.5 m, 1.5 m to 2.0 m and >2.0 m for the waterway is presented in **Table 20**.

Table 20: Waterway length with varying LAD w.r.t CD

Sl No.	Features	Results
1.	Waterway Length	72.0 Km
2.	Length with Topographic Survey	0.0 Km
3.	Length with Bathymetric Survey	72.0 Km
4.	Maximum available draft	8.05 m
5.	Minimum available draft	0.00 m
6.	Waterway length with <1.0 m draft	25.30 Km
7.	Waterway length with 1.0 – 1.5 m draft	14.31 Km

Sl No.	Features	Results
8.	Waterway length with 1.5 – 2.0 m draft	14.12 Km
9.	Waterway length with >2.0 m draft	18.28 Km

9.3 CROSS - STRUCTURES

During reconnaissance survey, details of cross-structures have been collected and their minimum horizontal and vertical clearance has been evaluated on the basis of visual assessment as shown in **Table 21** below. The detailed list of cross-structures is provided in **Table 3** and **Table 4**.

Table 21: Minimum Horizontal and Vertical Clearance along Waterways

Length (km)	Dams/ Barrages/Locks	Bridges/ Crossing	Min Ver. w.r.t. MHWS/Hor. Clearance	High-Tension Lines	Min Ver. Clearance (m) w.r.t. MHWS
72	0	3	8.0 m/80.0 m	3	7.0

Vertical Clearances are on the basis of visual assessment s per Ref No. 2, page 2 of 27, replies to Pre-bid queries raised by Prospective bidders in Pre-bid meeting held on 23.04.2015, wherein it was clarified by IWAI that, "In Stage –I, horizontal and vertical clearance is to be given as approximate on visual assessment."

9.4 SWOT ANALYSIS

SWOT analysis is a technique commonly used to assist in identifying strategic direction for an organization or practice. It helps to make an assessment of internal environment and scrutiny of external environment, with an objective to take maximum benefits by having an appropriate proposition. It is preferred for the present work as it yields useful information about the future viability of the considered inland waterway system. The predictive capabilities in the technique come about from the consideration of system's strengths and weaknesses in the context of the development of Inland Waterway System, which may present opportunities and threats.

The strengths and weaknesses of a system are determined by the internal elements, whereas external forces dictate opportunities and threats. Strengths can be defined as any available resource that can be used to improve its performance. Weaknesses are flaws/shortcomings of any system that may cause to lose a competitive advantage, efficiency or resources. Sometimes it is recommended to identify opportunities and threats first in order to more quickly ring to light the system's strengths and weaknesses. Many of the threats are based on weaknesses.

	INTERNAL		
P	**STRENGTH**	**WEAKNESS**	N
O S I T I V E	➢ Commitment of Govt. of India for Developing Inland Waterways Sector. ➢ Connectivity to Major Ports of Haldia and Calcutta via National Waterway – 1. ➢ Environmental friendly mode of Transport ➢ Increase in Infrastructure Facilities as alternative mode of transport. ➢ Comparatively high level of transport safety. ➢ Reliable services under predictable weather conditions. ➢ Low transport costs (per km) for bulk shipments. ➢ Long term effective cost control measures (O&M). ➢ Capable of bringing down decongestion from the Road Transport. ➢ Availability of tidal window, which provides additional draft for navigation. ➢ Demand of Local citizens and Political will.	➢ Huge Initial Investment ➢ High Maintenance Cost ➢ High tariff structure for Inland Transport. ➢ Limited knowledge of IWT among shippers. ➢ Dependence on inter-modality for door-to door services. ➢ Substantial cost differentials w.r.t other transports. ➢ Water level fluctuations having impacts on Ships Ballast /Loading conditions. ➢ Dredging capability of GoI is 16% of National requirement.	N E G A T I V E
	➢ Trigger new traffic in the hinterland ➢ Boost International and National trade of commodities. ➢ Improvement of the capacity/quality of the Infrastructure. ➢ Integration of Ports with Roads & Railways. ➢ Enhance inter-modality. ➢ Implementation of infrastructure links. ➢ Improved Supply-Demand logistic chains ➢ Creation of reliable employment for the people. ➢ Connectivity of Rupnarayan waterway with National waterway 1, 35 and 92. ➢ Connectivity of Rupnarayan waterway with existing Haldia Port.	➢ Lack of Skilled Man-power. ➢ Environmental policy restrictions on transport infrastructure policies. ➢ Limited financial means. ➢ Fast growing economic sectors often road oriented: low IWT affinity. ➢ Priority of investments in road/ rail infrastructure as per the present scenario. ➢ Land Acquisition	
	OPPORTUNITY	**THREAT**	
	EXTERNAL		

Figure 6: SWOT Analysis

Further, SWOT analysis helps in categorizing the key internal and external factors that are important to achieving the objective. With regards to assessing the feasibility of proposed waterway for navigation, this exercise will help us identify the important factors to be considered while designing the future action for DPR study in Stage 2 and strategic plan for its development.

9.5 SUMMARY

The salient features of the feasibility study for 72 km stretch of Rupnarayan as national waterway are,

- The proposed national waterway of 72 km of Rupnarayan river is feasible for throughout the year navigation considering the available tidal variation of 1.7 m.
- The horizontal and vertical clearance of existing cross-structures is in the range of 80m – 100m and 8m respectively.
- On the basis of reduced water depth, LAD of > 2.0 m is available for 18.28 km length of the waterway, 1.5 m to 2.0 m is available for 14.12 km length, 1.5 to 1.0 m is available for 14.31 km and <1.0 of LAD is available for 25.30 km of the waterway stretch respectively with respect to chart datum;
- Considering the length of the river and availability of numerous minor and major industries 5km reach across the bank , the river has huge economic potential.
- The waterway will be an alternated mode of connectivity to the existing and proposed Ports coming up in and nearby Rupnarayan waterway.
- Availability of Kolaghat Thermal power plant gives an additional economic advantage to the waterway, as the waterway can be used for coal transportation to the power plant located about 2.5 Km from the waterway. Coal can be easily transported by conveyor belt directly from waterway to the site.
- Not only there is existing traffic but also the development of waterway will trigger new traffic.

9.6 CRITICAL AREAS REQUIRING DETAILED INVESTIGATIONS

Critical areas along the waterways, requiring detailed investigations during Stage – II, are identified on the basis of draft availability, location of hindrances, areas requiring clearances etc. On the basis of above, the waterway length of about 42.94 Km, having flow depth of less than 1 m w.r.t Chart Datum requires detail investigation during DPR stage studies.

9.7 SURVEY AND INVESTIGATIONS REQUIRED FOR STAGE – II STUDIES

Following survey and investigations are required to be done during Stage – II studies:

i) Hydrographic and Hydro morphological Survey, as per TOR, comprising of:

a) Erection of bench mark pillars and water level gauges and observing reading.
b) Detailed bathymetric and topographic survey.
c) Current velocity and discharge measurement.
d) Collection of water and bottom samples and testing.
e) Collection of topographical features.

ii) Traffic Survey.
iii) Geo-tech investigation on proposed locations for Jetties and Terminal structures.
iv) Environmental impact assessment (EIA).

9.8 WAY FORWARD: WATERWAY DEVELOPMENT

The Combining knowledge on the physical constraints, actual and future uses of the river and the valley, economic potential and needs, or absence thereof, allows the characterization of the river for development as a waterway. The reconnaissance survey data collected with regard to physical constraints can be turned into cost to make a river navigable. The potential of possible navigation in the stretches of proposed inland waterway have been determined using raw water depths. Many stretches are generally navigable without any obstructions, except few shallow patches. Although several challenges do exist to make Rupnarayan as National waterway, but with respect to long-term economic interest of the nation the financial investment is advisable.

Economic Interest / **Financial Investment**	Local	Regional	National	International
Low			Rupnarayan Waterway	
Moderate				
High				
Very High				

Rupnarayan waterway is recommended for Stage – II DPR preparation in view of the following potential advantages:

a) Connectivity of Kolaghat Thermal Power Plant with Rupnarayan waterway.
b) Connectivity with a Haldia Port and Kolkata Port.
c) Connectivity with Indo Bangladesh Protocol Route
d) Increasing cargo potential.

e) Reduction in existing traffic load on rail and road infrastructure.

In view of the above, it is recommended to develop the Rupnarayan waterway for large Cargo and Passenger ferry services.

Annexure 1: Levelling Results along Rupnarayan Waterway

Five Temporary Bench Marks were established in between the course of survey at different places by using Trimble RTK SPS 855. Auto level SOKIA B-30 was used to establish the zero of the tide gauge with reference the TBMs. The observed readings in Auto Level are provided as below

LEVELLING BETWEEN TEMPORARY BENCH MARK 1 & TIDE POLE

BS	FS	HI	RL	REMARK
1.332		3.192	1.932	TBM 1
	2.521		0.671	TIDE POLE

BS	FS	HI	RL	REMARK
2.74		3.411	0.671	TIDE POLE
	1.551		1.932	TBM 1

LEVELLING BETWEEN TEMPORARY BENCH MARK 2 & TIDE POLE

BS	FS	HI	RL	REMARK
1.332		6.422	5.09	TBM 2
1.526	3.861	4.087	2.561	CP 1
	3.468		0.619	TIDE POLE

BS	FS	HI	RL	REMARK
3.485		4.104	0.619	TIDE POLE
3.819	1.551	6.372	2.553	CP 2
	1.282		5.09	TBM 2

LEVELLING BETWEEN TEMPORARY BENCH MARK 3 & TIDE POLE

BS	FS	HI	RL	REMARK
1.562		6.662	5.1	TBM 3
1.491	3.981	4.172	2.681	CP 1
	3.721		0.451	TIDE POLE

BS	FS	HI	RL	REMARK
3.689		4.14	0.451	TIDE POLE
4.051	1.623	6.568	2.517	CP 2
	1.468		5.1	TBM 3

LEVELLING BETWEEN TEMPORARY BENCH MARK 4 & TIDE POLE

BS	FS	HI	RL	REMARK
0.892		3.258	2.366	TBM 4
	3.131		0.127	TIDE POLE

BS	FS	HI	RL	REMARK
3.234		3.361	0.127	TBM 4
	0.995		2.366	TIDE POLE

LEVELLING BETWEEN TEMPORARY BENCH MARK 5 & TIDE POLE

BS	FS	HI	RL	REMARK
1.522		5.458	3.936	TBM 5
1.621	4.631	2.448	0.827	CP 1
	3.713		-1.265	TIDE POLE

BS	FS	HI	RL	REMARK
3.485		2.22	-1.265	TIDE POLE
4.813	1.551	5.482	0.669	CP 2
	1.546		3.936	TBM 5

Annexure 2: Observed Water levels at the Tide Poles

BONDAR TBM - 1 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
11:30	8-Jan-16	1.035
11:45	8-Jan-16	1.025
12:00	8-Jan-16	1.001
12:15	8-Jan-16	0.977
12:30	8-Jan-16	0.952
12:45	8-Jan-16	0.938
13:00	8-Jan-16	1.063
13:15	8-Jan-16	1.135
13:30	8-Jan-16	1.198
13:45	8-Jan-16	1.275
14:00	8-Jan-16	1.327
14:15	8-Jan-16	1.388
14:30	8-Jan-16	1.457
14:45	8-Jan-16	1.538

RANICHOK TBM - 2 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
11:00	10-Jan-16	1.021
11:15	10-Jan-16	0.997
11:30	10-Jan-16	0.979
11:45	10-Jan-16	0.953
12:00	10-Jan-16	1.002
12:15	10-Jan-16	1.17
12:30	10-Jan-16	1.324
12:45	10-Jan-16	1.456

RANICHOK TBM - 2 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
13:00	10-Jan-16	1.555
13:15	10-Jan-16	1.648
13:30	10-Jan-16	1.739
13:45	10-Jan-16	1.792
14:00	10-Jan-16	1.863
14:15	10-Jan-16	1.93
14:30	10-Jan-16	1.962
14:45	10-Jan-16	1.99
15:00	10-Jan-16	1.979
15:15	10-Jan-16	1.953

KOLAGHAT TBM - 3 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
9:15	10-Jan-16	0.771
9:30	10-Jan-16	0.731
9:45	10-Jan-16	0.711
10:00	10-Jan-16	0.681
10:15	10-Jan-16	0.641
10:30	10-Jan-16	0.616
10:45	10-Jan-16	1.031
11:00	10-Jan-16	1.371
11:15	10-Jan-16	1.601
11:30	10-Jan-16	1.841
11:45	10-Jan-16	2.021
12:00	10-Jan-16	2.111

KOLAGHAT TBM - 3 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
12:15	10-Jan-16	2.201
12:30	10-Jan-16	2.251
12:45	10-Jan-16	2.301
13:00	10-Jan-16	2.324
13:15	10-Jan-16	2.341
13:30	10-Jan-16	2.349
13:45	10-Jan-16	2.311
14:00	10-Jan-16	2.211
14:15	10-Jan-16	2.131
14:30	10-Jan-16	2.041
14:45	10-Jan-16	1.971
15:00	10-Jan-16	1.881
15:15	10-Jan-16	1.831
15:30	10-Jan-16	1.771
15:45	10-Jan-16	1.691
16:00	10-Jan-16	1.641
16:15	10-Jan-16	1.581
16:30	10-Jan-16	1.501
16:45	10-Jan-16	1.451
17:00	10-Jan-16	1.321

SASHATI TBM - 4 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
15:10	10-Jan-16	0.863
15:25	10-Jan-16	0.775

SASHATI TBM - 4 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
15:40	10-Jan-16	0.67
15:55	10-Jan-16	0.54
16:10	10-Jan-16	0.459
16:25	10-Jan-16	0.339
12:00	11-Jan-16	2.055
12:15	11-Jan-16	2.105
12:30	11-Jan-16	2.145
12:45	11-Jan-16	2.185
13:00	11-Jan-16	2.225
13:15	11-Jan-16	2.205
13:30	11-Jan-16	2.165
13:45	11-Jan-16	2.065
14:00	11-Jan-16	1.955
14:15	11-Jan-16	1.785
14:30	11-Jan-16	1.645
14:45	11-Jan-16	1.505
15:00	11-Jan-16	1.355
15:15	11-Jan-16	1.195
15:30	11-Jan-16	1.045
15:45	11-Jan-16	0.975

GADHIADA TBM - 5 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
13:55	11-Jan-16	1.366
14:10	11-Jan-16	1.156

GADHIADA TBM - 5 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are w.r.t. MSL.		
TIME	**DATE**	**WATER LEVEL**
14:25	11-Jan-16	0.916
14:40	11-Jan-16	0.716
14:55	11-Jan-16	0.626
15:10	11-Jan-16	0.356
15:25	11-Jan-16	0.176
15:40	11-Jan-16	-0.054
15:55	11-Jan-16	-0.224
16:10	11-Jan-16	-0.383
16:25	11-Jan-16	-0.409

