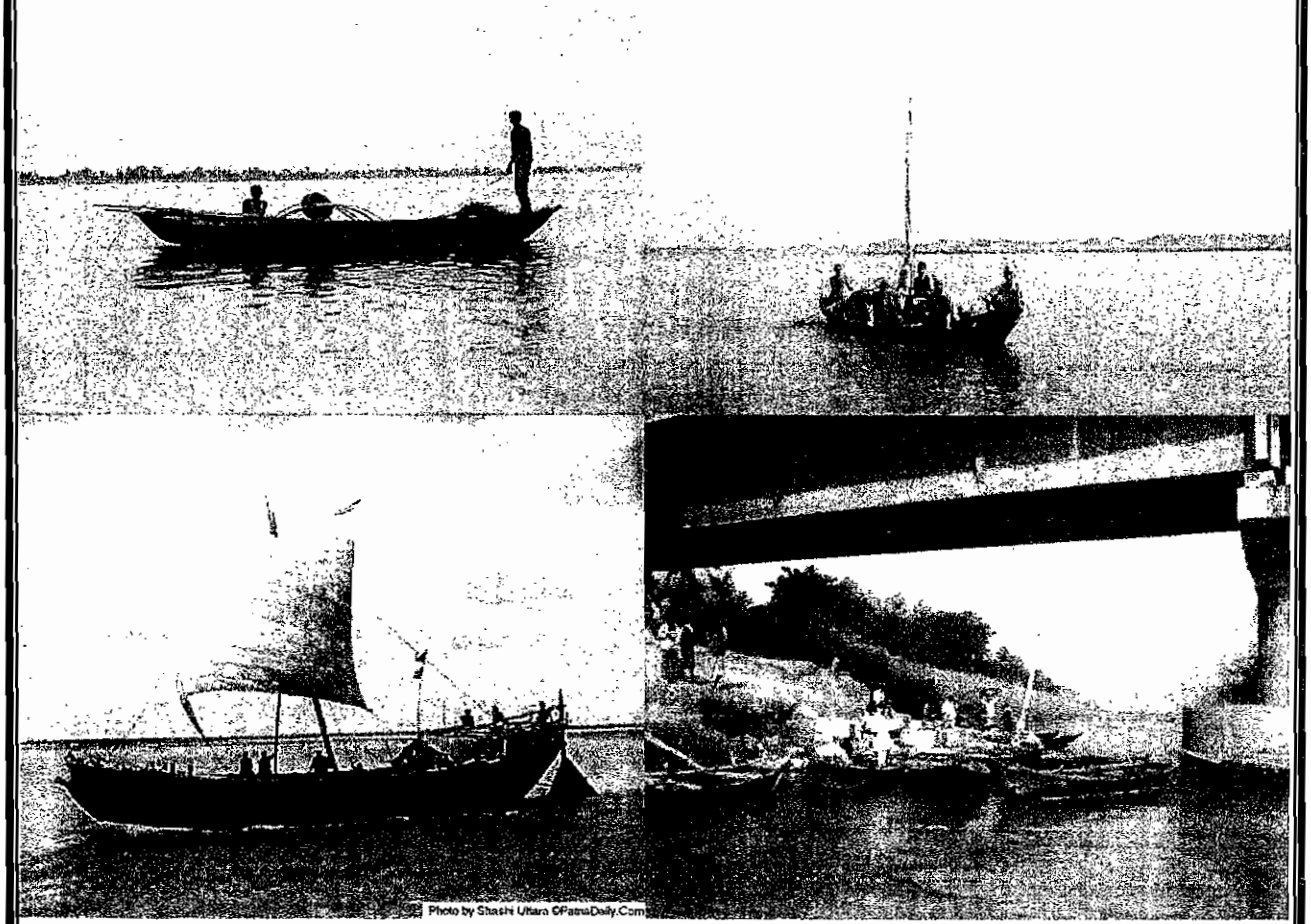
TRANSPORT DEPARTMENT

GOVERNMENT OF BIHAR

DETAILED PROJECT REPORT FOR DEVELOPMENT OF IWT ON RIVER GANDAK IN BIHAR



FINAL REPORT

FEBRUARY, 2013

RITES LTD

(A GOVERNMENT OF INDIA ENTERPRISE)

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DPR FOR DEVELOPMENT OF IWT ON RIVER GANDAK

CONTENTS

ACKNOWLEDGEMENTS

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RITES express their gratitude to Honourable Ramanad Singh, Minister of Transport, Government of Bihar for spending his valuable time and guidance for the project studies. RITES has made a presentation to the Honourable Minister during the course of the study. RITES extend their sincere thanks to Sri Sunil Barathwal I.A.S., Secretary, Transport, Sri R.S. Paswan I.A.S., Transport Commissioner, Government of Bihar for their excellent co-operation. RITES also convey their thanks to Sri S. Majumdar, I.A.S., former Principal Secretary cum Transport Commissioner, for his help and guidance. Sri K.K. Pathak, I.A.S., Secretary cum Transport Commissioner is kind enough to visit the site for inspection of field investigations carried out by the RITES team and provided his valuable guidance and inspiration to the project studies for which RITES indeed indebted to him. RITES convey their thanks to all the staff and officers of Transport Department particularly Sri S.P. Upadhyay, Joint Secretary, Sri Bishist Singh, Deputy Secretary, Sri B.K. Rai, Deputy Director (IWT), Sri Madan Prasad, Deputy Director (IWT, former) for their excellent co-operation throughout out the study period.

Sri Jitendra Kumar Sinha, I.A.S., District Magistrate, Patna, Government of Bihar is kind enough to share his valuable knowledge and experience on river course changes particularly for selection of IWT terminal locations for which RITES indebted to him.

RITES convey their sincere thanks to Inland Waterways Authority of India (IWAI) for taking up the project under centrally sponsored scheme. The guidance provided by officers of IWAI who involved in various joint meetings held with Transport Department, Government of Bihar particularly Sri Sivaraman Director, Patna (former), Sri S.V.K Reddy, Director, Patna are duly acknowledged.

RITES also convey their sincere thanks to various Government Departments viz., Central Water Commission, Survey of India, Inland Waterways Authority of India etc., for providing the data utilized in the report.

CHAPTER - 1

INTRODUCTION

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INTRODUCTION

1.1 PREAMBLE

Rivers constitute an important means of transport in Eastern India comprising Bihar, Bengal and Assam. Post independence, the country embarked upon a large programme of agricultural production and industrialization, which was resulted in substantial increase in the movement of cargo traffic. Apart from the above, the change in economic policy and the rapid increase in the industrialization during the last decade made their impact on the existing traffic movement by various means. Due to the immense increase in road traffic, Government of India given due attention in widening and relaying of National Highways including the construction of time bound Golden Quadrilateral and North-South corridors. Similarly, the dedicated rail corridors for the movement of goods by rail are in the implementation stage by the Government. Thus, it is now well recognized that all modes of transport need to be developed and the vital role which rivers can play in meeting the ever increasing transport demands of a fast developing economy can not be ignored.

Inland Water Transport is the cheapest mode of transport for certain kind of traffic both over long and short distances especially between the places located on the waterfront. One of the crucial problems facing the country today is the inflation in which the transport cost of commodities is an important factor to be reckoned with. Inland Water Transport being more energy efficient than other modes of surface transport can help in reducing the transport cost and stabilizing the prices of commodities. A liter of fuel is known to move 24 km by road, 85 km by rail and 105 km by water. IWT is thus the least energy consuming system of transport. Further it has many other inherent advantages. It generates more employment per unit of investment than any other mode. According to National Transport Policy Committee Report (1980), the employment potential per Rs.1 lakh investment is 33.59 man-years by IWT, compared to 16.95 by road and

4.30 by railways. It requires lower capital investment on track as compared to rail and road since Waterways are a gift of nature and require lower capital expenditure on maintenance as well as on operation. It provides a relatively pollution free atmosphere and contributes towards preservation of environment.

Development of Waterways offers the least expensive means of expanding transportation. It is for this reason that the developed nations in Europe and the USA have improved their waterways for transportation. In the USA, 13 percent of all transportation is done by Inland waterways at a total cost of less than 2 percent. New roads and railways are expensive. They require land acquisition with consequent problem of rehabilitation and environment. Water Transport, on the other hand is relatively more economical with track being provided by nature. In fact, with scientific conservancy measures, it may in certain instances be possible to re-claim land from the rivers while undertaking channel improvement works.

The National Transport Policy Committee Report (1980) had observed that if the national economy grows at a rate consistent with national aspirations for balanced and orderly growth, the transport system is likely under stress all through and hence there is need to develop and encourage every mode of transport with in an integrated frame work. In such a framework, an over riding consideration in today's context will be to encourage modes requiring least energy consumption. Such energy considerations led the committee to suggest according encouragement to IWT.

More over, the inland waterways have played an important role in the Indian transport system since ancient times. Though inland water transport is comparatively a cheaper and efficient means of transportation in recent times the importance of this mode of transport has declined considerably with the expansion of road and rail transport. In addition diversion of river water for irrigation has also reduced the importance of inland water transport. The decline is also due to deforestation of hill range leading to erosion, accumulation of silt in rivers and failure to modernize the fleet to suit local conditions. The

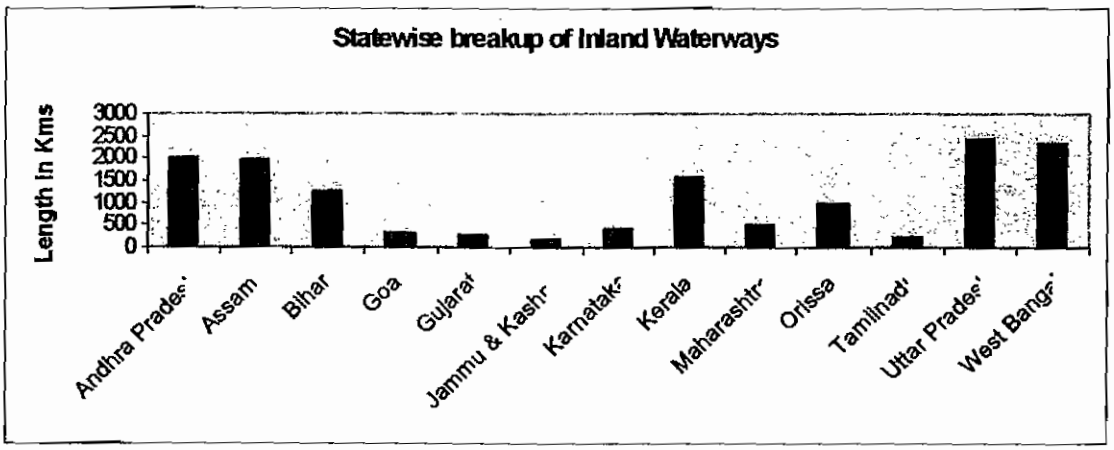
transportation of goods in an organized form is confined to West Bengal, Assam, parts of North Eastern Region and Goa. The Seventh Plan was an important landmark in the development of inland water transport. The expenditure on this sector in the plan (at Rs. 131.85 crores) was more than expenditure incurred right up to the end of the sixth plan.

Three objectives were laid down in the Seventh Plan for development of inland water transport.

- Development of inland water transport in the regions where it enjoys natural advantage.
- Modernization of vessels and country crafts to suit local conditions.
- Improvement in the productivity of assets.

The Inland Waterway Authority has been set up which is a big step forward and should help in the accelerated development of inland water transport.

It can be seen from the following chart; around 1200 km length of waterway is available in the State of Bihar.



Since India has vast IWT potential, it could play a significant role in augmenting the country's transport infrastructure. India has about 14,500 km of inland waterways network comprising rivers, lakes and canals and the IWT sector has only recently received its due attention. Much more needs to be done to really take advantage of this sector.

With Global economy and the WTO regime, there would be greater movement of goods to and fro. This would create heavy pressures on the already burdened transport system of rail and road. There is limit for expansion of rail and road capacity on account of constraints of available land, exorbitant cost and environmental considerations. Inland Water Transport can play a supportive role for Rail and Road Transport. The cost effectiveness of IWT can be addressed from the fact that while the development of 1 km of highway costs Rs 6 crores, much less than this amount is enough to develop 100 km of waterways.

There are some hazardous commodities that should / cannot be allowed to be transported on road. In view of these constraints and considerations, the development of Inland Water Transport has been relevant in today's context.

IWT has advantages over railways and roadways both in terms of cost and energy consumption in cargo transportation. As per estimates, for every one rupee spent for IWT development, the corresponding cost for development of same length of roadways and railways would be Rs 2 and Rs 5, respectively. In case of energy consumption, the ratio would be between 1.5 and 4, respectively. The major inherent advantages of IWT include doubling of load capacities for a small increase in depth thereby providing an aging flexibility and cost elasticity, which do not exist in other modes of transport.

Besides lower fuel consumption and construction costs, the IWT has the advantage of ensuring minimum human loss against very frequent accidents occurring in case of roads and railways.

Regional cargo transportation using riverine systems is confined to Goa, West Bengal, Assam and Kerala. If the inland waterways were developed with the necessary infrastructure such as fairway, terminals and navigational aids, the Inland Water Transport mode could become quite competitive and attract considerable cargo.

To give a thrust to Inland Water Transport mode, the following waterways have now taken up to study their viability by the State Transport Department, Government of Bihar.

- River Gandak
- River Kosi
- River Son and
- River Ganga at Patna

This report is dealt with the development of Inland Water Transport on river Gandak.

1.2 BACKGROUND

The Transport Department, Government of Bihar proposes to carry out Detailed Project Report (DPR) studies for develop Inland Water Transport on Rivers Kosi, Gandak, Sone and Ganga at Patna in Bihar under centrally sponsored schemes and accordingly floated tenders to appoint consultancy firm for the above studies.

RITES has responded to the above tender and offered its services to carry out DPR studies for the above identified waterways in Bihar state as per the scope of work and methodology given below. The transport department, Government of Bihar vide work order ***No.PR-1/WT-201/2006 PROJECT-6 DATE 21-02-2007*** has appointed RITES LTD for the above job.

1.3 SCOPE OF SERVICES

The scope of work is as follows:

1.3.1 Collection of Hydro-morphological Data

The consultants propose to collect and study the available reports and hydrographic survey charts of the identified waterways. The collection and study of the data shall include water level, depth, velocity, discharge, cross sections, bed and bank material, hydrographic, topographic data etc.

As per the notification of the transport department, Government of Bihar, the Detailed Project Reports are to be prepared based on collection of hydro-morphological data, hydrographic survey, model study, techno economic feasibility study and traffic survey. Since RITES has carried out hydrographic surveys / investigations on rivers Kosi and Gandak and also hydrographic surveys on river Ganga at Patna, the available data with us will be utilized for preparation of DPR. As such no field investigations will be carried out on these three rivers (Gandak, Kosi and Ganga at Patna). Accordingly the consultants proposed to prepare the DPR's based on collection of data, from various organizations.

As far as Son River is concerned the State Transport Department, Government of Bihar shall provide the available data or assist the consultants to collect the relevant data from Inland Waterways Authority of India. In case no hydrographic data is available, it is proposed to carry out a single line thalweg survey on river Son from Dehri on Son to Ganga confluence near Semariya (226km), to assess the available depths in the navigation channel. The other topographic features will be obtained from Survey of India Toposheets / Satellite Imageries.

The consultants proposed to ascertain the latest river features based on Satellite Imageries using the appropriate software in built model. As such no model study will be carried out.

1.3.2 Waterway design and navigation facilities

The consultants shall design navigational channel of the identified waterways and the works shall include, fixation of channel dimension for navigation, assessment of dredging requirement for design vessel, navigational aids, temporary channel marking, short term river conservancy works etc.

1.3.3 Terminal design and infrastructure facilities

The consultants shall select the site for terminal locations, plan and Conceptual design of terminals taking into consideration the site conditions and available construction material, cargo to be handled.

1.3.4 Advice on Vessel

The consultants shall advice suitable types of cargo vessels for the projected cargo, workout the details of the type of vessels their number and cost.

Estimation of scale of facilities and preliminary cost assessment

The consultants shall work out cost estimates for various facilities proposed to be provided viz, dredging, river conservancy, channel marking, loading / unloading terminals and vessels.

1.3.5 Traffic projections and Economic Evaluation.

The consultants shall review the traffic data and projections made by State Government departments for the identified waterways. If any limited data on

traffic is required the same shall be collected from other agencies like IWAI to augment the above data. Based on the traffic data collected, traffic projections will be made.

1.4 Report

Based on the items described above, detailed project reports will be prepared for the four identified waterways viz, Gandak river, Kosi river, Sone river and Ganga river at Patna. The report shall be prepared in three stages.

- Interim Report
- Draft report
- Final report

1.5 River Gandak

The Gandak is the major tributary of the Ganga which takes its rise in the central mountainous basin of Nepal and flows in south westerly direction till it emerges out of Mahabharat Range of mountains into plains through a gorge near Tribeni Ghat in Bihar after a flow of about 418 kms. It then flows almost in south easterly direction passing the towns of Bagaha, Lalganj and Hajipur and finally joins the Ganga abreast of Patna after traversing a course of about 323 km (**Fig.1.1**). Vessels of 1.20m drafts can ply on this river throughout the year as far as Lalganj 28 kms from its mouth.

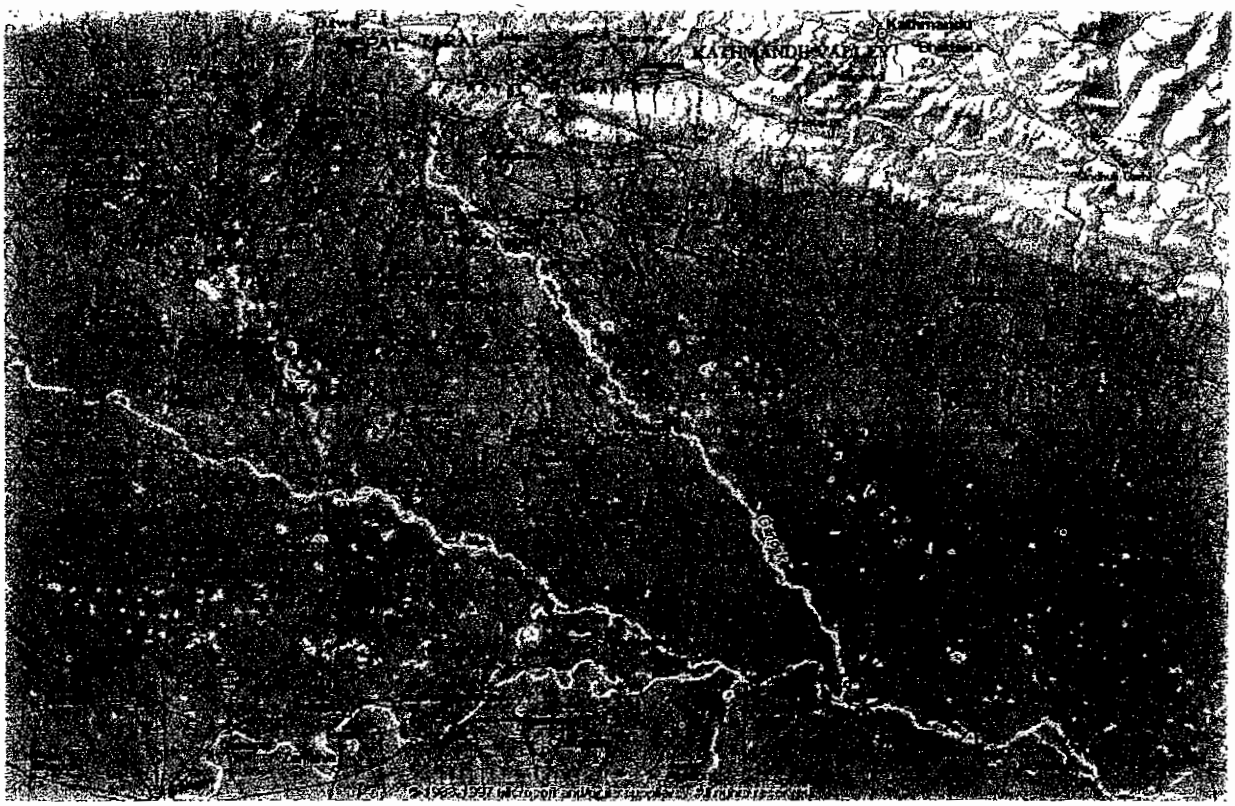


Fig. 1.1: River Gandak from Valmikinagar (India-Nepal Border) to Patna

The river is navigable during monsoon by large boats upto 40 tonnes capacity from its confluence with the Ganga upstream to Chatighat – a distance of about 158 km. In the dry season, smaller boats of 10 tonnes capacity ply in this region. Above Chatighat and up to Tribeni Ghat on Indo Nepal Border, a distance of 165 km, the river is navigable by boats of 20 tonnes capacity during the rainy season and 10 tones capacity during the dry season. A barrage has been constructed across the river at Bhaisalotan (Valmiki Nagar) on the Indo-Nepal Border with canals taking off on both banks for irrigation purposes **(Fig. 1.2)**. A provision has also been made for navigation locks both upstream and downstream of the barrage on the right bank for passage of boats across the barrage. These locks have been partially constructed and are not operational at present. As a result of the barrage and consequent pounding up of water level, the Gandak is also navigable upstream of the barrage inside Nepal for about 70 km up to Narayan Ghat throughout the year by small cargo boats except during heavy floods when navigation is considered risky on account of very high current velocity, eddies

and whirlpools. Shortly after entering India, the Gandak acquires the character of a deltaic river, its banks being above the level of the surrounding country, which is protected by artificial embankments from inundation. In spite of these the Gandak frequently does over flow its banks causing severe floods.

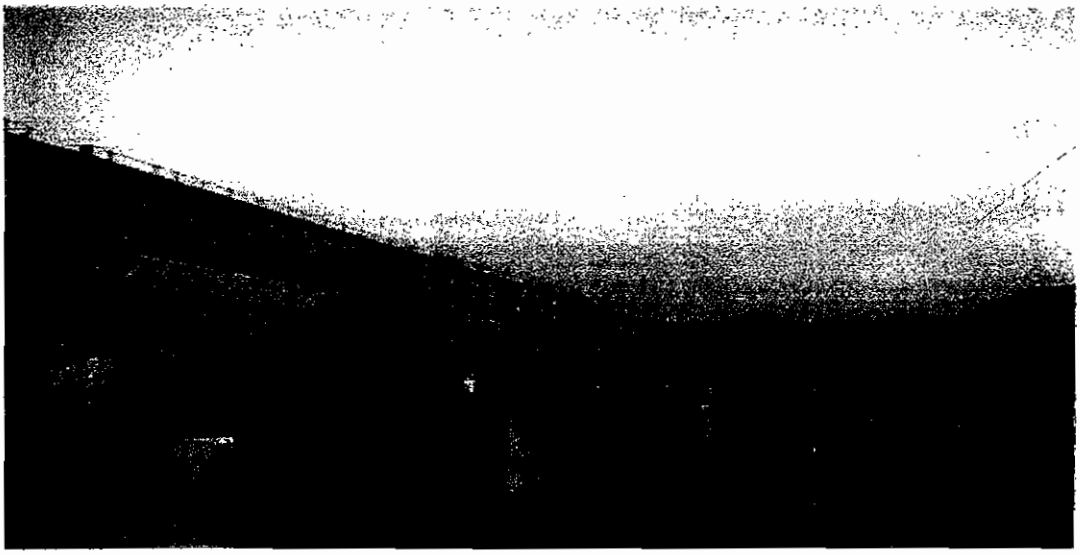


Fig. 1.2: A view of Gandak barrage at Valmiki Nagar (Indo-Nepal border)

The Salient feature of Gandak Barrage near the INDO – NEPAL Border

(1) Catchments area	38850sq. km.
(2) Annual rainfall	1397 mm.
(3) Design discharge	8,50,000 cusec.
(4) Pond level	110.34m.
(5) High flood level	113.05 m. U/S 112.44 m. D/S
(6) Crest level	
Under sluice	104.24 m
Weir	105.77 m.
Reverse sluice	104.24 m
(7) Afflux during max. discharge	0.915 m
(8) Discharge:	
Indian side Main Canal	15645 Cusec
Nepal side Main Canal	18,800 Cusec
(9) Lock Gate for Navigation:	
Upstream lock gate size	30.48 m x 6.1 m
Downstream lock gate size	54.86 m x 6.1 m

CHAPTER - 2

TRAFFIC CHARACTERSTICS AND TRAFFIC PROJECTIONS

CHAPTER-2
TRAFFIC CHARACTERSTICS
AND
TRAFFIC PROJECTIONS

2.1 CHARACTERSTICS OF THE STATE OF BIHAR

Bihar is located in the eastern part of the country and is an entirely land–locked state, although the outlet to the sea through the port of Kolkata is not far away. It is bounded by Nepal in the north and by Jharkhand in the south. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east. The Bihar state has total area of 94163.0 sq km of which 1095 sqkm is urbanised area.

The state has extensive and well developed railway system providing vital links to mining industry and tourism with important cities and Ports in the country. The total rail length in the state is in excess of 5400 Kms. The State is serviced by 2118 Kms. of National Highways, 4192 Kms. of State Highways, 12526 Kms of district roads and over 69000 Kms. of other roads. South Bihar has extensive network of roads linking major industrial locations in the state. Patna in Bihar is connected with Delhi, Kolkata, Mumbai, Lucknow and Varansi by scheduled air services.

Bihar is richly endowed with water resources, both the ground water resource and the surface water resource. Not only by rainfall but it has considerable water supply from the rivers which flow within the territory of the State. Ganga is the main river which is joined by tributaries with their sources in the Himalayas. Some of them are Saryu (Ghaghra), Gandak, Budhi Gandak, Kosi, Bagmati, Kamla-Balan and Mahananda. There are some other rivers that start from the platue area and meet in Ganga or its associate rivers after flowing towards north. Some of them are Son, Uttari Koyal, Punpun, Panchane and Karmnasha.

The economy of the state is mainly based on agricultural and trading activities. The soil is extremely fertile which makes it ideal for agriculture. Bihar is the first largest producer of vegetables and second largest producer of fruits in the country. The major agro based industries of Bihar

are of rice, sugar, edible oil. The main large and small scale industries of the state can be categorized as follows:

- Agro based Industries such as rice mills, sugar mills and edible oil mills
- Power
- Oil refinery
- Textiles
- Engineering industries
- Tobacco and
- Information Technology

2.2 PROJECT INFLUENCE AREA

The study area comprises of the influence areas of Rivers Gandak, Sapt Kosi, Son and Ganga for providing inland water transport (IWT) services. The proposed IWT services would mainly serve the parts of Bihar and Jharkhand in India and parts of Nepal. The influence area of three rivers is summarized as follows:

1. Paschim Champaran –Patna stretch of Gandak river comprises of 8 districts of Bihar namely Paschim Champaran, Gopalganj, Purba Champaran, Siwan, Muzaffarpur, Saran, Vaishali and Patna.
2. Patna –Aurangabad stretch of Son river comprises of 4 district namely Bhojpur , Rohtas, Jahanabad and Aurangabad.
3. Supaul – Bhagalpur stretch of Sapt Kosi river primarily comprises of 5 districts namely Supaul, Madhepura, Saharsa, Khagaria and Bhagalpur.

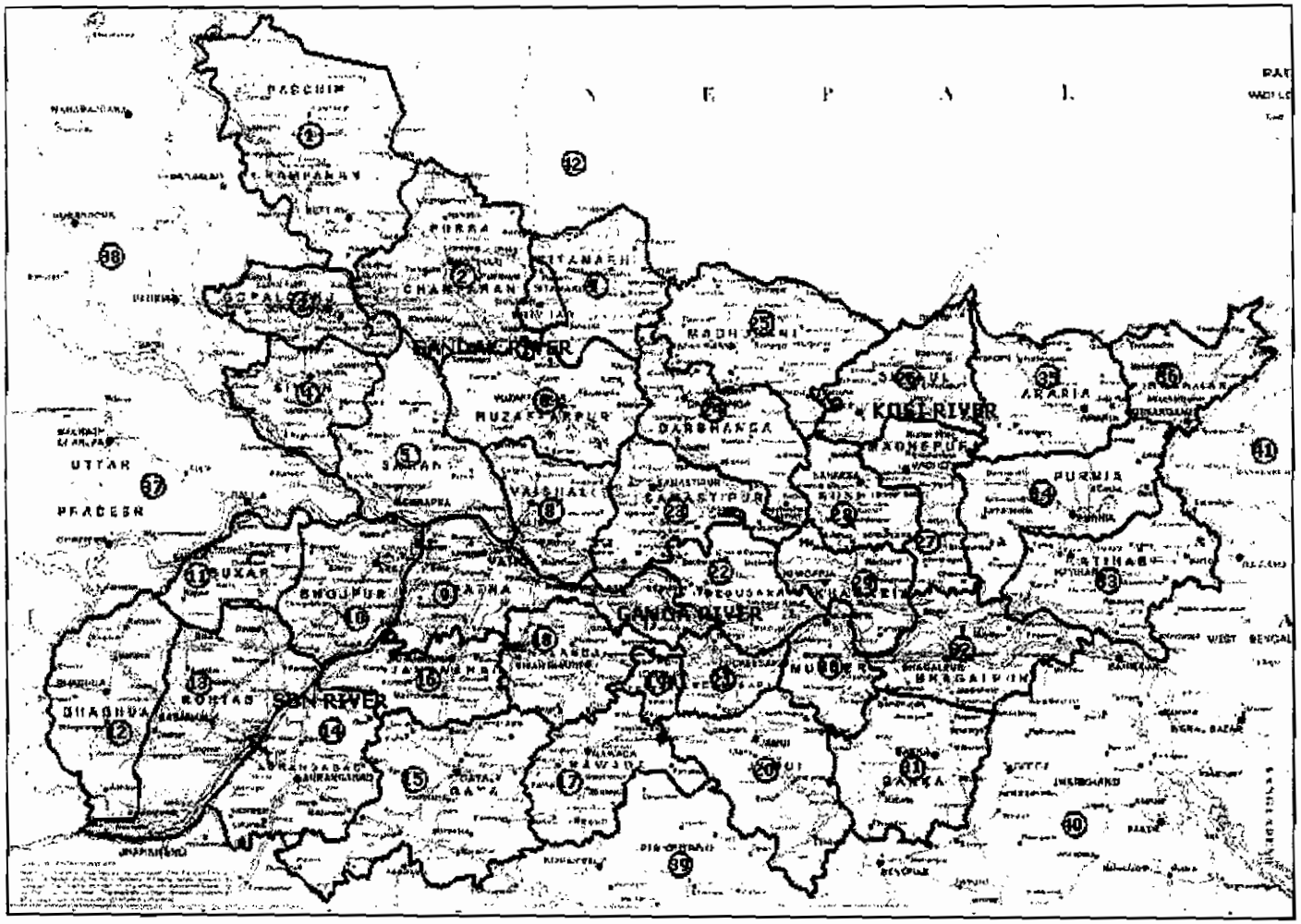
For the purpose of traffic analysis, 42 traffic zones have been identified, 36 are internal zones comprising of various districts of Bihar, and 8 are external zones i.e. outside the boundary of Bihar. The name of the traffic zones is given in **Table 2.1** below and shown in the **Figure 2.1.**

Table 2.1 Traffic Zone List

Zone Number	Name of Traffic Zone
1	Paschim Champaran
2	Purba Champaran
3	Gopal Ganj
4	Siwan
5	Chapra (Saran)
6	Mujaffarpur
7	Sitamarhi & Sheohar
8	Vaishali
9	Patna
10	Bhojpur (Ara)
11	Buxar
12	Bhabhua
13	Rohtas (Sasaram)
14	Aurangabad
15	Gaya
16	Jahanabad
17	Nawada
18	Nalanda (Bihar Sharif)
19	Shekhpur
20	Jamui
21	Lucke Sarai

Zone Number	Name of Traffic Zone
22	Begusarai
23	Samastipur
24	Darbhanga
25	Madhubani
26	Supaul
27	Madhepura
28	Saharsa
29	Khagaria
30	Munger
31	Banka
32	Bhagalpur
33	Katihar
34	Purnia
35	Araria
36	Kishanganj
37	East U.P.
38	Delhi & Punjab
39	Jharkhand I
40	Jharkhand II
41	East India
42	Nepal

Figure 2.1 Traffic Zone System



2.3 DEMOGRAPHIC PROFILE

The area and population of districts of Bihar is given in **Table 2.2**. As per Census 2001 figures, total population of Bihar is 82, 878,796. While the decadal population growth rate for the state of Bihar is 28.43% for the period 1991-2001, it grows at the rate of 30-35% in some districts. It is evident from the table that the three top districts in Bihar are Patna, East Champaran and Muzaffarpur. Patna is the most populous district of the State. The average population of a district in Bihar works out to be 22.4 Lakh.

Table No.2.2 District Wise Population of Bihar State

S no	District	Population 1991	Population 2001	%age Decadal Growth Rate
1	Patna	3,618,211	4,709,851	30.17
2	Purba Champaran	3,043,061	3,933,636	29.27
3	Muzaffarpur	2,953,903	3,743,836	26.74
4	Madhubani	2,832,024	3,570,651	26.08
5	Gaya	2,664,803	3,464,983	30.03
6	Samastipur	2,716,929	3,413,413	25.63
7	Darbhanga	2,510,959	3,285,473	30.85
8	Saran	2,572,980	3,251,474	26.37
9	Pachim Champaran	2,333,666	3,043,044	30.40
10	Vaishali	2,146,065	2,712,389	26.39
11	Siwan	2,170,971	2,708,840	24.78
12	Sitamarhi	2,013,796	2,669,887	32.58
13	Purnia	1,878,885	2,540,788	35.23
14	Rohtas	1,917,416	2,448,762	27.71
15	Bhagalpur	1,909,967	2,430,331	27.24
16	Katihar	1,825,380	2,389,533	30.91
17	Nalanda	1,996,257	2,368,327	18.64
18	Begusarai	1,814,773	2,342,989	29.11
19	Bhojpur	1,792,771	2,233,415	24.58
20	Gopalganj	1,704,310	2,149,343	26.11
21	Araria	1,611,638	2,124,831	31.84
22	Aurangabad	1,539,988	2,004,960	30.19
23	Nawada	1,359,694	1,809,425	33.08
24	Supaul	1,342,841	1,745,069	29.95
25	Banka	1,292,504	1,608,778	24.47
26	Madhepura	1,177,706	1,524,596	29.45
27	Jehanabad	1,174,900	1,511,406	28.64
28	Saharsa	1,132,413	1,506,418	33.03
29	Buxar	1,087,676	1,403,462	29.03
30	Jamui	1,051,527	1,397,474	32.90
31	Kishanganj	984,107	1,294,063	31.50
32	Kaimur	983,269	1,284,575	30.64
33	Khagaria	987,227	1,276,677	29.32
34	Munger	943,583	1,135,499	20.34
35	Lakhisarai	646,395	801,173	23.94
36	Sheikhpura	420,260	525,137	24.96
37	Sheohar	377,699	514,288	36.16
Total		**64,530,554**	**82,878,796**	**28.43**

2.4 PRIMARY TRAFFIC AND TRAVEL SURVEYS

The following traffic and travel surveys have been conducted as part of the study in order to determine commodity wise O-D flows in the project influence area:

- Classified traffic volume count survey (15 locations)
- Vehicle occupancy survey
- Road side origin-destination survey

These above surveys have been conducted day and night continuously for three days. In addition Industrial Surveys were also conducted in Bihar. About 100 medium and large scale industries were surveyed in the study area to determine the willingness of industry management to use inland water transport for the inbound shipment of raw materials as used by the industries and outbound shipment of the finished product manufactured by the industries.

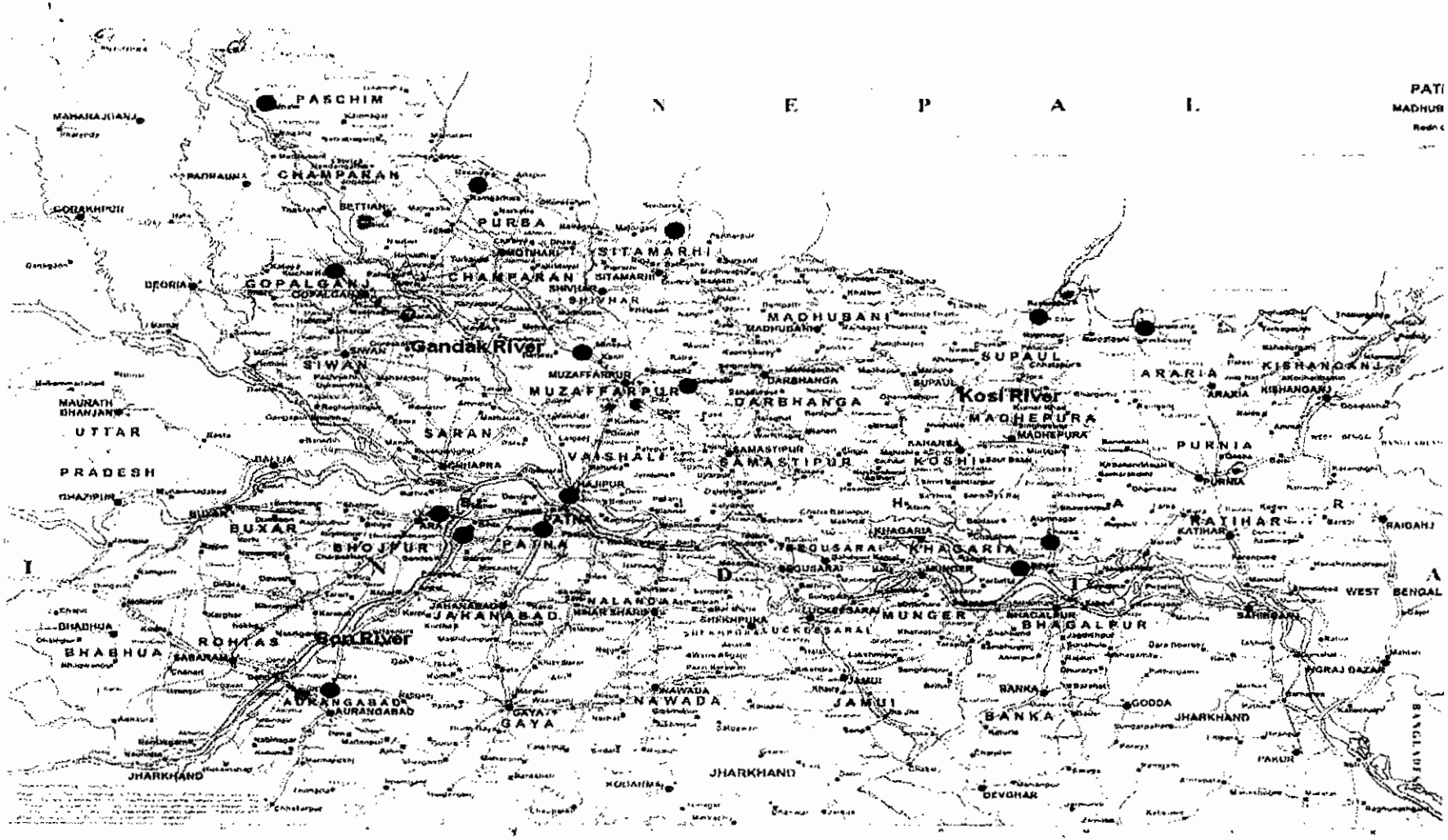
The survey performs for traffic and industrial surveys are given in **Annexures 2.1 to 2.3**. The data collected through the above field surveys have been analysed to assess the present classified traffic volumes and movement pattern at various identified locations near the rivers influence area throughout the state of Bihar. The survey locations are listed in **Table 2.3** below and also shown in **Figure 2.2**.

Table 2.3 List of Traffic Surveys Locations

Location no.	Locations of Traffic Surveys
1	Hajipur Bridge
2	Ara Buxar Road (Near Undawant Nagar)
3	Muzaffarpur- Darbhanga Road (Near Galghatti)
4	Jahanabad Road (Near Bihta)
5	Jahanabad Road (Near Punpun)
6	Muzaffarpur Purvi Champaran Road (Near Kanti)
7	Aurangabad-Jahanabad Road (Near Obra)
8	Khagaria Bhagalpur Road (Near Bihpur)
9	Bhagalpur -Madhepura Road Near Chausa
10	Sonbarsa Nepal Border Road (Sitamarhi)
11	Raxaul -Nepal Border Road
12	Bagha-Nepal Border Road (Paschim Champaran)
13	Gopalganj Gorakhpur Road(Near Kuchal Kot)
14	Ararai- Nepal Bordar Near Forbes Ganj
15	Supaul Nepal Border Road Near Basant Pur

Source: Primary Survey September '2008

FIGURE 2.2. TRAFFIC SURVEY LOCATIONS



2.5 TRAFFIC VOLUME CHARACTERISTICS

Classified Traffic Volume Count

The classified traffic volume surveys have been conducted at 15 identified locations for 72 hours continuously i.e. three days. The quantum and temporal variation of total and daily traffic moving in the study area are presented in the following sections.

2.5.1 Traffic Volume (Average Daily Traffic – 24 hours)

The traffic count both in terms of number of vehicles and passenger car units (PCUs) have been computed for the total daily (24 hours) traffic continuously for three days at different identified locations which are presented in **Table 2.4** .It is observed that the daily traffic at different locations varies from 2513 PCU's (3159 vehicles) at Sonbarsa Nepal Border (Sitamarhi) to 41873 PCU's (28233 vehicles) at Hajipur Bridge Patna.

Table 2.4 Average Daily Traffic Volume (24 Hours) at Identified Locations

Sl. No.	Name of Location	DAILY TRAFFIC						AVERAGE DAILY TRAFFIC	
		Day-1		Day-2		Day-3			
		Vehicle	PCU's	Vehicle	PCU's	Vehicle	PCU's	Vehicle	PCU's
1	Hajipur Bridge	25693	38712	25944	37770	33062	49138	28233	41873
2	Ara Buxar Road (Near Undawant Nagar)	16761	26924	19904	31592	19878	31462	18848	29993
3	Muzaffarpur- Darbhanga Road (Near Galghati)	9218	12733	6111	8769	11351	16754	8893	12752
4	Jahanabd Road (Near Bhita)	3468	4316	2788	3434	3942	4724	3399	4158
5	Jahanabad Road (Near Punpun)	3983	4051	3057	2990	4260	4339	3767	3793
6	Muzaffarpur Puri Champuran Road (Near Kanti)	14187	21332	17623	25509	16246	25983	16019	24275
7	Aurangabad -Jahanabad Road (Near Obra)	4539	4778	4727	5418	5961	7086	5076	5760
8	Khagaria Bhagalpur Road (Near Bihpur)	3958	6798	4428	7567	3166	4911	3851	6425
9	Bhagal Pur MadhePura Road Near Chausa	5183	4295	7592	6898	7433	6651	6736	5948
10	Sonbasara Nepal Border Road (Sita Marhi)	2955	2259	3237	2801	3286	2481	3159	2513
11	Raxaul Nepal Border Road	16375	18535	18228	20466	20375	22580	18326	20527
12	Bagha NepaL Border Road (Paschim Chamarm)	7875	8456	4329	5475	8361	8738	6855	7556
13	Gopalganj Gorakhpur Road (Near Kuchkal Lot)	5653	6400	5984	7007	6281	6897	5973	6768
14	Ararai NepaL Border (Near Forbesganj)	3160	3846	3648	4686	4163	5658	3657	4730
15	Supaul Nepal Border Road (Near Basantpur)	5473	3917	5389	3714	5364	3680	5409	3770

Source: Primary Survey September '2008

2.5.2 Peak Hour Traffic

The peak hour traffic characteristics at the identified locations are presented in **Table 2.5**. The peak hour factor is the percentage of peak hour traffic to the total daily traffic. The peak hour factor varies from 5.53% at Ara Buxar Road (Near Undawant Nagar) to 9.15% at Supaul Nepal Border Road (Near Basant Pur). The averaging peak hour average in all the locations is about 7.07%.

Table 2.5 Peak Hour Characteristics at Identified Locations

S. No.	Name of Location	Average 24 Hr. Traffic (PCUs)	Average Peak Hr. Traffic (PCUs)	Average % Peak Hour Share/ Factor
1	Hajipur Bridge	41873	2319	5.54
2	Ara Buxar Road (Near Undawant Nagar)	29993	1658	5.53
3	Muzaffarpur- Darbhanga Road (Near Galghatti)	12752	733	5.75
4	Jahanabad Road (Near Bihta)	4158	246	5.92
5	Jahanabad Road (Near Punpun)	3793	254	6.70
6	Muzaffarpur Purvi Champaran Road (Near Kanti)	24275	1837	7.57
7	Aurangabad-Jahanabad Road (Near Obra)	5760	381	6.61
8	Khagaria Bhagalpur Road (Near Bihpur)	6425	486	7.56
9	Bhagalpur -Madhepura Road Near Chausa	5948	371	6.24
10	Sonbarsa Nepal Border Road (Sitamarhi)	2513	204	8.12
11	Raxaul -Nepal Border Road	20527	1861	9.07
12	Bagha-Nepal Border Road (Paschim Champaran)	7556	509	6.74
13	Gopalganj Gorakhpur Road(Near Kuchal Kot)	6768	568	8.39
14	Ararai- Nepal Bordar Near Forbes Ganj	4730	339	7.17
15	Supaul Nepal Border Road Basant Pur	3770	345	9.15

Source: Primary Survey September '2008

2.5.3 Composition of Traffic

The composition of traffic in terms of fast moving, goods and slow moving at various identified locations are presented in **Table 2.6.** The daily traffic composition of fast moving passenger traffic varying from 28.67% at Ara Buxar Road (near Undawant Nagar) to 54.13% at Hazipur Bridge (Patna). On an average the light fast moving passenger vehicles comprises 76% of total traffic. It is observed that the share of slow moving vehicles varies from 9.15% to 59.75% with an average of about 20%. The share of bus traffic is as low as 1.11% at Raxual (Nepal Border Road (maximum of about 10.26% at Aurangabad-Jahanabad Road (Near Obra)with an average of about 2.6% of

total traffic. The fast passenger vehicles predominantly consist of two wheelers, cars and auto while the slow vehicles consist of cycles and cycle rickshaws. The share of goods traffic varies from 2.17% to 32.74% at various locations.

Table 2.6 Daily Traffic Composition (24 Hours) at Identified Locations

S.N.	Name of Location	Composition (%)			
		Bus	Fast Moving Passenger	Goods	Slow Moving Passenger
1	Hajipur Bridge	6.72	54.13	30.00	9.15
2	Ara Buxar Road (Near Undawant Nagar)	4.15	28.67	30.11	37.07
3	Muzaffarpur- Darbhanga Road (Near Galghatti)	9.33	43.52	27.32	19.84
4	Jahanabad Road (Near Bihta)	5.64	41.87	20.61	31.88
5	Jahanabad Road (Near Punpun)	4.76	63.12	8.42	23.69
6	Muzaffarpur Purvi Champaran Road (Near Kanti)	6.10	41.43	32.74	19.73
7	Aurangabad-Jahanabad Road (Near Obra)	10.26	52.01	17.69	20.03
8	Khagaria Bhagalpur Road (Near Bihpur)	4.03	36.98	30.48	28.51
9	Bhagalpur -Madhepura Road Near Chausa	4.06	35.05	5.28	55.62
10	Sonbarsa Nepal Border Road (Sitamarhi)	2.91	43.66	4.64	48.79
11	Raxaul -Nepal Border Road	1.11	33.42	5.71	59.75
12	Bagha-Nepal Border Road (Paschim Champaran)	1.32	37.94	19.89	40.84
13	Gopalganj Gorakhpur Road(Near Kuchal Kot)	1.40	46.28	19.97	32.35
14	Ararai- Nepal Bordar Near Forbes Ganj	6.37	33.42	2.52	57.68
15	Supaul Nepal Border Road Basant Pur	1.94	42.68	2.17	53.21

Source: Primary Survey September '2008

2.5.4 Occupancy of Vehicles and Passenger Trips

The average occupancy of various modes is presented in **Table 2.7**. The average Bus occupancy varies from 15 to 54 at different locations and averaging occupancy is **41**. Averaging occupancy for cars, two wheelers and auto rickshaws is about 3.9, 1.7, and 4.2 respectively. The mini buses have an averaging occupancy of 11.

Table 2.7 Occupancy of Fast Passenger Vehicles at Identified Locations

S. N.	Name of Locations	Average Occupancy				
		Car	2 Wh.	Auto	Bus	Mini Bus
1	Hajipur Bridge	3.39	1.70	4.86	52.42	9.06
2	Ara Buxar Road (Near Undawant Nagar)	2.94	1.44	3.66	54.25	15.1
3	Muzaffarpur- Darbhanga Road (Near Galghatti)	4.13	1.65	3.2	41.08	12.38
4	Jahanabad Road (Near Bihta)	4.21	1.64	4.32	46.06	12.01
5	Jahanabad Road (Near Punpun)	4.00	1.67	3.6	14.34	11.4
6	Muzaffarpur Purvi Champaran Road (Near Kanti)	3.89	1.64	4.65	49.17	12.77
7	Aurangabad-Jahanabad Road (Near Obra)	3.61	1.70	4.22	41.99	11.43
8	Khagaria Bhagalpur Road (Near Bihpur)	4.25	1.90	3.86	49.68	9.5
9	Bhagalpur -Madhepura Road Near Chausa	2.36	1.93	4.2	35.72	6.51
10	Sonbarsa Nepal Border Road (Sitamarhi)	5.10	1.64	3.66	36.11	6.13
11	Raxaul -Nepal Border Road	3.83	1.66	5.16	48.75	11.37
12	Bagha-Nepal Border Road (Paschim Champaran)	2.61	1.60	5.12	43.75	12.17
13	Gopalganj Gorakhpur Road(Near Kuchal Kot)	4.17	1.64	4.38	23.75	12.44
14	Ararai- Nepal Bordar Near Forbes Ganj	5.20	1.93	4.75	48.75	11.25
15	Supaul Nepal Border Road Near Basant Pur	5.40	1.80	3.72	34.44	11.67

Source: Primary Survey September '2008

Total daily passenger trips are presented in **Table 2.8.** It is observed that the passenger trips at different locations vary from 7,466 trips at Supaul Nepal Border Road near Basant Pur to 1,35,260 trips at Hajipur Bridge. Another major location is Muzaffarpur - Purvi Champaran Road (Near Kanti) which is handling 54,433 trips per day.

Table 2.8 Daily Passenger Trips at Identified Locations

S. No.	Location	Fast Moving Passenger Trips					Total Trips
		Car Jeep Van	2-Wh	Auto	Bus		
					Bus	Mini Bus	
1	Hajipur Bridge	17782	11417	16140	87926	1996	**135260**
2	Ara Buxar Road (Near Undawant Nagar)	5193	4284	2425	21573	5803	**39279**
3	Muzaffarpur- Darbhanga Road (Near Galghatti)	4733	3452	2022	20882	3978	**35068**
4	Jahanabad Road (Near Bihta)	2400	1105	775	5742	805	**10827**
5	Jahanabad Road (Near Punpun)	2100	2207	1913	750	1448	**8418**
6	Muzaffarpur Purvi Champaran Road (Near Kanti)	9619	4950	5330	29797	4738	**54433**
7	Aurangabad-Jahanabad Road (Near Obra)	2049	2715	2006	6396	4214	**17380**
8	Khagaria Bhagalpur Road (Near Bihpur)	1947	1319	1050	4223	668	**9206**
9	Bhagalpur -Madhepura Road Near Chausa	1309	3250	512	5382	801	**11254**
10	Sonbarsa Nepal Border Road (Sitamarhi)	316	2112	109	2130	202	**4869**
11	Raxaul -Nepal Border Road	3116	8600	673	5655	1004	**19049**
12	Bagha-Nepal Border Road (Paschim Champaran)	418	3283	1990	2085	523	**8300**
13	Gopalganj Gorakhpur Road (Near Kuchal Kot)	2651	3377	304	562	742	**7636**
14	Ararai- Nepal Bordar Near Forbes Ganj	950	1291	1761	6143	1204	**11348**
15	Supaul Nepal Border Road Near Basant Pur	1107	3682	215	1871	591	**7466**

Source: Primary Survey September '2008

2.6 GOODS MOVEMENT CHARACTERSTICS

2.6.1 Traffic Volume of Goods Vehicles and Sample Size

The origin destination survey of goods vehicles was conducted as per survey proforma at **Annexure 2.2** at the identified 15 locations along with traffic volume surveys on sample basis. The goods/ commodities have been categorized in different groups as given in **Table 2.9**.

Table 2.9: Constituents of Commodity Group

Code	Commodity Group	Commodity
1	Construction Material	Sand, Stone, Bricks, Iron, Steel, Cement, Marble and Stone Slab, Hardware, Fitting & Fixture, Timber & Furnishing Work, Machinery - Light & Heavy
2	Cereals/Cash Crops	Wheat, Rice, Bajra, Jawar, Millets, Maize, Gram, Pulses, Sugar Cane, Cotton, Barley, Oil Seed, Tobacco, Dry Chilies, Other
3	Perishable Commodities	Fruit, Vegetable, Dairy / Poultry Products, Fishing and Meat
4	Petroleum Products	Petrol, Diesel, Kerosene and L.P.G
5	Conventional Fuels	Coal and Firewood
6	Live Stock	Animals, Oil Cake and Bhusa
7	Chemicals	Fertilizer, Wine, Beverage & Soft drink, Acids
8	Mineral Ore	Lime Stone, Iron and Copper Ore
9	Others	Consumer Goods, Kirana /Perchun Appliances, Edible Oil, Refined Oil, Paper Products and Others
10	Empty	Empty Vehicle

As a part of Traffic surveys, the total number of goods vehicles passing at the survey locations were counted continuously for the duration of 72 hours (for three days). Total number of 14336 goods vehicle including trucks, LMV, MAV etc were interviewed. Sample Size varies from about 8% to 62% of goods vehicles at various locations. The location wise number of sample vehicles interviewed and their percentage distribution is given in **Table 2.10**.

Table 2.10 VOLUME OF GOODS VEHICLES AND SAMPLE SIZE

SN	Name of Location	Average Daily Goods Traffic				Average Sample Goods Traffic				Percentage of Sample Goods Traffic			
		LCV	Truck	MAV	Total	LCV	Truck	MAV	Total	LCV	Truck	MAV	Total
1	Hajipur Bridge	2327	5888	256	8471	294	376	90	760	12.63	6.39	35.20	8.9
2	Ara Buxar Road (Near Undawant Nagar)	1441	3996	238	5675	222	280	14	515	15.38	7.00	5.73	9.0
3	Muzaffarpur-Darbhanga Road (Near Galghati)	936	1384	109	2429	141	193	5	339	15.06	13.92	4.59	13.94
4	Jahanabd Road (Near Bhita)	305	369	27	701	65	56	4	125	21.44	15.10	14.63	17.8
5	Jahanabad Road (Near Punpun)	172	142	3	317	92	23	0	115	53.49	16.20	0.00	36.24
6	Muzaffarpur Purbi Champuran Road (Kanti)	1600	3215	429	5244	319	472	42	832	19.91	14.68	9.71	15.87
7	Aurangabad - Jahanabad Road (Near Obra)	301	591	6	898	100	130	7	237	33.11	22.04	129.41	26.4
8	Khagaria Bhagalpur Road (Near Bihpur)	184	889	101	1174	60	673	50	783	32.67	75.73	49.34	66.71
9	Bhagal Pur MadhePura Road Near Chusa	139	217	0	355	25	79	0	104	18.03	36.62	0.00	29.36
10	Sonbasara Nepal Border Road (Sita Marhi)	66	77	4	147	17	42	1	60	25.38	54.31	36.36	40.91
11	Raxaul Nepal Border Road	315	662	70	1047	74	280	11	365	23.47	42.32	15.24	34.83
12	Bagha NepaL Border Road (Paschim Champaran)	700	654	10	1364	60	40	0	100	8.58	6.11	0.00	7.33
13	Gopalganj Gorakhpur Road (Near Kuchkal Lot)	130	932	130	1193	37	350	21	408	28.64	37.54	15.90	34.21
14	Ararai NepaL Border (Near Forbesganj)	35	56	1	92	10	13	1	24	28.30	23.81	66.67	25.99
15	Supaul Nepal Border Road (Near Basantpur)	52	61	4	117	28	34	0	61	53.55	54.89	0.00	52.27

2.6.2 Commodity wise Goods Traffic

The total volume of good traffic (in tonnes) at various locations is given in **Table No. 2.11.**

Table 2.11: Distribution of Location wise Goods Traffic

S. No.	Location	Tonnage (3 Day)	Tonnage (Average)
1	Hajipur Bridge	71589	23863
2	Ara Buxar Road (Near Undawant Nagar)	51920	17307
3	Muzaffarpur- Darbhanga Road (Near Galghatti)	46003	15334
4	Jahanabad Road (Near Bihta)	3599	1200
5	Jahanabad Road (Near Punpun)	2461	820
6	Muzaffarpur Purvi Champaran Road (Near Kanti)	132984	44328
7	Aurangabad-Jahanabad Road (Near Obra)	11326	3775
8	Khagaria Bhagalpur Road (Near Bihpur)	36562	12187
9	Bhagalpur -Madhepura Road Near Chausa	10189	3396
10	Sonbarsa Nepal Border Road (Sitamarhi)	3509	1170
11	Raxaul -Nepal Border Road	17626	5875
12	Bagha-Nepal Border Road (Paschim Champaran)	16316	5439
13	Gopalganj Gorakhpur Road(Near Kuchal Kot)	40799	13600
14	Ararai- Nepal Bordar Near Forbes Ganj	3159	1053
15	Supaul Nepal Border Road Basant Pur	2869	956

2.7 INDUSTRIAL SURVEY

2.7.1 Industrial Survey was conducted at industries with a samples size of 103 as per Survey Proforma at **Annexure 2.3.** No. of industries covered this survey were Vaishali (50Nos), Patna (31 Nos), Mujaffarpur (17 Nos.) and Aurangabad (5 Nos). The summarized output in respect of the above has been presented in **Tables-2.12 to 2.14.** The industrial survey data has been given in **Annexure 2.4.**

Table No. 2.12 gives the type of commodities manufactured. It is observed from the table that about 39% of the manufactured items are construction material; where as 42% of the manufactured goods are household and food items. The remaining about 19% manufactured commodities are petroleum, mineral ores etc.

Table 2.12: Type of Commodity Manufactured as per Industries Survey

Code	Commodity Group	Type of Commodity Manufactured	Sample	%
1	Construction Material	Sand. Stone, Bricks, Iron, Steel, Cement, Marble and Stone Slab, Hardware, Fitting & Fixture, Timber & Furnishing Work, Machinary - Light & Heavy	40	38.83
2	Cereals/Cash Crops	Wheat, Rice, Bajra, Jawar, Millets, Maize, Gram, Pulses, Sugar Cane, Cotton, Barley, Oil Seed, Tobacco, Dry Chilies, Other	7	6.80
3	Perishable Commodities	Fruit, Vegetable, Diary / Poultry Products, Fishing and Meat	4	3.88
4	Petrolium Products	Petrol, Diesel, Kerosene, L.P.G	1	0.97
5	Conventional Fuels	Coal, FireWood	0	0.00
6	Live Stock	Animals, Oil Cake, Bhusa	1	0.97
7	Chemicals	Fertilizer, Wine, Beverage & Soft drink, Acids.	8	7.77
8	Mineral Ore	Lime Stone, Iron and Copper Ore.	10	9.71
9	Others	Consumer Goods, Kirana /Perchun Appliances, Edible Oil, Refined Oil, Paper Products and Others	32	31.07
Total			103	100.00

Source: Primary Survey September '2008

2.7.2 Distribution of Goods Movement by Mode of Transport

Table No.2.13 reveals that the entire goods manufactured by industries are transported through road based transport. Trucks are predominant mode of transport for the movements of goods. Only 1% of industrial goods are transported by railway.

Table 2.13: Mode used for Commodity Movement

Sl.No	Mode of Travel	No of Surveyed Establishments.	%age
1	Truck	93	90.29
2	Railway	1	0.97
3	LCV	3	2.91
4	CAR	1	0.97
5	Tractor	1	0.97
6	Truck + LCV	3	2.91
7	Truck+Railway	1	0.97
Total		103	100.00

Source: Primary Survey September '2008

2.7.3 Opinion survey

Opinion survey was carried out to obtain preference of industrial owners about shifting to Inland water transport system for the goods movement. The respondents were asked their willingness to shift to Inland water Transport with respect to their existing transport mode used. The **Table 2.14** shows a positive response from the industrials owners. The table indicates that 51% are willing to shift to Inland Water Transport if the existing cost of transport for the movement of goods remains the same with Inland water Transport system. Whereas 17% are willing to shift with reduction of 10% tariff in Inland Water transport as compared to road transport and additional 8% respondents are willing to shift with reduction of 20% of tariff as compared to the present transport system used by industries. About 25% respondents showed no response.

Table 2.14: Willingness to use Inland Water Transport from the Existing Mode of Transport use for Commodity Movements

S. No.	Category	No.of Surveyed Establishments	%age
(a)	Existing Cost	52	50.5
(b)	10% Cost Saving	17	16.5
(c)	15% Cost Saving	0	0.0
(d)	20% Cost Saving	8	7.8
(e)	No Response	26	25.2
Total		**103**	**100.00**

Source: Primary Survey September '2008

2.8 BASE YEAR (2008-09) FREIGHT TRAFFIC RELEVANT FOR IWT

2.8.1 The road freight captured during the O-D traffic surveys organized at selected road side locations forms the base traffic from which traffic relevant for IWT has been identified. The traffic relevant for IWT have identified giving due consideration to the following aspects.

- Nature of the commodity: For example perishable commodities like fruits, vegetables, milk etc have not been considered relevant for IWT movement. Similarly, inflammable and dangerous cargo e.g. petrol, diesel, kerosene etc. are not considered Further, cargo flows having origin and/or destinations far away from the river front have been excluded.

- Comparative cost of movement by road transport versus IWT has formed the basis for identifying cargo traffic that is likely to shift to IWT if this mode is developed.

2.8.2 Keeping view the above considerations, the following commodities/commodity groups have been considered relevant for Inland Water Transport (IWT) is given in **Table 2.15**

Table 2.15: Constituents of Commodity Identified For IWT

Code	Commodity Group	Commodity
1	Construction Material	Sand, Stone, Bricks, Iron, Steel, Cement, Marble and Stone Slab, Hardware, Fitting & Fixture, Timber & Furnishing Work, Machinery - Light & Heavy
2	Cereals/Cash Crops	Wheat, Rice, Bajra, Jawar, Millets, Maize, Gram, Pulses, Sugar Cane, Cotton, Barley, Oil Seed, Tobacco, Dry Chilies, Other
5	Conventional Fuels	Coal and Firewood
6	Live Stock	Animals, Oil Cake and Bhusa
7	Chemicals	Fertilizer, Wine, Beverage & Soft drink, Acids
8	Mineral Ore	Lime Stone, Iron and Copper Ore
9	Others	Consumer Goods, Kirana /Perchun Appliances, Edible Oil, Refined Oil, Paper Products and Others

2.8.3 For the user of any transport mode, total cost of transport from the initial origin to the final destination forms the major consideration in deciding a particular mode for transport for movement cargo. Other thing being the same or similar, a user prefers that mode whose transport cost less vis-a- vis other available modes of transport in the present context. A broad comparative cost analysis for moving a commodity for different distances by IWT and road transport has been carried. This analysis brings out that IWT will be less costly vis-a- vis road transports for distance above 50 kms. The details are presented in **Table 2.16.**

Table 2.16: Comparative Cost of by Road Transport and IWT (2006-07 Price Level)

Distance (Km)	Road Transport Cost/ Tonne (Rs.)	Cost of Transport by IWT (Rs./Tonne)				Additional Cost by Road (Rs./Tonne)
		Vessel	Local Cartage*	Additional Handling**	Total cost	
25	38.68	14.07	23.91	20	57.98	-19.30
50	77.36	28.14	23.91	20	72.05	5.31
75	116.04	42.21	23.91	20	86.12	29.91
100	154.71	56.28	23.91	20	100.19	54.52
125	193.39	70.36	23.91	20	114.27	79.13
150	232.07	84.43	23.91	20	128.34	103.74
* Average Local Cartage: 3 Km on either side i.e. 6 km in total						
** One additional handling on either side i.e. 2 additional handlings @ Rs. 10/tonne (Loading & Unloading)						

Source : Rites Report of IWT of Andhra Pradesh

2.8.4 Based on the commodity characteristics and comparative cost and allied considerations, the base year (2008-09) traffic relevant for IWT has been identified from the total O-D traffic flow estimates derived from the data collected during the O-D traffic surveys.

2.8.5 Even if the cost of movement by IWT is less between an O-D pair, the entire traffic may not shift from road transport to IWT in of some exigencies like urgency, non-availability of IWT at the required time. It has been assumed that 50% of traffic relevant for IWT System from road transport may shift to IWT. Considering above commodity specific traffic estimates is presented in the following tables for the proposed IWT System in the Gandak river.

2.8.6 Project Influence Area – Gandak River

The base year commodity wise Traffic and Section loading in metric tonnes per day is estimated for inland water transport system on Gandak River and is given in the **Tables 2.17 - 2.18.**

Table 2.17 Estimated Base Year Commodity wise Traffic on Gandak River

(in Metric Tonnes per Day)

Origin	Commodity wise Tonnage							Total (Tonnes/day)
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	2190	705	249	34	104	880	1117	5279
Vaishali	3	0	0	0	0	0	0	3
Kalyanpur	63	60	0	0	0	0	27	151
Bettiah	36	86	28	8	4	65	84	309
Bagha	173	60	0	55	25	86	37	436
Nepal	0	0	0	0	0	0	0	0
Total	2466	913	281	103	140	1038	1274	6178

Table 2.17 Cont.

Table 2.17

Direction 2- From Nepal to Patna								
Nepal	628	9	0	0	0	78	71	786
Bagha	171	725	0	8	0	189	180	1272
Bettiah	3	63	0	13	0	26	11	115
Kalyanpur	105	147	0	2	0	18	64	336
Vaishali	144	151	0	10	5	9	91	410
Patna	0	0	0	0	0	0	0	0
Total	**1051**	**1095**	**0**	**33**	**5**	**320**	**417**	**2920**
Both direction								
Nepal	628	9	0	0	0	78	71	786
Bagha	343	785	0	63	25	275	217	1708
Bettiah	38	149	28	21	4	91	95	424
Kalyanpur	169	208	0	2	0	18	91	487
Vaishali	147	151	0	10	5	9	91	413
Patna	2190	705	249	34	104	880	1117	5279
Total	**3516**	**2006**	**276**	**130**	**138**	**1350**	**1682**	**9097**

Type of Commodities : 1 Construction Material, 2. Cereals/Cash Crops, 5. Conventional Fuels, 6. Live Stock, 7. Chemicals, 8. Mineral Ore, 9. Others

Table 2.18: Estimated Base Year Commodity wise Section Loading on Various Sections on Gandak River (in Metric Tonnes per Day)

Section		Commodity wise Tonnage							Total
From	To	1	2	5	6	7	8	9	Tonnes/day
Direction 1- From Patna to Nepal									
Patna	Vaishali	2190	705	249	34	104	880	1113	*5274*
Vaishali	Kalyanpur	1184	374	217	6	29	409	580	*2798*
Kalyanpur	Bettiah	605	345	163	14	12	285	648	*2071*
Bettiah	Bagha	523	293	59	69	34	256	525	*1758*
Bagha	Nepal	119	122	0	0	9	86	410	*745*
Direction 2- From Nepal to Patna									
Nepal	Bagha	668	9	0	0	0	78	71	*826*
Bagha	Bettiah	799	734	0	8	0	266	252	*2058*
Bettiah	Kalyanpur	118	443	0	40	11	160	403	*1175*
Kalyanpur	Vaishali	223	590	0	42	11	178	426	*1470*
Vaishali	Patna	315	449	0	25	12	130	353	*1283*
Both Direction on Gandak River									
Nepal	Bagha	787	131	0	0	9	163	482	*1571*
Bagha	Bettiah	1322	1027	59	77	34	522	777	*3816*
Bettiah	Kalyanpur	723	788	163	53	23	446	1051	*3245*
Kalyanpur	Vaishali	1407	964	217	48	40	587	1006	*4268*
Vaishali	Patna	2505	1153	249	59	116	1010	1466	6558

Type of Commodities: 1 Construction Material, 2. Cereals/Cash Crops, 5. Conventional Fuels, 6. Live Stock, 7. Chemicals 8. Mineral Ore 9. Others

2.9 FORECAST FOR IWT TRAFFIC

The major determinants level of demand for transport and the flow pattern of cargo are the demand and supply levels of various commodities and services, their location and interaction patterns in the related area. These in turn crucially depend on existing anticipated economic activities, population and their income levels and distribution, availability of quality infrastructure etc. in the region. The GDP of the state Bihar, Jharkhand and the country Nepal plays a vital role in order to determine the growth of traffic. The GSDP of Bihar, Jharkhand and GDP of Nepal is given in **Table 2.19**. It is seen from the Table that the growth of GSDP of Bihar, Jharkhand and GDP of Nepal is more than 6% p. a.

Table 2.19 GSDP Bihar, Jharkhand State and GDP of Nepal

YEARS	GSDP of Bihar in US $ (Billions)	GSDP of Jharkhand in US $ (Billions)	GDP of Nepal in US $ (Billions)
1999-00	9.10	7.33	27.4
2000-01	9.70	6.64	33.7
2002-03	9.80	7.29	35.6
2003-04	11.60	8.37	36
2000-04	11.90	9.72	38.29
2004-05	12.60	12.58	39.53
2005-06	13.4	13.99	39.15
2006-07		16.61	41.18

Source: Bihar, Jharkhand Department of Planning & Development

Considering above for the projection of traffic, the growth of 6% p.a. has been considered for the next 25 years. Within the framework of the forecasting methodology referred to above, O-D freight traffic flows for each river stretch , terminal wise originating, terminating and total cargo loads have been worked for the six horizons i.e. 2012-13, 2015-16, 2020-21, 2025-26, 2030-31 and 2035-36. These estimates are presented in the **Tables 2.20 - 2.21,** for Gandak river project influence area.

Table :2.20 Estimated Total Annual Traffic for Horizon Years on Gandak River (in Tonnes)

Origin	2008-09	2012-13	2015-16	2020-21	2025-26	2030-31	2035-36
Direction 1 - Patna to Nepal							
Patna	1794860	2265969	2698806	3611611	4833150	6467845	8655436
Vaishali	1020	1288	1534	2052	2747	3676	4919
Kalyanpur	51340	64816	77196	103306	138247	185006	247579
Bettiah	105060	132636	157971	211401	282903	378588	506636
Bagha	148240	187150	222898	298288	399177	534188	714865
Nepal	0	0	0	0	0	0	0
Total	**2100520**	**2651858**	**3158405**	**4226659**	**5656223**	**7569302**	**10129434**
Direction 2 - Nepal to Patna							
Nepal	267240	337384	401830	537739	719617	963009	1288724
Bagha	432480	545996	650290	870235	1164570	1558458	2085568
Bettiah	39100	49363	58792	78677	105287	140898	188554
Kalyanpur	114240	144225	171775	229873	307622	411668	550905
Vaishali	139400	175989	209606	280500	375373	502333	672235
Patna	0	0	0	0	0	0	0
Total	**992460**	**1252958**	**1492293**	**1997025**	**2672469**	**3576367**	**4785985**
Both Direction							
Patna	1794860	2265969	2698806	3611611	4833150	6467845	8655436
Vaishali	140420	177277	211140	282553	378119	506009	677154
Kalyanpur	165580	209041	248971	333179	445869	596674	798484
Bettiah	144160	181999	216763	290078	388190	519486	695189
Bagha	580720	733146	873188	1168523	1563747	2092646	2800433
Nepal	267240	337384	401830	537739	719617	963009	1288724
Grand Total	**3092980**	**3904816**	**4650698**	**6223683**	**8328692**	**11145669**	**14915420**

Table 2.21 Estimated Horizon Years Section Loading of traffic on various sections on Gandak River (in Metric Tons)

Section		2008-09	2012-13	2015-16	2020-21	2025-26	2030-31	2035-36
From	To							
Direction 1 - Patna to Nepal								
Patna	Vaishali	1793160	2263823	2696250	3608190	4828572	6461719	864723E
Vaishali	Kalyanpur	951320	1201020	1430434	1914243	2561689	3428117	4587594
Kalyanpur	Bettiah	704140	888961	1058766	1416868	1896089	2537395	3395607
Bettiah	Bagha	597720	754608	898750	1202730	1609524	2153906	2882413
Bagha	Nepal	253300	319785	380870	509689	682079	912776	1221500
Direction 2 - Nepal to Patna								
Nepal	Bagha	280840	354554	422280	565105	756238	1012017	1354308
Bagha	Bettiah	699720	883380	1052120	1407974	1884187	2521467	3374292
Bettiah	Kalyanpur	399500	504360	600700	803872	1075763	1439613	1926527
Kalyanpur	Vaishali	499800	630986	751514	1005696	1345848	1801048	2410209
Vaishal	Patna	436220	550718	655914	877760	1174641	1571935	2103604
Both Direction								
Patna	Vaishali	2229380	2814541	3352163	4485951	6003214	8033654	10750842
Vaishali	Kalyanpur	1451120	1832006	2181948	2919939	3907536	5229165	6997803
Kalyanpur	Bettiah	1103640	1393320	1659466	2220741	2971852	3977008	5322134
Bettiah	Bagha	1297440	1637988	1950870	2610704	3493711	4675374	6256705
Bagha	Nepal	534140	674339	803149	1074795	1438318	1924793	2575808

Commodity wise freight traffic flows have also been worked for the six horizon years i.e. 2012-13, 2015-16, 2020-21, 2025-26, 2030-31 and 2035-36. These estimates are presented in the **Tables 2.22 to 2.28** for Gandak river project influence area.

Table 2.22 Annual Cargo Loads by Commodity for Year 2008-09 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2008-09							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	744600	239700	84660	11560	35360	299200	379780	1794860
Vaishali	1020	0	0	0	0	0	0	1020
Kalyanpur	21420	20740	0	0	0	0	9180	51340
Bettiah	12240	28900	9520	2720	1360	21760	28560	105060
Bagha	58820	20400	0	18700	8500	29240	12580	148240
Nepal	0	0	0	0	0	0	0	0
Total	**838100**	**309740**	**94180**	**32980**	**45220**	**350200**	**430100**	**2100520**
Direction 2- From Nepal to Patna								
Nepal	213520	3060	0	0	0	26520	24140	267240
Bagha	58140	246160	0	2720	0	64260	61200	432480
Bettiah	1020	21080	0	4420	0	8840	3740	39100
Kalyanpur	35700	49980	0	680	0	6120	21760	114240
Vaishali	48960	51340	0	3400	1700	3060	30940	139400
Patna	0	0	0	0	0	0	0	0
Total	**357340**	**371620**	**0**	**11220**	**1700**	**108800**	**141780**	992460
Both direction								
Nepal	213520	3060	0	0	0	26520	24140	267240
Bagha	116960	266560	0	21420	8500	93500	73780	580720
Bettiah	13260	49980	9520	7140	1360	30600	32300	144160
Kalyanpur	57120	70720	0	680	0	6120	30940	165580
Vaishali	49980	51340	0	3400	1700	3060	30940	140420
Patna	744600	239700	84660	11560	35360	299200	379780	1794860
Grand Total	**1195440**	**681360**	**94180**	**44200**	**46920**	**459000**	**571880**	**3092980**

Table 2.23 Estimated Annual Cargo Loads by Commodity for Year 2012-13 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2012-13							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	940040	302616	106881	14594	44641	377733	479463	2265969
Vaishali	1288	0	0	0	0	0	0	1288
Kalyanpur	27042	26184	0	0	0	0	11590	64816
Bettiah	15453	36486	12019	3434	1717	27471	36056	132636
Bagha	74259	25755	0	23608	10731	36915	15882	187150
Nepal	0	0	0	0	0	0	0	0
Total	**1058082**	**391040**	**118900**	**41636**	**57089**	**442119**	**542991**	**2651858**
Direction 2- From Nepal to Patna								
Nepal	269564	3863	0	0	0	33481	30476	337384
Bagha	73400	310771	0	3434	0	81127	77264	545996
Bettiah	1288	26613	0	5580	0	11160	4722	49363
Kalyanpur	45070	63099	0	858	0	7726	27471	144225
Vaishali	61811	64816	0	4292	2146	3863	39061	175989
Patna	0	0	0	0	0	0	0	0
Total	**451134**	**469162**	**0**	**14165**	**2146**	**137357**	**178994**	**1252958**
Both direction								
Nepal	269564	3863	0	0	0	33481	30476	337384
Bagha	147659	336526	0	27042	10731	118042	93146	733146
Bettiah	16740	63099	12019	9014	1717	38632	40778	181999
Kalyanpur	72113	89282	0	858	0	7726	39061	209041
Vaishali	63099	64816	0	4292	2146	3863	39061	177277
Patna	940040	302616	106881	14594	44641	377733	479463	2265969
Grand Total	**1509215**	**860201**	**118900**	**55801**	**59235**	**579477**	**721985**	**3904816**

Table 2.24 Estimated Annual Cargo Loads by Commodity for Year 2015-16 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2015-16							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	1119603	360420	127297	17382	53168	449886	571049	2698806
Vaishali	1534	0	0	0	0	0	0	1534
Kalyanpur	32208	31185	0	0	0	0	13803	77196
Bettiah	18404	43455	14315	4090	2045	32719	42944	157971
Bagha	88444	30674	0	28118	12781	43966	18916	222898
Nepal	0	0	0	0	0	0	0	0
Total	**1260193**	**465734**	**141612**	**49590**	**67994**	**526571**	**646711**	**3158405**
Direction 2- From Nepal to Patna								
Nepal	321055	4601	0	0	0	39876	36298	401830
Bagha	87421	370134	0	4090	0	96623	92022	650290
Bettiah	1534	31697	0	6646	0	13292	5624	58792
Kalyanpur	53680	75151	0	1022	0	9202	32719	171775
Vaishali	73618	77196	0	5112	2556	4601	46522	209606
Patna	0	0	0	0	0	0	0	0
Total	**537307**	**558779**	**0**	**16871**	**2556**	**163595**	**213185**	**1492293**
Both direction								
Nepal	321055	4601	0	0	0	39876	36298	401830
Bagha	175865	400808	0	32208	12781	140589	110938	873188
Bettiah	19938	75151	14315	10736	2045	46011	48567	216763
Kalyanpur	85887	106337	0	1022	0	9202	46522	248971
Vaishali	75151	77196	0	5112	2556	4601	46522	211140
Patna	1119603	360420	127297	17382	53168	449886	571049	2698806
Grand Total	**1797500**	**1024514**	**141612**	**66460**	**70550**	**690166**	**859896**	**4650698**

Table 2.25 Estimated Annual Cargo Loads by Commodity for Year 2020 - 21 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2020-21							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	1498281	482323	170353	23261	71151	602049	764192	**3611611**
Vaishali	2052	0	0	0	0	0	0	**2052**
Kalyanpur	43101	41733	0	0	0	0	18472	**103306**
Bettiah	24629	58152	19156	5473	2737	43785	57468	**211401**
Bagha	118357	41049	0	37628	17104	58837	25313	**298288**
Nepal	0	0	0	0	0	0	0	**0**
Total	**1686422**	**623258**	**189509**	**66362**	**90992**	**704671**	**865446**	4226659
Direction 2- From Nepal to Patna								
Nepal	429644	6157	0	0	0	53363	48574	**537739**
Bagha	116989	495322	0	5473	0	129304	123146	**870235**
Bettiah	2052	42417	0	8894	0	17788	7526	**78677**
Kalyanpur	71835	100570	0	1368	0	12315	43785	**229873**
Vaishali	98517	103306	0	6841	3421	6157	62257	**280500**
Patna	0	0	0	0	0	0	0	**0**
Total	**719038**	**747772**	**0**	**22577**	**3421**	**218927**	**285289**	1997025
Both direction								
Nepal	429644	6157	0	0	0	53363	48574	**537739**
Bagha	235346	536371	0	43101	17104	188140	148460	**1168523**
Bettiah	26682	100570	19156	14367	2737	61573	64994	**290078**
Kalyanpur	114937	142303	0	1368	0	12315	62257	**333179**
Vaishali	100570	103306	0	6841	3421	6157	62257	**282553**
Patna	1498281	482323	170353	23261	71151	602049	764192	**3611611**
Grand Total	**2405460**	**1371030**	**189509**	**88939**	**94412**	**923598**	**1150735**	6223683

Table 2.26 Estimated Annual Cargo Loads by Commodity for Year 2025 - 26 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2025-26							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	2005039	645458	227970	31128	95216	805678	1022661	4833150
Vaishali	2747	0	0	0	0	0	0	2747
Kalyanpur	57679	55848	0	0	0	0	24720	138247
Bettiah	32960	77821	25635	7324	3662	58595	76906	282903
Bagha	158389	54933	0	50355	22889	78737	33875	399177
Nepal	0	0	0	0	0	0	0	0
Total	**2256813**	**834059**	**253605**	**88808**	**121767**	**943009**	**1158162**	**5656223**
Direction 2- From Nepal to Patna								
Nepal	574961	8240	0	0	0	71412	65004	719617
Bagha	156558	662853	0	7324	0	173038	164798	1164571
Bettiah	2747	56764	0	11902	0	23804	10071	105287
Kalyanpur	96132	134585	0	1831	0	16480	58595	307622
Vaishali	131838	138247	0	9155	4578	8240	83314	375373
Patna	0	0	0	0	0	0	0	0
Total	**962235**	**1000688**	**0**	**30213**	**4578**	**292974**	**381781**	**2672469**
Both direction								
Nepal	574961	8240	0	0	0	71412	65004	719617
Bagha	314947	717786	0	57679	22889	251774	198673	1563747
Bettiah	35706	134585	25635	19226	3662	82399	86977	388190
Kalyanpur	153811	190433	0	1831	0	16480	83314	445869
Vaishali	134585	138247	0	9155	4578	8240	83314	378119
Patna	2005039	645458	227970	31128	95216	805678	1022661	4833150
Grand Total	**3219048**	**1834748**	**253605**	**119021**	**126345**	**1235983**	**1539943**	**8328692**

Table 2.27 Estimated Annual Cargo Loads by Commodity for Year 2030 - 31 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2030-31							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	2683194	863768	305075	41657	127421	1078178	1368551	**6467845**
Vaishali	3676	0	0	0	0	0	0	**3676**
Kalyanpur	77188	74737	0	0	0	0	33080	**185006**
Bettiah	44107	104142	34306	9802	4901	78413	102917	**378588**
Bagha	211960	73512	0	67386	30630	105367	45333	**534188**
Nepal	0	0	0	0	0	0	0	**0**
Total	**3020125**	**1116160**	**339381**	**118845**	**162952**	**1261959**	**1549881**	**7569302**
Direction 2- From Nepal to Patna								
Nepal	769427	11027	0	0	0	95566	86989	**963009**
Bagha	209510	887047	0	9802	0	231563	220536	**1558458**
Bettiah	3676	75963	0	15928	0	31855	13477	**140898**
Kalyanpur	128646	180105	0	2450	0	22054	78413	**411668**
Vaishali	176429	185006	0	12252	6126	11027	111493	**502333**
Patna	0	0	0	0	0	0	0	**0**
Total	**1287688**	**1339147**	**0**	**40432**	**6126**	**392065**	**510910**	**3576367**
Both direction								
Nepal	769427	11027	0	0	0	95566	86989	**963009**
Bagha	421470	960559	0	77188	30630	336931	265869	**2092646**
Bettiah	47783	180105	34306	25729	4901	110268	116394	**519486**
Kalyanpur	205834	254842	0	2450	0	22054	111493	**596674**
Vaishali	180105	185006	0	12252	6126	11027	111493	**506009**
Patna	2683194	863768	305075	41657	127421	1078178	1368551	**6467845**
Grand Total	**4307813**	**2455306**	**339381**	**159276**	**169078**	**1654024**	**2060791**	**11145669**

Table 2.28 Estimated Annual Cargo Loads by Commodity for Year 2035 - 36 on Gandak River (in Tonnes)

Origin	Commodity wise Tonnage - 2035-36							Total Tonnage per Annum
	1	2	5	6	7	8	9	
Direction 1- From Patna to Nepal								
Patna	3590719	1155916	408260	55746	170518	1442846	1831431	8655436
Vaishali	4919	0	0	0	0	0	0	4919
Kalyanpur	103295	100015	0	0	0	0	44269	247579
Bettiah	59026	139366	45909	13117	6558	104934	137726	506636
Bagha	283650	98376	0	90178	40990	141005	60665	714864
Nepal	0	0	0	0	0	0	0	0
Total	**4041608**	**1493673**	**454169**	**159041**	**218066**	**1688786**	**2074091**	**10129434**
Direction 2- From Nepal to Patna								
Nepal	1029667	14756	0	0	0	127889	116411	1288723
Bagha	280371	1187069	0	13117	0	309884	295128	2085568
Bettiah	4919	101655	0	21315	0	42630	18036	188554
Kalyanpur	172158	241021	0	3279	0	29513	104934	550905
Vaishali	236102	247579	0	16396	8198	14756	149203	672235
Patna	0	0	0	0	0	0	0	0
Total	**1723217**	**1792080**	**0**	**54107**	**8198**	**524671**	**683712**	**4785985**
Both direction								
Nepal	1029667	14756	0	0	0	127889	116411	1288724
Bagha	564022	1285445	0	103295	40990	450889	355793	2800434
Bettiah	63944	241021	45909	34432	6558	147564	155762	695189
Kalyanpur	275452	341036	0	3279	0	29513	149203	798484
Vaishali	241021	247579	0	16396	8198	14756	149203	677154
Patna	3590719	1155916	408260	55746	170518	1442846	1831431	8655436
Grand Total	**5764825**	**3285754**	**454169**	**213148**	**226264**	**2213457**	**2757803**	**14915420**

Table 2.29 O-D Survey Gandak IWT Traffic : Originating Traffic

Direction 1 : Patna to Nepal

			Annual Traffic in Metric Tonnes						
ORIGIN	DESTINATION	COMMODITY	2008-09	2012-13	2015-16	2020-21	2025-26	2030-31	2035-3(
PATNA	Vaishali, Kalyanpur, Bettiah, Bagha, Nepal	Construction Material	744600	940040					
		Cereals/Cash Crops	239700	302616					
		Conventional Fuels	84660	106881					
		Live Stock	11560	14594					
		Chemicals	35360	44641					
		Mineral Ore	299200	377733					
		Others	379780	479463					
		Sub -Total	1794860	2265969	2698806	3611611	4833150	6467845	865543
Vaishali	Kalyanpur, Bettiah, Bagha, Nepal	Construction Material	1020	1288					
		Cereals/Cash Crops	0	0					
		Conventional Fuels	0	0					
		Live Stock	0	0					
		Chemicals	0	0					
		Mineral Ore	0	0					
		Others	0	0					
		Sub -Total	1020	1288	1534	2052	2747	3676	491
Kalyanpur	Bettiah, Bagha, Nepal	Construction Material	21420	27042					
		Cereals/Cash Crops	20400	25755					
		Conventional Fuels	0	0					
		Live Stock	0	0					
		Chemicals	0	0					
		Mineral Ore	0	0					
		Others	9520	12019					
		Sub -Total	51340	64816	77196	103306	138247	185006	24757
Bettiah	Bagha, Nepal	Construction Material	12240	15453					
		Cereals/Cash Crops	29240	36915					
		Conventional Fuels	9520	12019					
		Live Stock	2720	3434					
		Chemicals	1360	1717					
		Mineral Ore	22100	27901					
		Others	27880	35198					
		Sub -Total	105060	132636	157971	211401	282903	378588	50663(
Bagha	Nepal	Construction Material	58820	74259					
		Cereals/Cash Crops	20400	25755					
		Conventional Fuels	0	0					

		Live Stock	18700	23608					
		Chemicals	8500	10731					
		Mineral Ore	29240	36915					
		Others	12580	15882					
		Sub -Total	148240	187150	222898	298288	399177	534188	71
Nepal	Nepal	Construction Material	0	0					
		Cereals/Cash Crops	0	0					
		Conventional Fuels	0	0					
		Live Stock	0	0					
		Chemicals	0	0					
		Mineral Ore	0	0					
		Others	0	0					
		Sub -Total	0	0	0	0	0	0	

Table 2.30 O-D Survey Gandak IWT Traffic : Originating Traffic

Direction 2 : Nepal to Patna

			Annual Traffic in Metric Tonnes						
ORIGIN	DESTINATION	COMMODITY	2008-09	2012-13	2015-16	2020-21	2025-26	2030-31	2035-
Nepal	Bagha, Bettiah, Kalyanpur, Vaishali, Patna	Construction Material	213520	269564					
	Bagha, Bettiah,	Cereals/Cash Crops	3060	3863					
		Conventional Fuels	0	0					
		Live Stock	0	0					
		Chemicals	0	0					
		Mineral Ore	26520	33481					
		Others	24140	30476					
		Sub -Total	267240	337384	401830	537739	719616	963009	12887
Bagha	Bettiah, Kalyanpur, Vaishali, Patna	Construction Material	58140	73400					
		Cereals/Cash Crops	246500	311201					
		Conventional Fuels	0	0					
		Live Stock	2720	3434					
		Chemicals	0	0					
		Mineral Ore	64260	81127					
		Others	60860	76836					
		Sub -Total	432480	545996	650290	870235	1164570	1558458	208556
Bettiah	Kalyanpur, Vaishali, Patna	Construction Material	1020	1288					
		Cereals/Cash Crops	21420	27042					
		Conventional Fuels	0	0					
		Live Stock	4420	5580					
		Chemicals	0	0					

		Mineral Ore	8840	11160					
		Others	3400	4292					
		Sub -Total	**39100**	**49363**	**58792**	**78677**	**105287**	**140898**	**18855**
Kalyanpur	**Vaishali, Patna**	Construction Material	35700	45070					
		Cereals/Cash Crops	49980	63099					
		Conventional Fuels	0	0					
		Live Stock	680	858					
		Chemicals	0	0					
		Mineral Ore	6120	7726					
		Others	21760	27471					
		Sub -Total	**114240**	**144225**	**171775**	**229873**	**307622**	**411668**	**55090**
Vaishali	**Patna**	Construction Material	48960	61811					
		Cereals/Cash Crops	51340	64816					
		Conventional Fuels	0	0					
		Live Stock	3400	4292					
		Chemicals	1700	2146					
		Mineral Ore	3060	3863					
		Others	30940	39061					
		Sub -Total	**139400**	**175989**	**209606**	**280500**	**375373**	**502333**	**67223**
Patna	**Patna**	Construction Material	0	0					
		Cereals/Cash Crops	0	0					
		Conventional Fuels	0	0					
		Live Stock	0	0					
		Chemicals	0	0					
		Mineral Ore	0	0					
		Others	0	0					
		Sub -Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Annexure 2.1

DEVELOPMENT OF INLAND WATER TRANSPORT IN PATNA BIHAR
SURVEY BY RITES (A GOVERNMENT OF INDIA UNDERTAKING)

CLASSIFIED TRAFFIC VOLUME COUNT

Location Number
Approach Name
Direction From To

Name of Enumerator
Name of Supervisor
Duration
Day Date

Time Period	Motorised vehicle											Non- Motorised			
	Passenger Vehicle					Goods Vehicle			Agricultural Vehicle		Others	Slow Moving		Others	Remarks
	Car/Jeep/Van	Scooter/ Motorcycle	Auto	Minibus	Bus	LCV	2-3 Axle	MAV	Tractor	Tractor Trailer		Cycle	Cycle Rickshaw		

Annexure 2.2

DEVELOPMENT OF INLAND WATER TRANSPORT IN PATNA BIHAR
SURVEY BY RITES (A GOVERNMENT OF INDIA UNDERTAKING)

ORIGIN-DESTINATION SURVEY FOR GOODS VEHICLE

Location and Location Number :

Day:

Name of Surveyor :

Name of the Road :

Date:

Name of Supervisor :

Direction :

Number of Hours :

TIME OF SURVEY	TYPE OF VEHICLE	ORIGIN	DESTINATION	COMMODITY	TONNAGE	FREQUENCY	ROUTE DETAILS	TRIP		
								LENGTH	TIME	COST
1	2	3	4	5	6	7	8	9	10	11

NOTE : LIST TO BE EXPANDED AS PER SITE CONDITIONS

FREQUENCY : 1. DAILY 2. WEEKLY 3. MONTHLY

Annexure 2.3

DEVELOPMENT OF INLAND WATER TRANSPORT IN PATNA, BIHAR SURVEY BY RITES (A GOVERNMENT OF INDIA UNDERTAKING)

INDUSTRIAL SURVEY

Date : Enumerator's Name :
Form No : Supervisor's Name :
Traffic Zone No. :

(1) Type of Industry
(a) Small scale
(b) Medium scale
(c) Large scale

(2) Full Address

(3) Size/Area of Industry: Plot Area _____Sqm. Floor Area_____ Sqm.