Annexure 3: Water Depth along Rupnarayan Waterway

(0.0 Km Chainage starts from confluence of Rupnarayan River with Hooghly River)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
0.000	3.60	-2.820	-0.22	2.60	1.00
0.062	5.00	-2.815	-0.22	2.60	2.40
0.123	6.10	-2.811	-0.21	2.60	3.50
0.185	4.00	-2.806	-0.21	2.60	1.40
0.246	4.60	-2.801	-0.20	2.60	2.00
0.308	5.20	-2.796	-0.20	2.60	2.60
0.369	7.50	-2.792	-0.19	2.60	4.90
0.431	7.40	-2.787	-0.19	2.60	4.80
0.492	7.40	-2.782	0.12	2.90	4.50
0.554	7.90	-2.778	-0.18	2.60	5.30
0.615	7.20	-2.773	-0.17	2.60	4.60
0.677	6.90	-2.768	-0.17	2.60	4.30
0.738	6.90	-2.763	-0.16	2.60	4.30
0.800	6.90	-2.759	-0.16	2.60	4.30
0.861	6.70	-2.754	-0.15	2.60	4.10
0.923	6.50	-2.749	-0.15	2.60	3.90
0.985	6.30	-2.745	-0.14	2.60	3.70
1.046	5.90	-2.740	-0.14	2.60	3.30
1.108	5.40	-2.735	-0.14	2.60	2.80
1.169	5.40	-2.730	-0.13	2.60	2.80
1.231	5.20	-2.726	-0.03	2.70	2.50
1.292	5.20	-2.721	-0.12	2.60	2.60
1.354	5.20	-2.716	-0.02	2.70	2.50
1.415	5.30	-2.712	-0.01	2.70	2.60
1.477	5.00	-2.707	-0.11	2.60	2.40
1.538	5.60	-2.702	-0.10	2.60	3.00
1.600	5.50	-2.697	0.00	2.70	2.80
1.661	5.80	-2.693	-0.09	2.60	3.20
1.723	5.70	-2.688	0.01	2.70	3.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
1.785	5.30	-2.683	0.02	2.70	2.60
1.846	4.80	-2.679	-0.08	2.60	2.20
1.908	5.10	-2.674	-0.07	2.60	2.50
1.969	5.30	-2.669	0.03	2.70	2.60
2.031	5.40	-2.664	0.04	2.70	2.70
2.092	5.50	-2.660	0.04	2.70	2.80
2.154	5.10	-2.655	0.04	2.70	2.40
2.215	5.40	-2.650	0.05	2.70	2.70
2.277	5.60	-2.646	0.05	2.70	2.90
2.338	5.40	-2.641	0.06	2.70	2.70
2.400	5.20	-2.636	0.06	2.70	2.50
2.461	5.10	-2.631	0.07	2.70	2.40
2.523	5.20	-2.627	0.07	2.70	2.50
2.584	5.00	-2.622	0.18	2.80	2.20
2.646	4.90	-2.617	0.18	2.80	2.10
2.708	4.80	-2.613	0.09	2.70	2.10
2.769	4.60	-2.608	0.19	2.80	1.80
2.831	4.50	-2.603	0.20	2.80	1.70
2.892	4.40	-2.598	0.20	2.80	1.60
2.954	4.20	-2.594	0.11	2.70	1.50
3.015	4.20	-2.589	0.21	2.80	1.40
3.077	4.50	-2.584	0.22	2.80	1.70
3.138	4.30	-2.580	0.22	2.80	1.50
3.200	4.10	-2.575	0.13	2.70	1.40
3.261	3.90	-2.570	0.13	2.70	1.20
3.323	3.80	-2.565	0.23	2.80	1.00
3.384	3.70	-2.561	0.24	2.80	0.90
3.446	4.00	-2.556	0.24	2.80	1.20
3.507	3.80	-2.551	0.25	2.80	1.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
3.569	3.60	-2.547	0.25	2.80	0.80
3.631	3.50	-2.542	0.26	2.80	0.70
3.692	3.60	-2.537	0.26	2.80	0.80
3.754	3.90	-2.532	0.27	2.80	1.10
3.815	3.70	-2.528	0.27	2.80	0.90
3.877	3.60	-2.523	0.28	2.80	0.80
3.938	3.50	-2.518	0.28	2.80	0.70
4.000	3.26	-2.514	0.14	2.65	0.61
4.061	3.19	-2.509	0.14	2.65	0.54
4.095	3.04	-2.506	0.14	2.65	0.39
4.163	2.91	-2.501	0.16	2.66	0.25
4.227	2.72	-2.496	0.16	2.66	0.06
4.295	2.50	-2.491	0.18	2.67	0.00
4.297	2.50	-2.491	0.18	2.67	0.00
4.432	2.08	-2.481	0.19	2.67	0.00
4.434	2.07	-2.480	0.19	2.67	0.00
4.500	2.06	-2.475	0.20	2.68	0.00
4.502	2.06	-2.475	0.20	2.68	0.00
4.570	2.01	-2.470	0.21	2.68	0.00
4.632	2.00	-2.465	0.22	2.69	0.00
4.696	1.97	-2.460	0.23	2.69	0.00
4.697	1.97	-2.460	0.23	2.69	0.00
4.832	1.90	-2.450	0.25	2.70	0.00
4.833	1.90	-2.450	0.25	2.70	0.00
4.897	1.87	-2.445	0.26	2.70	0.00
4.898	1.88	-2.445	0.26	2.70	0.00
4.964	1.89	-2.440	0.27	2.71	0.00
5.026	1.87	-2.435	0.27	2.71	0.00
5.088	1.88	-2.430	0.29	2.72	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
5.089	1.88	-2.430	0.29	2.72	0.00
5.151	1.87	-2.425	0.29	2.72	0.00
5.152	1.87	-2.425	0.29	2.72	0.00
5.214	1.91	-2.421	0.30	2.72	0.00
5.215	1.91	-2.421	0.30	2.72	0.00
5.277	1.93	-2.416	0.32	2.74	0.00
5.278	1.93	-2.416	0.32	2.74	0.00
5.335	1.94	-2.411	0.33	2.74	0.00
5.336	1.94	-2.411	0.33	2.74	0.00
5.399	1.95	-2.406	0.34	2.75	0.00
5.400	1.95	-2.406	0.34	2.75	0.00
5.464	1.99	-2.401	0.35	2.75	0.00
5.521	2.00	-2.397	0.35	2.75	0.00
5.636	2.06	-2.388	0.37	2.76	0.00
5.637	2.06	-2.388	0.37	2.76	0.00
5.701	2.05	-2.383	0.39	2.77	0.00
5.703	2.05	-2.383	0.39	2.77	0.00
5.830	2.17	-2.373	0.40	2.77	0.00
5.832	2.16	-2.373	0.40	2.77	0.00
5.895	2.18	-2.368	0.42	2.79	0.00
5.897	2.19	-2.368	0.42	2.79	0.00
5.956	2.14	-2.364	0.43	2.79	0.00
5.957	2.13	-2.364	0.43	2.79	0.00
6.018	2.07	-2.359	0.44	2.80	0.00
6.019	2.07	-2.359	0.44	2.80	0.00
6.081	2.03	-2.354	0.45	2.80	0.00
6.082	2.02	-2.354	0.45	2.80	0.00
6.146	1.99	-2.349	0.47	2.82	0.00
6.147	1.98	-2.349	0.47	2.82	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
6.213	1.90	-2.344	0.48	2.82	0.00
6.214	1.90	-2.344	0.48	2.82	0.00
6.281	1.79	-2.339	0.48	2.82	0.00
6.282	1.79	-2.339	0.48	2.82	0.00
6.349	1.63	-2.334	0.50	2.83	0.00
6.350	1.62	-2.334	0.50	2.83	0.00
6.418	1.59	-2.328	0.50	2.83	0.00
6.419	1.60	-2.328	0.50	2.83	0.00
6.490	1.61	-2.323	0.53	2.85	0.00
6.492	1.62	-2.323	0.53	2.85	0.00
6.544	1.57	-2.319	0.53	2.85	0.00
6.545	1.58	-2.319	0.53	2.85	0.00
6.613	1.54	-2.313	0.54	2.85	0.00
6.615	1.54	-2.313	0.54	2.85	0.00
6.683	1.57	-2.308	0.55	2.86	0.00
6.684	1.56	-2.308	0.55	2.86	0.00
6.753	1.55	-2.303	0.56	2.86	0.00
6.754	1.54	-2.303	0.56	2.86	0.00
6.824	1.53	-2.297	0.58	2.88	0.00
6.825	1.52	-2.297	0.58	2.88	0.00
6.898	1.53	-2.292	0.59	2.88	0.00
6.900	1.53	-2.292	0.59	2.88	0.00
6.973	1.55	-2.286	0.59	2.88	0.00
6.974	1.55	-2.286	0.59	2.88	0.00
7.047	1.57	-2.280	0.61	2.89	0.00
7.049	1.57	-2.280	0.61	2.89	0.00
7.122	1.66	-2.275	0.62	2.89	0.00
7.123	1.65	-2.274	0.62	2.89	0.00
7.197	1.70	-2.269	0.64	2.91	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
7.199	1.71	-2.269	0.64	2.91	0.00
7.273	1.82	-2.263	0.65	2.91	0.00
7.274	1.81	-2.263	0.65	2.91	0.00
7.387	1.91	-2.254	0.66	2.91	0.00
7.388	1.91	-2.254	0.66	2.91	0.00
7.456	2.01	-2.249	0.67	2.92	0.00
7.457	2.04	-2.249	0.67	2.92	0.00
7.531	2.14	-2.243	0.68	2.92	0.00
7.532	2.14	-2.243	0.68	2.92	0.00
7.608	2.19	-2.237	0.70	2.94	0.00
7.609	2.20	-2.237	0.70	2.94	0.00
7.685	2.29	-2.231	0.71	2.94	0.00
7.687	2.30	-2.231	0.71	2.94	0.00
7.762	2.42	-2.225	0.71	2.94	0.00
7.764	2.43	-2.225	0.72	2.95	0.00
7.838	2.56	-2.220	0.73	2.95	0.00
7.839	2.56	-2.220	0.73	2.95	0.00
7.909	2.66	-2.214	0.74	2.95	0.00
7.911	2.67	-2.214	0.74	2.95	0.00
7.992	2.85	-2.208	0.76	2.97	0.00
8.098	3.02	-2.200	0.77	2.97	0.05
8.100	3.03	-2.200	0.77	2.97	0.06
8.186	3.18	-2.193	0.79	2.98	0.20
8.187	3.18	-2.193	0.79	2.98	0.20
8.272	3.47	-2.186	0.79	2.98	0.49
8.273	3.46	-2.186	0.79	2.98	0.48
8.359	3.61	-2.180	0.80	2.98	0.63
8.360	3.61	-2.180	0.80	2.98	0.63
8.451	3.37	-2.173	0.83	3.00	0.37

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
8.453	3.36	-2.173	0.83	3.00	0.36
8.542	3.39	-2.166	0.83	3.00	0.39
8.544	3.39	-2.166	0.83	3.00	0.39
8.632	3.43	-2.159	0.85	3.01	0.42
8.634	3.43	-2.159	0.85	3.01	0.42
8.723	3.53	-2.152	0.86	3.01	0.52
8.725	3.53	-2.152	0.86	3.01	0.52
8.811	3.52	-2.145	0.86	3.01	0.51
8.812	3.52	-2.145	0.86	3.01	0.51
8.924	3.58	-2.136	0.88	3.02	0.56
8.925	3.58	-2.136	0.88	3.02	0.56
9.013	3.54	-2.130	0.89	3.02	0.52
9.015	3.55	-2.130	0.89	3.02	0.53
9.101	3.53	-2.123	0.92	3.04	0.49
9.103	3.55	-2.123	0.92	3.04	0.51
9.185	3.76	-2.116	0.92	3.04	0.72
9.187	3.77	-2.116	0.92	3.04	0.73
9.272	3.51	-2.110	0.93	3.04	0.47
9.274	3.51	-2.110	0.93	3.04	0.47
9.360	3.58	-2.103	0.95	3.05	0.53
9.361	3.58	-2.103	0.95	3.05	0.53
9.440	3.44	-2.097	0.95	3.05	0.39
9.442	3.45	-2.097	0.95	3.05	0.40
9.526	3.54	-2.090	0.97	3.06	0.48
9.528	3.55	-2.090	0.97	3.06	0.49
9.612	3.54	-2.084	0.98	3.06	0.48
9.614	3.51	-2.084	0.98	3.06	0.45
9.693	3.46	-2.078	0.98	3.06	0.40
9.694	3.42	-2.077	0.98	3.06	0.36

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
9.772	3.43	-2.072	1.00	3.07	0.36
9.773	3.43	-2.071	1.00	3.07	0.36
9.851	3.40	-2.065	1.00	3.07	0.33
9.852	3.42	-2.065	1.00	3.07	0.35
9.928	3.34	-2.060	1.02	3.08	0.26
9.930	3.33	-2.059	1.02	3.08	0.25
10.000	3.64	-2.054	1.03	3.08	0.56
10.001	3.66	-2.054	1.03	3.08	0.58
10.063	3.60	-2.049	1.05	3.10	0.50
10.064	3.60	-2.049	1.05	3.10	0.50
10.126	3.46	-2.044	1.06	3.10	0.36
10.127	3.45	-2.044	1.06	3.10	0.35
10.187	3.24	-2.040	1.06	3.10	0.14
10.188	3.24	-2.040	1.06	3.10	0.14
10.250	3.07	-2.035	1.08	3.11	0.00
10.251	3.07	-2.035	1.08	3.11	0.00
10.316	2.99	-2.030	1.08	3.11	0.00
10.317	2.98	-2.030	1.08	3.11	0.00
10.376	2.82	-2.025	1.09	3.12	0.00
10.377	2.81	-2.025	1.09	3.12	0.00
10.432	2.69	-2.021	1.10	3.12	0.00
10.434	2.69	-2.021	1.10	3.12	0.00
10.482	2.60	-2.017	1.10	3.12	0.00
10.484	2.60	-2.017	1.10	3.12	0.00
10.544	2.52	-2.012	1.12	3.13	0.00
10.545	2.52	-2.012	1.12	3.13	0.00
10.608	2.51	-2.008	1.12	3.13	0.00
10.609	2.51	-2.007	1.12	3.13	0.00
10.672	2.46	-2.003	1.14	3.14	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
10.673	2.46	-2.002	1.14	3.14	0.00
10.733	2.40	-1.998	1.14	3.14	0.00
10.734	2.40	-1.998	1.14	3.14	0.00
10.796	2.36	-1.993	1.15	3.14	0.00
10.798	2.36	-1.993	1.15	3.14	0.00
10.862	2.41	-1.988	1.17	3.16	0.00
10.863	2.41	-1.988	1.17	3.16	0.00
10.928	2.43	-1.983	1.18	3.16	0.00
10.929	2.44	-1.983	1.18	3.16	0.00
10.987	2.54	-1.978	1.19	3.17	0.00
10.989	2.54	-1.978	1.19	3.17	0.00
11.047	2.77	-1.974	1.20	3.17	0.00
11.048	2.77	-1.974	1.20	3.17	0.00
11.115	2.59	-1.969	1.20	3.17	0.00
11.116	2.59	-1.969	1.20	3.17	0.00
11.186	2.62	-1.963	1.22	3.18	0.00
11.187	2.62	-1.963	1.22	3.18	0.00
11.256	2.64	-1.958	1.22	3.18	0.00
11.258	2.65	-1.958	1.22	3.18	0.00
11.321	2.60	-1.953	1.25	3.20	0.00
11.323	2.61	-1.953	1.25	3.20	0.00
11.382	2.54	-1.948	1.25	3.20	0.00
11.384	2.55	-1.948	1.25	3.20	0.00
11.446	2.50	-1.943	1.26	3.20	0.00
11.448	2.49	-1.943	1.28	3.22	0.00
11.511	2.46	-1.938	1.28	3.22	0.00
11.513	2.46	-1.938	1.28	3.22	0.00
11.577	2.41	-1.933	1.29	3.22	0.00
11.578	2.40	-1.933	1.29	3.22	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
11.642	2.35	-1.928	1.30	3.23	0.00
11.643	2.35	-1.928	1.30	3.23	0.00
11.705	2.29	-1.923	1.31	3.23	0.00
11.706	2.28	-1.923	1.31	3.23	0.00
11.762	2.20	-1.919	1.33	3.25	0.00
11.763	2.20	-1.919	1.33	3.25	0.00
11.816	2.10	-1.915	1.34	3.25	0.00
11.817	2.10	-1.915	1.34	3.25	0.00
11.876	2.03	-1.910	1.34	3.25	0.00
11.878	2.04	-1.910	1.34	3.25	0.00
11.964	1.98	-1.904	1.37	3.27	0.00
11.965	1.98	-1.904	1.37	3.27	0.00
12.026	1.93	-1.899	1.37	3.27	0.00
12.027	1.93	-1.899	1.37	3.27	0.00
12.088	1.85	-1.894	1.40	3.29	0.00
12.089	1.85	-1.894	1.40	3.29	0.00
12.150	1.76	-1.889	1.40	3.29	0.00
12.151	1.75	-1.889	1.40	3.29	0.00
12.211	1.66	-1.885	1.41	3.29	0.00
12.212	1.67	-1.885	1.41	3.29	0.00
12.271	1.55	-1.880	1.43	3.31	0.00
12.273	1.54	-1.880	1.43	3.31	0.00
12.331	1.43	-1.876	1.43	3.31	0.00
12.332	1.42	-1.875	1.43	3.31	0.00
12.388	1.35	-1.871	1.45	3.32	0.00
12.389	1.36	-1.871	1.45	3.32	0.00
12.445	1.28	-1.867	1.45	3.32	0.00
12.447	1.28	-1.867	1.45	3.32	0.00
12.505	1.22	-1.862	1.46	3.32	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
12.506	1.22	-1.862	1.46	3.32	0.00
12.564	1.15	-1.858	1.48	3.34	0.00
12.565	1.15	-1.858	1.48	3.34	0.00
12.623	1.14	-1.853	1.49	3.34	0.00
12.624	1.14	-1.853	1.49	3.34	0.00
12.734	1.09	-1.845	1.52	3.36	0.00
12.735	1.08	-1.845	1.52	3.36	0.00
12.793	1.04	-1.840	1.52	3.36	0.00
12.794	1.04	-1.840	1.52	3.36	0.00
12.851	1.01	-1.836	1.52	3.36	0.00
12.853	1.02	-1.836	1.52	3.36	0.00
12.911	1.00	-1.831	1.55	3.38	0.00
12.912	1.00	-1.831	1.55	3.38	0.00
12.970	1.01	-1.827	1.55	3.38	0.00
12.971	1.01	-1.826	1.55	3.38	0.00
13.022	1.02	-1.823	1.58	3.40	0.00
13.023	1.02	-1.823	1.58	3.40	0.00
13.077	1.08	-1.818	1.58	3.40	0.00
13.078	1.08	-1.818	1.58	3.40	0.00
13.200	1.13	-1.809	1.57	3.38	0.00
13.201	1.13	-1.809	1.57	3.38	0.00
13.259	1.15	-1.804	1.58	3.38	0.00
13.260	1.14	-1.804	1.58	3.38	0.00
13.318	1.07	-1.800	1.58	3.38	0.00
13.320	1.07	-1.800	1.58	3.38	0.00
13.378	1.00	-1.795	1.61	3.41	0.00
13.379	1.00	-1.795	1.61	3.41	0.00
13.439	0.94	-1.791	1.62	3.41	0.00
13.440	0.94	-1.791	1.62	3.41	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
13.560	0.93	-1.781	1.67	3.45	0.00
13.561	0.93	-1.781	1.67	3.45	0.00
13.617	0.93	-1.777	1.67	3.45	0.00
13.618	0.93	-1.777	1.67	3.45	0.00
13.673	0.94	-1.773	1.68	3.45	0.00
13.674	0.95	-1.773	1.68	3.45	0.00
13.725	0.91	-1.769	1.69	3.46	0.00
13.726	0.91	-1.769	1.69	3.46	0.00
13.785	0.94	-1.764	1.70	3.46	0.00
13.787	0.94	-1.764	1.70	3.46	0.00
13.850	0.96	-1.759	1.70	3.46	0.00
13.851	0.96	-1.759	1.70	3.46	0.00
13.941	0.96	-1.752	1.71	3.46	0.00
13.942	0.96	-1.752	1.71	3.46	0.00
14.006	1.25	-1.747	1.71	3.46	0.00
14.007	1.27	-1.747	1.71	3.46	0.00
14.045	1.60	-1.744	1.73	3.47	0.00
14.045	1.60	-1.744	1.73	3.47	0.00
14.073	1.67	-1.742	1.73	3.47	0.00
14.074	1.67	-1.742	1.73	3.47	0.00
14.101	1.73	-1.740	1.74	3.48	0.00
14.102	1.73	-1.740	1.74	3.48	0.00
14.129	1.77	-1.738	1.74	3.48	0.00
14.130	1.77	-1.738	1.74	3.48	0.00
14.158	1.80	-1.736	1.74	3.48	0.00
14.159	1.81	-1.736	1.74	3.48	0.00
14.185	1.86	-1.733	1.75	3.48	0.00
14.186	1.86	-1.733	1.75	3.48	0.00
14.213	1.90	-1.731	1.75	3.48	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
14.214	1.90	-1.731	1.75	3.48	0.00
14.240	1.92	-1.729	1.76	3.49	0.00
14.241	1.93	-1.729	1.76	3.49	0.00
14.259	1.94	-1.728	1.76	3.49	0.00
14.259	1.93	-1.728	1.76	3.49	0.00
14.277	1.94	-1.726	1.76	3.49	0.00
14.278	1.94	-1.726	1.76	3.49	0.00
14.296	1.95	-1.725	1.76	3.49	0.00
14.296	1.95	-1.725	1.77	3.49	0.00
14.314	1.91	-1.724	1.77	3.49	0.00
14.314	1.91	-1.724	1.77	3.49	0.00
14.332	1.90	-1.722	1.78	3.50	0.00
14.333	1.89	-1.722	1.78	3.50	0.00
14.350	1.88	-1.721	1.78	3.50	0.00
14.351	1.88	-1.721	1.78	3.50	0.00
14.368	1.95	-1.720	1.79	3.51	0.00
14.424	2.07	-1.715	1.79	3.51	0.00
14.425	2.07	-1.715	1.79	3.51	0.00
14.486	2.14	-1.710	1.81	3.52	0.00
14.487	2.14	-1.710	1.81	3.52	0.00
14.551	2.15	-1.705	1.81	3.52	0.00
14.552	2.15	-1.705	1.81	3.52	0.00
14.619	2.16	-1.700	1.82	3.52	0.00
14.620	2.15	-1.700	1.82	3.52	0.00
14.688	2.09	-1.695	1.51	3.20	0.00
14.689	2.09	-1.695	1.51	3.20	0.00
14.745	2.01	-1.693	1.51	3.20	0.00
14.746	2.01	-1.693	1.51	3.20	0.00
14.801	1.96	-1.690	1.52	3.21	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
14.803	1.95	-1.690	1.52	3.21	0.00
14.859	1.89	-1.688	1.52	3.21	0.00
14.860	1.89	-1.688	1.52	3.21	0.00
14.919	1.82	-1.685	1.52	3.21	0.00
14.921	1.82	-1.685	1.52	3.21	0.00
14.983	1.73	-1.683	1.54	3.22	0.00
14.984	1.73	-1.683	1.54	3.22	0.00
15.041	1.66	-1.680	1.54	3.22	0.00
15.042	1.66	-1.680	1.54	3.22	0.00
15.100	1.57	-1.678	1.55	3.23	0.00
15.101	1.58	-1.678	1.55	3.23	0.00
15.157	1.47	-1.675	1.55	3.23	0.00
15.158	1.47	-1.675	1.55	3.23	0.00
15.216	1.31	-1.673	1.57	3.24	0.00
15.217	1.31	-1.673	1.57	3.24	0.00
15.276	1.10	-1.671	1.57	3.24	0.00
15.278	1.10	-1.670	1.57	3.24	0.00
15.337	0.91	-1.668	1.57	3.24	0.00
15.338	0.90	-1.668	1.57	3.24	0.00
15.399	0.90	-1.665	1.58	3.25	0.00
15.400	0.90	-1.665	1.58	3.25	0.00
15.454	0.88	-1.663	1.59	3.25	0.00
15.455	0.88	-1.663	1.59	3.25	0.00
15.505	0.88	-1.661	1.60	3.26	0.00
15.506	0.88	-1.661	1.60	3.26	0.00
15.557	0.85	-1.659	1.60	3.26	0.00
15.558	0.84	-1.659	1.60	3.26	0.00
15.607	0.80	-1.657	1.60	3.26	0.00
15.608	0.80	-1.657	1.60	3.26	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
15.657	0.88	-1.655	1.63	3.28	0.00
15.658	0.88	-1.655	1.63	3.28	0.00
15.709	1.06	-1.653	1.63	3.28	0.00
15.710	1.07	-1.653	1.63	3.28	0.00
15.761	1.02	-1.650	1.64	3.29	0.00
15.762	1.03	-1.650	1.64	3.29	0.00
15.804	1.03	-1.649	1.64	3.29	0.00
15.894	1.01	-1.645	1.66	3.30	0.00
15.895	1.02	-1.645	1.66	3.30	0.00
15.942	1.11	-1.643	1.66	3.30	0.00
15.943	1.11	-1.643	1.66	3.30	0.00
15.988	1.11	-1.641	1.67	3.31	0.00
15.989	1.11	-1.641	1.67	3.31	0.00
16.081	1.26	-1.637	1.67	3.31	0.00
16.082	1.26	-1.637	1.67	3.31	0.00
16.180	1.29	-1.633	1.69	3.32	0.00
16.181	1.29	-1.633	1.69	3.32	0.00
16.225	1.31	-1.631	1.70	3.33	0.00
16.226	1.30	-1.631	1.70	3.33	0.00
16.268	1.25	-1.629	1.70	3.33	0.00
16.268	1.25	-1.629	1.70	3.33	0.00
16.306	1.23	-1.628	1.70	3.33	0.00
16.354	1.10	-1.626	1.72	3.35	0.00
16.355	1.10	-1.626	1.72	3.35	0.00
16.541	0.65	-1.618	1.80	3.42	0.00
16.548	0.65	-1.618	1.81	3.43	0.00
16.548	0.65	-1.618	1.81	3.43	0.00
16.643	1.00	-1.614	1.86	3.47	0.00
16.643	1.02	-1.614	1.86	3.47	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
16.718	0.48	-1.611	1.89	3.50	0.00
16.719	0.51	-1.611	1.89	3.50	0.00
16.827	0.76	-1.606	1.92	3.53	0.00
16.828	0.77	-1.606	1.92	3.53	0.00
16.869	0.76	-1.604	1.93	3.53	0.00
16.870	0.76	-1.604	1.93	3.53	0.00
16.914	0.78	-1.602	1.93	3.53	0.00
16.915	0.76	-1.602	1.94	3.54	0.00
17.022	0.82	-1.598	1.95	3.55	0.00
17.023	0.82	-1.598	1.95	3.55	0.00
17.120	0.78	-1.594	1.97	3.56	0.00
17.121	0.78	-1.594	1.97	3.56	0.00
17.224	0.95	-1.590	1.97	3.56	0.00
17.225	0.96	-1.590	1.97	3.56	0.00
17.326	2.50	-1.585	1.98	3.57	0.00
17.327	2.59	-1.585	1.98	3.57	0.00
17.380	3.11	-1.583	2.00	3.58	0.00
17.381	3.11	-1.583	2.00	3.58	0.00
17.435	3.27	-1.581	2.00	3.58	0.00
17.436	3.32	-1.581	2.00	3.58	0.00
17.490	3.26	-1.579	2.00	3.58	0.00
17.491	3.24	-1.579	2.00	3.58	0.00
17.544	3.31	-1.576	2.01	3.59	0.00
17.596	3.83	-1.574	2.02	3.59	0.24
17.598	3.84	-1.574	2.02	3.59	0.25
17.746	6.32	-1.568	2.03	3.60	2.72
17.826	4.85	-1.565	2.06	3.62	1.23
17.915	5.46	-1.561	2.07	3.63	1.83
17.916	5.44	-1.561	2.07	3.63	1.81

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
18.048	5.79	-1.555	2.08	3.64	2.15
18.049	5.79	-1.555	2.08	3.64	2.15
18.147	5.45	-1.551	2.10	3.65	1.80
18.245	5.67	-1.547	2.11	3.66	2.01
18.246	5.66	-1.547	2.11	3.66	2.00
18.344	5.27	-1.543	2.13	3.67	1.60
18.344	5.29	-1.543	2.13	3.67	1.62
18.444	5.59	-1.539	2.16	3.70	1.89
18.444	5.57	-1.539	2.16	3.70	1.87
18.541	5.56	-1.535	2.19	3.72	1.84
18.542	5.56	-1.535	2.19	3.72	1.84
18.633	5.40	-1.531	2.19	3.72	1.68
18.634	5.38	-1.531	2.19	3.72	1.66
18.679	5.45	-1.529	2.19	3.72	1.73
18.680	5.45	-1.529	2.19	3.72	1.73
18.724	5.55	-1.527	2.19	3.72	1.83
18.725	5.57	-1.527	2.19	3.72	1.85
18.818	5.61	-1.523	2.21	3.73	1.88
18.819	5.61	-1.523	2.21	3.73	1.88
18.932	5.66	-1.519	2.22	3.74	1.92
18.932	5.64	-1.519	2.22	3.74	1.90
19.043	5.19	-1.514	2.24	3.75	1.44
19.043	5.24	-1.514	2.24	3.75	1.49
19.139	5.48	-1.510	2.25	3.76	1.72
19.237	5.21	-1.506	2.26	3.77	1.44
19.238	5.17	-1.506	2.26	3.77	1.40
19.324	5.19	-1.502	2.27	3.77	1.42
19.325	5.21	-1.502	2.27	3.77	1.44
19.410	4.96	-1.499	2.28	3.78	1.18

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
19.411	4.96	-1.499	2.28	3.78	1.18
19.534	5.03	-1.494	2.30	3.79	1.24
19.535	5.01	-1.494	2.30	3.79	1.22
19.616	5.09	-1.490	2.30	3.79	1.30
19.617	5.07	-1.490	2.30	3.79	1.28
19.738	5.18	-1.485	2.31	3.80	1.38
19.739	5.18	-1.485	2.31	3.80	1.38
19.814	5.34	-1.482	2.33	3.81	1.53
19.815	5.33	-1.482	2.33	3.81	1.52
19.928	5.40	-1.477	2.33	3.81	1.59
19.929	5.37	-1.477	2.33	3.81	1.56
20.038	5.00	-1.473	2.35	3.82	1.18
20.039	5.03	-1.473	2.35	3.82	1.21
20.114	5.36	-1.470	2.36	3.83	1.53
20.115	5.44	-1.469	2.36	3.83	1.61
20.189	5.20	-1.466	2.36	3.83	1.37
20.190	5.32	-1.466	2.36	3.83	1.49
20.225	5.49	-1.465	2.38	3.84	1.65
20.226	5.48	-1.465	2.38	3.84	1.64
20.333	4.99	-1.460	2.39	3.85	1.14
20.333	5.01	-1.460	2.39	3.85	1.16
20.420	0.00	-1.457	0.59	2.05	0.00
20.436	5.15	-1.456	2.39	3.85	1.30
20.436	5.15	-1.456	2.39	3.85	1.30
20.537	5.11	-1.452	2.41	3.86	1.25
20.538	5.09	-1.452	2.41	3.86	1.23
20.623	4.89	-1.448	2.42	3.87	1.02
20.624	4.90	-1.448	2.42	3.87	1.03
20.717	4.87	-1.444	2.43	3.87	1.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
20.745	5.03	-1.443	2.43	3.87	1.16
20.746	5.04	-1.443	2.43	3.87	1.17
20.840	4.92	-1.439	2.43	3.87	1.05
20.841	3.60	-1.439	0.61	2.05	1.55
20.943	3.70	-1.435	0.62	2.06	1.64
20.945	3.69	-1.435	0.62	2.06	1.63
21.038	5.88	-1.431	2.45	3.88	2.00
21.044	3.77	-1.431	0.63	2.06	1.71
21.046	3.77	-1.431	0.63	2.06	1.71
21.141	3.71	-1.427	0.64	2.07	1.64
21.143	3.72	-1.427	0.64	2.07	1.65
21.237	4.97	-1.423	2.48	3.90	1.07
21.238	5.01	-1.423	2.48	3.90	1.11
21.338	1.88	-1.419	0.67	2.09	0.00
21.397	4.78	-1.416	2.48	3.90	0.88
21.406	3.75	-1.416	0.73	2.15	1.60
21.502	3.56	-1.412	0.74	2.15	1.41
21.504	3.57	-1.412	0.74	2.15	1.42
21.599	3.44	-1.408	0.75	2.16	1.28
21.601	3.45	-1.408	0.75	2.16	1.29
21.695	3.72	-1.404	0.76	2.16	1.56
21.697	3.69	-1.404	0.76	2.16	1.53
21.790	3.66	-1.400	0.76	2.16	1.50
21.792	3.66	-1.400	0.76	2.16	1.50
21.884	3.72	-1.396	0.76	2.16	1.56
21.886	3.73	-1.396	0.76	2.16	1.57
21.977	3.64	-1.392	0.77	2.16	1.48
21.979	3.65	-1.392	0.77	2.16	1.49
22.071	3.85	-1.388	0.78	2.17	1.68

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
22.073	3.88	-1.388	0.78	2.17	1.71
22.163	4.16	-1.384	0.79	2.17	1.99
22.165	4.16	-1.384	0.79	2.17	1.99
22.256	4.47	-1.381	0.79	2.17	2.30
22.257	4.45	-1.380	0.79	2.17	2.28
22.349	4.39	-1.377	0.79	2.17	2.22
22.351	4.41	-1.377	0.79	2.17	2.24
22.395	5.08	-1.375	0.80	2.17	2.91
22.397	5.13	-1.375	0.80	2.17	2.96
22.486	5.36	-1.371	0.81	2.18	3.18
22.488	5.29	-1.371	0.81	2.18	3.11
22.577	4.02	-1.367	0.81	2.18	1.84
22.579	4.02	-1.367	0.81	2.18	1.84
22.667	3.95	-1.363	0.82	2.18	1.77
22.669	4.00	-1.363	0.82	2.18	1.82
22.758	4.06	-1.360	0.82	2.18	1.88
22.760	4.03	-1.360	0.82	2.18	1.85
22.849	3.58	-1.356	0.82	2.18	1.40
22.851	3.57	-1.356	0.82	2.18	1.39
22.939	3.41	-1.352	0.84	2.19	1.22
22.941	3.43	-1.352	0.84	2.19	1.24
23.026	3.61	-1.349	0.84	2.19	1.42
23.028	3.60	-1.348	0.84	2.19	1.41
23.111	3.45	-1.345	0.85	2.19	1.26
23.113	3.45	-1.345	0.85	2.19	1.26
23.199	3.31	-1.341	0.87	2.21	1.10
23.201	3.32	-1.341	0.87	2.21	1.11
23.282	3.09	-1.338	0.87	2.21	0.88
23.284	3.08	-1.338	0.87	2.21	0.87