(4) No. of workers:

(5) No. of visitors/day:

(6) Commodity manufactured:

(7) Total Annual Production (in Metric Ton):

(8) **Raw Material Details:**

Raw material required	
Place of origin of raw material and their tonnage	
Mode used	
Total distance and route details	
Time incurred	
Cost incurred	

(9) **Finished Product Details:**

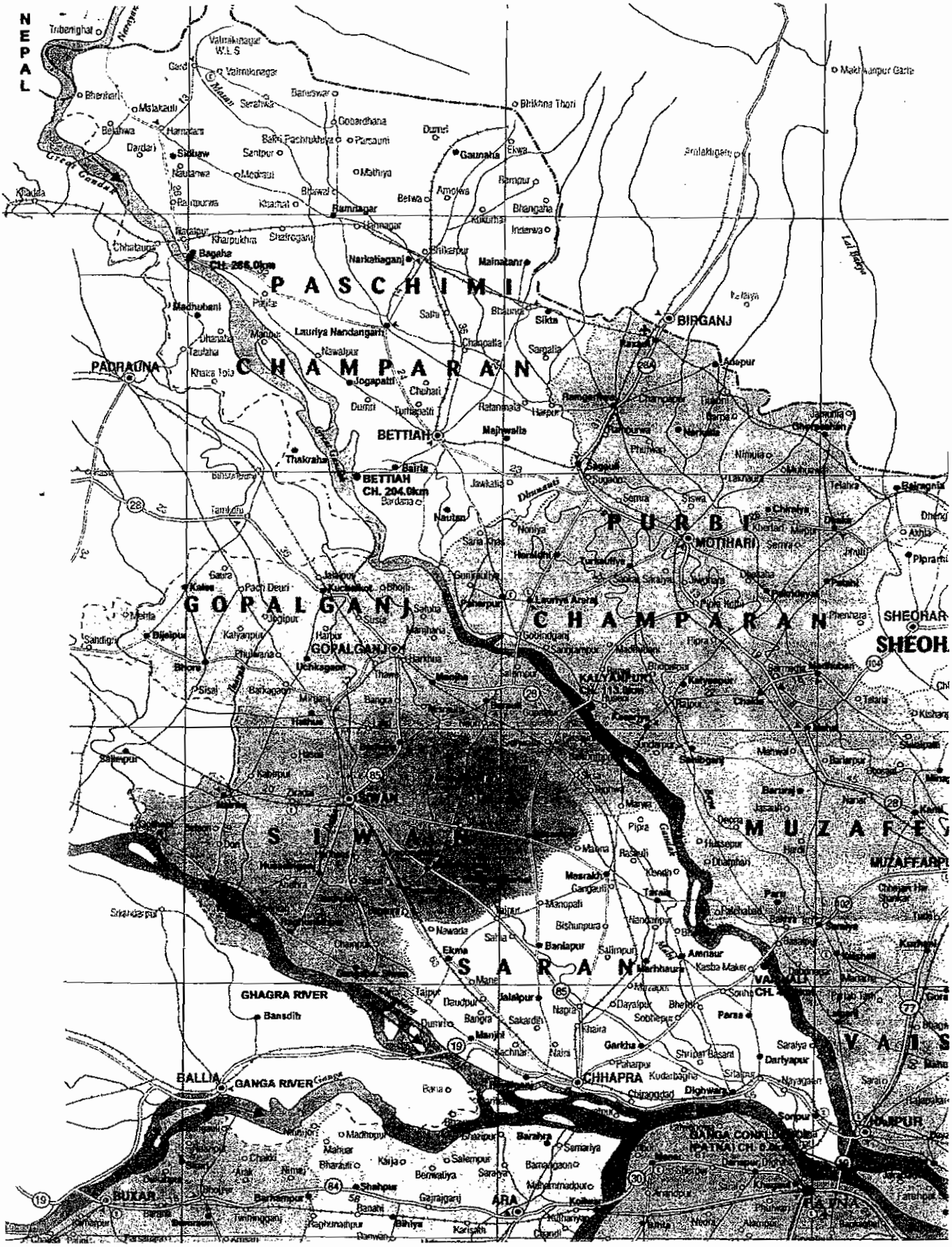
Finished Product type:	
Place of destination of finished product and their tonnage	
Mode used	
Total distance and route details	
Time incurred	
Cost incurred	

(10) Opinion to shift to Inland water Transport:
At what cost savings:

a. Existing cost
b. At 10% extra cost
c. At 15% extra cost
d. At 20% extra cost

(11) Any future industry expansion plan (in terms of tonnage of finished product):

ANNEXURE – 2.5



INDEX MAP: PROPOSED GANDAK RIVER TERMINAL LOCATION

Industrial Survey Data (2008-09)

ANNEXURE - 2.4

Sl.No	Code	Type of Industry	Size of Industry (in Sq.Ft.)		No. of Workers	No. of Visitors	Commodity Manufacturer		Annual Production (in ton)	RAW Material Required		Place of Origin		Mode Used	Total Distance and Route	Time Incurred (in Hrs.)	Finish Product		Place of Destination		Mode Used	Total Distance and Route	Time Incurred	Opinion Code
		1	Plot Area	Floor Area	4	5	6	Code	7	8	Code	8	Zone Code	8	8	8	9	Commodity Code	9	Zone Code	9	9	9	10
1	14	A	30000	15000	15	20	Plywood, Board, Furniture	1	150	Wood, Pinal, Gond, Ply etc.	1	Aurangabad	14	Truck	Bihar, Jharkhand	48	Plywood	9	Patna, Bihar, Jharkhand	9,40	Truck	50 Km	8	a
2	14	B	30000	20000	25	5	Alkatra,Koltar	1	12	chemical	7	Gaya	15	Truck	120	8	koltar	1	Patna ,Aurangabad,Alwar	9,14,37	Truck	175--250	48	b
3	11	B	25000	25000	22	5	Dhan	2	5	dhan	2	Auran Gabad,Gaya	14,15	Truck	120	8	rice	2	Aurangabad,Patna	14,9	Truck	175	8	a
4	14	B	110000	110000	60	20	Ply Wood	1	365	pinal ,gond m,coal	1	palamu ,Jharkand	40	Truck	Gt Road	2	Plywood	1	Patna,Aurangabad,Gaya	9,14,15	Truck	G.t Road	48	a
5	14	A	10000	10000	25	5	Aulmumnium Utilise	1	50	old alumunium	1	Aurangabad	14	Truck	Gt Road	2	alumunium	8	Patna,Aurangabad,Gaya	9,14,15	Truck	50	48	a
6	6	C	16000	10000	7	5	Aata, Chokar	2	25	wheat	2	Bihar	9	Truck	Bipaa,Mu to Bihar	48	atta	9	Bhiar Dharbanga North Bihar	9,24	Truck	Bipss Bihar,North Bihar	48	0
7	6	C	16000	4000	60	125	Tawar,Spector	8	15	iron	8	Raipur, Kolkata	37,41	Truck	Bipass Raipur,kol to Muz	120	golbanaze,tawer,	9	Electricity, Railway10--15	8	Truck	Bipass Muz to all India	120	a
8	6	B	10000	10000	25	10	HD Pipe	8	20	rezing	8	Delhi,Patna	37,9	Truck	Bipass Delhi,Patna-Muz	48	hd pipe	1	Bihar, 20 Bund-> Pipe	9	Truck	bipass muz-bihar	48	0
9	6	B	15000	10000	35	10	Pressure Metre,Tembeure Metre	1	20	iron ,steel glass	1	Delhi,Mumbai	37,37	Truck	Bipass Delhi,Mumbai to Muz	240	pressure metre	9	All India ,1400/yr	9,40	Truck, Railway	bipass&railway all india	240	0
10	6	B	4000	4000	8	5	Iron Keel	8	4	iron kowyel	8	Bokara,Patna to Muz	40,9,6	Truck	Bakara, Patna to Muz by Bipass	48	kanti	1	Muz , tton	6	Truck	Bypass	48	a
11	6	B	8000	4000	25	5	Micro Newton Mixture	7	50	boron ,copper, zink, mag	7	Mumbai, Punjab	37,37	Truck	Mumbai, Punjab to Muz 40--50 ton	240	micro newton mixture	9	All Bihar 40--50ton	9,40	Truck	Mumbai,Punjab,to Muz,Bipass	240	0
12	6	C	160000	60000	450	60	Wagon	1	20	loha ,steel, iron ,rod	1	Railway Supply of India	8	Railway	Railway	240	wagon	8	All Railway Supply	9,22,32	Railway	Railway, Truck, Bypass	240	b
13	6	C	15000	15000	50	10	Pottery Feed	2	150	makka, khali, dara, prestimize	2	M.P Bihar 100--150	37,9	Truck	M.p Bihar by Pass& Railway	200	dana, cuttle feed	6	Bihar U.p Asam ,Jharkand	9,38,40	Truck ,Railway	Muz to U.p, Asam ,Jharkand Bypass	240	0
14	6	C	32000	16000	10	5	Medical,Feed Speriment	9	1000	tim,zera,kala namak	9	Mumbai,Kanpur 4ton	37	Truck	Mumbai ,Karnal to Muz ,by Pass	10	feed speriment	9	Ranchi,Kalihan,Darbanga	40,33,24	Truck	Ranchi, Kalihar to Muz Bypass	92	0
15	6	C	7000	7000	10	7	Lether,Processing Chemical	7	1000	salted skin,weagh blue	7	All Bihar 1000 ton	9	Truck & Van	Muz to Kolkatta,by Pass	48	lether processing	9	Muz to Kolkatta ,1000 ton	6,41	Truck ,van	Muz to Kalkaata 1000 ton	48	0
16	6	C	16000	8000	30	8	Plastic Pipe P.V.C	1	2	plastic dana	1	Lucknow,Delhi, Kanpur 2ton	37,37,37	Truck	Lucknow, Delhi, Kanpur to Muz Bypass	92	p.v.c pipe	1	Patna, Bhagalpur	9,32	Truck	All India-Muz Bypass	48	a
17	6	B	8000	8000	20	9	Khadh	7	8	gobar,khaine kaa dust	7	Motihari, Siwasn,Sit Marhi 500 bora	2,4,7	Truck	Muz to Mafihani,Siwan,Sitamarhi	48	kadh	7	Nepal,Bihar, Jharkand,500 bora	42,9,39	Truck	Muz to Nepal,Bihar, ,Jharkand,	48	0
18	6	B	10000	10000	20	7	Iron Keel	8	30	loha coal	8	Muz,Patna,Bihar,25*35	6,9,	Truck	Muz to Patna,Bihar,by Pass	48	kanti	8	All Bihar 25*35	9	Truck	Muz to All Bihar Bypass	48	a
19	6	B	7000	7000	20	5	Iron Keel	8	30	loha, coal	8	Muz to Patna 25-32	6,9	Truck	Muz to Patna by Pass	48	kanti	8	Muz to Bihar 25*32	6,9	Truck	Muz to Bihar 25*32	48	a
20	6	C	16000	16000	25	10	Thresher	9	10	kacha loha	9	Delhi,Bihar,Ranchi 10 ton	37,9,40	Truck	Muz to Delhi,Bihar,Ranchi,byPass	92	thresher	9	Bihar, ,Jharkand 10ton	9,39	Truck	Muz to Bihar Jharkand Bypass	92	a
21	6	0	15000	15000	25	5	Kit Nasak Dana	7	10	shope scroll(power)& chemival	7	10 ton	6	Truck	u.p to muz bypass	92	kit nasak dana	7	All India 10 ton	9,39,40,41	Truck	Bipass Muz to all India	240	a
22	6	B	10000	10000	20	10	Plastic,Pancell,Soupt,Pvc Pipe	8	5	rood soring, useless plastic	9	Muz,Bihar 1000kg	6,9	truck	bypass bihar to muz	4	plastic,pandel,souput	9	All Bihar,Patna	9,40,41,37	Truck	Bipass Muz to all India	72	a
23	9	B	80000	60000	50	25	Ply Board	1	5	mango,cernal popular(wood)	1	Muz 2 ton	6	Truck	bypass muz tofuthwa	4	Plywood	9	Bihar,Patna	9,	Truck	Bypass	48	a
24	9	C	40000	38000	410	90	Basan,Aata	9	20000	chana ,wheat	2	Calcutta,M.p, Indore	41,37,37	truck	bypass road,cernal	114	basan,atta	9	All Bihar,Bengal	9,41	Truck	G.t Road	120	b
25	9	C	75000	70000	100	20	Tablet,Liquid,Injuction&Medicine	9	1	vitamine(b1,b2,b6)para	9	Calcutta,Delhi,Mumbai	41,37,37	Truck	Gt Road	100	diff type of medicine	9	Patna,U.p,Jharkand,Asam	9,38,39,41	Truck	Bypass& G.t Road	72	a
26	9	B	85000	85000	90	15	Mobile Oil	4	2	black oil,kamical,box	4	Jharkand,Bihar,Patna	40,9	Truck, LCV	Gt Road	48	mobele	4	Delhi,Bironi	37,22	Truck & LCV	G.t Road	96	a
27	9	B	13000	13000	25	3	Ply Board	1	1	semal, popular mango	1	Bihar-Sitamarhi 25--30pit	9,7	Truck	Bihar to Sita Mari,Bypass	48	ply	9	Patna,Jharkand 20--25ft	9,40	Truck	Jharkand to Bihar20--25ft	0	a
28	9	C	200010	180000	300	50	Cement	1	1800	dinkar,hipson,slay,coal,pathar	5	Rajsthan,Jharkand w.b	37,40,41	Truck	G.t Road Bypass	168	cement	1	Patna,Jharkand 20--25ft	9,40	Truck	G.t Road	24	d
29	9	C	150000	140000	200	70	Biscute,Cream Biscute	9	1800	maida,sugar,aata,cent	9	Bihar,Delhi,Jharkand	9,37,40	Truck	G.t Road Bypass	48	biscute,cream biscute	9	Patna,Begusarai, Jharkand,U.p	9,22,40,38	Truck	G.t Road	36	0
30	9	B	110000	100000	65	25	Ply Wood	1	10	pangal,faran qund,kur,coal	5	Bihar,Jharkand	9,40	Truck	Gt Road	48	ply wood	9	Patna,Jharkand,Other City	9,39	Truck	G.t Road	36	a
31	9	C	100000	85000	100	10	Ply Wood	1	10	kur,pinal,gullu,face	1	Chatra,Jharkand,Calcutta	40,40,41	Truck	Gt Road	48	ply wood	9	Buxar,Bihra,Jhakand	11,40	Truck	Bypass& G.t Road	36	a
32	9	B	131000	131000	70	5	Ply Wood	1	5	pinal,faran,kur,gullu	1	Bihar Jharkand	9,39	Truck	G.t Road Bypass	48	ply wood	9	All Bihar& Other City	9	Truck	g.t road, by pass	36	a
33	8	B	85000	844101	50	15	Ply Wood	1	4	pinal,gund	1	Jharkand,Calcutta	40,41	Truck	Nh Road,G.t Road	72	ply wood	9	Bihar Only	9	Truck	N.H. Road	24	a
34	8	B	70000	60000	65	20	Aata,Maida,Suli	9	10	wheat,tuo,makal	2	Punjab,Harayana	37,37	Truck	Gt Road	144	maida,aata,suji	9	All Bihar & Jharkand	9,40	Truck	N.H. Road	36	0
35	8	B	25000	20000	25	75	Glass Factory	1	5	hajipur	8	Hajipur	8	Truck	Hazipur,Vaishali	0	I want to make glass	9	Vaisali	8	Truck	Hazipur,Vaishali		0
36	8	C	90000	75000	250	30	Sugar Factory	9	5	carbon,hydrogen,oxygen mix	9	punjab	37	Truck	Gujarat to Hajipur,Vaishali	72	bake sugar	9	Punjab	37	Truck	Gujrat to Hajipur, Vaishali	192	b
37	8	B	60000	40000	50	300	Juice Factory	9	80	mango chemical	7	Allahabad	38	Truck	Muzaffarpur	14	make juice	3	Allahahab	38	Truck	Muzarar puir	14	a
38	8	B	80000	60000	50	75	Juice Factory	9	80	lichi kamical	7	Sata Madi, Muz	7,6	Truck	Bypass Road Vaishali	12	juice	3	Sita madi,Muz	7,6	Truck	Bypass Road Vaishali	12	a
39	8	B	70000	55000	30	20	Machine Made Pipe	1	5	mix up cement	1	Patna	9	Tractor	Mahatma Gandhi Saita Pull	4	cement pipe	1	Patna	9	Tractor	Mahatma Gandhi Saitu	4	a
40	8	B	60000	50000	60	35	Masalla	9	2	masala	9	Patna	9	LCV	Hajipur to Patna	2	masala	9	Patna	9	LCV	Mahatma Gandhi Saitu	2	a
41	8	A	40000	25000	50	20	Potato Keep In Store	2	2	machine keep potato safe	2	Patna, Mathipur	9	Truck	Gandhi Saitu Pull	3	potato keep	3	patna mathipu	9	Truck	Mahatma Gandhi Saitu	3	a
42	8	A	40000	30000	150	100	Potato,Mango Keep	2	5	chemical	7	Hajipur	8	Truck	Bypass	4	potato ,mango	3	Hajipur	8	Truck	bypass road vaishali	4	a
43	8	B	75000	55000	160	85	Prepare Coldrink	7	8	chemical	7	patna	9	Truck	Bypass	5	cold rink	7	Patna	9	Truck	Bypass	5	a
44	8	A	50000	35000	30	22	Potato	9	2	potato	9	Bajar Samiti	9	Truck	Gandhi Saitu Pull to Market Samiti	4	potato	3	Bajar Samiti	9	Truck	Bypass	4	a
45	8	B	50000	45000	50	80	Cold Milk	3	40	soda	3	Chapra	5	Truck , Trolly	Chapra to Vaishali	3	cold milk	3	Fulvari	9	Truck & Trolly	Bypass	3	a
46	8	A	50000	40000	80	45	Prepare Khad	7	2	with the help of machine	7	Patna,Bihar	9	LCV	Bypass road	4	prepare khad	7	Patna	9	LCV	Bypass	4	a
47	8	A	50000	40000	25	10	Thermacoat	9	2			Patna	9	Truck	Gandhi Saitu Road	4	prepare thermacoal	7	Bindasarif ,Patna	18,9	Truck	Mahatma Gandhi Saitu	4	0
48	8	A	40000	35000	85	30	Prepare Bread	9	1	aata,maida,sugar	9	Patna	9	Truck	Mahyma Gandhi Saitu Pull	3	bread	9	Patna	9	Truck	Mahatma Gandhi Saitu	3	a

S	Code	Type of Industry	Size of Industry (in Sq.Ft.)		No. of Workers	No. of Visitors	Commodity Manufactured		Annual Production (In ton)	RAW Material Required		Place of Origin		Mode Used	Total Distance and Route	Time Incurred (in Hrs.)	Finish Product		Place of Destination		Mode Used	Total Distance and Route	Time Incurred	Opinion Code
	1		Plot Area	Floor Area	4	5	6	Code	7	8	Code	8	Zone Code	8	8	8	9	Commodity Code	9	Zone Code	9	9	9	10
1	8	B	45000	40000	115	50	Shakti Tube Ltd	9	4	sulason	9	pahadi	9	Truck	Pahad to Vishali	2	prepare tube	9	Bihar,Patna	9	Truck	Bypass	2	a
2	8	A	50000	35000	60	25	Potato,Onion,Mango Keep	9	2	chemical	7	Bajar Samiti Patna	9	Truck	Mahtma Gandhi Saitu Pull	4	potato,mango,protect	3	Patna	9	Truck	Mahatma Gandhi Saitu	4	0
3	8	A	40000	35000	50	20	Prepare Chemical	7	1	powder,chemical	7	Exibishion Road	9	Truck	Mahtma Gandhi Saitu Pull	3	chemical	7	Patna	9	Truck	Mahatma Gandhi Saitu	3	b
4	8	C	210000	210000	250	70	Cock Food	6	3	wheat,luo,bajra,makka,vitamine	2	Darbanga,M.p, punjab	24,37,37	Truck	Gt Road	150	cock food	6	Patna,Jharkand	9,40	Truck & LCV	G.t Road	52	d
53	9	A	5250	4500	13	3	CB Boxes	9	8	kasaph peper	9	Kasipur,100 ton	37	Truck	Kasipur to Patna	120	cb boxes	9	Bata India Pvt,Bita Jang pat 100 ton	9	Truck & LCV	4km	1	a
54	9	B	5000	6000	40	10	Polythin,Plastic Bag	9	4	finnes low density polythene	9	Gujarat,3--4 ton	37	Truck	Gujarat to Patna,Bypass	200	printed polythene	9	Bihar,Jharkand,U.p 3--4 ton	9,40,38	Truck	patna	192	b
55	9	B	10000	10000	35	50	Medical	9	2	paraSATIC MATE	9	Delhi,Mumbai 40--50 peti	37,37	Truck, Railway	Railway& Truck Bypass Road	120	I.p medical	9	Delhi,Mumbai	37	Truck & Rail	Railway & Truck Bypass Delhi,Mumbai	120	0
56	9	B	15000	10000	12	10	Cement	1	10	asland,clekars,gipusium	1	u.p 10ton	38	Truck	Bypass to Ftahwa	160	cement	1	Bihar,10 ton	9	Truck	Bypass ,Bihar	48	0
57	9	C	26000	20000	20	8	Cement	1	12	aslong,clekar	1	Girdhia,up 15 ton	38	Truck	Bypass Girdhia up to Fathwa	100	cement	1	Bihar 15 ton	9	Truck	Bypass Futhwa to Bihar	48	b
58	9	B	16000	16000	40	10	Plly Board	1	2	semal,mango(wood)	1	MUFF, 2TQN	6	Truck LCV	Bypass Muz to Patna	4	ply board	9	Bihar 2 ton	9	Truck	Bypass Futhwa to Bihar	72	a
59	9	B	16000	16000	50	10	Satoo,Besan,Aata	2	5	chana,wheat,gera,goki	2	Bihar,up,Jharkand	9,38,40	Truck	Bypas,Bihar,U.p,Jharkand to Fatkwa	400	satoo,besan,aata	9	Bypass Oil India	9	Truck	Bypas Fathwa to all India	480	0
60	9	B	17000	17000	12	10	D.C Set (Scrap Cutting)	1	25	karkar	1	Tata 1000 ton-1500 ton	39	Truck	Tata to Patna,Bypass	96	karkar	1	Bihar 50 ton--150 ton	9	Truck	Patna Bihar Bypass	48	a
61	9	B	14000	14000	20	12	Ply Board	1	1	mango,semal,popular(wood)	1	Muz 40--50sq.ft	6	Truck	Muz to Patna,Bypass	0	pky board&cut slide	9	Only to Patna,40--50sq.ft	9	Truck	Patna to Muz, Bypass		a
62	9	A	13000	13000	15	7	Ply Board	1	1	mango,semal,popular(wood)	1	Muz 40--50sq.ft	6	Truck	Bypass	24	ply board	9	Bihar,Maharsatra	9,37	Truck	Bihar to Maharastra,Bypass	150	b
63	9	A	9000	9000	20	7	Ply Board	1	2	mango,semal,popular(wood)	1	u.p to patna 40--45sq ft	38,9	Truck	Bypass	120	ply	9	U.p to Bihar,30--32sq ft	38	Truck	U.p to Bihar,Bypass	120	a
64	9	A	8000	8000	30	5	Ply Board	1	2	mango,semal,popular(wood)	1	Bihar to Muz ,30--35sq.ft	9,6	Truck	Bihar to Muz ,Bypass	48	ply board only	9	Only to Patna,40--50sq.ft	9	Truck	Bihar to Muz ,Bypass	48	b
65	9	C	11000	11000	40	8	Ply Board	1	2	mango,semal,popular(wood)	1	Bihar,Muz ,15--25sq.ft	9,6	Truck	Patna to Muz,Bypass	0	ply	9	Patna, Muz	9,6	Truck	Patna,Muz,Bypass	24	b
66	9	B	16000	16000	60	20	Tmt Sariya,8m-M,10mm,6mmsariya	1	30	tngota	8	Bihar,10ton	9	Truck	Bihar to Patna,Bypass	24	tmt sariya	1	Magadh Iron,Bihar	9	Truck	Bypass	24	a
67	9	B	48000	48000	40	20	Airtel,Hutch,Idea,Mobile Tower Part	9	3	ingel,patel,cabel,nat-volt	9	10 Ton,Patwari Patra	9	Truk, Tractor	Bihar & Jharkand	48	mobile tower parts	9	Bhagalpur & Patna	32,9	Truck	Bihar & Jharkand	48	a
68	9	A	40000	40000	55	20	Food Product Process	9	2			u.p 100ton	38	Truck	U.p to Patna,Bypass	48	food product&biscuit	9	Patna	9	Truck	only Patna & Bihar	48	b
69	9	B	30000	30000	100	10	Silco Magnlz	9	3	magniz,cock,&dola-mite	9	Udisaa,Gujrat,M.p	40,37	Truck	Bypass	168	silco maging	9	U.p, Gujrat, Gzb	38,37,37	Truck	U.p,Gujarat,Gaziyabad	72	a
70	9	C	205000	20200	300	90	Ply Board	1	5	kur,pinal,gultu,face	1	West Bengal,Jharkand,U.p	41,40,38	Truck	Gt Road	120	ply wood	9	Fathuwa,Jharkand,U.p	9,40,38	Truck	Bypass,Ara, patna Road & G.t Road	72	d
71	9	C	1500000	150000	220	30	Alkatra	1	25	char coal,coal,wood	1	Jharkand,W.b	39,41	Truck	Gt Road	96	alkatra	1	Patna,Jharkand	9,40	Truck	Bypass& G.t Road	72	a
72	8	B	85000	65000	60	25	Ply Wood	1	15	qund,pinal,coal,vora	1	Kodarama,Jharkand	40	Truck	0	48	ply wood	9	Patna,Barhi Lakhisarai	9,21	Truck ,Van	0	24	a
73	8	B	95000	90000	85	30	Ply Wood	1	50	bore,gultu,faran,coal	1	Chatra, Jharkand	39	Truck	G.t Road & N.h 37	24	ply wood	9	Patna Only	9	Truck	N.h-37,45	48	a
74	9	B	130000	130000	50	30	Cement	1	9	chuna ,stone,tipsum	1	Ramgad,Tata	39,40	Truck	Gt Road	144	cement	1	Patna,Other City	9	Truck	G.t Road	72	0
75	8	B	30000	20000	20	12	Plastic Prepare	1	1	chemical,durty fplastic	1	Patna	9	Truck	Mahatma Gandhi Sita Pull	4	prepare polythene	9	Patna	9	Truck	Mahatma Gandhi Saitu	4	a
76	8	B	40000	35000	40	25	Makkai	2	1	hen food	6	Bihar,Maimar	9	Truck	Mahatma Gandhi Sita Pull	5	hen food	6	Bihar,Lakhisarayt	9,21	Truck	Mahatma Gandhi Saitu	5	a
77	8	B	75000	60000	80	25	Chad,Loha	1	4	wetting loha	1	Sitamadi	7	Truck	Bypass	7	chad	1	Sitamadi,Basusaraya	7,22	Truck	Bypass	7	b
78	8	B	60000	50000	50	20	plastic pipe	1	1	plastic wetting	1	Patna	9	Truck	Bypass	3	plastic pipe	8	Patna	9	Truck	Bypass	3	a
79	8	A	30000	20000	25	10	Almira	8	2	loha chadar	8	sitamadi	7	Truck	Bypass	6	almira	9	Sitamadi,Patna	7,9	Truck	Bypass	24	a
80	8	B	40000	25000	50	35	Fruit Juice Mango,Lichi,Pineapple	3	5	mango,pineapple,lichi	3	Patna	9	Truck	Mahatma Gandhi Sita Pull	4	juice	3	Patna	9	Truck	Mahatma Gandhi Saitu	4	b
81	8	C	185000	150000	160	35	Juice Factory	3	584	fruit&alchol	3	Bihar,Asam,Kashmir	9,41,37	Truck	G.t Road,Byopass Road	192	juice	3	Patna,Begusaraj &U.p	9,22,38	Truck & LCV	N.H Road	48	b
82	8	B	20000	15000	35	10	Big Poly Bag Of Biscute	9	2	plastic	9	Purvi Champaran	2	Truck	250 km bypass road	15	biscute poly bag	9	Patna	9	Truck	80 km bypas	4	0
83	8	B	40000	35000	90	40	Potato,Onion,Balgan Are Keep	9	8	chemical machine	9	Patna,Aatra,Vaksar	9,10,11	Truck	Bypass	8	all product keep good	9	Patna ,Aara	9,10	Truck	Bypass	8	b
84	8	A	65000	50000	50	15	Aata,Suji,Maida	9	3	makka,wheat,luo	9	Muz,Hariyana,Punjab	6,37,37	Truck	G.t road 800km	120	aata, maida, suji	9	Patna, Bihar, Other City	9	Truck	Patna,Bihar,& Other City	48	0
85	8	B	40000	30000	30	15	Ply Wood	1	2	cut to machine	1	sitamadi	7	Truck	70 km Bypass	8	ply wood	9	Patna,Sitamadi	9,7	Truck	80km Bypass	8	a
86	8	C	240000	228000	300	90	Plastic Pipe	8	20	plane plastic&chemical	8	West Bangal & Jharkand	41,40	Truck	500--700km	72	plastic pipe	8	Patna,Bihar,Jharzand	9,40	Truck	70--400km	48	d
87	8	C	200000	200000	210	40	Aata,Maida,Sugi	9	50	hweat,maida	9	Darbanga, Haryana,Punjab,U.p	24,37,38	Truck	G.t Road 125--1500km	120	aata,maida,sugi	9	Bihar ,Patna	9	Truck,LCV,MAX	60km N.H Road	48	d
88	8	C	48000	8000	80	35	Cold Milk	3	600	milk	3	Vaishali Gilla	8	Truck	Bypass	48	cold milk	3	Patna	9	Truck	Bypass	48	0
89	8	B	65000	50000	50	15	Tractor	9	50	tractor engine,tractor part	9	Chapda	5	Truck	60 km	24	tractor	9	Bakhitiyapur,,Jharkand, Punjab	9,40,37	Truck	90--1500 km	72	0
90	8	B	20000	15000	20	10	Cement Pipe,Nada,Gamla	1	2	cement,chad,reta,gitti	1	Jharkand,Muz	40,6	Truck & LCV	G.t Road,550 km	48	pipe,nada,gamala,	8	Local City,Patna	9	Truck & LCV	N.H Road	24	a
91	8	C	140000	140000	110	40	Small Metal	1	1500	stone	1	Rohtash,Raxaul	13,2	Truck	N.h road	24	small metal	1	patna,bihar,Jharkand	9,40	Truck	N.H Road & G.t Road	72	d
92	8	C	250000	250000	263	100	Maida,Suji,Aata	9	14	wheat,bajara,luo,makka	2	Hariyana,Punjab,Darbanga	37,24	Truck	0	120	maida,aata,sugi	9	Begusaraj & Jharkand	22,40	Truck & LCV	125--500km	48	d
93	9	C	340000	325000	460	100	Tmt Bars	1	10	reta	1	Jharkand,U.p	39,38	Truck	G.t Road,Bypass Road	144	tmt bars	1	Bihar,,Jharkand,Delhi,Calcutta,Other	9,39,37,41	Truck	G.t Road	120	d
94	8	A	40000	25000	40	25	Shoes Brush	9	7	bala or plastic	9	Hajipur	8	LCV	Bypass	1	shoes brush	9	Patna	9	LCV	Mahatma Gandhi Saitu	3	a
95	8	B	60000	30000	20	15	Jewellery Work	9	0	gold,machine	9	Hajipur	8	CAR	Bypass	4	gold jewellers	9	Patna	9	BIKE	Bypass	4	b
96	8	B	40000	25000	30	20	Gitti	1	15	stone cut to machine	1	Gaya	15	Truck	Bypass	6	gitti	1	Gaya,	15	Truck	Bypass	6	a
97	8	B	50000	40000	50	20	Tractor Part	9	1	loha chapra	9	Sita madi	7	Truck	Bypass	8	tractor part	9	Patna,Sitamadi	9,7	Truck	Bypass	8	b
98	8	B	70000	50000	40	25	Coconut	9	1	coconut	9	Patna	9	Truck	Bypass	3	gadda	9	Patna	9	Truck	Bypass	3	b
99	8	B	70000	40000	35	25	Plastic Pipe	8	1	plastic pipe	8	Patna	9	Truck	Mahatma Gandhi Sita Pull	2	pipe,nada,gamala,	1	Patna	9	Truck	Mahatma Gandhi Saitu	2	b
100	8	B	50000	40000	30	15	Prepare Khad	7	2	with the help of gobbar	7	Gaya,Bihar	15,9	Truck	Bypass	5	khad	7	Gaya,Bihar	15,9	Truck	Bypass	6	b
101	8	B	50000	30000	35	20	Glass Fiver	8	18	plastic	8	Patna	9	Truck	Mahatma Gandhi Sita Pull	3	plastic glass	9	Patna	9	Truck	Mahatma Gandhi Saitu	3	a
102	8	B	60000	45000	40	25	Alkatra	1	80	suloson	1	Muz,Patna,Bihar,25*35	6,9	Truck	Bypass	8	alkatra	1	Hajipur,Patna	8,9	Truck	Bypass	6	b
103	8	B	90000	70000	100	50	Potato Onion	9	500	mix chemical in machine	9	Muzaffpur	6	Truck	Bypass	8	to safe wheat	2	Muzaffarpur ,Bihar	6,9	Truck	Mahatma Gandhi Saitu	8	b

List of Codes

(1) Industry Type Code
(a) Small scale
(b) Medium scale
(c) Large scale

(2) Opinion Code
a. Existing cost
b. At 10% extra cost
c. At 15% extra cost
d. At 20% extra cost
e. 0 - no response

CHAPTER - 3

ADVISE ON VESSEL

CHAPTER-3

ADVISE ON VESSEL

3.0 INTRODUCTION

The main parameters governing Inland Waterway Fleet design are:

- Waterway characteristics like river course, depth of water, radius of bends, current/velocities of water etc.
- Cargo characteristics like type of cargo, quantum of cargo, distance of transportation.
- The vessel dimensions like length, beam, moulded depth, minimum and maximum draft.
- Physical constraints like clearance under bridges, navigation locks size etc. and
- Capital, Operating and maintenance cost.

3.1 FACTORS INFLUENCING DESIGN PARAMETERS

3.1.1 CARGO CHARACTERISTICS

The cargo consists of Construction Material (Cement, Sand, Stone, Iron, Steel etc), Cereals/Cash Crops (Wheat, Rice, Pulses, Sugar etc), Conventional Fuels (Coal and Firewood etc), Live Stock (Animals, Oil Cake etc), Chemicals (Fertilizer, Wine etc), Mineral Ore (Lime Stone, Iron etc), Others (Consumer Goods, Kirana / Perchun Appliances, Edible Oil, Paper Products etc). The volume of total cargo originating and terminating from different terminals is shown in Traffic chapter.

For quick movement of general cargo it would be necessary that it stays for minimum time in the loading / unloading terminals and does not wait long for vessels. To achieve objective by selecting a craft size so that atleast one craft moves every 5 days from terminals towards destination.

3.1.2 CARGO FACTORS

The following cargo factors influence the design parameters:

- Volume and nature of cargo i.e. the cargo mix to be transported.
- Method of cargo handling facilities required and or available.
- Average lot size and length of Haul.
- Balance of out and return cargo.
- Requirement for protection against weather.

3.1.3 WATERWAY FEATURES / HYDRAULIC AND MORPHOLOGICAL FACTORS

The field investigations done in the total stretch of the river bring out the following characteristics of the waterway which shall influence selection of the vessel for transportation.

- Variations in vertical clearance and enough river widths all along the waterway available throughout the year.
- Some stretches shallow water depth and some stretches sufficient navigational depths available.
- Radius of Bends.
- Current Velocities.

Thus, the waterway conditions during lean season would dictate, the selected vessel should have shallow draft to ensure navigation all around the year.

3.1.4 PHYSICAL CONSTRAINTS

On the water transport route, to navigate the river, the existing structures for which vertical and horizontal clearances are to be studied for effective vessel design.

3.1.5 OPERATIONAL FACTORS

- Speed of vessel under varying hydraulic conditions.
- Relation between speed, propulsive power and energy consumption.
- Rate of loading and unloading of cargo.
- Time lost in transit in locking operations, change of pilot at beats, cargo transfer, crossing of state or national border.
- Number of unworkable days per year.
- Susceptibility of vessel to damage and crew efficiency.

3.2 TYPES OF VESSELS

For Inland water transportation there are mainly two types of vessels namely self propelled barges and dumb barges in tow.

3.2.1 SELF PROPELLED BARGE

Self propelled cargo boats move under their own power and attain a higher speed than dumb barges in tow. These boats are also more effective against strong currents and are designed to meet particular requirement of traffic and route. In shallow rivers, low draught vessels are designed with twin screws in tunnels. These vessels are not economical to run in deeper waters. Similarly vessels designed for deeper draft cannot be used in shallow rivers. Costly cargoes which can stand a high freight rate like perishable goods requiring 'scheduled navigation' are transported by self propelled river vessels. These vessels have a low turn around time in ports and locks (since no time is lost in anchoring and making up tows), are speedy and can call at many ports along the route. With proper scheduling of sailing of such vessels and full cargo

availability, these can be an economic proposition inspite of the high cost of procurement.

3.2.2 DUMB BARGE

Dumb barges are cheap and apart from being used for carriage of cargo, are also used for storing, as floating warehouses or, even as pontoon jetties. These vessels require very little care and withstand rough handling. Small dumb barges do not normally have any permanent crew and lie unattended. Transportation of cargo in dumb barges is a slow process and there is normally no fixed schedule. So bulk, unpacked and imperishable cargo is transported in such barges which offer a low freight rate. In Europe (Danube and Rhine) and U.S.A. river transportation is done in dumb barges in private sector.

3.2.2.1 TOWING ARRANGEMENT

Dumb barges are grouped together to form flotilla which are towed by river tugs. Three methods of towing have been used internationally depending upon channel depths and widths as well as the weather conditions experienced along the route.

a) Towing astern
b) Towing alongside and,
c) Push towing

The first method, towing astern or pull towing has been used in European waters. A long towline is paid out from the stern of the river tug (moving in front) to the foremost barge of the flotilla. The flotilla may be made up of a number of rows of barges secured to each other or held together by a tie-line passed from barge to barge. Sometimes, barges may be tied to the center barge alongside. In this system, the propeller race of the tug impinges on the front barge thus increasing the resistance of the barge flotilla. There can be an augmentation of resistance as high as over 80% of the individual barge due to this. To reduce this increase in resistance, a minimum length of towline equal to 1.25 times the length of the tug is recommended. This increases the total length of tow considerably. Further, when the tow is to take a turn, the radius of bend must be quite large. Therefore, this form of transportation is good where only long straight stretches of waterway are available.

In towing alongside or abreast, one barge is secured fast to one side of the tug or two barges are secured to either side of the tug. This is an efficient method of towing, the only disadvantage being that the width of the waterway required should be more to accommodate flotilla of twin barge width. **The conventional method on the National waterway no.1 / River Ganga in India has been towing abreast or side towing.**

In push towing, flotilla, consisting of a number of barges arranged abreast and in rows, is formed by securing all the barges to one another tightly. The pusher tug pushes the flotilla from behind. The propeller race does not affect resistance. Also since all the barges and tug are close together, the incidence of increase in resistance due to interference is minimum. This system is prevalent in USA and is now being adopted in Europe and elsewhere including India (eq. CIWTC) for its obvious advantages over pull towing. The individual units of barges are normally full with rectangular bilge with/without end shapes.

3.2.2.2 TOWING TUG

River tugs are designed and built as per particular requirements. The designs are different for pull towing and push towing. In push towing the foredeck is made square to facilitate matching of barge end. Bollards and fairleads are mostly in the forward. In pull towing, the mooring arrangements are astern and there is arrangement for paying out rope (winch or capstan). Either of the tugs can be used for side towing by suitable provision of bollards on their sides.

The various types of propulsion system have been used on river/canals. The systems most extensively used are paddle wheel propulsion, propulsion with other sophistication such as multiple propellers and rudders, 'Kort' nozzles and raised tunnels and rudder-propeller propulsions.

The paddle wheel propulsion has disappeared since quite long from most of world waterways although it offered good maneuverability, good stopping and backing abilities, easy repair without dry docking and its suitability of use in shallow water with efficient propulsion. The disadvantage which outweighed its advantages was heavier hull construction with associated problems, big reduction gear and overall low efficiency.

The propeller propulsion system consisting of propellers and complete rudder system comprising of normal rudders behind propellers and flanking rudders in the front of propellers for reverse and stopping maneuvers is being widely used. In number of shallow draft vessels, with this type of propulsion, 'Kort' nozzles and raised tunnels have been provided with propeller of lower diameter to get better efficiency and thrust, provide protection to waterway bottom and the banks and to protect the propeller from damage. However, construction is difficult in case of tugs provided with 'Kort' nozzle or tunnel.

The third type i.e. rudder propeller system was initially developed for motorizing dumb barges and small vessels with ready-to-install units but it has been developed for propelling even the bigger size vessels. The advantage of this type is its high maneuverability, simple installation without requiring floating dry docking facilities. The disadvantages are lower efficiency as compared with system of fixed propellers with nozzles, vulnerability of freely suspended propulsion arm and complicated machinery parts.

In pull towing, the propeller race of the tug impinges on the front barge thus increasing considerably the resistance of the barge fleet. Moreover, pull towing requires deployment of crew for steering the towed barges and has, in addition, the disadvantage of being less maneuverable.

3.2.2.3 PUSH TUG

The important parameter for selection of the tug is the power requirement which depends upon the displacement of tug and barges, the maximum dimensions of the convoy, current velocity, the parameters of waterway and the speed. Out of these factors speed largely governs the power requirement. Researchers have suggested limiting value of speeds in shallow and narrow canals. In shallow water of unrestricted width, the economic speed in m /sec should be less than $2.5^*\sqrt{H}$ where H is the depth of water. In narrow canals, economic speed should be less than $1.2 \times \sqrt{A/C}$ for a blockage ratio of 5 (The ratio of wet canal cross section to area of submerged mid ship section) where A and C are canal cross section and canal perimeter respectively. The blockage ratio should not be less than 4.5 to prevent erosion of canal bed and slopes caused due to return currents and waves. Thus the mid ship cross section on this route should be less than 13.67 sq. mtrs. The vessel speed on the above consideration should not be higher than 6.12 knots/hr. in river section and 2.68 knots in canal section. The power requirement of push tug has been based on the speed in river section.

In 'push towing' barges are lashed together by wire ropes to form a single unit and this, in turn, is lashed rigidly to the towing knees of the pusher tug. The tug, working at the rear can handle a fleet of barges at a greater speed and with a greater control than is possible in 'pull towing' operations. The tug is equipped with a set of steering and flanking (backing) rudders which afford maximum control for forward, backward and sideward movements as are required in restricted channels. *For this reason, push towing has been recognized as the most efficient. It requires 20% less power than pull towing for comparable loads.*

3.2.3 TOWED FLOTILLA VS. SELF PROPELLED VESSEL

The merits and demerits of both the alternative that will help in making final choice are:

a) In a towed flotilla, the cargo carrying unit and the engine unit are separate. Therefore, they can be scheduled independent of each other and thus ensure maximum transport efficiency. As the self propelled vessels are expected to be more economical over long lead, both the alternatives have to be compared for cargo transportation.

b) In towing system, when towing unit is down for engine survey, maintenance and repair, the cargo units need not be down and can be moved with another available towing unit, whereas in self propelled barge system, one engine unit is always tied up with cargo unit.

c) Flotilla can be formed with varying units of barges. Therefore, this system can adjust to a fluctuating or uncertain transportation environment in an efficient manner. The system efficiency is much higher since only limited numbers of barge that can be fully loaded are utilized. But this cannot be done for self propelled vessels. If regular cargo is available in sufficient quantity, transport efficiency of self propelled vessel can be more than flotilla.

d) Dumb barges are simple and less expensive to build and comparatively few towing tugs are required to operate the flotilla combinations. Self propelled barges are comparatively larger vessels and are more complex for building since the engine; supporting bunkers and crew accommodation are to be housed. The procurement price is generally 3 to 3.5 times that of a dumb vessel of same capacity.

e) It is well known in naval architecture that long slender vessels experience less resistance in motion. Well designed (ends properly shaped) dumb barges in flotillas experience proportionately less resistance than single vessels. Two single units in tandem experience 1.36 times the resistance of a single unit and a flotilla of 4 barges with two abreast in two rows experience 3.16 times the resistance of a single unit. The average resistance per single barge in a flotilla can be taken as 0.75 times that of a single barge on its own. With this resistance there would be net saving of 25% fuel, if barges are well designed and are moved in closely packed flotillas as against self propelled barges.

f) A dumb barge can remain unattended in voyage and need not house any crew member. For a flotilla of 2 barges and one towing 4 crew members are sufficient. But for 2 independent self propelled vessels at least 8 crew members would required. Thus crew wage bill is reduced by half in case of towed system.

g) Maintenance for a flotilla system is easier and cheaper since barges are repaired separately from tugs. Downtime due to repair is also reduced.

3.3 TRAFFIC:

Estimated Traffic On Various Sections On Gandak River:

Section	2012-13 (Tons)	2025-26 (Tons)	2035-36 (Tons)
Vaishali – Patna	22,63,823	48,28,572	86,47,238
Kalyanpur - Vaishali	12,01,020	25,61,689	45,87,594
Bettiah – Kalyanpur	8,88,961	18,96,089	33,95,607
Bagha – Bettiah	8,83,380	18,84,187	33,74,292
Nepal – Bagaha	3,54,554	7,56,238	13,54,308
Total	**55,91,738**	**1,19,26,775**	**2,13,59,039**

3.4 OPTIMAL VESSEL SIZE

Keeping in view the channel parameters and propulsion systems as discussed above, the following type of self propelled vessel having cargo capacity 100 tonnes is proposed.

100 tonnes vessel is recommended for channel 25m wide X 1.2m depth and attract private Entrepreneurs to divert the traffic-load from rail/road sector and this vessel will carry 100 tonnes when restricted draught D = 1.0m. This type of 100 tonnes vessel is recommended to reduce expenditure on dredging.

Principal particulars of these self propelled vessels for operation on river are:-

100 tonne vessel

Length Over All	:	32.00 metres
Breadth	:	5.00 metres
Draught	:	1.00 metres
Cargo capacity	:	100 tonnes when 1.0m draft.
Propulsion System	:	Marine Diesel Engines with propeller = 2 nos, Output = 100 BHP

3.5 FLEET REQUIREMENT

The fleet requirement has been estimated considering the relevant factors as under:

- Volume of traffic to be moved.
- Nature of cargo.
- Return of load available.
- Movement distance.
- Vessel characteristics.
- Capacity and speed.
- Water constraints – limiting speed, draft available round the year.
- Loading / Unloading capacities.
- No. of operational days in a year.

The following parameters have been used in the estimation of fleet requirement.

3.5.1 VESSEL CAPACITY UTILISATION

Due to difference in density of cargo and storage characteristics the utilization factor has been taken as 0.8 for bulk and general cargo.

Return load

Same vessel will carry return cargo. i.e both direction traffic in this waterway in 2012-13 is **83,52,194** Tons., same vessel will transport remaining balance traffic (83,52,194 – 55,91,738) Tons = **27,60,456** Tons.

Annual Operational Days

Annual Operational days as 300 per year.

Average Voyage Speed

The average speed has been taken as 10km per hr. for 100t capacity vessel.

Cargo average distance

Bagha to bettiah is 82 km.
Bettiah to Kalyanpur is 91 km.
Kalyanpur to Vaishali is 65 km.
Vaishali to Patna is 48 km.

Loadings / Unloading rate

For general cargo as well as bulk cargo average loading and unloading rate according to system design is 5T X 10C/hr i.e. 50TPH loading/unloading per crane.

Waiting at Terminals

For Vessel average 2 hours berth waiting at each terminal has been considered.

3.5.2 100 Tonnes Vessel:

Bagha to Patna Route:

Average speed of Vessel	5.3 knots or 10 km/hr
No. of working days per year a) Waterway b) Vessel	 300 days 300 days vessel will be available.
BHP	2 X 100 = 200 BHP
Vessel Utilization Factor	80%
Crane	5T X 10C /hr i.e. 50TPH loading / unloading
Loading efficiency	75%
Unloading efficiency	55%
Detention time at each terminal for loading and unloading	24hrs(12hours per day)
Number of working hrs of the vessel / year	300 X 24 = 7200 Hrs.
Average Loading Time (hrs.)	(100 X 0.8) / (50 X 0.75) = 2.1 Hrs.
Average Unloading Time (hrs.)	(100 X 0.8) / (50 X 0.55) =2.9 Hrs.
Berth Waiting Time (hrs.)	2 Hrs.
Average Trip distance – km (eachway)	286 km
Average Round Trip Time (Hrs.)	2.1 + 2.9 + 2 + 286 /10 = 35.6.
Number of Round Trips Per Year	7200 / 35.6 = 202.2 Say 202 Round Trip.

No. of Vessel Requirement (100T)

Base Year (2012-13):

Throughput Per Vessel/ Annum (Tonnes)	202 X 100 = 20,200 Tonnes.
Total Annual Throughput	55,91,738 tpa.
No. of Vessel Required	55,91,738 / 20,200 = 276.81
Therefore, Nos. of Vessel Required	276.0

2025-26:

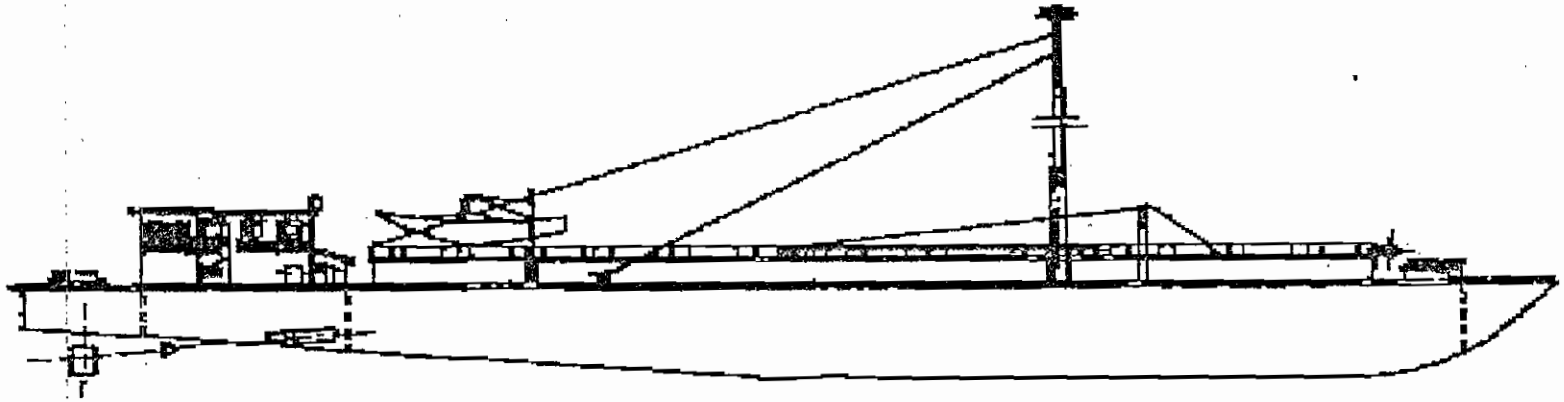
Throughput Per Vessel/ Annum (Tonnes)	202 X 100 = 20,200 Tonnes.
Total Annual Throughput	1,19,26,775 tpa.
No. of Vessel Required	1,19,26,775 / 20,200 = 590.43
Therefore, Nos. of Vessel Required	590.0

2035-36:

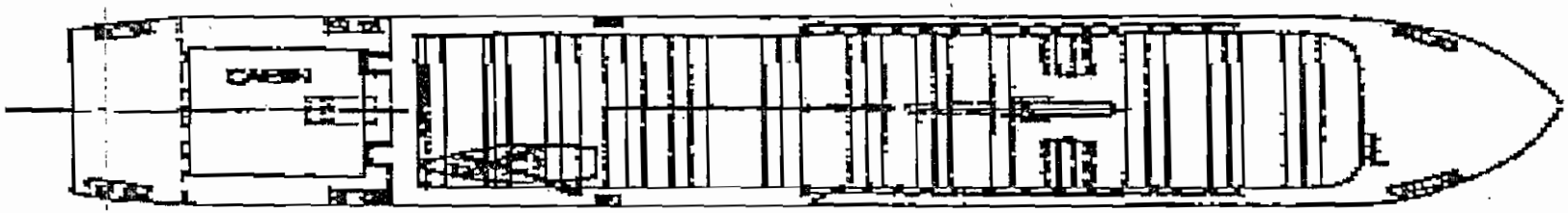
Throughput Per Vessel/ Annum (Tonnes)	202 X 100 = 20,200 Tonnes.
Total Annual Throughput	2,13,59,039 tpa.
No. of Vessel Required	2,13,59,039 / 20,200 = 1057.3
Therefore, Nos. of Vessel Required	1057.0

3.5.3 Summary:

Type of Vessel		Additional no. of Vessel	
	Base Year 2012 - 13	2025-26	2035-36
100T Vessel	276	314	467



ELEVATION



PLAN

Fig:- A Typical Diagram of Vessel

CHAPTER - 4

WATERWAY

CHAPTER – 4

WATERWAY

4.1 HYDROGRAPHIC SURVEY

Thalweg survey on river Gandak was carried out from Gandak barrage at Valmikinagar to Ganga confluence at Patna **(Fig. 4.1)**. The details of the equipment used for Thalweg survey are as follows:

Hydrotrac

Make	ODOM Hydrographic system USA
Frequency	33 - 200 kHz (Single frequency)
Accuracy (for measuring depth)	200kHz – 1cm +/- 0.1% depth 33 kHz – 10cm +/- 0.1% depth
Accuracy (for GPS)	Less than +/- 5m when used in differential mode

The soundings were recorded along the deep course of the river. The surveys were carried out using recording type Echosounder cum Global Positioning System (Hydrotrac) as described below:

Hydrotrac is specially designed equipment which records a continuous profile of the reservoir bed along with global positioning system. The vital part of the hydrotrac is transducer. The transducer transmits the sound pulses downward into the water and receives the reflected echos from the bed and converts the acoustical energy to electrical energy. The echo sounder measures the time interval between the emission of the sound pulse (acoustic signal) and its return as an echo and converts it into a linear distance in metres.

The hydrotrac has an integrated Starlink Invicta 210L GPS receiver with a built-in DGPS correction receiver. With DGPS correction the receiver gives an accuracy of 1 m.

The depths recorded using Hydrotrac were subjected to the water level and sounding datum corrections before plotting on the survey drawings (L-section drawings).

The Thalweg survey data was supplemented with the latest satellite imageries to update the information on high banks, islands, sand chars, and tributaries and channel bifurcations etc.

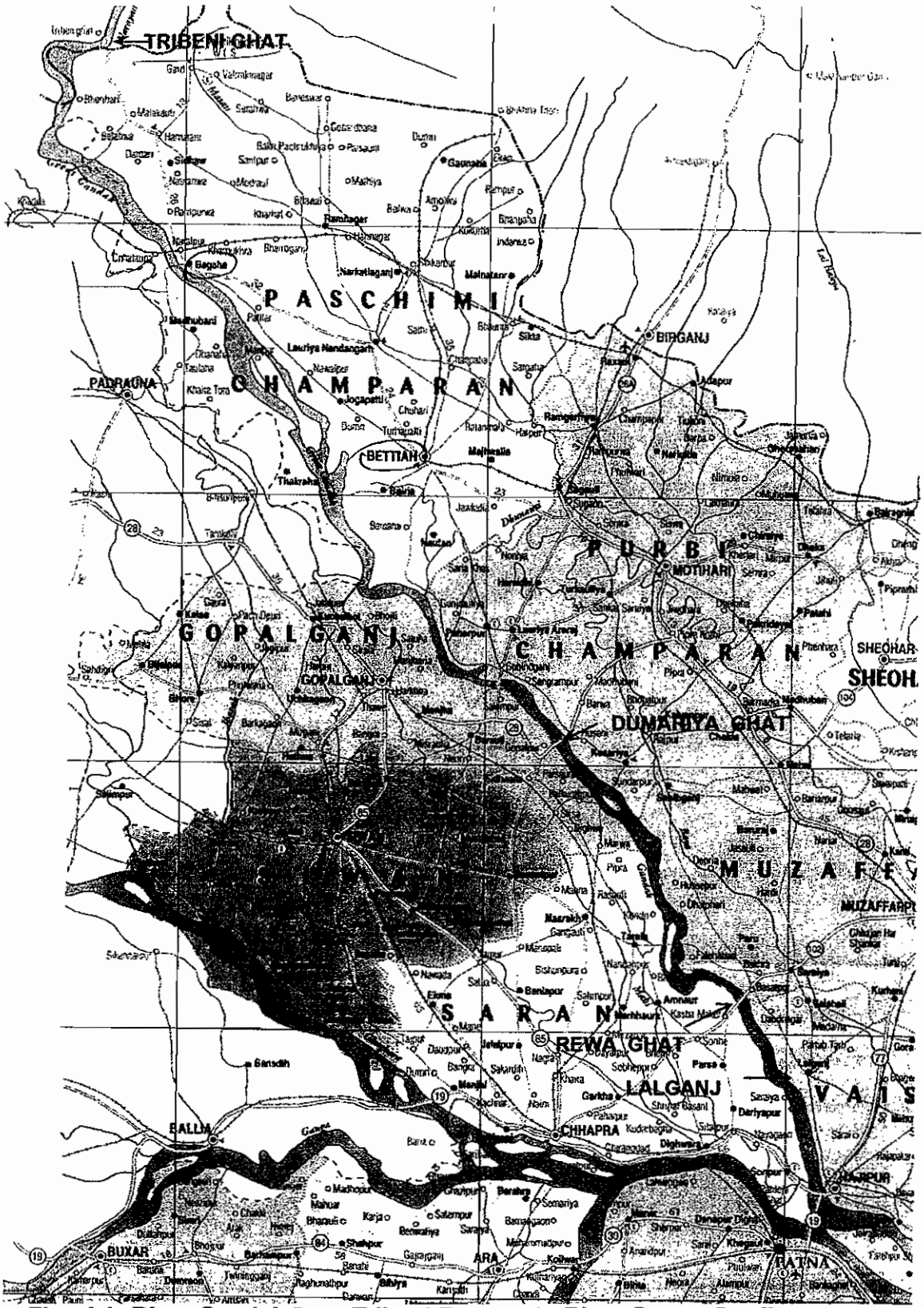


Fig. 4.1: River Gandak from Tribeni Barrage to River Ganga Confluence

4.2 RIVER HYDROLOGY

4.2.1 Collection of data

To study the availability of navigational depths during different seasons in a year it is required to analyze the historical water level data on the waterway under consideration for development. It is a standard practice to analyze at least 5 to 10 year's water level data to arrive meaningful standard low water levels.

The hydrological data such as water levels, discharges and sediment load on river Gandak have been collected from Central Water Commission, Patna for the period from 1996 to 2006 at the available gauge stations viz., Tribeni/ Valmikinagar, Dumarighat, Lalganj, Rewa and Hazipur and analyzed to establish standard low water level and to study the availability of water for navigation. While the water levels were recorded round the year at Tribeni, Dumarighat and Lalganj which is Shown in **Fig 4.1**. The gauge records at Rewa and Hazipur were observed only during monsoon period.

4.2.2 Analysis of hydrological data

The hydrological data used for analysis belongs to 10 years period between 1996 and 2006 as per the data supplied by the Central Water Commission.

Valmikinagar / Tribeni:

The monthly maximum and minimum water levels and corresponding discharges of river Gandak at Valmikinagar/Tribeni are provided in **Table 4.1.**

Table 4.1: MONTHLY MAXIMUM, MINIMUM AND AVERAGE WATER LEVELS AND CORRESPONDING DISCHARGES OF RIVER GANDAK AT VALMIKI NAGAR

Month/ Year	Min. Water Level (in m)	Max. Water Level (in m)	Averge Water Level (in m)	Min. Discharge (in cumecs)	Max. Discharge (in cumecs)	Average Discharge (in cumecs)
Apr-96	103.88	104.07	103.96	287.00	328.50	309.58
May-96	103.75	104.65	103.94	206.80	710.00	299.41
Jun-96	103.99	106.10	105.05	318.20	2811.00	1345.31
Jul-96	105.50	108.55	106.72	1900.00	9200.00	4219.19
Aug-96	106.46	108.00	107.06	3370.00	7620.00	4720.65
Sep-96	105.06	107.46	106.50	2450.00	5860.00	3596.00
Oct-96	105.30	106.76	105.70	1580.00	3930.00	2224.52
Nov-96	104.70	105.70	105.02	123.00	2200.00	1098.97
Dec-96	103.68	104.71	104.36	91.00	830.00	553.22
Jan-97	103.12	104.80	103.35	39.33	165.40	54.91
Feb-97	102.93	103.19	103.04	37.51	41.78	38.62

Month/ Year	Min. Water Level (in m)	Max. Water Level (in m)	Averge Water Level (in m)	Min. Discharge (in cumecs)	Max. Discharge (in cumecs)	Average Discharge (in cumecs)
Mar-97	102.90	104.52	103.09	36.71	64.10	39.46
Apr-97	103.21	104.65	104.24	43.08	660.00	426.78
May-97	103.38	104.10	103.84	201.90	357.60	253.35
Jun-97	103.23	106.13	104.60	12.93	2850.00	1015.04
Jul-97	105.90	107.50	106.57	350.00	5960.00	3557.58
Aug-97	105.90	107.52	106.51	2510.00	6052.00	3602.52
Sep-97	105.60	106.30	105.95	2040.00	3120.00	2582.20
Oct-97	104.75	105.60	105.07	850.00	2040.00	1286.03
Nov-97	104.68	104.90	104.78	800.00	1040.00	907.67
Dec-97	104.55	105.70	104.87	710.00	2200.00	1034.52
Jan-98	104.15	104.69	104.49	160.10	780.00	578.93
Feb-98						
Mar-98	103.09	104.23	103.26	81.33	136.00	94.19
Apr-98	104.56	104.75	104.65	685.00	880.00	775.83
May-98	104.19	104.82	104.60	188.00	950.00	721.19
Jun-98	104.60	106.90	105.31	720.00	4840.00	1747.33
Jul-98	106.60	107.88	107.09	3620.00	7230.00	4824.52
Aug-98	106.66	108.81	107.72	3740.00	10220.00	6710.00
Sep-98	105.90	108.20	106.63	2510.00	8210.00	4001.83
Oct-98	105.30	106.34	105.74	1580.00	3180.00	2271.77
Nov-98	105.01	105.50	105.29	160.00	1900.00	1516.67
Dec-98						
Jan-99	103.57	104.42	103.90	79.35	333.70	199.29
Feb-99	103.43	103.67	103.58	79.75	778.44	111.39
Mar-99	103.12	103.71	103.29	62.44	100.90	73.05
Apr-99	103.62	104.72	104.18	87.87	850.00	321.92
May-99	104.40	105.85	104.78	60.00	2440.00	954.03
Jun-99	104.50	107.92	105.68	610.00	7300.00	2307.33
Jul-99	105.82	109.01	107.28	2400.00	12700.00	5529.61
Aug-99	106.84	108.98	107.49	4110.00	12450.00	6088.06
Sep-99	106.59	107.72	107.01	3594.00	6590.00	4612.07
Oct-99	105.80	107.35	106.27	2350.00	5540.00	3122.55
Nov-99	104.99	105.84	105.36	1138.00	2410.00	1682.60
Dec-99	104.44	109.50	104.83	612.00	1104.00	797.74
Jan-00	104.26	104.47	104.37	442.00	603.00	522.13
Feb-00	103.81	104.61	104.21	116.20	730.00	354.88
Mar-00	103.77	104.54	104.01	48.64	666.00	255.21
Apr-00	104.55	105.12	104.83	675.00	1330.00	959.33
May-00	104.59	106.04	105.16	711.00	2710.00	1419.61
Jun-00	105.41	108.40	106.49	1765.00	8800.00	3671.87
Jul-00	106.85	107.80	107.16	4135.00	6830.00	4989.32
Aug-00	106.98	108.54	107.45	4460.00	9290.00	5852.26

Month/ Year	Min. Water Level (in m)	Max. Water Level (in m)	Averge Water Level (in m)	Min. Discharge (in cumecs)	Max. Discharge (in cumecs)	Average Discharge (in cumecs)
Sep-00	106.28	107.62	106.98	1510.00	6290.00	4455.67
Oct-00	105.20	106.20	105.65	1450.00	2950.00	2126.45
Nov-00	104.56	105.60	104.95	684.00	2050.00	1110.07
Dec-00	104.39	104.55	104.47	533.00	675.00	604.87
Jan-01	104.07	104.37	104.22	322.00	519.00	418.23
Feb-01	103.79	104.06	103.92	185.00	316.00	247.93
Mar-01	103.63	103.78	103.70	130.00	180.00	153.97
Apr-01						
May-01	104.08	105.07	104.33	328.00	1255.00	515.10
Jun-01	104.32	106.50	105.64	484.00	4705.00	2232.30
Jul-01	105.83	108.74	106.77	2395.00	9990.00	4329.87
Aug-01	106.89	109.45	107.66	4235.00	14950.00	6738.48
Sep-01	105.96	107.86	106.91	2590.00	7070.00	4494.30
Oct-01	105.50	106.40	105.74	1900.00	3290.00	2266.13
Nov-01	104.78	105.53	105.07	900.00	1945.00	1278.70
Dec-01	104.14	104.80	104.44	364.00	920.00	592.35
Jan-02	104.00	104.07	104.02	286.00	322.00	291.81
Feb-02	103.92	104.02	103.96	243.00	292.00	259.68
Mar-02	103.91	104.05	103.94	239.00	310.00	253.03
Apr-02	103.90	105.14	104.73	234.00	1360.00	907.27
May-02	104.24	106.11	105.22	428.00	2815.00	1499.06
Jun-02	104.98	106.25	105.62	1127.00	3035.00	2059.23
Jul-02	106.24	109.50	107.15	1520.00	13200.00	4961.71
Aug-02	106.60	108.14	107.23	3610.00	8029.00	5188.00
Sep-02	106.00	106.95	106.40	277.00	4385.00	3220.23
Oct-02	104.90	106.17	105.56	1035.00	2905.00	1997.65
Nov-02	104.86	106.20	105.30	980.00	2950.00	1612.97
Dec-02	104.37	105.80	105.35	519.00	2350.00	1697.23
Jan-03	104.03	104.50	104.13	298.00	456.00	350.23
Feb-03	104.00	104.07	104.03	280.00	322.00	298.86
Mar-03	104.02	105.16	104.23	292.00	1390.00	481.39
Apr-03	105.04	105.36	105.15	1210.00	1690.00	1370.50
May-03	105.08	105.65	105.28	1270.00	2125.00	1576.29
Jun-03	104.95	107.06	105.62	1092.00	4684.00	2123.27
Jul-03	106.00	108.68	107.20	1270.00	9780.00	5066.19
Aug-03	106.90	109.45	107.35	4260.00	14950.00	5664.71
Sep-03	104.10	107.60	106.86	566.00	6230.00	4317.57
Oct-03	105.26	106.25	105.60	1540.00	3035.00	2049.84
Nov-03	105.38	105.68	105.48	1720.00	2170.00	1863.50
Dec-03	104.55	105.40	105.00	675.00	15410.00	1652.71
Jan-04	104.12	104.46	104.21	352.00	594.00	411.16
Feb-04	103.95	104.16	104.04	261.00	376.00	307.97
Mar-04	103.84	103.95	103.89	208.00	257.00	230.77
Apr-04	104.00	105.30	104.50	280.00	1600.00	654.03

Month/ Year	Min. Water Level (in m)	Max. Water Level (in m)	Averge Water Level (in m)	Min. Discharge (in cumecs)	Max. Discharge (in cumecs)	Average Discharge (in cumecs)
May-04	104.20	106.00	104.73	400.00	15770.00	1400.26
Jun-04	104.98	106.55	105.54	1127.00	3530.00	1959.37
Jul-04	105.80	108.08	106.92	2330.00	7858.00	4472.35
Aug-04	106.33	107.96	106.81	3171.00	7470.00	4111.68
Sep-04	105.84	107.34	106.48	2410.00	5590.00	3506.70
Oct-04	105.35	107.12	105.78	1675.00	4858.00	2341.94
Nov-04	105.13	105.42	105.25	1345.00	1780.00	1528.00
Dec-04	103.93	105.25	104.71	257.00	1525.00	922.26
Jan-05	103.90	103.95	103.91	234.00	257.00	240.00
Feb-05	103.90	103.92	103.91	234.00	243.00	237.61
Mar-05	103.83	104.03	103.91	203.00	298.00	238.23
Apr-05	103.80	104.28	104.10	190.00	456.00	350.73
May-05	103.83	104.30	104.22	203.00	470.00	416.52
Jun-05	104.27	105.95	104.75	172.00	2575.00	935.53
Jul-05	105.51	107.05	106.47	1915.00	4656.00	3404.23
Aug-05	106.20	108.10	106.87	2950.00	7915.00	4347.61
Sep-05	105.50	106.60	106.00	244.00	3620.00	2623.73
Oct-05	104.87	106.60	105.57	1000.00	3610.00	2015.55
Nov-05	104.76	105.46	105.05	880.00	1900.00	1245.53
Dec-05	104.16	104.95	104.53	376.00	1092.00	687.03
Jan-06	104.07	104.14	104.09	322.00	364.00	336.71
Feb-06	104.05	104.09	104.07	310.00	334.00	321.80
Mar-06	104.00	104.05	104.03	280.00	310.00	296.76
Apr-06	103.99	104.33	104.13	275.00	491.00	358.60
May-06	104.20	106.00	104.50	400.00	2650.00	677.55
Jun-06	104.63	106.18	105.38	750.00	2920.00	1740.43
Jul-06	105.70	106.95	106.41	2200.00	4385.00	3361.65
Aug-06	105.76	107.80	106.38	2290.00	6830.00	3412.45
Sep-06	105.68	107.60	106.38	2170.00	5960.00	3361.93
Oct-06						
Nov-06	104.52	104.71	104.63	648.00	830.00	752.57
Dec-06	104.34	104.98	104.75	498.00	1127.00	879.26

The water level and discharge hydrograph of river Gandak at Valmikinagar / Tribeni are shown in **Fig. 4.2 & 4.3**. The hydrograph indicates that monthly maximum and minimum water level variations in the river Gandak at Tribeni. The hydrograph generally indicates the trend of water level variations over a year. The river starts rising from June and peak flood water prevails from July to September. The flood waters however prevail up to October. The water levels start falling from November. From January to April the river is at its low stage.

Dumarighat:

The monthly maximum, minimum and average water levels and corresponding discharges of river Gandak at Dumaria Ghat are provided in **Table 4.2**.

The maximum water level of 62.9 m above MSL for typical year 2000 was noticed in the month of August and the corresponding discharge was 6543 cumecs. The minimum water level of 58.0 m above MSL was noticed for the same year (2000) and the corresponding discharge was 96 cumecs. Hence there is a rise in stage of the river of 4.9 m from lean period to flood period and the corresponding rise in discharge was 6447 cumecs.

The water level and discharge hydrograph for monthly maximum and minimum water levels of river Gandak at Dumarighat gauge station is shown in **Fig. 4.4 & 4.5**. The trend of water level variations is more or less similar as that of Tribeni hydrograph. The river starts rising from June and peak water levels have been noticed during August. The water level progressively reduces from September to December. From January to May, the river experiences low waters.

Table 4.2: MONTHLY MAXIMUM, MINIMUM AND AVERAGE WATER LEVELS AND CORRESPONDING DISCHARGES OF RIVER GANDAK AT DUMARIA GHAT

Month/ Year	Maximum Water Level (in m)	Minimum Water Level (in m)	Average Water Level (in m)	Maximum Discharge (in cumecs)	Minimum Discharge (in cumecs)	Average Discharge (in cumecs)
Jan-96	59.6	59.0	59.2			
Feb-96	59.5	59.1	59.2			
Mar-96	59.4	58.8	59.1			
Apr-96	59.4	59.1	59.3			
May-96	59.6	58.6	59.1			
Jun-96	61.4	58.9	60.0	1977	482	1099
Jul-96	62.6	60.9	61.7	5704	2240	4146
Aug-96	62.6	61.4	61.9	6202	3244	4856
Sep-96	90.8	60.8	62.5	4662	2337	3268
Oct-96	61.7	60.3	60.8	2827	1065	1836
Nov-96	60.3	59.7	59.9	912.6	574.8	744.3
Dec-96	59.7	59.0	59.3	458.6	338.5	400.9
Jan-97	59.0	58.6	58.8	300.7	202.5	248
Feb-97	58.6	58.1	58.3	130.6	120.2	145.9
Mar-97	58.4	58.0	58.2	179.1	110.9	147.3
Apr-97	59.1	58.2	58.9	392.7	331	351.7
May-97	59.3	58.4	58.8	469.3	260.9	355.3
Jun-97	61.2	58.5	59.5	1194	384.6	700.8
Jul-97	62.0	61.2	61.7	4346	3353	3688
Aug-97	62.2	61.2	61.6	4739	3147	3620
Sep-97	61.7	61.0	61.3	3150	2324	2765
Oct-97	61.0	59.9	60.3	1259	868.2	1251
Nov-97	60.1	59.7	59.9	809.1	693.3	732.4
Dec-97	60.5	59.6	59.8	958.9	671.6	986.7
Jan-98	59.6	59.0	59.4	570.6	428.3	500.4

Month/ Year	Maximum Water Level (in m)	Minimum Water Level (in m)	Average Water Level (in m)	Maximum Discharge (in cumecs)	Minimum Discharge (in cumecs)	Average Discharge (in cumecs)
Feb-98	59.3	58.7	59.0	338.7	221.8	274.7
Mar-98	59.0	58.6	58.8	238.9	166.1	203.5
Apr-98	59.9	59.0	59.5	506.3	396.3	438.5
May-98	60.5	59.6	60.1	828.3	528.7	663.5
Jun-98	61.9	60.0	60.6	2738	672.4	1374
Jul-98	63.0	61.8	62.2	5665	4714	5248
Aug-98	63.0	61.7	62.5	8733	4996	7075
Sep-98	62.9	60.9	61.6	6098	2174	3548
Oct-98	61.4	60.2	60.6	2193	1528	1768
Nov-98	60.2	59.4	59.7	1212	749.8	969
Dec-98	59.4	58.7	59.0	605.7	387.4	506.5
Jan-99	58.8	58.3	58.6	414.9	280.8	357.5
Feb-99	58.3	58.0	58.1	204.3	140.7	169.6
Mar-99	58.0	57.8	58.0	136.9	125.2	130
Apr-99	58.9	58.0	58.5	334.2	222	274.7
May-99	60.2	58.3	58.9	596.1	319	433.9
Jun-99	61.6	58.5	60.2	2261	463.3	1351
Jul-99	62.4	61.1	61.7	3945	3578	3732
Aug-99	62.9	61.2	61.8	5991	2801	4369
Sep-99	62.5	61.3	61.8	4518	3189	3836
Oct-99	62.0	60.2	61.0	3365	1151	2072
Nov-99	60.2	59.5	59.9	844.5	679.5	788.5
Dec-99	59.4	58.9	59.1	555.5	381.8	453.5
Jan-00	59.0	58.5	58.7	376.5	207.4	293.4
Feb-00	58.9	58.5	58.7	296.3	245.8	279.3
Mar-00	58.6	58.0	58.2	137.9	96	118.5
Apr-00	59.0	58.6	58.8	238.1	220.3	228.2
May-00	60.6	58.6	59.2	722.3	232	421.1
Jun-00	62.4	60.1	61.1	3963	1337	2543
Jul-00	62.2	61.6	61.9	4497	3828	4147
Aug-00	62.9	61.7	62.2	6543	4051	5063
Sep-00	62.2	60.9	61.7	4519	2774	3626
Oct-00	60.8	59.6	60.1	1365	629	897.1
Nov-00	59.7	59.3	59.6	611	457	532.7
Dec-00	59.3	58.6	59.0	379	289	337.1
Jan-01	58.6	58.3	58.4	287.8	209.8	214
Feb-01	58.3	58.1	58.2	188.5	164.1	177.6
Mar-01	58.3	58.1	58.2	185.7	173.1	181.2
Apr-01	58.6	58.2	58.5	230.9	207	221.5
May-01	59.3	58.6	58.9	315.5	251.9	286.3
Jun-01	61.1	59.2	60.3			
Jul-01	62.3	60.7	61.3			

Month/ Year	Maximum Water Level (in m)	Minimum Water Level (in m)	Average Water Level (in m))	Maximum Discharge (in cumecs)	Minimum Discharge (in cumecs)	Average Discharge (in cumecs)
Aug-01	63.2	61.6	62.2			
Sep-01	62.4	60.7	61.5			
Oct-01	61.0	59.9	60.4			
Nov-01	59.8	59.4	59.6			
Dec-01	59.4	58.9	59.2			
Jan-02	59.0	58.6	58.8			
Feb-02	59.0	58.6	58.8			
Mar-02	58.6	58.3	58.4			
Apr-02	59.2	58.1	58.8			
May-02	60.5	59.0	59.5			
Jun-02	61.0	59.4	60.2			
Jul-02	63.1	60.7	61.7			
Aug-02	62.3	61.2	61.7			
Sep-02	61.5	60.5	61.0			
Oct-02	60.7	59.7	60.0			
Nov-02	59.7	59.2	59.4			
Dec-02	59.1	58.4	58.9			
Jan-03	58.5	58.2	58.3			
Feb-03	58.5	58.1	58.3			
Mar-03	58.6	57.7	58.0			
Apr-03	58.8	58.4	58.6			
May-03	59.1	58.0	58.8			
Jun-03	61.2	58.8	59.7			
Jul-03	62.5	61.2	61.7			
Aug-03	62.9	61.4	61.8			
Sep-03	61.9	60.9	61.6			
Oct-03	60.9	59.5	60.0			
Nov-03	59.5	59.0	59.2			
Dec-03	59.0	58.3	58.7			
Jan-04	58.4	57.9	58.2			
Feb-04	58.3	57.7	58.1			
Mar-04	58.0	57.6	57.7			
Apr-04	58.6	57.7	58.3			
May-04	59.8	58.1	58.7			
Jun-04	60.9	59.0	59.7			
Jul-04	61.6	59.8	61.1			
Aug-04	61.8	60.8	61.0			
Sep-04	61.3	60.5	60.9			
Oct-04	61.0	59.8	60.3			
Nov-04	59.8	59.1	59.4			
Dec-04	59.1	58.3	58.8			
Jan-05	58.5	58.1	58.2			

Month/ Year	Maximum Water Level (in metre)	Minimum Water Level (in metre)	Average Water Level (in m)	Maximum Discharge (in cumecs)	Minimum Discharge (in cumecs)	Average Discharge (in cumecs)
Feb-05	58.3	57.9	58.1			
Mar-05	58.0	57.8	57.9			
Apr-05	58.8	58.0	58.4			
May-05	58.9	58.4	58.6			
Jun-05	59.9	58.1	58.8			
Jul-05	61.3	60.1	60.8			
Aug-05	61.7	60.9	61.2			
Sep-05	61.1	60.2	60.7			
Oct-05	61.1	59.6	60.2			
Nov-05	60.1	59.4	59.7			
Dec-05	59.4	58.6	59.1			
Jan-06	58.5	58.0	58.2			
Feb-06	58.1	57.8	57.9			
Mar-06	58.1	57.6	57.8			
Apr-06	58.9	57.7	58.4			
May-06	59.7	58.7	58.9			
Jun-06	61.6	59.7	60.5			
Jul-06	61.6	60.8	61.3			
Aug-06	61.9	60.8	61.2			
Sep-06	61.8	60.4	61.2			
Oct-06	60.4	59.8	60.1			
Nov-06	59.8	59.3	59.5			
Dec-06	59.3	58.6	59.0			

Rewa:

At Rewa, the water level data is available only during flood season as the gauge station is meant for flood warning purpose. Hence the data is not so useful for analysis of the availability of depths particularly during lean period from the navigation point of view. The water level data during monsoon period is presented in **Table. 4.3.**

Table 4.3 WATER LEVELS OF RIVER GANDAK AT REWA

YEAR	JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1996	52.34	49.820	53.680	51.480	53.740	52.170	53.260	51.675	52.845	51.450
1997	51.84	50.195	53.080	51.690	53.390	52.00	52.550	51.955	52.020	51.230
1998	52.95	50.870	53.850	52.810	54.420	52.860	54.110	51.930	52.680	51.690
1999	52.98	51.340	53.180	52.380	54.100	52.380	53.855	52.370	53.000	51.420
2000	53.925	51.090	53.610	52.690	54.180	52.940	53.720	52.445	52.440	51.870
2001	52.68	51.27	53.870	52.11	54.790	52.60	53.960	51.73	52.090	51.68
2002	52.64	51.65	54.720	51.96	53.955	52.30	52.650	51.32	51.830	51.185
2003	52.63	50.925	54.230	52.460	54.710	52.760	53.790	52.665	52.680	51.520
2004	52.505	50.705	53.840	51.230	53.550	52.120	53.080	51.980	52.700	51.960
2005	51.490	49.610	52.920	51.800	53.715	52.260	52.279	51.790	51.995	51.470
2006	52.400	50.950	52.910	51.940	53.485	52.005	53.480	51.940	51.940	51.690

Lalganj:

The maxium and minimum water levels and corresponding discharges data at Lalganj from 1996 to 2006 are presented in **table 4.4.** The monthly average discharges of river Gandak are also presented in the same table. The maximum water level of 50.69 m above MSL for typical year 2005 was noticed in the month of August and the corresponding discharge was 8030 cumecs. The minimum water level of 45.62 m above MSL was noticed for the same year (2005) and the corresponding discharge was 142 cumecs. Hence there is a rise in stage of the river of 5.07 m from lean period to flood period and the corresponding rise in discharge was 7888 cumecs.