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
23.366	2.91	-1.334	0.88	2.21	0.70
23.368	2.92	-1.334	0.88	2.21	0.71
23.450	2.52	-1.331	0.88	2.21	0.31
23.451	2.55	-1.331	0.88	2.21	0.34
23.531	2.87	-1.328	0.89	2.22	0.65
23.533	2.86	-1.328	0.89	2.22	0.64
23.613	2.83	-1.324	0.90	2.22	0.61
23.615	2.83	-1.324	0.90	2.22	0.61
23.696	2.56	-1.321	0.91	2.23	0.33
23.697	2.72	-1.321	0.90	2.22	0.50
23.698	2.55	-1.321	0.91	2.23	0.32
23.699	2.72	-1.321	0.90	2.22	0.50
23.779	2.55	-1.317	0.91	2.23	0.32
23.780	2.55	-1.317	0.91	2.23	0.32
23.857	2.45	-1.314	0.93	2.24	0.21
23.859	2.45	-1.314	0.93	2.24	0.21
23.936	2.24	-1.311	0.93	2.24	0.00
23.937	2.23	-1.311	0.93	2.24	0.00
24.018	1.77	-1.307	0.93	2.24	0.00
24.019	1.76	-1.307	0.93	2.24	0.00
24.100	1.62	-1.304	0.94	2.24	0.00
24.101	1.62	-1.304	0.94	2.24	0.00
24.182	1.73	-1.301	0.94	2.24	0.00
24.184	1.73	-1.300	0.94	2.24	0.00
24.263	1.65	-1.297	0.95	2.25	0.00
24.265	1.65	-1.297	0.95	2.25	0.00
24.342	1.57	-1.294	0.96	2.25	0.00
24.344	1.56	-1.294	0.96	2.25	0.00
24.419	1.50	-1.291	0.97	2.26	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
24.420	1.50	-1.291	0.97	2.26	0.00
24.493	1.43	-1.288	0.97	2.26	0.00
24.495	1.43	-1.288	0.97	2.26	0.00
24.569	1.34	-1.284	0.98	2.26	0.00
24.571	1.34	-1.284	0.98	2.26	0.00
24.644	1.27	-1.281	0.98	2.26	0.00
24.646	1.27	-1.281	0.98	2.26	0.00
24.720	1.19	-1.278	0.98	2.26	0.00
24.721	1.18	-1.278	0.98	2.26	0.00
24.794	1.07	-1.275	0.99	2.27	0.00
24.796	1.06	-1.275	0.99	2.27	0.00
24.861	0.77	-1.272	1.00	2.27	0.00
24.862	0.76	-1.272	1.00	2.27	0.00
24.928	0.96	-1.270	1.00	2.27	0.00
24.930	0.99	-1.269	1.00	2.27	0.00
25.006	1.92	-1.266	1.01	2.28	0.00
25.081	2.35	-1.263	1.02	2.28	0.07
25.083	2.35	-1.263	1.02	2.28	0.07
25.150	2.53	-1.260	1.03	2.29	0.24
25.151	2.53	-1.260	1.03	2.29	0.24
25.220	2.52	-1.257	1.03	2.29	0.23
25.222	2.53	-1.257	1.03	2.29	0.24
25.289	2.49	-1.255	1.04	2.29	0.20
25.291	2.49	-1.254	1.04	2.29	0.20
25.358	2.39	-1.252	1.04	2.29	0.10
25.360	2.38	-1.252	1.04	2.29	0.09
25.423	2.04	-1.249	1.04	2.29	0.00
25.424	2.03	-1.249	1.04	2.29	0.00
25.489	1.72	-1.246	1.05	2.30	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
25.490	1.71	-1.246	1.05	2.30	0.00
25.552	1.48	-1.244	1.06	2.30	0.00
25.553	1.48	-1.244	1.06	2.30	0.00
25.613	1.56	-1.241	1.06	2.30	0.00
25.614	1.56	-1.241	1.06	2.30	0.00
25.676	1.65	-1.238	1.07	2.31	0.00
25.677	1.66	-1.238	1.07	2.31	0.00
25.736	1.65	-1.236	1.07	2.31	0.00
25.737	1.64	-1.236	1.07	2.31	0.00
25.810	1.63	-1.233	1.08	2.31	0.00
25.893	1.59	-1.229	1.09	2.32	0.00
25.894	1.59	-1.229	1.09	2.32	0.00
25.951	1.53	-1.227	1.10	2.33	0.00
25.952	1.53	-1.227	1.10	2.33	0.00
26.014	1.42	-1.224	1.11	2.33	0.00
26.015	1.42	-1.224	1.11	2.33	0.00
26.147	1.06	-1.219	1.11	2.33	0.00
26.148	1.06	-1.219	1.11	2.33	0.00
26.190	0.94	-1.217	1.12	2.34	0.00
26.191	0.93	-1.217	1.12	2.34	0.00
26.226	0.82	-1.216	1.12	2.34	0.00
26.227	0.82	-1.216	1.12	2.34	0.00
26.344	0.46	-1.211	1.15	2.36	0.00
26.345	0.47	-1.211	1.15	2.36	0.00
26.345	0.47	-1.211	1.15	2.36	0.00
26.431	0.33	-1.207	1.17	2.38	0.00
26.497	1.10	-1.204	1.21	2.41	0.00
26.508	1.07	-1.204	1.21	2.41	0.00
26.598	1.08	-1.200	1.25	2.45	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
26.598	1.06	-1.200	1.25	2.45	0.00
26.706	1.10	-1.196	1.28	2.48	0.00
26.706	1.11	-1.196	1.28	2.48	0.00
26.844	1.14	-1.190	1.29	2.48	0.00
26.845	1.14	-1.190	1.29	2.48	0.00
26.907	0.94	-1.187	1.30	2.49	0.00
26.908	0.92	-1.187	1.30	2.49	0.00
26.960	0.39	-1.185	1.30	2.49	0.00
26.961	0.39	-1.185	1.30	2.49	0.00
27.015	0.57	-1.183	1.32	2.50	0.00
27.016	0.58	-1.183	1.32	2.50	0.00
27.074	0.75	-1.180	1.32	2.50	0.00
27.075	0.76	-1.180	1.32	2.50	0.00
27.133	0.85	-1.178	1.32	2.50	0.00
27.135	0.86	-1.178	1.32	2.50	0.00
27.194	0.91	-1.175	1.33	2.51	0.00
27.195	0.91	-1.175	1.33	2.51	0.00
27.255	0.90	-1.173	1.34	2.51	0.00
27.257	0.89	-1.173	1.34	2.51	0.00
27.317	0.85	-1.170	1.34	2.51	0.00
27.318	0.85	-1.170	1.34	2.51	0.00
27.378	0.86	-1.168	1.34	2.51	0.00
27.379	0.86	-1.168	1.34	2.51	0.00
27.437	0.87	-1.165	1.34	2.51	0.00
27.439	0.86	-1.165	1.34	2.51	0.00
27.499	0.82	-1.163	1.36	2.52	0.00
27.500	0.81	-1.163	1.36	2.52	0.00
27.559	0.72	-1.160	1.36	2.52	0.00
27.560	0.72	-1.160	1.36	2.52	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
27.618	0.66	-1.158	1.36	2.52	0.00
27.619	0.66	-1.158	1.36	2.52	0.00
27.720	0.66	-1.154	1.37	2.52	0.00
27.764	0.63	-1.152	1.37	2.52	0.00
27.766	0.63	-1.152	1.37	2.52	0.00
27.817	0.57	-1.149	1.38	2.53	0.00
27.818	0.57	-1.149	1.38	2.53	0.00
27.843	0.47	-1.148	1.38	2.53	0.00
27.844	0.47	-1.148	1.38	2.53	0.00
27.888	0.47	-1.147	1.38	2.53	0.00
27.889	0.47	-1.146	1.38	2.53	0.00
27.941	0.54	-1.144	1.40	2.54	0.00
27.942	0.54	-1.144	1.40	2.54	0.00
27.996	0.59	-1.142	1.40	2.54	0.00
27.998	0.59	-1.142	1.40	2.54	0.00
28.053	0.63	-1.140	1.40	2.54	0.00
28.055	0.63	-1.140	1.40	2.54	0.00
28.110	0.70	-1.137	1.40	2.54	0.00
28.111	0.70	-1.137	1.40	2.54	0.00
28.240	0.76	-1.132	1.41	2.54	0.00
28.292	0.77	-1.130	1.41	2.54	0.00
28.348	0.84	-1.127	1.42	2.55	0.00
28.349	0.84	-1.127	1.42	2.55	0.00
28.405	0.82	-1.125	1.42	2.55	0.00
28.406	0.82	-1.125	1.42	2.55	0.00
28.463	1.02	-1.123	1.43	2.55	0.00
28.464	1.03	-1.123	1.43	2.55	0.00
28.520	1.12	-1.120	1.43	2.55	0.00
28.521	1.11	-1.120	1.43	2.55	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
28.577	0.94	-1.118	1.43	2.55	0.00
28.578	0.94	-1.118	1.43	2.55	0.00
28.634	0.98	-1.116	1.44	2.56	0.00
28.636	0.98	-1.115	1.44	2.56	0.00
28.691	1.05	-1.113	1.45	2.56	0.00
28.692	1.04	-1.113	1.45	2.56	0.00
28.747	0.99	-1.111	1.48	2.59	0.00
28.749	0.99	-1.111	1.48	2.59	0.00
28.804	1.09	-1.108	1.48	2.59	0.00
28.805	1.10	-1.108	1.48	2.59	0.00
28.929	1.12	-1.103	1.49	2.59	0.00
28.931	1.11	-1.103	1.49	2.59	0.00
28.982	0.98	-1.101	1.52	2.62	0.00
28.983	0.98	-1.101	1.52	2.62	0.00
29.030	0.86	-1.099	1.52	2.62	0.00
29.031	0.86	-1.099	1.52	2.62	0.00
29.076	0.68	-1.097	1.55	2.65	0.00
29.077	0.68	-1.097	1.55	2.65	0.00
29.129	0.62	-1.095	1.56	2.65	0.00
29.130	0.62	-1.095	1.56	2.65	0.00
29.183	0.77	-1.093	1.56	2.65	0.00
29.184	0.77	-1.093	1.59	2.68	0.00
29.239	1.06	-1.090	1.59	2.68	0.00
29.240	1.08	-1.090	1.59	2.68	0.00
29.299	1.74	-1.088	1.59	2.68	0.00
29.300	1.75	-1.088	1.59	2.68	0.00
29.390	1.99	-1.084	1.63	2.71	0.00
29.391	2.00	-1.084	1.63	2.71	0.00
29.451	2.41	-1.082	1.63	2.71	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
29.510	2.73	-1.079	1.65	2.73	0.00
29.512	2.74	-1.079	1.65	2.73	0.01
29.569	3.01	-1.077	1.65	2.73	0.28
29.570	3.02	-1.077	1.65	2.73	0.29
29.624	3.06	-1.074	1.66	2.73	0.33
29.625	3.06	-1.074	1.66	2.73	0.33
29.676	2.96	-1.072	1.69	2.76	0.20
29.677	2.95	-1.072	1.69	2.76	0.19
29.727	2.72	-1.070	1.69	2.76	0.00
29.727	2.72	-1.070	1.69	2.76	0.00
29.775	2.60	-1.068	1.72	2.79	0.00
29.776	2.60	-1.068	1.72	2.79	0.00
29.827	2.52	-1.066	1.72	2.79	0.00
29.828	2.52	-1.066	1.72	2.79	0.00
29.972	2.28	-1.060	1.73	2.79	0.00
29.973	2.28	-1.060	1.73	2.79	0.00
30.033	2.26	-1.057	1.76	2.82	0.00
30.034	2.26	-1.057	1.76	2.82	0.00
30.094	2.16	-1.055	1.77	2.82	0.00
30.095	2.16	-1.055	1.77	2.82	0.00
30.155	2.06	-1.052	1.80	2.85	0.00
30.157	2.05	-1.052	1.80	2.85	0.00
30.216	1.96	-1.050	1.80	2.85	0.00
30.218	1.96	-1.050	1.80	2.85	0.00
30.276	1.93	-1.047	1.80	2.85	0.00
30.277	1.93	-1.047	1.80	2.85	0.00
30.436	1.88	-1.041	1.82	2.86	0.00
30.437	1.88	-1.041	1.82	2.86	0.00
30.498	1.86	-1.038	1.82	2.86	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
30.499	1.86	-1.038	1.82	2.86	0.00
30.559	1.83	-1.036	1.82	2.86	0.00
30.561	1.83	-1.035	1.82	2.86	0.00
30.621	1.79	-1.033	1.83	2.86	0.00
30.623	1.79	-1.033	1.83	2.86	0.00
30.683	1.78	-1.030	1.83	2.86	0.00
30.684	1.78	-1.030	1.83	2.86	0.00
30.745	1.83	-1.028	1.84	2.87	0.00
30.750	1.84	-1.028	1.84	2.87	0.00
30.949	1.88	-1.019	1.85	2.87	0.00
30.951	1.88	-1.019	1.85	2.87	0.00
31.013	2.03	-1.017	1.85	2.87	0.00
31.014	2.04	-1.017	1.85	2.87	0.00
31.078	2.45	-1.014	1.86	2.87	0.00
31.142	3.05	-1.011	1.87	2.88	0.17
31.144	3.06	-1.011	1.87	2.88	0.18
31.208	3.32	-1.009	1.87	2.88	0.44
31.210	3.33	-1.009	1.87	2.88	0.45
31.275	3.62	-1.006	1.87	2.88	0.74
31.277	3.62	-1.006	1.87	2.88	0.74
31.343	3.67	-1.003	1.89	2.89	0.78
31.345	3.65	-1.003	1.89	2.89	0.76
31.416	3.89	-1.000	1.89	2.89	1.00
31.417	3.89	-1.000	1.89	2.89	1.00
31.481	4.05	-0.997	1.89	2.89	1.16
31.483	4.06	-0.997	1.89	2.89	1.17
31.546	4.18	-0.995	1.90	2.89	1.29
31.547	4.17	-0.995	1.90	2.89	1.28
31.609	4.21	-0.992	1.90	2.89	1.32

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
31.610	4.21	-0.992	1.90	2.89	1.32
31.672	4.02	-0.989	1.91	2.90	1.12
31.673	4.01	-0.989	1.91	2.90	1.11
31.734	3.75	-0.987	1.91	2.90	0.85
31.735	3.72	-0.987	1.91	2.90	0.82
31.792	3.92	-0.984	1.92	2.90	1.02
31.793	3.91	-0.984	1.92	2.90	1.01
31.851	3.82	-0.982	1.92	2.90	0.92
31.852	3.82	-0.982	1.92	2.90	0.92
31.907	3.89	-0.980	1.92	2.90	0.99
31.909	3.91	-0.979	1.92	2.90	1.01
31.968	3.82	-0.977	1.93	2.91	0.91
31.970	3.79	-0.977	1.93	2.91	0.88
32.028	3.82	-0.975	1.94	2.91	0.91
32.029	3.81	-0.974	1.94	2.91	0.90
32.089	3.85	-0.972	1.95	2.92	0.93
32.090	3.82	-0.972	1.95	2.92	0.90
32.150	3.81	-0.968	1.95	2.92	0.89
32.151	3.82	-0.968	1.95	2.92	0.90
32.209	3.76	-0.965	1.96	2.92	0.84
32.211	3.74	-0.965	1.96	2.92	0.82
32.270	3.77	-0.961	1.96	2.92	0.85
32.272	3.77	-0.961	1.96	2.92	0.85
32.330	3.81	-0.958	1.96	2.92	0.89
32.331	3.81	-0.957	1.96	2.92	0.89
32.388	3.77	-0.954	1.98	2.93	0.84
32.389	3.76	-0.954	1.98	2.93	0.83
32.448	3.64	-0.950	1.98	2.93	0.71
32.450	3.64	-0.950	1.98	2.93	0.71

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
32.507	3.60	-0.947	1.98	2.93	0.67
32.509	3.61	-0.947	1.98	2.93	0.68
32.544	3.62	-0.945	1.99	2.93	0.69
32.545	3.63	-0.945	1.99	2.93	0.70
32.599	3.69	-0.941	1.99	2.93	0.76
32.600	3.69	-0.941	1.99	2.93	0.76
32.651	3.67	-0.938	2.00	2.94	0.73
32.652	3.65	-0.938	2.00	2.94	0.71
32.707	3.75	-0.935	2.01	2.94	0.81
32.709	3.75	-0.935	2.01	2.94	0.81
32.763	3.26	-0.932	2.01	2.94	0.32
32.765	3.20	-0.931	2.01	2.94	0.26
32.819	3.07	-0.928	2.01	2.94	0.13
32.821	3.06	-0.928	2.01	2.94	0.12
32.875	3.33	-0.925	2.02	2.94	0.39
32.876	3.34	-0.925	2.02	2.94	0.40
32.928	2.91	-0.922	2.03	2.95	0.00
32.930	2.94	-0.922	2.03	2.95	0.00
32.981	2.23	-0.918	2.03	2.95	0.00
32.983	2.21	-0.918	2.03	2.95	0.00
33.037	1.85	-0.915	2.03	2.95	0.00
33.038	1.85	-0.915	2.03	2.95	0.00
33.093	1.81	-0.912	2.04	2.95	0.00
33.094	1.81	-0.912	2.04	2.95	0.00
33.151	2.07	-0.908	2.04	2.95	0.00
33.152	2.07	-0.908	2.04	2.95	0.00
33.209	1.91	-0.905	2.06	2.96	0.00
33.210	1.91	-0.905	2.06	2.96	0.00
33.265	1.91	-0.901	2.06	2.96	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
33.280	3.02	-0.901	2.06	2.96	0.06
33.281	3.02	-0.900	2.06	2.96	0.06
33.337	2.80	-0.897	2.06	2.96	0.00
33.338	2.77	-0.897	2.06	2.96	0.00
33.393	2.70	-0.894	2.07	2.96	0.00
33.394	2.72	-0.894	2.07	2.96	0.00
33.445	2.27	-0.891	2.08	2.97	0.00
33.446	2.28	-0.891	2.08	2.97	0.00
33.498	2.88	-0.887	2.08	2.97	0.00
33.547	3.23	-0.885	2.09	2.97	0.26
33.548	3.19	-0.884	2.09	2.97	0.22
33.591	2.45	-0.882	2.09	2.97	0.00
33.593	2.44	-0.882	2.09	2.97	0.00
33.647	1.88	-0.879	2.09	2.97	0.00
33.700	3.18	-0.875	2.10	2.98	0.20
33.701	3.17	-0.875	2.10	2.98	0.19
33.753	3.13	-0.872	2.11	2.98	0.15
33.754	3.15	-0.872	2.11	2.98	0.17
33.806	4.02	-0.869	2.11	2.98	1.04
33.807	4.02	-0.869	2.11	2.98	1.04
33.859	4.11	-0.866	2.11	2.98	1.13
33.860	4.13	-0.866	2.11	2.98	1.15
33.885	5.03	-0.864	2.12	2.98	2.05
33.886	5.02	-0.864	2.12	2.98	2.04
33.940	4.72	-0.861	2.13	2.99	1.73
33.941	4.70	-0.861	2.13	2.99	1.71
33.986	4.62	-0.858	2.13	2.99	1.63
33.986	4.58	-0.858	2.13	2.99	1.59
34.015	3.80	-0.856	2.13	2.99	0.81

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
34.016	3.80	-0.856	2.13	2.99	0.81
34.050	3.57	-0.854	2.14	2.99	0.58
34.051	3.57	-0.854	2.14	2.99	0.58
34.083	3.54	-0.852	2.15	3.00	0.54
34.083	3.53	-0.852	2.15	3.00	0.53
34.117	3.23	-0.850	2.15	3.00	0.23
34.118	3.23	-0.850	2.15	3.00	0.23
34.164	3.12	-0.848	2.15	3.00	0.12
34.165	3.12	-0.847	2.15	3.00	0.12
34.206	3.31	-0.845	2.16	3.00	0.31
34.207	3.26	-0.845	2.16	3.00	0.26
34.259	3.26	-0.842	2.16	3.00	0.26
34.260	3.37	-0.842	2.16	3.00	0.37
34.314	3.77	-0.839	2.17	3.01	0.76
34.315	3.82	-0.838	2.17	3.01	0.81
34.370	4.24	-0.835	2.17	3.01	1.23
34.371	4.21	-0.835	2.17	3.01	1.20
34.444	4.38	-0.831	2.18	3.01	1.37
34.445	4.37	-0.831	2.18	3.01	1.36
34.500	3.63	-0.827	2.18	3.01	0.62
34.500	3.65	-0.827	2.18	3.01	0.64
34.554	3.86	-0.824	2.19	3.01	0.85
34.555	3.85	-0.824	2.19	3.01	0.84
34.610	4.61	-0.821	2.20	3.02	1.59
34.611	4.59	-0.821	2.20	3.02	1.57
34.665	3.80	-0.817	2.20	3.02	0.78
34.666	3.78	-0.817	2.20	3.02	0.76
34.731	3.58	-0.814	2.21	3.02	0.56
34.732	3.61	-0.813	2.21	3.02	0.59

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
34.783	5.96	-0.810	2.21	3.02	2.94
34.783	6.07	-0.810	2.21	3.02	3.05
34.828	7.22	-0.808	2.21	3.02	4.20
34.829	7.31	-0.808	2.21	3.02	4.29
34.872	5.91	-0.805	2.22	3.03	2.88
34.873	5.87	-0.805	2.23	3.03	2.84
34.920	6.29	-0.802	2.23	3.03	3.26
34.921	6.26	-0.802	2.23	3.03	3.23
34.958	5.37	-0.800	2.23	3.03	2.34
34.958	5.36	-0.800	2.23	3.03	2.33
35.001	4.93	-0.797	2.23	3.03	1.90
35.002	4.97	-0.797	2.23	3.03	1.94
35.047	4.49	-0.795	2.24	3.03	1.46
35.048	4.40	-0.794	2.24	3.03	1.37
35.093	4.07	-0.792	2.25	3.04	1.03
35.094	4.03	-0.792	2.25	3.04	0.99
35.116	3.91	-0.790	2.25	3.04	0.87
35.117	3.93	-0.790	2.25	3.04	0.89
35.154	4.15	-0.788	2.26	3.05	1.10
35.155	4.16	-0.788	2.26	3.05	1.11
35.195	4.04	-0.786	2.26	3.05	0.99
35.196	4.05	-0.786	2.26	3.05	1.00
35.239	4.39	-0.783	2.27	3.05	1.34
35.239	4.41	-0.783	2.27	3.05	1.36
35.286	4.49	-0.780	2.27	3.05	1.44
35.287	4.50	-0.780	2.27	3.05	1.45
35.326	4.56	-0.778	2.27	3.05	1.51
35.327	4.55	-0.778	2.27	3.05	1.50
35.379	4.68	-0.775	2.29	3.06	1.62

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
35.380	4.65	-0.775	2.29	3.06	1.59
35.430	4.80	-0.772	2.29	3.06	1.74
35.431	4.78	-0.772	2.29	3.06	1.72
35.478	4.74	-0.769	2.29	3.06	1.68
35.479	4.77	-0.769	2.29	3.06	1.71
35.521	6.14	-0.766	2.29	3.06	3.08
35.522	6.20	-0.766	2.29	3.06	3.14
35.531	7.09	-0.766	2.29	3.06	4.03
35.532	7.00	-0.765	2.29	3.06	3.94
35.572	5.83	-0.763	2.31	3.07	2.76
35.572	5.83	-0.763	2.31	3.07	2.76
35.614	5.55	-0.761	2.31	3.07	2.48
35.615	5.57	-0.760	2.31	3.07	2.50
35.663	5.33	-0.758	2.31	3.07	2.26
35.664	5.33	-0.758	2.31	3.07	2.26
35.706	4.63	-0.755	2.32	3.08	1.55
35.707	4.57	-0.755	2.33	3.08	1.49
35.712	4.07	-0.755	2.33	3.08	0.99
35.713	4.09	-0.755	2.33	3.08	1.01
35.760	3.61	-0.752	2.33	3.08	0.53
35.761	3.55	-0.752	2.33	3.08	0.47
35.808	3.62	-0.749	2.33	3.08	0.54
35.809	3.61	-0.749	2.33	3.08	0.53
35.857	3.13	-0.746	2.33	3.08	0.05
35.858	3.12	-0.746	2.33	3.08	0.04
35.908	2.96	-0.743	2.35	3.09	0.00
35.909	2.93	-0.743	2.35	3.09	0.00
35.945	2.36	-0.741	2.35	3.09	0.00
35.946	2.38	-0.741	2.35	3.09	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
35.995	1.67	-0.738	2.35	3.09	0.00
35.996	1.63	-0.738	2.35	3.09	0.00
36.045	1.89	-0.735	2.36	3.09	0.00
36.046	2.01	-0.735	2.36	3.09	0.00
36.092	1.20	-0.732	2.36	3.09	0.00
36.093	1.22	-0.732	2.37	3.10	0.00
36.132	0.82	-0.729	2.37	3.10	0.00
36.133	0.81	-0.729	2.37	3.10	0.00
36.178	0.54	-0.727	2.37	3.10	0.00
36.179	0.54	-0.727	2.37	3.10	0.00
36.211	0.91	-0.725	2.39	3.11	0.00
36.212	0.92	-0.725	2.39	3.11	0.00
36.262	0.91	-0.722	2.39	3.11	0.00
36.264	0.92	-0.722	2.39	3.11	0.00
36.315	1.07	-0.719	2.39	3.11	0.00
36.316	1.08	-0.718	2.39	3.11	0.00
36.367	1.34	-0.715	2.39	3.11	0.00
36.368	1.34	-0.715	2.39	3.11	0.00
36.417	1.45	-0.712	2.40	3.11	0.00
36.418	1.46	-0.712	2.40	3.11	0.00
36.471	1.59	-0.709	2.41	3.12	0.00
36.472	1.59	-0.709	2.41	3.12	0.00
36.525	2.07	-0.706	2.41	3.12	0.00
36.526	2.09	-0.706	2.41	3.12	0.00
36.578	2.53	-0.703	2.42	3.12	0.00
36.579	2.53	-0.703	2.42	3.12	0.00
36.629	2.30	-0.700	2.42	3.12	0.00
36.630	2.31	-0.700	2.42	3.12	0.00
36.665	2.59	-0.698	2.42	3.12	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
36.666	2.58	-0.697	2.42	3.12	0.00
36.714	1.94	-0.695	2.44	3.13	0.00
36.715	1.94	-0.695	2.44	3.13	0.00
36.761	0.99	-0.692	2.44	3.13	0.00
36.762	0.96	-0.692	2.44	3.13	0.00
36.810	1.42	-0.689	2.44	3.13	0.00
36.858	3.16	-0.686	2.44	3.13	0.03
36.859	3.18	-0.686	2.44	3.13	0.05
36.905	3.38	-0.683	2.45	3.13	0.25
36.906	3.37	-0.683	2.45	3.13	0.24
36.956	3.74	-0.680	2.46	3.14	0.60
36.957	3.74	-0.680	2.46	3.14	0.60
37.008	4.28	-0.677	2.46	3.14	1.14
37.009	4.24	-0.677	2.46	3.14	1.10
37.060	3.35	-0.674	2.47	3.14	0.21
37.061	3.37	-0.674	2.47	3.14	0.23
37.110	4.39	-0.671	2.47	3.14	1.25
37.111	4.39	-0.671	2.47	3.14	1.25
37.153	4.35	-0.668	2.47	3.14	1.21
37.154	4.38	-0.668	2.47	3.14	1.24
37.202	4.53	-0.665	2.48	3.15	1.38
37.203	4.56	-0.665	2.48	3.15	1.41
37.250	4.59	-0.662	2.49	3.15	1.44
37.251	4.59	-0.662	2.49	3.15	1.44
37.298	5.16	-0.660	2.49	3.15	2.01
37.299	5.17	-0.659	2.49	3.15	2.02
37.345	4.88	-0.657	2.49	3.15	1.73
37.346	4.84	-0.657	2.49	3.15	1.69
37.382	5.08	-0.655	2.51	3.16	1.92

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
37.383	5.08	-0.654	2.51	3.16	1.92
37.425	5.30	-0.652	2.51	3.16	2.14
37.426	5.30	-0.652	2.51	3.16	2.14
37.468	4.84	-0.649	2.51	3.16	1.68
37.469	4.86	-0.649	2.51	3.16	1.70
37.511	4.58	-0.647	2.51	3.16	1.42
37.511	4.60	-0.647	2.51	3.16	1.44
37.594	4.40	-0.642	2.53	3.17	1.23
37.626	4.26	-0.640	2.53	3.17	1.09
37.627	4.29	-0.640	2.53	3.17	1.12
37.708	3.68	-0.635	2.54	3.17	0.51
37.747	3.62	-0.633	2.54	3.17	0.45
37.748	3.62	-0.633	2.54	3.17	0.45
37.788	3.77	-0.630	2.55	3.18	0.59
37.789	3.77	-0.630	2.55	3.18	0.59
37.829	3.63	-0.628	2.55	3.18	0.45
37.829	3.61	-0.628	2.55	3.18	0.43
37.892	2.77	-0.624	2.57	3.19	0.00
37.926	2.33	-0.622	2.57	3.19	0.00
37.927	2.32	-0.622	2.57	3.19	0.00
38.008	2.01	-0.617	2.57	3.19	0.00
38.048	1.89	-0.615	2.58	3.19	0.00
38.049	1.88	-0.615	2.58	3.19	0.00
38.089	1.82	-0.612	2.59	3.20	0.00
38.090	1.82	-0.612	2.59	3.20	0.00
38.193	1.64	-0.606	2.60	3.21	0.00
38.234	1.59	-0.603	2.61	3.21	0.00
38.235	1.59	-0.603	2.61	3.21	0.00
38.276	1.54	-0.601	2.61	3.21	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
38.277	1.54	-0.601	2.61	3.21	0.00
38.317	1.51	-0.598	2.61	3.21	0.00
38.318	1.51	-0.598	2.61	3.21	0.00
38.383	1.50	-0.594	2.62	3.21	0.00
38.384	1.49	-0.594	2.62	3.21	0.00
38.427	1.51	-0.592	2.63	3.22	0.00
38.428	1.51	-0.592	2.63	3.22	0.00
38.471	1.53	-0.589	2.63	3.22	0.00
38.472	1.53	-0.589	2.63	3.22	0.00
38.515	1.54	-0.587	2.64	3.23	0.00
38.516	1.54	-0.586	2.64	3.23	0.00
38.559	1.56	-0.584	2.65	3.23	0.00
38.560	1.56	-0.584	2.65	3.23	0.00
38.603	1.56	-0.581	2.65	3.23	0.00
38.604	1.56	-0.581	2.65	3.23	0.00
38.647	1.50	-0.579	2.65	3.23	0.00
38.648	1.50	-0.579	2.65	3.23	0.00
38.690	1.64	-0.576	2.65	3.23	0.00
38.691	1.64	-0.576	2.65	3.23	0.00
38.731	1.70	-0.574	2.67	3.24	0.00
38.732	1.70	-0.574	2.67	3.24	0.00
38.803	1.58	-0.569	2.67	3.24	0.00
38.837	1.29	-0.567	2.68	3.25	0.00
38.838	1.29	-0.567	2.68	3.25	0.00
38.876	1.16	-0.565	2.69	3.25	0.00
38.877	1.16	-0.565	2.69	3.25	0.00
38.913	1.14	-0.563	2.69	3.25	0.00
38.914	1.15	-0.563	2.69	3.25	0.00
38.996	1.67	-0.558	2.69	3.25	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
39.013	1.36	-0.557	2.70	3.26	0.00
39.014	1.37	-0.557	2.70	3.26	0.00
39.135	1.82	-0.549	2.72	3.27	0.00
39.135	1.83	-0.549	2.72	3.27	0.00
39.207	2.03	-0.545	2.72	3.27	0.00
39.243	2.03	-0.543	2.73	3.27	0.00
39.244	2.03	-0.543	2.73	3.27	0.00
39.275	1.57	-0.541	2.74	3.28	0.00
39.276	1.57	-0.541	2.74	3.28	0.00
39.316	1.45	-0.539	2.74	3.28	0.00
39.317	1.45	-0.538	2.74	3.28	0.00
39.398	0.98	-0.534	2.75	3.28	0.00
39.438	0.99	-0.531	2.75	3.28	0.00
39.439	0.99	-0.531	2.75	3.28	0.00
39.519	0.90	-0.526	2.76	3.29	0.00
39.526	0.85	-0.526	2.76	3.29	0.00
39.527	0.84	-0.526	2.76	3.29	0.00
39.608	0.80	-0.521	2.77	3.29	0.00
39.609	0.80	-0.521	2.77	3.29	0.00
39.650	0.80	-0.518	2.77	3.29	0.00
39.692	0.78	-0.516	2.77	3.29	0.00
39.729	0.72	-0.514	2.78	3.29	0.00
39.729	0.73	-0.514	2.78	3.29	0.00
39.813	0.92	-0.509	2.79	3.30	0.00
39.847	0.64	-0.507	2.79	3.30	0.00
39.848	0.65	-0.507	2.79	3.30	0.00
39.885	0.64	-0.504	2.80	3.30	0.00
39.886	0.64	-0.504	2.80	3.30	0.00
39.927	1.44	-0.502	2.80	3.30	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
39.928	1.43	-0.502	2.80	3.30	0.00
39.971	1.36	-0.499	2.80	3.30	0.00
39.972	1.35	-0.499	2.80	3.30	0.00
40.020	1.14	-0.496	2.80	3.30	0.00
40.021	1.14	-0.496	2.80	3.30	0.00
40.133	0.83	-0.489	2.81	3.30	0.00
40.134	0.82	-0.489	2.81	3.30	0.00
40.215	0.74	-0.485	2.83	3.31	0.00
40.216	0.73	-0.485	2.83	3.31	0.00
40.295	0.70	-0.480	2.83	3.31	0.00
40.296	0.70	-0.480	2.83	3.31	0.00
40.313	0.78	-0.479	2.83	3.31	0.00
40.314	0.78	-0.479	2.83	3.31	0.00
40.402	2.02	-0.473	2.84	3.31	0.00
40.445	1.74	-0.471	2.84	3.31	0.00
40.445	1.74	-0.471	2.84	3.31	0.00
40.483	1.65	-0.468	2.84	3.31	0.00
40.484	1.65	-0.468	2.84	3.31	0.00
40.525	1.71	-0.466	2.84	3.31	0.00
40.526	1.71	-0.466	2.84	3.31	0.00
40.598	1.88	-0.462	2.86	3.32	0.00
40.633	2.12	-0.460	2.86	3.32	0.00
40.633	2.12	-0.459	2.86	3.32	0.00
40.693	2.31	-0.456	2.86	3.32	0.00
40.727	2.32	-0.454	2.87	3.32	0.00
40.728	2.32	-0.454	2.87	3.32	0.00
40.795	2.39	-0.450	2.87	3.32	0.00
40.827	2.31	-0.448	2.87	3.32	0.00
40.827	2.31	-0.448	2.87	3.32	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
40.929	1.99	-0.442	2.88	3.32	0.00
40.930	1.98	-0.442	2.88	3.32	0.00
41.028	1.93	-0.436	2.88	3.32	0.00
41.029	1.92	-0.436	2.88	3.32	0.00
41.128	1.86	-0.430	2.89	3.32	0.00
41.128	1.87	-0.430	2.89	3.32	0.00
41.230	1.68	-0.424	2.90	3.32	0.00
41.247	1.61	-0.423	2.90	3.32	0.00
41.248	1.60	-0.423	2.90	3.32	0.00
41.314	1.59	-0.419	2.89	3.31	0.00
41.348	1.64	-0.417	2.89	3.31	0.00
41.348	1.64	-0.417	2.89	3.31	0.00
41.447	1.56	-0.411	2.90	3.31	0.00
41.448	1.56	-0.411	2.90	3.31	0.00
41.518	1.80	-0.406	2.90	3.31	0.00
41.519	1.81	-0.406	2.90	3.31	0.00
41.646	1.73	-0.399	2.91	3.31	0.00
41.646	1.73	-0.399	2.91	3.31	0.00
41.744	1.27	-0.393	2.92	3.31	0.00
41.744	1.26	-0.393	2.92	3.31	0.00
41.830	1.40	-0.388	2.92	3.31	0.00
41.831	1.40	-0.388	2.92	3.31	0.00
41.930	1.20	-0.382	2.93	3.31	0.00
41.930	1.21	-0.382	2.93	3.31	0.00
42.034	1.03	-0.375	2.93	3.31	0.00
42.035	1.03	-0.375	2.93	3.31	0.00
42.146	1.11	-0.369	2.94	3.31	0.00
42.147	1.11	-0.369	2.94	3.31	0.00
42.183	0.96	-0.367	2.94	3.31	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
42.184	0.96	-0.366	2.94	3.31	0.00
42.220	0.89	-0.364	2.95	3.31	0.00
42.221	0.89	-0.364	2.95	3.31	0.00
42.331	0.84	-0.358	2.95	3.31	0.00
42.332	0.84	-0.358	2.95	3.31	0.00
42.406	0.83	-0.353	2.96	3.31	0.00
42.437	1.52	-0.351	2.96	3.31	0.00
42.438	1.51	-0.351	2.96	3.31	0.00
42.479	1.26	-0.349	2.96	3.31	0.00
42.480	1.25	-0.349	2.96	3.31	0.00
42.517	1.32	-0.347	2.95	3.30	0.00
42.517	1.33	-0.346	2.95	3.30	0.00
42.590	1.70	-0.342	2.96	3.30	0.00
42.624	2.01	-0.340	2.96	3.30	0.00
42.625	1.98	-0.340	2.96	3.30	0.00
42.741	1.34	-0.333	2.97	3.30	0.00
42.741	1.35	-0.333	2.97	3.30	0.00
42.835	1.21	-0.327	2.97	3.30	0.00
42.835	1.21	-0.327	2.97	3.30	0.00
42.926	1.49	-0.322	2.98	3.30	0.00
42.927	1.49	-0.322	2.98	3.30	0.00
43.020	3.28	-0.316	2.98	3.30	0.00
43.020	3.30	-0.316	2.98	3.30	0.00
43.146	3.61	-0.309	2.99	3.30	0.31
43.146	3.61	-0.309	2.99	3.30	0.31
43.216	3.33	-0.305	3.00	3.30	0.03
43.235	3.44	-0.303	3.00	3.30	0.14
43.235	3.43	-0.303	3.00	3.30	0.13
43.299	3.87	-0.300	3.00	3.30	0.57