The water level and discharge hydrograph for monthly maximum and minimum water levels of river Gandak at Lalganj gauge station is shown in **Fig. 4.6 & 4.7.** The trend of water level variations is more or less similar as that of Tribeni and Dumarighat hydrographs. The river starts rising from June and peak water levels have been noticed up to September. The water level progressively reduces from October to December. From January to May, the river experiences low waters.

Table 4.4: **MONTHLY MAXIMUM AND MINIMUM WATER LEVELS AND CORRESPONDIN DISCHARGES OF RIVER GANDAK AT LALGANJ**

Month/ Year	Max. Water Level (m)	Max Discharge (cumecs)	Min. Water Level (m)	Min. Discharge (cumecs)	Average Discharge (cumecs)
Jun-96	48.59	1210	46.72	203	629
Jul-96	49.35	4245	47.85	700	1915
Aug-96	50.83	10350	48.74	1360	6010
Sep-96	50.78	9930	48.93	1575	4800
Oct-96	49.11	1845	48.12	850	1288
Nov-96	48.25	940	47.71	625	775
Dec-96	47.69	620	47.01	376	494
Jan-97	46.98	365	46.52	183	265
Feb-97	46.59	205	46.03	79	128
Mar-97	46.37	147	45.93	70	100
Apr-97	47.10	403	46.24	119	340
May-97	47.35	551	46.50	177	309
Jun-97	48.46	1330	46.54	190	621
Jul-97	49.48	2750	48.18	1110	2010
Aug-97	50.30	6180	49.01	1950	3502
Sep-97	49.99	4425	48.78	1650	2804
Oct-97	48.78	1650	47.67	800	998
Nov-97	47.77	847	47.40	667	733
Dec-97	47.98	980	47.22	525	760
Jan-98	47.59	742	46.99	359	604
Feb-98	46.97	319	46.50	184	255
Mar-98	46.83	226	46.40	174	198
Apr-98	47.66	720	46.62	198	447
May-98	48.18	1125	47.88	524	857
Jun-98	49.29	3090	47.72	770	1303
Jul-98	50.35	6450	49.25	3010	4512
Aug-98	51.59	15840	49.50	3530	9783

Month/ Year	Max. Water Level (m)	Max Discharge (cumecs)	Min. Water Level (m)	Min. Discharge (cumecs)	Average Discharge (cumecs)
Sep-98	51.27	13770	49.11	2750	6198
Oct-98	49.81	4275	48.63	1890	2673
Nov-98	48.59	1830	47.82	870	1242
Dec-98	47.80	840	47.12	370	555
Jan-99	47.29	448	46.63	207	353
Feb-99	46.61	200	46.10	114	138
Mar-99	46.15	127	45.95	91	112
Apr-99	47.66	720	46.62	198	462
May-99	48.18	1125	47.38	524	857
Jun-99	49.25	3030	46.69	217	1201
Jul-99	50.05	5025	48.61	1875	3675
Aug-99	51.04	12000	49.53	3590	6464
Sep-99	50.76	9750	49.75	4140	5761
Oct-99	49.94	4680	48.31	1430	2700
Nov-99	48.33	1455	47.55	640	769
Dec-99	47.49	600	47.03	426	466
Jan-00	47.12	515	46.05	151	333
Feb-00	46.89	360	46.48	156	295
Mar-00	46.81	332	46.33	165	219
Apr-00	47.24	482	46.81	328	416
May-00	48.15	1100	46.77	316	540
Jun-00	50.41	6600	47.77	790	2531
Jul-00	50.76	8100	49.16	2800	4897
Aug-00	50.87	8625	49.73	4275	5759
Sep-00	50.88	8650	49.06	2600	5930
Oct-00	48.93	2375	48.06	975	1425
Nov-00	48.02	950	47.52	600	768
Dec-00	47.51	600	46.71	286	387
Jan-01	46.69	281	46.32	165	197
Feb-01	46.35	182	46.20	151	157
Mar-01	46.42	201	46.17	139	165
Apr-01	46.79	287	46.29	164	240
May-01	47.57	625	46.85	251	376
Jun-01	48.86	2225	47.57	625	1403
Jul-01	50.76	8100	48.57	1700	4070
Aug-01	51.59	15750	49.48	3575	7876
Sep-01	50.77	8150	48.48	1550	4815
Oct-01	48.65	1800	47.88	800	1262
Nov-01	47.85	750	47.32	525	659
Dec-01	47.32	708	46.64	356	579
Jan-02	46.71	355	46.29	279	325
Feb-02	46.79	402	46.50	309	350
Mar-02	46.45	287	46.14	204	235
Apr-02	47.10	577	46.10	173	376
May-02	48.33	1325	46.89	400	699
Jun-02	48.44	1525	47.19	532	1072

Month/ Year	Max. Water Level (m)	Max Discharge (cumecs)	Min. Water Level (m)	Min. Discharge (cumecs)	Average Discharge (cumecs)
Jul-02	50.69	7880	48.15	1160	3273
Aug-02	50.21	6100	48.45	1540	3360
Sep-02	49.14	2700	47.87	930	1894
Oct-02	48.12	1140	47.28	580	720
Nov-02	47.47	680	47.12	500	584
Dec-02	47.12	500	46.45	256	428
Jan-03	46.43	236	46.17	166	196
Feb-03	46.47	282	46.05	195	237
Mar-03	46.52	299	45.87	175	214
Apr-03	46.73	349	46.44	281	307
May-03	47.12	441	46.49	293	367
Jun-03	48.85	2200	46.93	401	799
Jul-03	50.13	6020	48.85	2200	3290
Aug-03	51.16	9670	49.27	3120	5597
Sep-03	51.19	9770	50.10	5900	8231
Oct-03	50.10	5900	48.10	1040	2221
Nov-03	48.05	1090	47.25	530	710
Dec-03	47.25	530	46.56	294	413
Jan-04	46.62	307	46.20	220	263
Feb-04	46.45	270	45.98	167	215
Mar-04	46.21	241	45.90	148	169
Apr-04	46.87	385	46.16	225	320
May-04	47.67	718	46.28	238	405
Jun-04	48.74	2000	47.07	482	896
Jul-04	49.79	4800	47.85	900	2578
Aug-04	50.33	6740	48.99	2480	3334
Sep-04	49.74	4580	48.37	1460	2586
Oct-04	48.89	2280	47.69	790	1338
Nov-04	47.69	790	47.02	415	568
Dec-04	47.02	415	46.34	247	376
Jan-05	46.43	263	45.97	177	218
Feb-05	46.27	233	45.74	194	209
Mar-05	45.78	165	45.62	142	155
Apr-05	46.59	385	45.76	172	247
May-05	46.59	385	46.05	225	300
Jun-05	47.49	665	45.88	221	355
Jul-05	49.84	5000	47.77	840	3081
Aug-05	50.69	8030	49.16	2850	5105
Sep-05	49.49	3680	48.01	1050	1971
Oct-05	48.95	2380	45.47	655	1066
Nov-05	47.45	640	47.28	550	601
Dec-05	47.32	575	46.52	264	404
Jan-06	46.47	248	46.00	213	221
Feb-06	48.00	225	45.81	185	202
Mar-06	46.12	272	45.70	160	174
Apr-06	46.61	392	45.73	146	263
May-06	47.39	990	46.61	295	465
Jun-06	48.16	1290	47.12	460	731

Hazipur:

At Hazipur, the water level data is available only during flood season as the gauge station is meant for flood warning purpose. Hence the data is not so useful for analysis of the availability of depths particularly during lean period from the navigation point of view. The water level data during monsoon period is presented in **Table. 4.5.**

Table 4.5: WATER LEVELS OF RIVER GANDAK AT HAJIPUR

	JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER	
YEAR	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1996	45.375	43.635	47.505	45.115	50.035	47.395	49.900	46.305	46.895	46.120
1997	44.800	44.040	47.400	44.810	48.830	46.905	49.150	46.425	46.420	44.940
1998	45.770	44.390	48.540	45.775	49.890	47.830	49.720	46.900	47.840	46.120
1999	45.730	44.310	49.040	45.300	49.290	48.200	49.460	47.995	48.000	45.900
2000	47.000	45.410	49.310	46.290	48.610	47.810	49.450	47.000	47.995	45.570
2001	45.970	44.220	47.290	45.940	49.480	47.605	48.970	46.050	46.810	45.960
2002	45.000	44.510	47.670	44.780	48.640	46.280	48.540	46.920	46.910	45.495
2003	45.540	44.300	47.480	45.560	49.270	47.485	50.500	48.500	49.235	47.280
2004	44.825	44.020	46.860	44.290	48.930	46.370	48.790	46.470	46.920	46.130
2005	44.380	43.430	48.420	44.395	49.190	47.250	48.080	45.960	47.140	45.420
2006	44.880	44.130	47.270	44.480	48.840	46.570	48.830	46.345	46.340	44.800

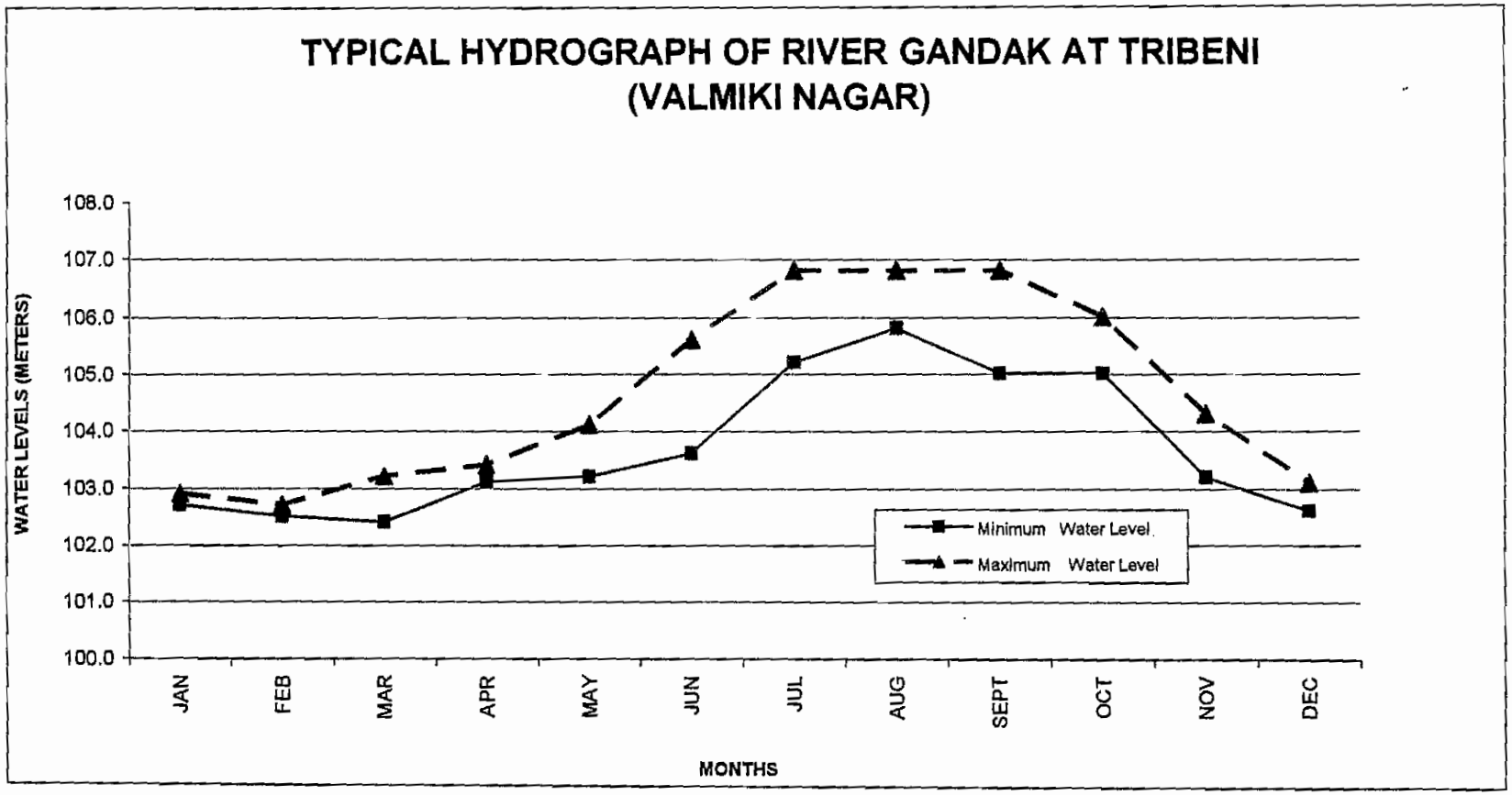


Fig. 4.2: Water Level Hydrograph of river Gandak at Tribeni

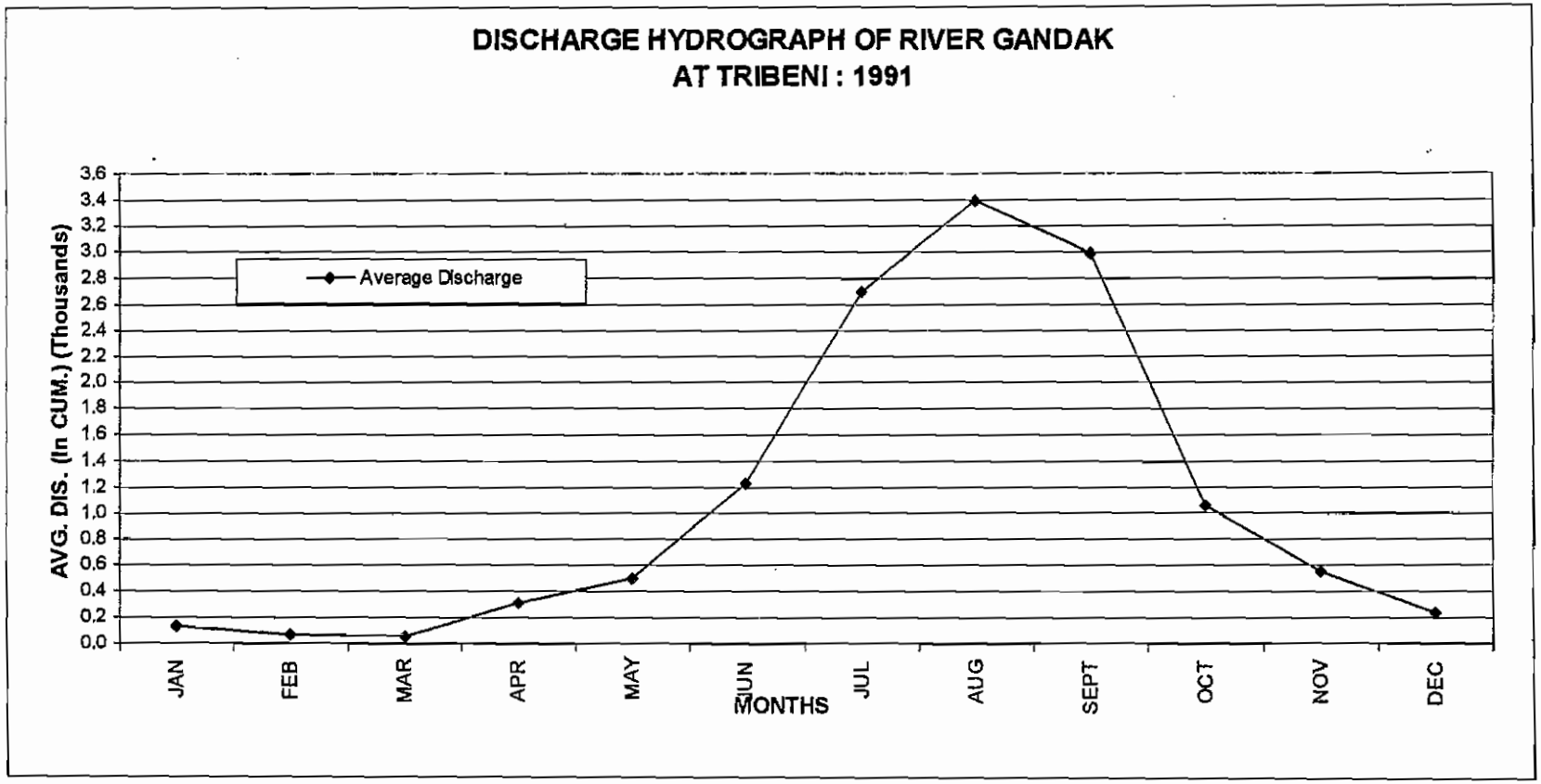


Fig. 4.3: Discharge Hydrograph of River Gandak at Tribeni

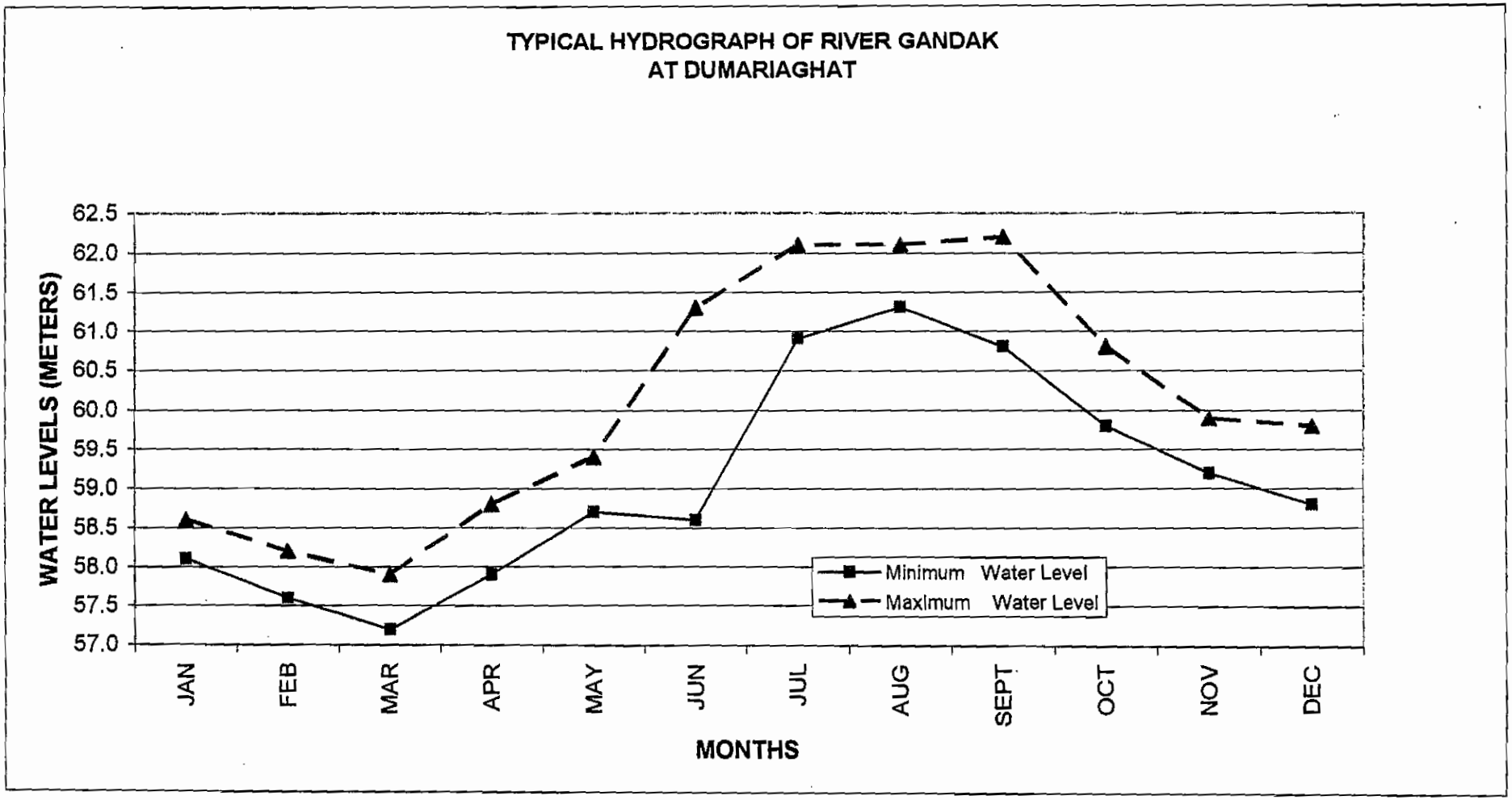


Fig. 4.4: Water Level Hydrograph of river Gandak at Dumaria

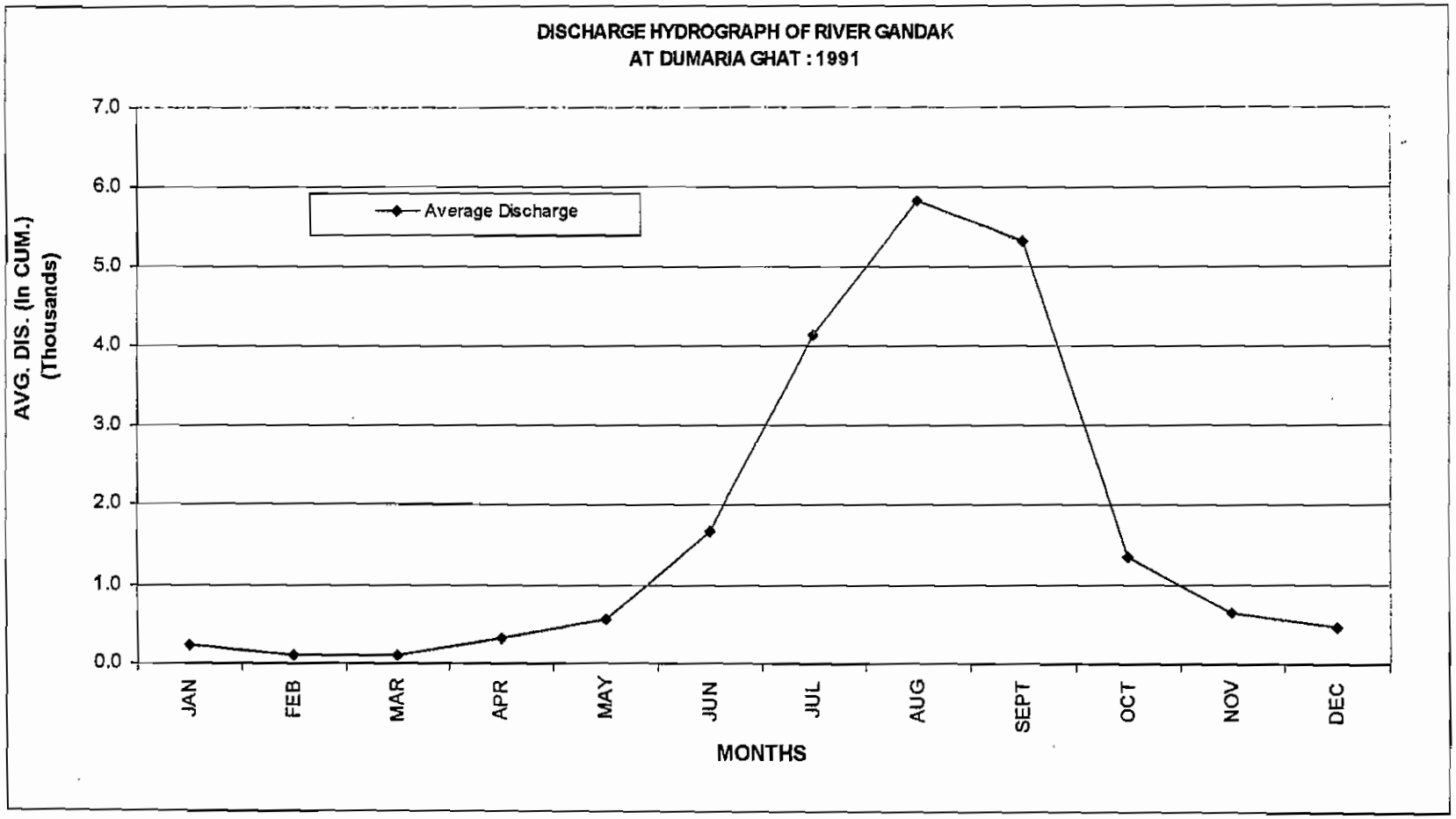


Fig. 4.5: Discharge Hydrograph of river Gandak at Dumaria

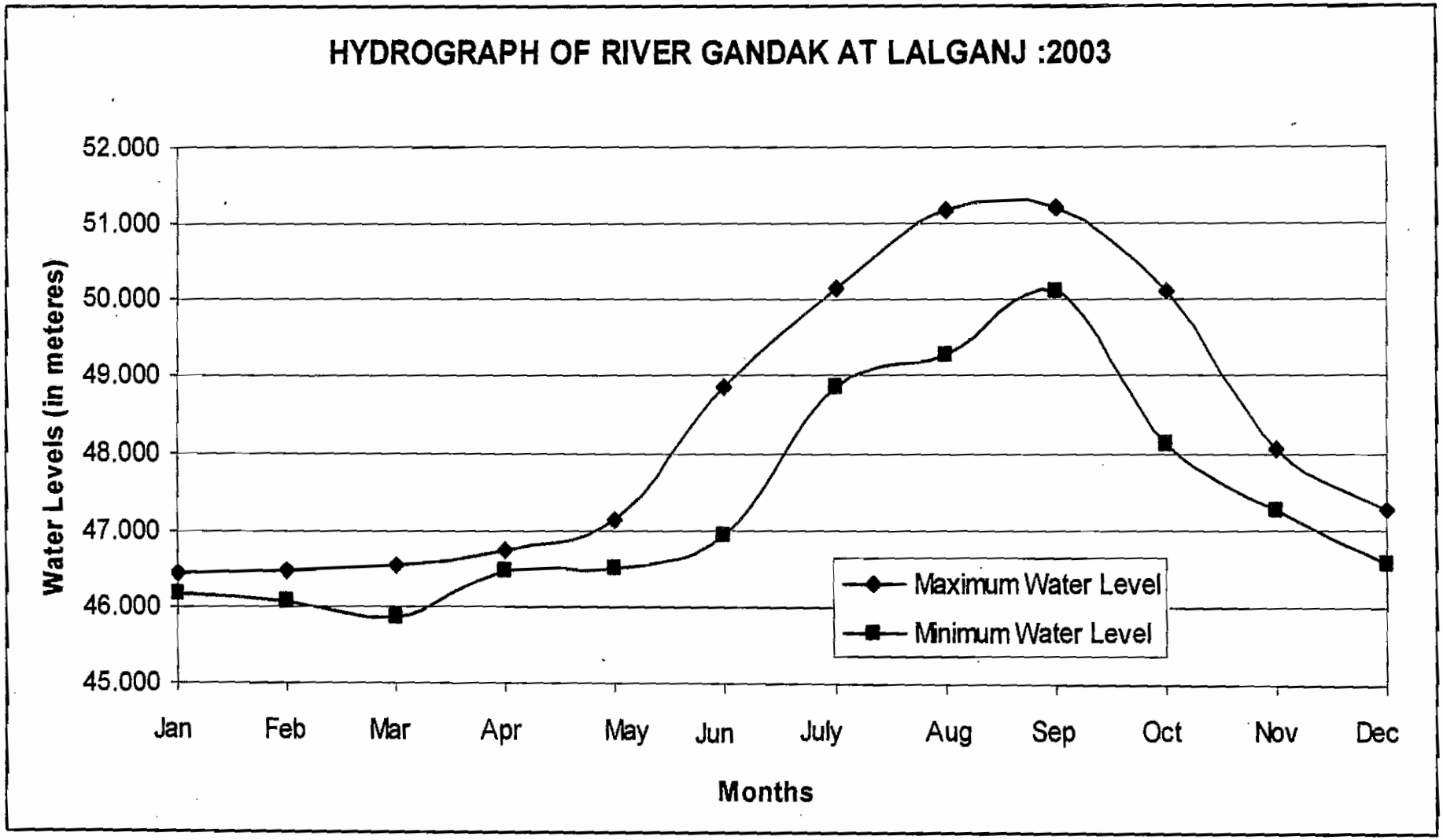


Fig. 4.6 : Water Level Hydrograph of river Gandak at Lalganj

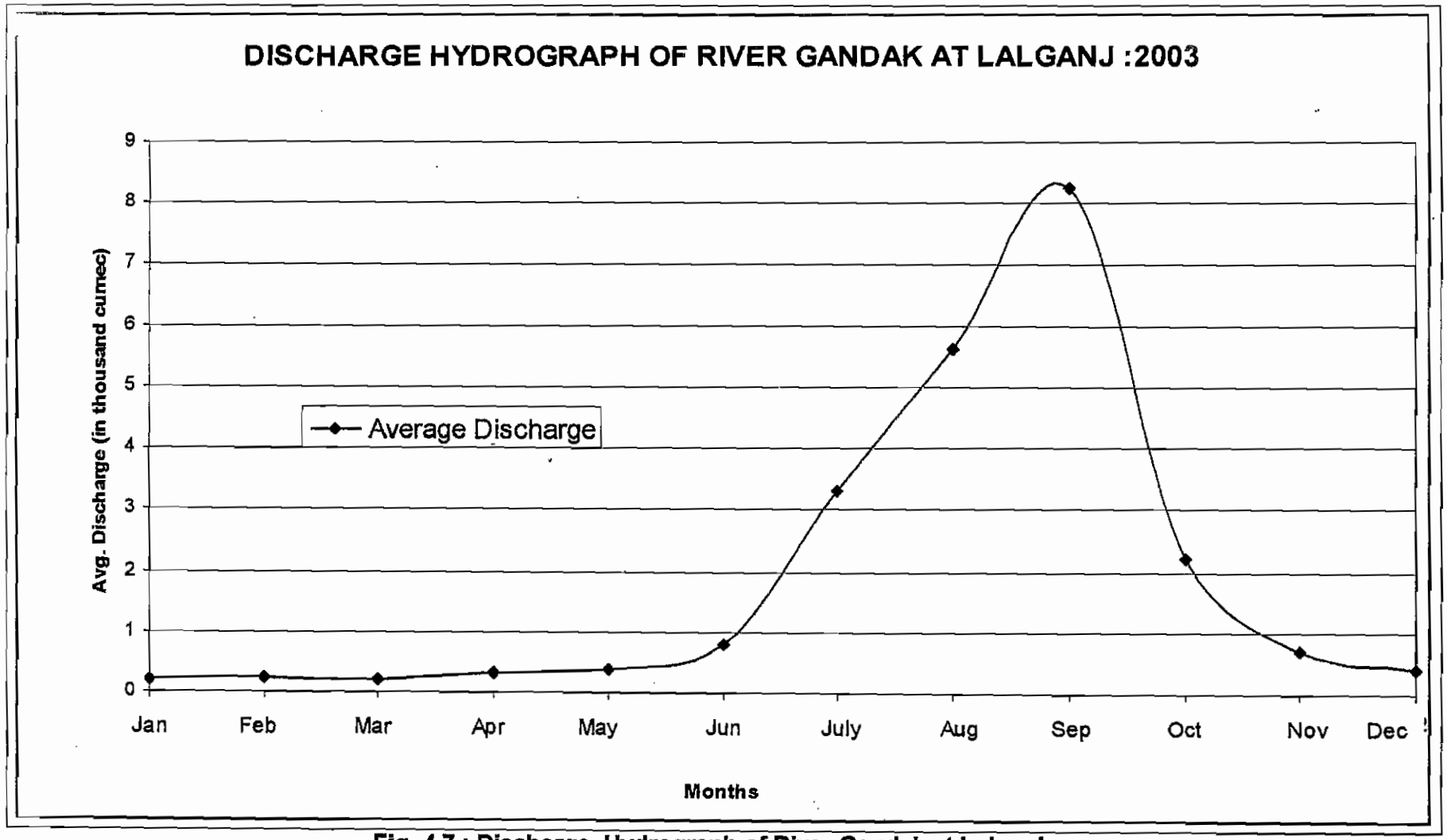


Fig. 4.7 : Discharge Hydrograph of River Gandak at Lalganj

4.2.3 Standard low water level (chart datum)

The standard low water level (SLWL) has been fixed by analyzing long period water level data at the available gauge stations viz., Tribeni Ghat, Dumariya Ghat, Rewa Ghat, and Lalganj being maintained by Central Water Commission. The long period water level data was supplemented with the water level data collected during survey period and some data already available with the consultants'.

The chart datum values fixed at the above gauge stations viz., Tribeni Ghat, Dumariya Ghat, Rewa Ghat, and Lalganj have been extended for the intermediate stations of the waterway based on the short period water level observations during survey period by interpolation. The chart datum values for the entire river reach of Gandak are as follows:

Table 4.6: The chart datum (CD) values and river gradient of Gandak

LOW WATER LEVELS AND GRADIENT OF RIVER GANDAK DURING SURVEY PERIOD								
Sl. No.	DATE	TRIBENI GHAT	Dumariya Ghat	Rewa Ghat	Lalganj Ghat	Slope Tribeni to Dumariya Ghat	Slope Dumariya to Rewa Ghat	Slope Rewa to Lalganj Ghat
	Chainage	0	218.879	284.660	310.25			
1	28-Apr-08	104.100	58.320	49.720	46.184	1: 4,781.1	1: 7,649.0	1: 7,237.0
2	29-Apr-08	104.000	58.360	49.780	46.234	1: 4,795.8	1: 7,666.8	1: 7,216.6
3	30-Apr-08	103.900	58.400	49.840	46.299	1: 4,810.5	1: 7,684.7	1: 7,226.8
4	01-May-08	103.950	58.440	49.920	46.349	1: 4,809.5	1: 7,720.8	1: 7,166.1
5	02-May-08	104.000	58.440	49.920	46.359	1: 4,804.2	1: 7,720.8	1: 7,186.2
6	03-May-08	104.000	58.420	49.920	46.334	1: 4,802.1	1: 7,738.9	1: 7,136.1
7	04-May-08	104.000	58.420	49.920	46.314	1: 4,802.1	1: 7,738.9	1: 7,096.5
8	05-May-08	104.000	58.440	49.900	46.304	1: 4,804.2	1: 7,702.7	1: 7,116.2
9	06-May-08	104.130	58.460	49.980	46.374	1: 4,792.6	1: 7,757.2	1: 7,096.5
10	07-May-08	104.100	58.460	50.050	46.404	1: 4,795.8	1: 7,821.8	1: 7,018.7
	Average Slope in between stretch					1: 4,800	1: 7,720	1: 7,150
	Lowest WL During Survey	103.900	58.320	49.720	46.184			
	10 yrs lowest Water Level	102.91	57.60	49.61	45.47			
	Average Slope in between stretch					1: 4,858	1: 7,438	1: 6,467

4.2.4 Depths for Navigation

The reduced depths below the chart datum are used to assess the navigation depths. The reduced depths, that is, the depths below the chart datum show that these depths would be ensured even during dry season on long term basis.

4.2.5 Longitudinal Section of river Gandak:

The depths along the deeper course of the river in the form of longitudinal section are presented in **Fig. 4.8.** The gauge locations are also depicted on the same drawings.

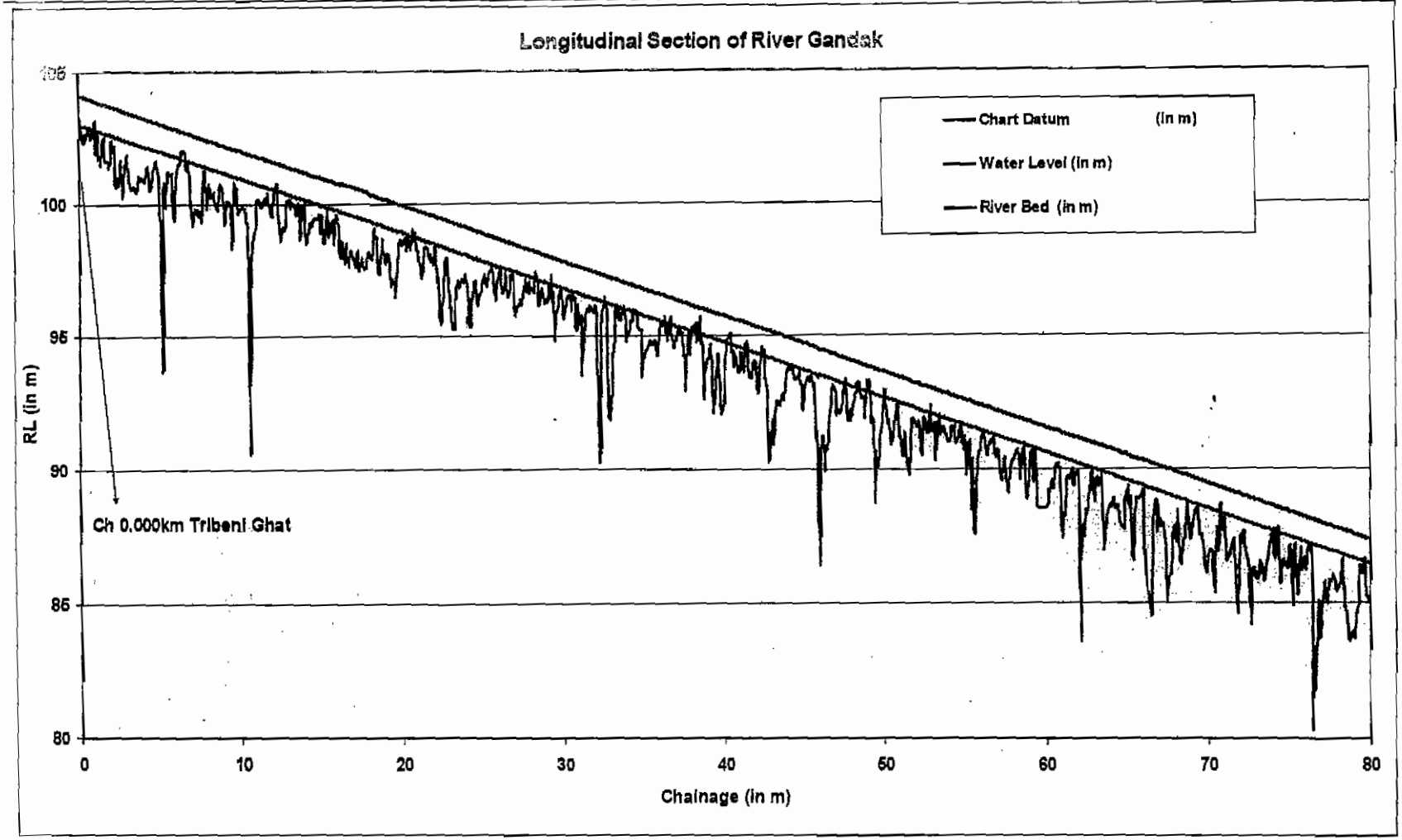


Fig 4.8: LONGITUDINAL SECTION OF RIVER GANDAK (Sheet No. 1 of 4)

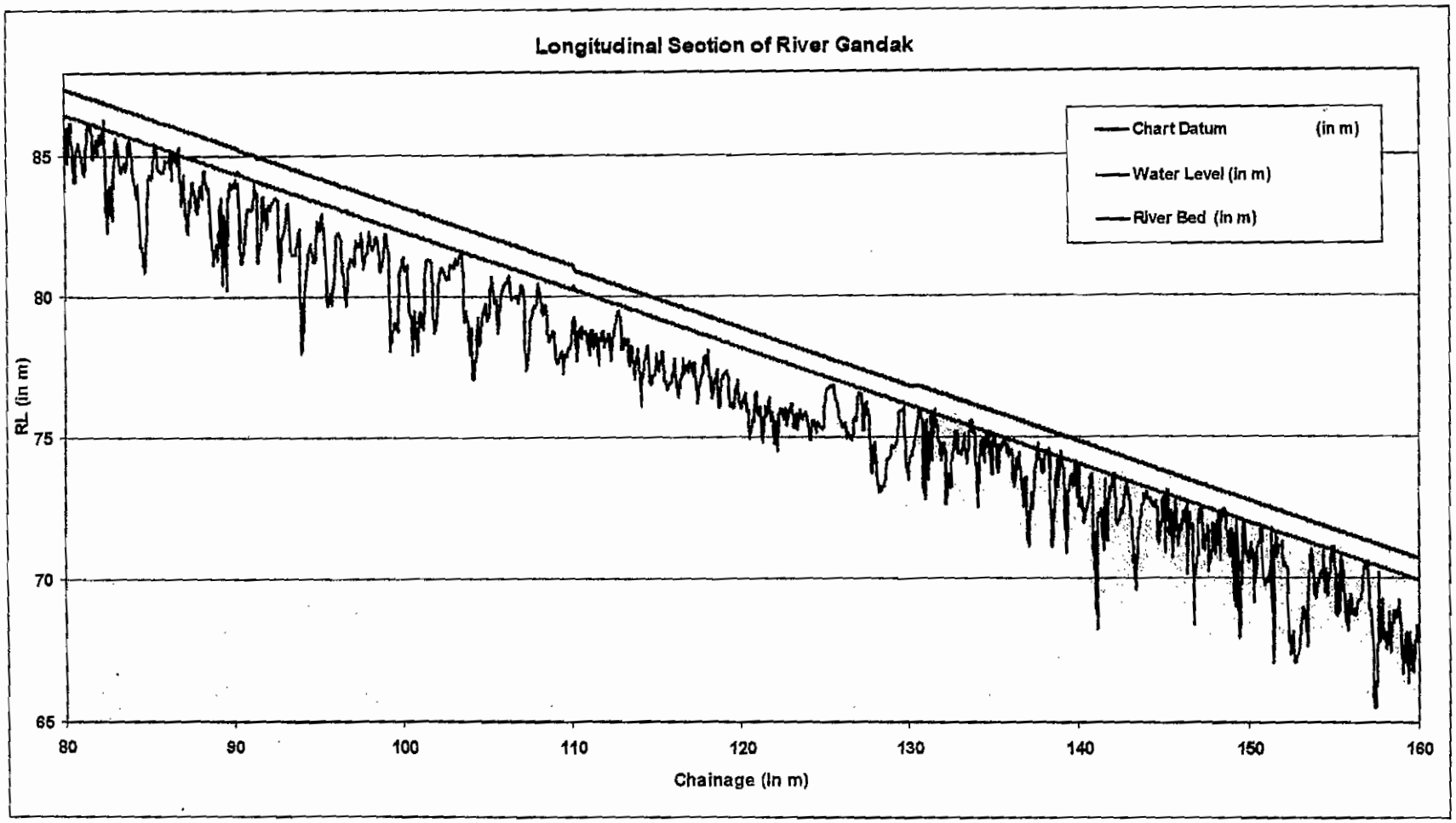


Fig 4.8: LONGITUDINAL SECTION OF RIVER GANDAK (Sheet No. 2 of 4)

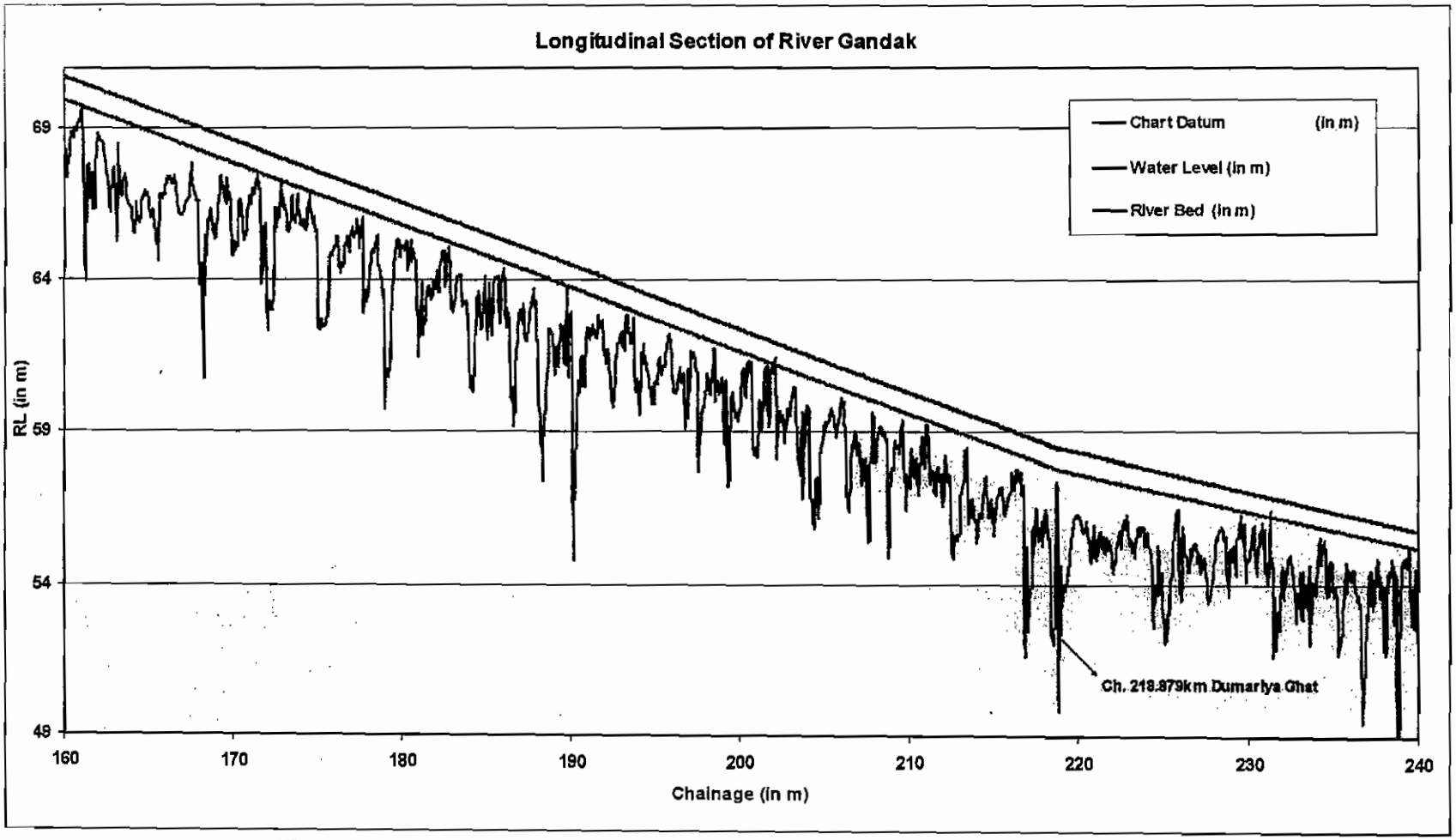


Fig 4.8: LONGITUDINAL SECTION OF RIVER GANDAK (Sheet No. 3 of 4)

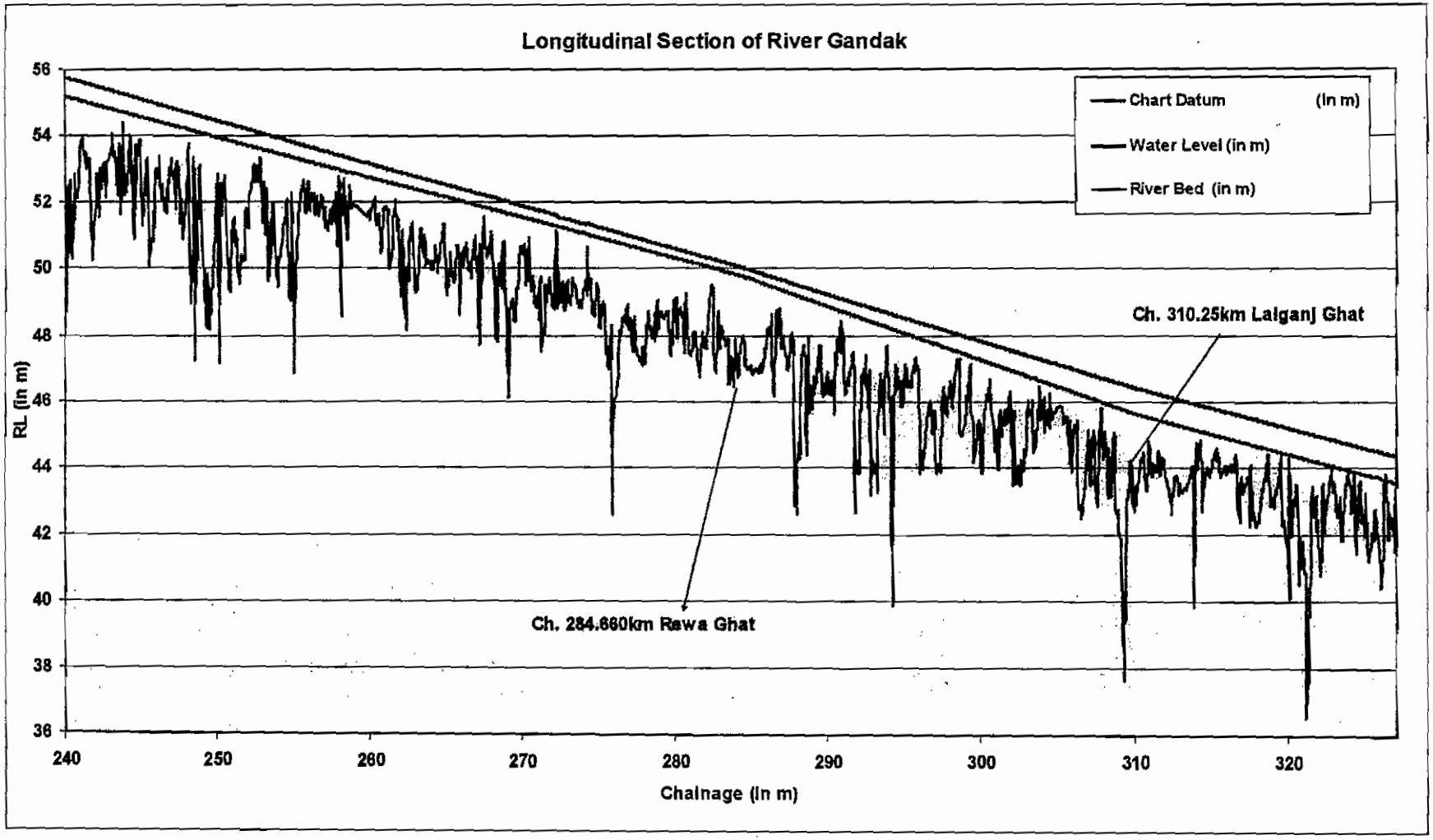


Fig 4.8: LONGITUDINAL SECTION OF RIVER GANDAK (Sheet No. 4 of 4)

4.3 STUDY OF NAVIGATIONAL ROUTE USING CURRENT SATELLITE IMAGERIES

The morphological characteristics of river Gandak have been examined by analyzing recent satellite imageries for the year 2007. The satellite imageries of river Gandak from Valmiki Nagar (India – Nepal border) to river Ganga confluence are depicted in imageries Gandak 1 to Gandak 18. The hydro-morphological characteristics of the river are based on inputs of river hydrology as explained above and the recent river regime as supported by satellite imageries. The entire river course is distinctly divided into seven reaches to study the river morphology as stated below:

4.3.1 Valmiki Nagar to Bagaha

After crossing Tribeni barrage, the main flow of the Gandak river takes the center channel for almost three kilometers and then takes the left channel near $27^0$25'48" N and then the river meanders to the right bank upto $27^0$18'36"N. The river takes the braided form near Bajahi. Near Basai, the flow takes the center channel and it takes the left bank near Madanpur protected forest at $27^0$13'48" N. The river again meanders from left bank to right bank near Churihwan and again traverses towards center near Bagaha. Due to this river behaviour, huge sand bars are formed on both sides of the river.

4.3.2 Bagaha to Chatia Ghat

After crossing Bagaha, the river runs along the left bank and takes a sharp turn near Chainpur. The river meanders from left bank to right bank near Bharpatiya and again from right bank to left bank. Due to this, huge sand bars are formed along both sides of the river banks. Near Hanuman Ganj, other branches of the river meet and make a single channel. Bansi River and Choti Gandak River meets Gandak along the right bank.

4.3.3 Chatia Ghat to Dumaria Ghat

River channel meanders from one bank to another. Near Nawada, the river bifurcates into two parts and takes the right branch. Both branches meet near Amarpura. Due to this, huge sand bars are formed along both sides of the river upto Pakri. At Pakri, again the river bifurcates and the main channel flows along the left side. After traveling about five kilometers, both branches join each other.

4.3.3 Dumaria Ghat to Rewa Ghat

The river crosses NH 28 at Dumaria Ghat. In this reach, the river takes several bends but follows a single channel. At Dhekaha, the river bifurcates and main channel takes the left bank. After traveling about six kilometers, both channel meets at Madhopurtoli. near Sarangpur, river again bifurcates and leaves the left bank and follows the right bank for about seventeen kilometers to join the left channel at Fatehabad causing huge sand bar development near Madhopurtoli and Sahansi.

4.3.4 Rewa Ghat to Lalganj

The river crosses the NH 102 near Rewa Ghat. Mainly in this reach, the river flows in a single channel.

4.3.5 Lalganj to Hazipur

In this reach the river mainly flows in north to south direction and crosses the road and rail bridge.

4.3.6 Hazipur to Ganga confluence

After crossing Hazipur, the river traverses by another about 4-5 km to join river Ganga.

4.4 SATELLITE MODEL STUDIES

The river course changes have been examined using latest satellite imageries. The hydromorphological changes based on satellite model studies are as follows:

4.4.1 Morphological Changes of River Gandak based on Satellite Imageries

History shows that the Gandak river has shifted about 80 km to the east due to tilting in the last 5000 years. However, the rate of shifting is rather slow and steady.

The river Gandak exhibits braided morphology in the upstream reaches and meandering course in the downstream reaches. The mid stream reach is characterized by low width-depth ratio, gentle gradient, variable peak discharge, frequent flooding and high sediment load. The mid stream reaches are in response to its inability to transport high sediment load due to gentle channel slope and dominance of aggradation process. The foot hills fed and plains fed rivers generally show meandering morphology. The river Gandak is with moderate discharge and suspended load alters its channels after passage of each flood. The flood plains of Gandak are affected by frequent channel migration through avulsion and cut offs.

The channel of river Gandak has shifted at certain locations when compared to the survey results with satellite imageries available. The following satellite imageries illustrate the difference in the changed river course.

FiG 4.9 Morphological Changes of River Gandak (Sheet no 1 of 4)

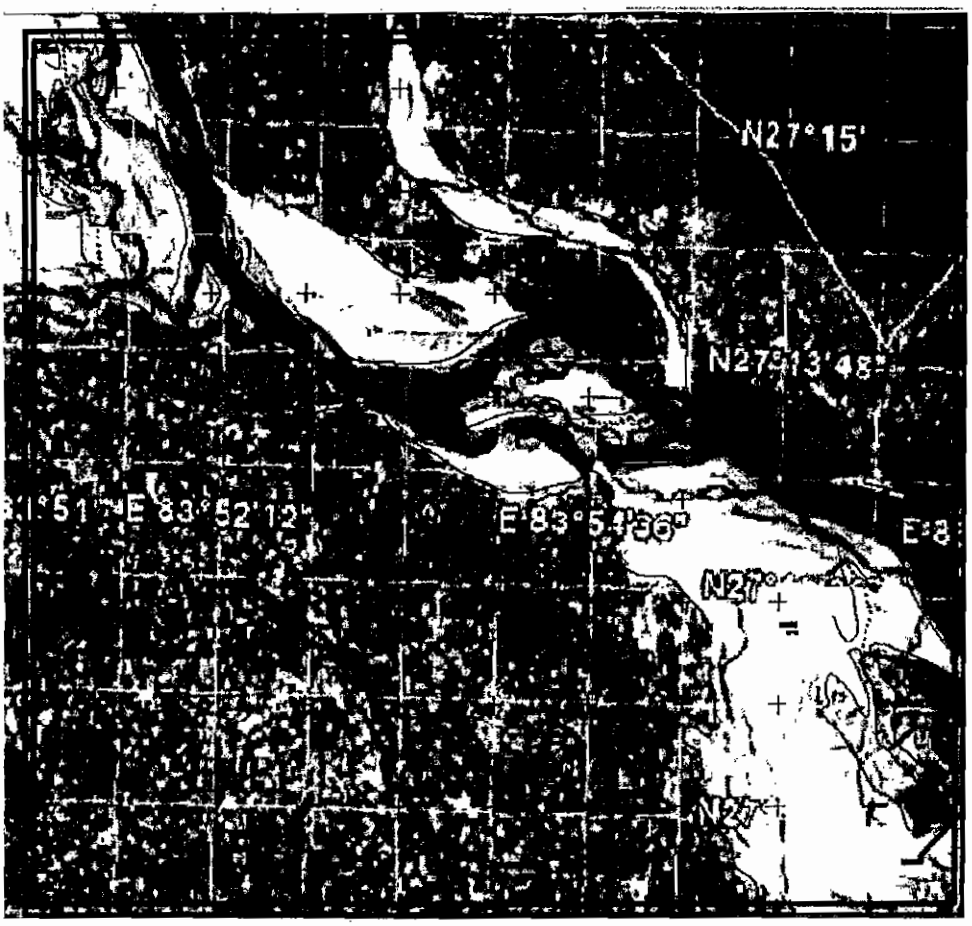


FiG 4.9 Morphological Changes of River Gandak(Sheet no 2 of 4)

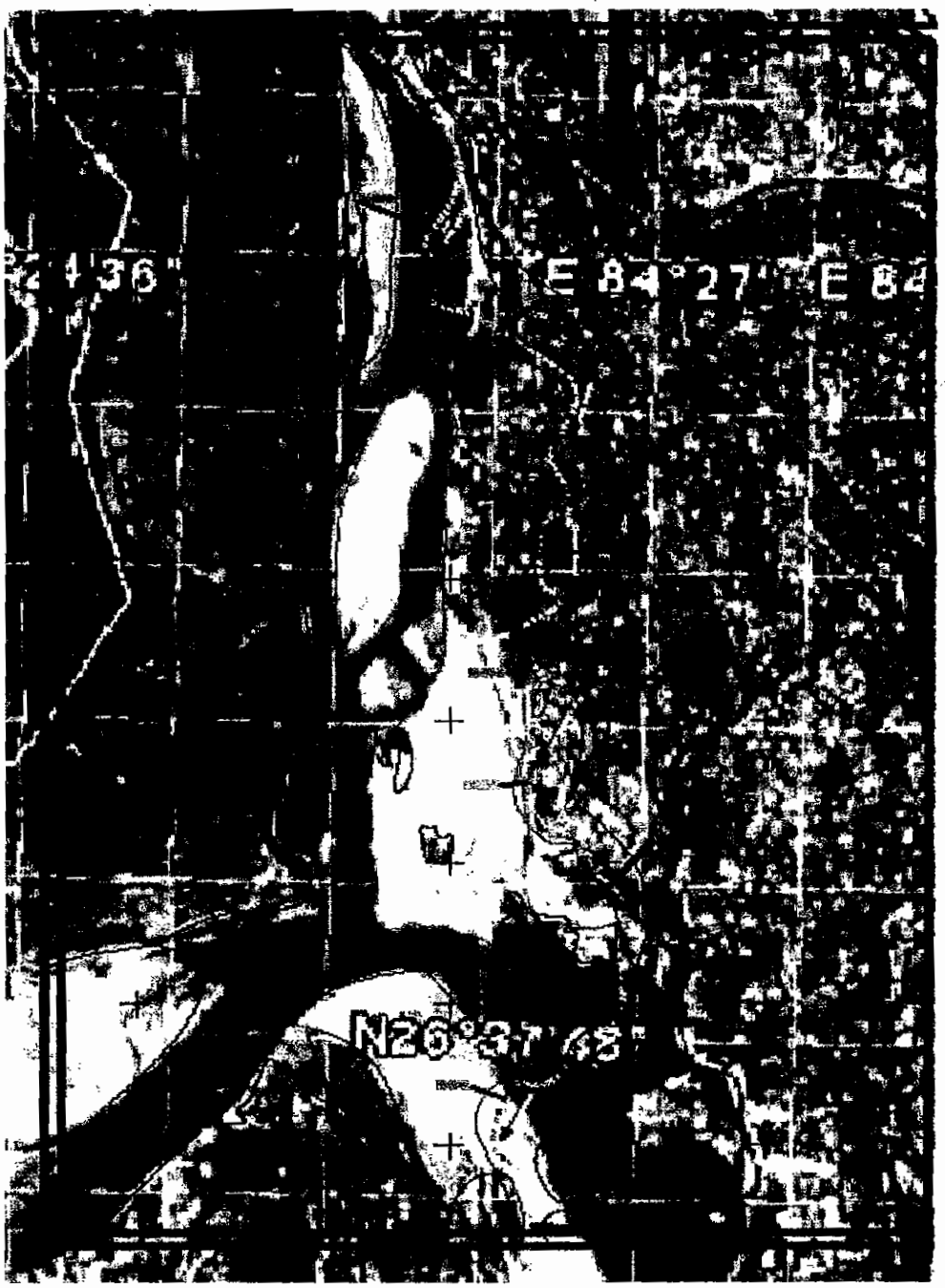


FiG 4.9 Morphological Changes of River Gandak(Sheet no 3 of 4)

FiG 4.9 Morphological Changes of River Gandak (Sheet no 4 of 4)

4.4.2 Morphological changes of river Gandak based on hydrographic surveys

The rivers can generally be grouped into three types: braided, straight, and meandering. Braided channels are those marked by successive divisions and rejoining of the flow around alluvial islands. Straight channels are those which have, at the bank-full stage, a negligible sinuosity over a distance many times the channel width. Meandering channels show more or less regular inflections in the direction of the channel and are quite sinuous in plan. The Gandak typically exhibits braided and meandering pattern. The river up to Tribeni Ghat near India-Nepal border exhibits meandering nature.

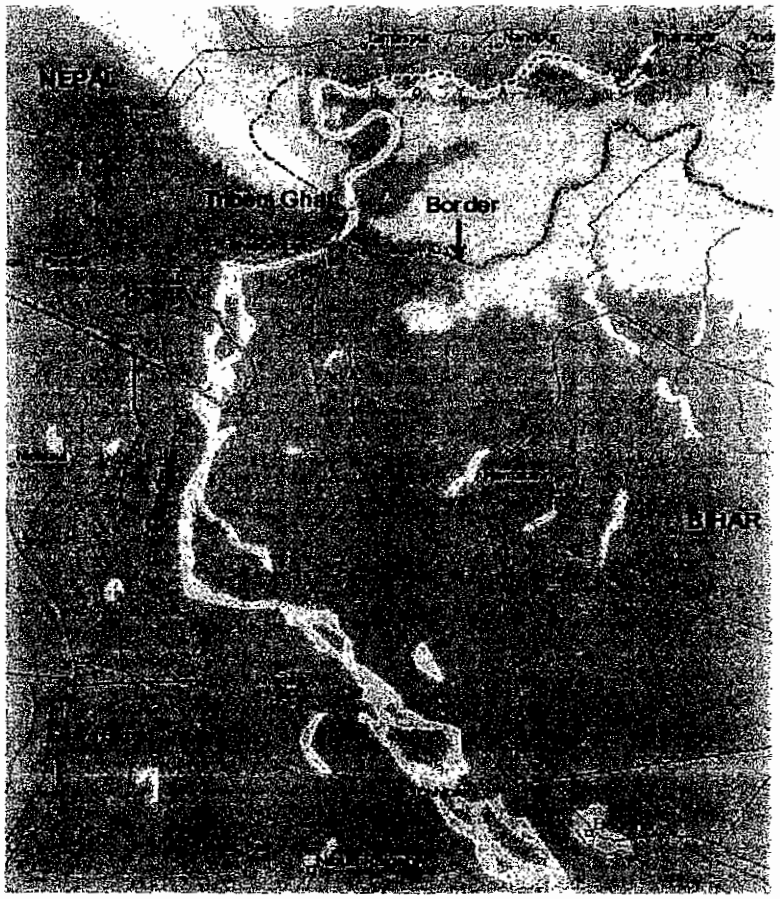


Fig. 4.10 : Meandering and Braided pattern of river Gandak near India-Nepal border

The river Gandak runs in plains downstream of barrage at India- Nepal border and exhibits braided pattern due to formation of islands and sand bars (locally known as sand chars) at the centre of the river. The sand chars are a product of the river itself and are composed of both bed load and suspended sediment. The islands with vegetation in green colour shown in satellite imageries are more or less stable and can be considered

as semi-permanent or permanent. On the other hand the sand bars without vegetation are unstable and change their location frequently. Out of the several channels, the river in general possesses one or two main channels and the rest are secondary channels. The main active channel is known as "thalweg" (deepest channel). Within the islands and sand bars/chars the active flow channel (thalweg) meanders from one bank to another bank as shown in satellite imageries.

The detailed processes responsible for tne formation of a braided river are still poorly understood. From the past studies, it appears that the braided channels occur in river systems having a relatively steep slope, an overabundance of bed load, or a combination of the two. In mountainous streams, slope is the dominant factor causing braiding, but in large alluvial river such as the Gandak bed load is the more important factor. The channels have a wide and shallow bed choked with sand bars. Water flows in a number of branching and reuniting channels, with one or two often serving as major channels. The mid-channel sand chars and sand banks shift rapidly with the ever changing flow regimes, and in consequence there is a day-to-day variation in channel configuration. The position of the main current in a braided stream is extremely unstable and causes the river course constantly to shift its position. There is also a distinct lack of tight bends between the sand chars, and only gently curved thalwegs exist within the wide and shallow channel. The Gandak exhibits most of these features.

4.5 WATERWAY DEVELOPMENT

4.5.1 Classification of Inland Waterway of India

In most of the countries where inland navigation is developed such as in Europe, China, Russia etc., the waterways have been classified in different classes depending on their physical characteristics and development potential in future. In India, classification of inland waterways does not exist. Although some basic data about depth and width of navigational channels are available based on the techno-economic feasibility studies conducted for some waterways. RITES have carried out most of the techno-economic feasibility studies on various waterways in India. The recommendations for different Inland Waterway systems in India and sub-continent by RITES are given in fairway design section.

Generally, with larger waterway dimensions bigger IWT vessels can operate resulting in lower shipping cost per tonne of cargo as compared to the shipping cost of smaller vessels. One of the important factors contributing to lower shipping cost by operation of bigger vessels is the improvement in power to load ratio, i.e. capacity of cargo carrying per unit of engine power. Therefore, every waterway should be developed to larger dimensions (depth and width of navigation channel) subject to the physical characteristics of the waterway. However, for developing a waterway to larger dimensions (in other wards waterway of higher class) additional investment would be required. Therefore, there would be an optimum

waterway class for a particular waterway whereby total cost to the system (i.e., increase in cost due to development work vis-à-vis reduction in shipping cost) is minimum. This optimum solution is required for each waterway and for this purpose classification of waterways would facilitate planning for the optimum class of the waterway.

The classification of waterways by Inland Waterway Authority of India is discussed below:

Various classes of waterways are as given below:

Class I: Waterways with navigable channel of minimum depth 1.2 m, bottom width 30 m, (in case of rivers) and depth 1.5 m, bottom width 20 m, (in case of canals) with minimum radius at bends 300 m, minimum vertical clearance 4 m, and horizontal clearance between piers 30 m, (in case of rivers) and 20 m, (in case of canals).

Class II: Waterways with navigable channel of minimum depth 1.4 m, bottom width 40 m, (in case of rivers) and depth1.8 m, bottom width 30 m, (in case of canals) with minimum radius at bends 500m, in minimum vertical clearance 5 m, and horizontal clearance between piers 40 m, (in case of rivers) and 30 m, (in case of canals).

Class III: Waterways with navigable channel of minimum depth 1.7m, bottom width 50 m, (in case of rivers) and depth 2.2 m bottom width 40 m, (in case of canals) with minimum radius at bends 700m minimum vertical clearance 7 m, and horizontal clearance between piers 50 m, (in case of rivers) and 40 m, (in case of canals).

Class IV: Waterways with navigable channel of minimum depth 2.0 m, bottom width 50 m, (in case of rivers) and depth 2.5m, bottom width 50 m, (in case of canals) with minimum radius at bends 800m, minimum vertical clearance 10 m, and horizontal clearance between piers 50 m, (in case of rivers) and 50 m, (in case of canals).

Class IV (A): Waterways on rivers only with navigable channel of minimum depth 2.0 m, bottom width 80 m, with minimum radius at bends 800 m, minimum vertical clearance 10 m, and horizontal clearance between piers 80 m.

Class V: Waterways with navigable channel of minimum depth 2.75m, bottom width 60 m, (in case of rivers) and depth 3.5 m, bottom width 60 m, (in case at canals) with minimum radius at bends 900m, minimum vertical clearance 10 m, and horizontal clearance between piers 60 m, (both in case of rivers and canals).

Class V (A): Waterways on rivers only with navigable channel of minimum depth 2.75 m, bottom width 100 m, with minimum radius of bends 900 m, minimum vertical clearance 10 m, and horizontal clearance between piers 100 m.

On all the above cases:

a) Minimum depth of channel should be available for 95% of year.
b) Vertical clearance over the waterway should be available in at least central 75% portion of each of the spans in entire width of the waterway during lean season.

The present classification of Inland Waterways in India by Inland Waterways Authority of India is shown below:

Classification of Inland Waterways in India

Classification of Waterway	Tonnage (DWT) of SPV (T)	Barge Units			Minimum Dimensions of Navigational channel in lean season				Radius at Bend (m)
					Rivers		Canals		
		Dimension of Single Barge (LxBxD) (m)	Dimension of Barge units (LxBxD) (m)	Tonnage of Barge units (DWT) (T)	Depth (m)	Bottom width (m)	Depth (m)	Bottom width (m)	
I	100	32 x 5 x 1.0	80x5x1.0	200	1.2	30	1.5	20	300
II	300	45 x8 x 1.2	110 x 8 x 1.2	600	1.4	40	1.8	30	500
III	500	58 x 9 x 1.5	141 x 9 x 1.5	1000	1.7	50	2.2	40	700
IV	1000	70 x 12 x 1.8	170 x 12 x 1.8	2000	2.0	50	2.5	50	800
V	1000	70 x 12 x 1.8	170 x 24 x 1.8	4000	2.0	80			800
VI	2000	86 x 14 x 2.5	210 x 28 x 2.5	4000	2.75	60	3.5	60	900
VII	2000	86 x 14 x 2.5	210 x 28 x 2.5	8000	2.75	100			900

SPV = Self Propelled Vessel L = Overall length
B = Beam width D = Loaded draft

4.5.1 Bridges on river Gandak

Four bridges exist across river Gandak, the horizontal and vertical clearances of these bridges are provided below in Table 4.6(a) :

Table - 4.6(a) : Details of bridges across Gandak river

Sl. No.	Location of bridge	Chainage (in Km)	Type of bridge	No. of spans	Clear span of bridge (in m)	HFL (in m)	Vertical clearance above HFL (in m)
1	Rewa ghat Road bridge(NH 102)	45.90	RCC cum Steel	--	--	94.73	1.0
2	Dumariya ghat Road bridge	218.90	RCC	--	--	--	1.2
3	Rewa ghat Road bridge (NH 102)	284.50	RCC	28+2	32.16	56.04	1.50
4	Hazipur Road Bridge (NH - 19)	326.10	RCC	-	26.00	--	5.00

4.5.3 Minimum clearance for cross structures

The vertical clearance of a bridge or any other cross structure comprises of the height of the fixed points of an empty vessel (air draught above the Navigational High Water Level (NHWL) plus overhead tolerance. The overhead tolerance is closely related to the safety of the vessel passing through such structures and is determined by several factors such as the wave variation, draught variation caused by vessels motion, back-water caused by piers, the errors of observed water level and vessel's draught etc.

Generally recommended overhead tolerances are:

For rivers in plains: 0.3 m for 100 / 300 T vessel
0.5 m for 500 / 1000 T vessel
1.0 / 1.5 m for 2000 / 3000 T vessel

For rivers in hilly And mountainous areas: 0.5 m for 100 / 300 T vessel
1.0 / 1.5 m for 500 / 3000 T vessel

For cross-structures like bridges the horizontal clearance between piers have been kept same considering waterways navigation is restricted to singleway navigation.

For fixing vertical clearance, the calculation of Navigational High Water Level (NHWL) is an important factor so as to reduce the cost of cross-structures without causing unacceptable effect to the shipping operation. This has been defined as under:

- *Rivers:* Highest flood level at a frequency of 5% in any year over a period of last twenty years
- *Canals:* The designed full supply level

As per Chinese Standards, minimum clearance of 11 m has been specified for Waterway of 2000 tons capacity. However, in European classification, the minimum specified vertical clearance is 9.1 m. The IWAI / MOST have specified a clearance of 10.0 m for 1000 T / 2000 T vessel; 7 m for 500 T vessel and 5 m for 300 T vessel.

4.5.4 FAIRWAY DESIGN

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 RITES are furnished below:

Depth of a Channel

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 maneuvering.
- 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 maneuver respectively.
- 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 maneuverability of the vessel.

Our experience in inland waterways in India and sub-continent (Nepal, Bangladesh and Myanmar) shows that the under keel clearance for free maneuverability 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
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 = 1.4 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

The above norms also at par with the National Waterway No.1 (Ganga-Bhagirathi -Hooghly river system) considering future development.

Slopes

The selection of slopes is in accordance with the soil characteristics of the bed and banks, width of the waterway etc. The adopted channel slopes are 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.

The guidelines for width allowance in bends proposed by Delft Hydraulics are described in **Table – 4.7 :**

Table 4.7: Guidelines for width allowance at bends

Quality of the cross-section	Minimum radius permitted	At keel level of up going loaded ship	At keel level of down coming unloaded ship.
Normal cross-section	R/L=6	0.5 L^2 /R	L^2 /R
Narrow cross-section	R/L = 4	0.5 L^2 /R	L^2 /R

The norms for desirable bend radius as per Dutch guidelines are 4 L for narrow and one-way sections and 6L for normal section (L – overall length of barge unit). The Chinese norms for minimum bend radii are in the range of 4L to 5L. The proposed bend radii for the present waterway are 5L.

The minimum radius of the adopted bend is 250 m. Wherever the radius of the bend is less than 4 times of the length of the designed vessel i.e. 4x32.0 = 128, additional widths are provided for free maneuverability of the vessel. The additional width provided in the present fairway system for a designed vessel is:

$\Delta b = L^2 /R = 32.0X32.0/128 = 8.0$ m

As per the design criteria discussed above the channel dimensions for the proposed waterway is as follows:

Table: Design channel dimension for 100 Tonnes capacity of vessel

Channel	100 tons vessel
Bottom width	25 m
Depth below CD (SLWL)	1.2 m
Side slopes	1:5

Discharge requirement for Navigation

The design discharge, available discharge and additional discharge required have been calculated through a model run on river Gandak at various gauge locations under case studies of design channel and furnished below:

Case Study for 100 tonnes Vessel

Hydraulic Particulars: Bottom Width of Channel = 25m, Depth =1.2 m & Side Slope =1:5

S. No.	*Location*	*Chainage (Km)*	*Design Discharge (in Cumecs)*	*Discharge Available (in Cumecs) (Minimum)*	Remarks
1	Valimiki Nagar	0	39.130	38 (Feb,97) - 135 (March,01)	Adequate Discharge is available
2	Dumaia Ghat	219	39.130	96 (Mar,2000) - 173(Mar,01)	Adequate Discharge is available
3	Lalganj	307	39.130	70 (March,97) - 204 (March,02)	Adequate Discharge is available
4	Hazipur	326	39.130		

From the above model run for adequacy of discharge it is clear that the design channel under case study for 100 tonnes vessel having channel dimensions of bottom width of 25 m, depth of 1.2 m below CD will meet the requirement.

4.5.5 Dredging of Navigational channel

The analysis of hydrological data on river Gandak from Valmikinagar to Hazipur has indicated the availability of water level above the chart datum level (Standard Low Water Level) under natural conditions for navigation purpose. The availability of depths below chart datum level together will provide the availability of depths for navigation.

The dredging quantities for the above design channel have been worked out based on the bathymetric surveys carried out. The dredging quantities for different option of channel are as follows:

Table 4.8 : Dredging quantities for designed channel

Option of channel	Dredging quantity in million cu m
Bottom width 25 m & Depth: 1.2 m (100 tons vessel)	1.88

Dredgeability of the bed material

The selection of a suitable dredger is however, depends upon the type of material to be dredged and other morphological and physical constraints in a specific waterway.

The results of the sieve analysis of the riverbed material of river Gandak from Gandak barrage at Tribeni to Ganga confluence at Patna are in **Table - 4.9:**

Table - 4.9: Type of bed material for different places of river Gandak

Sl. No.	Location	Type of Bed Material			
		Clay(in %)	Silt (in %)	Sand (in %)	Gravel (in %)
1	Triveni Ghat	13	25	62	Nil
2	Dumaria Ghat	22	47	31	Nil
3	Hazipur	11	48	41	Nil

The above results indicate that the bed material is composed of mainly silt and sand.

Selection of dredging equipment

The capital dredging is usually carried out with a cutter-suction dredger whereas maintenance dredging will be carried out with a trailing suction hopper dredger. There are various types of dredgers available in the market viz., suction dredger, bucket dredger, grab dredger, backhoe / dipper dredger, water injection dredger, pneumatic dredger etc. While most of these dredgers are ideally suit for sea conditions to dredge harbour and approach channels, the selection of a dredger for inland waterway is rather critical due to various mobility factors, seasonal variation of water levels (floods / dry season) and shallow depths.

The cutter suction dredgers having conventional centrifugal pumps or modern jet pumps will be more effective to dredge out the material. In a

cutter-suction dredger or CSD, the suction tube has a cutter head at the suction inlet, to loosen the bed and transport it to the suction mouth. The cutter can also be used for hard consolidated type of bed. The dredged soil is usually sucked up by a wear resistant centrifugal pump and discharged through a pipe line or to barge.

Alternately the modern amphibious cutter suction dredger is also suitable for the Gandak waterway. The amphibious dredger can be road transportable, able to unload itself from the truck / lorry and can dredge rivers / canals having depths of 2.0 to 3.0. These dredgers can walk into the river and even in dry portions of the river during lean period. The dredgers can also be disassembled for transportation to other locations. These dredgers are indigenously available in India. Specifications of typical dredging equipment suitable to the Gandak waterway are indicated below:

- Length overall : 20 m
- Width : 4.1 m
- Dredging depth : 6 m
- Suction pipe : 325 mm
- Discharge pipe : 300 mm
- Installed capacity : 350 k.w.
- Cutter power : 50 k.w.
- H.P : 500 BHP
- Draft : 1.0 m
- Rated output with 500 m pipe line : 200 cu m / hour

The low draft amphibious dredgers with bucket arrangement to remove the material are also ideally suitable. Specifications of typical amphibious bucket dredger are given below:

- Length : 9.05 m
- Beam : 2.5 m
- Draft : 0.5 m
- B.H.P : 63 BHP
- Weight : 7.5 tons
- Digging depth : 2.75 m over stern
  : 3.75 m over side
- Reach : 7 m
- Bucket capacity : 200 litres

In the case of bucket dredger, hopper tugs / barges are required to transport the material to disposal grounds. The type of dredging effort (either floating or mobile shore based) will, however, depend on the detailed investigations on the availability of indigenous equipment, disposal area, and environmental impact.

4.6 SHORT TERM RIVER CONSERVANCY WORKS IN GANDAK

In planning of short term river conservancy works, there are no uniform rules of procedure due to a variety of factors, which vary considerably from river to river viz., size of the river, geological formation of bed and banks, mobility and migratory tendency of the river course, quantity and character of sediment in suspension and on bed, low water discharges, extent of channel meandering and bank caving, sources of sediment load, navigation requirements etc. Under such circumstances, the first step in planning consists in dividing the river into suitable reaches. After determination of low water profiles, the minimum navigable depths should be drawn on the hydrographic charts to provide guidance for suitable measures to be undertaken. Before taking up regulation of an entire river stretch, it is desirable to restrict to certain test stretches in the first instance to study the effectiveness so that the same could be suitably implemented in other reaches for better-cost control.

The descriptions of the existing features of the waterway as supported by the hydrographic survey drawings show that there are number of shoals on river Gandak. These shoals or sand bars are pronounced below the confluence of tributaries / Nallas / streams which limit the depths in the navigation channel. The details of prominent shoals are provided elsewhere. These shoals reoccur during every lean season as the confluence streams carry silt and get deposit at the mouth. Hence river-training measures required to maintain the navigable channel particularly during lean season when the navigable depths are reduced to minimum.

Bandals are proposed at the shoal areas to close a minor channel and indirectly improve the navigable depths in the main channel. They are vertical mats or screens of bamboo supported on bamboo poles driven into the bed. These are generally immersed from the surface of water by a third to a half of the water depths. They generally form angles of 30^0 to 45^0 with the surface currents that they are expected to divert towards the navigable channel.