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
43.299	3.86	-0.300	2.99	3.29	0.57
43.318	3.96	-0.298	2.99	3.29	0.67
43.318	3.94	-0.298	2.99	3.29	0.65
43.416	1.48	-0.293	3.00	3.29	0.00
43.417	1.47	-0.293	3.00	3.29	0.00
43.438	1.31	-0.291	3.00	3.29	0.00
43.438	1.31	-0.291	3.00	3.29	0.00
43.522	2.85	-0.286	2.99	3.28	0.00
43.534	3.17	-0.285	3.00	3.29	0.00
43.542	2.76	-0.285	2.99	3.28	0.00
43.623	2.52	-0.280	3.00	3.28	0.00
43.623	2.55	-0.280	3.00	3.28	0.00
43.688	2.64	-0.276	3.00	3.28	0.00
43.688	2.65	-0.276	3.00	3.28	0.00
43.820	1.67	-0.268	3.00	3.27	0.00
43.821	1.68	-0.268	3.00	3.27	0.00
43.920	0.97	-0.262	3.01	3.27	0.00
43.921	0.96	-0.262	3.01	3.27	0.00
44.032	2.57	-0.256	3.00	3.26	0.00
44.046	2.59	-0.255	3.01	3.26	0.00
44.047	2.60	-0.255	3.01	3.26	0.00
44.090	2.41	-0.252	3.01	3.26	0.00
44.109	2.54	-0.251	3.00	3.25	0.00
44.224	1.96	-0.244	3.00	3.24	0.00
44.224	2.00	-0.244	3.00	3.24	0.00
44.235	2.28	-0.243	3.00	3.24	0.00
44.235	2.28	-0.243	3.00	3.24	0.00
44.343	2.18	-0.237	3.00	3.24	0.00
44.343	2.17	-0.237	3.00	3.24	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
44.421	1.93	-0.232	3.00	3.23	0.00
44.422	1.93	-0.232	3.00	3.23	0.00
44.522	1.98	-0.226	3.00	3.23	0.00
44.522	1.97	-0.226	3.00	3.23	0.00
44.555	1.79	-0.224	3.01	3.23	0.00
44.556	1.78	-0.224	3.01	3.23	0.00
44.662	1.49	-0.218	3.00	3.22	0.00
44.663	1.49	-0.218	3.00	3.22	0.00
44.702	1.86	-0.215	3.00	3.22	0.00
44.703	1.88	-0.215	3.00	3.22	0.00
44.738	2.40	-0.213	3.01	3.22	0.00
44.818	2.87	-0.208	3.01	3.22	0.00
44.818	2.82	-0.208	3.01	3.22	0.00
44.838	2.11	-0.207	3.01	3.22	0.00
44.838	2.07	-0.207	3.01	3.22	0.00
44.912	3.84	-0.203	3.01	3.21	0.63
44.941	3.43	-0.201	3.01	3.21	0.22
44.942	3.43	-0.201	3.01	3.21	0.22
45.035	3.52	-0.195	3.01	3.21	0.31
45.036	3.53	-0.195	3.01	3.21	0.32
45.141	3.33	-0.189	3.01	3.20	0.13
45.141	3.32	-0.189	3.01	3.20	0.12
45.173	2.98	-0.187	3.01	3.20	0.00
45.174	2.96	-0.187	3.01	3.20	0.00
45.207	2.92	-0.185	3.01	3.20	0.00
45.239	3.38	-0.183	3.02	3.20	0.18
45.239	3.36	-0.183	3.02	3.20	0.16
45.269	3.34	-0.181	3.02	3.20	0.14
45.270	3.33	-0.181	3.02	3.20	0.13

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
45.298	2.75	-0.180	3.01	3.19	0.00
45.298	2.75	-0.180	3.01	3.19	0.00
45.327	2.37	-0.178	3.01	3.19	0.00
45.328	2.35	-0.178	3.01	3.19	0.00
45.431	2.20	-0.172	3.02	3.19	0.00
45.432	2.20	-0.172	3.02	3.19	0.00
45.531	2.63	-0.166	3.02	3.19	0.00
45.532	2.64	-0.166	3.02	3.19	0.00
45.627	3.74	-0.160	3.02	3.18	0.56
45.628	3.74	-0.160	3.02	3.18	0.56
45.714	3.56	-0.155	3.02	3.17	0.39
45.735	3.54	-0.153	3.02	3.17	0.37
45.736	3.55	-0.153	3.02	3.17	0.38
45.833	3.22	-0.148	3.01	3.16	0.06
45.847	3.11	-0.147	3.01	3.16	0.00
45.847	3.13	-0.147	3.01	3.16	0.00
45.926	2.86	-0.142	3.02	3.16	0.00
45.927	2.86	-0.142	3.02	3.16	0.00
46.029	2.54	-0.136	3.01	3.15	0.00
46.030	2.54	-0.136	3.01	3.15	0.00
46.113	1.95	-0.131	3.01	3.14	0.00
46.137	1.62	-0.129	3.00	3.13	0.00
46.137	1.61	-0.129	3.00	3.13	0.00
46.233	1.02	-0.124	3.01	3.13	0.00
46.234	1.03	-0.124	3.01	3.13	0.00
46.318	1.48	-0.118	3.00	3.12	0.00
46.319	1.48	-0.118	3.00	3.12	0.00
46.421	1.59	-0.112	3.01	3.12	0.00
46.421	1.59	-0.112	3.01	3.12	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
46.540	1.61	-0.105	2.99	3.10	0.00
46.541	1.60	-0.105	2.99	3.10	0.00
46.638	1.43	-0.099	3.00	3.10	0.00
46.669	1.25	-0.097	3.00	3.10	0.00
46.670	1.25	-0.097	3.00	3.10	0.00
46.841	0.97	-0.087	3.00	3.09	0.00
46.842	0.97	-0.087	3.00	3.09	0.00
46.873	0.84	-0.085	2.99	3.08	0.00
46.946	1.24	-0.081	3.00	3.08	0.00
46.946	1.26	-0.081	3.00	3.08	0.00
46.984	1.59	-0.079	2.74	2.82	0.00
46.985	1.59	-0.079	2.74	2.82	0.00
47.022	1.90	-0.076	2.74	2.82	0.00
47.023	1.90	-0.076	2.74	2.82	0.00
47.119	0.59	-0.070	2.50	2.57	0.00
47.119	0.59	-0.070	2.50	2.57	0.00
47.226	1.25	-0.064	1.99	2.05	0.00
47.227	1.24	-0.064	1.99	2.05	0.00
47.342	1.46	-0.057	1.74	1.80	0.00
47.343	1.46	-0.057	1.74	1.80	0.00
47.381	1.55	-0.055	1.75	1.80	0.00
47.415	1.67	-0.053	1.49	1.54	0.13
47.416	1.68	-0.053	1.49	1.54	0.14
47.499	1.92	-0.048	1.24	1.29	0.63
47.543	2.01	-0.045	1.24	1.29	0.72
47.543	2.01	-0.045	1.24	1.29	0.72
47.585	2.14	-0.043	1.25	1.29	0.85
47.586	2.14	-0.042	1.25	1.29	0.85
47.629	2.36	-0.040	0.99	1.03	1.33

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
47.630	2.37	-0.040	0.99	1.03	1.34
47.673	2.50	-0.037	0.99	1.03	1.47
47.674	2.49	-0.037	0.99	1.03	1.46
47.717	2.48	-0.035	0.99	1.02	1.46
47.718	2.49	-0.035	0.99	1.02	1.47
47.760	2.35	-0.032	0.99	1.02	1.33
47.761	2.36	-0.032	0.99	1.02	1.34
47.805	2.32	-0.030	0.99	1.02	1.30
47.806	2.32	-0.029	0.99	1.02	1.30
47.898	2.55	-0.024	1.00	1.02	1.53
47.940	2.55	-0.022	0.99	1.01	1.54
47.941	2.54	-0.022	0.99	1.01	1.53
47.978	2.34	-0.020	0.99	1.01	1.33
47.979	2.34	-0.020	0.99	1.01	1.33
48.026	2.39	-0.017	0.99	1.01	1.38
48.027	2.38	-0.017	0.99	1.01	1.37
48.069	2.32	-0.015	0.99	1.00	1.32
48.070	2.32	-0.015	0.99	1.00	1.32
48.119	2.50	-0.012	0.99	1.00	1.50
48.120	2.51	-0.012	0.99	1.00	1.51
48.166	3.06	-0.009	0.98	0.99	2.07
48.167	3.08	-0.009	0.98	0.99	2.09
48.219	3.69	-0.007	0.98	0.99	2.70
48.220	3.70	-0.006	0.98	0.99	2.71
48.272	3.70	-0.004	0.99	0.99	2.71
48.273	3.71	-0.004	0.99	0.99	2.72
48.319	4.30	-0.001	0.99	0.99	3.31
48.320	4.30	-0.001	0.99	0.99	3.31
48.373	3.83	0.002	0.99	0.99	2.84

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
48.374	3.84	0.002	0.99	0.99	2.85
48.424	3.73	0.005	0.98	0.98	2.75
48.425	3.71	0.005	0.98	0.98	2.73
48.479	3.25	0.008	0.99	0.98	2.27
48.480	3.24	0.008	0.99	0.98	2.26
48.534	2.55	0.011	0.99	0.98	1.57
48.535	2.54	0.011	0.99	0.98	1.56
48.588	2.26	0.014	0.99	0.98	1.28
48.594	2.26	0.014	0.99	0.98	1.28
48.645	2.39	0.017	1.00	0.98	1.41
48.646	2.39	0.017	1.00	0.98	1.41
48.723	2.30	0.021	1.00	0.98	1.32
48.724	2.29	0.022	1.00	0.98	1.31
48.807	2.29	0.026	1.01	0.98	1.31
48.808	2.30	0.026	1.01	0.98	1.32
48.875	5.10	0.030	1.02	0.99	4.11
48.876	5.17	0.030	1.02	0.99	4.18
48.935	2.18	0.033	1.02	0.99	1.19
48.936	2.15	0.033	1.02	0.99	1.16
48.993	2.08	0.037	1.03	0.99	1.09
48.994	2.10	0.037	1.03	0.99	1.11
49.053	2.96	0.040	1.03	0.99	1.97
49.054	2.94	0.040	1.03	0.99	1.95
49.112	2.66	0.043	1.03	0.99	1.67
49.113	2.61	0.043	1.03	0.99	1.62
49.176	1.96	0.047	1.04	0.99	0.97
49.177	1.94	0.047	1.04	0.99	0.95
49.238	2.16	0.050	1.04	0.99	1.17
49.239	2.18	0.050	1.04	0.99	1.19

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
49.297	2.29	0.053	1.04	0.99	1.30
49.299	2.31	0.053	1.04	0.99	1.32
49.357	3.17	0.057	1.05	0.99	2.18
49.359	3.17	0.057	1.05	0.99	2.18
49.418	2.94	0.060	1.05	0.99	1.95
49.419	2.93	0.060	1.05	0.99	1.94
49.477	2.51	0.063	1.05	0.99	1.52
49.478	2.51	0.063	1.05	0.99	1.52
49.529	2.37	0.066	1.06	0.99	1.38
49.531	2.37	0.066	1.06	0.99	1.38
49.581	2.49	0.069	1.06	0.99	1.50
49.582	2.52	0.069	1.06	0.99	1.53
49.630	4.05	0.072	1.07	1.00	3.05
49.632	4.05	0.072	1.07	1.00	3.05
49.683	3.83	0.075	1.07	1.00	2.83
49.684	3.83	0.075	1.07	1.00	2.83
49.741	3.44	0.078	1.08	1.00	2.44
49.742	3.42	0.078	1.08	1.00	2.42
49.792	2.81	0.081	1.08	1.00	1.81
49.793	2.78	0.081	1.08	1.00	1.78
49.849	2.62	0.084	1.08	1.00	1.62
49.850	2.61	0.084	1.08	1.00	1.61
49.894	2.26	0.087	1.09	1.00	1.26
49.895	2.28	0.087	1.09	1.00	1.28
49.948	1.76	0.090	1.09	1.00	0.76
49.949	1.76	0.090	1.09	1.00	0.76
50.003	1.36	0.093	1.09	1.00	0.36
50.004	1.36	0.093	1.09	1.00	0.36
50.058	1.43	0.096	1.10	1.00	0.43

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
50.059	1.44	0.096	1.10	1.00	0.44
50.114	1.21	0.099	1.10	1.00	0.21
50.115	1.20	0.099	1.10	1.00	0.20
50.169	1.38	0.102	1.10	1.00	0.38
50.171	1.37	0.102	1.10	1.00	0.37
50.227	1.20	0.105	1.11	1.00	0.20
50.228	1.19	0.105	1.11	1.00	0.19
50.288	1.13	0.108	1.12	1.01	0.12
50.289	1.12	0.109	1.12	1.01	0.11
50.346	1.29	0.112	1.12	1.01	0.28
50.347	1.30	0.112	1.12	1.01	0.29
50.396	1.02	0.115	1.12	1.01	0.01
50.397	1.05	0.115	1.12	1.01	0.04
50.451	1.17	0.118	1.13	1.01	0.16
50.452	1.16	0.118	1.13	1.01	0.15
50.512	1.19	0.121	1.13	1.01	0.18
50.513	1.19	0.121	1.13	1.01	0.18
50.569	1.46	0.124	1.13	1.01	0.45
50.570	1.45	0.124	1.13	1.01	0.44
50.621	1.36	0.127	1.14	1.01	0.35
50.622	1.37	0.127	1.14	1.01	0.36
50.675	4.28	0.130	1.14	1.01	3.27
50.676	4.34	0.130	1.14	1.01	3.33
50.725	4.29	0.133	1.14	1.01	3.28
50.726	4.30	0.133	1.14	1.01	3.29
50.778	4.45	0.136	1.15	1.01	3.44
50.779	4.47	0.136	1.15	1.01	3.46
50.837	3.62	0.139	1.15	1.01	2.61
50.838	3.62	0.139	1.15	1.01	2.61

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
50.897	2.41	0.142	1.15	1.01	1.40
50.899	2.39	0.142	1.15	1.01	1.38
50.955	1.63	0.146	1.16	1.01	0.62
50.967	1.61	0.146	1.16	1.01	0.60
51.024	1.33	0.149	1.16	1.01	0.32
51.025	1.33	0.149	1.16	1.01	0.32
51.092	2.09	0.153	1.16	1.01	1.08
51.093	2.09	0.153	1.16	1.01	1.08
51.155	2.25	0.157	1.17	1.01	1.24
51.156	2.26	0.157	1.17	1.01	1.25
51.214	2.59	0.160	1.17	1.01	1.58
51.215	2.59	0.160	1.17	1.01	1.58
51.261	2.35	0.163	1.18	1.02	1.33
51.262	2.34	0.163	1.18	1.02	1.32
51.320	2.30	0.166	1.19	1.02	1.28
51.322	2.30	0.166	1.19	1.02	1.28
51.364	2.30	0.168	1.19	1.02	1.28
51.365	2.29	0.168	1.19	1.02	1.27
51.420	2.54	0.171	1.19	1.02	1.52
51.422	2.55	0.171	1.19	1.02	1.53
51.462	3.47	0.174	1.19	1.02	2.45
51.463	3.47	0.174	1.19	1.02	2.45
51.517	2.69	0.177	1.20	1.02	1.67
51.518	2.68	0.177	1.20	1.02	1.66
51.568	2.36	0.180	1.20	1.02	1.34
51.569	2.35	0.180	1.20	1.02	1.33
51.622	3.89	0.183	1.20	1.02	2.87
51.623	3.89	0.183	1.20	1.02	2.87
51.680	4.27	0.186	1.21	1.02	3.25