The Bandals have the secondary effect of encouraging deposition of the rivers' bed load thereby indirectly deepening the navigable channel. Bandals are built in composite units; each about 20 m in length nearly continuous and spaced about 25 m apart formed with bamboo screens called mats. These mats are fixed and held up in position by vertical bamboo poles.

A typical design sketch of the proposed Bandals is shown in Fig.**11.** They are generally set at mean falling stage when the depths are in the range of 3 to 3.5 m. The minimum depth when a bandal construction is taken up is generally 1.8 m to 2 m. Actual layout and orientation of the bandals can be decided at the time of execution of the short term river conservancy works depending upon the direction of currents, depth of flow, size, shape and location of sand chars etc.

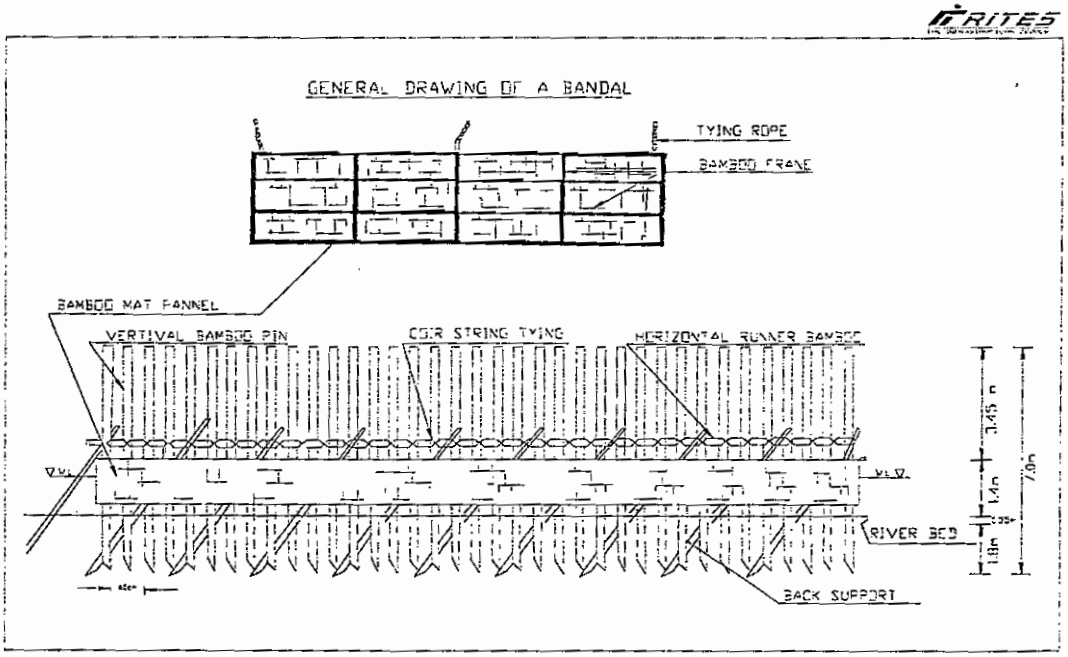


Fig. 4.11: A typical sketch of proposed Bandals for short term river conservancy works

Improvement of the navigable depths at the confluence of streams with river Gandak:

Formation of shallow areas is generally noticed at the mouths of the streams join with main Gandak river. The sand bars are formed below point of confluence of streams. The formation of sand bars at these locations may recur periodically and intensity of bars depends upon the silt carrying capacity of the joining streams. Generally, dredging is the only solution in such reaches, since formation of bars below tributary mouths is inherent in the nature of rivers. Thus, a combination of Bandalling and Dredging is proposed at these locations.

4.7 Aids to Navigation (Channel Marking)

The navigational channel goes on shifting due to change in river morphology depending on season with untrained rivers. On this kind of waterway, one of main problem is safety and ease of traffic. This can be achieved by providing proper marking to indicate where it is safe to navigate and where are shallows, snags etc. The channel marking is also very important for the safety and speed of navigation because in the inner bends of a curved channel in the river the current velocity is much lower than the outer bend. If proper markings are provided, ships/vessels sailing upstream will take the inner bends with relatively less head current, thus making better speed. The ship sailing downstream in the outer bend will get the advantage of current. The main approach of the problem of marking of shifting nature of navigable channel is to have the simple marks which could be shifted easily with less manpower and equipments.

As per the international conventions, the aids to navigation are a device external to a craft, designed to assist in determination of position of the craft or a safe course or to warn of dangers. Whereas, navigational aids are the equipments on board a ship.

CHANNEL IDENTIFICATION

The course of the navigable channel is not constant due to varying water level in different season. Due to this, it is necessary to identify the navigable channel at regular intervals for proper marking. Periodic interval longitudinal soundings will identify the navigable channel.

NAVIGATIONAL CHANNEL MARKING

IALA (International Association of Light house Authorities) system for maritime navigation and the SIGNI system (Signs and Signals on Inland Waterways) for inland waters are used for standardized beconage, buoyage and marking.

These two systems are such that the transition from maritime waters into inland waters poses no problems.

Uniform system of buoys and Shore marks for inland waterways in Asia and far-east as recommended by the inland waterway sub-committee of ESCAP at its third session in 1955.

For the waterway with shifting channel the demands are:

- One marking system
- The system must be logical so as to diminish risk of mistakes.
- The system must be cheap as possible but, of course, sufficient.
- The system must be maintainable.

AIMS OF THE AIDS TO NAVIGATION

- To determine the position of the vessel.
- To keep the vessel in the channel.
- To keep away from shallow water wrecks and other obstacles.
- To give notice of certain indication for the safety of the vessel.
- To be informed about traffic regulation on the waterway.
- To avoid collision with other vessels.

CLASSIFICATION:

The aids to navigation can be classified under difference scope of reference.

a) Number of information on each mark
   - Permanently available information like buoyage, beacons, light house.
   - Information in charge – signals at locks and bridges.

b) Legal reference

- Indicative Signs
- Mandatory Signs
- Prohibitory Signs
- Restrictive Signs
- Informative Signs

c) Technical reference

- Visual
- Audible
- Radio

In order to keep the system logical and cheap, the appreance of the marks must indicate at which side is. The appreance of the marks are three fold in shape, colour and number. For the two sides of the channel two different appreance are kept.

Appreance	Left Side	Right Side
Shape	Sharp/Slim top	flat wide top
Colour	Green or Black	Red
Number	Odd	Even

The most simple means of river improvement for the navigation purposes are the marking of the main navigable channel to adopt navigation as far as possible to the prevailing river conditions. These results in marking of the channel at frequent interval by shifting of the marks already provided depending on the water depth, current and channel width etc.

MATERIALS

In the case of temporary marks, commonly bamboos of size 23 cms circumference and 7 mts. long are used with bamboo mats suitably white washed by lime. The bamboo mats are tied with coir rope.

For making a snag, 16 liters empty tins suitably painted are laid as buoy tied with rope and anchored with stone block. Efforts must be made to salvage them after the lean season i.e. before the floods so that they are not navigational hazards.

In case of buoys, FRP construction is preferable due to light weight no wear rust, little resale value and less maintenance. Shore marks/ beacons could be either of steel towers or of concrete poles.

The inland waterways have varying morphological conditions which required adapt ion of various aids to navigation taking into consideration the multiple factors affecting the design laying and maintenance of such aids.

TYPES OF BUOYS AND SHORE MARKS:

For the inland navigation, buoys and beacons may be of a smaller and simple type. Dub buoys where day navigation exists and wooden shore marks fixed on concrete or wooden stakes or trees will be usually sufficient to aid the master of the vessel. These aids should be covered with reflecting material such as skotchlite tape or fluorescent paint so that they can be spotted at night with the help of search light. The salient features of a buoy are as follows:

Diameter	915 mm
Focal plane Height	1160 mm
Height Overall	1980 mm
Weight	170 Kg.
Reader Reflector	Small
Batteries	Disposable
Diameter of Chain	12.5 mm
Sinker Weight	136 kg.
Maximum Current	11 km/hour

The laying of buoy at the right place with proper anchoring arrangement is of great importance as otherwise the buoys are likely to get shifted out of its right place. This is not acceptable for the shipping. The shape of the buoy, anchor chain and anchor are to be designed properly to withstand the current. In most of the rivers, floods carry lot of silt, waterweeds, tree branches etc. They get entangled with anchor chain, including enormous strain on the anchor. The buoy and anchoring system are normally designed for current speed up to 6 knots i.e. 11 km/hr.

THE RIVER GANDAK:

The natural condition of the river Gandak makes it necessary that the navigational channel be marked in a clear way to enable the navigation in a relative ease and with confidence. Such markers and other devices used for the purpose of safe and efficient navigation are called aids in navigation.

A vessel approaching a restricted navigational channel must be able to see and distinguish clearly, easily and well in time the position and "line" of the channel in proper perspective before entering it and to stay accurately within the narrow/restricted channel thereafter. Further the vessel should be warned of shallow waters; wreck sand other hazards and is able to receive information on various navigation and safety aspects and traffic regulations etc. The channel can be distinguished by the marking which demarcate both of its edges. As a further measure to facilitate the navigation in the river, a series of inter-connected transits are sometimes laid so that the vessel can be navigated along the channel more precisely.

Thus a proper navigation aids scheme in narrow channels is usually a dual arrangement with buoys or other type of markers delineating the edges of the channel and a series of transits (each consisting of a front and backing mark) which gives an accurate visual delineation of the navigational; track. It may not be out of place to mention here that each transit defines a straight line, which has only length but no width. Obviously, no vessel or barge can navigate so accurately due to the intrinsic limitation of its steering systems and capabilities. Moreover, at turns where the channel is curved, following transits is well high impossible. Further, in situations where an inward and outward bound ship / vessels are navigating the same section of the channel, only one of them can use the transit (to port or starboard) a vessel lies when not exactly on it. Thus it is true to say that transits are not a substitute for channel marking or buoyage. On the other hand where the channels are deep and wide only marking at edges may be sufficient and transits may be dispensed with. At the same time, transits increase to a substantial degree the safety factor and level of confidence of the navigator when navigating a more or less restricted channel due to their high degree of accuracy with which the navigator is able to determine his position virtually from minute to minute. Ideally, transits marks should be erected at both ends so that these can be easily visible to the navigator whether he is proceeding upstream or downstream. However occasionally this is not possible and channel marking may only be done on one side of the channel.

Generally, buoys are laid to mark the boundaries/edges of the channels because the erection of fixed marks or structures on the sea or river bed, under water, is more expensive as well as become hazardous to navigation in case ship/vessel going out of control (due to their close proximity to the navigational channel. In wide channels fairway buoys are also laid in the middle of the channels. The designs of buoys and their riding and ground tackle is however such that there is a certain amount of play in the exact position of the buoy. During floods in the river very strong currents are prevailing, there may be a significant difference in the position taken up by the buoy in flood and dry seasons. The amount of variation would depend partly on the length of its riding chain which depends, in turn, upon the depth of water and the strength of currents experienced. Further, buoys may (and often do) drag out of position or may break from their ground tackle and drift away altogether for various reasons. Thus, buoys are by and large the least reliable of navaids and mariners are therefore advised not to place implicit reliance on them.

While visibility conditions may differ from time to time and season to season and as between day and night, a practical distance between two consecutive channel markers/buoys in riverine channels would be approximately, 2-3 kms. This would insure their being sighted and "recognized" well in time by navigators in normal visibility conditions.

There are a number of systems of navigational aids and the better known of these are in use in coastal and near shore waters. For obvious reasons these have, therefore, been unified by International Conventions. The principal systems of maritime buoyage are "cardinal" and "lateral" systems

and there is another version of these as adopted in coastal waters of the USA.

Modern navigation aids include installation of radar, echo sounder, radio telephone abroad vessels. Information about rivers, water levels are available in pilot books for rivers with well developed navigation. The Hugli is an example in West Bengal, where the "Tide Tables for the Hugli River" are published every year by the order of Surveyor General of India. Navigational Aids installed along the channel appear in this priced publication.

Navigational Aids broadly include:

- Information on water levels
- Information on Charted Depth referred to a chart datum on survey charts.

PROBLEMS SPECIFIC TO USE OF CONVENTIONAL NAVIGATION AIDS IN RIVER GANDAK

There are number of special problems which mitigate against the adoption and use of conventional navigational aids to demarcate the navigational channel of the Gandak River. Some of these are mentioned below.

WATER LEVEL FLUCTUATIONS AND HIGH CURRENT VELOCITIES

The variation in water level is high between lean and flood season. Depending on the type of bank lines (high, low etc.) this also leads to a considerable amount of horizontal water spread so that a channel which appears to be near a bank in the dry season may seem quite far away in the flood. The velocity during flood season increases to very high. During peak flood the water velocity crosses the permissible limit, which occur once in a while for a short duration and navigation during this period is hazardous. Peak flood period for maximum 10 days in mid August, navigation would be suspended during this period.

For use of conventional navigational aids these conditions create various difficulties. Buoys are moored to the river bed by means of some form of anchor and a long length of chain. This chain is kept at 2 to 3 times the depth of water at the buoy station for current velocities usually found in the navigational channels. This requires long chain so as to ensure that the buoy does not drag out of position or go adrift altogether. Even so, the possibility that the buoy will drag or part in floods cannot be ruled out due to the very high current velocities experienced. Apart from the high cost implies that very long chain may lie in a heap on the river bed and pose other problems in the dry or low water season when the proper marking of the channel is of critical importance. Also, at this stage the water depth will be low and long chain will allow too much of free movement to the buoy, especially in the context of the narrow channel which is marked. The buoy may thus take up a position which may be more or less incorrect or even misleading.

As for fixed markers, beacons and the like, using them at shallow edges of channel is sometimes resorted to. However, so as to visible at all river stages, these structures will have to be very tall and sturdy as otherwise they will go under water in floods and become dangers to navigation rather than aid.

UNSTABLE CHANNEL:

For the night navigation the lighted navigation aids are required. The lighted navigational aids are, much costlier and difficult to maintain. Besides due to very nature of night conditions, importance of proper station – keeping of navaids and their proper functioning is more critical. When such a difficult job has to be done day and night over a vast river distance of about 338 Km.(From Bhaisolotan Barrage to Confluence of Ganga near Patna (Hazipur)), the requirement in terms of manpower, hardware; inventories, surveillance, quick response arrangement etc. become extremely high, involves substantial capital and maintenance expenditure.

It is therefore it is recommended indigenous or "country type" navigational aids in river Gandak in place of conventional type navaids. However specific locations may be provided with conventional navaids wherever it is necessary. The indigenous or country type navaids are prevalent in use in India for decades. These are made from locally available materials which are easy to erect, cheap and plentiful enough. These are successfully used in river Brahmputra since long back. A brief description and sketches of indigenous system presently in use on the Brahmaputra are given in figure.

- In considering and recommending a proper response to this difficult situation consideration needs to be given to comprehensiveness, economy, ease of handling and erection etc without compromising the safety of navigation. It is felt the system should include the following features.
- It should be a simple, mainly visual system and useful for all types of vessels with no special on board equipment or installation.
- It should rely mainly on shore based marks rather than floating markers, such as buoys.
- As for as possible, marks should be placed on high/stable banks rather than on sand dunes or chars.
- Where placement of marks on chars is unavoidable they should so made as to pose no danger in the event of their coming into collision with a passing vessel during high river stage.
- The material to be used should be cheap and available locally.
- All marks, whether floating/shore based should be of uniform colour and shape and clearly distinctive. They should not create confusion with other shore based marks e.g. road signs etc.
- As for as possible, system should be as per norms of International conventions or at least should not create any confusion.
- The system should be capable of being used for night navigation.

- The system should be comprehensive enough so as to be able to be used in future situations resulting from a more highly developed transport & industrial/urban environment.

For dealing safely with all navigation situations in a river such as the Gandak, marks to convey the following types of information or instructions may be envisaged.

The location of best navigation channel with relation to the left or right bank.

- The location of channel with respect to a mid ground such as islands/shoal.
- The point of departure and heading where channel crosses from one bank to another.
- Bridge spans under which a vessel are required to pass and spans which are closed for navigation.
- Sectors where overtaking is prohibited.
- Sectors in which meeting is not permitted.
- Sectors where anchoring is permitted (or not permitted).
- Instructions to go one side of the channel or another.
- Indication of channel closure.
- Marking of special areas .e.g. Anchorages, waiting areas etc.

However, number of other measures that are required to provide safe navigation is given below:

INSPECTION OF CHANNEL:

The responsibility of the inspection party may be given as follows:

- Gathering channel information and as far as necessary, transmitting the information to vessel master.
- Marking the best available channels for navigation.
- The prediction of available depths some days in advance is required to enable the operators to load the vessels exactly to the permitted draft.

RIVER MAPS:

River maps to be published above every 5 years based on the information collected by the inspecting party and surveys. Chainage system has to be indicated in the chart to enable the operator to know his location in the waterway. It should contain prominent structures, trees, temples etc. on firm bank. The chainage pillars could be very 5 kms or so depending on the location and also nearer to the navigable channel to enable the master to see.

RIVER NOTICES:

River notices should be made available to vessel operators at regular interval with following information:

- Water levels of the main Gauge stations and rise and fall at those locations.
- The available depth for each particular section of the waterway.
- Information of changes in channels and marking system.
- Other information about location of dredging wrecks etc.

TRAINING:

Master and crew of the buoy laying vessel should be trained in handling, laying, picking up, relaying of buoys regularly in order to affect economy in the overall cost.

The operators in the shifting river should be conversant with the marks for the safety of the vessel. The Masters and deck hands are to be trained. After considering the problems and the various riverine navigation aids systems in use in countries where inland navigation is well established we feel that the system adopted by the European Economic Commission, known as "Signs and Signals on Inland Waterways" or "SIGNI" could be adopted in river Gandak. This system is simple, yet comprehensive and hence preferable to the so-called "Uniform system of buoys and shore marks for inland waterways in Asia and far-East". Adopting the more comprehensive "SIGNI" system at this stage will ensure long lasting continuity as developments, not only in IWT but also on-shore, call for markings to deal with more and more varied situations. The system also has a comprehensive set of lights and their combinations for night navigation. The description of the SIGNI system is available from the Inland Transport Committee publication, 1982, brought out by the Economic Commission for Europe, United Nations, and New York.

There are some situations or positions which can best be marked by floating marks i.e. buoys where proper on-shore marking is not feasible. In such situations use of buoys may be unavoidable. SIGNI systems also incorporate buoyage. However uses of buoys are kept to be minimum to keep the maintenance of navigation aids and cost thereof within reasonable limits. The buoys can be used for low river stages and have to be withdrawn when the river starts rising.

So far as shore marks are concerned, these may be made mainly of timber, bamboo or both, together with Hessian cloth etc. Many types are available with various authorities. The tall marks are required, especially for erection on main bank mild steel tubular or telescopic marks may be used. As for as possible ,top marks of various shapes should be three dimensional objects & not the flat board as the latter are apt to turn in

direction due to wind pressure. Thus a drum can serve in place of a rectangular top mark, a cone in place of triangle, a double cone as a diamonds etc. The SIGNI system top marks mainly use shapes and /or colours to convey the standard meanings.

The vital importance of night navigation is fully appreciated. Introduction of night navigation along the Gandak River could nearly double the productivity of fleet and the infrastructure thus having a highly beneficial effect on water transport economics on the river Gandak. The SIGNI system covers signs and signals for both day and night navigation will be operational (and of higher cost) rather than systemic.

One of the problems of lighted aids to navigation is the failure of lights. Such failure may be due to malfunction, normal wear and tear or even theft and vandalism. Due to the very long stretch of the river Gandak and the relative remoteness of the various aids, detection and correction of such failures is so problematical as to defy a fool proof but economical solution. Considering the great difficulties and dangers due to such failures to the water borne traffic, a second line defence should be provided for such contingencies. To overcome to this problem, we recommend to use Retro reflective paint or fluorescent paint or Scotchlite type fluorescent tape on shore marks on the one hand and for the mandatory requirement that any vessel underway between sunset and sunrise shall be equipped with an efficient search light. It may not out of place to mention here that very powerful search lights were carried for similar purpose by all vessels ply in the waters of the sunder bans.

Proposed Aids to Navigation System on River Gandak

The system and different type of Navigation Marks proposed 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 grounds between the navigational channel, bifurcated channels and isolated dangers in the middle of the navigational channel.
- Shore Marks
  - Bank wise Marks, to indicate the channel at points where it approaches a bank.
  - Crossing Marks, to indicate crossings 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 vessels in one-way or sequential passage or to prohibit navigation.
- Marks on Bridges, to indicate the passage through bridges.
- Depth Indicator marks, to indicate shallow areas ahead in the navigational channel.
- Width Indicator marks, to indicate the narrow stretches ahead in the navigational channel.
- Short term River conservancy Marks, to indicate the ongoing short term river conservancy works in the river to the navigators.

The terms used as Left and Right shall respectively mean to the left and to the right of an observer facing downstream.

The detailed Sketches and description of the navigational marks proposed to be erected in river Gandak has been given in Figure 2 (in 4 sheets).

Locations:

Shoals/Sand Chars

The Aids to navigations has to be provided at various shoals present in river Gandak creates hazards to safe navigation to vessels/ship plying in the river. The details of some prominent shoals that encountered in the navigation channel of river Gandak and have to be properly marked for early warning to navigators are listed in the **table 4.10** given below.

Table 4.10: Details of Shoals along river Gandak

S.No.	Chainage (in Km)		Length(Approx) (in M)	Remarks
	From	To		
1	0.00	4.50	4500	Due to bends and large numbers of tributaries
2	6.90	9.60	2700	Shoals & bars are
3	11.00	16.80	5800	Formed in
4	17.00	38.00	21000	The river
5	54.00	79.00	25000	
6	81.00	87.00	6000	
7	96.50	98.50	2000	
8	100.50	112.50	12000	
9	129.00	150.00	21000	
10	159.00	166.00	7000	
11	178.00	198.00	20000	
12	201.00	204.00	3000	
13	214.50	218.00	3500	
14	231.00	234.00	3000	
15	241.60	252.00	10400	
16	260.00	262.00	2000	
17	270.50	273.00	2500	
18	286.00	287.50	1500	
19	288.50	291.00	2500	
20	296.00	300.80	4800	
21	300.00	300.25	250	
22	307.50	309.50	2000	
23	329.50	335.00	5500	

167.950 m

Most of the Shoals are formed in the navigational channel of river Gandak at the locations of tributaries/streams/Nallas joining with the river. Which are formed due to sediment load carried by tributaries etc.

Near to Shoal areas the navigational channel has to be fully demarcated by the channel marking either country type navigation aids or sufficient numbers of buoys are to be provided for safe and efficient navigation.

Shallow Areas:

The shallow areas present in the river Gandak have been identified and are provided in the above table. These areas are to be dredged out for sufficient depth or properly marked for safe navigation.

The navigation aids – Proceed with caution / shallow areas has to be provided and narrow channel areas are properly marked for speed limit and no overtaking zone. The above data is based on hydrographic survey conducted in November/December, 2008, however before installation of navigation aids a detailed hydrographic survey is required and same should be periodically repeated to access the actual depth in future as river carries considerable amount of sediment load from its catchment areas/distributaries joining it. The transported sediment load has 90% fine materials which are deposited in the river in due course of time, by virtue

of the river behavior. The depth given in above table is charted depth i.e. reduced to chart datum. The shallow areas given in the table has to be marked properly for safe navigation. The navigation aids – Proceed with Caution/ shallow area has to be provided and narrow channel areas are properly marked for speed limit and no overtaking zone. As mentioned above the above data is based on Surveys conducted during April/May, 2008, however before installation of the navigation aids a detailed hydrographic surveys is required and same should be periodically repeated to access the actual depth in future as river carries considerable amount of sediment load from its catchments areas/distributaries joining it .The transported sediment load has 90% fine materials which are deposited in the river in due course of time, by virtue of this behaviour river changes its course year by year.

The bends are dangerous areas for safe navigation, as the line of sight is not clear in those areas and because of poor visibility there is always possibility of head on collision between the ships/vessels coming from opposite directions. These areas should be properly marked for bends and speed restriction to avoid any accident.

The bends present in the main channel of the Gandak River based on hydrographic survey conducted during April/May, 2008 by RITES from Bhaisolotan to Sonpur has been found out from the Hydrographic Surveys and presented in **table 4.11.**

Table 4.11: The details of critical bends

S. No.	Chainage (in Km)	Radius (in m)
1	2.000	187
2	16.250	242
3	26.250	186
4	31.000	257
5	32.000	175
6	33.250	120
7	36.500	124
8	36.750	189
9	38.750	109
10	40.000	196
11	44.000	87
12	46.750	210
13	49.000	217
14	50.500	258
15	55.000	75
16	58.750	158
17	59.250	162
18	70.000	220
19	70.750	93
20	72.000	214
21	75.750	268
22	83.500	183
23	85.250	214

S. No.	Chainage (in Km)	Radius (in m)
24	86.000	147
25	86.750	195
26	90.250	246
27	93.000	183
28	93.500	211
29	103.500	143
30	110.750	233
31	131.500	94
32	133.500	197
33	135.750	97
34	138.750	107
35	139.250	148
36	141.500	143
37	143.500	175
38	144.500	192
39	145.250	38
40	145.500	74
41	146.300	54
42	146.750	104
43	147.000	42
44	148.000	46
45	150.750	84
46	155.000	90

S. No.	Chainage (in Km)	Radius (in m)
47	155.500	60
48	157.250	206
49	161.250	146
50	168.000	272
51	171.750	80
52	173.500	75
53	174.500	93
54	177.500	212
55	182.750	67
56	186.250	155
57	193.750	47
58	198.500	53
59	200.750	48
60	201.750	118
61	202.250	98
62	206.250	168
63	210.000	230
64	213.250	138
65	216.500	101
66	219.000	64
67	224.500	98
68	225.750	149
69	229.500	48
70	231.000	52

S. No.	Chainage (in Km)	Radius (in m)
71	234.500	76
72	238.500	57
73	239.500	82
74	243.750	74
75	248.250	88
76	252.250	52
77	253.000	39
78	256.000	89
79	257.750	106
80	260.750	95
81	282.500	57
82	291.000	77
83	295.750	41
84	299.500	159
85	303.750	67
86	307.250	53
87	307.750	109
88	315.750	191
89	316.750	111
90	323.750	77
91	326.000	79
92	329.750	95
93	332.750	248

Bifurcation of Channel:

The bifurcation of channel into two or more channels /streams has been recommended for proper marking i.e. Bifurcation Marks are to provided in advance to warn the navigators. The major bifurcations present in the river from Bhaisolotan Barrage to Confluence of Ganga (Hazipur) has been identified and given in **Table 4.12.**

Table 4.12: Locations of channel bifurcation

S. No.	Position		Remarks
	Easting	Northing	
1	$85^0$10'48"	$25^0$39'00"	Bifurcation Marks are to be provided at the locations where channel is bifurcating in two or more than two streams, in advance to the Navigator and route to be followed.
2	$84^0$57'12"	$26^0$06'36"	
3	$84^0$55'12"	$26^0$11'24"	
4	$84^0$55'12"	26^{01}2'36"	
5	$84^0$57'00"	$26^0$06'36"	
6	$84^0$48'36"	$26^0$18'36"	
7	$84^0$50'24"	$26^0$16'12"	
8	$84^0$40'12"	$26^0$18'30"	

Table 4.12: Locations of channel bifurcation

S. No.	Position		Remarks
9	84^{0}34'12"	26^{0}30'00"	
10	84^{0}21'00"	26^{0}40'48"	
11	84^{0}25'48"	26^{0}37'48"	
12	84^{0}16'12"	26^{0}51'36"	
13	84^{0}09'00"	27^{0}00'00"	
14	84^{0}14'24"	26^{0}52'48"	
15	84^{0}00'36"	27^{0}04'48"	
16	84^{0}06'00"	27^{0}00'12"	
17	84^{0}8'24"	27^{0}00'00"	
18	84^{0}10'12"	26^{0}58'48"	
19	83^{0}58'12"	27^{0}11'24"	
20	84^{0}00'00"	27^{0}07'12"	
21	84^{0}00'36"	27^{0}04'36"	
22	83^{0}54'36"	27^{0}13'48"	
23	83^{0}51'00"	27^{0}16'48"	
24	83^{0}57'36"	27^{0}11'48"	
25	83^{0}50'36"	27^{0}18'36"	
26	83^{0}51'00"	27^{0}16'12"	
27	83^{0}54'36"	27^{0}13'48"	

RITES
THE INFRASTRUCTURE PEOPLE

Navigational Aids

1. Lateral Marks: To mark the left and right sides of the route to be followed.

(a) Left:

Colour: White

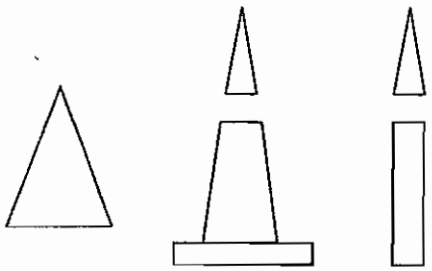
Shape: Conical Pillar or spar

Top Mark: Single,white cone,point upward

Light:

Colour: Green

Rhythm: Single flashing



(a) Right:

Colour: Red

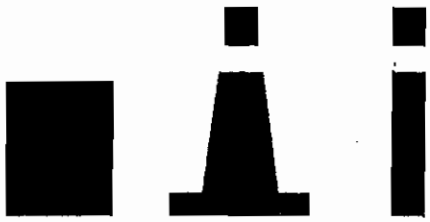
Shape: Cylindrical (Can) Pillar or spar

Top Mark: Singlered cylinder (can)

Light:

Colour: Red

Rhythm: Single flashing



2. Bifurcation Marks: To Mark middle ground,bifurcated channels and isolated dangers in mid-channels.

Colour: Red and White Vertical Strips

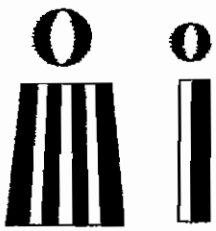
Shape: Truncated Cone , Pillar or spar

Top Mark: Single Sphere with Red and White Vertical Strips

Light:

Colour: White

Rhythm: Group Flashing flashing with three flashes



3. Shore Marks: To Indicate the channel at points where it approaches a bank.

3.1 Bank- Wise Marks:

Left Bank Marks:

Colour: White

Shape: Post with Top Mark

Top Mark: Conical

Light:

Colour: Green

Right Bank Marks:

Colour: Red/White top mark red post

Shape: Post with Top Mark

Top Mark: Cylindrical

Light:

Colour: Red

Rhythm: Single Flashing

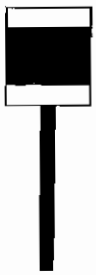


Fig 4.12 Typical Schematic Sketch of Proposed aids to Navigation

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4. Crossing Marks: To indicate crossing & alignment of the channel from one bank to another.

Left Bank:

Colour: White top mark , White/Black Post.

Shape: Post with Top Mark

Top Mark: Two squares facing upstream & Downstream.

Light:

Colour: White

Rhythm: Morse Code "A"

Right Bank:

Colour: Red top mark , Red/White Post.

Shape: Post with Top Mark

Top Mark: Two squares facing upstream & Downstream.

Light:

Colour: White

Rhythm: Morse Code "N"

5. Marks of Prohibited Areas: To indicate no permission of entry.

Colour: White with Red tborder & slant, and black ship figure.

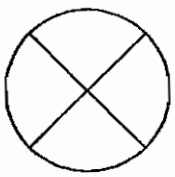
Shape: Circular

Light:

Colour: Green

Rhythm: Quick Flashing Light.

6. Marks on Bridges: To indicate passage through Bridges..



No Pass

Pass

Pass with attention.

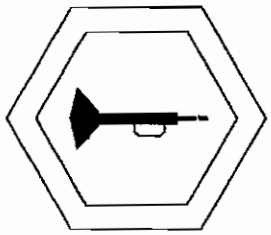
Fig 4.12 Typical Schematic Sketch of Proposed aids to Navigation (Cont.)

7. Sound Signal Marks:

To indicate use of horning or other sound signal.

Colour: White board with black horn figure.

Shape: Hexagon



Light:

Colour: Green

Rhythm: Quick flashing light.

8. Marks for Traffic Control: To upbound or downbound vessels in oneway or sequential passage or to prohibit navigations.

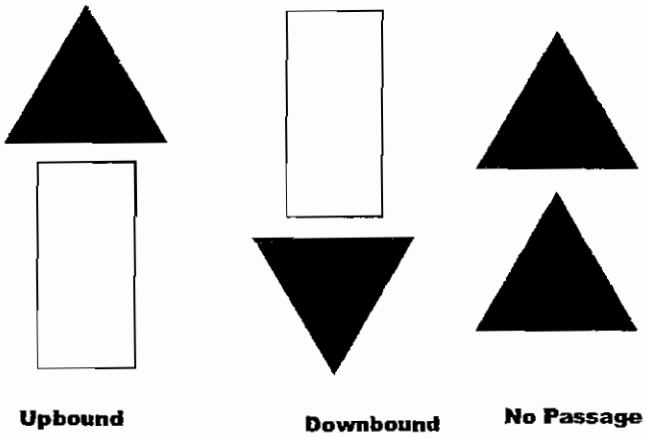


Fig 4.12 Typical Schematic Sketch of Proposed aids to Navigation (Cont.)

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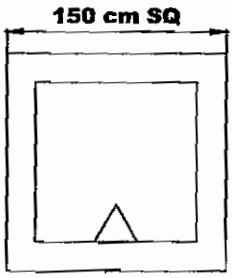
9. Depth IndicationMarks :

To indicate the shallow areas or where

Depth Of Water Limited

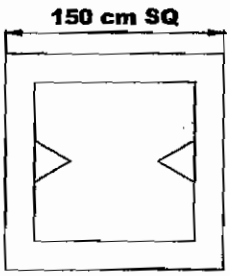


Depth Of Water Limited

10. Width Indicator Marks:

To indicate the areas where the

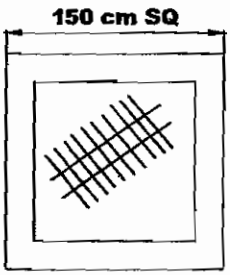
Width Of Channel Limited



Width Of Channel Limited

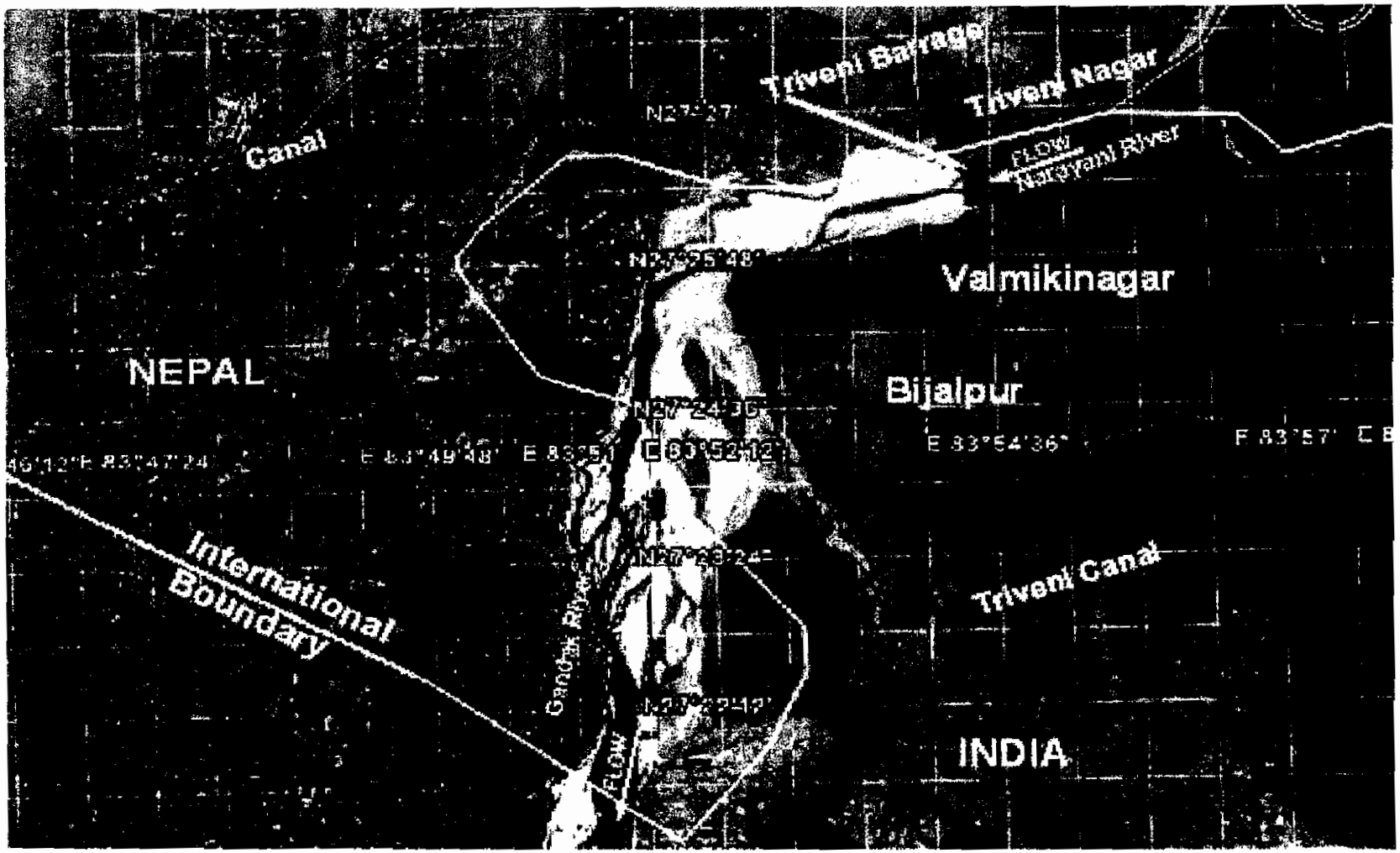
11. River Training Marks:

To indicate the areas where the the river training works viz. Bandalling etc. are in progress to the Navigator.

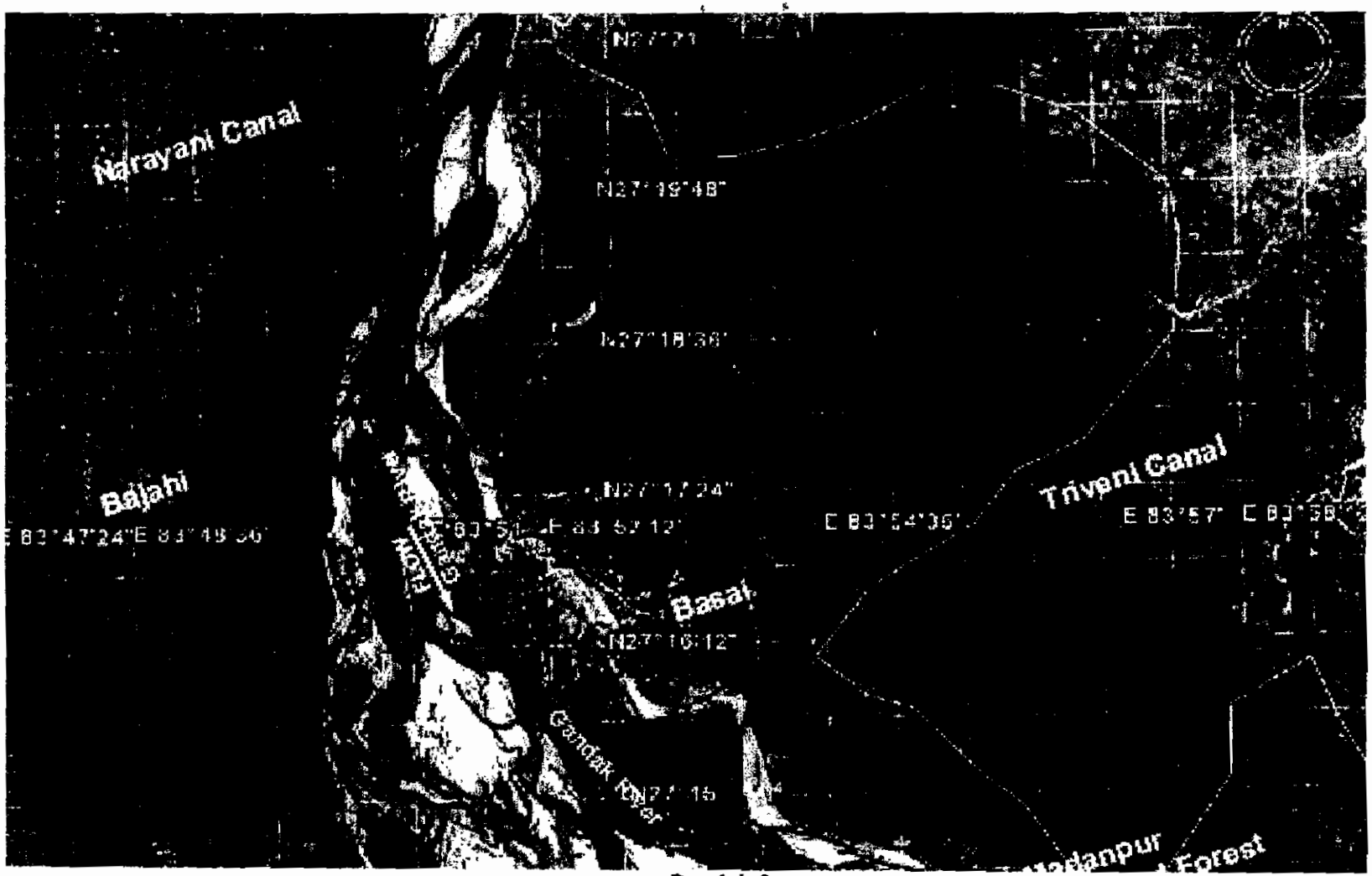


River Training Works are in Progress

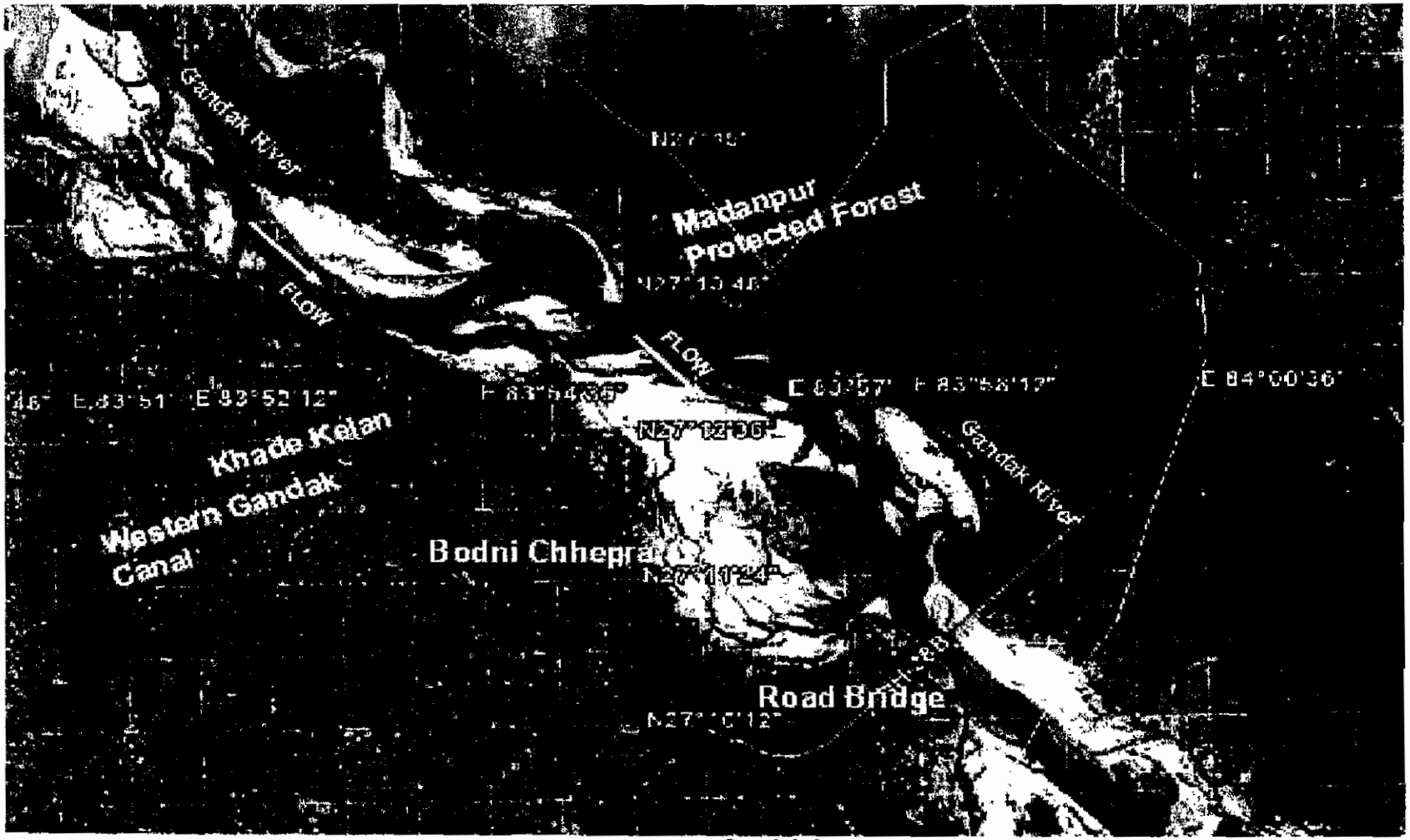
Fig 4.12 Typical Schematic Sketch of Proposed aids to Navigation (Cont.)


Triveni Barrage
Triveni Nagar
Canal
FLOW
Narayani River
Valmikinagar
NEPAL
Bijalpur
International Boundary
Gandak River
Triveni Canal
INDIA
FLOW

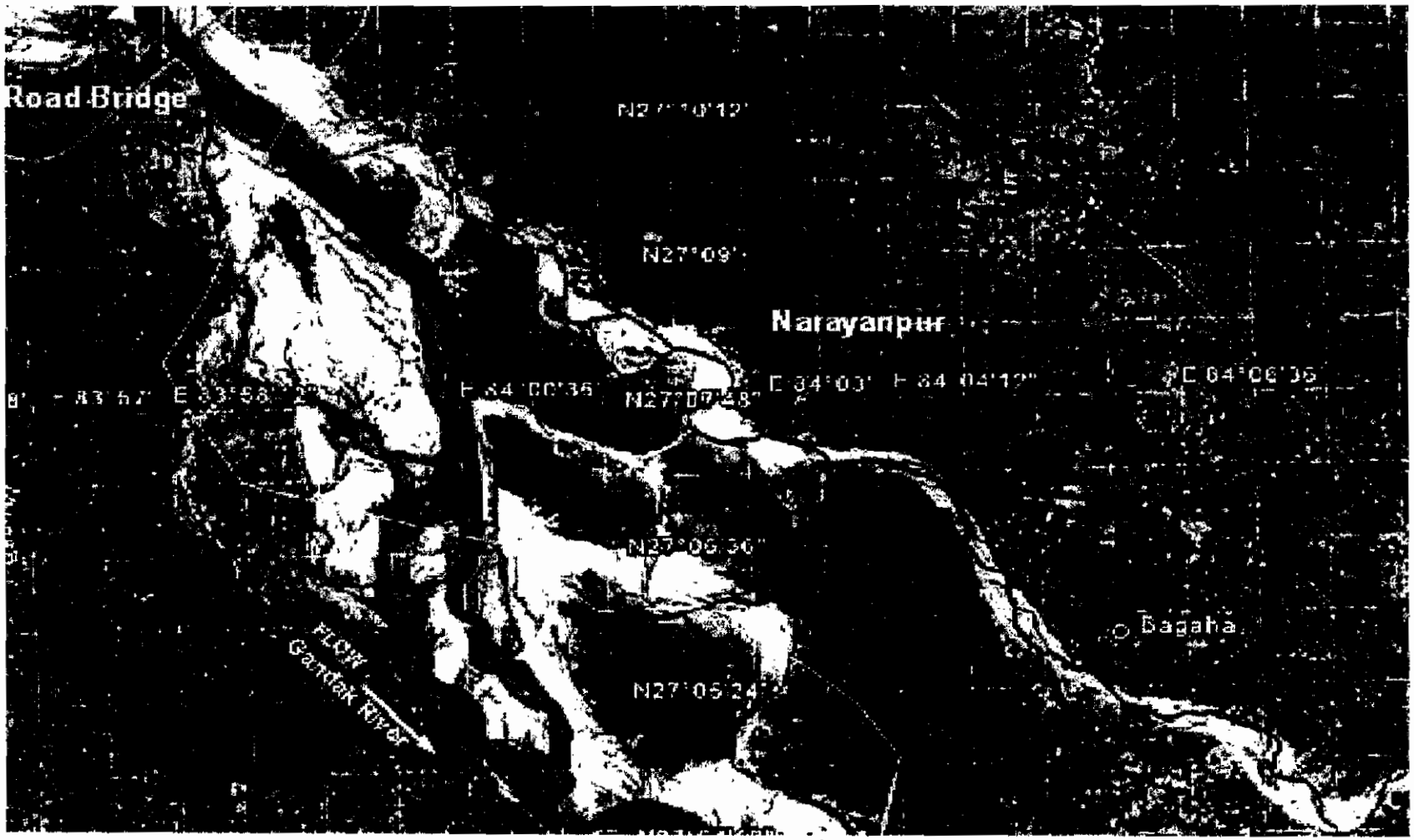
Gandak 1


Narayani Canal
Baljahi
Triveni Canal
Basal
Gandak River
Forest

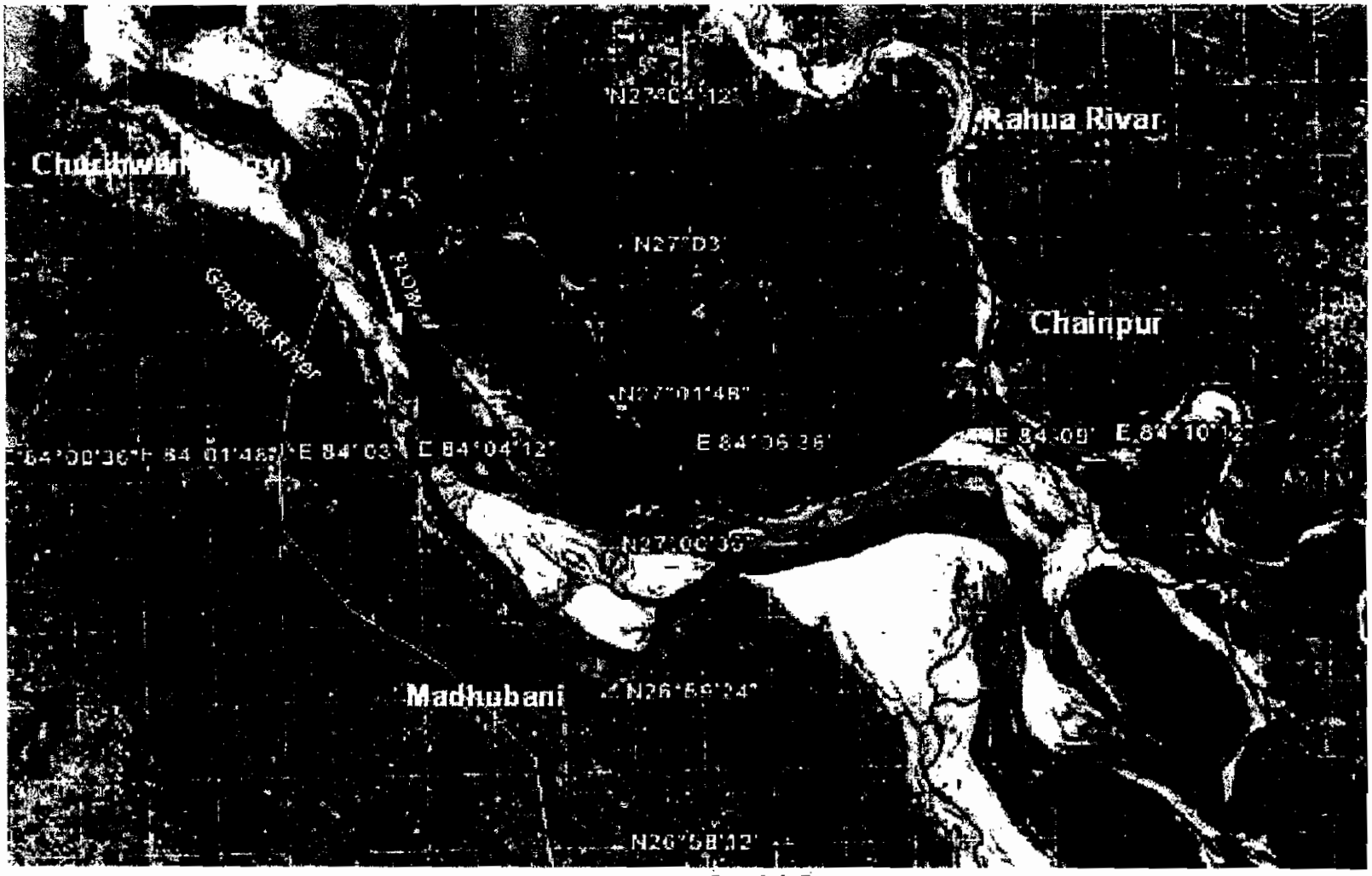
Gandak 2


Gandak River
Madanpur
Protected Forest
FLOW
FLOW
Khade Kelan
Western Gandak
Canal
Bodni Chhepra
Gandak River
Road Bridge

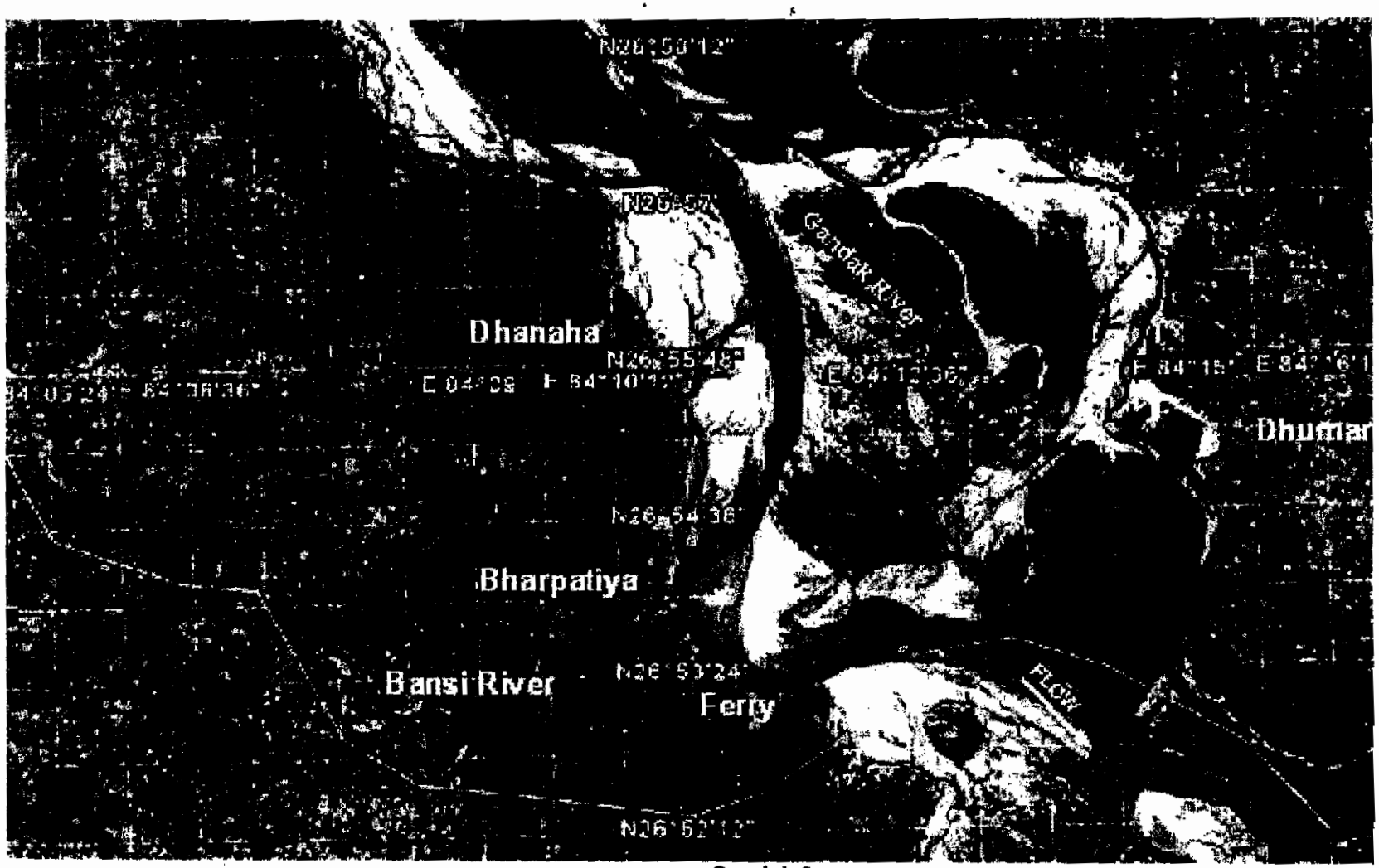
Gandak 3


Road Bridge
N27°09'
Narayanpur
E 84°03'
E 84°04'12"
N27°06'30"
Bagaha
Flow
Gandak River

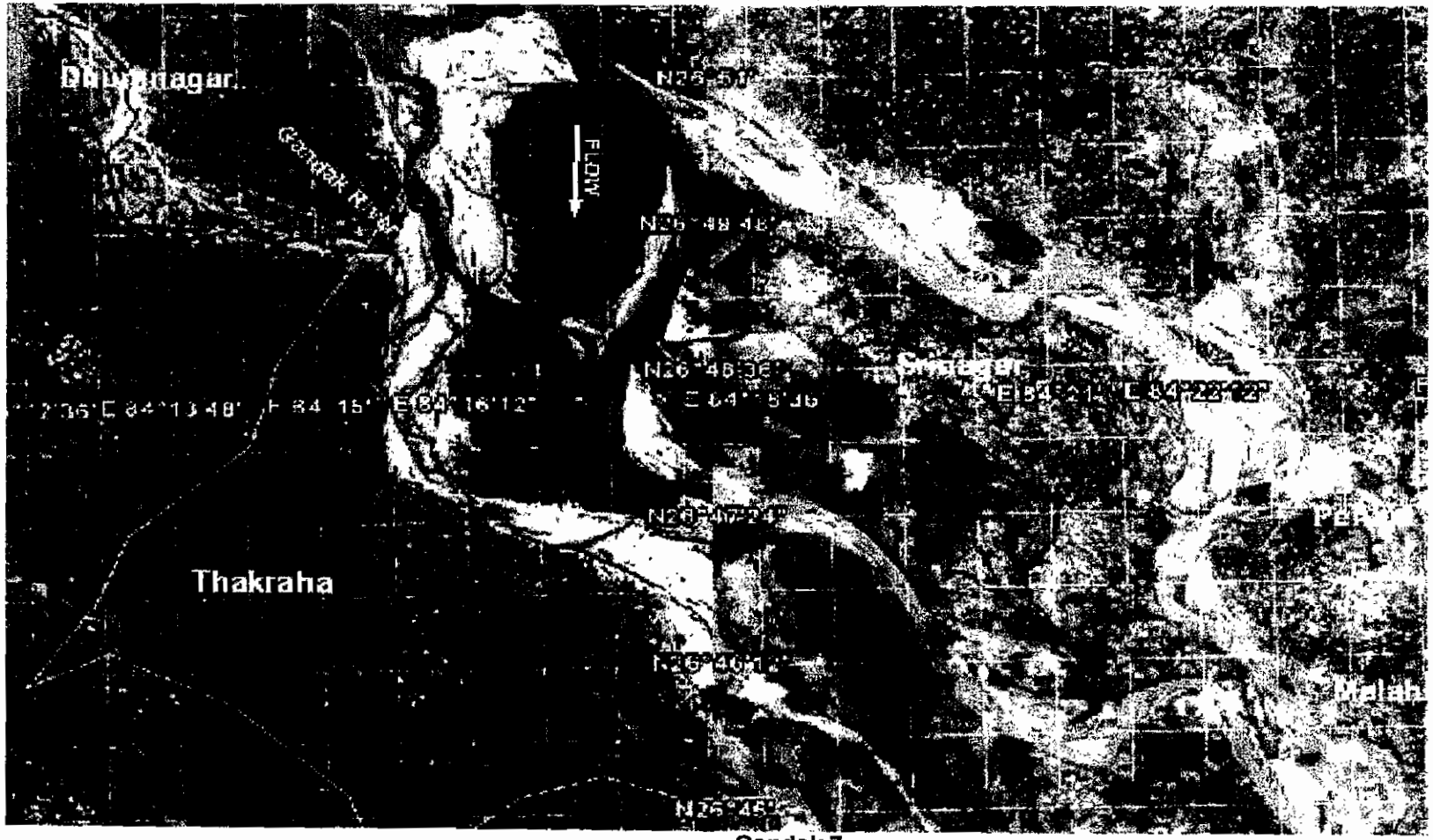
Gandak 4


Rahua Rivar
Chainpur
Madhubani
Gandak River
N27°03'
N27°01'48"
E 84°03'
E 84°04'12"
E 84°06'36"
E 84°09'
N26°59'24"

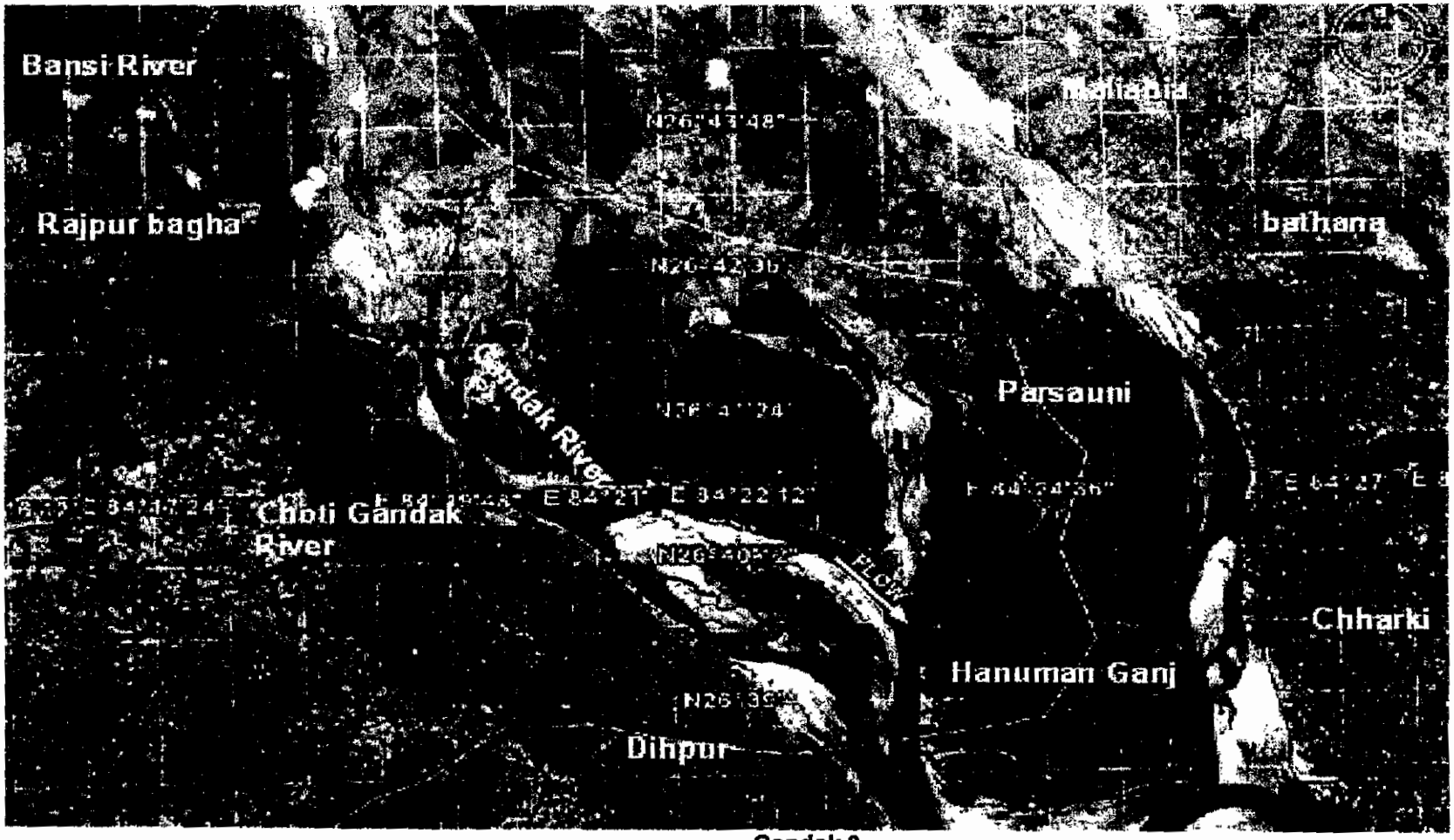
Gandak 5


Dhanaha
Bharpatiya
Bansi River
Ferry
Gandak River
Dhuma
FLOW

Gandak 6


Dhuvanagar
Gandak River
FLOW
N26°50'
N26°48'48"
N26°46'36"
E84°15'36"
N26°47'24"
Thakraha
N26°46'12"
N26°45'

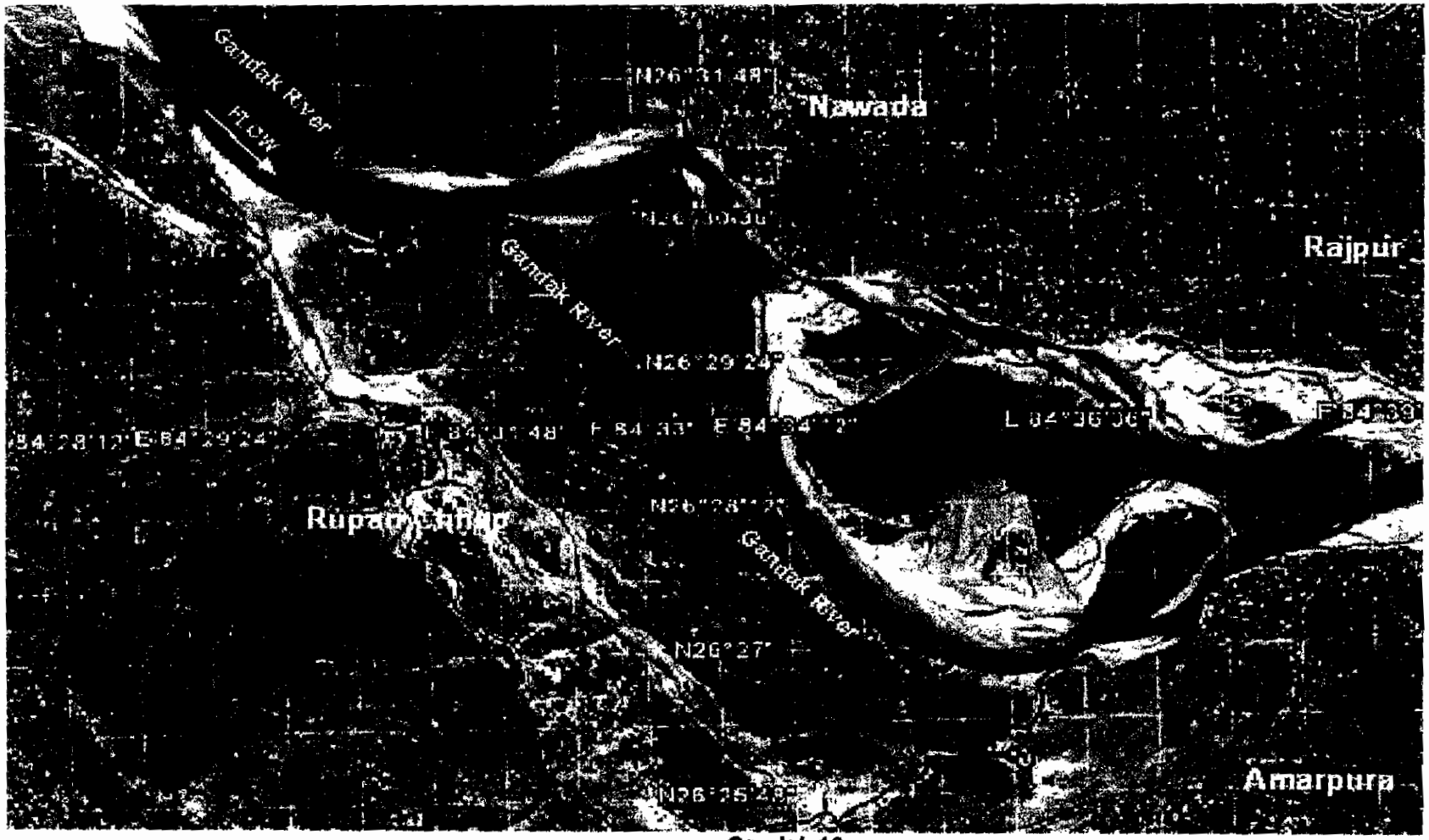
Gandak 7


Bansi River
Rajpur bagha
bathana
Parsauni
Gandak River
Chhoti Gandak River
Chharki
Hanuman Ganj
Dihpur

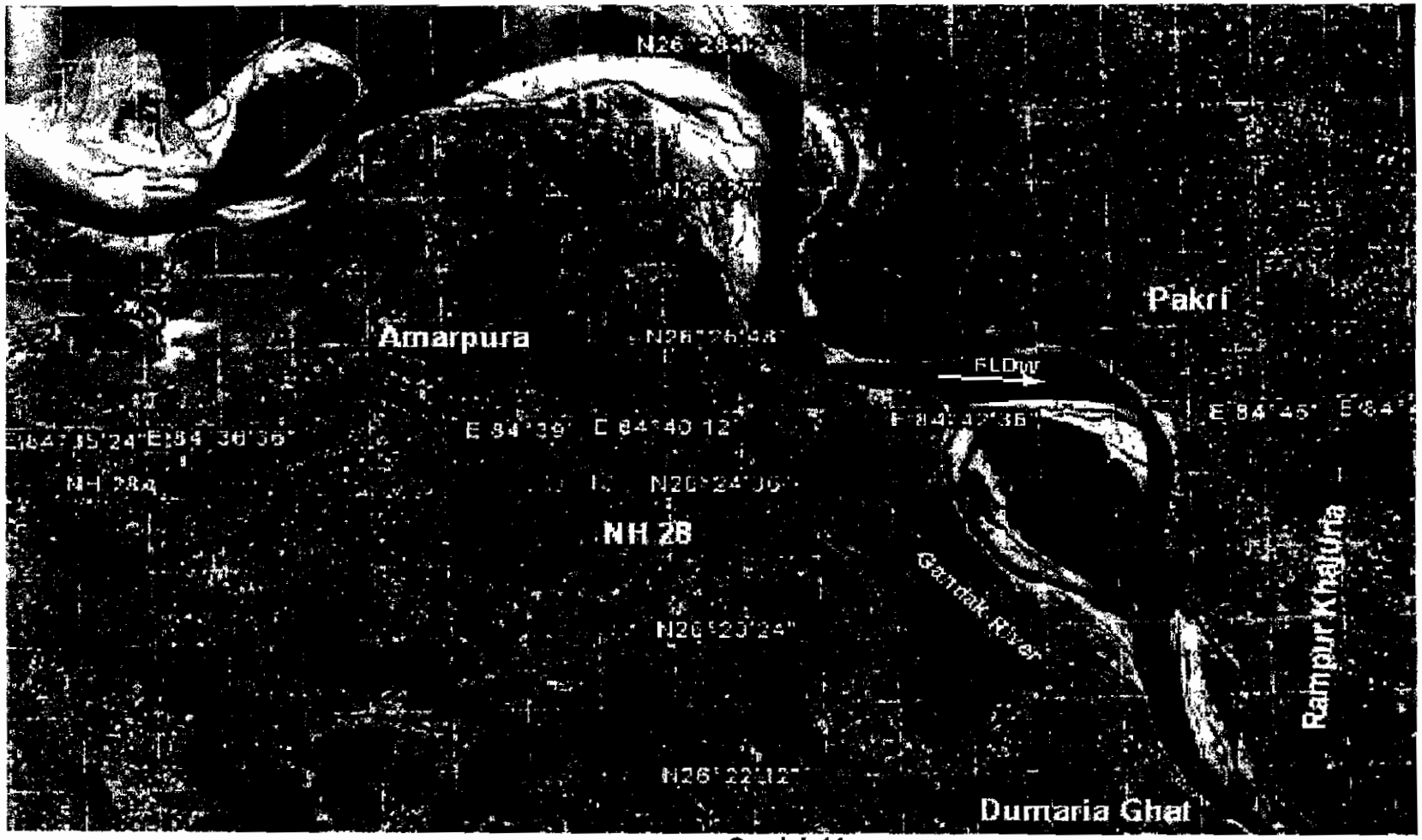
Gandak 8


Amwa
Mathai
Mathai
Chatia Ghat
Ripra
Gandak River
FLOW
Gandak River
FLOW
Gansia
N26°31'48"
E84°27'
E 84°30'36"

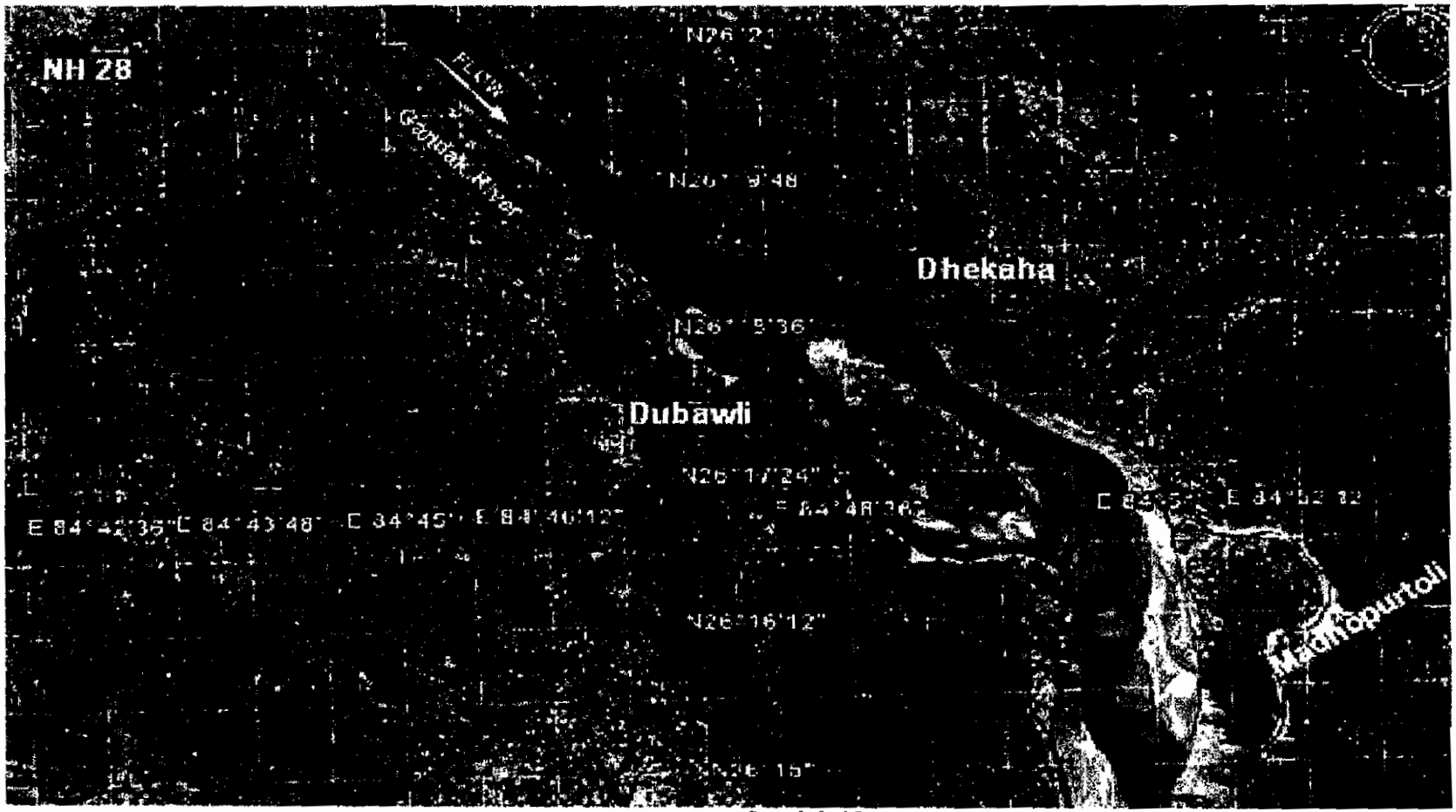
Gandak 9


Gandak River
Flow
Nawada
Rajpur
Gandak River
Gandak River
Amarpura

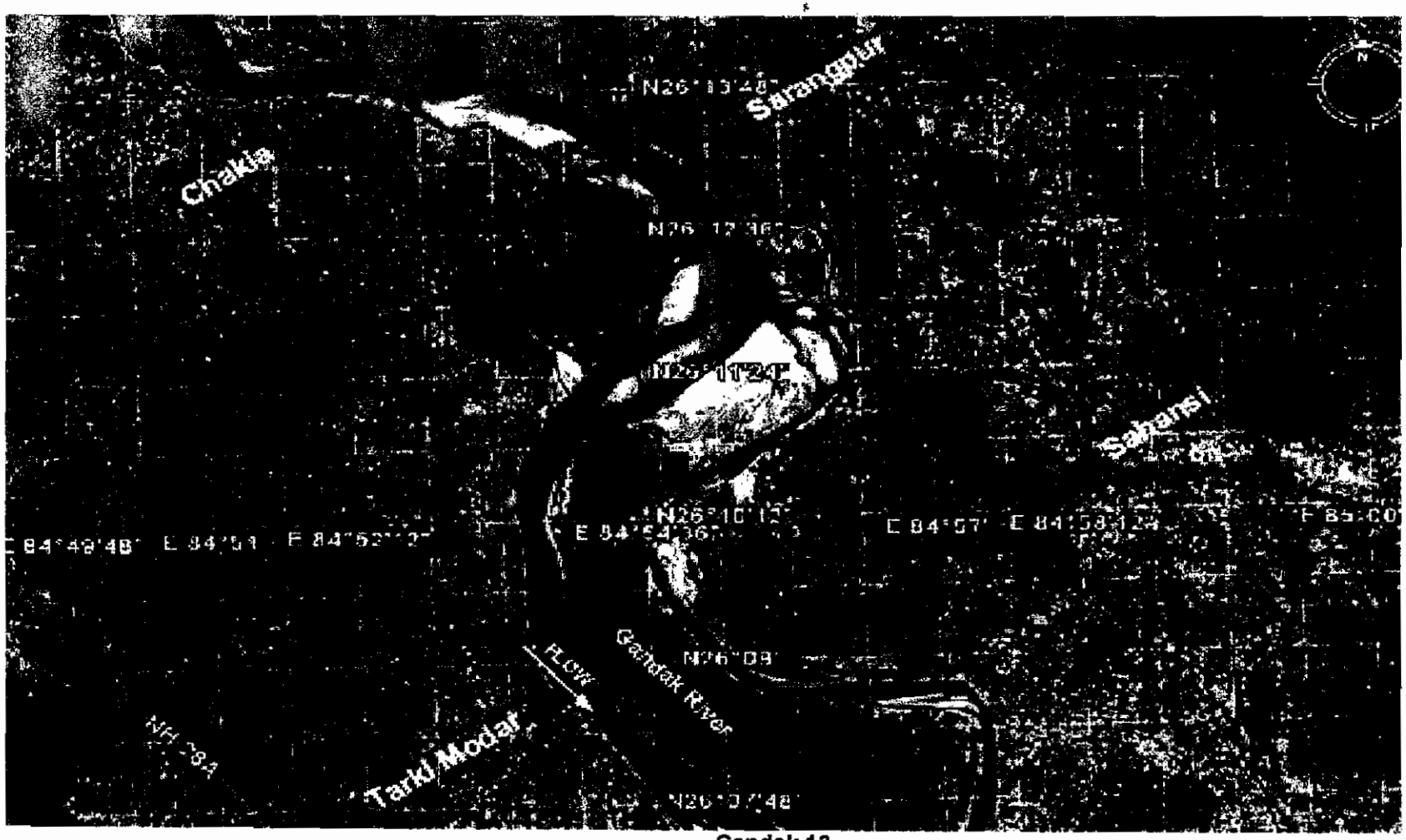
Gandak 10


Amarpura
Pakri
FLOW
NH 28
Gandak River
Rampur Khajuria
Dumaria Ghat

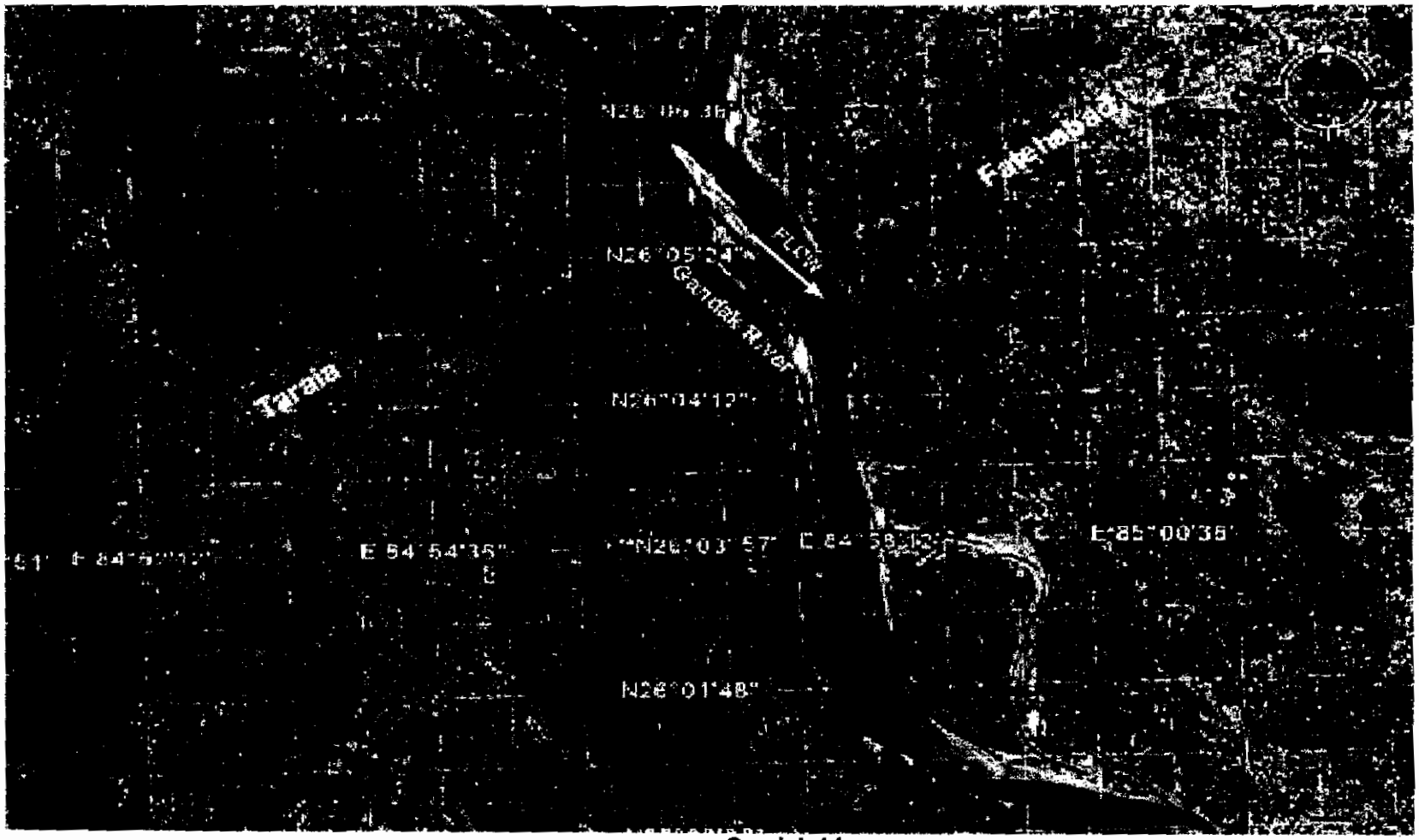
Gandak 11


NH 28
FLOW
Gandak River
N26°21'
N26° 9'48"
Dhekaha
N26° 5'36"
Dubawli
N26°1'24"
E 84°42'36"
E 84°43'48"
E 84°45'
E 84°46'12"
E 84°48'36"
E 84°52'12"
N26°16'12"
Madhopurtoli