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
51.681	4.27	0.186	1.21	1.02	3.25
51.743	4.21	0.189	1.21	1.02	3.19
51.744	4.15	0.189	1.21	1.02	3.13
51.801	3.31	0.193	1.21	1.02	2.29
51.802	3.29	0.193	1.21	1.02	2.27
51.857	2.75	0.196	1.22	1.02	1.73
51.857	2.75	0.196	1.22	1.02	1.73
51.913	2.58	0.199	1.22	1.02	1.56
51.914	2.57	0.199	1.22	1.02	1.55
51.970	2.17	0.202	1.22	1.02	1.15
51.971	2.19	0.202	1.22	1.02	1.17
52.028	2.15	0.205	1.23	1.02	1.13
52.029	2.15	0.205	1.23	1.02	1.13
52.087	2.42	0.208	1.23	1.02	1.40
52.088	2.43	0.209	1.23	1.02	1.41
52.139	3.80	0.211	1.23	1.02	2.78
52.140	3.88	0.211	1.23	1.02	2.86
52.179	5.60	0.214	1.23	1.02	4.58
52.180	5.61	0.214	1.23	1.02	4.59
52.229	5.17	0.216	1.24	1.02	4.15
52.230	5.16	0.216	1.24	1.02	4.14
52.284	4.46	0.219	1.24	1.02	3.44
52.285	4.43	0.219	1.24	1.02	3.41
52.341	4.03	0.223	1.24	1.02	3.01
52.342	4.02	0.223	1.24	1.02	3.00
52.399	4.31	0.226	1.25	1.02	3.29
52.400	4.33	0.226	1.25	1.02	3.31
52.540	5.06	0.234	1.80	1.57	3.49
52.541	5.05	0.234	1.80	1.57	3.48

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
52.562	3.75	0.235	1.79	1.56	2.19
52.563	3.72	0.235	1.79	1.56	2.16
52.605	2.21	0.237	1.80	1.56	0.65
52.606	2.18	0.237	1.80	1.56	0.62
52.634	1.20	0.239	1.80	1.56	0.00
52.671	1.19	0.241	1.80	1.56	0.00
52.757	0.96	0.246	1.81	1.56	0.00
52.758	0.96	0.246	1.81	1.56	0.00
52.799	1.13	0.248	1.81	1.56	0.00
52.800	1.13	0.248	1.81	1.56	0.00
52.824	1.23	0.249	1.80	1.55	0.00
52.825	1.24	0.249	1.80	1.55	0.00
52.862	1.43	0.252	1.80	1.55	0.00
52.862	1.44	0.252	1.80	1.55	0.00
52.907	1.46	0.254	1.79	1.54	0.00
52.908	1.46	0.254	1.79	1.54	0.00
52.948	1.47	0.256	1.80	1.54	0.00
52.986	1.65	0.258	1.80	1.54	0.11
52.987	1.65	0.258	1.80	1.54	0.11
53.023	1.80	0.260	1.80	1.54	0.26
53.024	1.79	0.261	1.80	1.54	0.25
53.026	1.85	0.261	1.80	1.54	0.31
53.026	1.84	0.261	1.80	1.54	0.30
53.147	1.12	0.267	1.79	1.52	0.00
53.148	1.13	0.267	1.79	1.52	0.00
53.185	1.48	0.270	1.79	1.52	0.00
53.230	1.66	0.272	1.79	1.52	0.14
53.230	1.66	0.272	1.79	1.52	0.14
53.276	1.70	0.275	1.79	1.52	0.18

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
53.277	1.72	0.275	1.79	1.52	0.20
53.316	2.13	0.277	1.80	1.52	0.61
53.317	2.13	0.277	1.80	1.52	0.61
53.354	2.32	0.279	1.79	1.51	0.81
53.354	2.33	0.279	1.79	1.51	0.82
53.398	1.84	0.281	1.79	1.51	0.33
53.399	1.81	0.281	1.79	1.51	0.30
53.434	1.21	0.283	1.78	1.50	0.00
53.435	1.20	0.283	1.78	1.50	0.00
53.479	0.99	0.286	1.75	1.46	0.00
53.509	1.27	0.288	1.75	1.46	0.00
53.510	1.28	0.288	1.75	1.46	0.00
53.648	1.74	0.295	1.75	1.45	0.29
53.649	1.74	0.295	1.75	1.45	0.29
53.695	1.87	0.298	1.75	1.45	0.42
53.696	1.87	0.298	1.75	1.45	0.42
53.736	2.12	0.300	1.74	1.44	0.68
53.736	2.13	0.300	1.74	1.44	0.69
53.776	2.21	0.302	1.74	1.44	0.77
53.777	2.20	0.302	1.74	1.44	0.76
53.816	1.95	0.305	1.73	1.43	0.52
53.817	1.95	0.305	1.73	1.43	0.52
53.901	2.04	0.309	1.74	1.43	0.61
53.941	2.12	0.312	1.73	1.42	0.70
53.942	2.12	0.312	1.73	1.42	0.70
53.982	2.14	0.314	1.73	1.42	0.72
53.982	2.14	0.314	1.73	1.42	0.72
54.025	2.14	0.316	1.73	1.41	0.73
54.026	2.14	0.316	1.73	1.41	0.73

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
54.068	2.12	0.319	1.73	1.41	0.71
54.069	2.12	0.319	1.73	1.41	0.71
54.111	2.23	0.321	1.72	1.40	0.83
54.112	2.23	0.321	1.72	1.40	0.83
54.149	2.22	0.323	1.72	1.40	0.82
54.150	2.22	0.323	1.72	1.40	0.82
54.193	2.23	0.326	1.73	1.40	0.83
54.194	2.23	0.326	1.73	1.40	0.83
54.229	2.27	0.328	1.72	1.39	0.88
54.230	2.28	0.328	1.72	1.39	0.89
54.273	2.30	0.330	1.72	1.39	0.91
54.274	2.29	0.330	1.72	1.39	0.90
54.314	2.11	0.332	1.72	1.39	0.72
54.315	2.10	0.332	1.72	1.39	0.71
54.358	2.18	0.335	1.72	1.39	0.79
54.359	2.19	0.335	1.72	1.39	0.80
54.404	1.93	0.337	1.73	1.39	0.54
54.405	1.94	0.337	1.73	1.39	0.55
54.441	1.98	0.339	1.72	1.38	0.60
54.442	1.97	0.339	1.72	1.38	0.59
54.487	2.19	0.342	1.72	1.38	0.81
54.488	2.19	0.342	1.72	1.38	0.81
54.526	1.92	0.344	1.71	1.37	0.55
54.527	1.90	0.344	1.71	1.37	0.53
54.572	1.48	0.347	1.72	1.37	0.11
54.573	1.48	0.347	1.72	1.37	0.11
54.617	1.26	0.349	1.72	1.37	0.00
54.657	1.58	0.351	1.71	1.36	0.22
54.657	1.60	0.351	1.71	1.36	0.24

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
54.702	1.49	0.354	1.71	1.36	0.13
54.703	1.47	0.354	1.71	1.36	0.11
54.747	1.07	0.356	1.71	1.35	0.00
54.748	1.08	0.356	1.71	1.35	0.00
54.792	1.26	0.359	1.71	1.35	0.00
54.844	1.77	0.362	1.71	1.35	0.42
54.845	1.76	0.362	1.71	1.35	0.41
54.890	1.47	0.364	1.70	1.34	0.13
54.891	1.47	0.364	1.70	1.34	0.13
54.949	1.59	0.368	1.71	1.34	0.25
54.950	1.59	0.368	1.71	1.34	0.25
55.001	2.15	0.370	1.70	1.33	0.82
55.002	2.17	0.370	1.70	1.33	0.84
55.046	2.57	0.373	1.70	1.33	1.24
55.047	2.58	0.373	1.70	1.33	1.25
55.095	2.34	0.376	1.71	1.33	1.01
55.096	2.31	0.376	1.70	1.32	0.99
55.145	1.76	0.378	1.70	1.32	0.44
55.146	1.77	0.378	1.70	1.32	0.45
55.188	2.25	0.381	1.70	1.32	0.93
55.189	2.26	0.381	1.70	1.32	0.94
55.236	2.90	0.383	1.69	1.31	1.59
55.237	2.91	0.384	1.69	1.31	1.60
55.281	3.21	0.386	1.70	1.31	1.90
55.282	3.18	0.386	1.70	1.31	1.87
55.330	2.60	0.389	1.69	1.30	1.30
55.331	2.60	0.389	1.69	1.30	1.30
55.380	2.08	0.391	1.69	1.30	0.78
55.381	2.07	0.392	1.69	1.30	0.77

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
55.429	1.58	0.394	1.69	1.30	0.28
55.430	1.56	0.394	1.69	1.30	0.26
55.482	1.60	0.397	1.69	1.29	0.31
55.483	1.62	0.397	1.69	1.29	0.33
55.535	4.79	0.400	1.69	1.29	3.50
55.536	4.84	0.400	1.69	1.29	3.55
55.590	3.72	0.403	1.67	1.27	2.45
55.591	3.71	0.403	1.67	1.27	2.44
55.640	3.06	0.406	1.68	1.27	1.79
55.641	3.05	0.406	1.68	1.27	1.78
55.691	2.47	0.409	1.68	1.27	1.20
55.692	2.46	0.409	1.68	1.27	1.19
55.747	2.83	0.412	1.67	1.26	1.57
55.748	2.84	0.412	1.67	1.26	1.58
55.812	3.34	0.416	1.68	1.26	2.08
55.813	3.33	0.416	1.68	1.26	2.07
55.873	4.03	0.419	1.67	1.25	2.78
55.874	4.07	0.419	1.67	1.25	2.82
55.929	9.18	0.422	1.67	1.25	7.93
55.930	9.30	0.422	1.67	1.25	8.05
55.985	8.68	0.425	1.68	1.25	7.43
55.986	8.67	0.425	1.68	1.25	7.42
56.038	7.15	0.428	1.67	1.24	5.91
56.039	7.10	0.428	1.67	1.24	5.86
56.091	4.12	0.431	1.67	1.24	2.88
56.092	4.11	0.431	1.67	1.24	2.87
56.144	4.08	0.434	1.66	1.23	2.85
56.145	4.05	0.434	1.66	1.23	2.82
56.190	3.61	0.437	1.67	1.23	2.38

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
56.191	3.63	0.437	1.67	1.23	2.40
56.235	3.54	0.439	1.67	1.23	2.31
56.236	3.54	0.439	1.67	1.23	2.31
56.289	3.39	0.442	1.66	1.22	2.17
56.291	3.38	0.442	1.66	1.22	2.16
56.331	3.78	0.444	1.66	1.22	2.56
56.332	3.79	0.444	1.66	1.22	2.57
56.389	4.44	0.448	1.66	1.21	3.23
56.390	4.42	0.448	1.66	1.21	3.21
56.442	3.18	0.451	1.66	1.21	1.97
56.443	3.15	0.451	1.66	1.21	1.94
56.500	2.49	0.454	1.65	1.20	1.29
56.501	2.48	0.454	1.65	1.20	1.28
56.555	2.01	0.457	1.66	1.20	0.81
56.556	2.00	0.457	1.66	1.20	0.80
56.612	1.95	0.460	1.66	1.20	0.75
56.613	1.96	0.460	1.66	1.20	0.76
56.673	2.07	0.463	1.65	1.19	0.88
56.674	2.06	0.463	1.65	1.19	0.87
56.733	2.19	0.467	1.66	1.19	1.00
56.734	2.20	0.467	1.66	1.19	1.01
56.794	2.06	0.470	1.65	1.18	0.88
56.795	2.05	0.470	1.65	1.18	0.87
56.855	2.49	0.473	1.65	1.18	1.31
56.856	2.49	0.474	1.65	1.18	1.31
56.917	2.41	0.477	1.66	1.18	1.23
56.918	2.41	0.477	1.66	1.18	1.23
56.975	2.14	0.480	1.65	1.17	0.97
56.976	2.14	0.480	1.65	1.17	0.97

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
57.033	1.49	0.483	1.65	1.17	0.32
57.034	1.49	0.483	1.65	1.17	0.32
57.094	1.37	0.487	1.64	1.15	0.22
57.095	1.37	0.487	1.64	1.15	0.22
57.156	1.58	0.490	1.64	1.15	0.43
57.158	1.58	0.490	1.64	1.15	0.43
57.218	1.68	0.494	1.64	1.15	0.53
57.219	1.69	0.494	1.64	1.15	0.54
57.280	1.52	0.497	1.64	1.14	0.38
57.281	1.52	0.497	1.64	1.14	0.38
57.342	1.67	0.501	1.64	1.14	0.53
57.343	1.67	0.501	1.64	1.14	0.53
57.404	1.84	0.504	1.63	1.13	0.71
57.406	1.84	0.504	1.63	1.13	0.71
57.467	1.93	0.508	1.64	1.13	0.80
57.468	1.94	0.508	1.64	1.13	0.81
57.532	2.18	0.511	1.64	1.13	1.05
57.534	2.18	0.511	1.64	1.13	1.05
57.595	2.22	0.515	1.63	1.12	1.10
57.596	2.22	0.515	1.63	1.12	1.10
57.657	2.30	0.518	1.64	1.12	1.18
57.658	2.30	0.518	1.64	1.12	1.18
57.716	2.39	0.521	1.63	1.11	1.28
57.718	2.38	0.521	1.63	1.11	1.27
57.780	2.40	0.525	1.63	1.11	1.29
57.781	2.40	0.525	1.63	1.11	1.29
57.841	2.18	0.528	1.63	1.10	1.08
57.842	2.18	0.528	1.63	1.10	1.08
57.899	1.91	0.532	1.63	1.10	0.81

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
57.900	1.91	0.532	1.63	1.10	0.81
57.921	1.85	0.533	1.63	1.10	0.75
57.921	1.85	0.533	1.63	1.10	0.75
58.046	2.04	0.540	1.59	1.05	0.99
58.046	2.05	0.540	1.59	1.05	1.00
58.136	2.24	0.545	1.57	1.03	1.21
58.137	2.24	0.545	1.57	1.03	1.21
58.225	2.76	0.550	1.57	1.02	1.74
58.244	2.82	0.551	1.57	1.02	1.80
58.244	2.82	0.551	1.57	1.02	1.80
58.342	2.36	0.556	1.57	1.01	1.35
58.343	2.36	0.556	1.57	1.01	1.35
58.414	1.91	0.560	1.57	1.01	0.90
58.415	1.90	0.560	1.57	1.01	0.89
58.432	2.01	0.561	1.57	1.01	1.00
58.433	2.02	0.561	1.57	1.01	1.01
58.512	2.43	0.566	1.57	1.00	1.43
58.531	2.36	0.567	1.57	1.00	1.36
58.532	2.36	0.567	1.57	1.00	1.36
58.608	2.23	0.571	1.56	0.99	1.24
58.630	2.32	0.572	1.56	0.99	1.33
58.631	2.33	0.572	1.56	0.99	1.34
58.737	2.49	0.578	1.56	0.98	1.51
58.737	2.50	0.578	1.56	0.98	1.52
58.842	2.53	0.584	1.56	0.98	1.55
58.843	2.53	0.584	1.56	0.98	1.55
58.943	2.57	0.590	1.58	0.99	1.58
58.943	2.56	0.590	1.58	0.99	1.57
59.003	2.37	0.593	1.58	0.99	1.38

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
59.023	2.40	0.594	1.58	0.99	1.41
59.106	2.35	0.599	1.59	0.99	1.36
59.122	2.35	0.599	1.59	0.99	1.36
59.162	2.45	0.602	1.60	1.00	1.45
59.163	2.45	0.602	1.60	1.00	1.45
59.183	2.49	0.603	1.60	1.00	1.49
59.339	2.39	0.612	1.61	1.00	1.39
59.339	2.39	0.612	1.61	1.00	1.39
59.415	2.09	0.616	1.63	1.01	1.08
59.434	1.80	0.617	1.63	1.01	0.79
59.434	1.80	0.617	1.63	1.01	0.79
59.529	1.65	0.622	1.63	1.01	0.64
59.549	1.58	0.623	1.63	1.01	0.57
59.549	1.58	0.623	1.63	1.01	0.57
59.624	1.46	0.627	1.64	1.01	0.45
59.644	1.55	0.629	1.65	1.02	0.53
59.644	1.56	0.629	1.65	1.02	0.54
59.729	1.44	0.633	1.65	1.02	0.42
59.729	1.44	0.633	1.65	1.02	0.42
59.834	1.58	0.639	1.66	1.02	0.56
59.835	1.59	0.639	1.66	1.02	0.57
59.928	1.83	0.644	1.66	1.02	0.81
59.947	1.92	0.645	1.67	1.02	0.90
59.948	1.92	0.645	1.67	1.02	0.90
60.026	2.24	0.650	1.67	1.02	1.22
60.045	2.31	0.651	1.68	1.03	1.28
60.045	2.31	0.651	1.68	1.03	1.28
60.136	2.68	0.656	1.69	1.03	1.65
60.144	2.67	0.656	1.69	1.03	1.64