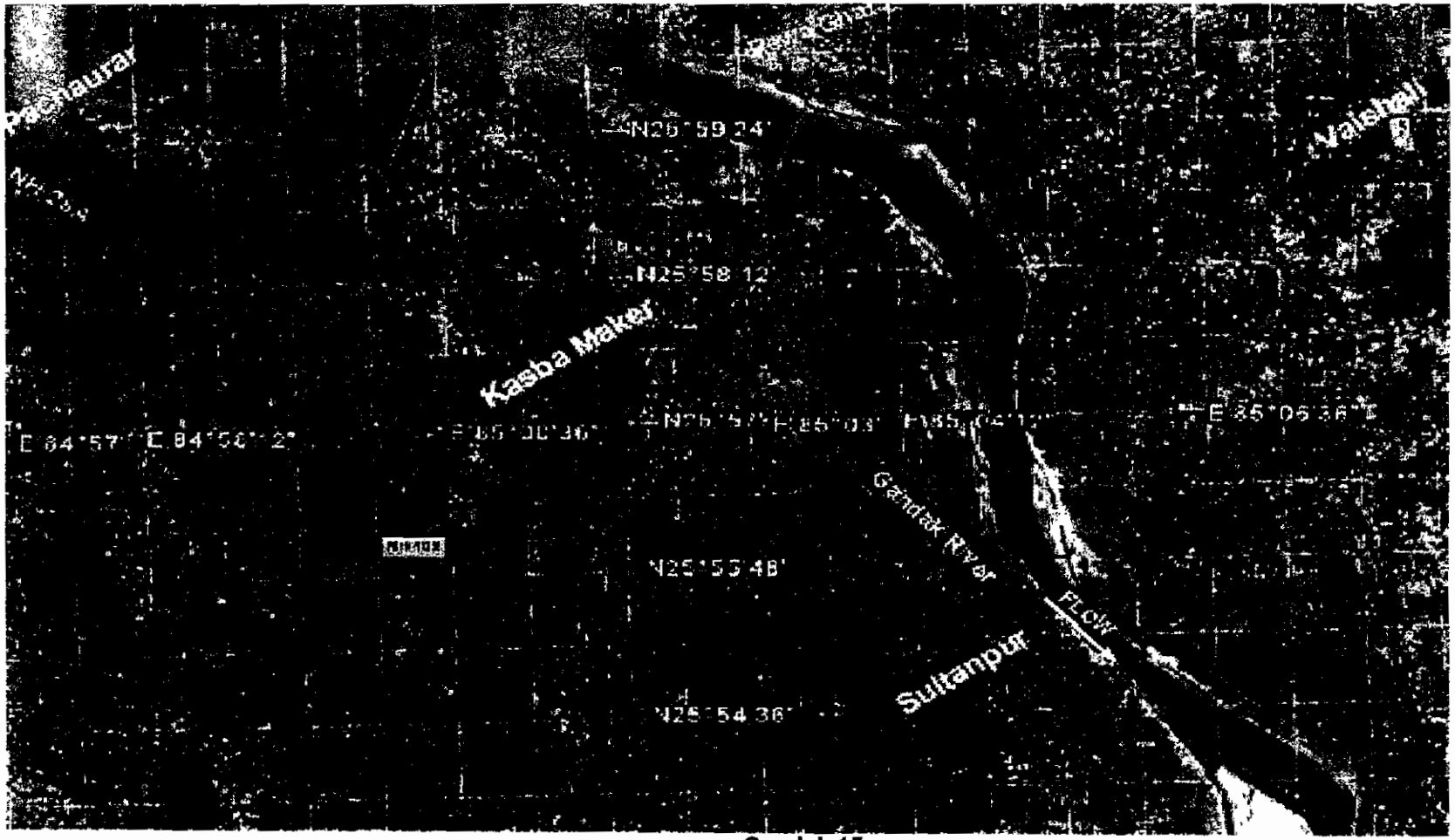
Gandak 12


Chakia
Sarangpur
Sahansi
Tarki Modar
Gandak River
FLOW
N26°13'48"
N26°11'24"
N26°08'
E84°49'48"
E84°57'
E84°58'12"

Gandak 13

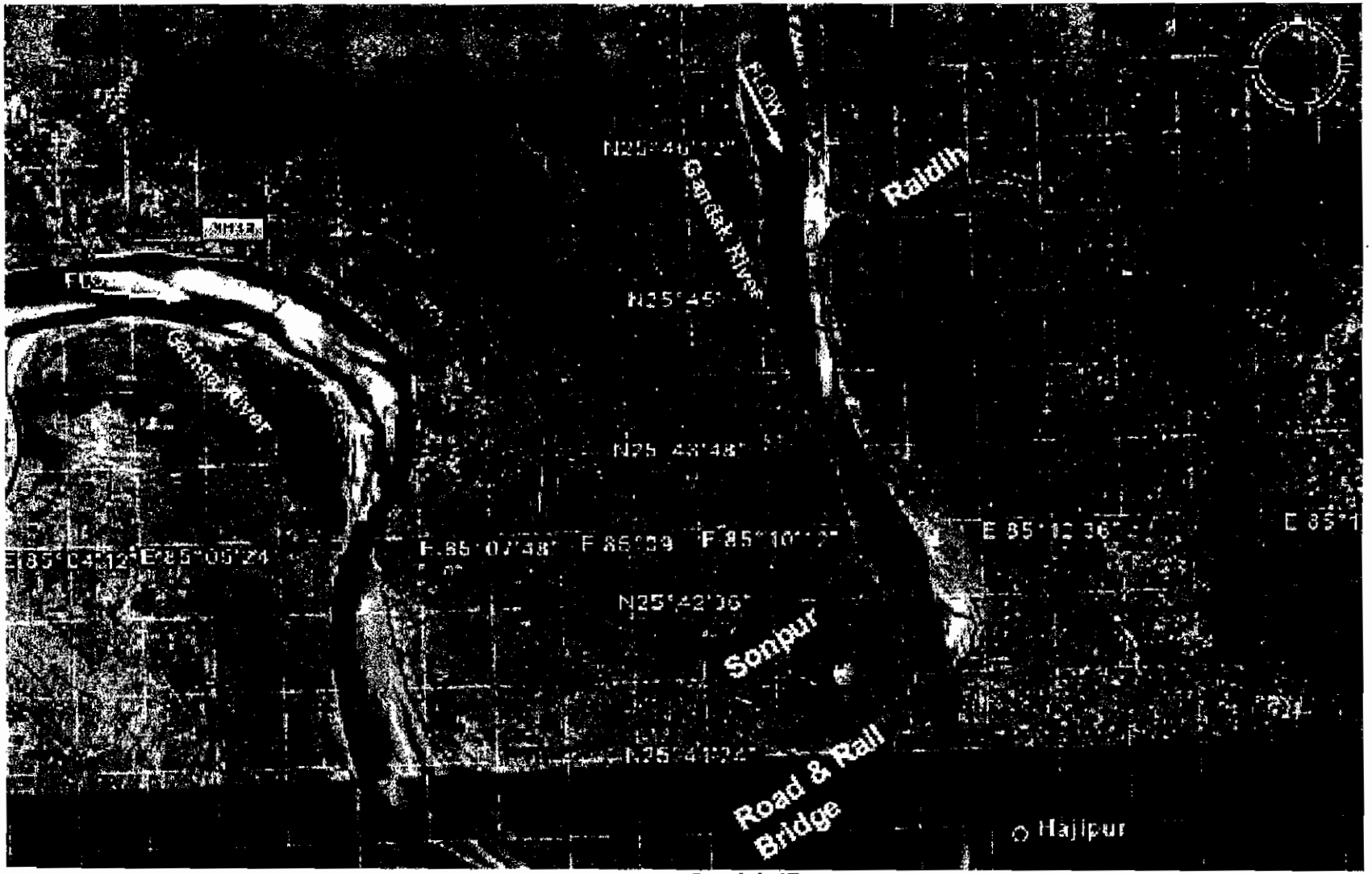


Gandak 14

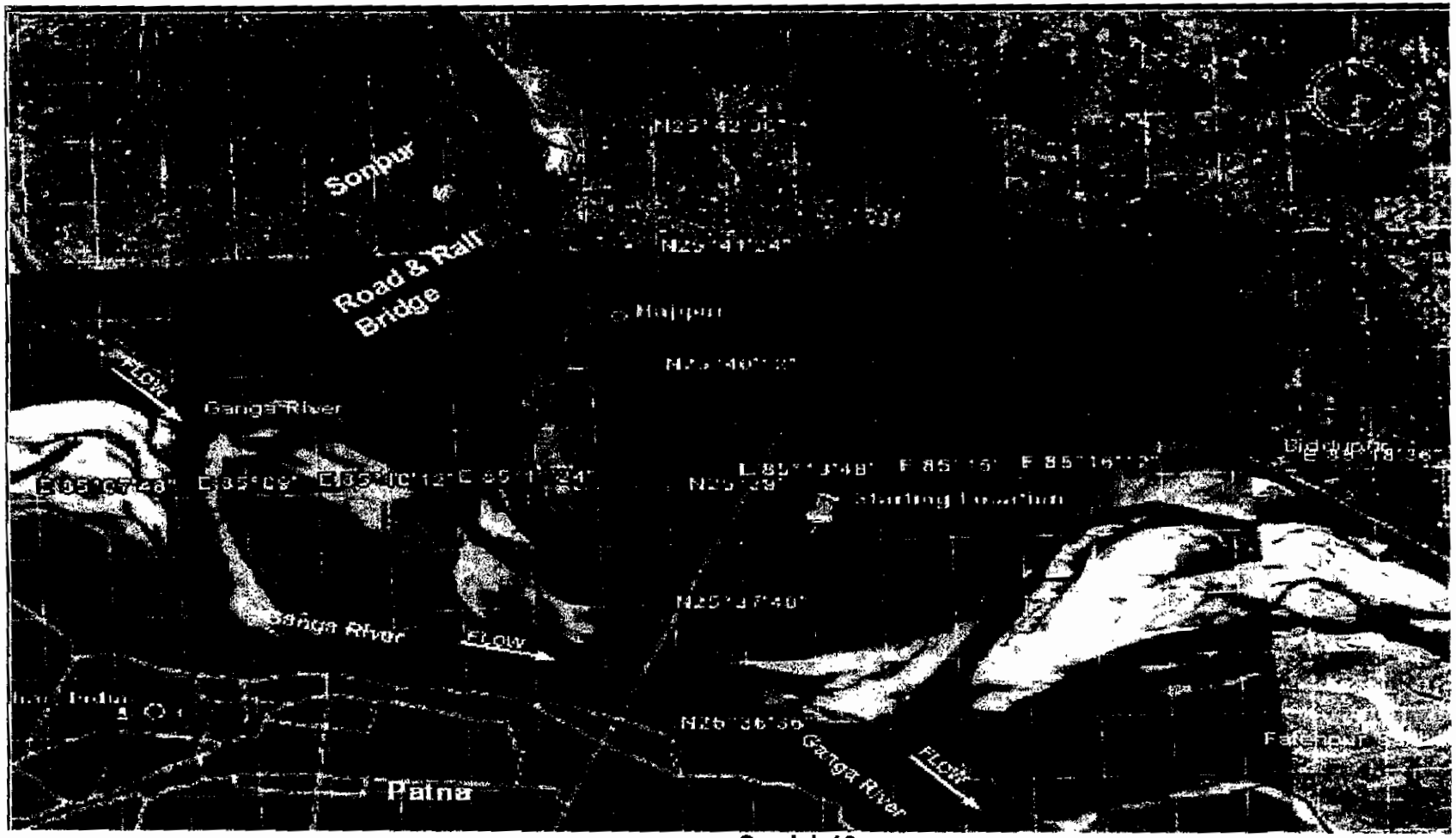

Pachnaur
N25°59'24"
Vaishali
N25°58'12"
Kasba Maker
E 84°57'
E 84°58'2"
E 85°06'36"
Gandak R.D.
N25°53'48"
Sultanpur
N25°54'36"

Gandak 15

Gandak 16


FLOW
Gandak River
Raidih
NH-31
Ganga River
N25°45'
N25°43'48"
E 85°12'36"
E 85°1
E85°04'12"
E85°05'24
E 85°07'38"
E 85°09
N25°42'06"
Sonpur
Road & Rail
Bridge
Hajipur

Gandak 17


Sonpur
Road & Rail Bridge
Ganga River
FLOW
Ganga River
FLOW
Ganga River
FLOW
Patna

Gandak 18

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Annexure – 4.1

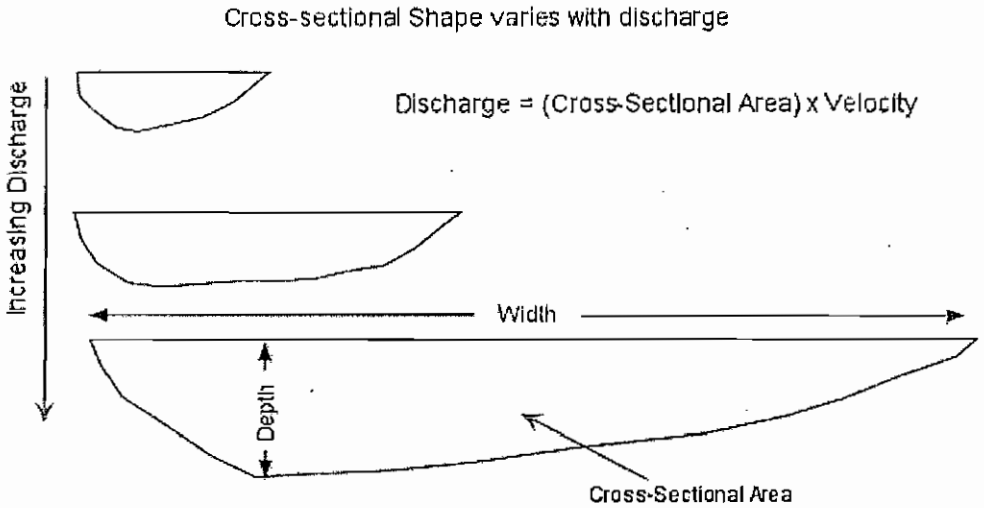
Mechanism to increase River discharge :

i) **By method of dredging width and depth can be increased, consequently discharge will be improved**

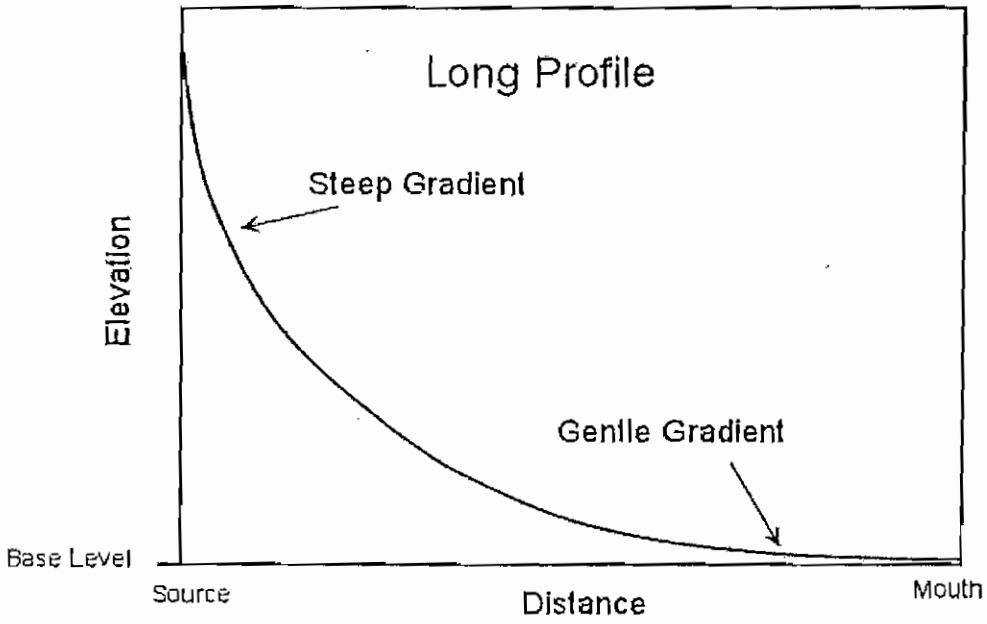
- **Geometry and Dynamics of Stream Channels**

The stream channel is the conduit for water being carried by the stream. The stream can continually adjust its channel shape and path as the amount of water passing through the channel changes The volume of water passing any point on a stream is called the discharge. Discharge is measured in units of volume/time (m^3/sec).

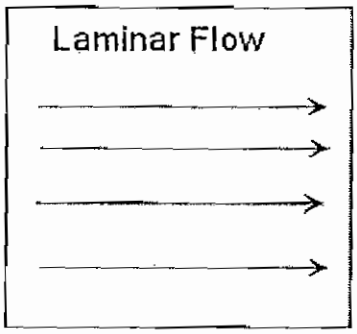
- Cross Sectional Shape - varies with position in the stream and discharge. The deepest parts of a channel occur where the stream velocity is the highest. Both width and depth increase downstream because discharge increases downstream. As discharge increases the cross sectional shape will change, with the stream becoming deeper and wider.

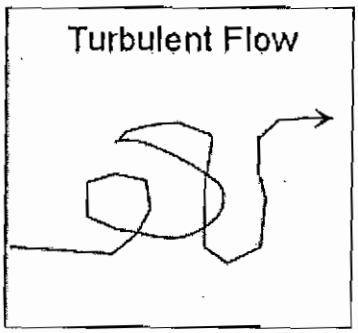


- Long Profile - a plot of elevation versus distance. Usually shows a steep gradient near the source of the stream and a gentle gradient as the stream approaches its mouth.



- Velocity - A stream's velocity depends on position in the stream channel, irregularities in the stream channel caused by resistant rock, and stream gradient.





The average velocity is the time it takes a given particle of water to traverse a given distance. Stream flow can be either laminar, in which all water molecules travel along similar parallel paths, or turbulent, in which individual particles take irregular paths. Turbulent flow can keep sediment in suspension longer than laminar flow and aids in erosion of the stream bottom. Average linear velocity is generally greater in laminar flow than in turbulent flow.

- Discharge - The discharge of a stream is the amount of water passing any point in a given time.

$$Q = A \times V$$

Discharge (m^3/sec) = Cross-sectional Area (width x average depth) (m^2) x Average Velocity (m/sec)

As the amount of water in a stream increases, the stream must adjust its velocity and cross sectional area in order to form a balance. Discharge increases as more water is added through rainfall, tributary streams, or from groundwater seeping into the stream. As discharge increases, generally width, depth, and velocity of the stream also increase. Increasing the depth and width of the stream may cause the stream to overflow is channel resulting in a flood.

ii) Release of water from Gandak Barrage at Bhaisalotan (Valmiki Nagar)

River discharge can be controlled / increased by monitoring Gandak barrage at Bhaisalotan (Valmiki Nagar). If release of water by Gandak Barrage increases, river gets more discharge for navigation.

iii) Creating a reservoir of required water

Assuming 300 days navigation, water required
= 300 X additional discharge required for augmentation(in cumecs) X 60 X 60 X 24
= Y M cum

Therefore a reservoir to supply Y M cum of water annually for navigation purposes may have to be created. A careful study of the topography of the area and water course would have to be undertaken to locate exactly this reservoir.

iv) River Training Measures

There are two basic methods for river training works:

1) Water Restriction method.
2) Water Guide method.

The first method consists of restriction, compression of the channel and an increase in average flow velocity in order to achieve necessary scour of the river bed. The second method provides for increased flow in the predetermined alignment to obtain the designed depth. Both the method involve an interference with the morphological and hydraulic aspects of the river. It is an established fact that the river reacts violently on any human interference. Hence a comprehensive study of the river including the hydraulic and morphological process is to be undertaken before arriving at any permanent workable solution for the river training works.

It is suggested to adopt an experimental solution of using the dredge spoils for positive purpose of providing a guidance to the flow at no additional cost. The method envisages dumping the dredged soil obtainable from capital / maintenance dredging, in strategic locations so as to divert the flow into the predetermined channel. Of course, there exists the danger that greater part of the dumped material may flow back to the predetermined channel if proper selection of dumping region is not done. This, however, provides valuable knowledge of flow pattern and changes in course with time as an insight into the mechanism of river behavior, an understanding of the hydraulic characteristics and their consequences to human interference, experimentation with such means would contribute to an understanding of the river behaviour and valuable data acquisition at no additional cost for implementation of the permanent measures for river training and control works. In addition to the inadequacy of data for a workable solution for river training works, other consideration which influence the decision are:

- The depth deficiencies occur at a limited number of locations.
- The depth deficiency occurs only during well defined period.

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Annexure – 4.2

DEPTH AND WIDTH OF RIVER GANDAK AT 10km INTERVAL

Chainage (in Km)	Main Channel Width (in m)	Depth below C.D. (in m) (Max. Depth)	Depth below C.D. (in m) (Min. Depth)	Remarks
0	134.6	0.6	0.3	Gandak Barrage at Balmikinagar
10	165.0	1.3	1.0	
20	490.3	0.5	0.3	Near Domakhand Village
30	388.6	0.7	0.1	Near Dannur Sukrauli Village
40	205.7	2.2	1.4	Near Bhaisaha Village
50	168.1	0.7	0.0	
60	413.4	2.0	1.8	Near Bagaha Village
70	233.7	2.5	1.8	Near Balua Village
80	340.6	1.3	0.8	Near Ratwal Village
90	237.3	0.6	0.4	Near Nauka TollaVillage
100	375.0	1.1	1.0	Near Raghunathpur Village
110	672.5	2.1	1.9	
120	1227.4	2.1	1.7	
130	816.3	2.5	1.8	Near Peepra Ghat Village
140	401.6	1.6	0.2	Near Gadai Bathna Village
150	132.4	1.5	1.1	Near Tengraghat Village
160	520.7	2.2	1.6	Near Rajwahi Village
170	1449.4	3.1	3.1	Near Senrahi Village
180	485.7	0.9	0.8	Near Kalvinia

				Tola Village
190	158.9	1.1	0.9	Near Baghbar Village
200	269.6	2.1	1.5	Near Saillcpur Village
210	265.9	2.2	2.1	Near Bhawanipur Village
220	169.6	1.4	1.4	Near Dumariya Ghat Village
230	548.5	1.6	1.6	Near Majheri Gaon Village
240	321.5	3.0	2.7	Near Madhopur Hazari Village
250	95.0	1.6	1.3	Near Sonabarsa Village
260	951.9	0.9	0.9	Near Singrahi Gaon Village
270	236.1	1.1	0.9	Near Fatehabad Village
280	412.3	1.4	1.2	Near Ratanpur Dihgaon Village
290	611.5	2.5	2.0	
300	370.8	3.4	2.9	Near Parsavana Village
310	487.5	3.0	2.6	Near Balua Ghat Lalganj Gauge site
320	518.7	2.9	2.8	Near Kalyanpur Village
330	370.0	0.3	0.2	Near Hazipur Village
336	251.2	1.6	0.0	Near Ganga Confluence at Patna.

Dredging Quantity on River Gandak (100 T Vessel)

Width at Bottom level = 25 m
Draft depth below C.D. = 1.2 m
Side slope in Soil = 1: 5

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
0.000	0.00	[illegible]	1.20	37.20	0.00
250.000	250.00	[illegible]	0.90	26.55	7968.75
500.000	250.00	[illegible]	1.10	33.55	7512.50
750.000	250.00	[illegible]	1.00	30.00	7943.75
1000.000	250.00	[illegible]	0.60	16.80	5850.00
1013.110	13.11	[illegible]	0.30	7.95	162.25
1031.067	17.96	[illegible]	0.30	7.95	142.76
1054.526	23.46	[illegible]	1.60	52.80	712.56
1064.993	10.47	[illegible]	1.40	44.80	510.79
1138.930	73.94	[illegible]	1.10	33.55	2896.52
1181.877	42.95	[illegible]	0.90	26.55	1290.55
1195.732	13.86	[illegible]	0.50	13.75	279.19
1229.739	34.01	[illegible]	0.10	2.55	277.16
1276.805	47.07	[illegible]	0.20	5.20	182.39
1328.518	51.71	[illegible]	0.10	2.55	200.39
1379.345	50.83	[illegible]	0.00	0.00	64.81
1435.788	56.44	[illegible]	0.60	16.80	474.13
1497.911	62.12	[illegible]	0.90	26.55	1346.52
1574.409	76.50	[illegible]	1.00	30.00	2162.97
1607.071	32.66	[illegible]	0.40	10.80	666.32
1649.008	41.94	[illegible]	0.10	2.55	279.93
1693.357	44.35	[illegible]	0.10	2.55	113.09
1743.495	50.14	[illegible]	0.10	2.55	127.86
1799.647	56.15	[illegible]	0.10	2.55	143.19
1863.163	63.52	[illegible]	0.00	0.00	80.99
1915.511	52.35	[illegible]	0.10	2.55	66.75
1972.062	56.55	[illegible]	0.20	5.20	219.14
2009.554	37.49	[illegible]	0.60	16.80	412.42
2015.000	5.45	[illegible]	0.80	23.20	108.93
2090.944	75.94	[illegible]	1.00	30.00	2020.11
2141.031	50.09	[illegible]	0.60	16.80	1172.05
2191.036	50.00	[illegible]	0.80	23.20	1000.10
2251.524	60.49	1.60	0.00	0.00	701.67
2273.970	22.45	2.00	0.00	0.00	0.00
2351.767	77.80	1.60	0.00	0.00	0.00
2437.484	85.72	1.90	0.00	0.00	0.00
2525.853	88.37	1.40	0.00	0.00	0.00
2608.902	83.05	[illegible]	0.30	7.95	330.13
2707.827	98.92	2.20	0.00	0.00	393.23
2785.422	77.59	1.80	0.00	0.00	0.00
2873.292	87.87	[illegible]	0.10	2.55	112.04
2959.441	86.15	[illegible]	0.20	5.20	333.83
3044.589	85.15	[illegible]	0.60	16.80	936.64
3132.407	87.82	1.40	0.00	0.00	737.67
3204.713	72.31	1.60	0.00	0.00	0.00
3268.784	64.07	1.90	0.00	0.00	0.00
3342.040	73.26	1.80	0.00	0.00	0.00
3427.677	85.64	1.70	0.00	0.00	0.00
3505.714	78.04	1.70	0.00	0.00	0.00
3588.425	82.71	1.90	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
3666.858	78.43	1.80	0.00	0.00	0.00
3746.067	79.21	[illegible]	0.00	0.00	0.00
3821.464	75.40	1.40	0.00	0.00	0.00
3887.302	65.84	[illegible]	0.00	0.00	0.00
3958.769	71.47	[illegible]	0.00	0.00	0.00
4032.438	73.67	[illegible]	0.00	0.00	0.00
4110.323	77.89	1.40	0.00	0.00	0.00
4181.032	70.71	[illegible]	0.20	5.20	183.85
4265.225	84.19	[illegible]	0.40	10.80	673.55
4340.330	75.11	[illegible]	0.00	0.00	405.57
4408.280	67.95	1.60	0.00	0.00	0.00
4497.128	88.85	1.50	0.00	0.00	0.00
4570.137	73.01	[illegible]	0.40	10.80	394.25
4640.444	70.31	[illegible]	0.30	7.95	659.13
4720.838	80.39	[illegible]	0.50	13.75	872.28
4793.118	72.28	[illegible]	0.60	16.80	1104.08
4872.962	79.84	[illegible]	0.80	23.20	1596.89
4992.384	119.42	[illegible]	0.00	0.00	1385.30
5044.174	51.79	1.80	0.00	0.00	0.00
5102.039	57.87	3.40	0.00	0.00	0.00
5156.990	54.95	8.30	0.00	0.00	0.00
5219.846	62.86	7.80	0.00	0.00	0.00
5272.237	52.39	1.80	0.00	0.00	0.00
5322.597	50.36	[illegible]	0.00	0.00	0.00
5377.275	54.68	1.90	0.00	0.00	0.00
5432.840	55.56	2.10	0.00	0.00	0.00
5491.829	58.99	[illegible]	0.00	0.00	0.00
5549.656	57.83	[illegible]	0.20	5.20	150.35
5599.260	49.60	[illegible]	0.50	13.75	470.00
5646.750	47.49	[illegible]	0.40	10.80	582.95
5699.592	52.84	[illegible]	0.40	10.80	570.69
5762.233	62.64	[illegible]	0.50	13.75	768.93
5825.703	63.47	[illegible]	0.30	7.95	688.66
5878.284	52.58	2.40	0.00	0.00	209.01
5933.999	55.72	2.50	0.00	0.00	0.00
5996.003	62.00	1.80	0.00	0.00	0.00
6055.176	59.17	[illegible]	0.00	0.00	0.00
6112.973	57.80	[illegible]	0.70	19.95	576.53
6160.774	47.80	[illegible]	0.90	26.55	1111.38
6208.863	48.09	[illegible]	0.80	23.20	1196.20
6281.093	72.23	[illegible]	0.90	26.55	1796.74
6322.583	41.49	[illegible]	1.10	33.55	1246.77
6363.751	41.17	[illegible]	1.30	40.95	1533.54
6391.540	27.79	[illegible]	1.50	48.75	1246.32
6418.344	26.80	[illegible]	1.60	52.80	1361.01
6472.028	53.68	[illegible]	1.40	44.80	2619.75
6516.678	44.65	[illegible]	1.60	52.80	2178.94
6634.541	117.86	[illegible]	1.50	48.75	5984.51
6669.357	34.82	[illegible]	1.40	44.80	1628.49
6702.986	33.63	[illegible]	1.00	30.00	1257.73
6743.370	40.38	[illegible]	0.80	23.20	1074.23
6789.725	46.35	[illegible]	1.10	33.55	1315.32
6838.526	48.80	[illegible]	1.00	30.00	1550.67
6883.225	44.70	[illegible]	0.10	2.55	727.49
6906.180	22.95	1.50	0.00	0.00	29.27

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
6955.763	49.58	1.80	0.00	0.00	0.00
7013.973	58.21	1.60	0.00	0.00	0.00
7055.300	41.33	2.40	0.00	0.00	0.00
7138.230	82.93	2.10	0.00	0.00	0.00
7203.911	65.68	1.80	0.00	0.00	0.00
7272.995	69.08	2.00	0.00	0.00	0.00
7340.646	67.65	1.80	0.00	0.00	0.00
7406.858	66.21	1.80	0.00	0.00	0.00
7480.703	73.84	2.00	0.00	0.00	0.00
7554.493	73.79	1.80	0.00	0.00	0.00
7633.157	78.66	2.20	0.00	0.00	0.00
7721.619	88.46	1.70	0.00	0.00	0.00
7805.416	83.80	[illegible]	1.00	30.00	1256.96
7870.992	65.58	[illegible]	1.00	30.00	1967.29
7945.468	74.48	1.60	0.00	0.00	1117.14
8011.828	66.36	[illegible]	0.00	0.00	0.00
8091.328	79.50	[illegible]	0.60	16.80	667.81
8188.543	97.22	[illegible]	0.30	7.95	1203.04
8281.445	92.90	[illegible]	0.10	2.55	487.74
8384.175	102.73	[illegible]	0.30	7.95	539.34
8437.783	53.61	[illegible]	0.00	0.00	213.10
8548.355	110.57	1.50	0.00	0.00	0.00
8640.483	92.13	1.50	0.00	0.00	0.00
8745.547	105.06	[illegible]	0.20	5.20	273.17
8852.718	107.17	[illegible]	0.70	19.95	1347.68
8957.599	104.88	[illegible]	0.40	10.80	1612.55
9031.096	73.50	2.00	0.00	0.00	396.89
9121.916	90.82	1.80	0.00	0.00	0.00
9231.202	109.29	[illegible]	0.10	2.55	139.34
9333.521	102.32	[illegible]	0.20	5.20	396.49
9427.755	94.23	[illegible]	0.00	0.00	245.01
9572.495	144.74	2.80	0.00	0.00	0.00
9646.021	73.53	2.00	0.00	0.00	0.00
9725.431	79.41	[illegible]	0.90	26.55	1054.17
9839.777	114.35	[illegible]	0.60	16.80	2478.46
9864.753	24.98	[illegible]	0.60	16.80	419.60
9894.466	29.71	1.40	0.00	0.00	249.59
9955.166	60.70	[illegible]	0.00	0.00	0.00
10270.000	314.83	[illegible]	0.20	5.20	818.57
10335.047	65.05	[illegible]	0.00	0.00	169.13
10350.000	14.95	[illegible]	0.00	0.00	0.00
10423.068	73.07	[illegible]	0.00	0.00	0.00
10430.000	6.93	1.60	0.00	0.00	0.00
10458.211	28.21	1.70	0.00	0.00	0.00
10479.596	21.39	1.70	0.00	0.00	0.00
10496.188	16.59	2.10	0.00	0.00	0.00
10513.235	17.05	2.50	0.00	0.00	0.00
10551.909	38.67	3.30	0.00	0.00	0.00
10599.925	48.02	6.30	0.00	0.00	0.00
10624.750	24.83	8.70	0.00	0.00	0.00
10654.312	29.56	10.10	0.00	0.00	0.00
10688.555	34.24	5.00	0.00	0.00	0.00
10701.278	12.72	6.60	0.00	0.00	0.00
10739.255	37.98	4.10	0.00	0.00	0.00
10740.000	0.75	2.80	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
10750.000	10.00	3.00	0.00	0.00	0.00
10790.000	40.00	2.40	0.00	0.00	0.00
10865.398	75.40	2.10	0.00	0.00	0.00
10936.775	71.38	1.90	0.00	0.00	0.00
11003.788	67.01	1.40	0.00	0.00	0.00
11031.000	27.21	[illegible]	0.40	10.80	146.95
11119.233	88.23	[illegible]	0.60	16.80	1217.62
11178.851	59.62	[illegible]	0.60	16.80	1001.59
11234.742	55.89	[illegible]	0.40	10.80	771.30
11305.701	70.96	[illegible]	0.50	13.75	871.03
11392.761	87.06	[illegible]	0.40	10.80	1068.67
11456.692	63.93	[illegible]	0.40	10.80	690.45
11519.854	63.16	[illegible]	0.60	16.80	871.64
11569.685	49.83	[illegible]	0.60	16.80	837.16
11630.004	60.32	[illegible]	0.70	19.95	1108.38
11684.384	54.38	[illegible]	0.70	19.95	1084.88
11738.509	54.12	[illegible]	0.90	26.55	1258.41
11784.825	46.32	[illegible]	0.70	19.95	1076.84
11860.614	75.79	[illegible]	0.60	16.80	1392.63
11927.049	66.44	[illegible]	0.50	13.75	1014.80
12002.049	75.00	[illegible]	0.10	2.55	611.25
12082.229	80.18	[illegible]	0.20	5.20	310.70
12143.549	61.32	[illegible]	0.90	26.55	973.45
12198.702	55.15	[illegible]	1.30	40.95	1861.41
12353.189	154.49	[illegible]	1.50	48.75	6928.76
12375.209	22.02	[illegible]	1.50	48.75	1073.49
12406.026	30.82	[illegible]	1.10	33.55	1268.11
12471.646	65.62	1.60	0.00	0.00	1100.78
12519.902	48.26	1.40	0.00	0.00	0.00
12580.963	61.06	1.90	0.00	0.00	0.00
12679.858	98.89	1.40	0.00	0.00	0.00
12756.263	76.41	1.40	0.00	0.00	0.00
12845.274	89.01	[illegible]	0.10	2.55	113.49
12905.772	60.50	[illegible]	0.50	13.75	493.06
12961.591	55.82	[illegible]	0.80	23.20	1031.27
13034.527	72.94	[illegible]	0.90	26.55	1814.27
13094.965	60.44	[illegible]	1.00	30.00	1708.89
13150.092	55.13	[illegible]	0.90	26.55	1558.73
13214.352	64.26	[illegible]	0.70	19.95	1494.06
13277.432	63.08	[illegible]	0.90	26.55	1466.61
13342.121	64.69	[illegible]	0.90	26.55	1717.49
13408.430	66.31	[illegible]	0.80	23.20	1649.46
13473.653	65.22	[illegible]	0.60	16.80	1304.46
13543.531	69.88	[illegible]	0.50	13.75	1067.38
13606.727	63.20	[illegible]	0.50	13.75	868.95
13675.123	68.40	[illegible]	1.00	30.00	1496.17
13718.273	43.15	[illegible]	0.60	16.80	1009.72
13750.958	32.68	1.60	0.00	0.00	274.56
13787.319	36.36	[illegible]	0.00	0.00	0.00
13830.693	43.37	[illegible]	0.70	19.95	432.66
13887.362	56.67	[illegible]	0.80	23.20	1222.64
13950.336	62.97	[illegible]	0.50	13.75	1163.46
14012.101	61.77	[illegible]	1.00	30.00	1351.12
14028.000	15.90	[illegible]	0.90	26.55	449.54
14096.047	68.05	[illegible]	0.40	10.80	1270.78

Annexure 4.3

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
14159.544	63.50	1.70	0.00	0.00	342.89
14217.243	57.70	1.50	0.00	0.00	0.00
14275.608	58.36	[illegible]	0.10	2.55	74.42
14345.039	69.43	[illegible]	0.40	10.80	463.46
14416.852	71.81	[illegible]	0.20	5.20	574.51
14477.649	60.80	[illegible]	0.30	7.95	399.74
14562.892	85.24	[illegible]	0.30	7.95	677.69
14634.300	71.41	[illegible]	0.60	16.80	883.63
14718.540	84.24	[illegible]	0.60	16.80	1415.24
14817.481	98.94	[illegible]	0.60	16.80	1662.21
14924.731	107.25	[illegible]	0.80	23.20	2145.02
14977.801	53.07	[illegible]	0.70	19.95	1144.97
15008.735	30.93	[illegible]	0.10	2.55	348.01
15069.546	60.81	[illegible]	0.20	5.20	235.65
15123.037	53.49	[illegible]	0.80	23.20	759.58
15208.458	85.42	[illegible]	0.00	0.00	990.90
15267.475	59.02	[illegible]	0.00	0.00	0.00
15336.481	69.01	[illegible]	0.60	16.80	579.65
15383.204	46.72	[illegible]	1.00	30.00	1093.31
15432.740	49.54	[illegible]	0.60	16.80	1159.16
15468.196	35.46	[illegible]	0.70	19.95	651.51
15519.074	50.88	[illegible]	0.10	2.55	572.38
15521.449	2.38	[illegible]	0.10	2.55	6.06
15573.153	51.70	[illegible]	0.20	5.20	200.36
15633.423	60.27	[illegible]	0.50	13.75	571.07
15692.163	58.74	[illegible]	0.70	19.95	989.78
15773.629	81.47	[illegible]	0.80	23.20	1757.62
15837.761	64.13	[illegible]	0.00	0.00	743.94
15897.563	59.80	[illegible]	0.40	10.80	322.93
15989.073	91.51	[illegible]	1.00	30.00	1866.81
16039.377	50.30	[illegible]	0.90	26.55	1422.35
16089.970	50.59	[illegible]	0.20	5.20	803.17
16143.310	53.34	[illegible]	0.00	0.00	138.69
16205.584	62.27	1.70	0.00	0.00	0.00
16265.260	59.68	1.70	0.00	0.00	0.00
16322.184	56.92	[illegible]	0.10	2.55	72.58
16750.000	427.82	[illegible]	0.10	2.55	1090.93
17000.000	250.00	1.40	0.00	0.00	318.75
17250.000	250.00	1.40	0.00	0.00	0.00
17500.000	250.00	1.50	0.00	0.00	0.00
17750.000	250.00	1.80	0.00	0.00	0.00
18161.000	411.00	1.40	0.00	0.00	0.00
18236.634	75.63	[illegible]	0.40	10.80	408.43
18300.337	63.70	[illegible]	0.60	16.80	879.10
18356.081	55.74	[illegible]	1.00	30.00	1304.43
18380.000	23.92	[illegible]	0.90	26.55	676.31
18434.521	54.52	[illegible]	0.60	16.80	1181.75
18489.491	54.97	[illegible]	0.70	19.95	1010.08
18545.163	55.67	[illegible]	0.20	5.20	700.08
18598.990	53.83	1.60	0.00	0.00	139.95
18620.000	21.01	1.80	0.00	0.00	0.00
18674.636	54.64	1.80	0.00	0.00	0.00
18680.000	5.36	1.60	0.00	0.00	0.00
18737.348	57.35	1.40	0.00	0.00	0.00
18795.016	57.67	[illegible]	0.70	19.95	575.24

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
18849.048	54.03	[illegible]	0.50	13.75	910.46
18906.597	57.55	[illegible]	0.20	5.20	545.28
18961.222	54.63	[illegible]	0.00	0.00	142.03
19016.691	55.47	[illegible]	0.10	2.55	70.73
19061.700	45.01	[illegible]	0.00	0.00	57.39
19130.180	68.48	[illegible]	0.20	5.20	178.05
19213.760	83.58	[illegible]	0.10	2.55	323.88
19261.184	47.42	[illegible]	0.20	5.20	183.77
19315.272	54.09	[illegible]	0.00	0.00	140.64
19397.494	82.22	2.10	0.00	0.00	0.00
19467.840	70.35	1.90	0.00	0.00	0.00
19526.864	59.02	2.00	0.00	0.00	0.00
19596.123	69.26	2.10	0.00	0.00	0.00
19648.424	52.30	2.50	0.00	0.00	0.00
19734.411	85.99	2.00	0.00	0.00	0.00
19800.139	65.73	1.50	0.00	0.00	0.00
19876.098	75.96	[illegible]	0.50	13.75	522.22
19946.258	70.16	[illegible]	0.90	26.55	1413.72
19996.374	50.12	[illegible]	0.70	19.95	1165.21
20061.249	64.87	[illegible]	0.90	26.55	1508.34
20112.893	51.64	[illegible]	0.80	23.20	1284.65
20177.499	64.61	[illegible]	0.80	23.20	1498.87
20244.076	66.58	[illegible]	1.00	30.00	1770.96
20318.902	74.83	[illegible]	1.00	30.00	2244.79
20373.275	54.37	[illegible]	0.60	16.80	1272.33
20424.334	51.06	[illegible]	1.00	30.00	1194.78
20462.862	38.53	[illegible]	1.00	30.00	1155.85
20499.855	36.99	[illegible]	0.80	23.20	984.02
20545.293	45.44	[illegible]	0.80	23.20	1054.16
20599.396	54.10	[illegible]	0.70	19.95	1167.27
20642.162	42.77	[illegible]	1.00	30.00	1068.09
20711.393	69.23	[illegible]	1.10	33.55	2199.84
20751.393	40.00	[illegible]	1.50	48.75	1645.99
20789.991	38.60	[illegible]	1.30	40.95	1731.14
20829.359	39.37	[illegible]	1.30	40.95	1612.11
20883.503	54.14	[illegible]	1.40	44.80	2321.41
20921.828	38.33	[illegible]	1.50	48.75	1792.68
20967.537	45.71	[illegible]	0.80	23.20	1644.37
21016.503	48.97	[illegible]	0.70	19.95	1056.45
21089.667	73.16	[illegible]	0.40	10.80	1124.90
21145.860	56.19	[illegible]	0.50	13.75	689.77
21213.937	68.08	[illegible]	0.20	5.20	645.04
21289.661	75.72	1.40	0.00	0.00	196.89
21388.517	98.86	[illegible]	0.00	0.00	0.00
21473.847	85.33	[illegible]	0.80	23.20	989.83
21537.265	63.42	[illegible]	1:00	30.00	1686.92
21597.704	60.44	[illegible]	0.90	26.55	1708.93
21648.903	51.20	[illegible]	0.90	26.55	1359.34
21699.831	50.93	[illegible]	0.80	23.20	1266.84
21807.705	107.87	[illegible]	0.50	13.75	1992.96
21873.157	65.45	[illegible]	0.80	23.20	1209.24
21991.362	118.20	[illegible]	0.40	10.80	2009.48
22054.181	62.82	[illegible]	1.30	40.95	1625.45
22173.482	119.30	[illegible]	1.30	40.95	4885.41
22176.040	2.56	[illegible]	1.30	40.95	104.75

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
22230.150	54.11	1.40	0.00	0.00	1107.91
22290.067	59.92	1.40	0.00	0.00	0.00
22355.773	65.71	1.20	0.00	0.00	0.00
22484.770	129.00	3.00	0.00	0.00	0.00
22613.901	129.13	1.40	0.00	0.00	0.00
22697.771	83.87	0.90	0.50	13.75	576.61
22775.425	77.65	0.60	0.80	23.20	1434.66
22845.115	69.69	0.60	0.80	23.20	1616.83
22912.903	67.79	0.80	0.40	10.80	1152.40
22976.553	63.65	1.10	0.10	2.55	424.87
23049.035	72.48	2.00	0.00	0.00	92.42
23130.196	81.16	2.30	0.00	0.00	0.00
23234.911	104.71	3.00	0.00	0.00	0.00
23318.127	83.22	3.00	0.00	0.00	0.00
23395.665	77.54	2.00	0.00	0.00	0.00
23461.206	65.54	1.70	0.00	0.00	0.00
23517.687	56.48	1.40	0.10	2.55	72.02
23578.687	61.00	1.30	0.00	0.00	77.78
23656.986	78.30	1.30	0.00	0.00	0.00
23777.702	120.72	1.00	0.20	5.20	313.87
23843.249	65.55	0.80	0.20	5.20	340.85
23906.833	63.58	1.10	0.10	2.55	246.39
23964.110	57.28	1.00	0.20	5.20	221.95
23964.110	0.00	0.80	0.40	10.80	0.00
24133.195	169.09	1.50	0.00	0.00	913.06
24202.178	68.98	2.10	0.00	0.00	0.00
24269.692	67.51	2.50	0.00	0.00	0.00
24351.105	81.41	2.70	0.00	0.00	0.00
24421.811	70.71	1.60	0.00	0.00	0.00
24489.735	67.92	1.60	0.00	0.00	0.00
24569.884	80.15	1.20	0.00	0.00	0.00
24628.822	58.94	0.90	0.30	7.95	234.28
24721.745	92.92	1.50	0.00	0.00	369.38
24787.891	66.15	1.80	0.00	0.00	0.00
24847.518	59.63	1.40	0.00	0.00	0.00
24912.973	65.45	1.30	0.00	0.00	0.00
25000.000	87.03	2.00	0.10	2.55	110.96
25067.346	67.35	0.90	0.50	13.75	548.88
25151.932	84.59	0.70	0.70	19.95	1425.27
25222.891	70.96	0.70	0.70	19.95	1415.65
25282.339	59.45	0.90	0.50	13.75	1001.70
25345.033	62.69	1.10	0.30	7.95	680.23
25423.137	78.10	0.90	0.50	13.75	847.43
25495.522	72.39	0.80	0.90	26.55	1458.57
25571.096	75.57	0.70	1.00	30.00	2136.86
25637.215	66.12	0.80	0.90	26.55	1869.53
25684.293	47.08	0.60	1.10	33.55	1414.68
25740.501	56.21	0.80	0.90	26.55	1689.07
25802.670	62.17	1.10	0.20	5.20	986.93
25869.601	66.93	1.30	0.00	0.00	174.03
25935.691	66.09	1.10	0.20	5.20	171.84
26001.332	65.64	0.90	0.50	13.75	621.95
26066.598	65.27	0.60	0.80	23.20	1205.79
26122.752	56.15	0.70	1.10	33.55	1593.38
26146.242	23.49	0.70	1.10	33.55	788.12

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
26193.883	47.64	[illegible]	1.10	33.55	1598.34
26238.751	44.87	[illegible]	0.80	23.20	1273.16
26295.229	56.48	[illegible]	0.20	5.20	801.99
26349.624	54.39	[illegible]	0.30	7.95	357.65
26416.213	66.59	[illegible]	0.80	23.20	1037.14
26487.235	71.02	[illegible]	1.00	30.00	1889.20
26544.911	57.68	[illegible]	0.90	26.55	1630.77
26616.166	71.26	[illegible]	0.10	2.55	1036.77
26679.305	63.14	[illegible]	0.30	7.95	331.49
26741.824	62.52	[illegible]	0.60	16.80	773.67
26806.281	64.46	[illegible]	1.00	30.00	1508.31
26869.165	62.88	[illegible]	0.90	26.55	1778.05
26924.733	55.57	[illegible]	1.10	33.55	1669.82
26971.120	46.39	[illegible]	1.00	30.00	1473.96
26987.215	16.09	[illegible]	0.90	26.55	455.06
27035.696	48.48	[illegible]	0.30	7.95	836.31
27095.737	60.04	1.70	0.00	0.00	238.67
27161.303	65.57	1.40	0.00	0.00	0.00
27217.883	56.58	[illegible]	0.00	0.00	0.00
27288.791	70.91	[illegible]	0.00	0.00	0.00
27371.805	83.01	[illegible]	0.00	0.00	0.00
27440.534	68.73	[illegible]	0.20	5.20	178.70
27504.938	64.40	[illegible]	0.00	0.00	167.45
27566.151	61.21	[illegible]	0.40	10.80	330.56
27632.949	66.80	[illegible]	0.70	19.95	1027.02
27690.881	57.93	[illegible]	0.90	26.55	1346.93
27750.716	59.84	[illegible]	1.00	30.00	1691.85
27812.231	61.51	[illegible]	0.60	16.80	1439.44
27871.041	58.81	[illegible]	0.80	23.20	1176.22
27926.015	54.97	[illegible]	1.00	30.00	1462.29
28000.026	74.01	[illegible]	0.60	16.80	1731.88
28067.695	67.67	[illegible]	0.80	23.20	1353.37
28127.253	59.56	[illegible]	0.80	23.20	1381.77
28184.543	57.29	[illegible]	0.70	19.95	1236.04
28247.275	62.73	[illegible]	0.60	16.80	1152.70
28304.396	57.12	[illegible]	0.70	19.95	1049.60
28374.257	69.86	[illegible]	1.50	48.75	2399.73
28442.287	68.03	[illegible]	1.30	40.95	3051.14
28500.647	58.36	[illegible]	1.10	33.55	2173.92
28559.799	59.15	[illegible]	0.30	7.95	1227.40
28611.818	52.02	[illegible]	0.40	10.80	487.69
28688.950	77.13	[illegible]	0.60	16.80	1064.42
28757.169	68.22	[illegible]	0.90	26.55	1478.66
28820.872	63.70	[illegible]	0.60	16.80	1380.75
28894.050	73.18	[illegible]	0.40	10.80	1009.87
28954.332	60.28	[illegible]	0.40	10.80	651.05
29017.774	63.44	[illegible]	0.50	13.75	778.75
29083.487	65.71	[illegible]	0.40	10.80	806.63
29147.044	63.56	[illegible]	0.70	19.95	977.20
29187.185	40.14	[illegible]	1.30	40.95	1222.29
29262.559	75.37	[illegible]	1.30	40.95	3086.57
29304.489	41.93	[illegible]	1.40	44.80	1797.78
29341.498	37.01	[illegible]	1.60	52.80	1806.03
29385.599	44.10	[illegible]	0.50	13.75	1467.45
29452.302	66.70	[illegible]	0.70	19.95	1123.95

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
29477.087	24.79	0.30	0.90	26.55	576.26
29522.181	45.09	1.60	0.00	0.00	598.63
29569.647	47.47	2.10	0.00	0.00	0.00
29630.401	60.75	[illegible]	0.00	0.00	0.00
29702.268	71.87	[illegible]	0.30	7.95	285.68
29758.715	56.45	[illegible]	0.60	16.80	698.54
29811.509	52.79	[illegible]	0.80	23.20	1055.88
29894.744	83.23	[illegible]	0.90	26.55	2070.47
29959.824	65.08	[illegible]	1.10	33.55	1955.65
30011.472	51.65	[illegible]	0.50	13.75	1221.50
30105.328	93.86	[illegible]	0.00	0.00	645.26
30169.154	63.83	[illegible]	0.30	7.95	253.71
30242.210	73.06	[illegible]	0.70	19.95	1019.13
30304.842	62.63	[illegible]	0.70	19.95	1249.51
30379.660	74.82	[illegible]	0.80	23.20	1614.21
30448.746	69.09	[illegible]	1.00	30.00	1837.67
30505.691	56.95	[illegible]	1.00	30.00	1708.36
30554.695	49.00	[illegible]	0.40	10.80	999.69
30580.635	25.94	[illegible]	0.60	16.80	357.98
30700.335	119.70	[illegible]	1.00	30.00	2800.99
30745.859	45.52	[illegible]	1.00	30.00	1365.72
30795.820	49.96	[illegible]	0.80	23.20	1328.95
30838.917	43.10	[illegible]	0.10	2.55	554.89
30885.365	46.45	1.40	0.00	0.00	59.23
30947.397	62.03	[illegible]	0.00	0.00	0.00
31003.032	55.63	[illegible]	0.70	19.95	554.96
31062.979	59.95	[illegible]	0.20	5.20	753.84
31130.391	67.41	[illegible]	0.10	2.55	261.23
31163.097	32.71	[illegible]	0.20	5.20	126.74
31194.483	31.39	[illegible]	0.30	7.95	206.37
31243.969	49.49	3.10	0.00	0.00	196.71
31308.134	64.16	1.90	0.00	0.00	0.00
31381.105	72.97	1.80	0.00	0.00	0.00
31458.025	76.92	[illegible]	0.20	5.20	200.00
31549.673	91.65	[illegible]	0.60	16.80	1008.13
31619.759	70.09	[illegible]	0.70	19.95	1287.84
31689.892	70.13	[illegible]	0.60	16.80	1288.70
31718.495	28.60	[illegible]	0.80	23.20	572.07
31805.731	87.24	[illegible]	0.80	23.20	2023.87
31860.287	54.56	[illegible]	0.70	19.95	1177.06
31916.491	56.20	[illegible]	0.70	19.95	1121.28
31976.179	59.69	[illegible]	0.60	16.80	1096.77
32041.452	65.27	[illegible]	0.80	23.20	1305.46
32115.631	74.18	[illegible]	0.90	26.55	1845.21
32157.817	42.19	[illegible]	0.40	10.80	787.83
32186.539	28.72	1.50	0.00	0.00	155.10
32312.445	125.91	6.00	0.00	0.00	0.00
32376.604	64.16	4.40	0.00	0.00	0.00
32443.413	66.81	[illegible]	0.00	0.00	0.00
32507.068	63.65	[illegible]	0.50	13.75	437.63
32570.537	63.47	[illegible]	1.10	33.55	1501.05
32621.598	51.06	[illegible]	1.30	40.95	1902.02
32683.436	61.84	[illegible]	1.50	48.75	2773.44
32730.422	46.99	[illegible]	1.10	33.55	1933.49
32774.727	44.30	[illegible]	0.60	16.80	1115.37

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
32826.855	52.13	1.50	0.00	0.00	437.89
32892.447	65.59	4.00	0.00	0.00	0.00
32965.695	73.25	4.40	0.00	0.00	0.00
33060.311	94.62	3.90	0.00	0.00	0.00
33126.513	66.20	2.70	0.00	0.00	0.00
33165.577	39.06	2.00	0.00	0.00	0.00
33216.292	50.71	1.80	0.00	0.00	0.00
33267.331	51.04	[redacted]	0.20	5.20	132.71
33319.659	52.33	[redacted]	0.60	16.80	575.61
33377.717	58.06	[redacted]	1.10	33.55	1461.61
33418.401	40.68	[redacted]	1.10	33.55	1364.96
33451.480	33.08	[redacted]	1.10	33.55	1109.81
33488.074	36.59	[redacted]	0.70	19.95	978.89
33533.757	45.68	[redacted]	1.00	30.00	1140.94
33599.329	65.57	[redacted]	0.90	26.55	1854.07
33670.186	70.86	[redacted]	0.70	19.95	1647.44
33747.999	77.81	[redacted]	1.00	30.00	1943.38
33810.373	62.37	[redacted]	1.40	44.80	2332.77
33870.137	59.76	[redacted]	1.30	40.95	2562.41
33927.714	57.58	[redacted]	1.30	40.95	2357.77
33985.601	57.89	[redacted]	0.30	7.95	1415.33
34034.817	49.22	[redacted]	0.00	0.00	195.64
34051.000	16.18	[redacted]	0.20	5.20	42.08
34125.951	74.95	[redacted]	0.20	5.20	389.75
34203.525	77.57	[redacted]	0.60	16.80	853.32
34248.386	44.86	[redacted]	0.80	23.20	897.23
34318.576	70.19	[redacted]	0.80	23.20	1628.40
34387.340	68.76	[redacted]	0.90	26.55	1710.51
34437.455	50.12	[redacted]	1.30	40.95	1691.39
34520.541	83.09	[redacted]	1.40	44.80	3562.30
34565.608	45.07	[redacted]	1.30	40.95	1932.26
34620.710	55.10	[redacted]	1.10	33.55	2052.55
34683.184	62.47	[redacted]	0.90	26.55	1877.35
34752.123	68.94	[redacted]	0.80	23.20	1714.87
34827.250	75.13	[redacted]	0.60	16.80	1502.55
34920.179	92.93	[redacted]	0.50	13.75	1419.49
34980.294	60.12	2.30	0.00	0.00	413.30
35049.635	69.34	1.90	0.00	0.00	0.00
35153.663	104.03	1.60	0.00	0.00	0.00
35198.040	44.38	1.50	0.00	0.00	0.00
35263.455	65.42	[redacted]	0.00	0.00	0.00
35327.924	64.47	[redacted]	0.00	0.00	0.00
35360.228	32.30	[redacted]	0.00	0.00	0.00
35441.647	81.42	[redacted]	0.10	2.55	103.81
35516.359	74.71	[redacted]	0.30	7.95	392.24
35583.918	67.56	[redacted]	0.20	5.20	444.20
35642.112	58.19	[redacted]	0.20	5.20	302.61
35710.977	68.86	[redacted]	0.30	7.95	452.79
35775.140	64.16	[redacted]	0.30	7.95	510.11
35844.074	68.93	[redacted]	0.30	7.95	548.02
35919.094	75.02	1.40	0.00	0.00	298.21
35985.696	66.60	[redacted]	0.00	0.00	0.00
35988.568	2.87	[redacted]	0.00	0.00	0.00
36059.912	71.34	[redacted]	0.50	13.75	490.49
36121.420	61.51	[redacted]	1.10	33.55	1454.66

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
36195.645	74.23	[illegible]	1.10	33.55	2490.26
36318.484	122.84	[illegible]	1.00	30.00	3903.22
36362.511	44.03	[illegible]	1.30	40.95	1561.87
36417.204	54.69	[illegible]	1.50	48.75	2452.97
36491.170	73.97	[illegible]	1.10	33.55	3043.68
36547.247	56.08	[illegible]	0.50	13.75	1326.24
36630.505	83.26	[illegible]	0.80	23.20	1538.20
36691.984	61.48	[illegible]	1.30	40.95	1971.94
36767.621	75.64	[illegible]	1.60	52.80	3545.49
36788.205	20.58	[illegible]	1.10	33.55	888.71
36928.902	140.70	[illegible]	0.30	7.95	2919.47
37011.000	82.10	[illegible]	0.50	13.75	890.77
37055.416	44.42	[illegible]	0.40	10.80	545.21
37118.956	63.54	[illegible]	0.60	16.80	876.87
37184.499	65.54	[illegible]	0.80	23.20	1310.85
37228.511	44.01	[illegible]	0.90	26.55	1094.81
37296.569	68.06	[illegible]	1.10	33.55	2045.15
37353.701	57.13	[illegible]	1.10	33.55	1916.78
37394.436	40.74	[illegible]	1.00	30.00	1294.36
37462.412	67.98	[illegible]	0.90	26.55	1922.03
37506.448	44.04	[illegible]	1.00	30.00	1245.11
37582.197	75.75	[illegible]	0.30	7.95	1437.35
37640.363	58.17	[illegible]	0.00	0.00	231.22
37682.354	41.99	2.30	0.00	0.00	0.00
37711.493	29.14	1.40	0.00	0.00	0.00
37731.334	19.84	[illegible]	0.10	2.55	25.30
37783.866	52.53	[illegible]	0.30	7.95	275.80
37909.720	125.85	[illegible]	1.00	30.00	2388.09
37979.875	70.15	[illegible]	0.30	7.95	1331.19
38000.000	20.12	[illegible]	0.30	7.95	160.00
38085.847	85.85	[illegible]	1.10	33.55	1781.32
38159.772	73.92	[illegible]	1.40	44.80	2896.01
38203.108	43.34	[illegible]	1.40	44.80	1941.48
38244.906	41.80	[illegible]	1.50	48.75	1955.10
38298.941	54.04	[illegible]	1.50	48.75	2634.23
38347.411	48.47	[illegible]	1.60	52.80	2461.07
38388.774	41.36	[illegible]	0.80	23.20	1571.79
38439.229	50.45	[illegible]	1.10	33.55	1431.65
38490.040	50.81	[illegible]	1.50	48.75	2090.88
38548.073	58.03	[illegible]	1.50	48.75	2829.14
38575.569	27.50	[illegible]	1.90	65.55	1571.39
38615.615	40.05	[illegible]	0.80	23.20	1777.06
38653.585	37.97	[illegible]	0.90	26.55	944.51
38704.909	51.32	[illegible]	1.10	33.55	1542.27
38755.790	50.88	[illegible]	0.70	19.95	1361.09
38809.853	54.06	2.30	0.00	0.00	539.28
38873.514	63.66	1.80	0.00	0.00	0.00
38956.989	83.47	[illegible]	0.00	0.00	0.00
39025.809	68.82	[illegible]	0.20	5.20	178.94
39094.199	68.39	[illegible]	0.40	10.80	547.12
39175.042	80.84	[illegible]	0.40	10.80	873.11
39252.926	77.88	[illegible]	0.90	26.55	1454.49
39298.925	46.00	[illegible]	0.00	0.00	610.65
39373.689	74.76	2.70	0.00	0.00	0.00
39460.552	86.86	2.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
39553.686	93.13	1.90	0.00	0.00	0.00
39638.322	84.64	[illegible]	0.50	13.75	581.87
39737.087	98.77	[illegible]	0.60	16.80	1508.64
39824.349	87.26	2.00	0.00	0.00	733.01
39896.234	71.88	2.70	0.00	0.00	0.00
40000.000	103.77	2.20	0.00	0.00	0.00
40087.307	87.31	1.40	0.00	0.00	0.00
40223.074	135.77	[illegible]	1.10	33.55	2277.51
40336.375	113.30	[illegible]	1.50	48.75	4662.35
40420.602	84.23	[illegible]	1.60	52.80	4276.63
40443.003	22.40	[illegible]	1.60	52.80	1182.76
40484.832	41.83	[illegible]	1.60	52.80	2208.57
40519.582	34.75	[illegible]	1.00	30.00	1438.66
40558.864	39.28	[illegible]	0.90	26.55	1110.70
40617.165	58.30	[illegible]	1.00	30.00	1648.47
40672.436	55.27	[illegible]	0.90	26.55	1562.79
40698.982	26.55	[illegible]	0.40	10.80	495.76
40757.735	58.75	[illegible]	0.80	23.20	998.80
40827.656	69.92	[illegible]	0.70	19.95	1508.55
40887.635	59.98	[illegible]	0.30	7.95	836.71
40968.492	80.86	[illegible]	0.20	5.20	531.64
41036.795	68.30	[illegible]	0.40	10.80	546.43
41069.000	32.20	[illegible]	1.00	30.00	656.98
41148.157	79.16	[illegible]	1.00	30.00	2374.71
41206.669	58.51	[illegible]	0.60	16.80	1369.19
41287.752	81.08	[illegible]	0.40	10.80	1118.95
41333.605	45.85	[illegible]	0.50	13.75	562.85
41414.471	80.87	[illegible]	1.30	40.95	2211.70
41480.122	65.65	[illegible]	1.60	52.80	3077.40
41529.210	49.09	[illegible]	1.30	40.95	2301.01
41579.740	50.53	[illegible]	0.70	19.95	1538.65
41661.547	81.81	[illegible]	0.30	7.95	1141.20
41721.596	60.05	[illegible]	0.20	5.20	394.83
41785.321	63.73	[illegible]	0.20	5.20	331.38
41854.768	69.45	[illegible]	0.50	13.75	658.02
41927.223	72.45	[illegible]	0.80	23.20	1338.60
41993.889	66.67	[illegible]	0.80	23.20	1546.67
42087.368	93.48	[illegible]	0.20	5.20	1327.41
42169.279	81.91	1.50	0.00	0.00	212.97
42265.116	95.84	[illegible]	0.20	5.20	249.18
42325.209	60.09	[illegible]	1.30	40.95	1386.64
42396.117	70.91	[illegible]	1.40	44.80	3040.18
42447.555	51.44	[illegible]	1.60	52.80	2510.16
42497.840	50.29	[illegible]	1.30	40.95	2357.12
42552.632	54.79	[illegible]	1.50	48.75	2457.44
42593.403	40.77	[illegible]	0.40	10.80	1213.97
42658.055	64.65	[illegible]	0.30	7.95	606.12
42742.194	84.14	[illegible]	0.00	0.00	334.46
42816.034	73.84	4.00	0.00	0.00	0.00
42926.471	110.44	3.80	0.00	0.00	0.00
43027.655	101.18	2.30	0.00	0.00	0.00
43109.297	81.64	3.30	0.00	0.00	0.00
43203.952	94.65	2.60	0.00	0.00	0.00
43303.334	99.38	1.60	0.00	0.00	0.00
43433.570	130.24	1.60	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
43529.069	95.50	1.70	0.00	0.00	0.00
43610.151	81.08	1.40	0.00	0.00	0.00
43685.866	75.72	[illegible]	0.00	0.00	0.00
43784.781	98.91	1.40	0.00	0.00	0.00
43864.944	80.16	[illegible]	0.20	5.20	208.43
43944.974	80.03	[illegible]	0.60	16.80	880.34
44008.420	63.45	[illegible]	1.00	30.00	1484.63
44062.387	53.97	[illegible]	1.00	30.00	1619.03
44268.882	206.49	[illegible]	1.10	33.55	6561.38
44329.633	60.75	[illegible]	1.10	33.55	2038.22
44413.114	83.48	[illegible]	0.80	23.20	2368.77
44480.475	67.36	[illegible]	0.70	19.95	1453.33
44560.187	79.71	[illegible]	0.80	23.20	1719.79
44627.848	67.66	[illegible]	0.80	23.20	1569.73
44696.294	68.45	[illegible]	1.10	33.55	1942.18
44736.136	39.84	[illegible]	1.00	30.00	1265.98
44788.827	52.69	[illegible]	0.60	16.80	1232.97
44853.126	64.30	[illegible]	0.60	16.80	1080.24
44910.740	57.61	[illegible]	0.00	0.00	483.96
45000.000	89.26	1.50	0.00	0.00	0.00
45075.809	75.81	[illegible]	0.20	5.20	197.11
45133.640	57.83	[illegible]	0.70	19.95	727.22
45269.069	135.43	[illegible]	0.90	26.55	3148.75
45332.802	63.73	[illegible]	0.80	23.20	1585.36
45395.932	63.13	[illegible]	0.80	23.20	1464.62
45468.635	72.70	[illegible]	1.00	30.00	1933.89
45529.317	60.68	[illegible]	1.00	30.00	1820.46
45598.169	68.85	[illegible]	0.80	23.20	1831.47
45670.800	72.63	[illegible]	0.50	13.75	1341.87
45739.516	68.72	2.50	0.00	0.00	472.43
45796.144	56.63	2.40	0.00	0.00	0.00
45858.630	62.49	2.10	0.00	0.00	0.00
45928.129	69.50	3.10	0.00	0.00	0.00
45989.000	60.87	7.10	0.00	0.00	0.00
46076.287	87.29	3.70	0.00	0.00	0.00
46091.315	15.03	3.30	0.00	0.00	0.00
46131.656	40.34	2.30	0.00	0.00	0.00
46197.383	65.73	2.30	0.00	0.00	0.00
46284.796	87.41	3.50	0.00	0.00	0.00
46341.552	56.76	3.20	0.00	0.00	0.00
46398.888	57.34	2.80	0.00	0.00	0.00
46455.389	56.50	2.70	0.00	0.00	0.00
46516.269	60.88	2.10	0.00	0.00	0.00
46570.613	54.34	1.70	0.00	0.00	0.00
46627.638	57.02	[illegible]	0.00	0.00	0.00
46673.493	45.86	[illegible]	0.50	13.75	315.26
46722.530	49.04	[illegible]	0.70	19.95	826.28
46764.141	41.61	[illegible]	0.90	26.55	967.45
46794.371	30.23	[illegible]	1.00	30.00	854.77
46937.982	143.61	[illegible]	0.80	23.20	3820.04
46992.906	54.92	[illegible]	0.60	16.80	1098.49
47057.663	64.76	[illegible]	0.00	0.00	543.97
47143.712	86.05	[illegible]	0.10	2.55	109.72
47217.554	73.84	[illegible]	0.00	0.00	94.15
47299.684	82.13	[illegible]	0.10	2.55	104.72

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
47371.642	71.96	[illegible]	0.20	5.20	278.84
47417.095	45.45	[illegible]	0.40	10.80	363.63
47500.112	83.02	[illegible]	1.30	40.95	2148.06
47550.536	50.42	[illegible]	1.40	44.80	2161.93
47599.036	48.50	[illegible]	1.40	44.80	2172.81
47649.003	49.97	[illegible]	0.50	13.75	1462.79
47729.193	80.19	[illegible]	0.00	0.00	551.31
47801.968	72.78	[illegible]	0.10	2.55	92.79
47870.582	68.61	[illegible]	0.30	7.95	360.23
47942.101	71.52	[illegible]	0.00	0.00	284.29
48020.746	78.65	[illegible]	0.20	5.20	204.48
48085.041	64.29	[illegible]	0.50	13.75	609.20
48168.278	83.24	[illegible]	0.70	19.95	1402.54
48232.489	64.21	[illegible]	1.00	30.00	1603.68
48292.463	59.97	[illegible]	1.00	30.00	1799.25
48340.963	48.50	[illegible]	1.40	44.80	1813.87
48383.084	42.12	[illegible]	1.50	48.75	1970.24
48426.373	43.29	[illegible]	1.30	40 95	1941.53
48473.808	47.43	[illegible]	1.30	40.95	1942.43
48518.667	44.86	[illegible]	0.90	26.55	1514.03
48569.703	51.04	[illegible]	0.90	26.55	1355.01
48630.151	60.45	[illegible]	0.80	23.20	1503.65
48689.171	59.02	[illegible]	0.90	26.55	1468.13
48757.296	68.12	[illegible]	0.90	26.55	1808.72
48814.622	57.33	[illegible]	0.10	2.55	834.10
48876.233	61.61	[illegible]	1.10	33.55	1112.09
48926.673	50.44	[illegible]	1.50	48.75	2075.60
48976.089	49.42	[illegible]	1.70	56.95	2611.62
49098.489	122.40	[illegible]	1.60	52.80	6716.74
49166.524	68.03	[illegible]	0.00	0.00	1796.12
49238.411	71.89	[illegible]	0.30	7.95	285.76
49303.135	64.72	[illegible]	0.20	5.20	425.56
49380.950	77.82	3.60	0.00	0.00	202.32
49449.471	68.52	4.10	0.00	0.00	0.00
49508.072	58.60	2.60	0.00	0.00	0.00
49531.456	23.38	2.20	0.00	0.00	0.00
49582.985	51.53	2.70	0.00	0.00	0.00
49621.058	38.07	2.70	0.00	0.00	0.00
49676.730	55.67	2.60	0.00	0.00	0.00
49744.035	67.30	2.30	0.00	0.00	0.00
49744.035	0.00	1.80	0.00	0.00	0.00
49868.731	124.70	[illegible]	0.50	13.75	857.30
49973.408	104.68	[illegible]	1.50	48.75	3271.15
50021.066	47.66	[illegible]	1.50	48.75	2323.32
50096.570	75.50	[illegible]	0.50	13.75	2359.51
50177.780	81.21	[illegible]	0.30	7.95	881.13
50237.832	60.05	[illegible]	0.20	5.20	394.85
50300.185	62.35	[illegible]	0.40	10.80	498.82
50378.448	78.26	[illegible]	0.00	0.00	422.63
50446.893	68.44	1.70	0.00	0.00	0.00
50519.831	72.94	1.50	0.00	0.00	0.00
50605.161	85.33	[illegible]	0.10	2.55	108.80
50655.454	50.29	[illegible]	0.70	19.95	565.79
50730.544	75.09	[illegible]	1.00	30.00	1875.40
50795.334	64.79	[illegible]	1.10	33.55	2058.69

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
50846.174	50.84	[illegible]	1.00	30.00	1615.45
50905.204	59.03	[illegible]	0.00	0.00	885.45
50975.348	70.14	[illegible]	0.00	0.00	0.00
51047.392	72.04	1.80	0.00	0.00	0.00
51055.000	7.61	1.60	0.00	0.00	0.00
51133.395	78.40	2.00	0.00	0.00	0.00
51218.150	84.75	[illegible]	0.10	2.55	108.07
51302.959	84.81	[illegible]	0.00	0.00	108.14
51388.892	85.93	2.30	0.00	0.00	0.00
51465.675	76.78	2.10	0.00	0.00	0.00
51543.575	77.90	2.60	0.00	0.00	0.00
51631.163	87.59	1.80	0.00	0.00	0.00
51705.616	74.45	[illegible]	0.60	16.80	625.41
52023.000	317.38	[illegible]	0.50	13.75	4848.04
52089.236	66.24	[illegible]	0.70	19.95	1116.08
52157.041	67.81	[illegible]	0.10	2.55	762.81
52219.880	62.84	[illegible]	0.60	16.80	607.98
52295.266	75.39	[illegible]	0.00	0.00	633.24
52380.238	84.97	1.70	0.00	0.00	0.00
52462.850	82.61	[illegible]	0.90	26.55	1096.68
52521.485	58.64	[illegible]	0.90	26.55	1556.78
52592.876	71.39	[illegible]	0.60	16.80	1547.40
52664.656	71.78	[illegible]	0.40	10.80	990.57
52723.643	58.99	[illegible]	1.00	30.00	1203.33
52795.754	72.11	[illegible]	1.50	48.75	2839.39
52816.838	21.08	[illegible]	1.60	52.80	1070.52
52831.994	15.16	[illegible]	0.50	13.75	504.34
53009.500	177.51	[illegible]	0.50	13.75	2440.71
53052.565	43.06	[illegible]	0.80	23.20	795.63
53112.199	59.63	[illegible]	0.90	26.55	1483.41
53163.568	51.37	1.70	0.00	0.00	681.93
53222.898	59.33	[illegible]	0.10	2.55	75.65
53302.898	80.00	[illegible]	0.50	13.75	652.01
53396.316	93.42	[illegible]	1.30	40.95	2554.96
53464.182	67.87	[illegible]	0.50	13.75	1856.14
53547.093	82.91	[illegible]	0.70	19.95	1397.06
53621.938	74.85	[illegible]	0.80	23.20	1614.79
53685.061	63.12	[illegible]	0.70	19.95	1361.88
53732.656	47.59	[illegible]	0.70	19.95	949.52
53801.213	68.56	[illegible]	0.60	16.80	1259.74
54039.000	237.79	[illegible]	0.30	7.95	2942.62
54114.941	75.94	[illegible]	0.80	23.20	1182.79
54182.619	67.68	[illegible]	0.90	26.55	1683.51
54248.921	66.30	[illegible]	0.80	23.20	1649.27
54310.272	61.35	[illegible]	1.00	30.00	1631.93
54378.530	68.26	[illegible]	0.80	23.20	1815.68
54457.641	79.11	[illegible]	0.30	7.95	1232.14
54535.731	78.09	[illegible]	0.40	10.80	732.10
54598.536	62.81	[illegible]	0.60	16.80	866.71
54665.756	67.22	[illegible]	1.00	30.00	1572.95
54725.382	59.63	[illegible]	1.00	30.00	1788.79
54780.857	55.47	[illegible]	0.70	19.95	1385.48
54841.372	60.51	[illegible]	0.80	23.20	1305.61
54899.821	58.45	[illegible]	0.20	5.20	829.99
54968.491	68.67	[illegible]	0.70	19.95	863.53

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
55016.770	48.28	[illegible]	0.00	0.00	481.59
55061.700	44.93	1.90	0.00	0.00	0.00
55162.585	100.89	1.50	0.00	0.00	0.00
55251.666	89.08	[illegible]	0.30	7.95	354.10
55292.467	40.80	[illegible]	0.60	16.80	504.92
55344.104	51.64	2.90	0.00	0.00	433.76
55391.718	47.61	3.10	0.00	0.00	0.00
55477.220	85.50	[illegible]	0.00	0.00	0.00
55538.580	61.36	3.50	0.00	0.00	0.00
55613.169	74.59	4.00	0.00	0.00	0.00
55677.076	63.91	2.30	0.00	0.00	0.00
55749.191	72.11	1.60	0.00	0.00	0.00
55867.238	118.05	[illegible]	0.30	7.95	469.24
55932.579	65.34	[illegible]	0.40	10.80	612.57
56022.000	89.42	[illegible]	0.90	26.55	1669.95
56075.124	53.12	[illegible]	1.10	33.55	1596.38
56109.154	34.03	[illegible]	0.90	26.55	1022.60
56141.224	32.07	[illegible]	1.00	30.00	906.79
56142.873	1.65	[illegible]	1.10	33.55	52.40
56191.267	48.39	[illegible]	1.10	33.55	1623.63
56240.193	48.93	[illegible]	0.90	26.55	1470.23
56299.974	59.78	[illegible]	0.40	10.80	1116.42
56368.289	68.31	[illegible]	0.30	7.95	640.46
56432.125	63.84	[illegible]	0.60	16.80	789.97
56496.071	63.95	[illegible]	0.70	19.95	1175.03
56563.615	67.54	[illegible]	0.90	26.55	1570.40
56632.510	68.89	[illegible]	0.80	23.20	1713.75
56707.350	74.84	[illegible]	1.10	33.55	2123.60
56775.332	67.98	[illegible]	1.10	33.55	2280.80
56832.938	57.61	[illegible]	0.60	16.80	1450.23
56894.218	61.28	[illegible]	0.40	10.80	845.67
56964.074	69.86	[illegible]	0.60	16.80	964.02
57034.118	70.04	[illegible]	0.60	16.80	1176.75
57100.984	66.87	[illegible]	0.20	5.20	735.52
57167.932	66.95	1.60	0.00	0.00	174.07
57239.404	71.47	1.70	0.00	0.00	0.00
57304.540	65.14	1.60	0.00	0.00	0.00
57374.480	69.94	[illegible]	0.20	5.20	181.85
57445.574	71.09	[illegible]	0.40	10.80	568.76
57544.507	98.93	1.40	0.00	0.00	534.24
57630.733	86.23	1.70	0.00	0.00	0.00
57703.237	72.50	2.00	0.00	0.00	0.00
57777.642	74.40	[illegible]	0.00	0.00	0.00
57859.404	81.76	[illegible]	0.20	5.20	212.59
57945.050	85.65	[illegible]	0.40	10.80	685.18
58013.620	68.57	[illegible]	0.50	13.75	841.70
58085.682	72.06	[illegible]	0.70	19.95	1214.25
58155.151	69.47	[illegible]	0.80	23.20	1498.79
58230.451	75.30	[illegible]	0.90	26.55	1873.10
58288.692	58.24	[illegible]	0.70	19.95	1354.11
58353.694	65.00	[illegible]	0.00	0.00	648.40
58422.399	68.70	[illegible]	0.00	0.00	0.00
58501.143	78.74	[illegible]	0.50	13.75	541.38
58605.630	104.49	[illegible]	1.30	40.95	2857.72
58651.238	45.61	[illegible]	1.30	40.95	1867.65

Chainage (m)	Length (m)	Reduced Soundings w.r.t. C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
58693.350	42.11	[illegible]	0.30	7.95	1029.64
58767.896	74.55	2.00	0.00	0.00	296.32
58841.758	73.86	1.80	0.00	0.00	0.00
58929.030	87.27	[illegible]	0.00	0.00	0.00
59005.000	75.97	[illegible]	0.60	16.80	638.15
59080.252	75.25	[illegible]	1.00	30.00	1760.91
59165.798	85.55	[illegible]	0.70	19.95	2136.52
59186.893	21.09	[illegible]	0.30	7.95	294.28
59218.819	31.93	[illegible]	0.00	0.00	126.91
59285.001	66.18	[illegible]	0.00	0.00	0.00
59351.001	66.00	[illegible]	1.30	40.95	1351.36
59417.001	66.00	2.75	0.00	0.00	1351.35
59461.464	44.46	3.08	0.00	0.00	0.00
60067.200	605.74	2.93	0.00	0.00	0.00
60165.826	98.63	2.32	0.00	0.00	0.00
60247.726	81.90	2.38	0.00	0.00	0.00
60330.276	82.55	2.17	0.00	0.00	0.00
60412.845	82.57	1.89	0.00	0.00	0.00
60494.565	81.72	2.16	0.00	0.00	0.00
60574.309	79.74	1.61	0.00	0.00	0.00
60647.977	73.67	[illegible]	0.00	0.00	0.00
60737.784	89.81	[illegible]	0.00	0.00	0.00
60814.455	76.67	1.73	0.00	0.00	0.00
60882.198	67.74	[illegible]	0.00	0.00	0.00
60953.978	71.78	2.77	0.00	0.00	0.00
61029.477	75.50	3.86	0.00	0.00	0.00
61110.298	80.82	2.98	0.00	0.00	0.00
61194.057	83.76	3.00	0.00	0.00	0.00
61280.043	85.99	2.02	0.00	0.00	0.00
61348.542	68.50	1.55	0.00	0.00	0.00
61411.229	62.69	1.59	0.00	0.00	0.00
61526.386	115.16	1.60	0.00	0.00	0.00
61568.310	41.92	[illegible]	0.00	0.00	0.00
61635.192	66.88	[illegible]	0.00	0.00	0.00
61663.909	28.72	1.70	0.00	0.00	0.00
61709.469	45.56	1.84	0.00	0.00	0.00
61751.301	41.83	1.66	0.00	0.00	0.00
61817.916	66.61	[illegible]	0.00	0.00	0.00
61880.970	63.05	[illegible]	0.00	0.00	0.00
61943.637	62.67	[illegible]	0.00	0.00	0.00
62014.478	70.84	1.73	0.00	0.00	0.00
62026.500	12.02	2.70	0.00	0.00	0.00
62092.223	65.72	7.42	0.00	0.00	0.00
62157.133	64.91	5.52	0.00	0.00	0.00
62241.383	84.25	3.27	0.00	0.00	0.00
62322.615	81.23	3.12	0.00	0.00	0.00
62395.642	73.03	3.51	0.00	0.00	0.00
62474.725	79.08	2.52	0.00	0.00	0.00
62550.376	75.65	2.68	0.00	0.00	0.00
62609.522	59.15	2.45	0.00	0.00	0.00
62674.059	64.54	1.69	0.00	0.00	0.00
62743.672	69.61	1.46	0.00	0.00	0.00
62798.833	55.16	[illegible]	0.00	0.00	0.00
62836.167	37.33	[illegible]	0.17	4.39	82.04
62874.285	38.12	[illegible]	0.18	4.66	172.61