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
60.144	2.67	0.656	1.69	1.03	1.64
60.234	2.97	0.661	1.69	1.03	1.94
60.234	2.97	0.661	1.69	1.03	1.94
60.305	3.12	0.665	1.71	1.04	2.08
60.306	3.12	0.665	1.71	1.04	2.08
60.408	2.43	0.671	1.71	1.04	1.39
60.409	2.43	0.671	1.71	1.04	1.39
60.544	2.58	0.679	1.72	1.04	1.54
60.544	2.59	0.679	1.72	1.04	1.55
60.637	2.52	0.684	1.73	1.05	1.47
60.638	2.51	0.684	1.73	1.05	1.46
60.726	3.28	0.689	1.74	1.05	2.23
60.743	3.42	0.690	1.74	1.05	2.37
60.744	3.41	0.690	1.74	1.05	2.36
60.839	2.60	0.695	1.74	1.05	1.55
60.839	2.60	0.695	1.74	1.05	1.55
60.939	2.59	0.700	1.75	1.05	1.54
60.939	2.60	0.700	1.75	1.05	1.55
61.036	1.88	0.706	1.76	1.05	0.83
61.037	1.88	0.706	1.76	1.05	0.83
61.108	1.42	0.710	1.76	1.05	0.37
61.127	1.26	0.711	1.76	1.05	0.21
61.127	1.26	0.711	1.76	1.05	0.21
61.232	1.21	0.717	1.77	1.05	0.16
61.232	1.21	0.717	1.77	1.05	0.16
61.341	1.36	0.723	1.77	1.05	0.31
61.341	1.36	0.723	1.77	1.05	0.31
61.448	2.66	0.729	1.78	1.05	1.61
61.449	2.66	0.729	1.78	1.05	1.61

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
61.548	2.50	0.734	1.78	1.05	1.45
61.548	2.50	0.734	1.78	1.05	1.45
61.634	3.01	0.739	1.79	1.05	1.96
61.634	3.01	0.739	1.79	1.05	1.96
61.654	3.27	0.740	1.79	1.05	2.22
61.654	3.27	0.740	1.79	1.05	2.22
61.671	3.27	0.741	1.79	1.05	2.22
61.832	5.92	0.750	1.80	1.05	4.87
61.833	5.88	0.750	1.80	1.05	4.83
61.851	4.67	0.751	1.80	1.05	3.62
61.852	4.66	0.751	1.80	1.05	3.61
62.018	3.66	0.760	1.81	1.05	2.61
62.037	3.40	0.761	1.81	1.05	2.35
62.037	3.40	0.762	1.81	1.05	2.35
62.058	3.32	0.763	1.81	1.05	2.27
62.058	3.32	0.763	1.81	1.05	2.27
62.228	3.13	0.772	1.82	1.05	2.08
62.229	3.13	0.772	1.82	1.05	2.08
62.250	2.86	0.773	1.82	1.05	1.81
62.251	2.86	0.773	1.82	1.05	1.81
62.271	2.67	0.774	1.82	1.05	1.62
62.442	1.51	0.784	1.83	1.05	0.46
62.442	1.51	0.784	1.83	1.05	0.46
62.464	1.41	0.785	1.84	1.05	0.36
62.464	1.41	0.785	1.84	1.05	0.36
62.616	2.46	0.794	1.84	1.05	1.41
62.637	3.02	0.795	1.84	1.05	1.97
62.637	3.03	0.795	1.84	1.05	1.98
62.659	3.43	0.796	1.85	1.05	2.38

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
62.659	3.44	0.796	1.85	1.05	2.39
62.679	3.76	0.797	1.85	1.05	2.71
62.821	2.95	0.805	1.86	1.05	1.90
62.840	3.39	0.806	1.86	1.05	2.34
62.840	3.40	0.806	1.86	1.05	2.35
62.947	4.43	0.812	1.86	1.05	3.38
62.947	4.42	0.812	1.86	1.05	3.37
63.049	3.38	0.818	1.87	1.05	2.33
63.049	3.38	0.818	1.87	1.05	2.33
63.141	2.78	0.823	1.87	1.05	1.73
63.142	2.78	0.823	1.87	1.05	1.73
63.230	2.84	0.828	1.88	1.05	1.79
63.230	2.84	0.828	1.88	1.05	1.79
63.328	3.19	0.833	1.88	1.05	2.14
63.329	3.20	0.833	1.88	1.05	2.15
63.410	3.12	0.838	1.89	1.05	2.07
63.432	2.89	0.839	1.89	1.05	1.84
63.432	2.88	0.839	1.89	1.05	1.83
63.545	2.12	0.845	1.90	1.05	1.07
63.545	2.12	0.845	1.90	1.05	1.07
63.638	2.07	0.851	1.90	1.05	1.02
63.639	2.07	0.851	1.90	1.05	1.02
63.731	2.82	0.856	1.91	1.05	1.77
63.731	2.81	0.856	1.91	1.05	1.76
63.824	2.67	0.861	1.91	1.05	1.62
63.846	2.61	0.862	1.91	1.05	1.56
63.846	2.60	0.862	1.91	1.05	1.55
63.940	2.28	0.867	1.86	0.99	1.29
64.045	2.40	0.873	1.86	0.99	1.41

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
64.045	2.42	0.873	1.86	0.99	1.43
64.138	3.23	0.878	1.85	0.97	2.26
64.141	3.11	0.878	1.86	0.98	2.13
64.142	3.11	0.878	1.86	0.98	2.13
64.249	2.46	0.884	1.84	0.96	1.50
64.249	2.44	0.884	1.84	0.96	1.48
64.336	2.16	0.889	1.85	0.96	1.20
64.336	2.15	0.889	1.85	0.96	1.19
64.336	2.09	0.889	1.85	0.96	1.13
64.337	2.09	0.889	1.85	0.96	1.13
64.433	2.73	0.895	1.84	0.95	1.78
64.446	2.65	0.895	1.85	0.95	1.70
64.447	2.65	0.895	1.85	0.95	1.70
64.540	3.48	0.901	1.84	0.94	2.54
64.541	3.48	0.901	1.84	0.94	2.54
64.612	3.82	0.905	1.84	0.94	2.88
64.633	3.56	0.906	1.85	0.94	2.62
64.633	3.54	0.906	1.85	0.94	2.60
64.736	2.84	0.912	1.84	0.93	1.91
64.737	2.85	0.912	1.84	0.93	1.92
64.846	2.88	0.918	1.85	0.93	1.95
64.846	2.87	0.918	1.85	0.93	1.94
64.913	2.29	0.921	1.84	0.92	1.37
64.934	2.90	0.923	1.84	0.92	1.98
64.934	2.91	0.923	1.84	0.92	1.99
65.018	3.24	0.927	1.85	0.92	2.32
65.039	3.09	0.928	1.85	0.92	2.17
65.040	3.07	0.928	1.85	0.92	2.15
65.148	2.01	0.934	1.84	0.91	1.10

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
65.148	2.01	0.934	1.84	0.91	1.10
65.233	2.61	0.939	1.85	0.91	1.70
65.233	2.61	0.939	1.85	0.91	1.70
65.318	3.80	0.944	1.84	0.90	2.90
65.334	3.42	0.945	1.84	0.90	2.52
65.334	3.45	0.945	1.84	0.90	2.55
65.444	1.96	0.951	1.84	0.89	1.07
65.445	1.94	0.951	1.84	0.89	1.05
65.544	2.83	0.956	1.85	0.89	1.94
65.544	2.83	0.956	1.85	0.89	1.94
65.639	3.97	0.962	1.85	0.89	3.08
65.640	3.97	0.962	1.85	0.89	3.08
65.714	4.11	0.966	1.85	0.88	3.23
65.734	4.44	0.967	1.85	0.88	3.56
65.735	4.45	0.967	1.85	0.88	3.57
65.817	6.44	0.972	1.85	0.88	5.56
65.832	6.66	0.972	1.85	0.88	5.78
65.832	6.65	0.972	1.85	0.88	5.77
65.928	6.24	0.978	1.86	0.88	5.36
65.929	6.21	0.978	1.86	0.88	5.33
66.011	2.89	0.982	1.85	0.87	2.02
66.035	2.96	0.984	1.85	0.87	2.09
66.036	2.97	0.984	1.85	0.87	2.10
66.138	4.69	0.989	1.86	0.87	3.82
66.138	4.67	0.989	1.86	0.87	3.80
66.221	4.24	0.994	1.86	0.87	3.37
66.243	4.21	0.995	1.86	0.86	3.35
66.244	4.19	0.995	1.86	0.86	3.33
66.328	2.70	1.000	1.86	0.86	1.84

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
66.328	2.72	1.000	1.86	0.86	1.86
66.418	2.84	1.000	1.86	0.86	1.98
66.434	3.92	1.000	1.86	0.86	3.06
66.434	3.92	1.000	1.86	0.86	3.06
66.543	3.80	1.000	1.85	0.85	2.95
66.645	2.30	1.000	1.85	0.85	1.45
66.646	2.30	1.000	1.85	0.85	1.45
66.734	2.10	1.000	1.85	0.85	1.25
66.735	2.10	1.000	1.85	0.85	1.25
66.760	2.36	1.000	1.85	0.85	1.51
66.835	2.83	1.000	1.84	0.84	1.99
66.836	2.83	1.000	1.84	0.84	1.99
66.935	2.81	1.000	1.84	0.84	1.97
66.935	2.81	1.000	1.84	0.84	1.97
67.037	2.77	1.000	1.84	0.84	1.93
67.037	2.76	1.000	1.84	0.84	1.92
67.142	3.03	1.000	1.83	0.83	2.20
67.142	3.04	1.000	1.83	0.83	2.21
67.245	2.54	1.000	1.83	0.83	1.71
67.246	2.56	1.000	1.83	0.83	1.73
67.346	2.83	1.000	1.82	0.82	2.01
67.347	2.83	1.000	1.82	0.82	2.01
67.441	2.44	1.000	1.82	0.82	1.62
67.441	2.44	1.000	1.82	0.82	1.62
67.541	2.52	1.000	1.81	0.81	1.71
67.635	2.08	1.000	1.81	0.81	1.27
67.635	2.07	1.000	1.81	0.81	1.26
67.730	2.03	1.000	1.81	0.81	1.22
67.731	2.06	1.000	1.81	0.81	1.25

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
67.842	1.78	1.000	1.80	0.80	0.98
67.843	1.78	1.000	1.80	0.80	0.98
67.938	2.37	1.000	1.80	0.80	1.57
67.938	2.38	1.000	1.80	0.80	1.58
68.043	2.24	1.000	1.79	0.79	1.45
68.043	2.24	1.000	1.79	0.79	1.45
68.148	2.47	1.000	1.79	0.79	1.68
68.148	2.47	1.000	1.79	0.79	1.68
68.231	2.71	1.000	1.78	0.78	1.93
68.232	2.71	1.000	1.78	0.78	1.93
68.334	3.48	1.000	1.78	0.78	2.70
68.335	3.46	1.000	1.78	0.78	2.68
68.445	3.27	1.000	1.78	0.78	2.49
68.446	3.27	1.000	1.78	0.78	2.49
68.532	2.81	1.000	1.77	0.77	2.04
68.532	2.83	1.000	1.77	0.77	2.06
68.644	3.90	1.000	1.77	0.77	3.13
68.645	3.90	1.000	1.77	0.77	3.13
68.749	4.85	1.000	1.76	0.76	4.09
68.750	4.85	1.000	1.76	0.76	4.09
68.828	3.27	1.000	1.76	0.76	2.51
68.842	3.61	1.000	1.76	0.76	2.85
68.842	3.60	1.000	1.76	0.76	2.84
68.904	4.57	1.000	1.75	0.75	3.82
68.917	4.46	1.000	1.75	0.75	3.71
69.048	2.00	1.000	1.74	0.74	1.26
69.049	1.99	1.000	1.74	0.74	1.25
69.144	2.10	1.000	1.74	0.74	1.36
69.144	2.10	1.000	1.74	0.74	1.36

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
69.225	2.52	1.000	1.73	0.73	1.79
69.225	2.50	1.000	1.73	0.73	1.77
69.240	2.13	1.000	1.73	0.73	1.40
69.240	2.14	1.000	1.73	0.73	1.41
69.346	1.55	1.000	1.72	0.72	0.83
69.346	1.54	1.000	1.72	0.72	0.82
69.434	2.21	1.000	1.72	0.72	1.49
69.434	2.21	1.000	1.72	0.72	1.49
69.518	1.79	1.000	1.71	0.71	1.08
69.536	1.58	1.000	1.71	0.71	0.87
69.536	1.59	1.000	1.71	0.71	0.88
69.644	2.86	1.000	1.72	0.72	2.14
69.645	2.87	1.000	1.72	0.72	2.15
69.704	3.48	1.000	1.74	0.74	2.74
69.704	3.48	1.000	1.74	0.74	2.74
69.800	2.98	1.000	1.76	0.76	2.22
69.800	2.99	1.000	1.76	0.76	2.23
69.922	2.68	1.000	1.79	0.79	1.89
69.923	2.68	1.000	1.79	0.79	1.89
70.017	2.44	1.000	1.81	0.81	1.63
70.040	2.42	1.000	1.81	0.81	1.61
70.040	2.39	1.000	1.81	0.81	1.58
70.087	2.37	1.000	1.82	0.82	1.55
70.110	2.57	1.000	1.82	0.82	1.75
70.186	2.09	1.000	1.83	0.83	1.26
70.211	2.38	1.000	1.84	0.84	1.54
70.290	2.96	1.000	1.86	0.86	2.10
70.314	3.09	1.000	1.86	0.86	2.23
70.315	3.09	1.000	1.86	0.86	2.23

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
70.416	2.92	1.000	1.88	0.88	2.04
70.417	2.93	1.000	1.88	0.88	2.05
70.443	2.89	1.000	1.88	0.88	2.01
70.526	1.83	1.000	1.90	0.90	0.93
70.526	1.81	1.000	1.90	0.90	0.91
70.640	3.28	1.000	1.94	0.94	2.34
70.640	3.30	1.000	1.94	0.94	2.36
70.692	3.00	1.000	1.94	0.94	2.06
70.717	3.18	1.000	1.95	0.95	2.23
70.829	2.12	1.000	1.96	0.96	1.16
70.829	2.13	1.000	1.96	0.96	1.17
70.857	1.91	1.000	1.98	0.98	0.93
70.959	2.70	1.000	2.00	1.00	1.70
71.097	3.18	1.000	2.01	1.01	2.17
71.200	2.66	1.000	2.04	1.04	1.62
71.299	2.58	1.000	2.06	1.06	1.52
71.400	2.31	1.000	2.07	1.07	1.24
71.500	1.86	1.000	2.10	1.10	0.76
71.600	2.03	1.000	2.12	1.12	0.91
71.702	2.19	1.000	2.14	1.14	1.05
71.801	2.43	1.000	2.17	1.17	1.26
71.901	2.84	1.000	2.18	1.18	1.66
72.004	3.03	1.000	2.18	1.18	1.85
72.071	2.07	1.000	2.18	1.18	0.89

Annexure 4: Photographs along Rupnarayan Waterway

TBM 1 PRATAPPUR FERRY GHAT CHAINAGE 68.0

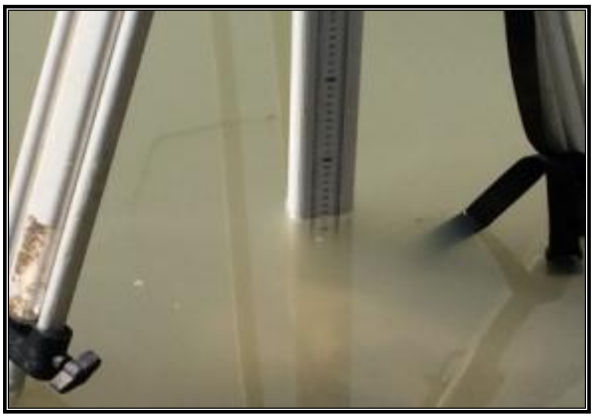
CWC BENCH MARK AT BONDAR CHAINAGE 65.5

CWC BENCH MARK AT BONDAR CHAINAGE 65.5

SURVEY BOAT CARRIED MANUALLY DUE TO RESTRICTED ACCESS TO RIVER AT CHAINAGE 68.0

SURVEYOR CROSSING RIVER BY FERRY FOR LEVEL TRANSFER OBSERVATION AT PRATAPPUR CHAINAGE 68

CWC TIDE POLE BONDAR CHAINAGE 65.5



TIDE POLE ERECTED AT GOPIGANJ CHAINAGE 48.5

KOLAGHAT RAILWAY BRIDGE CHAINAGE 30

SAND MINING DREDGE AT CHAINAGE 50

KOLAGHAT ROAD BRIDGE CHAINAGE 30.5

HIGH TENTION LINE CHAINAGE 41.5

HIGH TENTION LINE CHAINAGE 29.0

BANDAR CHAINAGE 50.0

MOBILE TOWER CHAINAGE 49.0