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
62947.826	73.54	1.84	0.00	0.00	171.43
63015.445	67.62	2.14	0.00	0.00	0.00
63021.200	5.76	2.11	0.00	0.00	0.00
63078.823	57.62	[illegible]	0.00	0.00	0.00
63134.367	55.54	[illegible]	0.00	0.00	0.00
63184.954	50.59	[illegible]	0.00	0.00	0.00
63262.505	77.55	1.50	0.00	0.00	0.00
63348.199	85.69	[illegible]	0.00	0.00	0.00
63386.225	38.03	[illegible]	0.04	1.01	19.17
63392.609	6.38	[illegible]	0.12	3.07	13.03
63467.458	74.85	[illegible]	0.00	0.00	114.97
63550.101	82.64	3.73	0.00	0.00	0.00
63642.009	91.91	3.31	0.00	0.00	0.00
63780.124	138.11	2.37	0.00	0.00	0.00
63918.917	138.79	2.07	0.00	0.00	0.00
64002.000	83.08	2.12	0.00	0.00	0.00
64084.479	82.48	1.83	0.00	0.00	0.00
64166.415	81.94	1.77	0.00	0.00	0.00
64265.795	99.38	2.11	0.00	0.00	0.00
64348.092	82.30	2.05	0.00	0.00	0.00
64426.131	78.04	1.99	0.00	0.00	0.00
64599.891	173.76	2.59	0.00	0.00	0.00
64718.271	118.38	2.76	0.00	0.00	0.00
64803.502	85.23	2.77	0.00	0.00	0.00
64855.673	52.17	1.76	0.00	0.00	0.00
64937.376	81.70	1.64	0.00	0.00	0.00
65038.523	101.15	[illegible]	0.07	1.77	89.75
65045.200	6.68	1.55	0.00	0.00	5.93
65118.339	73.14	1.96	0.00	0.00	0.00
65184.821	66.48	1.63	0.00	0.00	0.00
65260.857	76.04	1.51	0.00	0.00	0.00
65322.776	61.92	3.22	0.00	0.00	0.00
65404.636	81.86	3.85	0.00	0.00	0.00
65483.854	79.22	2.76	0.00	0.00	0.00
65572.563	88.71	1.51	0.00	0.00	0.00
65724.979	152.42	1.45	0.00	0.00	0.00
65825.261	100.28	[illegible]	0.00	0.00	0.00
65909.244	83.98	[illegible]	0.02	0.50	21.08
65986.384	77.14	[illegible]	0.12	3.07	137.85
66045.913	59.53	2.89	0.00	0.00	91.44
66426.000	380.09	5.66	0.00	0.00	0.00
66525.097	99.10	4.41	0.00	0.00	0.00
66559.104	34.01	3.02	0.00	0.00	0.00
66591.409	32.30	2.49	0.00	0.00	0.00
66593.314	1.91	2.15	0.00	0.00	0.00
66676.748	83.43	1.79	0.00	0.00	0.00
66744.500	67.75	[illegible]	0.00	0.00	0.00
66820.200	75.70	1.47	0.00	0.00	0.00
66831.950	11.75	2.45	0.00	0.00	0.00
66905.431	73.48	1.48	0.00	0.00	0.00
66970.565	65.13	[illegible]	0.00	0.00	0.00
67043.496	72.93	[illegible]	0.20	5.20	189.63
67123.689	80.19	[illegible]	0.00	0.00	208.51
67211.018	87.33	[illegible]	0.00	0.00	0.00
67291.908	80.89	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
67372.096	80.19	2.00	0.00	0.00	0.00
67451.661	79.57	4.10	0.00	0.00	0.00
67565.642	113.98	3.20	0.00	0.00	0.00
67649.547	83.90	2.90	0.00	0.00	0.00
67740.099	90.55	1.80	0.00	0.00	0.00
67846.032	105.93	[illegible]	0.00	0.00	0.00
67937.032	91.00	[illegible]	0.10	2.55	116.03
68012.966	75.93	1.70	0.00	0.00	96.82
68086.304	73.34	[illegible]	0.70	19.95	731.55
68170.480	84.18	[illegible]	0.00	0.00	839.67
68243.240	72.76	2.10	0.00	0.00	0.00
68326.637	83.40	2.50	0.00	0.00	0.00
68424.781	98.14	1.70	0.00	0.00	0.00
68546.573	121.79	[illegible]	0.00	0.00	0.00
68625.567	78.99	[illegible]	0.70	19.95	787.96
68701.881	76.31	[illegible]	1.10	33.55	2041.41
68751.052	49.17	[illegible]	0.80	23.20	1395.24
68820.038	68.99	[illegible]	0.50	13.75	1274.51
68884.198	64.16	1.40	0.00	0.00	441.11
68963.964	79.77	[illegible]	0.00	0.00	0.00
69053.422	89.46	[illegible]	0.40	10.80	483.08
69140.344	86.92	[illegible]	0.60	16.80	1199.52
69214.731	74.39	[illegible]	0.90	26.55	1612.35
69298.815	84.08	[illegible]	1.00	30.00	2377.47
69382.279	83.46	[illegible]	1.10	33.55	2652.07
69461.908	79.63	[illegible]	0.30	7.95	1652.31
69519.075	57.17	[illegible]	0.10	2.55	300.13
69591.101	72.03	[illegible]	0.10	2.55	183.67
69663.248	72.15	1.40	0.00	0.00	91.99
69740.117	76.87	2.00	0.00	0.00	0.00
69770.581	30.46	2.20	0.00	0.00	0.00
69833.068	62.49	2.20	0.00	0.00	0.00
69935.122	102.05	2.50	0.00	0.00	0.00
70028.562	93.44	1.80	0.00	0.00	0.00
70164.954	136.39	1.50	0.00	0.00	0.00
70248.910	83.96	1.60	0.00	0.00	0.00
70326.486	77.58	2.60	0.00	0.00	0.00
70380.912	54.43	3.10	0.00	0.00	0.00
70425.926	45.01	2.60	0.00	0.00	0.00
70474.690	48.76	[illegible]	0.10	2.55	62.18
70546.609	71.92	[illegible]	0.10	2.55	183.40
70572.357	25.75	[illegible]	0.40	10.80	171.87
70592.489	20.13	[illegible]	0.60	16.80	277.83
70632.874	40.38	1.50	0.00	0.00	339.24
70690.457	57.58	[illegible]	0.30	7.95	228.90
70734.546	44.09	[illegible]	1.40	44.80	1162.86
70752.972	18.43	[illegible]	1.60	52.80	899.17
70758.320	5.35	[illegible]	1.50	48.75	271.58
70769.037	10.72	[illegible]	1.40	44.80	501.28
70786.068	17.03	[illegible]	1.00	30.00	636.98
70832.247	46.18	[illegible]	0.70	19.95	1153.32
70851.314	19.07	[illegible]	0.50	13.75	321.28
70868.651	17.34	[illegible]	0.60	16.80	264.83
70919.547	50.90	[illegible]	0.80	23.20	1017.93
70947.719	28.17	[illegible]	1.00	30.00	749.38

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
71000.033	52.31	[illegible]	1.00	30.00	1569.40
71034.398	34.37	[illegible]	1.00	30.00	1030.97
71069.987	35.59	1.50	0.00	0.00	533.84
71093.724	23.74	1.60	0.00	0.00	0.00
71099.091	5.37	1.60	0.00	0.00	0.00
71132.635	33.54	1.80	0.00	0.00	0.00
71172.837	40.20	1.70	0.00	0.00	0.00
71237.534	64.70	1.50	0.00	0.00	0.00
71285.282	47.75	1.60	0.00	0.00	0.00
71318.371	33.09	1.40	0.00	0.00	0.00
71359.622	41.25	1.50	0.00	0.00	0.00
71411.120	51.50	[illegible]	0.00	0.00	0.00
71483.855	72.73	[illegible]	0.20	5.20	189.12
71539.863	56.01	[illegible]	0.30	7.95	368.26
71612.871	73.01	[illegible]	0.20	5.20	480.04
71651.160	38.29	1.80	0.00	0.00	99.56
71756.656	105.50	3.10	0.00	0.00	0.00
71799.416	42.76	3.60	0.00	0.00	0.00
71816.841	17.42	3.50	0.00	0.00	0.00
71969.928	153.09	[illegible]	0.50	13.75	1052.48
72003.646	33.72	[illegible]	0.10	2.55	274.81
72049.809	46.16	[illegible]	0.50	13.75	376.23
72119.231	69.42	[illegible]	0.70	19.95	1169.77
72184.649	65.42	[illegible]	0.70	19.95	1305.09
72215.248	30.60	[illegible]	0.20	5.20	384.80
72254.026	38.78	[illegible]	0.20	5.20	201.65
72289.327	35.30	[illegible]	0.20	5.20	183.57
72336.796	47.47	1.40	0.00	0.00	123.42
72463.801	127.00	1.70	0.00	0.00	0.00
72487.048	23.25	1.50	0.00	0.00	0.00
72525.712	38.66	1.80	0.00	0.00	0.00
72570.613	44.90	2.00	0.00	0.00	0.00
72618.392	47.78	3.80	0.00	0.00	0.00
72653.165	34.77	2.80	0.00	0.00	0.00
72689.088	35.92	2.30	0.00	0.00	0.00
72728.395	39.31	1.90	0.00	0.00	0.00
72768.698	40.30	1.70	0.00	0.00	0.00
72819.701	51.00	2.00	0.00	0.00	0.00
72855.430	35.73	1.70	0.00	0.00	0.00
72899.398	43.97	1.90	0.00	0.00	0.00
72952.834	53.44	2.00	0.00	0.00	0.00
73000.421	47.59	2.10	0.00	0.00	0.00
73080.802	80.38	2.00	0.00	0.00	0.00
73151.985	71.18	1.80	0.00	0.00	0.00
73206.566	54.58	1.40	0.00	0.00	0.00
73294.809	88.24	1.60	0.00	0.00	0.00
73332.954	38.15	1.50	0.00	0.00	0.00
73383.941	50.99	1.70	0.00	0.00	0.00
73432.286	48.34	2.00	0.00	0.00	0.00
73459.275	26.99	1.70	0.00	0.00	0.00
73467.925	8.65	1.70	0.00	0.00	0.00
73520.209	52.28	2.00	0.00	0.00	0.00
73590.613	70.40	1.50	0.00	0.00	0.00
73697.949	107.34	[illegible]	0.30	7.95	426.67
73773.619	75.67	[illegible]	0.70	19.95	1055.59

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
73849.706	76.09	[illegible]	0.90	26.55	1769.04
73920.122	70.42	[illegible]	0.80	23.20	1751.59
73977.041	56.92	[illegible]	1.10	33.55	1615.08
74063.543	86.50	[illegible]	1.30	40.95	3222.22
74073.543	10.00	[illegible]	0.70	19.95	304.51
74123.425	49.88	[illegible]	0.10	2.55	561.18
74207.421	84.00	[illegible]	0.50	13.75	684.57
74288.295	80.87	[illegible]	1.40	44.80	2367.60
74349.820	61.52	[illegible]	1.40	44.80	2756.31
74429.367	79.55	1.90	0.00	0.00	1781.87
74511.245	81.88	1.80	0.00	0.00	0.00
74600.500	89.26	[illegible]	0.10	2.55	113.81
74699.685	99.18	[illegible]	0.20	5.20	384.35
74798.902	99.22	[illegible]	0.00	0.00	257.97
74901.049	102.15	[illegible]	0.00	0.00	0.00
74985.503	84.45	[illegible]	0.50	13.75	580.63
75088.416	102.91	[illegible]	0.80	23.20	1901.32
75152.161	63.75	[illegible]	0.50	13.75	1177.70
75221.546	69.38	2.60	0.00	0.00	477.02
75296.374	74.83	[illegible]	0.70	19.95	746.42
75376.825	80.45	[illegible]	1.00	30.00	2009.27
75467.650	90.82	2.20	0.00	0.00	1362.37
75526.190	58.54	2.10	0.00	0.00	0.00
75595.995	69.80	[illegible]	0.30	7.95	277.48
75673.878	77.88	[illegible]	0.60	16.80	963.81
75737.730	63.85	[illegible]	0.80	23.20	1277.04
75803.794	66.06	[illegible]	0.10	2.55	850.59
75863.194	59.40	[illegible]	0.30	7.95	311.86
75938.908	75.71	[illegible]	0.60	16.80	936.96
76008.592	69.68	[illegible]	0.10	2.55	674.20
76082.080	73.49	[illegible]	0.50	13.75	598.93
76177.651	95.57	[illegible]	1.10	33.55	2260.27
76250.670	73.02	[illegible]	1.10	33.55	2449.78
76335.302	84.63	[illegible]	1.10	33.55	2839.41
76397.852	62.55	[illegible]	0.00	0.00	1049.29
76454.601	56.75	6.90	0.00	0.00	0.00
76521.576	66.97	4.20	0.00	0.00	0.00
76595.937	74.36	3.90	0.00	0.00	0.00
76621.674	25.74	5.40	0.00	0.00	0.00
76744.637	122.96	2.80	0.00	0.00	0.00
76818.341	73.70	2.10	0.00	0.00	0.00
76894.598	76.26	3.50	0.00	0.00	0.00
76970.749	76.15	2.80	0.00	0.00	0.00
77050.608	79.86	2.10	0.00	0.00	0.00
77133.235	82.63	1.60	0.00	0.00	0.00
77206.635	73.40	[illegible]	0.00	0.00	0.00
77292.068	85.43	1.70	0.00	0.00	0.00
77388.963	96.90	2.10	0.00	0.00	0.00
77481.047	92.08	[illegible]	0.00	0.00	0.00
77580.749	99.70	[illegible]	0.00	0.00	0.00
77696.176	115.43	[illegible]	0.20	5.20	300.11
77788.151	91.98	[illegible]	0.20	5.20	478.28
77879.142	90.99	[illegible]	0.00	0.00	236.58
77966.907	87.77	1.50	0.00	0.00	0.00
78080.862	113.96	[illegible]	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
78165.524	84.66	[illegible]	0.10	2.55	107.95
78246.675	81.15	[illegible]	0.60	16.80	785.14
78316.283	69.61	[illegible]	0.90	26.55	1508.75
78400.180	83.90	1.80	0.00	0.00	1113.75
78467.387	67.21	2.00	0.00	0.00	0.00
78573.996	106.61	2.20	0.00	0.00	0.00
78662.734	88.74	2.90	0.00	0.00	0.00
78756.413	93.68	3.20	0.00	0.00	0.00
78862.525	106.11	2.90	0.00	0.00	0.00
78961.591	99.07	2.80	0.00	0.00	0.00
79052.346	90.76	3.00	0.00	0.00	0.00
79130.897	78.55	2.30	0.00	0.00	0.00
79215.117	84.22	2.00	0.00	0.00	0.00
79293.525	78.41	1.70	0.00	0.00	0.00
79362.153	68.63	[illegible]	1.00	30.00	1029.43
79415.774	53.62	[illegible]	0.80	23.20	1426.33
79455.783	40.01	[illegible]	0.70	19.95	863.20
79513.615	57.83	[illegible]	0.70	19.95	1153.76
79563.437	49.82	[illegible]	1.30	40.95	1517.06
79617.952	54.52	[illegible]	1.30	40.95	2232.42
79672.730	54.78	[illegible]	1.40	44.80	2348.59
79703.524	30.79	[illegible]	0.60	16.80	948.47
79772.161	68.64	[illegible]	0.00	0.00	576.55
79831.744	59.58	1.40	0.00	0.00	0.00
79901.353	69.61	1.50	0.00	0.00	0.00
79968.855	67.50	[illegible]	0.00	0.00	0.00
80041.400	72.55	[illegible]	0.40	10.80	391.75
80118.782	77.38	[illegible]	0.70	19.95	1189.76
80186.829	68.05	1.70	0.00	0.00	678.77
80265.733	78.90	[illegible]	0.00	0.00	0.00
80342.725	76.99	[illegible]	0.80	23.20	893.12
80428.480	85.75	[illegible]	1.00	30.00	2281.07
80494.451	65.97	1.50	0.00	0.00	989.57
80544.996	50.55	2.30	0.00	0.00	0.00
80583.874	38.88	2.20	0.00	0.00	0.00
80600.579	16.71	2.30	0.00	0.00	0.00
80668.802	68.22	1.50	0.00	0.00	0.00
80758.854	90.05	[illegible]	0.30	7.95	357.96
80833.164	74.31	[illegible]	0.20	5.20	488.60
80912.715	79.55	[illegible]	0.00	0.00	206.84
81001.528	88.81	[illegible]	0.00	0.00	0.00
81092.369	90.84	1.70	0.00	0.00	0.00
81187.193	94.82	1.90	0.00	0.00	0.00
81268.996	81.80	1.60	0.00	0.00	0.00
81353.806	84.81	[illegible]	0.70	19.95	845.98
81434.885	81.08	[illegible]	1.00	30.00	2024.97
81493.354	58.47	[illegible]	1.00	30.00	1754.08
81579.477	86.12	[illegible]	1.10	33.55	2736.55
81628.992	49.52	[illegible]	0.40	10.80	1098.01
81692.293	63.30	[illegible]	0.20	5.20	506.41
81772.831	80.54	[illegible]	0.00	0.00	209.41
81865.010	92.18	[illegible]	0.70	19.95	919.49
81968.639	103.63	[illegible]	0.20	5.20	1303.14
82039.770	71.13	[illegible]	0.80	23.20	1010.06
82119.404	79.63	[illegible]	0.90	26.55	1980.89

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
82145.340	25.94	[illegible]	0.80	23.20	645.17
82211.665	66.32	[illegible]	0.60	16.80	1326.50
82283.921	72.26	[illegible]	1.10	33.55	1819.05
82337.112	53.19	[illegible]	1.40	44.80	2083.79
82374.257	37.14	[illegible]	1.60	52.80	1812.66
82411.969	37.71	1.60	0.00	0.00	995.62
82450.656	38.69	2.00	0.00	0.00	0.00
82512.306	61.65	3.70	0.00	0.00	0.00
82595.393	83.09	2.60	0.00	0.00	0.00
82679.107	83.71	2.00	0.00	0.00	0.00
82773.957	94.85	2.90	0.00	0.00	0.00
82816.162	42.20	3.10	0.00	0.00	0.00
82843.460	27.30	1.70	0.00	0.00	0.00
82921.140	77.68	2.00	0.00	0.00	0.00
82983.005	61.86	[illegible]	0.50	13.75	425.32
83076.024	93.02	[illegible]	1.00	30.00	2034.80
83143.622	67.60	[illegible]	0.70	19.95	1688.26
83221.103	77.48	[illegible]	0.40	10.80	1191.27
83342.297	121.19	[illegible]	0.00	0.00	654.46
83417.024	74.73	1.40	0.00	0.00	0.00
83509.485	92.46	[illegible]	0.20	5.20	240.40
83608.708	99.22	[illegible]	0.00	0.00	257.99
83702.522	93.81	[illegible]	0.10	2.55	119.62
83790.992	88.47	[illegible]	0.70	19.95	995.29
83858.905	67.91	[illegible]	1.10	33.55	1816.69
83945.678	86.77	[illegible]	0.90	26.55	2607.53
84136.289	190.61	1.50	0.00	0.00	2530.36
84216.921	80.63	2.10	0.00	0.00	0.00
84327.198	110.28	1.70	0.00	0.00	0.00
84470.255	143.06	3.80	0.00	0.00	0.00
84536.394	66.14	3.80	0.00	0.00	0.00
84637.120	100.73	4.00	0.00	0.00	0.00
84740.629	103.51	4.70	0.00	0.00	0.00
84834.142	93.51	4.20	0.00	0.00	0.00
84920.260	86.12	2.80	0.00	0.00	0.00
85000.027	79.77	1.50	0.00	0.00	0.00
85078.759	78.73	[illegible]	0.10	2.55	100.39
85150.535	71.78	[illegible]	0.00	0.00	91.52
85221.772	71.24	[illegible]	0.00	0.00	0.00
85278.962	57.19	[illegible]	0.40	10.80	308.83
85336.533	57.57	[illegible]	1.30	40.95	1489.67
85395.818	59.29	[illegible]	1.30	40.95	2427.73
85448.999	53.18	[illegible]	1.10	33.55	1980.97
85496.903	47.90	[illegible]	0.70	19.95	1281.46
85548.532	51.63	[illegible]	0.50	13.75	869.95
85592.969	44.44	[illegible]	0.40	10.80	545.47
85944.118	351.15	[illegible]	0.40	10.80	3792.41
86027.064	82.95	[illegible]	0.80	23.20	1410.09
86094.747	67.68	[illegible]	0.80	23.20	1570.25
86188.232	93.49	[illegible]	0.80	23.20	2168.86
86297.392	109.16	[illegible]	1.10	33.55	3097.41
86363.555	66.16	[illegible]	0.20	5.20	1281.93
86440.142	76.59	[illegible]	1.10	33.55	1483.87
86631.241	191.10	[illegible]	1.00	30.00	6072.16
86729.000	97.76	[illegible]	0.70	19.95	2441.55

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
86809.204	80.20	[illegible]	1.30	40.95	2442.21
86878.972	69.77	[illegible]	1.50	48.75	3129.11
86922.926	43.95	1.80	0.00	0.00	1071.39
87000.044	77.12	[illegible]	0.10	2.55	98.33
87074.435	74.39	[illegible]	0.50	13.75	606.29
87114.039	39.60	[illegible]	0.30	7.95	429.71
87175.537	61.50	1.90	0.00	0.00	244.46
87244.783	69.25	2.30	0.00	0.00	0.00
87310.528	65.75	2.70	0.00	0.00	0.00
87400.330	89.80	1.60	0.00	0.00	0.00
87494.378	94.05	1.70	0.00	0.00	0.00
87573.917	79.54	[illegible]	0.10	2.55	101.42
87660.290	86.37	[illegible]	0.40	10.80	576.54
87792.626	132.34	1.80	0.00	0.00	714.62
87875.276	82.65	1.90	0.00	0.00	0.00
87957.623	82.35	1.60	0.00	0.00	0.00
88032.339	74.72	[illegible]	0.20	5.20	194.27
88088.976	56.64	[illegible]	0.30	7.95	372.39
88165.165	76.19	[illegible]	0.00	0.00	302.86
88244.116	78.95	[illegible]	0.90	26.55	1048.07
88319.645	75.53	[illegible]	0.90	26.55	2005.30
88391.675	72.03	[illegible]	0.70	19.95	1674.70
88467.423	75.75	[illegible]	0.40	10.80	1164.63
88542.038	74.61	[illegible]	0.30	7.95	699.52
88607.713	65.68	[illegible]	0.10	2.55	344.80
88666.380	58.67	1.90	0.00	0.00	74.81
88735.810	69.43	3.00	0.00	0.00	0.00
88803.527	67.72	3.00	0.00	0.00	0.00
88850.637	47.11	3.50	0.00	0.00	0.00
89007.083	156.45	2.80	0.00	0.00	0.00
89093.942	86.86	3.30	0.00	0.00	0.00
89181.275	87.33	2.40	0.00	0.00	0.00
89247.141	65.87	2.10	0.00	0.00	0.00
89319.078	71.94	[illegible]	0.10	2.55	91.73
89389.800	70.72	4.10	0.00	0.00	90.18
89495.793	105.99	1.70	0.00	0.00	0.00
89569.505	73.71	1.80	0.00	0.00	0.00
89649.555	80.05	4.30	0.00	0.00	0.00
89725.283	75.73	[illegible]	0.20	5.20	196.90
89798.422	73.14	[illegible]	0.30	7.95	480.90
89868.432	70.01	[illegible]	0.80	23.20	1090.42
89952.198	83.77	[illegible]	0.60	16.80	1675.31
90032.876	80.68	[illegible]	0.80	23.20	1613.57
90096.259	63.38	[illegible]	0.70	19.95	1367.50
90156.375	60.12	[illegible]	1.00	30.00	1501.39
90214.231	57.86	[illegible]	0.70	19.95	1444.96
90310.000	95.77	[illegible]	0.80	23.20	2066.23
90491.267	181.27	3.10	0.00	0.00	2102.70
90626.267	135.00	2.60	0.00	0.00	0.00
90735.687	109.42	2.20	0.00	0.00	0.00
90858.687	123.00	[illegible]	0.00	0.00	0.00
91072.100	213.41	[illegible]	0.10	2.55	272.11
91159.597	87.50	[illegible]	0.20	5.20	339.05
91266.193	106.60	[illegible]	1.00	30.00	1876.11
91330.472	64.28	[illegible]	0.70	19.95	1605.37

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
91398.910	68.44	[illegible]	0.80	23.20	1476.55
91460.362	61.45	2.90	0.00	0.00	712.85
91647.492	187.13	2.00	0.00	0.00	0.00
91745.580	98.09	[illegible]	0.40	10.80	529.68
91828.605	83.02	[illegible]	0.70	19.95	1276.51
91955.359	126.75	1.60	0.00	0.00	1264.37
92050.057	94.70	[illegible]	0.10	2.55	120.75
92150.514	100.46	[illegible]	0.50	13.75	818.73
92233.531	83.02	[illegible]	0.30	7.95	900.74
92325.659	92.13	[illegible]	0.50	13.75	999.58
92413.760	88.10	[illegible]	0.70	19.95	1484.52
92506.307	92.55	[illegible]	0.80	23.20	1996.71
92609.039	102.73	[illegible]	0.70	19.95	2216.44
92691.778	82.74	[illegible]	0.70	19.95	1650.65
92775.190	83.41	3.20	0.00	0.00	832.04
92865.052	89.86	1.90	0.00	0.00	0.00
92952.722	87.67	1.70	0.00	0.00	0.00
93044.805	92.08	[illegible]	0.00	0.00	0.00
93142.832	98.03	[illegible]	0.30	7.95	389.66
93234.645	91.81	[illegible]	0.80	23.20	1429.99
93342.380	107.73	[illegible]	0.50	13.75	1990.40
93427.320	84.94	1.80	0.00	0.00	583.97
93510.711	83.39	2.20	0.00	0.00	0.00
93605.080	94.37	2.20	0.00	0.00	0.00
93699.322	94.24	2.10	0.00	0.00	0.00
93816.262	116.94	1.70	0.00	0.00	0.00
93927.728	111.47	[illegible]	0.00	0.00	0.00
94028.936	101.21	5.50	0.00	0.00	0.00
94151.986	123.05	4.40	0.00	0.00	0.00
94297.303	145.32	3.20	0.00	0.00	0.00
94452.466	155.16	2.20	0.00	0.00	0.00
94591.980	139.51	1.60	0.00	0.00	0.00
94744.998	153.02	2.20	0.00	0.00	0.00
94880.132	135.13	2.10	0.00	0.00	0.00
94992.811	112.68	[illegible]	0.40	10.80	608.47
95105.472	112.66	[illegible]	0.20	5.20	901.29
95207.119	101.65	[illegible]	0.40	10.80	813.19
95321.531	114.41	[illegible]	0.70	19.95	1759.09
95422.954	101.42	1.70	0.00	0.00	1011.70
95525.031	102.08	2.90	0.00	0.00	0.00
95630.385	105.35	3.60	0.00	0.00	0.00
95734.401	104.02	3.20	0.00	0.00	0.00
95858.779	124.38	3.50	0.00	0.00	0.00
95967.345	108.57	2.10	0.00	0.00	0.00
96080.594	113.25	[illegible]	0.00	0.00	0.00
96177.852	97.26	[illegible]	0.30	7.95	386.60
96306.974	129.12	[illegible]	0.20	5.20	848.99
96405.432	98.46	[illegible]	0.00	0.00	255.99
96492.747	87.31	2.10	0.00	0.00	0.00
96579.211	86.46	2.40	0.00	0.00	0.00
96674.204	94.99	3.30	0.00	0.00	0.00
96776.674	102.47	2.10	0.00	0.00	0.00
96868.010	91.34	2.00	0.00	0.00	0.00
96945.774	77.76	1.70	0.00	0.00	0.00
97073.394	127.62	1.70	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
97162.997	89.60	1.90	0.00	0.00	0.00
97252.439	89.44	[illegible]	0.30	7.95	355.53
97352.491	100.05	[illegible]	0.10	2.55	525.28
97459.286	106.79	[illegible]	0.10	2.55	272.33
97570.938	111.65	[illegible]	0.60	16.80	1080.23
97659.431	88.49	[illegible]	0.30	7.95	1095.11
97749.463	90.03	1.80	0.00	0.00	357.88
97850.428	100.96	1.40	0.00	0.00	0.00
97957.797	107.37	[illegible]	0.10	2.55	136.90
98045.039	87.24	[illegible]	0.70	19.95	981.47
98131.041	86.00	[illegible]	0.50	13.75	1449.15
98233.026	101.98	[illegible]	0.10	2.55	831.18
98334.832	101.81	[illegible]	0.30	7.95	534.49
98474.242	139.41	[illegible]	0.60	16.80	1725.20
98570.231	95.99	[illegible]	0.40	10.80	1324.66
98676.904	106.67	1.50	0.00	0.00	576.04
98781.627	104.72	1.70	0.00	0.00	0.00
98895.261	113.63	[illegible]	0.00	0.00	0.00
98996.197	100.94	[illegible]	0.80	23.20	1170.86
99096.996	100.80	[illegible]	0.90	26.55	2507.37
99203.829	106.83	1.50	0.00	0.00	1418.21
99295.783	91.95	4.40	0.00	0.00	0.00
99405.503	109.72	4.00	0.00	0.00	0.00
99514.681	109.18	3.50	0.00	0.00	0.00
99632.809	118.13	3.40	0.00	0.00	0.00
99749.487	116.68	3.60	0.00	0.00	0.00
99900.382	150.89	1.90	0.00	0.00	0.00
99999.992	99.61	[illegible]	0.10	2.55	127.01
100109.184	109.19	[illegible]	0.20	5.20	423.13
100215.880	106.70	1.40	0.00	0.00	277.41
100335.029	119.15	[illegible]	0.00	0.00	0.00
100443.152	108.12	2.70	0.00	0.00	0.00
100547.768	104.62	3.20	0.00	0.00	0.00
100651.726	103.96	4.30	0.00	0.00	0.00
100754.043	102.32	2.80	0.00	0.00	0.00
100851.586	97.54	4.10	0.00	0.00	0.00
100968.170	116.58	4.00	0.00	0.00	0.00
101058.002	89.83	3.00	0.00	0.00	0.00
101148.822	90.82	2.70	0.00	0.00	0.00
101254.216	105.39	3.20	0.00	0.00	0.00
101360.458	106.24	1.90	0.00	0.00	0.00
101448.624	88.17	[illegible]	0.40	10.80	476.10
101557.817	109.19	[illegible]	0.40	10.80	1179.28
101648.447	90.63	[illegible]	0.50	13.75	1112.49
101735.308	86.86	[illegible]	0.40	10.80	1066.22
101830.557	95.25	1.90	0.00	0.00	514.35
101950.138	119.58	3.30	0.00	0.00	0.00
102045.781	95.64	2.60	0.00	0.00	0.00
102150.842	105.06	1.70	0.00	0.00	0.00
102241.953	91.11	[illegible]	0.00	0.00	0.00
102331.073	89.12	[illegible]	0.20	5.20	231.72
102422.443	91.37	[illegible]	0.30	7.95	600.76
102515.969	93.53	[illegible]	0.10	2.55	491.02
102604.680	88.71	[illegible]	0.10	2.55	226.22
102690.857	86.18	[illegible]	0.00	0.00	109.88

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
102780.515	89.66	[illegible]	0.00	0.00	0.00
102883.960	103.45	[illegible]	0.60	16.80	868.94
102980.162	96.20	[illegible]	0.50	13.75	1469.49
103066.394	86.23	[illegible]	0.50	13.75	1185.70
103142.743	76.35	[illegible]	0.80	23.20	1410.55
103225.912	83.17	[illegible]	0.60	16.80	1663.38
103308.079	82.17	[illegible]	0.70	19.95	1509.81
103384.969	76.89	[illegible]	0.90	26.55	1787.70
103453.198	68.23	[illegible]	1.00	30.00	1929.19
103531.578	78.38	[illegible]	1.10	33.55	2490.53
103608.638	77.06	1.60	0.00	0.00	1292.69
103681.945	73.31	1.60	0.00	0.00	0.00
103763.270	81.32	2.50	0.00	0.00	0.00
103840.212	76.94	2.10	0.00	0.00	0.00
103926.856	86.64	2.90	0.00	0.00	0.00
104022.738	95.88	3.60	0.00	0.00	0.00
104119.571	96.83	2.70	0.00	0.00	0.00
104211.990	92.42	4.20	0.00	0.00	0.00
104300.107	88.12	4.40	0.00	0.00	0.00
104406.679	106.57	3.10	0.00	0.00	0.00
104496.150	89.47	2.20	0.00	0.00	0.00
104588.295	92.14	3.20	0.00	0.00	0.00
104679.207	90.91	3.00	0.00	0.00	0.00
104785.419	106.21	2.20	0.00	0.00	0.00
104884.729	99.31	1.70	0.00	0.00	0.00
104987.192	102.46	1.60	0.00	0.00	0.00
105089.291	102.10	2.20	0.00	0.00	0.00
105183.166	93.87	1.60	0.00	0.00	0.00
105325.537	142.37	[illegible]	0.60	16.80	1195.93
105435.571	110.03	1.50	0.00	0.00	924.29
105504.287	68.72	1.50	0.00	0.00	0.00
105625.344	121.06	1.40	0.00	0.00	0.00
105697.158	71.81	2.50	0.00	0.00	0.00
105773.022	75.86	2.00	0.00	0.00	0.00
105860.179	87.16	1.50	0.00	0.00	0.00
105948.995	88.82	[illegible]	0.20	5.20	230.93
106061.339	112.34	[illegible]	0.50	13.75	1064.46
106136.001	74.66	[illegible]	0.60	16.80	1140.48
106210.799	74.80	[illegible]	0.60	16.80	1256.61
106291.970	81.17	[illegible]	0.90	26.55	1759.38
106398.305	106.33	[illegible]	0.50	13.75	2142.65
106472.849	74.54	[illegible]	0.10	2.55	607.54
106552.670	79.82	[illegible]	0.20	5.20	309.31
106650.620	97.95	[illegible]	0.20	5.20	509.34
106765.852	115.23	[illegible]	0.20	5.20	599.21
106859.436	93.58	[illegible]	0.00	0.00	243.32
106926.786	67.35	[illegible]	0.20	5.20	175.11
106995.344	68.56	[illegible]	0.60	16.80	754.14
107071.152	75.81	[illegible]	0.70	19.95	1392.97
107156.366	85.21	[illegible]	0.60	16.80	1565.82
107243.085	86.72	1.80	0.00	0.00	728.44
107330.448	87.36	3.50	0.00	0.00	0.00
107502.382	171.93	2.50	0.00	0.00	0.00
107587.558	85.18	1.80	0.00	0.00	0.00
107666.420	78.86	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
107763.218	96.80	1.40	0.00	0.00	0.00
107840.031	76.81	[illegible]	0.10	2.55	97.94
107923.265	83.23	[illegible]	0.10	2.55	212.25
107999.976	76.71	[illegible]	0.20	5.20	297.26
108090.238	90.26	[illegible]	1.00	30.00	1588.61
108186.026	95.79	[illegible]	0.40	10.80	1954.09
108275.689	89.66	[illegible]	0.10	2.55	598.51
108365.420	89.73	[illegible]	0.00	0.00	114.41
108453.702	88.28	[illegible]	0.10	2.55	112.56
108543.663	89.96	[illegible]	0.30	7.95	472.30
108635.029	91.37	1.70	0.00	0.00	363.18
108637.954	2.93	1.70	0.00	0.00	0.00
108708.715	70.76	2.10	0.00	0.00	0.00
108790.671	81.96	2.20	0.00	0.00	0.00
108888.055	97.38	1.80	0.00	0.00	0.00
108967.587	79.53	1.90	0.00	0.00	0.00
109064.320	96.73	2.40	0.00	0.00	0.00
109153.453	89.13	2.90	0.00	0.00	0.00
109475.281	321.83	2.40	0.00	0.00	0.00
109557.337	82.06	3.10	0.00	0.00	0.00
109642.402	85.06	2.50	0.00	0.00	0.00
109713.465	71.06	2.40	0.00	0.00	0.00
109793.797	80.33	2.50	0.00	0.00	0.00
109877.904	84.11	2.10	0.00	0.00	0.00
109947.648	69.74	2.10	0.00	0.00	0.00
110024.150	76.50	1.90	0.00	0.00	0.00
110101.202	77.05	1.40	0.00	0.00	0.00
110205.289	104.09	[illegible]	0.00	0.00	0.00
110500.000	294.71	[illegible]	0.00	0.00	0.00
110750.000	250.00	1.40	0.00	0.00	0.00
111000.000	250.00	1.50	0.00	0.00	0.00
111250.000	250.00	1.50	0.00	0.00	0.00
111500.000	250.00	2.30	0.00	0.00	0.00
111750.000	250.00	[illegible]	0.00	0.00	0.00
112000.000	250.00	1.50	0.00	0.00	0.00
112250.000	250.00	[illegible]	0.00	0.00	0.00
112500.000	250.00	[illegible]	0.00	0.00	0.00
112750.000	250.00	[illegible]	1.00	30.00	3750.00
113000.000	250.00	1.50	0.00	0.00	3750.00
113250.000	250.00	[illegible]	0.10	2.55	318.75
113500.000	250.00	[illegible]	0.00	0.00	318.75
113750.000	250.00	2.20	0.00	0.00	0.00
114000.000	250.00	2.30	0.00	0.00	0.00
114250.000	250.00	2.20	0.00	0.00	0.00
114500.000	250.00	[illegible]	0.00	0.00	0.00
114750.000	250.00	2.20	0.00	0.00	0.00
115000.000	250.00	[illegible]	0.00	0.00	0.00
115250.000	250.00	1.80	0.00	0.00	0.00
115500.000	250.00	2.00	0.00	0.00	0.00
115750.000	250.00	2.30	0.00	0.00	0.00
116000.000	250.00	[illegible]	0.00	0.00	0.00
116250.000	250.00	2.10	0.00	0.00	0.00
116500.000	250.00	2.10	0.00	0.00	0.00
116750.000	250.00	1.60	0.00	0.00	0.00
117000.000	250.00	[illegible]	0.10	2.55	318.75

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
117250.000	250.00	2.00	0.00	0.00	318.75
117500.000	250.00	1.80	0.00	0.00	0.00
117750.000	250.00	[illegible]	0.00	0.00	0.00
118000.000	250.00	[illegible]	0.40	10.80	1350.00
118250.000	250.00	2.10	0.00	0.00	1350.00
118500.000	250.00	1.40	0.00	0.00	0.00
118750.000	250.00	2.20	0.00	0.00	0.00
119000.000	250.00	[illegible]	0.00	0.00	0.00
119250.000	250.00	1.50	0.00	0.00	0.00
119500.000	250.00	2.10	0.00	0.00	0.00
119750.000	250.00	1.40	0.00	0.00	0.00
120000.000	250.00	2.00	0.00	0.00	0.00
120250.000	250.00	1.90	0.00	0.00	0.00
120500.000	250.00	3.10	0.00	0.00	0.00
120750.000	250.00	2.40	0.00	0.00	0.00
121000.000	250.00	1.40	0.00	0.00	0.00
121250.000	250.00	1.90	0.00	0.00	0.00
121500.000	250.00	2.40	0.00	0.00	0.00
121750.000	250.00	1.80	0.00	0.00	0.00
122000.000	250.00	2.20	0.00	0.00	0.00
122250.000	250.00	3.20	0.00	0.00	0.00
122500.000	250.00	2.00	0.00	0.00	0.00
122750.000	250.00	1.90	0.00	0.00	0.00
123000.000	250.00	1.50	0.00	0.00	0.00
123250.000	250.00	1.70	0.00	0.00	0.00
123500.000	250.00	1.90	0.00	0.00	0.00
123750.000	250.00	1.80	0.00	0.00	0.00
124000.000	250.00	1.60	0.00	0.00	0.00
124250.000	250.00	2.40	0.00	0.00	0.00
124500.000	250.00	2.10	0.00	0.00	0.00
124750.000	250.00	1.80	0.00	0.00	0.00
125000.000	250.00	[illegible]	0.60	16.80	2100.00
125250.000	250.00	[illegible]	0.90	26.55	5418.75
125500.000	250.00	[illegible]	1.00	30.00	7068.75
125750.000	250.00	[illegible]	0.30	7.95	4743.75
126000.000	250.00	1.40	0.00	0.00	993.75
126250.000	250.00	1.60	0.00	0.00	0.00
126500.000	250.00	1.70	0.00	0.00	0.00
126750.000	250.00	1.40	0.00	0.00	0.00
127000.000	250.00	[illegible]	0.60	16.80	2100.00
127250.000	250.00	[illegible]	0.00	0.00	2100.00
127500.000	250.00	[illegible]	0.80	23.20	2900.00
127750.000	250.00	2.80	0.00	0.00	2900.00
128000.000	250.00	1.70	0.00	0.00	0.00
128250.000	250.00	3.20	0.00	0.00	0.00
128500.000	250.00	2.80	0.00	0.00	0.00
128750.000	250.00	2.10	0.00	0.00	0.00
129000.000	250.00	1.60	0.00	0.00	0.00
129250.000	250.00	[illegible]	0.00	0.00	0.00
129500.000	250.00	[illegible]	0.90	26.55	3318.75
129750.000	250.00	[illegible]	1.10	33.55	7512.50
130000.000	250.00	1.80	0.00	0.00	4193.75
130250.000	250.00	1.40	0.00	0.00	0.00
130500.000	250.00	[illegible]	0.70	19.95	2493.75
130604.100	104.10	[illegible]	0.90	26.55	2420.33

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
130635.826	31.73	[illegible]	1.10	33.55	953.38
130675.402	39.58	[illegible]	1.00	30.00	1257.51
130802.297	126.89	[illegible]	0.50	13.75	2775.83
130837.221	34.92	2.80	0.00	0.00	240.11
130872.924	35.70	1.70	0.00	0.00	0.00
130920.147	47.22	2.90	0.00	0.00	0.00
130968.999	48.85	3.10	0.00	0.00	0.00
131028.039	59.04	2.00	0.00	0.00	0.00
131053.826	25.79	2.00	0.00	0.00	0.00
131102.344	48.52	[illegible]	0.80	23.20	562.81
131115.045	12.70	1.50	0.00	0.00	147.33
131173.679	58.63	2.40	0.00	0.00	0.00
131220.416	46.74	[illegible]	0.00	0.00	0.00
131270.624	50.21	1.80	0.00	0.00	0.00
131320.859	50.23	[illegible]	1.10	33.55	842.69
131365.816	44.96	1.60	0.00	0.00	754.16
131398.575	32.76	[illegible]	0.10	2.55	41.77
131433.526	34.95	[illegible]	0.50	13.75	284.86
131478.283	44.76	[illegible]	0.90	26.55	901.86
131512.269	33.99	[illegible]	1.40	44.80	1212.44
131559.235	46.97	[illegible]	1.30	40.95	2013.68
131587.962	28.73	[illegible]	0.70	19.95	874.75
131621.928	33.97	[illegible]	0.80	23.20	732.82
131661.405	39.48	[illegible]	0.90	26.55	982.01
131696.603	35.20	[illegible]	0.70	19.95	818.35
131740.480	43.88	[illegible]	0.50	13.75	739.33
131793.324	52.84	[illegible]	0.30	7.95	573.37
131850.999	57.67	[illegible]	0.20	5.20	379.21
131908.310	57.31	1.60	0.00	0.00	149.01
132021.600	113.29	[illegible]	0.00	0.00	0.00
132072.928	51.33	[illegible]	0.20	5.20	133.46
132140.712	67.78	1.80	0.00	0.00	176.24
132201.479	60.77	3.10	0.00	0.00	0.00
132315.365	113.89	2.00	0.00	0.00	0.00
132373.773	58.41	2.40	0.00	0.00	0.00
132463.204	89.43	2.40	0.00	0.00	0.00
132515.837	52.63	1.70	0.00	0.00	0.00
132558.371	42.53	[illegible]	0.00	0.00	0.00
132598.367	40.00	[illegible]	0.00	0.00	0.00
132638.139	39.77	[illegible]	0.20	5.20	103.41
132682.149	44.01	[illegible]	0.40	10.80	352.09
132728.373	46.22	[illegible]	0.30	7.95	433.35
132752.054	23.68	[illegible]	0.70	19.95	330.36
132801.754	49.70	[illegible]	0.80	23.20	1072.28
132852.239	50.48	[illegible]	0.40	10.80	858.25
132923.654	71.42	[illegible]	0.10	2.55	476.70
132952.545	28.89	[illegible]	0.10	2.55	73.68
133011.614	59.07	[illegible]	0.10	2.55	150.63
133047.410	35.80	[illegible]	0.10	2.55	91.29
133130.848	83.44	[illegible]	0.00	0.00	106.39
133214.294	83.45	[illegible]	0.40	10.80	450.61
133261.422	47.13	[illegible]	0.80	23.20	801.18
133302.321	40.90	[illegible]	0.60	16.80	817.99
133338.781	36.46	[illegible]	0.00	0.00	306.27
133451.629	112.85	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
133463.644	12.01		0.00	0.00	0.00
133498.875	35.23		0.30	7.95	140.05
133521.408	22.53		0.60	16.80	278.85
133540.551	19.14		0.70	19.95	351.75
133588.021	47.47		1.10	33.55	1269.84
133624.097	36.08		1.30	40.95	1343.83
133675.637	51.54		1.40	44.80	2209.77
133706.907	31.27		1.50	48.75	1462.65
133719.831	12.92		1.40	44.80	604.56
133732.850	13.02		1.10	33.55	510.01
133740.977	8.13		1.10	33.55	272.67
133759.703	18.73		1.00	30.00	595.01
133800.518	40.82		1.10	33.55	1296.91
133834.958	34.44		1.00	30.00	1094.34
133874.905	39.95		0.90	26.55	1129.49
133908.282	33.38		0.80	23.20	830.28
133948.868	40.59		0.40	10.80	689.96
134033.566	84.70	2.70	0.00	0.00	457.38
134086.276	52.71	2.10	0.00	0.00	0.00
134129.819	43.54	1.80	0.00	0.00	0.00
134185.644	55.83		0.00	0.00	0.00
134224.385	38.74		0.30	7.95	154.00
134259.108	34.72		0.70	19.95	484.39
134309.928	50.82		0.80	23.20	1096.45
134350.842	40.91		0.80	23.20	949.23
134371.640	20.80		0.50	13.75	384.24
134426.706	55.07		0.10	2.55	448.79
134463.130	36.42		0.10	2.55	92.89
134514.552	51.42		0.90	26.55	748.19
134573.718	59.17		1.00	30.00	1672.93
134610.340	36.62		1.10	33.55	1163.66
134676.443	66.10		1.30	40.95	2462.33
134687.134	10.69		1.30	40.95	437.80
134736.150	49.02		0.80	23.20	1572.21
134755.312	19.16		0.60	16.80	383.24
134783.232	27.92		0.50	13.75	426.48
134818.846	35.61		0.20	5.20	337.45
134837.189	18.34		0.00	0.00	47.70
134876.259	39.07		0.00	0.00	0.00
134911.616	35.36	1.50	0.00	0.00	0.00
134973.019	61.40		0.80	23.20	712.28
135020.462	47.44		1.00	30.00	1261.98
135048.664	28.20		1.10	33.55	896.13
135075.720	27.06		1.10	33.55	907.72
135100.248	24.53		1.00	30.00	779.37
135124.699	24.45		0.90	26.55	691.37
135164.142	39.44		0.70	19.95	917.05
135210.992	46.85		0.30	7.95	653.57
135250.030	39.04		0.00	0.00	155.18
135262.812	12.78		0.00	0.00	0.00
135290.791	27.98		0.10	2.55	35.68
135325.765	34.97		0.20	5.20	135.53
135348.060	22.29		0.90	26.55	353.93
135396.991	48.93		0.70	19.95	1137.66
135438.534	41.54		0.70	19.95	828.78

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
135466.864	28.33		0.80	23.20	611.22
135491.331	24.47		0.90	26.55	608.63
135511.684	20.35		1.00	30.00	575.50
135541.973	30.29		0.90	26.55	856.42
135565.472	23.50		1.10	33.55	706.14
135583.933	18.46		1.10	33.55	619.39
135605.117	21.18		1.10	33.55	710.72
135627.396	22.28		1.10	33.55	747.46
135629.939	2.54		1.00	30.00	80.80
135665.676	35.74		1.10	33.55	1135.54
135700.712	35.04		1.00	30.00	1113.28
135740.654	39.94		0.90	26.55	1129.36
135778.435	37.78		1.00	30.00	1068.28
135799.925	21.49		0.80	23.20	571.63
135822.420	22.49		0.70	19.95	485.33
135860.508	38.09		0.80	23.20	821.75
135885.118	24.61		0.60	16.80	492.21
135993.271	108.15		0.70	19.95	1987.32
136011.233	17.96		0.70	19.95	358.35
136051.279	40.05		0.70	19.95	798.91
136070.760	19.48		0.80	23.20	420.31
136095.120	24.36		0.60	16.80	487.20
136140.139	45.02		0.30	7.95	557.12
136191.300	51.16	1.60	0.00	0.00	203.37
136238.364	47.06		0.10	2.55	60.01
136285.197	46.83		0.30	7.95	245.88
136329.639	44.44		0.20	5.20	292.21
136376.953	47.31		0.50	13.75	448.31
136417.654	40.70		0.60	16.80	621.71
136463.554	45.90		0.40	10.80	633.42
136501.047	37.49		0.70	19.95	576.45
136544.724	43.68		0.80	23.20	942.34
136593.075	48.35		0.00	0.00	560.88
136648.301	55.23		0.00	0.00	0.00
136730.750	82.45	2.20	0.00	0.00	0.00
136766.417	35.67	2.20	0.00	0.00	0.00
136799.403	32.99	1.70	0.00	0.00	0.00
136841.032	41.63		0.00	0.00	0.00
136886.436	45.40		0.00	0.00	0.00
136929.544	43.11	1.90	0.00	0.00	0.00
136961.700	32.16	2.60	0.00	0.00	0.00
137020.035	58.34	3.10	0.00	0.00	0.00
137067.672	47.64	3.60	0.00	0.00	0.00
137100.995	33.32	3.20	0.00	0.00	0.00
137161.515	60.52	2.30	0.00	0.00	0.00
137208.544	47.03	1.70	0.00	0.00	0.00
137230.457	21.91	1.70	0.00	0.00	0.00
137279.782	49.33	1.60	0.00	0.00	0.00
137330.777	50.99	2.20	0.00	0.00	0.00
137373.308	42.53		0.00	0.00	0.00
137415.620	42.31		0.40	10.80	228.49
137459.734	44.11		0.50	13.75	541.50
137494.040	34.31		0.60	16.80	524.02
137522.207	28.17		0.80	23.20	563.36
137550.429	28.22		1.00	30.00	750.71

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
137584.688	34.26		1.50	48.75	1348.93
137604.285	19.60		1.40	44.80	916.67
137622.316	18.03		1.40	44.80	807.79
137634.968	12.65		1.30	40.95	542.48
137650.906	15.94		1.10	33.55	593.67
137670.293	19.39		0.90	26.55	582.59
137703.435	33.14		0.90	26.55	879.93
137727.838	24.40		0.90	26.55	647.90
137747.662	19.82		0.80	23.20	493.13
137788.621	40.96		0.70	19.95	883.69
137833.329	44.71		0.50	13.75	753.34
137859.015	25.69		0.40	10.80	315.30
137896.714	37.70		0.50	13.75	462.77
137912.491	15.78		0.70	19.95	265.84
137946.958	34.47		0.70	19.95	687.62
137965.223	18.26		0.80	23.20	394.07
137988.551	23.33		0.90	26.55	580.30
138018.953	30.40		0.90	26.55	807.19
138049.715	30.76		1.30	40.95	1038.20
138074.532	24.82		1.30	40.95	1016.27
138105.495	30.96		1.40	44.80	1327.56
138131.873	26.38		1.30	40.95	1130.93
138153.517	21.64		1.30	40.95	886.33
138191.252	37.74		1.10	33.55	1405.66
138222.618	31.37		1.30	40.95	1168.36
138242.681	20.06		1.40	44.80	860.21
138263.479	20.80		1.00	30.00	777.84
138275.458	11.98		0.70	19.95	299.18
138300.135	24.68		0.70	19.95	492.31
138327.614	27.48		0.90	26.55	638.89
138357.890	30.28		1.10	33.55	909.81
138394.324	36.43	3.30	0.00	0.00	611.19
138449.351	55.03	2.60	0.00	0.00	0.00
138499.713	50.36	2.80	0.00	0.00	0.00
138559.152	59.44	1.90	0.00	0.00	0.00
138619.195	60.04		0.10	2.55	76.56
138657.895	38.70		0.00	0.00	49.35
138696.079	38.18		1.00	30.00	572.77
138731.998	35.92		0.70	19.95	897.09
138757.880	25.88		0.50	13.75	436.11
138797.275	39.39		0.10	2.55	321.07
138824.595	27.32		0.30	7.95	143.43
138852.354	27.76		0.60	16.80	343.52
138873.611	21.26		0.90	26.55	460.75
138920.081	46.47		1.30	40.95	1568.38
138946.143	26.06		1.50	48.75	1168.87
138967.185	21.04		1.30	40.95	943.74
138979.501	12.32		1.10	33.55	458.78
138997.275	17.77		1.10	33.55	596.33
139021.532	24.26		1.00	30.00	770.76
139059.286	37.75		1.00	30.00	1132.63
139105.396	46.11		0.80	23.20	1226.53
139149.853	44.46		0.50	13.75	821.34
139213.718	63.86		0.00	0.00	439.08
139298.630	84.91	3.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
139343.066	44.44	1.80	0.00	0.00	0.00
139374.915	31.85	1.40	0.00	0.00	0.00
139421.643	46.73	[illegible]	0.20	5.20	121.50
139466.213	44.57	[illegible]	0.20	5.20	231.77
139508.832	42.62	[illegible]	0.30	7.95	280.22
139543.901	35.07	[illegible]	0.30	7.95	278.80
139584.605	40.70	[illegible]	0.70	19.95	567.83
139635.856	51.25	[illegible]	0.40	10.80	787.98
139671.540	35.68	[illegible]	0.40	10.80	385.40
139721.300	49.76	[illegible]	0.30	7.95	466.50
139781.613	60.31	[illegible]	1.10	33.55	1251.52
139823.077	41.46	[illegible]	1.30	40.95	1544.51
139825.227	2.15	[illegible]	1.30	40.95	88.06
139850.345	25.12	[illegible]	0.60	16.80	725.28
139890.756	40.41	[illegible]	0.50	13.75	617.29
139926.978	36.22	[illegible]	0.00	0.00	249.03
139966.431	39.45	[illegible]	0.20	5.20	102.58
140007.648	41.22	[illegible]	0.60	16.80	453.40
140047.392	39.74	[illegible]	1.00	30.00	930.01
140097.232	49.84	1.60	0.00	0.00	747.61
140141.508	44.28	1.50	0.00	0.00	0.00
140186.101	44.59	1.60	0.00	0.00	0.00
140230.219	44.12	[illegible]	0.00	0.00	0.00
140264.752	34.53	1.70	0.00	0.00	0.00
140296.320	31.57	2.10	0.00	0.00	0.00
140347.590	51.27	1.90	0.00	0.00	0.00
140385.496	37.91	1.90	0.00	0.00	0.00
140419.981	34.49	1.60	0.00	0.00	0.00
140473.347	53.37	1.60	0.00	0.00	0.00
140534.488	61.14	1.40	0.00	0.00	0.00
140580.829	46.34	[illegible]	0.20	5.20	120.49
140631.956	51.13	[illegible]	0.30	7.95	336.16
140672.413	40.46	[illegible]	0.60	16.80	500.67
140721.876	49.46	[illegible]	0.50	13.75	755.54
140787.640	65.76	[illegible]	1.00	30.00	1438.59
140815.946	28.31	1.50	0.00	0.00	424.60
140853.601	37.66	2.10	0.00	0.00	0.00
140877.582	23.98	2.40	0.00	0.00	0.00
140935.370	57.79	3.20	0.00	0.00	0.00
140974.691	39.32	4.30	0.00	0.00	0.00
141001.216	26.52	2.20	0.00	0.00	0.00
141032.650	31.43	3.80	0.00	0.00	0.00
141055.807	23.16	5.60	0.00	0.00	0.00
141067.423	11.62	3.70	0.00	0.00	0.00
141084.854	17.43	2.70	0.00	0.00	0.00
141118.740	33.89	2.10	0.00	0.00	0.00
141146.810	28.07	1.60	0.00	0.00	0.00
141180.744	33.93	1.50	0.00	0.00	0.00
141254.278	73.53	1.60	0.00	0.00	0.00
141284.267	29.99	1.50	0.00	0.00	0.00
141324.542	40.27	1.40	0.00	0.00	0.00
141361.566	37.02	1.70	0.00	0.00	0.00
141399.688	38.12	1.60	0.00	0.00	0.00
141429.472	29.78	1.40	0.00	0.00	0.00
141493.432	63.96	2.80	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
141534.919	41.49	[illegible]	0.90	26.55	550.76
141554.926	20.01	[illegible]	0.00	0.00	265.59
141597.330	42.40	[illegible]	0.20	5.20	110.26
141624.012	26.68	1.40	0.00	0.00	69.38
141664.590	40.58	2.10	0.00	0.00	0.00
141689.029	24.44	2.40	0.00	0.00	0.00
141724.807	35.78	1.60	0.00	0.00	0.00
141760.196	35.39	[illegible]	0.30	7.95	140.68
141796.251	36.06	[illegible]	0.70	19.95	502.98
141829.775	33.52	[illegible]	0.60	16.80	616.00
141860.716	30.94	[illegible]	0.60	16.80	519.82
141894.152	33.44	[illegible]	0.60	16.80	561.73
141936.664	42.51	[illegible]	0.80	23.20	850.25
141980.870	44.21	[illegible]	0.90	26.55	1099.62
142009.028	28.16	[illegible]	1.10	33.55	846.15
142042.911	33.88	[illegible]	1.30	40.95	1262.18
142075.912	33.00	[illegible]	1.30	40.95	1351.39
142117.596	41.68	[illegible]	1.40	44.80	1787.20
142147.700	30.10	[illegible]	1.00	30.00	1125.89
142172.029	24.33	[illegible]	0.30	7.95	461.65
142212.000	39.97	1.50	0.00	0.00	158.89
142252.732	40.73	1.70	0.00	0.00	0.00
142290.833	38.10	1.60	0.00	0.00	0.00
142340.471	49.64	1.60	0.00	0.00	0.00
142385.594	45.12	1.50	0.00	0.00	0.00
142441.997	56.40	1.50	0.00	0.00	0.00
142489.498	47.50	[illegible]	0.00	0.00	0.00
142524.527	35.03	[illegible]	0.10	2.55	44.67
142571.107	46.58	[illegible]	0.00	0.00	59.40
142645.522	74.41	[illegible]	0.50	13.75	511.61
142680.565	35.04	[illegible]	0.60	16.80	535.28
142713.549	32.98	[illegible]	0.60	16.80	554.14
142769.266	55.72	[illegible]	0.80	23.20	1114.34
142814.336	45.07	[illegible]	1.00	30.00	1198.88
142854.124	39.79	[illegible]	1.10	33.55	1264.28
142898.244	44.12	[illegible]	0.80	23.20	1251.90
142928.144	29.90	[illegible]	0.80	23.20	693.67
142976.458	48.31	[illegible]	0.60	16.80	966.29
143025.235	48.78	[illegible]	0.10	2.55	471.92
143073.428	48.19	[illegible]	0.20	5.20	186.75
143124.571	51.14	1.70	0.00	0.00	132.98
143186.051	61.48	2.90	0.00	0.00	0.00
143240.601	54.55	2.40	0.00	0.00	0.00
143297.927	57.33	2.80	0.00	0.00	0.00
143360.361	62.43	3.80	0.00	0.00	0.00
143451.518	91.16	2.30	0.00	0.00	0.00
143538.861	87.34	1.80	0.00	0.00	0.00
143607.810	68.95	1.40	0.00	0.00	0.00
143660.818	53.01	[illegible]	0.40	10.80	286.24
143714.135	53.32	[illegible]	0.40	10.80	575.83
143764.248	50.11	[illegible]	0.50	13.75	615.14
143827.102	62.85	[illegible]	0.70	19.95	1059.09
143872.790	45.69	[illegible]	0.90	26.55	1062.26
143914.509	41.72	[illegible]	0.90	26.55	1107.63
143962.171	47.66	[illegible]	1.00	30.00	1347.67

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
144006.884	44.71		0.90	26.55	1264.27
144051.953	45.07		0.80	23.20	1121.09
144120.851	68.90		0.80	23.20	1598.45
144161.871	41.02		0.80	23.20	951.67
144219.067	57.20		0.80	23.20	1326.93
144238.254	19.19		0.80	23.20	445.15
144303.007	64.75		0.60	16.80	1295.07
144365.483	62.48		0.60	16.80	1049.60
144421.409	55.93		0.60	16.80	939.56
144512.956	91.55		0.80	23.20	1830.96
144558.251	45.29		0.70	19.95	977.23
144619.071	60.82		0.50	13.75	1024.83
144658.407	39.34	1.40	0.00	0.00	270.44
144701.945	43.54	1.90	0.00	0.00	0.00
144826.661	124.72	1.60	0.00	0.00	0.00
144883.665	57.00		0.10	2.55	72.69
144924.845	41.18		0.50	13.75	335.62
144971.490	46.65		0.70	19.95	785.98
145035.320	63.83		1.00	30.00	1594.15
145065.579	30.26		0.80	23.20	804.90
145104.559	38.98	2.10	0.00	0.00	452.17
145137.957	33.40		0.00	0.00	0.00
145175.715	37.76		1.40	44.80	845.78
145181.079	5.36		1.30	40.95	229.99
145219.775	38.70		1.10	33.55	1441.42
145239.313	19.54		1.40	44.80	765.41
145259.836	20.52		1.30	40.95	879.95
145287.186	27.35		1.00	30.00	970.26
145313.591	26.40		0.00	0.00	396.08
145335.571	21.98	1.50	0.00	0.00	0.00
145371.893	36.32		0.00	0.00	0.00
145411.002	39.11		0.30	7.95	155.46
145443.164	32.16		0.60	16.80	398.00
145477.196	34.03	1.70	0.00	0.00	285.87
145517.525	40.33	2.20	0.00	0.00	0.00
145563.861	46.34		0.00	0.00	0.00
145595.611	31.75		0.20	5.20	82.56
145638.801	43.19		0.70	19.95	543.12
145678.608	39.81		1.10	33.55	1064.85
145707.406	28.80		0.70	19.95	770.36
145748.218	40.81		0.20	5.20	513.21
145772.667	24.45		0.00	0.00	63.57
145798.484	25.82		0.20	5.20	67.13
145835.318	36.83	1.70	0.00	0.00	95.77
145875.290	39.97		0.00	0.00	0.00
145931.730	56.44		0.10	2.55	71.97
145987.247	55.52		0.20	5.20	215.13
146013.346	26.10		0.10	2.55	101.14
146054.468	41.12		0.30	7.95	215.89
146107.697	53.23		0.50	13.75	577.54
146154.870	47.17		0.80	23.20	871.53
146194.937	40.07		0.60	16.80	801.34
146242.213	47.28		0.60	16.80	794.24
146269.519	27.31		0.40	10.80	376.83
146303.181	33.66		0.50	13.75	413.21

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
146326.026	22.85		1.10	33.55	540.29
146367.183	41.16		1.10	33.55	1380.81
146387.763	20.58	2.60	0.00	0.00	345.23
146422.808	35.05		0.20	5.20	91.12
146470.468	47.66		0.50	13.75	451.58
146498.169	27.70		0.70	19.95	466.78
146528.168	30.00		0.60	16.80	551.24
146558.007	29.84		0.30	7.95	369.26
146609.237	51.23		0.40	10.80	480.29
146690.154	80.92		0.30	7.95	758.60
146728.654	38.50	4.30	0.00	0.00	153.04
146777.729	49.08	3.00	0.00	0.00	0.00
146813.034	35.30	2.50	0.00	0.00	0.00
146869.086	56.05	2.50	0.00	0.00	0.00
146908.199	39.11	2.10	0.00	0.00	0.00
146981.210	73.01	1.50	0.00	0.00	0.00
147022.686	41.48		0.40	10.80	223.98
147073.850	51.16		1.00	30.00	1043.75
147130.376	56.53		1.00	30.00	1695.76
147140.788	10.41		1.10	33.55	330.85
147159.972	19.18		1.00	30.00	609.58
147179.060	19.09		0.90	26.55	539.71
147199.974	20.91		0.60	16.80	453.32
147247.863	47.89		1.10	33.55	1205.61
147286.920	39.06		0.00	0.00	655.19
147328.844	41.92	1.60	0.00	0.00	0.00
147369.429	40.58	1.50	0.00	0.00	0.00
147418.591	49.16	1.60	0.00	0.00	0.00
147469.447	50.86		0.10	2.55	64.85
147508.297	38.85		0.30	7.95	203.97
147550.834	42.54		0.50	13.75	461.52
147603.837	53.00		0.30	7.95	575.09
147652.308	48.47	2.20	0.00	0.00	192.68
147743.305	91.00	1.90	0.00	0.00	0.00
147776.012	32.71	1.80	0.00	0.00	0.00
147835.982	59.97		0.30	7.95	238.39
147877.294	41.31		0.60	16.80	511.24
147916.442	39.15		0.30	7.95	484.45
147952.590	36.15		0.50	13.75	392.21
147989.012	36.42	1.50	0.00	0.00	250.41
148059.040	70.03	1.60	0.00	0.00	0.00
148135.271	76.23		0.10	2.55	97.20
148180.460	45.19		1.10	33.55	815.67
148222.231	41.77		1.00	30.00	1327.27
148258.731	36.50		0.80	23.20	970.92
148303.203	44.47	1.80	0.00	0.00	515.88
148347.646	44.44		0.40	10.80	240.00
148380.462	32.82		1.00	30.00	669.45
148436.508	56.05		1.10	33.55	1780.87
148499.902	63.39		1.30	40.95	2361.43
148552.777	52.87		1.40	44.80	2267.02
148604.466	51.69		1.30	40.95	2216.15
148638.374	33.91		1.40	44.80	1453.84
148670.020	31.65		0.80	23.20	1075.96
148737.036	67.02		0.50	13.75	1238.12

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
148778.443	41.41		0.10	2.55	337.48
148823.560	45.12		0.10	2.55	115.05
148862.361	38.80	1.50	0.00	0.00	49.48
148918.111	55.75		0.60	16.80	468.31
148971.472	53.36		0.70	19.95	980.51
149028.490	57.02		0.40	10.80	876.65
149063.347	34.86		0.00	0.00	188.24
149193.841	130.49	3.20	0.00	0.00	0.00
149281.841	88.00		1.10	33.55	1476.21
149329.103	47.26	1.70	0.00	0.00	792.82
149379.689	50.59	1.70	0.00	0.00	0.00
149431.853	52.16	4.10	0.00	0.00	0.00
149511.488	79.63	3.30	0.00	0.00	0.00
149573.072	61.58	1.80	0.00	0.00	0.00
149635.795	62.72		0.30	7.95	249.33
149707.890	72.10		1.00	30.00	1368.01
149777.975	70.08		1.10	33.55	2226.94
149813.755	35.78		0.60	16.80	900.77
149855.608	41.85		0.30	7.95	517.93
149985.893	130.29	1.50	0.00	0.00	517.89
150041.763	55.87		0.10	2.55	71.24
150107.699	65.94		0.00	0.00	84.07
150178.570	70.87		0.50	13.75	487.25
150242.701	64.13		0.10	2.55	522.67
150282.201	39.50		0.00	0.00	50.37
150340.801	58.60	2.80	0.00	0.00	0.00
150376.351	35.55	1.50	0.00	0.00	0.00
150429.669	53.32	1.70	0.00	0.00	0.00
150491.113	61.44		0.10	2.55	78.35
150578.245	87.13		0.50	13.75	710.13
150620.627	42.38		0.60	16.80	647.39
150661.741	41.11		0.80	23.20	822.28
150692.994	31.25		1.00	30.00	831.33
150728.326	35.33		1.00	30.00	1059.97
150762.428	34.10		1.10	33.55	1083.59
150786.767	24.34		1.00	30.00	773.39
150810.559	23.79		0.90	26.55	672.73
150859.166	48.61	1.90	0.00	0.00	645.26
150898.972	39.81	2.10	0.00	0.00	0.00
150950.386	51.41	2.10	0.00	0.00	0.00
151000.043	49.66	1.90	0.00	0.00	0.00
151098.698	98.65	2.00	0.00	0.00	0.00
151155.248	56.55	1.70	0.00	0.00	0.00
151233.765	78.52	1.50	0.00	0.00	0.00
151283.744	49.98	1.90	0.00	0.00	0.00
151327.968	44.22		0.30	7.95	175.79
151362.836	34.87		1.10	33.55	723.53
151410.830	47.99	4.60	0.00	0.00	805.10
151453.815	42.99	3.00	0.00	0.00	0.00
151493.663	39.85	1.50	0.00	0.00	0.00
151574.839	81.18		1.10	33.55	1361.73
151609.415	34.58		0.40	10.80	766.72
151657.418	48.00		0.30	7.95	450.04
151745.656	88.24		0.40	10.80	827.23
151817.616	71.96		0.70	19.95	1106.39

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
151863.413	45.80		0.70	19.95	913.66
151924.347	60.93		0.80	23.20	1314.65
151980.992	56.65		0.90	26.55	1409.05
152039.700	58.71		0.00	0.00	779.35
152109.315	69.62		0.10	2.55	88.76
152198.285	88.97		0.00	0.00	113.44
152250.741	52.46		0.00	0.00	0.00
152304.251	53.51	1.60	0.00	0.00	0.00
152359.909	55.66	3.40	0.00	0.00	0.00
152397.754	37.85	4.20	0.00	0.00	0.00
152448.727	50.97	3.90	0.00	0.00	0.00
152573.502	124.78	3.30	0.00	0.00	0.00
152632.952	59.45	4.40	0.00	0.00	0.00
152929.989	297.04	4.00	0.00	0.00	0.00
153055.884	125.89	3.00	0.00	0.00	0.00
153137.261	81.38	2.40	0.00	0.00	0.00
153234.392	97.13	2.50	0.00	0.00	0.00
153254.501	20.11	2.30	0.00	0.00	0.00
153361.168	106.67	2.80	0.00	0.00	0.00
153443.914	82.75	3.60	0.00	0.00	0.00
153489.757	45.84	2.80	0.00	0.00	0.00
153548.076	58.32		0.10	2.55	74.36
153601.308	53.23		0.20	5.20	206.28
153638.444	37.14		0.60	16.80	408.50
153695.241	56.80		0.80	23.20	1135.94
153730.167	34.93		1.00	30.00	929.06
153785.337	55.17		0.70	19.95	1377.85
153864.047	78.71	1.50	0.00	0.00	785.14
153970.070	106.02	1.90	0.00	0.00	0.00
154034.557	64.49	1.70	0.00	0.00	0.00
154089.769	55.21		0.00	0.00	0.00
154172.039	82.27		0.00	0.00	0.00
154232.716	60.68		0.20	5.20	157.76
154289.731	57.01		0.20	5.20	296.48
154370.612	80.88		0.70	19.95	1017.09
154430.162	59.55		1.00	30.00	1487.26
154501.810	71.65	1.60	0.00	0.00	1074.73
154564.940	63.13		0.40	10.80	340.91
154627.381	62.44	1.70	0.00	0.00	337.18
154669.873	42.49	1.60	0.00	0.00	0.00
154732.099	62.23		0.20	5.20	161.79
154772.783	40.68		0.50	13.75	385.49
154821.231	48.45		0.70	19.95	816.36
154869.271	48.04		1.00	30.00	1199.80
154909.476	40.20		1.40	44.80	1503.67
154950.628	41.15		1.40	44.80	1843.64
154976.647	26.02		0.80	23.20	884.63
155000.713	24.07		1.40	44.80	818.24
155054.330	53.62		0.60	16.80	1651.41
155062.302	7.97		0.90	26.55	172.80
155093.610	31.31		0.20	5.20	497.03
155130.342	36.73	2.00	0.00	0.00	95.51
155184.089	53.75	2.20	0.00	0.00	0.00
155244.876	60.79	1.80	0.00	0.00	0.00
155277.965	33.09	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
155324.439	46.47	2.00	0.00	0.00	0.00
155376.996	52.56	[illegible]	0.00	0.00	0.00
155415.743	38.75	[illegible]	0.80	23.20	449.47
155438.677	22.93	[illegible]	1.00	30.00	610.06
155478.906	40.23	[illegible]	0.80	23.20	1070.07
155514.190	35.28	[illegible]	0.00	0.00	409.30
155535.561	21.37	[illegible]	0.00	0.00	0.00
155557.039	21.48	[illegible]	0.00	0.00	0.00
155581.359	24.32	[illegible]	0.50	13.75	167.20
155599.889	18.53	[illegible]	0.60	16.80	283.05
155630.171	30.28	1.90	0.00	0.00	254.38
155690.163	59.99	2.00	0.00	0.00	0.00
155727.658	37.49	2.10	0.00	0.00	0.00
155780.776	53.12	2.00	0.00	0.00	0.00
155851.299	70.52	2.60	0.00	0.00	0.00
155917.243	65.94	1.90	0.00	0.00	0.00
156000.963	83.72	1.40	0.00	0.00	0.00
156049.333	48.37	1.80	0.00	0.00	0.00
156092.451	43.12	2.00	0.00	0.00	0.00
156127.714	35.26	1.80	0.00	0.00	0.00
156177.298	49.58	1.90	0.00	0.00	0.00
156273.057	95.76	2.00	0.00	0.00	0.00
156318.181	45.12	1.90	0.00	0.00	0.00
156370.851	52.67	1.70	0.00	0.00	0.00
156440.214	69.36	1.50	0.00	0.00	0.00
156517.343	77.13	1.40	0.00	0.00	0.00
156574.510	57.17	1.40	0.00	0.00	0.00
156679.004	104.49	[illegible]	0.40	10.80	564.27
156726.628	47.62	[illegible]	0.30	7.95	446.48
156783.500	56.87	[illegible]	0.90	26.55	981.05
156856.326	72.83	[illegible]	1.30	40.95	2457.89
156883.154	26.83	[illegible]	1.10	33.55	999.31
156918.261	35.11	[illegible]	0.90	26.55	1054.99
156968.347	50.09	[illegible]	1.30	40.95	1690.39
157009.938	41.59	[illegible]	1.30	40.95	1703.18
157063.580	53.64	[illegible]	0.10	2.55	1166.71
157107.745	44.17	1.50	0.00	0.00	56.32
157152.439	44.69	1.70	0.00	0.00	0.00
157205.174	52.74	2.00	0.00	0.00	0.00
157255.404	50.23	1.80	0.00	0.00	0.00
157295.441	40.04	3.20	0.00	0.00	0.00
157338.175	42.73	4.40	0.00	0.00	0.00
157439.293	101.12	4.90	0.00	0.00	0.00
157536.073	96.78	3.00	0.00	0.00	0.00
157603.089	67.02	2.30	0.00	0.00	0.00
157648.648	45.56	[illegible]	0.90	26.55	604.81
157721.306	72.66	2.50	0.00	0.00	964.53
157767.420	46.11	2.10	0.00	0.00	0.00
157852.528	85.11	1.60	0.00	0.00	0.00
157893.661	41.13	[illegible]	0.00	0.00	0.00
157968.645	74.98	2.40	0.00	0.00	0.00
158034.515	65.87	2.20	0.00	0.00	0.00
158097.433	62.92	2.30	0.00	0.00	0.00
158142.907	45.47	2.80	0.00	0.00	0.00
158237.104	94.20	2.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
158272.478	35.37	1.50	0.00	0.00	0.00
158351.966	79.49	2.80	0.00	0.00	0.00
158419.976	68.01	1.80	0.00	0.00	0.00
158479.111	59.13	1.70	0.00	0.00	0.00
158530.134	51.02	1.40	0.00	0.00	0.00
158568.787	38.65	1.40	0.00	0.00	0.00
158651.418	82.63	1.60	0.00	0.00	0.00
158784.890	133.47	[illegible]	0.20	5.20	347.03
158837.126	52.24	[illegible]	0.20	5.20	271.63
158973.447	136.32	2.40	0.00	0.00	354.44
159021.627	48.18	3.40	0.00	0.00	0.00
159072.099	50.47	3.10	0.00	0.00	0.00
159143.832	71.73	3.00	0.00	0.00	0.00
159198.426	54.59	2.20	0.00	0.00	0.00
159265.912	67.49	2.00	0.00	0.00	0.00
159372.780	106.87	3.70	0.00	0.00	0.00
159430.491	57.71	2.00	0.00	0.00	0.00
159515.247	84.76	2.60	0.00	0.00	0.00
159570.124	54.88	3.20	0.00	0.00	0.00
159620.786	50.66	2.70	0.00	0.00	0.00
159672.882	52.10	3.30	0.00	0.00	0.00
159752.145	79.26	2.30	0.00	0.00	0.00
159818.430	66.29	1.90	0.00	0.00	0.00
159874.383	55.95	1.60	0.00	0.00	0.00
159914.570	40.19	2.00	0.00	0.00	0.00
159975.074	60.50	2.20	0.00	0.00	0.00
160021.362	46.29	1.60	0.00	0.00	0.00
160061.821	40.46	1.70	0.00	0.00	0.00
160137.841	76.02	2.50	0.00	0.00	0.00
160191.247	53.41	2.30	0.00	0.00	0.00
160264.209	72.96	2.00	0.00	0.00	0.00
160346.822	82.61	1.70	0.00	0.00	0.00
160431.744	84.92	[illegible]	0.20	5.20	220.80
160521.327	89.58	[illegible]	0.00	0.00	232.92
160570.393	49.07	[illegible]	0.30	7.95	195.04
160610.227	39.83	[illegible]	0.30	7.95	316.68
160681.797	71.57	[illegible]	0.40	10.80	670.98
160714.352	32.55	[illegible]	0.40	10.80	351.60
160744.478	30.13	[illegible]	0.30	7.95	282.44
160795.077	50.60	[illegible]	0.60	16.80	626.17
160847.445	52.37	[illegible]	0.60	16.80	879.79
160879.212	31.77	[illegible]	0.70	19.95	583.72
160917.242	38.03	[illegible]	0.70	19.95	758.70
160972.311	55.07	[illegible]	0.90	26.55	1280.36
161008.025	35.71	[illegible]	1.10	33.55	1073.22
161027.596	19.57	[illegible]	1.10	33.55	656.62
161066.088	38.49	[illegible]	0.80	23.20	1092.22
161095.941	29.85	[illegible]	0.20	5.20	423.91
161122.037	26.10	2.20	0.00	0.00	67.86
161163.946	41.91	2.90	0.00	0.00	0.00
161226.054	62.11	4.10	0.00	0.00	0.00
161278.186	52.13	5.70	0.00	0.00	0.00
161366.520	88.33	2.00	0.00	0.00	0.00
161415.895	49.38	1.90	0.00	0.00	0.00
161484.440	68.54	2.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
161538.598	54.16	3.00	0.00	0.00	0.00
161587.534	48.94	2.70	0.00	0.00	0.00
161666.633	79.10	2.10	0.00	0.00	0.00
161707.601	40.97	3.20	0.00	0.00	0.00
161757.444	49.84	3.30	0.00	0.00	0.00
161797.279	39.83	2.50	0.00	0.00	0.00
161826.450	29.17	1.90	0.00	0.00	0.00
161936.414	109.96	1.40	0.00	0.00	0.00
162004.923	68.51	[illegible]	0.50	13.75	471.00
162046.429	41.51	[illegible]	0.30	7.95	450.35
162211.018	164.59	[illegible]	0.20	5.20	1082.17
162479.812	268.79	1.70	0.00	0.00	698.87
162679.393	199.58	3.20	0.00	0.00	0.00
162748.483	69.09	2.50	0.00	0.00	0.00
162833.339	84.86	2.20	0.00	0.00	0.00
162893.954	60.61	1.90	0.00	0.00	0.00
162949.370	55.42	1.60	0.00	0.00	0.00
162952.845	3.48	1.70	0.00	0.00	0.00
163022.890	70.05	2.70	0.00	0.00	0.00
163078.591	55.70	3.90	0.00	0.00	0.00
163136.848	58.26	4.00	0.00	0.00	0.00
163195.909	59.06	2.00	0.00	0.00	0.00
163219.729	23.82	[illegible]	0.40	10.80	128.63
163263.522	43.79	2.10	0.00	0.00	236.49
163334.205	70.68	2.40	0.00	0.00	0.00
163412.749	78.54	2.50	0.00	0.00	0.00
163459.945	47.20	2.10	0.00	0.00	0.00
163571.442	111.50	1.70	0.00	0.00	0.00
163644.123	72.68	2.30	0.00	0.00	0.00
163744.701	100.58	2.70	0.00	0.00	0.00
163880.319	135.62	2.70	0.00	0.00	0.00
163955.567	75.25	2.80	0.00	0.00	0.00
164003.250	47.68	2.80	0.00	0.00	0.00
164069.233	65.98	3.40	0.00	0.00	0.00
164128.248	59.02	3.60	0.00	0.00	0.00
164197.920	69.67	2.70	0.00	0.00	0.00
164256.506	58.59	2.60	0.00	0.00	0.00
164318.295	61.79	3.10	0.00	0.00	0.00
164386.273	67.98	3.00	0.00	0.00	0.00
164444.621	58.35	3.20	0.00	0.00	0.00
164506.212	61.59	2.80	0.00	0.00	0.00
164572.149	65.94	2.50	0.00	0.00	0.00
164634.564	62.42	2.30	0.00	0.00	0.00
164747.873	113.31	2.10	0.00	0.00	0.00
164818.232	70.36	2.10	0.00	0.00	0.00
164870.843	52.61	2.20	0.00	0.00	0.00
164930.396	59.55	2.10	0.00	0.00	0.00
164986.596	56.20	2.40	0.00	0.00	0.00
165047.796	61.20	2.30	0.00	0.00	0.00
165102.033	54.24	2.80	0.00	0.00	0.00
165193.252	91.22	2.70	0.00	0.00	0.00
165289.927	96.67	2.60	0.00	0.00	0.00
165361.205	71.28	3.00	0.00	0.00	0.00
165436.575	75.37	3.30	0.00	0.00	0.00
165525.705	89.13	3.70	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
165540.089	14.38	3.00	0.00	0.00	0.00
165593.861	53.77	4.20	0.00	0.00	0.00
165656.494	62.63	2.00	0.00	0.00	0.00
165726.308	69.81	2.00	0.00	0.00	0.00
165817.211	90.90	2.10	0.00	0.00	0.00
165897.572	80.36	1.90	0.00	0.00	0.00
165952.228	54.66	1.90	0.00	0.00	0.00
166006.696	54.47	1.70	0.00	0.00	0.00
166071.677	64.98	1.50	0.00	0.00	0.00
166139.819	68.14	[illegible]	0.00	0.00	0.00
166196.475	56.66	1.40	0.00	0.00	0.00
166257.728	61.25	[illegible]	0.00	0.00	0.00
166345.499	87.77	[illegible]	0.00	0.00	0.00
166420.055	74.56	1.50	0.00	0.00	0.00
166526.520	106.46	[illegible]	0.00	0.00	0.00
166607.936	81.42	1.40	0.00	0.00	0.00
166691.957	84.02	1.90	0.00	0.00	0.00
166775.961	84.00	2.30	0.00	0.00	0.00
167007.945	231.98	2.40	0.00	0.00	0.00
167126.396	118.45	2.20	0.00	0.00	0.00
167200.630	74.23	2.00	0.00	0.00	0.00
167366.455	165.82	1.70	0.00	0.00	0.00
167397.558	31.10	1.70	0.00	0.00	0.00
167489.178	91.62	[illegible]	0.10	2.55	116.82
167542.322	53.14	[illegible]	0.60	16.80	514.18
167605.874	63.55	[illegible]	0.00	0.00	533.84
167672.150	66.28	[illegible]	0.00	0.00	0.00
167806.661	134.51	1.70	0.00	0.00	0.00
167876.354	69.69	1.70	0.00	0.00	0.00
167933.979	57.63	1.90	0.00	0.00	0.00
167991.848	57.87	2.70	0.00	0.00	0.00
168053.947	62.10	4.50	0.00	0.00	0.00
168114.417	60.47	4.10	0.00	0.00	0.00
168189.366	74.95	3.80	0.00	0.00	0.00
168256.208	66.84	7.50	0.00	0.00	0.00
168403.896	147.69	2.80	0.00	0.00	0.00
168481.708	77.81	3.50	0.00	0.00	0.00
168563.205	81.50	2.20	0.00	0.00	0.00
168620.800	57.60	2.20	0.00	0.00	0.00
168702.859	82.06	1.80	0.00	0.00	0.00
168765.580	62.72	2.30	0.00	0.00	0.00
168843.853	78.27	2.30	0.00	0.00	0.00
168886.405	42.55	2.80	0.00	0.00	0.00
169036.909	150.50	2.70	0.00	0.00	0.00
169101.538	64.63	1.90	0.00	0.00	0.00
169157.527	55.99	1.40	0.00	0.00	0.00
169214.931	57.40	[illegible]	0.30	7.95	228.19
169248.865	33.93	[illegible]	0.50	13.75	368.19
169292.054	43.19	[illegible]	0.60	16.80	659.71
169321.060	29.01	[illegible]	0.60	16.80	487.31
169361.189	40.13	[illegible]	0.60	16.80	674.17
169418.138	56.95	[illegible]	0.30	7.95	704.75
169485.576	67.44	[illegible]	0.10	2.55	354.05
169545.785	60.21	[illegible]	0.00	0.00	76.77
169603.331	57.55	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
169659.803	56.47	[illegible]	0.60	16.80	474.37
169697.708	37.91	[illegible]	0.20	5.20	416.96
169764.285	66.58	[illegible]	0.00	0.00	173.11
169812.793	48.51	[illegible]	0.10	2.55	61.85
169875.899	63.11	[illegible]	0.00	0.00	80.46
169974.396	98.50	3.10	0.00	0.00	0.00
170039.627	65.23	3.10	0.00	0.00	0.00
170091.010	51.38	2.60	0.00	0.00	0.00
170158.802	67.79	2.80	0.00	0.00	0.00
170201.381	42.58	2.90	0.00	0.00	0.00
170272.766	71.39	2.80	0.00	0.00	0.00
170323.083	50.32	2.30	0.00	0.00	0.00
170382.487	59.40	[illegible]	0.00	0.00	0.00
170444.894	62.41	[illegible]	0.00	0.00	0.00
170514.979	70.09	[illegible]	0.00	0.00	0.00
170559.021	44.04	1.90	0.00	0.00	0.00
170666.944	107.92	2.40	0.00	0.00	0.00
170731.920	64.98	2.30	0.00	0.00	0.00
170797.902	65.98	1.90	0.00	0.00	0.00
170864.437	66.53	1.60	0.00	0.00	0.00
170919.203	54.77	[illegible]	0.00	0.00	0.00
170963.131	43.93	[illegible]	0.30	7.95	174.62
171016.516	53.39	[illegible]	0.20	5.20	351.01
171075.639	59.12	[illegible]	0.20	5.20	307.44
171104.960	29.32	[illegible]	0.10	2.55	113.62
171157.907	52.95	[illegible]	0.50	13.75	431.52
171200.835	42.93	[illegible]	0.50	13.75	590.27
171249.354	48.52	[illegible]	0.40	10.80	595.57
171341.971	92.62	[illegible]	0.50	13.75	1136.88
171410.735	68.76	[illegible]	0.80	23.20	1270.42
171446.817	36.08	[illegible]	1.10	33.55	1023.83
171486.968	40.15	[illegible]	1.10	33.55	1347.06
171517.528	30.56	[illegible]	0.80	23.20	867.14
171560.417	42.89	[illegible]	0.60	16.80	857.80
171605.389	44.97	[illegible]	0.60	16.80	755.52
171621.630	16.24	[illegible]	0.60	16.80	272.87
171685.815	64.18	2.70	0.00	0.00	539.15
171751.695	65.88	3.70	0.00	0.00	0.00
171812.900	61.21	3.00	0.00	0.00	0.00
171875.524	62.62	1.80	0.00	0.00	0.00
171923.422	47.90	1.70	0.00	0.00	0.00
171960.657	37.24	2.10	0.00	0.00	0.00
171997.473	36.82	3.50	0.00	0.00	0.00
172067.399	69.93	3.80	0.00	0.00	0.00
172105.956	38.56	5.10	0.00	0.00	0.00
172136.174	30.22	4.20	0.00	0.00	0.00
172361.788	225.61	4.40	0.00	0.00	0.00
172439.609	77.82	3.50	0.00	0.00	0.00
172486.433	46.82	2.20	0.00	0.00	0.00
172517.851	31.42	[illegible]	0.20	5.20	81.69
172557.134	39.28	1.70	0.00	0.00	102.14
172581.139	24.00	[illegible]	0.20	5.20	62.42
172651.810	70.67	[illegible]	0.00	0.00	183.75
172702.913	51.10	1.40	0.00	0.00	0.00
172706.289	3.38	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
172776.090	69.80	[illegible]	0.00	0.00	0.00
172820.815	44.72	[illegible]	0.50	13.75	307.49
172880.317	59.50	[illegible]	1.30	40.95	1627.37
172920.779	40.46	[illegible]	1.30	40.95	1656.94
172972.600	51.82	[illegible]	0.30	7.95	1267.02
173061.946	89.35	[illegible]	0.40	10.80	837.62
173123.535	61.59	[illegible]	0.20	5.20	492.72
173199.321	75.79	[illegible]	0.00	0.00	197.05
173261.263	61.94	1.60	0.00	0.00	0.00
173325.408	64.15	1.60	0.00	0.00	0.00
173415.102	89.69	1.50	0.00	0.00	0.00
173465.012	49.91	[illegible]	0.30	7.95	198.39
173497.577	32.57	[illegible]	0.70	19.95	454.29
173539.480	41.90	[illegible]	0.80	23.20	904.05
173562.566	23.09	[illegible]	0.60	16.80	461.74
173585.554	22.99	[illegible]	0.20	5.20	252.87
173617.663	32.11	[illegible]	0.20	5.20	166.98
173638.490	20.83	[illegible]	0.20	5.20	108.30
173665.695	27.20	[illegible]	0.00	0.00	70.74
173706.829	41.13	[illegible]	0.00	0.00	0.00
173759.855	53.03	[illegible]	0.30	7.95	210.78
173803.038	43.18	[illegible]	0.50	13.75	468.54
173830.140	27.10	[illegible]	0.90	26.55	546.11
173857.880	27.74	[illegible]	0.80	23.20	690.04
173893.357	35.48	[illegible]	0.60	16.80	709.54
173993.459	100.10	[illegible]	0.00	0.00	840.87
174061.306	67.85	[illegible]	0.00	0.00	0.00
174109.066	47.76	[illegible]	0.00	0.00	0.00
174163.980	54.91	[illegible]	0.00	0.00	0.00
174215.962	51.98	[illegible]	0.20	5.20	135.16
174298.139	82.18	[illegible]	0.00	0.00	213.66
174349.993	51.85	1.40	0.00	0.00	0.00
174408.588	58.60	[illegible]	0.10	2.55	74.71
174459.154	50.57	[illegible]	0.40	10.80	337.53
174536.416	77.26	[illegible]	0.70	19.95	1187.90
174564.831	28.42	[illegible]	1.10	33.55	760.12
174589.284	24.45	[illegible]	0.80	23.20	693.85
174644.162	54.88	[illegible]	0.40	10.80	932.93
174703.663	59.50	[illegible]	0.10	2.55	397.17
174755.577	51.91	[illegible]	0.20	5.20	201.17
174797.888	42.31	[illegible]	0.10	2.55	163.96
174832.174	34.29	[illegible]	0.40	10.80	228.87
174880.188	48.01	[illegible]	0.00	0.00	259.28
174917.050	36.86	[illegible]	0.00	0.00	0.00
174963.830	46.78	[illegible]	0.00	0.00	0.00
175021.734	57.90	2.80	0.00	0.00	0.00
175083.765	62.03	4.30	0.00	0.00	0.00
175128.849	45.08	4.50	0.00	0.00	0.00
175190.887	62.04	4.40	0.00	0.00	0.00
175241.800	50.91	4.10	0.00	0.00	0.00
175292.518	50.72	4.10	0.00	0.00	0.00
175405.899	113.38	4.30	0.00	0.00	0.00
175524.757	118.86	4.20	0.00	0.00	0.00
175673.225	148.47	2.70	0.00	0.00	0.00
175721.018	47.79	2.10	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
175770.745	49.73	1.90	0.00	0.00	0.00
175837.139	66.39	1.80	0.00	0.00	0.00
175876.995	39.86	1.90	0.00	0.00	0.00
175935.291	58.30	1.60	0.00	0.00	0.00
175990.972	55.68	1.60	0.00	0.00	0.00
176065.071	74.10	1.50	0.00	0.00	0.00
176123.774	58.70	[illegible]	0.00	0.00	0.00
176185.490	61.72	[illegible]	0.00	0.00	0.00
176270.903	85.41	1.80	0.00	0.00	0.00
176352.942	82.04	2.40	0.00	0.00	0.00
176419.925	66.98	2.10	0.00	0.00	0.00
176470.448	50.52	2.20	0.00	0.00	0.00
176548.021	77.57	1.90	0.00	0.00	0.00
176594.823	46.80	1.70	0.00	0.00	0.00
176656.070	61.25	1.40	0.00	0.00	0.00
176698.770	42.70	[illegible]	0.10	2.55	54.45
176762.190	63.42	[illegible]	0.00	0.00	80.86
176814.188	52.00	1.40	0.00	0.00	0.00
176874.204	60.02	1.60	0.00	0.00	0.00
176930.846	56.64	[illegible]	0.10	2.55	72.22
177035.514	104.67	[illegible]	0.50	13.75	853.05
177082.317	46.80	[illegible]	0.40	10.80	574.50
177152.987	70.67	[illegible]	0.20	5.20	565.37
177255.265	102.28	[illegible]	0.50	13.75	969.09
177323.511	68.25	[illegible]	0.80	23.20	1260.84
177407.139	83.63	[illegible]	0.60	16.80	1672.57
177450.706	43.57	[illegible]	0.00	0.00	365.97
177489.714	39.01	[illegible]	0.10	2.55	49.74
177543.697	53.98	[illegible]	0.30	7.95	283.42
177604.979	61.28	[illegible]	0.70	19.95	854.90
177665.683	60.70	[illegible]	0.90	26.55	1411.36
177690.433	24.75	2.60	0.00	0.00	328.56
177724.047	33.61	3.40	0.00	0.00	0.00
177833.973	109.93	2.70	0.00	0.00	0.00
177904.871	70.90	3.00	0.00	0.00	0.00
177946.748	41.88	3.00	0.00	0.00	0.00
178031.325	84.58	2.70	0.00	0.00	0.00
178104.389	73.06	2.20	0.00	0.00	0.00
178190.342	85.95	1.50	0.00	0.00	0.00
178258.620	68.28	[illegible]	0.00	0.00	0.00
178325.611	66.99	[illegible]	0.00	0.00	0.00
178364.482	38.87	[illegible]	0.00	0.00	0.00
178396.079	31.60	[illegible]	0.10	2.55	40.29
178482.401	86.32	[illegible]	0.40	10.80	576.21
178526.530	44.13	[illegible]	0.50	13.75	541.69
178587.780	61.25	1.70	0.00	0.00	421.10
178640.959	53.18	1.70	0.00	0.00	0.00
178702.208	61.25	2.10	0.00	0.00	0.00
178764.185	61.98	2.10	0.00	0.00	0.00
178815.876	51.69	2.10	0.00	0.00	0.00
178840.282	24.41	2.20	0.00	0.00	0.00
178953.822	113.54	3.10	0.00	0.00	0.00
178990.383	36.56	6.20	0.00	0.00	0.00
179027.452	37.07	5.30	0.00	0.00	0.00
179107.960	80.51	5.00	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
179165.613	57.65	5.20	0.00	0.00	0.00
179278.495	112.88	4.80	0.00	0.00	0.00
179448.498	170.00	2.20	0.00	0.00	0.00
179483.253	34.76	1.80	0.00	0.00	0.00
179536.641	53.39	1.80	0.00	0.00	0.00
179591.733	55.09	[illegible]	0.10	2.55	70.25
179627.223	35.49	[illegible]	0.00	0.00	45.26
179666.013	38.79	[illegible]	0.50	13.75	266.69
179714.754	48.74	[illegible]	0.40	10.80	598.29
179767.782	53.03	[illegible]	0.60	16.80	731.80
179822.414	54.63	[illegible]	0.50	13.75	834.51
179867.707	45.29	[illegible]	0.20	5.20	429.16
179908.614	40.91	[illegible]	0.10	2.55	158.52
179955.717	47.10	[illegible]	0.30	7.95	247.30
180037.948	82.23	[illegible]	0.40	10.80	770.92
180081.524	43.58	[illegible]	0.50	13.75	534.91
180139.892	58.37	[illegible]	0.40	10.80	716.47
180199.654	59.76	[illegible]	0.40	10.80	645.44
180267.754	68.10	[illegible]	0.60	16.80	939.79
180303.142	35.39	[illegible]	0.60	16.80	594.52
180325.648	22.51	[illegible]	0.50	13.75	343.79
180355.282	29.63	1.50	0.00	0.00	203.74
180417.438	62.16	[illegible]	0.00	0.00	0.00
180494.027	76.59	[illegible]	0.40	10.80	413.58
180524.478	30.45	[illegible]	0.60	16.80	420.23
180555.382	30.90	[illegible]	0.80	23.20	618.10
180586.675	31.29	[illegible]	0.00	0.00	363.00
180662.494	75.82	[illegible]	0.50	13.75	521.26
180712.610	50.12	[illegible]	0.30	7.95	543.76
180782.795	70.19	[illegible]	0.00	0.00	278.99
180812.795	30.00	1.50	0.00	0.00	0.00
180882.980	70.19	1.80	0.00	0.00	0.00
180920.587	37.61	4.10	0.00	0.00	0.00
180950.806	30.22	3.60	0.00	0.00	0.00
180975.122	24.32	3.30	0.00	0.00	0.00
181005.681	30.56	3.50	0.00	0.00	0.00
181035.471	29.79	3.30	0.00	0.00	0.00
181095.440	59.97	3.30	0.00	0.00	0.00
181124.151	28.71	3.40	0.00	0.00	0.00
181160.403	36.25	1.70	0.00	0.00	0.00
181223.072	62.67	2.50	0.00	0.00	0.00
181299.747	76.67	3.40	0.00	0.00	0.00
181343.932	44.19	2.80	0.00	0.00	0.00
181396.417	52.48	2.90	0.00	0.00	0.00
181452.582	56.16	2.40	0.00	0.00	0.00
181502.873	50.29	1.90	0.00	0.00	0.00
181606.975	104.10	1.80	0.00	0.00	0.00
181673.863	66.89	1.80	0.00	0.00	0.00
181722.637	48.77	2.10	0.00	0.00	0.00
181797.596	74.96	1.90	0.00	0.00	0.00
181864.334	66.74	1.70	0.00	0.00	0.00
181929.514	65.18	1.50	0.00	0.00	0.00
182003.122	73.61	1.70	0.00	0.00	0.00
182040.307	37.18	[illegible]	0.00	0.00	0.00
182071.678	31.37	[illegible]	0.10	2.55	40.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
182086.025	14.35	[illegible]	0.00	0.00	18:30
182111.249	25.22	[illegible]	0.00	0.00	0.00
182140.399	29.15	1.50	0.00	0.00	0.00
182169.936	29.54	1.70	0.00	0.00	0.00
182212.091	42.16	1.80	0.00	0.00	0.00
182261.693	49.60	[illegible]	0.00	0.00	0.00
182300.464	38.77	[illegible]	0.40	10.80	209.36
182351.709	51.24	[illegible]	0.80	23.20	871.17
182404.383	52.67	[illegible]	0.80	23.20	1222.05
182456.757	52.37	[illegible]	0.70	19.95	1129.96
182491.740	34.98	[illegible]	0.70	19.95	697.91
182536.956	45.22	[illegible]	0.80	23.20	975.54
182567.167	30.21	[illegible]	0.10	2.55	388.98
182584.442	17.27	1.60	0.00	0.00	22.03
182638.215	53.77	[illegible]	0.00	0.00	0.00
182663.792	25.58	[illegible]	0.10	2.55	32.62
182710.945	47.15	[illegible]	0.70	19.95	530.48
182764.023	53.08	[illegible]	0.80	23.20	1145.16
182806.606	42.58	[illegible]	1.00	30.00	1132.72
182839.624	33.02	[illegible]	0.30	7.95	626.52
182876.050	36.43	[illegible]	0.00	0.00	144.80
182957.302	81.25	2.00	0.00	0.00	0.00
183035.053	77.75	2.20	0.00	0.00	0.00
183177.803	142.75	1.80	0.00	0.00	0.00
183254.072	76.27	[illegible]	0.10	2.55	97.25
183395.032	140.96	[illegible]	0.10	2.55	359.45
183485.682	90.65	[illegible]	0.20	5.20	351.28
183560.734	75.05	1.90	0.00	0.00	195.14
183660.268	99.53	1.90	0.00	0.00	0.00
183731.389	71.12	1.80	0.00	0.00	0.00
183842.970	111.58	1.80	0.00	0.00	0.00
183967.125	124.15	3.40	0.00	0.00	0.00
184096.306	129.18	4.40	0.00	0.00	0.00
184207.250	110.94	4.60	0.00	0.00	0.00
184281.971	74.72	3.60	0.00	0.00	0.00
184441.221	159.25	1.70	0.00	0.00	0.00
184514.547	73.33	[illegible]	0.00	0.00	0.00
184569.613	55.07	1.90	0.00	0.00	0.00
184637.135	67.52	1.40	0.00	0.00	0.00
184717.282	80.15	2.50	0.00	0.00	0.00
184800.490	83.21	2.40	0.00	0.00	0.00
184915.936	115.45	[illegible]	0.40	10.80	623.41
184976.122	60.19	[illegible]	0.40	10.80	650.02
185037.442	61.32	2.20	0.00	0.00	331.13
185072.945	35.50	2.70	0.00	0.00	0.00
185120.412	47.47	2.30	0.00	0.00	0.00
185160.706	40.29	[illegible]	0.20	5.20	104.77
185183.356	22.65	1.40	0.00	0.00	58.89
185230.092	46.74	1.50	0.00	0.00	0.00
185266.343	36.25	1.60	0.00	0.00	0.00
185311.871	45.53	2.50	0.00	0.00	0.00
185341.677	29.81	2.40	0.00	0.00	0.00
185391.179	49.50	1.60	0.00	0.00	0.00
185455.608	64.43	[illegible]	0.10	2.55	82.15
185502.679	47.07	[illegible]	0.50	13.75	383.63

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
185609.125	106.45	[illegible]	0.50	13.75	1463.64
185706.893	97.77	[illegible]	0.60	16.80	1493.41
185751.511	44.62	[illegible]	0.20	5.20	490.80
185778.646	27.14	2.00	0.00	0.00	70.56
185814.561	35.91	1.90	0.00	0.00	0.00
185864.724	50.16	1.50	0.00	0.00	0.00
185924.818	60.09	[illegible]	0.40	10.80	324.51
186019.869	95.05	[illegible]	0.90	26.55	1775.07
186058.387	38.52	[illegible]	0.60	16.80	834.90
186080.052	21.66	[illegible]	0.60	16.80	363.97
186091.055	11.00	[illegible]	0.60	16.80	184.85
186113.782	22.73	[illegible]	0.60	16.80	381.82
186152.493	38.71	[illegible]	0.00	0.00	325.18
186201.474	48.98	2.10	0.00	0.00	0.00
186222.154	20.68	1.50	0.00	0.00	0.00
186255.721	33.57	1.70	0.00	0.00	0.00
186308.149	52.43	1.80	0.00	0.00	0.00
186348.977	40.83	1.90	0.00	0.00	0.00
186398.175	49.20	2.20	0.00	0.00	0.00
186451.722	53.55	4.10	0.00	0.00	0.00
186525.853	74.13	4.50	0.00	0.00	0.00
186581.859	56.01	4.00	0.00	0.00	0.00
186629.139	47.28	5.30	0.00	0.00	0.00
186663.407	34.27	4.40	0.00	0.00	0.00
186713.120	49.71	3.40	0.00	0.00	0.00
186784.141	71.02	3.00	0.00	0.00	0.00
186843.539	59.40	2.40	0.00	0.00	0.00
186928.523	84.98	1.50	0.00	0.00	0.00
186992.359	63.84	1.40	0.00	0.00	0.00
187050.969	58.61	1.40	0.00	0.00	0.00
187092.666	41.70	1.40	0.00	0.00	0.00
187123.886	31.22	1.50	0.00	0.00	0.00
187166.900	43.01	1.80	0.00	0.00	0.00
187181.135	14.24	1.70	0.00	0.00	0.00
187201.085	19.95	[illegible]	0.00	0.00	0.00
187212.619	11.53	1.50	0.00	0.00	0.00
187242.281	29.66	2.00	0.00	0.00	0.00
187318.549	76.27	2.30	0.00	0.00	0.00
187381.157	62.61	2.20	0.00	0.00	0.00
187403.577	22.42	2.10	0.00	0.00	0.00
187455.964	52.39	2.00	0.00	0.00	0.00
187544.187	88.22	1.50	0.00	0.00	0.00
187629.202	85.02	[illegible]	0.10	2.55	108.40
187744.207	115.00	[illegible]	0.20	5.20	445.65
187803.989	59.78	[illegible]	0.70	19.95	751.77
187846.934	42.94	[illegible]	0.50	13.75	723.62
187891.063	44.13	[illegible]	0.10	2.55	359.66
187917.865	26.80	[illegible]	0.30	7.95	140.72
187943.724	25.86	[illegible]	0.20	5.20	170.03
187972.665	28.94	2.00	0.00	0.00	75.25
188017.899	45.23	2.20	0.00	0.00	0.00
188069.131	51.23	4.10	0.00	0.00	0.00
188172.106	102.98	4.60	0.00	0.00	0.00
188219.933	47.83	5.50	0.00	0.00	0.00
188278.498	58.57	5.10	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
188333.580	55.08	6.70	0.00	0.00	0.00
188404.393	70.81	6.10	0.00	0.00	0.00
188477.476	73.08	4.90	0.00	0.00	0.00
188531.783	54.31	4.20	0.00	0.00	0.00
188589.341	57.56	3.20	0.00	0.00	0.00
188646.267	56.93	2.30	0.00	0.00	0.00
188711.158	64.89	1.70	0.00	0.00	0.00
188803.155	92.00	1.60	0.00	0.00	0.00
188851.992	48.84	1.70	0.00	0.00	0.00
188923.675	71.68	1.80	0.00	0.00	0.00
189002.270	78.59	2.30	0.00	0.00	0.00
189056.245	53.98	3.00	0.00	0.00	0.00
189153.527	97.28	2.10	0.00	0.00	0.00
189222.873	69.35	2.80	0.00	0.00	0.00
189267.174	44.30	2.60	0.00	0.00	0.00
189322.265	55.09	2.60	0.00	0.00	0.00
189408.392	86.13	1.40	0.00	0.00	0.00
189463.172	54.78	1.70	0.00	0.00	0.00
189526.461	63.29	1.40	0.00	0.00	0.00
189583.007	56.55	2.20	0.00	0.00	0.00
189640.067	57.06	2.50	0.00	0.00	0.00
189708.682	68.61	2.60	0.00	0.00	0.00
189785.254	76.57	[illegible]	1.30	40.95	1567.83
189857.772	72.52	2.90	0.00	0.00	1484.81
189914.460	56.69	2.40	0.00	0.00	0.00
189993.098	78.64	[illegible]	0.10	2.55	100.27
190048.573	55.48	[illegible]	0.30	7.95	291.25
190086.034	37.46	2.80	0.00	0.00	148.91
190143.487	57.45	4.80	0.00	0.00	0.00
190207.566	64.08	8.90	0.00	0.00	0.00
190211.087	3.52	8.80	0.00	0.00	0.00
190287.265	76.18	5.40	0.00	0.00	0.00
190342.588	55.32	5.10	0.00	0.00	0.00
190384.529	41.94	4.40	0.00	0.00	0.00
190430.650	46.12	3.00	0.00	0.00	0.00
190487.840	57.19	3.30	0.00	0.00	0.00
190570.744	82.90	2.70	0.00	0.00	0.00
190628.939	58.20	2.30	0.00	0.00	0.00
190679.023	50.08	2.10	0.00	0.00	0.00
190736.679	57.66	3.10	0.00	0.00	0.00
190807.177	70.50	3.10	0.00	0.00	0.00
190856.945	49.77	2.40	0.00	0.00	0.00
190911.330	54.38	1.90	0.00	0.00	0.00
190943.601	32.27	1.90	0.00	0.00	0.00
191015.647	72.05	[illegible]	0.10	2.55	91.86
191055.890	40.24	[illegible]	0.00	0.00	51.31
191119.425	63.54	1.50	0.00	0.00	0.00
191172.519	53.09	1.40	0.00	0.00	0.00
191202.907	30.39	[illegible]	0.00	0.00	0.00
191253.285	50.38	[illegible]	0.00	0.00	0.00
191337.770	84.49	[illegible]	0.20	5.20	219.67
191396.859	59.09	[illegible]	0.00	0.00	153.63
191448.401	51.54	[illegible]	0.00	0.00	0.00
191516.757	68.36	[illegible]	0.00	0.00	0.00
191600.190	83.43	[illegible]	0.40	10.80	450.54

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
191629.935	29.74	[illegible]	0.40	10.80	321.25
191672.139	42.20	[illegible]	0.60	16.80	582.42
191747.293	75.15	[illegible]	0.40	10.80	1037.13
191783.915	36.62	[illegible]	0.30	7.95	343.34
191861.920	78.01	[illegible]	0.50	13.75	846.36
191944.108	82.19	[illegible]	0.00	0.00	565.04
192018.470	74.36	1.80	0.00	0.00	0.00
192077.758	59.29	1.60	0.00	0.00	0.00
192140.656	62.90	2.10	0.00	0.00	0.00
192197.017	56.36	1.60	0.00	0.00	0.00
192287.458	90.44	1.80	0.00	0.00	0.00
192373.781	86.32	2.60	0.00	0.00	0.00
192451.881	78.10	2.90	0.00	0.00	0.00
192531.591	79.71	3.50	0.00	0.00	0.00
192608.733	77.14	3.00	0.00	0.00	0.00
192670.954	62.22	2.50	0.00	0.00	0.00
192736.147	65.19	[illegible]	0.00	0.00	0.00
192813.781	77.63	[illegible]	0.00	0.00	0.00
192890.574	76.79	[illegible]	0.00	0.00	0.00
192936.622	46.05	[illegible]	0.00	0.00	0.00
192983.554	46.93	[illegible]	0.30	7.95	186.56
193033.955	50.40	[illegible]	0.40	10.80	472.51
193074.593	40.64	[illegible]	0.00	0.00	219.45
193144.674	70.08	[illegible]	0.00	0.00	0.00
193197.799	53.12	1.40	0.00	0.00	0.00
193251.011	53.21	[illegible]	0.30	7.95	211.52
193325.257	74.25	[illegible]	1.00	30.00	1408.81
193370.098	44.84	[illegible]	0.90	26.55	1267.88
193415.670	45.57	[illegible]	0.50	13.75	918.28
193491.945	76.27	[illegible]	0.60	16.80	1165.10
193548.841	56.90	[illegible]	0.20	5.20	625.86
193617.302	68.46	[illegible]	0.10	2.55	265.29
193687.758	70.46	[illegible]	0.90	26.55	1025.14
193727.369	39.61	[illegible]	0.90	26.55	1051.69
193763.927	36.56	[illegible]	0.50	13.75	736.64
193814.629	50.70	1.50	0.00	0.00	348.58
193897.644	83.01	2.60	0.00	0.00	0.00
193983.979	86.33	2.20	0.00	0.00	0.00
194020.586	36.61	2.30	0.00	0.00	0.00
194124.324	103.74	3.30	0.00	0.00	0.00
194186.095	61.77	[illegible]	0.00	0.00	0.00
194208.433	22.34	[illegible]	0.00	0.00	0.00
194242.498	34.07	1.40	0.00	0.00	0.00
194281.197	38.70	1.60	0.00	0.00	0.00
194323.605	42.41	[illegible]	0.00	0.00	0.00
194368.517	44.91	[illegible]	0.20	5.20	116.78
194455.423	86.91	1.60	0.00	0.00	225.96
194513.646	58.22	1.60	0.00	0.00	0.00
194585.570	71.92	1.90	0.00	0.00	0.00
194631.841	46.27	2.10	0.00	0.00	0.00
194680.872	49.03	2.30	0.00	0.00	0.00
194739.976	59.10	2.40	0.00	0.00	0.00
194792.080	52.10	2.80	0.00	0.00	0.00
194837.387	45.31	2.30	0.00	0.00	0.00
194878.953	41.57	2.60	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
194943.501	64.55	2.80	0.00	0.00	0.00
195005.259	61.76	2.20	0.00	0.00	0.00
195070.466	65.21	2.00	0.00	0.00	0.00
195119.840	49.37	2.00	0.00	0.00	0.00
195172.872	53.03	2.10	0.00	0.00	0.00
195243.439	70.57	1.50	0.00	0.00	0.00
195332.495	89.06	[illegible]	0.00	0.00	0.00
195396.683	64.19	1.70	0.00	0.00	0.00
195486.374	89.69	1.40	0.00	0.00	0.00
195572.950	86.58	1.40	0.00	0.00	0.00
195598.178	25.23	1.40	0.00	0.00	0.00
195646.969	48.79	[illegible]	0.00	0.00	0.00
195706.942	59.97	[illegible]	0.50	13.75	412.32
195756.454	49.51	[illegible]	0.80	23.20	914.73
195770.661	14.21	[illegible]	0.70	19.95	306.52
195773.426	2.77	[illegible]	0.80	23.20	59.66
195799.867	26.44	[illegible]	0.70	19.95	570.48
195822.357	22.49	[illegible]	0.80	23.20	485.22
195840.692	18.34	[illegible]	0.90	26.55	456.09
195893.451	52.76	[illegible]	0.70	19.95	1226.65
195937.992	44.54	[illegible]	0.70	19.95	888.61
195970.287	32.29	[illegible]	0.60	16.80	593.42
196052.458	82.17	[illegible]	0.30	7.95	1016.88
196123.042	70.58	2.20	0.00	0.00	280.58
196195.527	72.48	2.10	0.00	0.00	0.00
196264.643	69.12	2.20	0.00	0.00	0.00
196330.349	65.71	2.00	0.00	0.00	0.00
196407.513	77.16	1.60	0.00	0.00	0.00
196466.230	58.72	[illegible]	0.00	0.00	0.00
196521.836	55.61	1.60	0.00	0.00	0.00
196584.163	62.33	1.70	0.00	0.00	0.00
196626.095	41.93	1.70	0.00	0.00	0.00
196668.198	42.10	1.50	0.00	0.00	0.00
196719.581	51.38	1.50	0.00	0.00	0.00
196767.426	47.85	1.50	0.00	0.00	0.00
196833.285	65.86	3.30	0.00	0.00	0.00
196878.282	45.00	2.40	0.00	0.00	0.00
196938.000	59.72	2.90	0.00	0.00	0.00
197006.889	68.89	[illegible]	0.00	0.00	0.00
197043.021	36.13	2.00	0.00	0.00	0.00
197097.652	54.63	[illegible]	0.40	10.80	295.01
197141.191	43.54	[illegible]	0.60	16.80	600.84
197206.093	64.90	[illegible]	0.40	10.80	895.64
197251.172	45.08	[illegible]	0.60	16.80	622.11
197350.776	99.60	[illegible]	0.20	5.20	1095.64
197399.469	48.69	[illegible]	0.10	2.55	188.69
197458.809	59.34	[illegible]	0.10	2.55	151.32
197502.814	44.00	[illegible]	0.00	0.00	56.11
197536.896	34.08	4.00	0.00	0.00	0.00
197599.024	62.13	2.90	0.00	0.00	0.00
197643.110	44.09	4.50	0.00	0.00	0.00
197717.033	73.92	3.40	0.00	0.00	0.00
197762.717	45.68	3.00	0.00	0.00	0.00
197806.200	43.48	2.50	0.00	0.00	0.00
197838.091	31.89	2.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
197897.864	59.77	2.10	0.00	0.00	0.00
197961.469	63.60	2.30	0.00	0.00	0.00
198016.047	54.58	1.80	0.00	0.00	0.00
198072.628	56.58	1.70	0.00	0.00	0.00
198124.987	52.36	[illegible]	0.00	0.00	0.00
198190.709	65.72	[illegible]	0.00	0.00	0.00
198273.807	83.10	1.60	0.00	0.00	0.00
198328.313	54.51	1.80	0.00	0.00	0.00
198404.725	76.41	[illegible]	0.20	5.20	198.68
198484.567	79.84	[illegible]	0.70	19.95	1004.01
198515.730	31.16	[illegible]	1.00	30.00	778.30
198534.746	19.02	[illegible]	0.90	26.55	537.68
198553.708	18.96	[illegible]	0.80	23.20	471.68
198583.635	29.93	2.00	0.00	0.00	347.16
198643.622	59.99	[illegible]	0.00	0.00	0.00
198731.621	88.00	[illegible]	0.00	0.00	0.00
198780.242	48.62	1.70	0.00	0.00	0.00
198816.154	35.91	1.60	0.00	0.00	0.00
198879.171	63.02	1.60	0.00	0.00	0.00
198930.832	51.66	1.50	0.00	0.00	0.00
198984.400	53.57	[illegible]	0.10	2.55	68.30
199033.717	49.32	[illegible]	0.00	0.00	62.88
199069.047	35.33	1.50	0.00	0.00	0.00
199120.305	51.26	3.30	0.00	0.00	0.00
199175.449	55.14	[illegible]	0.00	0.00	0.00
199202.575	27.13	[illegible]	0.00	0.00	0.00
199271.666	69.09	2.50	0.00	0.00	0.00
199315.639	43.97	2.80	0.00	0.00	0.00
199387.478	71.84	4.60	0.00	0.00	0.00
199439.263	51.79	3.80	0.00	0.00	0.00
199466.885	27.62	3.20	0.00	0.00	0.00
199526.251	59.37	2.60	0.00	0.00	0.00
199550.915	24.66	1.90	0.00	0.00	0.00
199576.285	25.37	1.50	0.00	0.00	0.00
199591.166	14.88	1.90	0.00	0.00	0.00
199610.791	19.63	2.10	0.00	0.00	0.00
199656.152	45.36	1.80	0.00	0.00	0.00
199730.742	74.59	2.20	0.00	0.00	0.00
199827.428	96.69	2.30	0.00	0.00	0.00
199896.967	69.54	2.40	0.00	0.00	0.00
199940.960	43.99	2.20	0.00	0.00	0.00
200000.058	59.10	2.10	0.00	0.00	0.00
200061.808	61.75	1.50	0.00	0.00	0.00
200099.065	37.26	1.40	0.00	0.00	0.00
200164.036	64.97	[illegible]	0.20	5.20	168.93
200197.312	33.28	[illegible]	0.30	7.95	218.79
200250.714	53.40	[illegible]	0.70	19.95	744.96
200295.394	44.68	[illegible]	0.60	16.80	821.00
200340.477	45.08	1.40	0.00	0.00	378.70
200390.286	49.81	1.50	0.00	0.00	0.00
200429.858	39.57	1.40	0.00	0.00	0.00
200511.829	81.97	[illegible]	0.70	19.95	817.67
200583.136	71.31	[illegible]	1.00	30.00	1780.89
200613.040	29.90	[illegible]	0.90	26.55	845.53
200681.322	68.28	[illegible]	0.10	2.55	993.51

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
200740.086	58.76	[illegible]	0.00	0.00	74.93
200771.659	31.57	1.60	0.00	0.00	0.00
200807.314	35.65	2.70	0.00	0.00	0.00
200839.797	32.48	3.30	0.00	0.00	0.00
200925.334	85.54	3.00	0.00	0.00	0.00
201026.891	101.56	3.30	0.00	0.00	0.00
201070.254	43.36	3.30	0.00	0.00	0.00
201099.848	29.59	3.30	0.00	0.00	0.00
201133.855	34.01	2.80	0.00	0.00	0.00
201171.982	38.13	2.50	0.00	0.00	0.00
201228.995	57.01	1.40	0.00	0.00	0.00
201270.052	41.06	1.60	0.00	0.00	0.00
201314.883	44.83	1.60	0.00	0.00	0.00
201337.724	22.84	2.30	0.00	0.00	0.00
201395.643	57.92	[illegible]	0.00	0.00	0.00
201451.854	56.21	[illegible]	0.30	7.95	223.44
201476.606	24.75	[illegible]	0.50	13.75	268.57
201529.722	53.12	[illegible]	0.90	26.55	1070.28
201653.163	123.44	[illegible]	1.00	30.00	3490.29
201687.187	34.02	[illegible]	0.50	13.75	744.30
201731.904	44.72	2.10	0.00	0.00	307.43
201807.312	75.41	[illegible]	0.00	0.00	0.00
201857.366	50.05	[illegible]	0.50	13.75	344.13
201889.504	32.14	[illegible]	1.10	33.55	760.06
201958.894	69.39	[illegible]	0.90	26.55	2085.16
201997.608	38.71	[illegible]	1.10	33.55	1163.37
202074.921	77.31	[illegible]	0.90	26.55	2323.27
202107.009	32.09	[illegible]	1.40	44.80	1144.73
202169.550	62.54	[illegible]	1.50	48.75	2925.38
202192.316	22.77	3.10	0.00	0.00	554.92
202241.562	49.25	2.50	0.00	0.00	0.00
202271.554	29.99	2.40	0.00	0.00	0.00
202323.541	51.99	2.10	0.00	0.00	0.00
202363.124	39.58	1.50	0.00	0.00	0.00
202442.666	79.54	1.90	0.00	0.00	0.00
202525.894	83.23	1.60	0.00	0.00	0.00
202604.494	78.60	1.80	0.00	0.00	0.00
202678.297	73.80	2.50	0.00	0.00	0.00
202722.281	43.98	2.40	0.00	0.00	0.00
202853.983	131.70	1.50	0.00	0.00	0.00
202884.513	30.53	[illegible]	0.00	0.00	0.00
202999.236	114.72	1.50	0.00	0.00	0.00
203042.916	43.68	[illegible]	0.10	2.55	55.70
203091.782	48.87	[illegible]	0.20	5.20	189.36
203149.648	57.87	[illegible]	0.50	13.75	548.29
203193.910	44.26	[illegible]	0.60	16.80	676.11
203260.368	66.46	[illegible]	0.60	16.80	1116.51
203307.432	47.06	[illegible]	0.10	2.55	455.35
203369.206	61.77	[illegible]	0.00	0.00	78.77
203413.759	44.55	2.00	0.00	0.00	0.00
203444.423	30.66	2.20	0.00	0.00	0.00
203529.587	85.16	2.70	0.00	0.00	0.00
203575.474	45.89	3.10	0.00	0.00	0.00
203626.093	50.62	3.40	0.00	0.00	0.00
203665.790	39.70	3.10	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
203717.003	51.21	[illegible]	0.00	0.00	0.00
203779.506	62.50	4.10	0.00	0.00	0.00
203829.660	50.15	3.10	0.00	0.00	0.00
203891.338	61.68	1.90	0.00	0.00	0.00
203953.811	62.47	[illegible]	0.20	5.20	162.44
204021.644	67.83	[illegible]	0.20	5.20	352.74
204088.343	66.70	[illegible]	0.20	5.20	346.84
204119.529	31.19	[illegible]	0.00	0.00	81.09
204176.645	57.12	1.80	0.00	0.00	0.00
204233.150	56.51	3.70	0.00	0.00	0.00
204292.052	58.90	4.10	0.00	0.00	0.00
204352.083	60.03	4.10	0.00	0.00	0.00
204400.494	48.41	4.40	0.00	0.00	0.00
204499.743	99.25	4.90	0.00	0.00	0.00
204569.824	70.08	3.60	0.00	0.00	0.00
204614.210	44.39	3.20	0.00	0.00	0.00
204710.977	96.77	4.50	0.00	0.00	0.00
204779.852	68.87	3.10	0.00	0.00	0.00
204813.426	33.57	2.60	0.00	0.00	0.00
204868.321	54.89	2.20	0.00	0.00	0.00
205068.505	200.18	[illegible]	0.00	0.00	0.00
205108.901	40.40	1.60	0.00	0.00	0.00
205167.747	58.85	1.40	0.00	0.00	0.00
205270.657	102.91	[illegible]	0.00	0.00	0.00
205343.241	72.58	[illegible]	0.00	0.00	0.00
205438.508	95.27	[illegible]	0.40	10.80	514.45
205514.366	75.86	[illegible]	0.30	7.95	711.17
205570.129	55.76	[illegible]	0.20	5.20	366.65
205636.192	66.06	1.40	0.00	0.00	171.77
205707.705	71.51	1.50	0.00	0.00	0.00
205762.628	54.92	1.70	0.00	0.00	0.00
205835.596	72.97	1.50	0.00	0.00	0.00
205898.467	62.87	[illegible]	0.00	0.00	0.00
205966.844	68.38	[illegible]	0.30	7.95	271.80
206061.491	94.65	[illegible]	0.90	26.55	1632.67
206105.270	43.78	[illegible]	0.60	16.80	948.92
206184.630	79.36	[illegible]	0.70	19.95	1458.25
206212.384	27.75	[illegible]	0.80	23.20	598.78
206246.286	33.90	[illegible]	0.20	5.20	481.42
206295.334	49.05	[illegible]	0.00	0.00	127.53
206343.307	47.97	2.30	0.00	0.00	0.00
206381.400	38.09	3.40	0.00	0.00	0.00
206451.707	70.31	3.40	0.00	0.00	0.00
206479.829	28.12	3.50	0.00	0.00	0.00
206521.828	42.00	3.90	0.00	0.00	0.00
206613.102	91.27	2.80	0.00	0.00	0.00
206693.717	80.62	1.80	0.00	0.00	0.00
206757.228	63.51	1.80	0.00	0.00	0.00
206815.622	58.39	[illegible]	0.00	0.00	0.00
206887.922	72.30	[illegible]	0.00	0.00	0.00
206928.731	40.81	1.40	0.00	0.00	0.00
207027.929	99.20	2.00	0.00	0.00	0.00
207077.057	49.13	1.60	0.00	0.00	0.00
207165.392	88.34	2.00	0.00	0.00	0.00
207216.590	51.20	2.80	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
207279.407	62.82	2.90	0.00	0.00	0.00
207324.827	45.42	2.10	0.00	0.00	0.00
207376.516	51.69	2.60	0.00	0.00	0.00
207437.426	60.91	2.70	0.00	0.00	0.00
207498.493	61.07	2.00	0.00	0.00	0.00
207574.336	75.84	2.50	0.00	0.00	0.00
207640.042	65.71	4.70	0.00	0.00	0.00
207698.888	58.85	4.30	0.00	0.00	0.00
207748.916	50.03	2.40	0.00	0.00	0.00
207801.399	52.48	2.00	0.00	0.00	0.00
207857.742	56.34	[illegible]	0.00	0.00	0.00
207908.321	50.58	[illegible]	0.80	23.20	586.73
207931.432	23.11	[illegible]	0.60	16.80	462.23
207982.796	51.36	2.10	0.00	0.00	431.46
208028.942	46.15	2.10	0.00	0.00	0.00
208088.945	60.00	1.90	0.00	0.00	0.00
208124.779	35.83	1.50	0.00	0.00	0.00
208173.915	49.14	[illegible]	0.00	0.00	0.00
208212.802	38.89	[illegible]	0.00	0.00	0.00
208280.647	67.85	[illegible]	0.20	5.20	176.40
208284.036	3.39	[illegible]	0.30	7.95	22.29
208363.193	79.16	[illegible]	0.40	10.80	742.10
208412.651	49.46	[illegible]	0.30	7.95	463.67
208452.058	39.41	[illegible]	0.30	7.95	313.30
208517.598	65.54	[illegible]	0.10	2.55	344.09
208575.621	58.02	[illegible]	0.30	7.95	304.63
208624.582	48.96	[illegible]	0.30	7.95	389.25
208684.126	59.54	[illegible]	0.00	0.00	236.69
208727.112	42.99	1.50	0.00	0.00	0.00
208783.160	56.05	2.80	0.00	0.00	0.00
208833.060	49.90	4.90	0.00	0.00	0.00
208890.301	57.24	3.70	0.00	0.00	0.00
208959.327	69.03	3.90	0.00	0.00	0.00
209041.625	82.30	2.00	0.00	0.00	0.00
209154.270	112.64	2.00	0.00	0.00	0.00
209179.101	24.83	1.80	0.00	0.00	0.00
209236.675	57.57	[illegible]	0.10	2.55	73.41
209275.226	38.55	[illegible]	0.00	0.00	49.16
209334.563	59.34	[illegible]	0.00	0.00	0.00
209398.972	64.41	[illegible]	0.00	0.00	0.00
209465.589	66.62	[illegible]	0.00	0.00	0.00
209508.320	42.73	1.40	0.00	0.00	0.00
209554.812	46.49	[illegible]	0.20	5.20	120.89
209596.689	41.88	[illegible]	0.20	5.20	217.77
209644.168	47.48	[illegible]	0.80	23.20	674.20
209744.168	100.00	[illegible]	0.10	2.55	1287.50
209802.355	58.19	2.30	0.00	0.00	74.19
209860.083	57.73	2.00	0.00	0.00	0.00
209917.277	57.19	3.20	0.00	0.00	0.00
209983.032	65.75	2.10	0.00	0.00	0.00
210056.787	73.76	2.20	0.00	0.00	0.00
210123.973	67.19	2.40	0.00	0.00	0.00
210192.205	68.23	[illegible]	0.10	2.55	87.00
210292.277	100.07	1.70	0.00	0.00	127.60
210346.962	54.68	2.00	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
210406.032	59.07	1.80	0.00	0.00	0.00
210482.858	76.83	1.40	0.00	0.00	0.00
210533.695	50.84	1.60	0.00	0.00	0.00
210591.308	57.61	2.50	0.00	0.00	0.00
210650.170	58.86	1.60	0.00	0.00	0.00
210700.476	50.31	1.60	0.00	0.00	0.00
210729.995	29.52	1.50	0.00	0.00	0.00
210782.034	52.04	1.40	0.00	0.00	0.00
210856.932	74.90	0.60	0.60	16.80	629.15
210913.783	56.85	1.40	0.20	5.20	625.36
210948.467	34.68	1.50	0.10	2.55	134.41
211002.892	54.42	1.50	0.00	0.00	69.40
211051.895	49.00	0.50	1.00	30.00	735.06
211125.673	73.78	0.70	0.80	23.20	1962.49
211161.876	36.20	0.70	0.80	23.20	839.93
211200.057	38.18	0.90	0.60	16.80	763.61
211239.657	39.60	1.50	0.10	2.55	383.13
211276.928	37.27	1.60	0.00	0.00	47.53
211305.646	28.72	1.90	0.00	0.00	0.00
211329.267	23.62	2.10	0.00	0.00	0.00
211377.886	48.62	1.70	0.00	0.00	0.00
211455.938	78.05	1.60	0.00	0.00	0.00
211519.467	63.53	2.20	0.00	0.00	0.00
211582.944	63.48	2.10	0.00	0.00	0.00
211661.152	78.21	2.30	0.00	0.00	0.00
211721.377	60.23	1.60	0.00	0.00	0.00
211802.108	80.73	1.40	0.00	0.00	0.00
211879.396	77.29	1.80	0.00	0.00	0.00
211935.497	56.10	1.60	0.00	0.00	0.00
212025.777	90.28	2.60	0.00	0.00	0.00
212074.500	48.72	2.30	0.00	0.00	0.00
212163.850	89.35	1.00	0.20	5.20	232.32
212248.421	84.57	1.80	0.00	0.00	219.89
212296.054	47.63	1.70	0.00	0.00	0.00
212365.015	68.96	1.50	0.00	0.00	0.00
212405.272	40.26	1.60	0.00	0.00	0.00
212464.580	59.31	1.60	0.00	0.00	0.00
212525.261	60.68	2.00	0.00	0.00	0.00
212607.668	82.41	4.00	0.00	0.00	0.00
212649.715	42.05	4.20	0.00	0.00	0.00
212702.526	52.81	3.40	0.00	0.00	0.00
212746.738	44.21	3.80	0.00	0.00	0.00
212822.051	75.31	3.40	0.00	0.00	0.00
212873.185	51.13	3.50	0.00	0.00	0.00
212943.832	70.65	3.60	0.00	0.00	0.00
212989.594	45.76	3.30	0.00	0.00	0.00
213032.793	43.20	3.20	0.00	0.00	0.00
213102.552	69.76	2.30	0.00	0.00	0.00
213151.958	49.41	2.00	0.00	0.00	0.00
213204.421	52.46	1.70	0.00	0.00	0.00
213268.763	64.34	1.20	0.00	0.00	0.00
213305.569	36.81	0.60	0.60	16.80	309.18
213397.256	91.69	0.60	0.60	16.80	1540.34
213448.866	51.61	0.40	0.80	23.20	1032.20
213476.292	27.43	0.60	0.60	16.80	548.54

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
213537.630	61.34	2.90	0.00	0.00	515.24
213584.701	47.07	2.70	0.00	0.00	0.00
213630.987	46.29	2.40	0.00	0.00	0.00
213663.153	32.17	2.60	0.00	0.00	0.00
213705.641	42.49	2.60	0.00	0.00	0.00
213743.162	37.52	2.10	0.00	0.00	0.00
213798.375	55.21	2.10	0.00	0.00	0.00
213895.050	96.68	2.40	0.00	0.00	0.00
213908.843	13.79	2.70	0.00	0.00	0.00
213990.416	81.57	2.80	0.00	0.00	0.00
214055.751	65.33	3.40	0.00	0.00	0.00
214117.462	61.71	3.00	0.00	0.00	0.00
214186.221	68.76	2.50	0.00	0.00	0.00
214244.136	57.91	2.40	0.00	0.00	0.00
214323.829	79.69	2.60	0.00	0.00	0.00
214410.054	86.23	1.80	0.00	0.00	0.00
214464.944	54.89	[illegible]	0.00	0.00	0.00
214507.921	42.98	1.40	0.00	0.00	0.00
214575.363	67.44	[illegible]	0.00	0.00	0.00
214656.402	81.04	2.10	0.00	0.00	0.00
214710.097	53.69	2.40	0.00	0.00	0.00
214759.827	49.73	2.50	0.00	0.00	0.00
214791.823	32.00	2.40	0.00	0.00	0.00
214939.272	147.45	1.80	0.00	0.00	0.00
214972.046	32.77	2.30	0.00	0.00	0.00
215030.770	58.72	3.00	0.00	0.00	0.00
215078.899	48.13	2.50	0.00	0.00	0.00
215134.971	56.07	2.50	0.00	0.00	0.00
215186.867	51.90	1.70	0.00	0.00	0.00
215368.654	181.79	1.50	0.00	0.00	0.00
215414.842	46.19	1.40	0.00	0.00	0.00
215460.060	45.22	[illegible]	0.00	0.00	0.00
215520.022	59.96	[illegible]	0.00	0.00	0.00
215614.345	94.32	1.90	0.00	0.00	0.00
215732.912	118.57	2.10	0.00	0.00	0.00
215830.935	98.02	1.50	0.00	0.00	0.00
215956.062	125.13	1.60	0.00	0.00	0.00
216000.030	43.97	1.40	0.00	0.00	0.00
216057.495	57.47	[illegible]	0.10	2.55	73.27
216092.625	35.13	[illegible]	0.50	13.75	286.31
216134.803	42.18	[illegible]	0.50	13.75	579.96
216166.682	31.88	[illegible]	0.30	7.95	345.89
216236.465	69.78	[illegible]	0.00	0.00	277.39
216327.464	91.00	[illegible]	0.60	16.80	764.39
216372.071	44.61	[illegible]	0.70	19.95	819.66
216469.613	97.54	[illegible]	0.60	16.80	1792.34
216511.424	41.81	[illegible]	0.50	13.75	638.68
216552.519	41.09	[illegible]	0.30	7.95	445.88
216591.362	38.84	[illegible]	0.50	13.75	421.45
216631.204	39.84	[illegible]	0.60	16.80	608.59
216659.216	28.01	[illegible]	0.10	2.55	271.02
216693.112	33.90	[illegible]	0.00	0.00	43.22
216749.590	56.48	[illegible]	0.20	5.20	146.85
216792.332	42.74	2.10	0.00	0.00	111.13
216821.670	29.34	5.00	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
216860.401	38.73	6.60	0.00	0.00	0.00
216903.957	43.56	4.70	0.00	0.00	0.00
216985.591	81.63	3.00	0.00	0.00	0.00
217039.966	54.38	4.70	0.00	0.00	0.00
217053.968	14.00	5.70	0.00	0.00	0.00
217110.949	56.98	4.80	0.00	0.00	0.00
217163.042	52.09	4.70	0.00	0.00	0.00
217207.694	44.65	4.30	0.00	0.00	0.00
217259.448	51.75	4.10	0.00	0.00	0.00
217299.062	39.61	2.70	0.00	0.00	0.00
217350.052	50.99	2.20	0.00	0.00	0.00
217395.984	45.93	3.00	0.00	0.00	0.00
217435.127	39.14	2.60	0.00	0.00	0.00
217481.700	46.57	2.50	0.00	0.00	0.00
217568.887	87.19	1.60	0.00	0.00	0.00
217606.241	37.35	1.70	0.00	0.00	0.00
217674.665	68.42	2.50	0.00	0.00	0.00
217770.520	95.85	2.30	0.00	0.00	0.00
217812.242	41.72	2.20	0.00	0.00	0.00
217886.711	74.47	1.90	0.00	0.00	0.00
217946.027	59.32	2.70	0.00	0.00	0.00
217991.909	45.88	2.00	0.00	0.00	0.00
218104.100	112.19	1.50	0.00	0.00	0.00
218163.514	59.41	1.80	0.00	0.00	0.00
218221.232	57.72	2.40	0.00	0.00	0.00
218283.737	62.51	2.30	0.00	0.00	0.00
218339.480	55.74	2.50	0.00	0.00	0.00
218397.929	58.45	3.60	0.00	0.00	0.00
218444.562	46.63	5.40	0.00	0.00	0.00
218544.697	100.14	5.80	0.00	0.00	0.00
218596.356	51.66	5.50	0.00	0.00	0.00
218630.784	34.43	5.10	0.00	0.00	0.00
218658.382	27.60	4.10	0.00	0.00	0.00
218674.357	15.97	3.00	0.00	0.00	0.00
218708.511	34.15	2.20	0.00	0.00	0.00
218733.311	24.80	[illegible]	0.10	2.55	31.63
218763.959	30.65	[illegible]	0.80	23.20	394.60
218786.088	22.13	[illegible]	0.50	13.75	408.83
218807.088	21.00	[illegible]	0.00	0.00	144.38
218813.138	6.05	2.80	0.00	0.00	0.00
218843.352	30.21	6.30	0.00	0.00	0.00
218866.039	22.69	8.00	0.00	0.00	0.00
218897.545	31.51	6.30	0.00	0.00	0.00
218923.715	26.17	5.20	0.00	0.00	0.00
218948.705	24.99	5.40	0.00	0.00	0.00
218973.313	24.61	4.20	0.00	0.00	0.00
218995.754	22.44	3.20	0.00	0.00	0.00
219038.568	42.81	4.10	0.00	0.00	0.00
219075.157	36.59	4.50	0.00	0.00	0.00
219121.239	46.08	4.20	0.00	0.00	0.00
219156.170	34.93	4.30	0.00	0.00	0.00
219223.401	67.23	3.80	0.00	0.00	0.00
219258.770	35.37	3.90	0.00	0.00	0.00
219326.167	67.40	3.40	0.00	0.00	0.00
219376.281	50.11	3.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
219422.662	46.38	3.40	0.00	0.00	0.00
219466.940	44.28	3.20	0.00	0.00	0.00
219501.025	34.09	3.10	0.00	0.00	0.00
219540.891	39.87	2.70	0.00	0.00	0.00
219576.954	36.06	2.50	0.00	0.00	0.00
219620.371	43.42	2.20	0.00	0.00	0.00
219663.382	43.01	2.10	0.00	0.00	0.00
219704.591	41.21	1.80	0.00	0.00	0.00
219743.345	38.75	1.80	0.00	0.00	0.00
219780.651	37.31	1.70	0.00	0.00	0.00
219859.652	79.00	1.40	0.00	0.00	0.00
219878.204	18.55	1.50	0.00	0.00	0.00
219898.759	20.55	1.40	0.00	0.00	0.00
219913.192	14.43	1.40	0.00	0.00	0.00
219938.431	25.24	1.40	0.00	0.00	0.00
219974.424	35.99	1.40	0.00	0.00	0.00
220042.033	67.61	1.40	0.00	0.00	0.00
220121.051	79.02	1.50	0.00	0.00	0.00
220167.183	46.13	1.50	0.00	0.00	0.00
220204.850	37.67	1.60	0.00	0.00	0.00
220242.272	37.42	1.70	0.00	0.00	0.00
220276.644	34.37	1.70	0.00	0.00	0.00
220321.849	45.21	1.90	0.00	0.00	0.00
220367.069	45.22	1.80	0.00	0.00	0.00
220400.676	33.61	1.80	0.00	0.00	0.00
220443.577	42.90	1.70	0.00	0.00	0.00
220488.767	45.19	1.50	0.00	0.00	0.00
220544.411	55.64	1.80	0.00	0.00	0.00
220583.626	39.22	1.80	0.00	0.00	0.00
220623.466	39.84	2.20	0.00	0.00	0.00
220666.318	42.85	2.20	0.00	0.00	0.00
220695.383	29.06	2.20	0.00	0.00	0.00
220724.447	29.06	2.70	0.00	0.00	0.00
220775.815	51.37	2.80	0.00	0.00	0.00
220839.695	63.88	2.40	0.00	0.00	0.00
220914.791	75.10	2.00	0.00	0.00	0.00
220947.974	33.18	2.00	0.00	0.00	0.00
220987.826	39.85	1.60	0.00	0.00	0.00
221038.703	50.88	2.30	0.00	0.00	0.00
221073.162	34.46	2.40	0.00	0.00	0.00
221125.749	52.59	2.70	0.00	0.00	0.00
221174.817	49.07	2.20	0.00	0.00	0.00
221209.243	34.43	2.10	0.00	0.00	0.00
221265.187	55.94	1.80	0.00	0.00	0.00
221325.528	60.34	1.90	0.00	0.00	0.00
221368.238	42.71	2.00	0.00	0.00	0.00
221429.432	61.19	2.20	0.00	0.00	0.00
221475.151	45.72	1.90	0.00	0.00	0.00
221514.940	39.79	2.30	0.00	0.00	0.00
221580.089	65.15	2.40	0.00	0.00	0.00
221654.259	74.17	1.90	0.00	0.00	0.00
221737.590	83.33	2.10	0.00	0.00	0.00
221775.906	38.32	2.30	0.00	0.00	0.00
221851.211	75.30	2.00	0.00	0.00	0.00
221904.818	53.61	2.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
221959.156	54.34	2.50	0.00	0.00	0.00
222003.201	44.04	2.70	0.00	0.00	0.00
222036.973	33.77	2.90	0.00	0.00	0.00
222087.732	50.76	3.00	0.00	0.00	0.00
222146.074	58.34	2.70	0.00	0.00	0.00
222204.422	58.35	2.60	0.00	0.00	0.00
222265.523	61.10	2.20	0.00	0.00	0.00
222347.174	81.65	2.00	0.00	0.00	0.00
222415.743	68.57	1.90	0.00	0.00	0.00
222467.505	51.76	1.60	0.00	0.00	0.00
222525.741	58.24	2.10	0.00	0.00	0.00
222583.915	58.17	1.70	0.00	0.00	0.00
222650.291	66.38	1.60	0.00	0.00	0.00
222710.103	59.81	[illegible]	0.00	0.00	0.00
222757.328	47.23	1.40	0.00	0.00	0.00
222793.325	36.00	1.40	0.00	0.00	0.00
222828.794	35.47	[illegible]	0.20	5.20	92.22
222882.630	53.84	[illegible]	0.10	2.55	208.62
222919.200	36.57	[illegible]	0.00	0.00	46.63
222965.820	46.62	1.40	0.00	0.00	0.00
223019.742	53.92	1.90	0.00	0.00	0.00
223059.370	39.63	1.90	0.00	0.00	0.00
223103.547	44.18	1.80	0.00	0.00	0.00
223148.525	44.98	1.90	0.00	0.00	0.00
223185.146	36.62	2.20	0.00	0.00	0.00
223230.557	45.41	2.20	0.00	0.00	0.00
223282.920	52.36	2.00	0.00	0.00	0.00
223331.501	48.58	2.00	0.00	0.00	0.00
223368.261	36.76	2.30	0.00	0.00	0.00
223424.371	56.11	1.70	0.00	0.00	0.00
223482.043	57.67	1.60	0.00	0.00	0.00
223523.635	41.59	1.40	0.00	0.00	0.00
223575.430	51.80	1.40	0.00	0.00	0.00
223623.650	48.22	[illegible]	0.00	0.00	0.00
223649.793	26.14	1.60	0.00	0.00	0.00
223690.532	40.74	1.50	0.00	0.00	0.00
223729.516	38.98	1.40	0.00	0.00	0.00
223781.510	51.99	[illegible]	0.00	0.00	0.00
223841.935	60.43	[illegible]	0.00	0.00	0.00
223873.096	31.16	1.40	0.00	0.00	0.00
223923.628	50.53	1.80	0.00	0.00	0.00
223989.345	65.72	1.90	0.00	0.00	0.00
224031.928	42.58	1.40	0.00	0.00	0.00
224109.768	77.84	1.70	0.00	0.00	0.00
224163.483	53.72	1.80	0.00	0.00	0.00
224213.272	49.79	2.00	0.00	0.00	0.00
224281.558	68.29	2.10	0.00	0.00	0.00
224355.391	73.83	3.20	0.00	0.00	0.00
224413.981	58.59	3.70	0.00	0.00	0.00
224480.170	66.19	4.50	0.00	0.00	0.00
224574.925	94.75	3.10	0.00	0.00	0.00
224669.871	94.95	3.40	0.00	0.00	0.00
224718.378	48.51	1.90	0.00	0.00	0.00
224771.292	52.91	2.10	0.00	0.00	0.00
224817.039	45.75	3.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
224865.465	48.43	2.80	0.00	0.00	0.00
224943.219	77.75	2.70	0.00	0.00	0.00
224973.792	30.57	3.50	0.00	0.00	0.00
225074.035	100.24	4.80	0.00	0.00	0.00
225117.023	42.99	4.90	0.00	0.00	0.00
225184.702	67.68	4.90	0.00	0.00	0.00
225263.218	78.52	4.40	0.00	0.00	0.00
225310.528	47.31	3.30	0.00	0.00	0.00
225364.836	54.31	4.00	0.00	0.00	0.00
225402.653	37.82	3.60	0.00	0.00	0.00
225446.470	43.82	3.10	0.00	0.00	0.00
225493.564	47.09	2.70	0.00	0.00	0.00
225538.441	44.88	2.20	0.00	0.00	0.00
225604.144	65.70	1.70	0.00	0.00	0.00
225643.860	39.72	1.50	0.00	0.00	0.00
225687.162	43.30	1.50	0.00	0.00	0.00
225734.970	47.81	0.10	0.10	2.55	60.96
225766.206	31.24	0.80	0.40	10.80	208.50
225832.233	66.03	0.50	0.70	19.95	1015.17
225869.625	37.39	0.50	0.70	19.95	745.99
225903.552	33.93	0.90	0.30	7.95	473.29
225929.630	26.08	1.60	0.00	0.00	103.67
225960.267	30.64	3.00	0.00	0.00	0.00
226001.150	40.88	3.10	0.00	0.00	0.00
226027.488	26.34	3.30	0.00	0.00	0.00
226069.582	42.09	3.40	0.00	0.00	0.00
226110.774	41.19	2.70	0.00	0.00	0.00
226144.058	33.28	1.00	0.20	5.20	86.54
226194.925	50.87	1.50	0.00	0.00	132.26
226238.367	43.44	1.90	0.00	0.00	0.00
226311.761	73.39	1.90	0.00	0.00	0.00
226341.749	29.99	2.00	0.00	0.00	0.00
226379.646	37.90	2.00	0.00	0.00	0.00
226442.611	62.97	2.40	0.00	0.00	0.00
226527.752	85.14	2.50	0.00	0.00	0.00
226575.051	47.30	1.70	0.00	0.00	0.00
226643.035	67.98	2.00	0.00	0.00	0.00
226683.150	40.12	1.80	0.00	0.00	0.00
226732.890	49.74	1.90	0.00	0.00	0.00
226804.910	72.02	1.50	0.00	0.00	0.00
226945.702	140.79	1.50	0.00	0.00	0.00
226991.868	46.17	2.00	0.00	0.00	0.00
227040.172	48.30	2.00	0.00	0.00	0.00
227072.002	31.83	1.90	0.00	0.00	0.00
227114.513	42.51	1.80	0.00	0.00	0.00
227152.691	38.18	1.80	0.00	0.00	0.00
227194.909	42.22	2.40	0.00	0.00	0.00
227242.658	47.75	2.30	0.00	0.00	0.00
227333.686	91.03	2.00	0.00	0.00	0.00
227388.401	54.72	1.90	0.00	0.00	0.00
227440.110	51.71	1.90	0.00	0.00	0.00
227468.074	27.96	2.00	0.00	0.00	0.00
227537.722	69.65	2.80	0.00	0.00	0.00
227637.849	100.13	3.30	0.00	0.00	0.00
227689.311	51.46	3.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
227834.468	145.16	3.10	0.00	0.00	0.00
227935.219	100.75	2.10	0.00	0.00	0.00
228016.957	81.74	1.70	0.00	0.00	0.00
228075.007	58.05	1.70	0.00	0.00	0.00
228143.094	68.09	[illegible]	0.10	2.55	86.82
228209.458	66.36	[illegible]	0.00	0.00	84.62
228259.654	50.20	[illegible]	0.30	7.95	199.53
228335.568	75.91	[illegible]	0.40	10.80	711.70
228407.241	71.67	[illegible]	0.50	13.75	879.79
228453.717	46.48	[illegible]	0.40	10.80	570.50
228492.653	38.94	[illegible]	0.40	10.80	420.51
228524.186	31.53	[illegible]	0.20	5.20	252.27
228600.229	76.04	[illegible]	0.00	0.00	197.72
228636.321	36.09	[illegible]	0.10	2.55	46.02
228676.316	40.00	[illegible]	0.20	5.20	154.99
228721.123	44.81	1.70	0.00	0.00	116.50
228813.453	92.33	3.00	0.00	0.00	0.00
228876.052	62.60	2.90	0.00	0.00	0.00
228912.890	36.84	1.90	0.00	0.00	0.00
228956.327	43.44	1.50	0.00	0.00	0.00
229011.572	55.25	1.40	0.00	0.00	0.00
229060.376	48.80	1.80	0.00	0.00	0.00
229101.184	40.81	1.50	0.00	0.00	0.00
229149.776	48.59	[illegible]	0.00	0.00	0.00
229199.000	49.22	1.50	0.00	0.00	0.00
229239.176	40.18	1.90	0.00	0.00	0.00
229297.406	58.23	2.20	0.00	0.00	0.00
229345.228	47.82	[illegible]	0.10	2.55	60.98
229385.206	39.98	[illegible]	0.20	5.20	154.92
229445.011	59.80	[illegible]	0.40	10.80	478.44
229487.712	42.70	[illegible]	0.70	19.95	656.53
229548.223	60.51	[illegible]	0.30	7.95	844.15
229567.362	19.14	[illegible]	0.30	7.95	152.15
229581.726	14.36	[illegible]	1.00	30.00	272.56
229618.821	37.10	[illegible]	0.50	13.75	811.47
229632.624	13.80	[illegible]	0.30	7.95	149.76
229646.672	14.05	[illegible]	0.50	13.75	152.42
229663.921	17.25	[illegible]	0.50	13.75	237.18
229689.975	26.05	[illegible]	0.30	7.95	282.69
229705.475	15.50	[illegible]	0.20	5.20	101.91
229724.381	18.91	[illegible]	0.20	5.20	98.32
229749.857	25.48	[illegible]	0.70	19.95	320.37
229770.817	20.96	[illegible]	0.70	19.95	418.16
229800.328	29.51	[illegible]	0.30	7.95	411.68
229832.557	32.23	[illegible]	0.60	16.80	398.84
229872.476	39.92	2.30	0.00	0.00	335.32
229907.069	34.59	1.90	0.00	0.00	0.00
229936.794	29.73	1.60	0.00	0.00	0.00
229954.010	17.22	1.70	0.00	0.00	0.00
229996.967	42.96	1.60	0.00	0.00	0.00
230045.105	48.14	1.60	0.00	0.00	0.00
230054.793	9.69	1.60	0.00	0.00	0.00
230096.681	41.89	1.50	0.00	0.00	0.00
230138.267	41.59	1.50	0.00	0.00	0.00
230199.645	61.38	[illegible]	0.10	2.55	78.26

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
230256.612	56.97	[illegible]	0.40	10.80	380.26
230300.352	43.74	[illegible]	0.60	16.80	603.62
230340.386	40.03	[illegible]	0.70	19.95	735.63
230389.890	49.50	[illegible]	0.70	19.95	987.61
230410.597	20.71	1.80	0.00	0.00	206.55
230479.741	69.14	2.00	0.00	0.00	0.00
230520.705	40.96	1.60	0.00	0.00	0.00
230568.520	47.81	[illegible]	0.00	0.00	0.00
230612.631	44.11	[illegible]	0.10	2.55	56.25
230645.282	32.65	[illegible]	0.20	5.20	126.53
230687.537	42.25	[illegible]	0.30	7.95	277.83
230761.731	74.19	[illegible]	0.70	19.95	1035.02
230805.009	43.28	[illegible]	0.70	19.95	863.40
230863.827	58.82	[illegible]	0.90	26.55	1367.52
230888.951	25.12	[illegible]	0.10	2.55	365.55
230933.668	44.72	[illegible]	0.40	10.80	298.50
230983.356	49.69	[illegible]	0.60	16.80	685.69
230999.264	15.91	1.50	0.00	0.00	133.63
231022.602	23.34	1.80	0.00	0.00	0.00
231036.308	13.71	1.90	0.00	0.00	0.00
231067.922	31.61	1.60	0.00	0.00	0.00
231092.294	24.37	1.70	0.00	0.00	0.00
231140.742	48.45	2.10	0.00	0.00	0.00
231190.977	50.23	2.30	0.00	0.00	0.00
231241.915	50.94	1.80	0.00	0.00	0.00
231270.387	28.47	1.60	0.00	0.00	0.00
231295.788	25.40	[illegible]	1.40	44.80	568.99
231330.121	34.33	1.40	0.00	0.00	769.06
231377.132	47.01	1.40	0.00	0.00	0.00
231410.457	33.33	1.40	0.00	0.00	0.00
231438.510	28.05	1.90	0.00	0.00	0.00
231500.032	61.52	4.60	0.00	0.00	0.00
231539.201	39.17	2.70	0.00	0.00	0.00
231577.663	38.46	3.10	0.00	0.00	0.00
231617.378	39.72	4.40	0.00	0.00	0.00
231719.827	102.45	3.40	0.00	0.00	0.00
231767.343	47.52	3.20	0.00	0.00	0.00
231807.572	40.23	3.10	0.00	0.00	0.00
231838.815	31.24	3.70	0.00	0.00	0.00
231905.948	67.13	3.50	0.00	0.00	0.00
231972.625	66.68	1.80	0.00	0.00	0.00
231999.871	27.25	1.60	0.00	0.00	0.00
232040.247	40.38	1.80	0.00	0.00	0.00
232081.302	41.05	2.60	0.00	0.00	0.00
232134.811	53.51	2.60	0.00	0.00	0.00
232170.896	36.08	2.10	0.00	0.00	0.00
232220.847	49.95	1.70	0.00	0.00	0.00
232259.803	38.96	1.80	0.00	0.00	0.00
232298.335	38.53	1.60	0.00	0.00	0.00
232346.526	48.19	1.80	0.00	0.00	0.00
232380.572	34.05	1.50	0.00	0.00	0.00
232437.278	56.71	[illegible]	0.00	0.00	0.00
232476.162	38.88	[illegible]	0.00	0.00	0.00
232519.458	43.30	[illegible]	0.00	0.00	0.00
232558.201	38.74	1.60	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
232597.318	39.12	1.60	0.00	0.00	0.00
232633.207	35.89	1.80	0.00	0.00	0.00
232669.823	36.62	2.00	0.00	0.00	0.00
232704.155	34.33	2.10	0.00	0.00	0.00
232742.846	38.69	2.30	0.00	0.00	0.00
232795.806	52.96	3.30	0.00	0.00	0.00
232863.078	67.27	2.40	0.00	0.00	0.00
232920.217	57.14	2.40	0.00	0.00	0.00
232959.481	39.26	2.70	0.00	0.00	0.00
232998.991	39.51	2.80	0.00	0.00	0.00
233034.133	35.14	2.80	0.00	0.00	0.00
233072.891	38.76	1.70	0.00	0.00	0.00
233109.775	36.88	3.10	0.00	0.00	0.00
233147.255	37.48	3.10	0.00	0.00	0.00
233189.292	42.04	3.20	0.00	0.00	0.00
233218.812	29.52	1.70	0.00	0.00	0.00
233252.230	33.42	2.10	0.00	0.00	0.00
233308.289	56.06	2.00	0.00	0.00	0.00
233355.968	47.68	2.20	0.00	0.00	0.00
233402.642	46.67	2.70	0.00	0.00	0.00
233444.110	41.47	2.60	0.00	0.00	0.00
233481.516	37.41	2.10	0.00	0.00	0.00
233536.843	55.33	2.80	0.00	0.00	0.00
233568.039	31.20	2.70	0.00	0.00	0.00
233599.047	31.01	1.40	0.00	0.00	0.00
233623.647	24.60	3.90	0.00	0.00	0.00
233650.295	26.65	2.90	0.00	0.00	0.00
233714.897	64.60	3.20	0.00	0.00	0.00
233764.416	49.52	2.10	0.00	0.00	0.00
233805.252	40.84	1.90	0.00	0.00	0.00
233854.009	48.76	1.90	0.00	0.00	0.00
233924.722	70.71	2.20	0.00	0.00	0.00
233999.198	74.48	2.30	0.00	0.00	0.00
234031.877	32.68	2.10	0.00	0.00	0.00
234060.851	28.97	1.90	0.00	0.00	0.00
234090.210	29.36	1.50	0.00	0.00	0.00
234126.286	36.08	[illegible]	0.00	0.00	0.00
234157.425	31.14	[illegible]	0.20	5.20	80.97
234199.119	41.69	[illegible]	0.40	10.80	333.56
234224.837	25.72	[illegible]	0.80	23.20	437.20
234266.905	42.07	[illegible]	0.80	23.20	976.00
234284.668	17.76	[illegible]	0.20	5.20	252.23
234320.152	35.48	[illegible]	0.00	0.00	92.26
234370.410	50.26	[illegible]	0.30	7.95	199.78
234397.574	27.16	[illegible]	0.40	10.80	254.67
234460.060	62.49	[illegible]	0.60	16.80	862.31
234475.232	15.17	[illegible]	0.70	19.95	278.79
234493.840	18.61	[illegible]	0.70	19.95	371.23
234510.754	16.91	[illegible]	0.70	19.95	337.45
234530.899	20.15	[illegible]	0.70	19.95	401.90
234550.313	19.41	[illegible]	0.50	13.75	327.13
234583.366	33.05	[illegible]	0.00	0.00	227.24
234614.431	31.06	1.70	0.00	0.00	0.00
234649.106	34.68	2.30	0.00	0.00	0.00
234679.968	30.86	2.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
234700.624	20.66	2.10	0.00	0.00	0.00
234728.778	28.15	2.00	0.00	0.00	0.00
234739.499	10.72	2.20	0.00	0.00	0.00
234778.290	38.79	1.80	0.00	0.00	0.00
234806.088	27.80	1.60	0.00	0.00	0.00
234833.437	27.35	1.50	0.00	0.00	0.00
234856.885	23.45	[illegible]	0.10	2.55	29.90
234910.133	53.25	[illegible]	0.10	2.55	135.79
234948.680	38.55	1.40	0.00	0.00	49.15
235013.701	65.02	2.00	0.00	0.00	0.00
235045.504	31.80	1.90	0.00	0.00	0.00
235078.409	32.90	2.20	0.00	0.00	0.00
235115.528	37.12	2.10	0.00	0.00	0.00
235151.417	35.89	1.90	0.00	0.00	0.00
235174.251	22.83	1.90	0.00	0.00	0.00
235231.234	56.98	2.20	0.00	0.00	0.00
235281.644	50.41	3.60	0.00	0.00	0.00
235328.449	46.80	4.10	0.00	0.00	0.00
235419.155	90.71	3.50	0.00	0.00	0.00
235536.477	117.32	3.30	0.00	0.00	0.00
235573.580	37.10	2.90	0.00	0.00	0.00
235613.812	40.23	2.30	0.00	0.00	0.00
235671.358	57.55	2.00	0.00	0.00	0.00
235703.032	31.67	1.90	0.00	0.00	0.00
235755.371	52.34	[illegible]	0.00	0.00	0.00
235792.394	37.02	[illegible]	0.10	2.55	47.21
235832.929	40.53	[illegible]	0.00	0.00	51.69
235856.479	23.55	2.00	0.00	0.00	0.00
235891.026	34.55	1.40	0.00	0.00	0.00
235922.121	31.09	[illegible]	0.00	0.00	0.00
235963.783	41.66	[illegible]	0.00	0.00	0.00
236015.272	51.49	1.40	0.00	0.00	0.00
236049.486	34.21	1.40	0.00	0.00	0.00
236094.131	44.65	1.60	0.00	0.00	0.00
236128.668	34.54	[illegible]	0.00	0.00	0.00
236187.599	58.93	[illegible]	0.00	0.00	0.00
236228.889	41.29	[illegible]	0.00	0.00	0.00
236291.474	62.58	1.40	0.00	0.00	0.00
236340.090	48.62	1.90	0.00	0.00	0.00
236402.821	62.73	2.10	0.00	0.00	0.00
236445.513	42.69	2.20	0.00	0.00	0.00
236495.936	50.42	2.20	0.00	0.00	0.00
236525.045	29.11	2.00	0.00	0.00	0.00
236587.485	62.44	2.40	0.00	0.00	0.00
236631.890	44.41	2.60	0.00	0.00	0.00
236669.192	37.30	2.90	0.00	0.00	0.00
236769.085	99.89	6.10	0.00	0.00	0.00
236821.018	51.93	4.80	0.00	0.00	0.00
236906.626	85.61	4.40	0.00	0.00	0.00
236999.596	92.97	2.60	0.00	0.00	0.00
237048.224	48.63	2.70	0.00	0.00	0.00
237087.352	39.13	1.90	0.00	0.00	0.00
237111.883	24.53	1.60	0.00	0.00	0.00
237159.312	47.43	1.40	0.00	0.00	0.00
237213.971	54.66	[illegible]	0.10	2.55	69.70

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
237269.867	55.90	1.40	0.00	0.00	71.27
237319.571	49.70	2.20	0.00	0.00	0.00
237345.851	26.28	1.50	0.00	0.00	0.00
237390.472	44.62	2.40	0.00	0.00	0.00
237415.650	25.18	2.00	0.00	0.00	0.00
237459.241	43.59	1.90	0.00	0.00	0.00
237490.861	31.62	1.40	0.00	0.00	0.00
237536.668	45.81	1.40	0.00	0.00	0.00
237600.037	63.37	[illegible]	0.50	13.75	435.67
237624.501	24.46	[illegible]	0.30	7.95	265.43
237668.926	44.43	[illegible]	0.30	7.95	353.18
237702.844	33.92	[illegible]	0.40	10.80	317.99
237741.227	38.38	1.90	0.00	0.00	207.27
237758.086	16.86	[illegible]	0.00	0.00	0.00
237810.664	52.58	1.50	0.00	0.00	0.00
237855.705	45.04	1.50	0.00	0.00	0.00
237912.257	56.55	1.50	0.00	0.00	0.00
237999.000	86.74	2.90	0.00	0.00	0.00
238100.652	101.65	3.80	0.00	0.00	0.00
238129.267	28.62	3.10	0.00	0.00	0.00
238158.054	28.79	1.50	0.00	0.00	0.00
238204.974	46.92	1.90	0.00	0.00	0.00
238236.925	31.95	1.70	0.00	0.00	0.00
238271.769	34.84	[illegible]	0.00	0.00	0.00
238312.457	40.69	[illegible]	0.20	5.20	105.79
238355.607	43.15	[illegible]	0.00	0.00	112.20
238414.962	59.35	[illegible]	0.20	5.20	154.33
238467.972	53.01	[illegible]	0.30	7.95	348.55
238486.471	18.50	[illegible]	0.50	13.75	200.72
238496.915	10.44	[illegible]	0.60	16.80	159.54
238503.622	6.71	[illegible]	0.40	10.80	92.55
238514.949	11.33	[illegible]	0.50	13.75	139.04
238526.337	11.39	[illegible]	0.40	10.80	139.80
238542.082	15.74	[illegible]	0.00	0.00	85.03
238553.349	11.27	1.70	0.00	0.00	0.00
238574.676	21.33	2.70	0.00	0.00	0.00
238631.562	56.89	[illegible]	0.00	0.00	0.00
238640.202	8.64	[illegible]	0.20	5.20	22.47
238663.073	22.87	[illegible]	0.10	2.55	88.63
238692.312	29.24	[illegible]	0.00	0.00	37.28
238718.189	25.88	[illegible]	0.10	2.55	33.00
238741.068	22.88	1.40	0.00	0.00	29.18
238756.763	15.70	[illegible]	0.00	0.00	0.00
238804.916	48.15	7.80	0.00	0.00	0.00
238824.677	19.76	6.10	0.00	0.00	0.00
238847.381	22.70	9.10	0.00	0.00	0.00
238871.737	24.36	5.40	0.00	0.00	0.00
238889.620	17.88	3.10	0.00	0.00	0.00
238916.036	26.42	3.50	0.00	0.00	0.00
238935.845	19.81	2.60	0.00	0.00	0.00
238980.799	44.95	1.70	0.00	0.00	0.00
239011.900	31.10	1.40	0.00	0.00	0.00
239078.986	67.09	[illegible]	0.50	13.75	461.22
239108.016	29.03	[illegible]	0.50	13.75	399.17
239138.467	30.45	[illegible]	0.60	16.80	465.15

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
239169.954	31.49	[illegible]	0.50	13.75	480.96
239203.861	33.91	[illegible]	0.50	13.75	466.24
239223.697	19.84	[illegible]	0.70	19.95	334.24
239245.519	21.82	[illegible]	0.70	19.95	435.35
239274.507	28.99	[illegible]	0.70	19.95	578.32
239328.242	53.73	[illegible]	0.80	23.20	1159.32
239339.000	10.76	[illegible]	0.60	16.80	215.18
239358.739	19.74	[illegible]	0.40	10.80	272.40
239402.825	44.09	[illegible]	0.90	26.55	823.31
239436.496	33.67	[illegible]	1.00	30.00	952.06
239478.495	42.00	[illegible]	1.10	33.55	1334.54
239490.753	12.26	[illegible]	1.00	30.00	389.49
239517.814	27.06	[illegible]	0.80	23.20	719.82
239533.795	15.98	[illegible]	0.70	19.95	344.80
239543.906	10.11	[illegible]	0.60	16.80	185.80
239556.907	13.00	[illegible]	0.00	0.00	109.21
239580.241	23.33	2.20	0.00	0.00	0.00
239610.948	30.71	2.60	0.00	0.00	0.00
239626.374	15.43	2.00	0.00	0.00	0.00
239650.806	24.43	1.50	0.00	0.00	0.00
239670.525	19.72	1.40	0.00	0.00	0.00
239687.284	16.76	1.60	0.00	0.00	0.00
239713.342	26.06	2.50	0.00	0.00	0.00
239739.741	26.40	1.90	0.00	0.00	0.00
239758.348	18.61	1.60	0.00	0.00	0.00
239788.497	30.15	2.60	0.00	0.00	0.00
239831.315	42.82	[illegible]	0.40	10.80	231.22
239854.612	23.30	1.80	0.00	0.00	125.81
239871.279	16.67	2.70	0.00	0.00	0.00
239889.339	18.06	2.30	0.00	0.00	0.00
239914.569	25.23	3.00	0.00	0.00	0.00
239931.808	17.24	3.10	0.00	0.00	0.00
239966.287	34.48	3.00	0.00	0.00	0.00
240006.289	40.00	2.70	0.00	0.00	0.00
240050.602	44.31	3.00	0.00	0.00	0.00
240079.725	29.12	3.20	0.00	0.00	0.00
240119.970	40.25	6.50	0.00	0.00	0.00
240187.721	67.75	3.40	0.00	0.00	0.00
240228.469	40.75	3.10	0.00	0.00	0.00
240268.764	40.30	3.00	0.00	0.00	0.00
240297.803	29.04	2.80	0.00	0.00	0.00
240347.780	49.98	2.60	0.00	0.00	0.00
240394.142	46.36	4.20	0.00	0.00	0.00
240480.074	85.93	4.80	0.00	0.00	0.00
240520.901	40.83	3.50	0.00	0.00	0.00
240547.042	26.14	3.50	0.00	0.00	0.00
240578.598	31.56	3.20	0.00	0.00	0.00
240602.537	23.94	3.70	0.00	0.00	0.00
240632.210	29.67	2.40	0.00	0.00	0.00
240644.118	11.91	2.30	0.00	0.00	0.00
240662.955	18.84	2.70	0.00	0.00	0.00
240766.503	103.55	3.00	0.00	0.00	0.00
240849.481	82.98	2.10	0.00	0.00	0.00
240948.704	99.22	1.90	0.00	0.00	0.00
240985.181	36.48	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
241134.493	149.31	[illegible]	0.10	2.55	190.38
241167.303	32.81	[illegible]	0.00	0.00	41.84
241213.112	45.81	1.60	0.00	0.00	0.00
241266.622	53.51	1.60	0.00	0.00	0.00
241318.017	51.39	1.50	0.00	0.00	0.00
241342.083	24.07	1.80	0.00	0.00	0.00
241382.519	40.44	1.80	0.00	0.00	0.00
241416.535	34.02	1.60	0.00	0.00	0.00
241463.697	47.16	2.00	0.00	0.00	0.00
241550.651	86.95	1.70	0.00	0.00	0.00
241584.263	33.61	1.70	0.00	0.00	0.00
241634.720	50.46	2.10	0.00	0.00	0.00
241773.044	138.32	4.70	0.00	0.00	0.00
241887.086	114.04	3.80	0.00	0.00	0.00
242019.270	132.18	3.00	0.00	0.00	0.00
242076.164	56.89	2.20	0.00	0.00	0.00
242131.190	55.03	2.10	0.00	0.00	0.00
242165.658	34.47	2.20	0.00	0.00	0.00
242205.239	39.58	2.30	0.00	0.00	0.00
242251.031	45.79	3.40	0.00	0.00	0.00
242303.168	52.14	1.90	0.00	0.00	0.00
242358.849	55.68	2.50	0.00	0.00	0.00
242387.179	28.33	2.50	0.00	0.00	0.00
242458.049	70.87	1.90	0.00	0.00	0.00
242533.801	75.75	1.80	0.00	0.00	0.00
242581.844	48.04	1.80	0.00	0.00	0.00
242612.357	30.51	1.70	0.00	0.00	0.00
242656.166	43.81	2.60	0.00	0.00	0.00
242704.859	48.69	2.80	0.00	0.00	0.00
242738.628	33.77	2.10	0.00	0.00	0.00
242777.927	39.30	1.70	0.00	0.00	0.00
242856.711	78.78	1.60	0.00	0.00	0.00
242916.344	59.63	1.50	0.00	0.00	0.00
242988.654	72.31	1.40	0.00	0.00	0.00
243088.532	99.88	[illegible]	0.30	7.95	397.02
243114.465	25.93	[illegible]	0.40	10.80	243.13
243169.661	55.20	[illegible]	0.00	0.00	298.06
243191.941	22.28	1.50	0.00	0.00	0.00
243259.190	67.25	1.50	0.00	0.00	0.00
243299.436	40.25	[illegible]	0.00	0.00	0.00
243335.129	35.69	1.60	0.00	0.00	0.00
243374.019	38.89	1.50	0.00	0.00	0.00
243399.809	25.79	1.60	0.00	0.00	0.00
243423.484	23.67	2.30	0.00	0.00	0.00
243452.128	28.64	1.50	0.00	0.00	0.00
243463.474	11.35	2.60	0.00	0.00	0.00
243479.023	15.55	1.80	0.00	0.00	0.00
243526.890	47.87	1.70	0.00	0.00	0.00
243559.475	32.58	[illegible]	0.00	0.00	0.00
243579.551	20.08	[illegible]	0.10	2.55	25.60
243603.396	23.85	3.20	0.00	0.00	30.41
243640.995	37.60	[illegible]	0.00	0.00	0.00
243700.330	59.33	2.80	0.00	0.00	0.00
243735.365	35.04	2.60	0.00	0.00	0.00
243772.704	37.34	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
243800.434	27.73	[illegible]	0.20	5.20	72.10
243821.852	21.42	[illegible]	0.80	23.20	304.13
243850.467	28.61	[illegible]	0.00	0.00	331.94
243887.074	36.61	2.00	0.00	0.00	0.00
243926.698	39.62	2.60	0.00	0.00	0.00
243969.502	42.80	2.30	0.00	0.00	0.00
243999.791	30.29	2.50	0.00	0.00	0.00
244040.913	41.12	2.30	0.00	0.00	0.00
244075.333	34.42	2.20	0.00	0.00	0.00
244116.331	41.00	2.00	0.00	0.00	0.00
244154.221	37.89	1.70	0.00	0.00	0.00
244198.014	43.79	[illegible]	0.00	0.00	0.00
244250.772	52.76	[illegible]	0.10	2.55	67.27
244271.392	20.62	[illegible]	0.50	13.75	168.06
244297.407	26.01	[illegible]	0.40	10.80	319.34
244316.320	18.91	[illegible]	0.50	13.75	232.17
244331.274	14.95	[illegible]	0.30	7.95	162.25
244340.298	9.02	[illegible]	0.20	5.20	59.34
244356.935	16.64	2.10	0.00	0.00	43.26
244379.435	22.50	[illegible]	0.30	7.95	89.44
244412.572	33.14	2.10	0.00	0.00	131.73
244437.181	24.61	3.30	0.00	0.00	0.00
244505.915	68.73	3.80	0.00	0.00	0.00
244540.227	34.31	3.40	0.00	0.00	0.00
244564.422	24.20	2.80	0.00	0.00	0.00
244590.158	25.74	2.90	0.00	0.00	0.00
244626.689	36.53	[illegible]	0.30	7.95	145.22
244658.706	32.02	2.80	0.00	0.00	127.27
244703.468	44.76	[illegible]	0.00	0.00	0.00
244756.643	53.18	[illegible]	0.30	7.95	211.38
244801.739	45.10	[illegible]	0.00	0.00	179.26
244847.522	45.78	[illegible]	0.10	2.55	58.38
244890.933	43.41	[illegible]	0.50	13.75	353.80
244919.486	28.55	[illegible]	0.40	10.80	350.50
244947.694	28.21	[illegible]	0.50	13.75	346.26
244976.153	28.46	[illegible]	0.40	10.80	349.33
245013.241	37.09	1.40	0.00	0.00	200.28
245049.226	35.98	3.30	0.00	0.00	0.00
245066.324	17.10	3.20	0.00	0.00	0.00
245102.429	36.10	3.10	0.00	0.00	0.00
245169.448	67.02	2.60	0.00	0.00	0.00
245200.924	31.48	3.00	0.00	0.00	0.00
245251.011	50.09	1.80	0.00	0.00	0.00
245280.323	29.31	2.40	0.00	0.00	0.00
245319.037	38.71	2.30	0.00	0.00	0.00
245349.557	30.52	1.50	0.00	0.00	0.00
245390.864	41.31	[illegible]	0.00	0.00	0.00
245425.670	34.81	1.50	0.00	0.00	0.00
245463.143	37.47	2.20	0.00	0.00	0.00
245496.078	32.94	3.10	0.00	0.00	0.00
245541.432	45.35	4.40	0.00	0.00	0.00
245570.724	29.29	3.80	0.00	0.00	0.00
245740.664	169.94	3.60	0.00	0.00	0.00
245775.863	35.20	3.70	0.00	0.00	0.00
245799.664	23.80	2.80	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
245832.616	32.95	3.30	0.00	0.00	0.00
245872.581	39.97	2.60	0.00	0.00	0.00
245912.757	40.18	2.20	0.00	0.00	0.00
245947.240	34.48	1.90	0.00	0.00	0.00
245979.181	31.94	1.60	0.00	0.00	0.00
246026.962	47.78	1.50	0.00	0.00	0.00
246062.360	35.40	1.50	0.00	0.00	0.00
246114.239	51.88	1.60	0.00	0.00	0.00
246161.483	47.24	1.70	0.00	0.00	0.00
246233.128	71.65	[illegible]	0.00	0.00	0.00
246243.285	10.16	[illegible]	0.10	2.55	12.95
246268.821	25.54	1.40	0.00	0.00	32.56
246314.028	45.21	2.40	0.00	0.00	0.00
246343.244	29.22	2.30	0.00	0.00	0.00
246393.210	49.97	1.90	0.00	0.00	0.00
246444.752	51.54	2.10	0.00	0.00	0.00
246469.458	24.71	2.40	0.00	0.00	0.00
246493.861	24.40	2.70	0.00	0.00	0.00
246520.117	26.26	2.60	0.00	0.00	0.00
246569.804	49.69	2.50	0.00	0.00	0.00
246590.689	20.88	2.40	0.00	0.00	0.00
246609.088	18.40	2.40	0.00	0.00	0.00
246652.109	43.02	2.80	0.00	0.00	0.00
246687.138	35.03	2.00	0.00	0.00	0.00
246717.292	30.15	2.40	0.00	0.00	0.00
246749.911	32.62	1.80	0.00	0.00	0.00
246786.431	36.52	1.70	0.00	0.00	0.00
246826.700	40.27	1.70	0.00	0.00	0.00
246853.221	26.52	1.80	0.00	0.00	0.00
246887.280	34.06	1.40	0.00	0.00	0.00
246930.598	43.32	1.40	0.00	0.00	0.00
246987.390	56.79	[illegible]	0.20	5.20	147.66
247012.665	25.27	[illegible]	0.00	0.00	65.72
247046.896	34.23	[illegible]	0.00	0.00	0.00
247090.246	43.35	1.60	0.00	0.00	0.00
247133.051	42.80	1.50	0.00	0.00	0.00
247181.626	48.57	1.40	0.00	0.00	0.00
247223.709	42.08	1.50	0.00	0.00	0.00
247259.402	35.69	2.60	0.00	0.00	0.00
247295.089	35.69	1.40	0.00	0.00	0.00
247337.252	42.16	[illegible]	0.00	0.00	0.00
247372.988	35.74	[illegible]	0.10	2.55	45.57
247412.160	39.17	[illegible]	0.00	0.00	49.95
247461.802	49.64	[illegible]	0.00	0.00	0.00
247499.133	37.33	1.40	0.00	0.00	0.00
247558.239	59.11	2.30	0.00	0.00	0.00
247600.569	42.33	2.90	0.00	0.00	0.00
247643.057	42.49	2.50	0.00	0.00	0.00
247677.886	34.83	2.20	0.00	0.00	0.00
247731.924	54.04	2.90	0.00	0.00	0.00
247772.466	40.54	3.40	0.00	0.00	0.00
247794.528	22.06	3.00	0.00	0.00	0.00
247859.959	65.43	3.10	0.00	0.00	0.00
247916.291	56.33	2.40	0.00	0.00	0.00
247971.927	55.64	1.90	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
248013.528	41.60	2.00	0.00	0.00	0.00
248077.712	64.18	[illegible]	0.00	0.00	0.00
248125.913	48.20	[illegible]	0.40	10.80	260.29
248139.666	13.75	[illegible]	0.70	19.95	211.46
248183.708	44.04	[illegible]	0.70	19.95	878.65
248222.993	39.28	2.60	0.00	0.00	391.86
248294.863	71.87	5.20	0.00	0.00	0.00
248372.521	77.66	3.90	0.00	0.00	0.00
248420.807	48.29	3.50	0.00	0.00	0.00
248462.519	41.71	[illegible]	0.40	10.80	225.25
248489.461	26.94	[illegible]	0.30	7.95	252.58
248501.479	12.02	[illegible]	0.00	0.00	47.78
248511.048	9.57	[illegible]	0.10	2.55	12.21
248533.256	22.21	6.80	0.00	0.00	28.32
248569.255	36.00	5.20	0.00	0.00	0.00
248632.398	63.14	4.40	0.00	0.00	0.00
248686.214	53.82	3.20	0.00	0.00	0.00
248720.537	34.32	2.80	0.00	0.00	0.00
248765.502	44.96	1.80	0.00	0.00	0.00
248822.734	57.23	[illegible]	0.00	0.00	0.00
248857.025	34.29	[illegible]	0.10	2.55	43.73
248896.775	39.75	[illegible]	0.20	5.20	154.04
248931.838	35.06	2.10	0.00	0.00	91.17
248962.544	30.71	2.90	0.00	0.00	0.00
248983.947	21.40	3.10	0.00	0.00	0.00
249027.108	43.16	3.00	0.00	0.00	0.00
249084.247	57.14	3.90	0.00	0.00	0.00
249122.216	37.97	4.30	0.00	0.00	0.00
249160.992	38.78	4.80	0.00	0.00	0.00
249206.958	45.97	4.20	0.00	0.00	0.00
249257.234	50.28	5.70	0.00	0.00	0.00
249329.212	71.98	5.90	0.00	0.00	0.00
249373.034	43.82	4.30	0.00	0.00	0.00
249489.557	116.52	5.80	0.00	0.00	0.00
249532.943	43.39	5.90	0.00	0.00	0.00
249563.445	30.50	4.80	0.00	0.00	0.00
249578.091	14.65	5.40	0.00	0.00	0.00
249627.912	49.82	4.80	0.00	0.00	0.00
249688.327	60.41	4.50	0.00	0.00	0.00
249720.386	32.06	4.00	0.00	0.00	0.00
249770.805	50.42	4.00	0.00	0.00	0.00
249827.596	56.79	3.90	0.00	0.00	0.00
249865.562	37.97	2.70	0.00	0.00	0.00
249931.942	66.38	1.60	0.00	0.00	0.00
249991.185	59.24	1.60	0.00	0.00	0.00
250026.487	35.30	[illegible]	0.00	0.00	0.00
250068.106	41.62	[illegible]	0.10	2.55	53.07
250121.947	53.84	6.80	0.00	0.00	68.65
250161.840	39.89	4.10	0.00	0.00	0.00
250208.269	46.43	4.00	0.00	0.00	0.00
250233.572	25.30	2.80	0.00	0.00	0.00
250264.913	31.34	1.40	0.00	0.00	0.00
250344.418	79.51	2.40	0.00	0.00	0.00
250435.687	91.27	1.40	0.00	0.00	0.00
250475.926	40.24	[illegible]	0.10	2.55	51.31

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
250504.865	28.94	1.50	0.00	0.00	36.90
250594.998	90.13	2.20	0.00	0.00	0.00
250804.604	209.61	4.40	0.00	0.00	0.00
250842.525	37.92	4.60	0.00	0.00	0.00
250939.201	96.68	2.80	0.00	0.00	0.00
250988.145	48.94	3.10	0.00	0.00	0.00
251036.396	48.25	2.60	0.00	0.00	0.00
251076.060	39.66	2.40	0.00	0.00	0.00
251140.952	64.89	2.60	0.00	0.00	0.00
251182.815	41.86	2.80	0.00	0.00	0.00
251221.573	38.76	3.20	0.00	0.00	0.00
251272.376	50.80	3.00	0.00	0.00	0.00
251335.146	62.77	3.80	0.00	0.00	0.00
251438.040	102.89	4.20	0.00	0.00	0.00
251484.450	46.41	4.30	0.00	0.00	0.00
251531.502	47.05	3.40	0.00	0.00	0.00
251762.173	230.67	3.60	0.00	0.00	0.00
251800.519	38.35	3.30	0.00	0.00	0.00
251862.408	61.89	2.20	0.00	0.00	0.00
251904.957	42.55	2.00	0.00	0.00	0.00
252030.166	125.21	2.60	0.00	0.00	0.00
252070.061	39.89	2.50	0.00	0.00	0.00
252128.457	58.40	1.70	0.00	0.00	0.00
252184.778	56.32	1.40	0.00	0.00	0.00
252242.818	58.04	[illegible]	0.00	0.00	0.00
252285.976	43.16	[illegible]	0.00	0.00	0.00
252329.168	43.19	[illegible]	0.20	5.20	112.31
252361.274	32.11	[illegible]	0.40	10.80	256.85
252441.457	80.18	[illegible]	0.70	19.95	1232.83
252464.348	22.89	[illegible]	0.50	13.75	385.71
252496.123	31.77	[illegible]	0.10	2.55	258.97
252534.351	38.23	[illegible]	0.10	2.55	97.49
252570.539	36.19	[illegible]	0.20	5.20	140.23
252610.889	40.35	[illegible]	0.60	16.80	443.86
252654.428	43.54	[illegible]	0.40	10.80	600.84
252694.218	39.79	[illegible]	0.20	5.20	318.32
252735.853	41.64	[illegible]	0.10	2.55	161.34
252789.327	53.47	[illegible]	0.70	19.95	601.58
252830.516	41.19	[illegible]	0.90	26.55	957.65
252860.507	29.99	[illegible]	0.90	26.55	796.27
252893.530	33.02	[illegible]	0.90	26.55	876.76
252925.920	32.39	[illegible]	0.30	7.95	558.73
252957.979	32.06	1.50	0.00	0.00	127.44
252992.957	34.98	2.30	0.00	0.00	0.00
253030.726	37.77	1.50	0.00	0.00	0.00
253074.457	43.73	[illegible]	0.20	5.20	113.71
253102.571	28.11	[illegible]	0.00	0.00	73.10
253124.492	21.92	[illegible]	0.00	0.00	0.00
253141.368	16.88	2.60	0.00	0.00	0.00
253170.112	28.74	1.80	0.00	0.00	0.00
253189.118	19.01	1.90	0.00	0.00	0.00
253228.509	39.39	2.30	0.00	0.00	0.00
253265.785	37.28	[illegible]	0.00	0.00	0.00
253308.128	42.34	3.20	0.00	0.00	0.00
253353.096	44.97	3.90	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
253388.412	35.32	3.70	0.00	0.00	0.00
253501.611	113.20	2.40	0.00	0.00	0.00
253548.800	47.19	2.30	0.00	0.00	0.00
253594.956	46.16	2.00	0.00	0.00	0.00
253633.723	38.77	1.60	0.00	0.00	0.00
253672.718	39.00	1.60	0.00	0.00	0.00
253719.095	46.38	2.20	0.00	0.00	0.00
253762.625	43.53	2.60	0.00	0.00	0.00
253812.323	49.70	2.20	0.00	0.00	0.00
253875.262	62.94	3.60	0.00	0.00	0.00
253932.743	57.48	4.00	0.00	0.00	0.00
253998.988	66.24	3.70	0.00	0.00	0.00
254070.910	71.92	3.20	0.00	0.00	0.00
254147.946	77.04	3.20	0.00	0.00	0.00
254305.188	157.24	2.20	0.00	0.00	0.00
254368.327	63.14	2.00	0.00	0.00	0.00
254422.510	54.18	2.00	0.00	0.00	0.00
254462.224	39.71	1.90	0.00	0.00	0.00
254515.338	53.11	1.60	0.00	0.00	0.00
254565.128	49.79	1.40	0.00	0.00	0.00
254684.705	119.58	4.20	0.00	0.00	0.00
254835.158	150.45	4.30	0.00	0.00	0.00
254883.817	48.66	[illegible]	0.00	0.00	0.00
254956.955	73.14	2.50	0.00	0.00	0.00
254994.959	38.00	6.50	0.00	0.00	0.00
255028.952	33.99	5.10	0.00	0.00	0.00
255095.417	66.47	4.20	0.00	0.00	0.00
255146.149	50.73	3.60	0.00	0.00	0.00
255188.605	42.46	3.10	0.00	0.00	0.00
255226.887	38.28	2.80	0.00	0.00	0.00
255271.468	44.58	2.30	0.00	0.00	0.00
255298.817	27.35	2.10	0.00	0.00	0.00
255325.423	26.61	1.80	0.00	0.00	0.00
255358.911	33.49	1.60	0.00	0.00	0.00
255405.661	46.75	1.50	0.00	0.00	0.00
255456.900	51.24	[illegible]	0.00	0.00	0.00
255561.939	105.04	[illegible]	0.30	7.95	417.54
255632.618	70.68	[illegible]	0.40	10.80	662.62
255661.743	29.12	[illegible]	0.60	16.80	401.93
255690.763	29.02	[illegible]	0.50	13.75	443.29
255715.042	24.28	[illegible]	0.20	5.20	230.04
255772.058	57.02	1.50	0.00	0.00	148.25
255794.748	22.69	1.60	0.00	0.00	0.00
255821.114	26.37	[illegible]	0.10	2.55	33.62
255869.163	48.05	1.60	0.00	0.00	61.27
255897.881	28.72	1.40	0.00	0.00	0.00
255962.155	64.27	[illegible]	0.40	10.80	347.08
256018.649	56.49	[illegible]	0.60	16.80	779.62
256040.832	22.18	[illegible]	0.00	0.00	186.35
256054.472	13.64	[illegible]	0.00	0.00	0.00
256090.105	35.63	1.50	0.00	0.00	0.00
256117.870	27.76	[illegible]	0.00	0.00	0.00
256153.912	36.04	[illegible]	0.10	2.55	45.96
256225.508	71.60	[illegible]	0.20	5.20	277.44
256257.046	31.54	[illegible]	0.00	0.00	82.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
256278.825	21.78		0.10	2.55	27.77
256327.033	48.21		0.20	5.20	186.81
256376.299	49.27	1.50	0.00	0.00	128.10
256449.710	73.41	1.60	0.00	0.00	0.00
256510.359	60.65		0.10	2.55	77.33
256537.523	27.16		0.00	0.00	34.64
256590.671	53.15	1.40	0.00	0.00	0.00
256637.662	46.99	1.60	0.00	0.00	0.00
256720.940	83.28	1.40	0.00	0.00	0.00
256773.555	52.61		0.20	5.20	136.80
256808.074	34.52		0.20	5.20	179.50
256866.429	58.35		0.00	0.00	151.73
256922.927	56.50		0.20	5.20	146.90
256971.128	48.20	1.60	0.00	0.00	125.33
257016.251	45.12	1.70	0.00	0.00	0.00
257047.051	30.80		0.00	0.00	0.00
257109.803	62.75	1.90	0.00	0.00	0.00
257188.445	78.64	1.90	0.00	0.00	0.00
257229.756	41.31	1.70	0.00	0.00	0.00
257278.919	49.16	2.00	0.00	0.00	0.00
257324.856	45.94	1.60	0.00	0.00	0.00
257347.833	22.98	1.50	0.00	0.00	0.00
257396.382	48.55	1.70	0.00	0.00	0.00
257466.634	70.25		0.00	0.00	0.00
257517.730	51.10	1.80	0.00	0.00	0.00
257557.156	39.43	1.60	0.00	0.00	0.00
257602.125	44.97		0.10	2.55	57.34
257634.295	32.17		0.00	0.00	41.02
257689.599	55.30	1.60	0.00	0.00	0.00
257709.606	20.01	1.60	0.00	0.00	0.00
257737.899	28.29	1.50	0.00	0.00	0.00
257758.742	20.84		0.00	0.00	0.00
257795.749	37.01		0.40	10.80	199.84
257828.794	33.04		0.40	10.80	356.89
257852.809	24.01	2.40	0.00	0.00	129.69
257923.121	70.31	1.50	0.00	0.00	0.00
257941.708	18.59		0.30	7.95	73.89
257974.348	32.64		0.70	19.95	455.33
258003.571	29.22		0.90	26.55	679.45
258004.907	1.34		0.90	26.55	35.48
258021.548	16.64		0.80	23.20	413.94
258043.175	21.63		0.20	5.20	307.11
258069.520	26.34	2.40	0.00	0.00	68.50
258127.630	58.11	4.40	0.00	0.00	0.00
258127.630	0.00	2.40	0.00	0.00	0.00
258157.659	30.03	1.70	0.00	0.00	0.00
258210.710	53.05		0.00	0.00	0.00
258290.546	79.84		0.80	23.20	926.11
258308.590	18.04		0.90	26.55	448.85
258331.393	22.80		0.70	19.95	530.16
258342.680	11.29		0.40	10.80	173.55
258364.891	22.21		0.30	7.95	208.23
258386.497	21.61		0.40	10.80	202.56
258442.660	56.16		0.10	2.55	374.89
258455.850	13.19		0.10	2.55	33.64

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
258511.410	55.56	2.10	0.00	0.00	70.84
258562.308	50.90	2.00	0.00	0.00	0.00
258591.503	29.20	[illegible]	0.20	5.20	75.91
258625.861	34.36	[illegible]	0.10	2.55	133.14
258644.216	18.36	[illegible]	0.00	0.00	23.41
258678.530	34.31	[illegible]	0.60	16.80	288.24
258701.510	22.98	[illegible]	0.70	19.95	422.27
258722.720	21.21	[illegible]	0.70	19.95	423.14
258738.446	15.73	[illegible]	0.60	16.80	288.97
258755.642	17.20	[illegible]	0.30	7.95	212.81
258769.178	13.54	[illegible]	0.20	5.20	89.00
258820.281	51.10	[illegible]	0.10	2.55	198.03
258859.091	38.81	[illegible]	0.20	5.20	150.39
259388.360	529.27	[illegible]	0.10	2.55	2050.92
259859.305	470.94	[illegible]	0.00	0.00	600.46
259901.291	41.99	[illegible]	0.10	2.55	53.54
260020.390	119.10	[illegible]	0.00	0.00	151.86
260055.565	35.17	[illegible]	0.00	0.00	0.00
260093.131	37.57	[illegible]	0.20	5.20	97.68
260123.126	30.00	[illegible]	0.20	5.20	155.98
260214.967	91.84	[illegible]	0.30	7.95	603.86
260274.177	59.21	[illegible]	0.40	10.80	555.10
260306.844	32.67	[illegible]	0.40	10.80	352.82
260338.170	31.33	[illegible]	0.60	16.80	432.30
260379.997	41.83	[illegible]	0.10	2.55	404.68
260418.400	38.40	1.50	0.00	0.00	48.97
260468.430	50.03	1.40	0.00	0.00	0.00
260507.328	38.90	[illegible]	0.00	0.00	0.00
260552.634	45.31	[illegible]	0.10	2.55	57.77
260575.952	23.32	[illegible]	0.10	2.55	59.47
260609.817	33.86	[illegible]	0.10	2.55	86.36
260643.978	34.16	[illegible]	0.00	0.00	43.56
260696.746	52.77	1.70	0.00	0.00	0.00
260745.019	48.27	2.20	0.00	0.00	0.00
260781.633	36.61	2.10	0.00	0.00	0.00
260828.242	46.61	1.70	0.00	0.00	0.00
260880.628	52.39	1.40	0.00	0.00	0.00
260917.407	36.78	[illegible]	0.30	7.95	146.20
260946.685	29.28	[illegible]	0.30	7.95	232.76
260979.387	32.70	[illegible]	0.30	7.95	259.99
261025.428	46.04	[illegible]	0.30	7.95	366.03
261064.419	38.99	[illegible]	0.40	10.80	365.55
261109.010	44.59	[illegible]	0.40	10.80	481.58
261138.365	29.35	[illegible]	0.30	7.95	275.21
261161.930	23.57	[illegible]	0.20	5.20	154.95
261209.507	47.58	[illegible]	0.00	0.00	123.70
261251.750	42.24	[illegible]	0.30	7.95	167.92
261287.517	35.77	2.60	0.00	0.00	142.18
261326.760	39.24	2.60	0.00	0.00	0.00
261363.299	36.54	2.50	0.00	0.00	0.00
261399.833	36.53	2.30	0.00	0.00	0.00
261499.911	100.08	1.60	0.00	0.00	0.00
261566.389	66.48	[illegible]	0.00	0.00	0.00
261607.703	41.31	[illegible]	0.20	5.20	107.42
261634.588	26.88	[illegible]	0.30	7.95	176.77

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
261698.150	63.56	[illegible]	0.50	13.75	689.66
261710.883	12.73	[illegible]	0.70	19.95	214.56
261752.059	41.18	[illegible]	0.00	0.00	410.74
261759.966	7.91	[illegible]	0.00	0.00	0.00
261777.890	17.92	1.50	0.00	0.00	0.00
261799.324	21.43	[illegible]	0.00	0.00	0.00
261835.801	36.48	[illegible]	0.20	5.20	94.84
261878.305	42.50	[illegible]	0.10	2.55	164.71
261927.875	49.57	[illegible]	0.00	0.00	63.21
261964.011	36.14	2.10	0.00	0.00	0.00
261992.922	28.91	2.70	0.00	0.00	0.00
262021.340	28.42	3.10	0.00	0.00	0.00
262044.943	23.60	3.30	0.00	0.00	0.00
262108.891	63.95	1.90	0.00	0.00	0.00
262137.169	28.28	1.70	0.00	0.00	0.00
262164.763	27.59	1.40	0.00	0.00	0.00
262198.755	33.99	2.30	0.00	0.00	0.00
262229.715	30.96	3.20	0.00	0.00	0.00
262297.689	67.97	4.00	0.00	0.00	0.00
262367.825	70.14	3.40	0.00	0.00	0.00
262413.823	46.00	4.30	0.00	0.00	0.00
262447.408	33.59	3.10	0.00	0.00	0.00
262477.828	30.42	2.40	0.00	0.00	0.00
262510.397	32.57	2.50	0.00	0.00	0.00
262557.762	47.37	2.80	0.00	0.00	0.00
262590.443	32.68	1.70	0.00	0.00	0.00
262616.108	25.66	1.70	0.00	0.00	0.00
262644.891	28.78	1.60	0.00	0.00	0.00
262671.255	26.36	1.60	0.00	0.00	0.00
262710.056	38.80	[illegible]	0.00	0.00	0.00
262756.974	46.92	1.40	0.00	0.00	0.00
262787.734	30.76	[illegible]	0.00	0.00	0.00
262826.126	38.39	[illegible]	0.10	2.55	48.95
262855.902	29.78	[illegible]	0.00	0.00	37.97
262885.392	29.49	1.70	0.00	0.00	0.00
262921.738	36.35	2.40	0.00	0.00	0.00
262952.868	31.13	2.70	0.00	0.00	0.00
262981.275	28.41	3.00	0.00	0.00	0.00
263017.015	35.74	3.10	0.00	0.00	0.00
263057.814	40.80	3.10	0.00	0.00	0.00
263085.320	27.51	3.00	0.00	0.00	0.00
263138.243	52.92	2.80	0.00	0.00	0.00
263171.671	33.43	2.80	0.00	0.00	0.00
263216.174	44.50	2.50	0.00	0.00	0.00
263256.641	40.47	1.90	0.00	0.00	0.00
263305.048	48.41	1.60	0.00	0.00	0.00
263344.920	39.87	[illegible]	0.00	0.00	0.00
263365.868	20.95	[illegible]	0.00	0.00	0.00
263440.163	74.29	1.70	0.00	0.00	0.00
263473.548	33.38	1.60	0.00	0.00	0.00
263518.535	44.99	1.80	0.00	0.00	0.00
263550.286	31.75	1.90	0.00	0.00	0.00
263573.551	23.26	2.00	0.00	0.00	0.00
263600.222	26.67	[illegible]	0.00	0.00	0.00
263661.715	61.49	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
263688.376	26.66	2.20	0.00	0.00	0.00
263730.115	41.74	2.10	0.00	0.00	0.00
263767.288	37.17	2.10	0.00	0.00	0.00
263838.087	70.80	2.10	0.00	0.00	0.00
263881.735	43.65	2.10	0.00	0.00	0.00
263927.853	46.12	2.20	0.00	0.00	0.00
263995.743	67.89	2.10	0.00	0.00	0.00
264032.470	36.73	2.30	0.00	0.00	0.00
264088.840	56.37	2.30	0.00	0.00	0.00
264134.698	45.86	2.20	0.00	0.00	0.00
264177.192	42.49	2.30	0.00	0.00	0.00
264241.422	64.23	1.60	0.00	0.00	0.00
264287.884	46.46	1.60	0.00	0.00	0.00
264341.946	54.06	2.00	0.00	0.00	0.00
264397.019	55.07	1.70	0.00	0.00	0.00
264456.414	59.40	2.20	0.00	0.00	0.00
264489.986	33.57	2.40	0.00	0.00	0.00
264556.495	66.51	1.90	0.00	0.00	0.00
264605.590	49.10	1.60	0.00	0.00	0.00
264645.686	40.10	1.50	0.00	0.00	0.00
264693.873	48.19	1.40	0.00	0.00	0.00
264720.266	26.39	[illegible]	0.00	0.00	0.00
264767.328	47.06	[illegible]	0.00	0.00	0.00
264827.211	59.88	[illegible]	0.10	2.55	76.36
264852.996	25.78	[illegible]	0.30	7.95	135.38
264888.121	35.12	[illegible]	0.30	7.95	279.25
264911.783	23.66	[illegible]	0.10	2.55	124.23
264930.502	18.72	1.60	0.00	0.00	23.87
264966.190	35.69	2.00	0.00	0.00	0.00
265001.652	35.46	2.50	0.00	0.00	0.00
265030.966	29.31	2.70	0.00	0.00	0.00
265068.285	37.32	2.80	0.00	0.00	0.00
265098.254	29.97	2.90	0.00	0.00	0.00
265150.500	52.25	2.60	0.00	0.00	0.00
265201.976	51.48	2.70	0.00	0.00	0.00
265240.096	38.12	1.90	0.00	0.00	0.00
265287.632	47.54	1.70	0.00	0.00	0.00
265331.384	43.75	2.10	0.00	0.00	0.00
265362.496	31.11	2.10	0.00	0.00	0.00
265393.910	31.41	2.30	0.00	0.00	0.00
265421.463	27.55	2.30	0.00	0.00	0.00
265469.038	47.58	2.30	0.00	0.00	0.00
265517.989	48.95	2.50	0.00	0.00	0.00
265553.683	35.69	2.20	0.00	0.00	0.00
265593.695	40.01	2.40	0.00	0.00	0.00
265630.652	36.96	2.10	0.00	0.00	0.00
265667.463	36.81	1.70	0.00	0.00	0.00
265702.688	35.23	1.70	0.00	0.00	0.00
265749.279	46.59	1.40	0.00	0.00	0.00
265781.332	32.05	1.40	0.00	0.00	0.00
265814.071	32.74	1.40	0.00	0.00	0.00
265869.239	55.17	1.80	0.00	0.00	0.00
265924.144	54.90	3.40	0.00	0.00	0.00
265986.546	62.40	2.70	0.00	0.00	0.00
266011.048	24.50	2.30	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
266045.207	34.16	1.80	0.00	0.00	0.00
266103.490	58.28	1.70	0.00	0.00	0.00
266128.823	25.33	1.50	0.00	0.00	0.00
266170.916	42.09	1.40	0.00	0.00	0.00
266194.122	23.21	1.90	0.00	0.00	0.00
266223.048	28.93	1.50	0.00	0.00	0.00
266247.919	24.87	1.40	0.00	0.00	0.00
266286.599	38.68	1.40	0.00	0.00	0.00
266346.702	60.10	1.40	0.00	0.00	0.00
266368.567	21.87	[illegible]	0.00	0.00	0.00
266401.593	33.03	1.60	0.00	0.00	0.00
266425.787	24.19	1.80	0.00	0.00	0.00
266471.195	45.41	1.90	0.00	0.00	0.00
266508.275	37.08	2.10	0.00	0.00	0.00
266546.171	37.90	2.00	0.00	0.00	0.00
266588.007	41.84	2.10	0.00	0.00	0.00
266649.595	61.59	2.10	0.00	0.00	0.00
266679.425	29.83	2.30	0.00	0.00	0.00
266723.824	44.40	2.00	0.00	0.00	0.00
266771.909	48.08	1.50	0.00	0.00	0.00
266806.087	34.18	1.40	0.00	0.00	0.00
266840.503	34.42	1.70	0.00	0.00	0.00
266906.934	66.43	[illegible]	0.00	0.00	0.00
266944.583	37.65	[illegible]	0.20	5.20	97.89
266995.290	50.71	[illegible]	0.10	2.55	196.50
267023.174	27.88	2.10	0.00	0.00	35.56
267051.442	28.27	1.70	0.00	0.00	0.00
267094.233	42.79	1.80	0.00	0.00	0.00
267124.058	29.83	3.70	0.00	0.00	0.00
267148.753	24.69	2.50	0.00	0.00	0.00
267185.132	36.38	[illegible]	0.00	0.00	0.00
267204.903	19.77	4.10	0.00	0.00	0.00
267230.376	25.47	3.40	0.00	0.00	0.00
267261.922	31.55	3.40	0.00	0.00	0.00
267296.144	34.22	2.30	0.00	0.00	0.00
267335.890	39.75	2.70	0.00	0.00	0.00
267380.796	44.91	1.90	0.00	0.00	0.00
267422.913	42.12	1.40	0.00	0.00	0.00
267462.436	39.52	[illegible]	0.90	26.55	524.68
267470.975	8.54	[illegible]	0.80	23.20	212.41
267482.785	11.81	[illegible]	0.90	26.55	293.77
267491.589	8.80	[illegible]	0.80	23.20	219.03
267501.021	9.43	[illegible]	0.70	19.95	203.48
267511.044	10.02	[illegible]	0.70	19.95	199.98
267523.246	12.20	[illegible]	0.70	19.95	243.44
267547.932	24.69	[illegible]	0.40	10.80	379.55
267567.584	19.65	[illegible]	0.30	7.95	184.24
267591.421	23.84	[illegible]	0.30	7.95	189.51
267603.722	12.30	[illegible]	0.20	5.20	80.89
267630.335	26.61	1.40	0.00	0.00	69.20
267646.866	16.53	[illegible]	0.00	0.00	0.00
267690.332	43.47	1.50	0.00	0.00	0.00
267727.591	37.26	1.40	0.00	0.00	0.00
267762.839	35.25	1.40	0.00	0.00	0.00
267796.033	33.19	1.50	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
267830.144	34.11	1.40	0.00	0.00	0.00
267857.583	27.44	[illegible]	0.00	0.00	0.00
267897.328	39.75	[illegible]	0.20	5.20	103.34
267937.360	40.03	[illegible]	0.50	13.75	379.31
267960.650	23.29	[illegible]	0.20	5.20	220.67
268003.234	42.58	[illegible]	0.30	7.95	280.00
268035.788	32.55	[illegible]	0.20	5.20	214.04
268100.416	64.63	1.90	0.00	0.00	168.04
268163.989	63.57	2.30	0.00	0.00	0.00
268196.159	32.17	1.80	0.00	0.00	0.00
268236.994	40.84	3.60	0.00	0.00	0.00
268344.541	107.55	3.90	0.00	0.00	0.00
268375.366	30.82	2.80	0.00	0.00	0.00
268416.434	41.07	2.70	0.00	0.00	0.00
268453.356	36.92	1.60	0.00	0.00	0.00
268482.444	29.09	2.10	0.00	0.00	0.00
268501.147	18.70	1.80	0.00	0.00	0.00
268534.860	33.71	1.70	0.00	0.00	0.00
268554.884	20.02	1.90	0.00	0.00	0.00
268608.622	53.74	2.30	0.00	0.00	0.00
268645.204	36.58	2.10	0.00	0.00	0.00
268678.938	33.73	1.40	0.00	0.00	0.00
268742.997	64.06	[illegible]	0.20	5.20	166.56
268779.006	36.01	[illegible]	0.30	7.95	236.76
268831.269	52.26	2.30	0.00	0.00	207.75
268868.561	37.29	2.30	0.00	0.00	0.00
268934.385	65.82	2.40	0.00	0.00	0.00
268989.015	54.63	2.90	0.00	0.00	0.00
269029.744	40.73	3.10	0.00	0.00	0.00
269116.708	86.96	5.50	0.00	0.00	0.00
269173.515	56.81	3.40	0.00	0.00	0.00
269195.538	22.02	3.00	0.00	0.00	0.00
269228.904	33.37	2.80	0.00	0.00	0.00
269294.689	65.78	2.80	0.00	0.00	0.00
269329.904	35.21	2.50	0.00	0.00	0.00
269362.625	32.72	2.50	0.00	0.00	0.00
269405.084	42.46	2.70	0.00	0.00	0.00
269445.664	40.58	3.10	0.00	0.00	0.00
269509.366	63.70	3.20	0.00	0.00	0.00
269556.419	47.05	2.80	0.00	0.00	0.00
269589.309	32.89	2.70	0.00	0.00	0.00
269625.628	36.32	2.50	0.00	0.00	0.00
269663.444	37.82	2.20	0.00	0.00	0.00
269703.547	40.10	2.20	0.00	0.00	0.00
269787.935	84.39	1.50	0.00	0.00	0.00
269816.143	28.21	[illegible]	0.00	0.00	0.00
269861.583	45.44	[illegible]	0.10	2.55	57.94
269896.561	34.98	[illegible]	0.30	7.95	183.64
269926.649	30.09	[illegible]	0.20	5.20	197.84
270028.459	101.81	[illegible]	0.10	2.55	394.52
270067.055	38.60	[illegible]	0.10	2.55	98.42
270110.102	43.05	[illegible]	0.30	7.95	226.01
270146.084	35.98	[illegible]	0.40	10.80	337.33
270181.239	35.15	[illegible]	0.30	7.95	329.58
270237.149	55.91	1.50	0.00	0.00	222.25

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
270262.350	25.20	2.00	0.00	0.00	0.00
270296.252	33.90	1.80	0.00	0.00	0.00
270329.988	33.74	1.60	0.00	0.00	0.00
270342.797	12.81	[illegible]	0.00	0.00	0.00
270382.509	39.71	[illegible]	0.50	13.75	273.03
270421.264	38.76	[illegible]	0.50	13.75	532.89
270437.792	16.53	[illegible]	0.30	7.95	179.33
270455.888	18.10	[illegible]	0.60	16.80	223.94
270500.870	44.98	1.40	0.00	0.00	377.86
270518.385	17.51	1.90	0.00	0.00	0.00
270547.062	28.68	1.80	0.00	0.00	0.00
270577.439	30.38	1.80	0.00	0.00	0.00
270605.597	28.16	2.10	0.00	0.00	0.00
270636.389	30.79	1.90	0.00	0.00	0.00
270665.103	28.71	2.00	0.00	0.00	0.00
270700.294	35.19	1.70	0.00	0.00	0.00
270750.655	50.36	2.00	0.00	0.00	0.00
270806.118	55.46	2.50	0.00	0.00	0.00
270841.008	34.89	2.30	0.00	0.00	0.00
270879.577	38.57	2.30	0.00	0.00	0.00
270911.420	31.84	2.50	0.00	0.00	0.00
270968.042	56.62	2.60	0.00	0.00	0.00
271011.479	43.44	2.60	0.00	0.00	0.00
271053.705	42.23	2.10	0.00	0.00	0.00
271094.530	40.82	2.80	0.00	0.00	0.00
271121.800	27.27	2.90	0.00	0.00	0.00
271151.179	29.38	2.20	0.00	0.00	0.00
271197.082	45.90	1.70	0.00	0.00	0.00
271232.740	35.66	3.70	0.00	0.00	0.00
271268.042	35.30	3.90	0.00	0.00	0.00
271301.626	33.58	3.60	0.00	0.00	0.00
271344.393	42.77	3.20	0.00	0.00	0.00
271397.149	52.76	3.30	0.00	0.00	0.00
271424.946	27.80	3.40	0.00	0.00	0.00
271451.816	26.87	3.30	0.00	0.00	0.00
271485.118	33.30	3.10	0.00	0.00	0.00
271520.167	35.05	1.90	0.00	0.00	0.00
271572.854	52.69	2.40	0.00	0.00	0.00
271598.226	25.37	2.30	0.00	0.00	0.00
271652.433	54.21	2.00	0.00	0.00	0.00
271677.183	24.75	2.00	0.00	0.00	0.00
271716.509	39.33	1.80	0.00	0.00	0.00
271778.330	61.82	1.60	0.00	0.00	0.00
271806.244	27.91	1.80	0.00	0.00	0.00
271824.872	18.63	1.80	0.00	0.00	0.00
271844.073	19.20	1.80	0.00	0.00	0.00
271882.838	38.77	1.90	0.00	0.00	0.00
271919.430	36.59	2.20	0.00	0.00	0.00
271960.522	41.09	2.30	0.00	0.00	0.00
271999.032	38.51	2.50	0.00	0.00	0.00
272041.555	42.52	2.30	0.00	0.00	0.00
272088.285	46.73	2.20	0.00	0.00	0.00
272135.369	47.08	2.40	0.00	0.00	0.00
272189.622	54.25	[illegible]	1.00	30.00	813.79
272500.000	310.38	1.60	0.00	0.00	4655.68

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
272750.000	250.00	2.20	0.00	0.00	0.00
273000.000	250.00	2.00	0.00	0.00	0.00
273250.000	250.00	2.00	0.00	0.00	0.00
273500.000	250.00	1.60	0.00	0.00	0.00
273750.000	250.00	2.10	0.00	0.00	0.00
274000.000	250.00	2.20	0.00	0.00	0.00
274217.000	217.00	[redacted]	0.00	0.00	0.00
274249.456	32.46	1.80	0.00	0.00	0.00
274287.819	38.36	[redacted]	0.80	23.20	445.02
274326.260	38.44	1.50	0.00	0.00	445.92
274386.607	60.35	1.60	0.00	0.00	0.00
274428.921	42.31	[redacted]	0.00	0.00	0.00
274465.137	36.22	1.60	0.00	0.00	0.00
274497.102	31.97	[redacted]	0.00	0.00	0.00
274532.477	35.38	1.80	0.00	0.00	0.00
274564.114	31.64	2.00	0.00	0.00	0.00
274643.605	79.49	2.40	0.00	0.00	0.00
274687.766	44.16	2.20	0.00	0.00	0.00
274719.867	32.10	2.30	0.00	0.00	0.00
274776.597	56.73	2.40	0.00	0.00	0.00
274812.303	35.71	2.20	0.00	0.00	0.00
274856.409	44.11	1.70	0.00	0.00	0.00
274908.248	51.84	1.40	0.00	0.00	0.00
274994.147	85.90	1.60	0.00	0.00	0.00
275049.768	55.62	2.70	0.00	0.00	0.00
275072.223	22.45	2.20	0.00	0.00	0.00
275094.144	21.92	2.40	0.00	0.00	0.00
275125.307	31.16	2.70	0.00	0.00	0.00
275151.457	26.15	2.70	0.00	0.00	0.00
275190.666	39.21	2.20	0.00	0.00	0.00
275228.943	38.28	2.00	0.00	0.00	0.00
275268.745	39.80	2.10	0.00	0.00	0.00
275317.925	49.18	1.90	0.00	0.00	0.00
275363.139	45.21	2.10	0.00	0.00	0.00
275415.755	52.62	2.00	0.00	0.00	0.00
275463.249	47.49	3.50	0.00	0.00	0.00
275542.716	79.47	3.20	0.00	0.00	0.00
275604.170	61.45	3.60	0.00	0.00	0.00
275647.945	43.77	3.80	0.00	0.00	0.00
275729.798	81.85	3.00	0.00	0.00	0.00
275771.981	42.18	3.50	0.00	0.00	0.00
275815.929	43.95	2.50	0.00	0.00	0.00
275857.058	41.13	2.90	0.00	0.00	0.00
275903.255	46.20	8.10	0.00	0.00	0.00
275934.389	31.13	6.30	0.00	0.00	0.00
276003.635	69.25	4.90	0.00	0.00	0.00
276208.789	205.15	4.60	0.00	0.00	0.00
276277.953	69.16	3.60	0.00	0.00	0.00
276299.123	21.17	3.30	0.00	0.00	0.00
276315.383	16.26	3.60	0.00	0.00	0.00
276343.578	28.19	2.70	0.00	0.00	0.00
276375.062	31.48	2.70	0.00	0.00	0.00
276414.465	39.40	2.80	0.00	0.00	0.00
276449.623	35.16	2.60	0.00	0.00	0.00
276503.024	53.40	2.80	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
276555.885	52.86	2.40	0.00	0.00	0.00
276593.000	37.12	2.30	0.00	0.00	0.00
276621.118	28.12	2.30	0.00	0.00	0.00
276647.341	26.22	2.20	0.00	0.00	0.00
276682.562	35.22	2.30	0.00	0.00	0.00
276738.151	55.59	2.20	0.00	0.00	0.00
276771.216	33.07	2.20	0.00	0.00	0.00
276803.086	31.87	2.40	0.00	0.00	0.00
276832.420	29.33	2.30	0.00	0.00	0.00
276868.291	35.87	2.00	0.00	0.00	0.00
276903.048	34.76	1.80	0.00	0.00	0.00
276926.188	23.14	1.80	0.00	0.00	0.00
276958.949	32.76	2.10	0.00	0.00	0.00
276987.502	28.55	2.50	0.00	0.00	0.00
277034.631	47.13	2.30	0.00	0.00	0.00
277126.276	91.64	2.20	0.00	0.00	0.00
277163.850	37.57	2.40	0.00	0.00	0.00
277203.075	39.22	2.60	0.00	0.00	0.00
277301.600	98.52	3.20	0.00	0.00	0.00
277350.388	48.79	3.20	0.00	0.00	0.00
277390.917	40.53	2.10	0.00	0.00	0.00
277443.840	52.92	2.80	0.00	0.00	0.00
277487.205	43.37	2.80	0.00	0.00	0.00
277543.739	56.53	3.20	0.00	0.00	0.00
277592.339	48.60	3.30	0.00	0.00	0.00
277684.460	92.12	3.40	0.00	0.00	0.00
277725.731	41.27	3.40	0.00	0.00	0.00
277767.359	41.63	3.40	0.00	0.00	0.00
277802.411	35.05	3.30	0.00	0.00	0.00
277853.730	51.32	3.50	0.00	0.00	0.00
277885.950	32.22	2.90	0.00	0.00	0.00
277938.957	53.01	3.50	0.00	0.00	0.00
277974.955	36.00	3.00	0.00	0.00	0.00
278052.224	77.27	3.00	0.00	0.00	0.00
278096.749	44.52	3.40	0.00	0.00	0.00
278164.316	67.57	2.40	0.00	0.00	0.00
278203.155	38.84	2.30	0.00	0.00	0.00
278240.922	37.77	2.10	0.00	0.00	0.00
278282.468	41.55	1.80	0.00	0.00	0.00
278327.884	45.42	2.10	0.00	0.00	0.00
278349.371	21.49	2.00	0.00	0.00	0.00
278382.103	32.73	2.30	0.00	0.00	0.00
278412.395	30.29	2.30	0.00	0.00	0.00
278453.287	40.89	2.30	0.00	0.00	0.00
278531.867	78.58	2.60	0.00	0.00	0.00
278580.382	48.52	2.60	0.00	0.00	0.00
278663.818	83.44	1.80	0.00	0.00	0.00
278729.139	65.32	2.60	0.00	0.00	0.00
278754.880	25.74	2.30	0.00	0.00	0.00
278794.545	39.66	1.90	0.00	0.00	0.00
278840.347	45.80	1.40	0.00	0.00	0.00
278870.485	30.14	2.20	0.00	0.00	0.00
278905.562	35.08	2.30	0.00	0.00	0.00
278935.217	29.66	2.20	0.00	0.00	0.00
279002.552	67.33	1.90	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
279036.168	33.62	1.90	0.00	0.00	0.00
279085.663	49.49	1.80	0.00	0.00	0.00
279159.569	73.91	1.80	0.00	0.00	0.00
279196.977	37.41	1.90	0.00	0.00	0.00
279289.851	92.87	1.90	0.00	0.00	0.00
279344.595	54.74	1.90	0.00	0.00	0.00
279379.113	34.52	1.80	0.00	0.00	0.00
279430.234	51.12	1.80	0.00	0.00	0.00
279469.559	39.33	1.70	0.00	0.00	0.00
279498.033	28.47	1.80	0.00	0.00	0.00
279548.381	50.35	1.70	0.00	0.00	0.00
279592.735	44.35	1.80	0.00	0.00	0.00
279634.599	41.86	2.50	0.00	0.00	0.00
279673.332	38.73	2.70	0.00	0.00	0.00
279722.885	49.55	3.00	0.00	0.00	0.00
279767.205	44.32	2.60	0.00	0.00	0.00
279812.057	44.85	2.70	0.00	0.00	0.00
279863.823	51.77	2.10	0.00	0.00	0.00
279912.062	48.24	1.90	0.00	0.00	0.00
279977.459	65.40	1.40	0.00	0.00	0.00
280031.153	53.69	[illegible]	0.00	0.00	0.00
280045.693	14.54	1.40	0.00	0.00	0.00
280092.268	46.57	[illegible]	0.00	0.00	0.00
280115.605	23.34	1.80	0.00	0.00	0.00
280147.961	32.36	2.30	0.00	0.00	0.00
280179.715	31.75	2.40	0.00	0.00	0.00
280229.442	49.73	2.10	0.00	0.00	0.00
280336.153	106.71	1.50	0.00	0.00	0.00
280388.734	52.58	1.50	0.00	0.00	0.00
280421.916	33.18	1.40	0.00	0.00	0.00
280454.729	32.81	1.70	0.00	0.00	0.00
280488.427	33.70	1.70	0.00	0.00	0.00
280529.947	41.52	1.70	0.00	0.00	0.00
280572.230	42.28	1.90	0.00	0.00	0.00
280612.039	39.81	2.80	0.00	0.00	0.00
280656.795	44.76	1.80	0.00	0.00	0.00
280685.574	28.78	1.50	0.00	0.00	0.00
280707.627	22.05	[illegible]	0.00	0.00	0.00
280730.668	23.04	[illegible]	0.00	0.00	0.00
280759.814	29.15	[illegible]	0.00	0.00	0.00
280780.459	20.64	[illegible]	0.20	5.20	53.68
280807.434	26.98	1.80	0.00	0.00	70.14
280862.563	55.13	2.30	0.00	0.00	0.00
280918.691	56.13	2.30	0.00	0.00	0.00
280962.244	43.55	2.70	0.00	0.00	0.00
281000.523	38.28	2.80	0.00	0.00	0.00
281061.842	61.32	2.80	0.00	0.00	0.00
281099.297	37.45	2.80	0.00	0.00	0.00
281150.383	51.09	2.60	0.00	0.00	0.00
281178.533	28.15	2.50	0.00	0.00	0.00
281213.458	34.92	2.20	0.00	0.00	0.00
281255.127	41.67	2.10	0.00	0.00	0.00
281293.174	38.05	2.20	0.00	0.00	0.00
281345.842	52.67	2.10	0.00	0.00	0.00
281386.330	40.49	2.20	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
281435.792	49.46	2.60	0.00	0.00	0.00
281467.064	31.27	2.80	0.00	0.00	0.00
281603.596	136.53	3.40	0.00	0.00	0.00
281661.031	57.44	3.40	0.00	0.00	0.00
281720.284	59.25	2.80	0.00	0.00	0.00
281763.349	43.06	2.60	0.00	0.00	0.00
281799.322	35.97	2.30	0.00	0.00	0.00
281838.269	38.95	2.00	0.00	0.00	0.00
281888.807	50.54	2.50	0.00	0.00	0.00
281933.495	44.69	2.20	0.00	0.00	0.00
281965.387	31.89	2.40	0.00	0.00	0.00
282011.365	45.98	2.30	0.00	0.00	0.00
282053.961	42.60	2.50	0.00	0.00	0.00
282088.421	34.46	2.20	0.00	0.00	0.00
282126.326	37.90	1.90	0.00	0.00	0.00
282157.586	31.26	1.80	0.00	0.00	0.00
282200.361	42.77	1.70	0.00	0.00	0.00
282257.874	57.51	[illegible]	0.00	0.00	0.00
282351.781	93.91	[illegible]	0.50	13.75	645.61
282391.459	39.68	[illegible]	0.70	19.95	668.58
282480.554	89.09	[illegible]	0.40	10.80	1369.84
282488.609	8.06	[illegible]	0.00	0.00	43.51
282510.934	22.32	2.00	0.00	0.00	0.00
282568.033	57.10	3.00	0.00	0.00	0.00
282655.008	86.97	3.10	0.00	0.00	0.00
282696.265	41.26	2.70	0.00	0.00	0.00
282742.976	46.71	2.80	0.00	0.00	0.00
282770.377	27.40	2.40	0.00	0.00	0.00
282791.099	20.72	2.30	0.00	0.00	0.00
282817.648	26.55	1.70	0.00	0.00	0.00
282846.916	29.27	[illegible]	0.00	0.00	0.00
282944.451	97.53	2.30	0.00	0.00	0.00
282978.845	34.39	2.10	0.00	0.00	0.00
283013.233	34.39	1.90	0.00	0.00	0.00
283068.035	54.80	1.70	0.00	0.00	0.00
283113.426	45.39	1.90	0.00	0.00	0.00
283160.474	47.05	2.00	0.00	0.00	0.00
283225.673	65.20	2.10	0.00	0.00	0.00
283283.737	58.06	2.20	0.00	0.00	0.00
283313.798	30.06	2.30	0.00	0.00	0.00
283427.419	113.62	2.10	0.00	0.00	0.00
283460.400	32.98	2.00	0.00	0.00	0.00
283507.836	47.44	2.60	0.00	0.00	0.00
283537.798	29.96	3.40	0.00	0.00	0.00
283604.134	66.34	3.40	0.00	0.00	0.00
283630.875	26.74	2.60	0.00	0.00	0.00
283677.776	46.90	2.50	0.00	0.00	0.00
283723.569	45.79	2.70	0.00	0.00	0.00
283767.187	43.62	2.80	0.00	0.00	0.00
283823.592	56.41	3.40	0.00	0.00	0.00
283873.785	50.19	3.20	0.00	0.00	0.00
283912.305	38.52	2.70	0.00	0.00	0.00
283947.387	35.08	2.00	0.00	0.00	0.00
283987.580	40.19	2.00	0.00	0.00	0.00
284132.494	144.91	3.10	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
284193.588	61.09	2.80	0.00	0.00	0.00
284252.628	59.04	2.50	0.00	0.00	0.00
284296.450	43.82	2.30	0.00	0.00	0.00
284341.984	45.53	2.20	0.00	0.00	0.00
284390.466	48.48	2.00	0.00	0.00	0.00
284423.803	33.34	1.90	0.00	0.00	0.00
284465.249	41.45	1.80	0.00	0.00	0.00
284526.259	61.01	2.20	0.00	0.00	0.00
284581.446	55.19	2.30	0.00	0.00	0.00
284597.276	15.83	2.70	0.00	0.00	0.00
284605.996	8.72	2.50	0.00	0.00	0.00
284655.012	49.02	2.50	0.00	0.00	0.00
284660.000	4.99	[illegible]	1.50	48.75	121.59
284717.348	57.35	2.80	0.00	0.00	1397.85
284836.033	118.69	2.80	0.00	0.00	0.00
284912.586	76.55	2.70	0.00	0.00	0.00
284938.270	25.68	2.70	0.00	0.00	0.00
285018.447	80.18	2.70	0.00	0.00	0.00
285091.959	73.51	2.90	0.00	0.00	0.00
285294.128	202.17	2.70	0.00	0.00	0.00
285447.846	153.72	2.80	0.00	0.00	0.00
285511.501	63.65	2.70	0.00	0.00	0.00
285581.481	69.98	2.70	0.00	0.00	0.00
285651.398	69.92	2.40	0.00	0.00	0.00
285709.480	58.08	2.70	0.00	0.00	0.00
285783.143	73.66	2.30	0.00	0.00	0.00
285835.255	52.11	2.50	0.00	0.00	0.00
285896.102	60.85	2.20	0.00	0.00	0.00
285937.063	40.96	2.00	0.00	0.00	0.00
285981.595	44.53	1.90	0.00	0.00	0.00
286019.263	37.67	1.90	0.00	0.00	0.00
286112.859	93.60	1.40	0.00	0.00	0.00
286172.891	60.03	[illegible]	0.00	0.00	0.00
286237.037	64.15	[illegible]	0.00	0.00	0.00
286272.272	35.23	1.40	0.00	0.00	0.00
286312.740	40.47	[illegible]	0.10	2.55	51.60
286338.785	26.05	[illegible]	0.30	7.95	136.74
286370.859	32.07	1.50	0.00	0.00	127.50
286414.967	44.11	3.20	0.00	0.00	0.00
286484.053	69.09	3.30	0.00	0.00	0.00
286528.931	44.88	3.00	0.00	0.00	0.00
286591.253	62.32	1.80	0.00	0.00	0.00
286609.196	17.94	[illegible]	0.00	0.00	0.00
286628.666	19.47	[illegible]	0.00	0.00	0.00
286662.011	33.35	[illegible]	0.50	13.75	229.26
286688.887	26.88	1.50	0.00	0.00	184.78
286742.055	53.17	1.40	0.00	0.00	0.00
286771.986	29.93	1.40	0.00	0.00	0.00
286811.788	39.80	[illegible]	0.20	5.20	103.49
286861.409	49.62	[illegible]	0.60	16.80	545.83
286897.352	35.94	[illegible]	0.50	13.75	549.04
286930.601	33.25	[illegible]	0.20	5.20	315.04
286980.809	50.21	1.60	0.00	0.00	130.55
287010.133	29.32	1.80	0.00	0.00	0.00
287043.230	33.10	1.60	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
287082.504	39.27	1.50	0.00	0.00	0.00
287114.936	32.43	1.40	0.00	0.00	0.00
287137.885	22.95	1.40	0.00	0.00	0.00
287172.682	34.80	1.70	0.00	0.00	0.00
287211.178	38.50	1.90	0.00	0.00	0.00
287319.442	108.26	2.20	0.00	0.00	0.00
287360.191	40.75	2.30	0.00	0.00	0.00
287395.885	35.69	2.30	0.00	0.00	0.00
287435.102	39.22	2.30	0.00	0.00	0.00
287469.159	34.06	2.30	0.00	0.00	0.00
287502.981	33.82	2.10	0.00	0.00	0.00
287542.610	39.63	1.90	0.00	0.00	0.00
287566.759	24.15	1.80	0.00	0.00	0.00
287606.410	39.65	1.40	0.00	0.00	0.00
287657.375	50.97	1.20	0.00	0.00	0.00
287690.830	33.45	1.30	0.00	0.00	0.00
287739.720	48.89	1.40	0.00	0.00	0.00
287774.110	34.39	1.60	0.00	0.00	0.00
287900.237	126.13	6.40	0.00	0.00	0.00
287936.832	36.59	5.80	0.00	0.00	0.00
287976.404	39.57	5.90	0.00	0.00	0.00
288009.261	32.86	6.60	0.00	0.00	0.00
288071.002	61.74	5.80	0.00	0.00	0.00
288132.953	61.95	4.50	0.00	0.00	0.00
288180.340	47.39	4.90	0.00	0.00	0.00
288205.598	25.26	4.90	0.00	0.00	0.00
288243.309	37.71	3.30	0.00	0.00	0.00
288310.964	67.65	2.30	0.00	0.00	0.00
288338.381	27.42	2.00	0.00	0.00	0.00
288376.862	38.48	1.60	0.00	0.00	0.00
288422.148	45.29	1.60	0.00	0.00	0.00
288464.415	42.27	1.50	0.00	0.00	0.00
288506.047	41.63	1.50	0.00	0.00	0.00
288546.581	40.53	1.90	0.00	0.00	0.00
288582.886	36.30	3.30	0.00	0.00	0.00
288640.978	58.09	4.70	0.00	0.00	0.00
288696.979	56.00	3.90	0.00	0.00	0.00
288767.099	70.12	1.20	0.00	0.00	0.00
288770.437	3.34	1.50	0.00	0.00	0.00
288825.891	55.45	3.40	0.00	0.00	0.00
288898.410	72.52	2.60	0.00	0.00	0.00
288995.685	97.28	3.30	0.00	0.00	0.00
289035.919	40.23	2.80	0.00	0.00	0.00
289101.255	65.34	2.80	0.00	0.00	0.00
289140.340	39.08	2.30	0.00	0.00	0.00
289165.140	24.80	2.60	0.00	0.00	0.00
289183.933	18.79	2.60	0.00	0.00	0.00
289240.946	57.01	2.40	0.00	0.00	0.00
289326.407	85.46	2.10	0.00	0.00	0.00
289358.128	31.72	2.10	0.00	0.00	0.00
289410.891	52.76	1.70	0.00	0.00	0.00
289451.969	41.08	1.60	0.00	0.00	0.00
289492.185	40.22	1.40	0.00	0.00	0.00
289507.415	15.23	1.30	0.00	0.00	0.00
289539.749	32.33	1.30	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
289595.011	55.26	2.50	0.00	0.00	0.00
289638.478	43.47	2.50	0.00	0.00	0.00
289683.040	44.56	2.80	0.00	0.00	0.00
289740.814	57.77	2.50	0.00	0.00	0.00
289784.788	43.97	2.70	0.00	0.00	0.00
289858.972	74.18	2.40	0.00	0.00	0.00
289881.362	22.39	2.60	0.00	0.00	0.00
289927.135	45.77	2.50	0.00	0.00	0.00
289991.825	64.69	2.00	0.00	0.00	0.00
290054.457	62.63	2.60	0.00	0.00	0.00
290094.530	40.07	2.60	0.00	0.00	0.00
290140.370	45.84	2.40	0.00	0.00	0.00
290172.765	32.40	2.30	0.00	0.00	0.00
290205.630	32.87	2.50	0.00	0.00	0.00
290244.226	38.60	2.70	0.00	0.00	0.00
290294.950	50.72	2.30	0.00	0.00	0.00
290344.381	49.43	2.20	0.00	0.00	0.00
290406.122	61.74	3.20	0.00	0.00	0.00
290454.133	48.01	2.90	0.00	0.00	0.00
290489.034	34.90	1.40	0.00	0.00	0.00
290528.831	39.80	1.50	0.00	0.00	0.00
290584.711	55.88	1.70	0.00	0.00	0.00
290634.005	49.29	[redacted]	0.00	0.00	0.00
290658.492	24.49	[redacted]	0.30	7.95	97.34
290683.494	25.00	[redacted]	0.30	7.95	198.77
290701.274	17.78	[redacted]	0.00	0.00	70.68
290748.967	47.69	[redacted]	0.00	0.00	0.00
290775.617	26.65	[redacted]	0.50	13.75	183.23
290794.266	18.65	[redacted]	0.60	16.80	284.87
290835.976	41.71	[redacted]	0.40	10.80	575.61
290849.068	13.09	[redacted]	0.90	26.55	244.49
290855.024	5.96	[redacted]	0.80	23.20	148.17
290871.501	16.48	[redacted]	0.60	16.80	329.53
290885.301	13.80	[redacted]	0.00	0.00	115.93
290915.815	30.51	[redacted]	0.00	0.00	0.00
290948.703	32.89	[redacted]	0.30	7.95	130.74
290971.526	22.82	[redacted]	0.50	13.75	247.63
290995.936	24.41	[redacted]	0.60	16.80	372.87
291025.683	29.75	[redacted]	0.40	10.80	410.51
291045.776	20.09	[redacted]	0.10	2.55	134.13
291067.687	21.91	1.70	0.00	0.00	27.94
291094.382	26.69	2.00	0.00	0.00	0.00
291118.740	24.36	2.20	0.00	0.00	0.00
291139.017	20.28	2.30	0.00	0.00	0.00
291172.808	33.79	2.50	0.00	0.00	0.00
291220.010	47.20	2.40	0.00	0.00	0.00
291270.953	50.94	2.30	0.00	0.00	0.00
291308.831	37.88	2.20	0.00	0.00	0.00
291344.119	35.29	2.00	0.00	0.00	0.00
291379.675	35.56	2.20	0.00	0.00	0.00
291442.264	62.59	1.90	0.00	0.00	0.00
291485.938	43.67	1.80	0.00	0.00	0.00
291520.302	34.36	1.80	0.00	0.00	0.00
291551.690	31.39	1.50	0.00	0.00	0.00
291587.019	35.33	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
291630.910	43.89	[illegible]	0.00	0.00	0.00
291664.230	33.32	[illegible]	0.00	0.00	0.00
291702.022	37.79	[illegible]	0.00	0.00	0.00
291729.697	27.68	1.90	0.00	0.00	0.00
291769.936	40.24	3.40	0.00	0.00	0.00
291797.129	27.19	4.30	0.00	0.00	0.00
291833.049	35.92	6.00	0.00	0.00	0.00
291875.937	42.89	4.20	0.00	0.00	0.00
291892.385	16.45	4.80	0.00	0.00	0.00
291902.395	10.01	3.80	0.00	0.00	0.00
291987.305	84.91	4.70	0.00	0.00	0.00
292093.042	105.74	4.70	0.00	0.00	0.00
292130.569	37.53	2.80	0.00	0.00	0.00
292167.796	37.23	3.10	0.00	0.00	0.00
292206.540	38.74	2.70	0.00	0.00	0.00
292235.654	29.11	2.40	0.00	0.00	0.00
292261.445	25.79	1.90	0.00	0.00	0.00
292318.591	57.15	1.70	0.00	0.00	0.00
292364.904	46.31	1.50	0.00	0.00	0.00
292414.910	50.01	1.60	0.00	0.00	0.00
292476.396	61.49	2.00	0.00	0.00	0.00
292507.240	30.84	[illegible]	0.10	2.55	39.33
292550.644	43.40	2.10	0.00	0.00	55.34
292627.866	77.22	1.80	0.00	0.00	0.00
292659.527	31.66	1.80	0.00	0.00	0.00
292690.987	31.46	2.70	0.00	0.00	0.00
292707.934	16.95	1.50	0.00	0.00	0.00
292741.855	33.92	3.60	0.00	0.00	0.00
292755.670	13.81	3.70	0.00	0.00	0.00
292768.191	12.52	3.00	0.00	0.00	0.00
292798.550	30.36	3.20	0.00	0.00	0.00
292834.981	36.43	3.90	0.00	0.00	0.00
292861.373	26.39	5.30	0.00	0.00	0.00
292897.898	36.53	4.30	0.00	0.00	0.00
292937.124	39.23	4.20	0.00	0.00	0.00
292976.636	39.51	4.30	0.00	0.00	0.00
293141.775	165.14	4.50	0.00	0.00	0.00
293205.316	63.54	4.30	0.00	0.00	0.00
293248.919	43.60	5.10	0.00	0.00	0.00
293291.438	42.52	3.70	0.00	0.00	0.00
293311.467	20.03	3.30	0.00	0.00	0.00
293352.637	41.17	2.50	0.00	0.00	0.00
293374.298	21.66	2.10	0.00	0.00	0.00
293418.816	44.52	1.80	0.00	0.00	0.00
293450.567	31.75	1.70	0.00	0.00	0.00
293481.886	31.32	1.50	0.00	0.00	0.00
293515.972	34.09	1.80	0.00	0.00	0.00
293559.121	43.15	2.10	0.00	0.00	0.00
293594.093	34.97	2.50	0.00	0.00	0.00
293629.553	35.46	2.40	0.00	0.00	0.00
293661.312	31.76	1.80	0.00	0.00	0.00
293693.654	32.34	3.30	0.00	0.00	0.00
293726.781	33.13	3.00	0.00	0.00	0.00
293751.938	25.16	1.80	0.00	0.00	0.00
293793.453	41.51	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
293819.411	25.96	[illegible]	0.00	0.00	0.00
293852.149	32.74	[illegible]	0.60	16.80	275.00
293876.453	24.30	[illegible]	0.40	10.80	335.41
293892.651	16.20	[illegible]	0.50	13.75	198.83
293914.452	21.80	[illegible]	0.30	7.95	236.55
293938.775	24.32	[illegible]	0.60	16.80	301.00
293989.843	51.07	2.10	0.00	0.00	428.97
294017.715	27.87	2.20	0.00	0.00	0.00
294051.399	33.68	2.10	0.00	0.00	0.00
294080.180	28.78	2.40	0.00	0.00	0.00
294133.367	53.19	2.60	0.00	0.00	0.00
294176.995	43.63	2.30	0.00	0.00	0.00
294208.397	31.40	3.50	0.00	0.00	0.00
294249.551	41.15	8.30	0.00	0.00	0.00
294358.205	108.65	2.30	0.00	0.00	0.00
294406.815	48.61	1.70	0.00	0.00	0.00
294471.098	64.28	[illegible]	0.10	2.55	81.97
294510.849	39.75	[illegible]	0.00	0.00	50.69
294545.736	34.89	1.50	0.00	0.00	0.00
294566.628	20.89	1.80	0.00	0.00	0.00
294594.089	27.46	1.40	0.00	0.00	0.00
294639.219	45.13	1.60	0.00	0.00	0.00
294676.549	37.33	1.70	0.00	0.00	0.00
294702.613	26.06	1.60	0.00	0.00	0.00
294726.032	23.42	1.70	0.00	0.00	0.00
294764.607	38.58	1.50	0.00	0.00	0.00
294796.725	32.12	1.60	0.00	0.00	0.00
294839.405	42.68	2.20	0.00	0.00	0.00
294872.125	32.72	2.30	0.00	0.00	0.00
294901.634	29.51	2.10	0.00	0.00	0.00
294931.256	29.62	2.10	0.00	0.00	0.00
294966.879	35.62	1.80	0.00	0.00	0.00
295034.643	67.76	[illegible]	0.10	2.55	86.40
295056.749	22.11	[illegible]	0.20	5.20	85.66
295103.635	46.89	[illegible]	0.20	5.20	243.81
295137.590	33.95	[illegible]	0.10	2.55	131.58
295178.755	41.17	[illegible]	0.10	2.55	104.98
295205.123	26.37	1.60	0.00	0.00	33.62
295228.694	23.57	1.60	0.00	0.00	0.00
295272.793	44.10	1.40	0.00	0.00	0.00
295297.760	24.97	1.50	0.00	0.00	0.00
295322.625	24.87	1.50	0.00	0.00	0.00
295379.875	57.25	1.40	0.00	0.00	0.00
295420.605	40.73	1.50	0.00	0.00	0.00
295451.756	31.15	1.60	0.00	0.00	0.00
295483.657	31.90	1.60	0.00	0.00	0.00
295506.361	22.70	1.50	0.00	0.00	0.00
295540.037	33.68	[illegible]	0.00	0.00	0.00
295579.577	39.54	[illegible]	0.10	2.55	50.42
295607.888	28.31	[illegible]	0.20	5.20	109.71
295624.964	17.08	[illegible]	0.30	7.95	112.28
295656.444	31.48	[illegible]	0.30	7.95	250.28
295692.961	36.52	[illegible]	0.10	2.55	191.72
295729.982	37.02	[illegible]	0.40	10.80	247.12
295763.263	33.28	[illegible]	0.50	13.75	408.53

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
295786.107	22.84	[illegible]	0.40	10.80	280.41
295803.151	17.04	[illegible]	0.40	10.80	184.08
295852.237	49.09	[illegible]	0.30	7.95	460.18
295886.483	34.25	[illegible]	0.30	7.95	272.26
295929.436	42.95	[illegible]	0.20	5.20	282.42
296000.035	70.60	4.00	0.00	0.00	183.56
296046.648	46.61	3.40	0.00	0.00	0.00
296066.262	19.61	3.70	0.00	0.00	0.00
296108.438	42.18	3.40	0.00	0.00	0.00
296153.744	45.31	3.50	0.00	0.00	0.00
296197.277	43.53	3.50	0.00	0.00	0.00
296253.621	56.34	3.90	0.00	0.00	0.00
296293.258	39.64	3.40	0.00	0.00	0.00
296336.692	43.43	3.40	0.00	0.00	0.00
296363.289	26.60	3.20	0.00	0.00	0.00
296416.948	53.66	3.00	0.00	0.00	0.00
296467.798	50.85	2.60	0.00	0.00	0.00
296519.056	51.26	2.40	0.00	0.00	0.00
296552.573	33.52	2.30	0.00	0.00	0.00
296598.788	46.21	2.20	0.00	0.00	0.00
296640.021	41.23	1.90	0.00	0.00	0.00
296681.643	41.62	1.90	0.00	0.00	0.00
296734.125	52.48	1.90	0.00	0.00	0.00
296761.113	26.99	1.90	0.00	0.00	0.00
296818.386	57.27	2.40	0.00	0.00	0.00
296866.408	48.02	2.80	0.00	0.00	0.00
296900.092	33.68	2.50	0.00	0.00	0.00
296936.653	36.56	2.40	0.00	0.00	0.00
296970.012	33.36	2.20	0.00	0.00	0.00
297006.500	36.49	2.10	0.00	0.00	0.00
297053.821	47.32	2.60	0.00	0.00	0.00
297098.426	44.60	3.90	0.00	0.00	0.00
297264.944	166.52	3.60	0.00	0.00	0.00
297356.182	91.24	3.80	0.00	0.00	0.00
297402.529	46.35	2.90	0.00	0.00	0.00
297432.369	29.84	2.70	0.00	0.00	0.00
297471.824	39.45	1.90	0.00	0.00	0.00
297495.913	24.09	1.80	0.00	0.00	0.00
297541.787	45.87	1.40	0.00	0.00	0.00
297589.174	47.39	[illegible]	0.00	0.00	0.00
297630.727	41.55	1.50	0.00	0.00	0.00
297679.776	49.05	1.90	0.00	0.00	0.00
297718.063	38.29	2.00	0.00	0.00	0.00
297747.482	29.42	1.80	0.00	0.00	0.00
297806.096	58.61	2.10	0.00	0.00	0.00
297861.417	55.32	1.50	0.00	0.00	0.00
297903.490	42.07	1.50	0.00	0.00	0.00
297926.220	22.73	[illegible]	0.00	0.00	0.00
297955.918	29.70	[illegible]	0.00	0.00	0.00
297994.879	38.96	[illegible]	0.20	5.20	101.30
298070.843	75.96	[illegible]	0.00	0.00	197.51
298111.782	40.94	1.70	0.00	0.00	0.00
298154.454	42.67	1.80	0.00	0.00	0.00
298205.638	51.18	1.70	0.00	0.00	0.00
298277.769	72.13	[illegible]	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
298327.673	49.90	[illegible]	0.70	19.95	497.80
298407.286	79.61	[illegible]	0.90	26.55	1851.02
298436.649	29.36	[illegible]	0.80	23.20	730.42
298472.755	36.11	[illegible]	0.70	19.95	778.99
298500.170	27.41	[illegible]	0.70	19.95	546.92
298546.253	46.08	[illegible]	0.90	26.55	1071.44
298562.470	16.22	[illegible]	0.80	23.20	403.42
298593.040	30.57	[illegible]	0.90	26.55	760.43
298595.531	2.49	[illegible]	0.80	23.20	61.97
298635.518	39.99	2.30	0.00	0.00	463.85
298738.379	102.86	2.50	0.00	0.00	0.00
298841.519	103.14	2.50	0.00	0.00	0.00
298902.602	61.08	2.30	0.00	0.00	0.00
298943.362	40.76	2.00	0.00	0.00	0.00
298982.182	38.82	2.00	0.00	0.00	0.00
299023.732	41.55	1.80	0.00	0.00	0.00
299056.402	32.67	1.50	0.00	0.00	0.00
299102.150	45.75	[illegible]	0.00	0.00	0.00
299131.979	29.83	1.40	0.00	0.00	0.00
299177.922	45.94	1.40	0.00	0.00	0.00
299197.303	19.38	[illegible]	0.10	2.55	24.72
299235.003	37.70	[illegible]	0.40	10.80	251.65
299278.783	43.78	[illegible]	0.60	16.80	604.17
299313.591	34.81	[illegible]	0.90	26.55	754.46
299340.148	26.56	[illegible]	0.70	19.95	617.45
299351.934	11.79	[illegible]	0.10	2.55	132.60
299373.423	21.49	1.50	0.00	0.00	27.40
299430.119	56.70	1.90	0.00	0.00	0.00
299468.699	38.58	2.40	0.00	0.00	0.00
299527.170	58.47	3.20	0.00	0.00	0.00
299679.637	152.47	2.60	0.00	0.00	0.00
299737.562	57.92	2.20	0.00	0.00	0.00
299776.132	38.57	2.00	0.00	0.00	0.00
299840.814	64.68	2.00	0.00	0.00	0.00
299863.967	23.15	1.90	0.00	0.00	0.00
299915.358	51.39	2.00	0.00	0.00	0.00
299968.510	53.15	2.90	0.00	0.00	0.00
300083.667	115.16	3.40	0.00	0.00	0.00
300120.222	36.55	3.10	0.00	0.00	0.00
300169.222	49.00	2.10	0.00	0.00	0.00
300198.614	29.39	2.20	0.00	0.00	0.00
300232.965	34.35	1.60	0.00	0.00	0.00
300269.584	36.62	1.50	0.00	0.00	0.00
300295.697	26.11	1.40	0.00	0.00	0.00
300342.724	47.03	[illegible]	0.00	0.00	0.00
300387.529	44.81	[illegible]	0.00	0.00	0.00
300428.250	40.72	[illegible]	0.20	5.20	105.88
300460.963	32.71	[illegible]	0.20	5.20	170.11
300514.698	53.73	[illegible]	0.30	7.95	353.31
300535.674	20.98	[illegible]	0.50	13.75	227.60
300566.767	31.09	[illegible]	0.70	19.95	523.93
300598.524	31.76	[illegible]	0.60	16.80	583.53
300618.274	19.75	[illegible]	0.30	7.95	244.41
300649.437	31.16	[illegible]	0.20	5.20	204.90
300698.833	49.40	[illegible]	0.00	0.00	128.44

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
300852.597	153.76	2.20	0.00	0.00	0.00
300902.207	49.61	2.60	0.00	0.00	0.00
300952.988	50.78	2.10	0.00	0.00	0.00
301018.494	65.51	2.00	0.00	0.00	0.00
301058.115	39.62	2.30	0.00	0.00	0.00
301085.086	26.97	2.60	0.00	0.00	0.00
301105.266	20.18	3.00	0.00	0.00	0.00
301125.805	20.54	3.10	0.00	0.00	0.00
301163.447	37.64	3.10	0.00	0.00	0.00
301190.058	26.61	2.60	0.00	0.00	0.00
301205.848	15.79	2.40	0.00	0.00	0.00
301220.819	14.97	2.30	0.00	0.00	0.00
301236.874	16.05	1.80	0.00	0.00	0.00
301262.462	25.59	[illegible]	0.00	0.00	0.00
301317.646	55.18	1.90	0.00	0.00	0.00
301358.146	40.50	2.10	0.00	0.00	0.00
301399.667	41.52	2.10	0.00	0.00	0.00
301445.102	45.43	1.60	0.00	0.00	0.00
301480.806	35.70	1.60	0.00	0.00	0.00
301521.532	40.73	1.70	0.00	0.00	0.00
301555.634	34.10	1.40	0.00	0.00	0.00
301601.827	46.19	[illegible]	0.00	0.00	0.00
301643.489	41.66	1.40	0.00	0.00	0.00
301681.979	38.49	1.50	0.00	0.00	0.00
301739.219	57.24	1.70	0.00	0.00	0.00
301779.193	39.97	[illegible]	0.00	0.00	0.00
301809.347	30.15	[illegible]	0.10	2.55	38.45
301858.338	48.99	[illegible]	0.20	5.20	189.84
301907.205	48.87	[illegible]	0.40	10.80	390.94
301954.378	47.17	[illegible]	0.50	13.75	579.05
301988.129	33.75	1.40	0.00	0.00	232.04
302020.081	31.95	1.90	0.00	0.00	0.00
302057.523	37.44	2.50	0.00	0.00	0.00
302083.329	25.81	2.90	0.00	0.00	0.00
302110.136	26.81	3.10	0.00	0.00	0.00
302135.026	24.89	3.50	0.00	0.00	0.00
302151.532	16.51	2.60	0.00	0.00	0.00
302185.183	33.65	[illegible]	0.00	0.00	0.00
302219.680	34.50	2.00	0.00	0.00	0.00
302240.920	21.24	3.40	0.00	0.00	0.00
302347.726	106.81	3.30	0.00	0.00	0.00
302456.769	109.04	2.80	0.00	0.00	0.00
302549.392	92.62	3.40	0.00	0.00	0.00
302601.266	51.87	3.30	0.00	0.00	0.00
302656.641	55.38	2.70	0.00	0.00	0.00
302729.954	73.31	2.90	0.00	0.00	0.00
302785.939	55.99	2.90	0.00	0.00	0.00
302835.976	50.04	2.30	0.00	0.00	0.00
302877.631	41.65	2.30	0.00	0.00	0.00
302914.007	36.38	2.50	0.00	0.00	0.00
302959.025	45.02	2.10	0.00	0.00	0.00
302991.819	32.79	1.60	0.00	0.00	0.00
303083.463	91.64	[illegible]	0.50	13.75	630.06
303105.834	22.37	[illegible]	0.00	0.00	153.80
303154.468	48.63	[illegible]	0.10	2.55	62.01

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
303251.872	97.40	[illegible]	0.00	0.00	124.20
303307.109	55.24	[illegible]	0.50	13.75	379.76
303337.758	30.65	[illegible]	0.20	5.20	290.40
303388.380	50.62	2.00	0.00	0.00	131.62
303440.640	52.26	2.30	0.00	0.00	0.00
303498.646	58.01	2.10	0.00	0.00	0.00
303587.300	88.65	1.80	0.00	0.00	0.00
303626.606	39.31	1.60	0.00	0.00	0.00
303655.749	29.14	1.50	0.00	0.00	0.00
303700.871	45.12	[illegible]	0.00	0.00	0.00
303733.232	32.36	[illegible]	0.00	0.00	0.00
303777.666	44.43	[illegible]	0.50	13.75	305.48
303802.393	24.73	[illegible]	0.70	19.95	416.66
303824.828	22.44	[illegible]	1.00	30.00	560.33
303853.123	28.29	[illegible]	0.80	23.20	752.64
303890.871	37.75	[illegible]	0.00	0.00	437.89
303919.435	28.56	[illegible]	0.10	2.55	36.42
303940.323	20.89	[illegible]	0.20	5.20	80.94
303975.003	34.68	[illegible]	0.30	7.95	228.03
303987.061	12.06	[illegible]	0.10	2.55	63.31
304004.311	17.25	[illegible]	0.20	5.20	66.85
304034.467	30.16	[illegible]	0.50	13.75	285.73
304070.954	36.49	[illegible]	0.40	10.80	447.89
304102.989	32.03	[illegible]	0.70	19.95	492.54
304124.871	21.88	[illegible]	0.00	0.00	218.27
304156.934	32.06	1.50	0.00	0.00	0.00
304221.361	64.43	[illegible]	0.10	2.55	82.15
304287.352	65.99	[illegible]	0.30	7.95	346.45
304314.406	27.05	[illegible]	0.40	10.80	253.64
304390.025	75.62	[illegible]	0.00	0.00	408.35
304482.155	92.13	1.40	0.00	0.00	0.00
304529.945	47.79	[illegible]	0.90	26.55	634.41
304559.030	29.09	[illegible]	0.20	5.20	461.73
304602.116	43.09	[illegible]	0.10	2.55	166.96
304634.960	32.84	[illegible]	0.20	5.20	127.28
304703.736	68.78	[illegible]	0.30	7.95	452.21
304831.816	128.08	[illegible]	0.40	10.80	1200.76
304956.622	124.81	[illegible]	0.50	13.75	1531.99
305051.644	95.02	[illegible]	0.60	16.80	1451.47
305215.490	163.85	[illegible]	0.60	16.80	2752.62
305350.211	134.72	[illegible]	0.30	7.95	1667.18
305412.496	62.28	[illegible]	0.10	2.55	327.00
305478.428	65.93	[illegible]	0.30	7.95	346.15
305519.043	40.62	[illegible]	0.20	5.20	267.05
305573.908	54.86	[illegible]	0.40	10.80	438.92
305642.968	69.06	[illegible]	0.30	7.95	647.44
305717.746	74.78	1.70	0.00	0.00	297.25
305786.461	68.72	[illegible]	0.00	0.00	0.00
305834.625	48.16	[illegible]	0.30	7.95	191.46
305872.435	37.81	1.70	0.00	0.00	150.30
305928.635	56.20	2.40	0.00	0.00	0.00
305966.461	37.83	[illegible]	0.00	0.00	0.00
306009.355	42.89	1.70	0.00	0.00	0.00
306079.764	70.41	[illegible]	0.20	5.20	183.07
306133.723	53.96	[illegible]	0.00	0.00	140.30

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
306172.071	38.35	1.20	0.00	0.00	0.00
306239.264	67.19	0.90	0.30	7.95	267.10
306295.096	55.83	2.40	0.00	0.00	221.93
306355.455	60.36	3.00	0.00	0.00	0.00
306389.410	33.96	3.50	0.00	0.00	0.00
306476.440	87.03	3.30	0.00	0.00	0.00
306525.745	49.31	3.80	0.00	0.00	0.00
306577.052	51.31	3.40	0.00	0.00	0.00
306658.838	81.79	3.60	0.00	0.00	0.00
306734.270	75.43	2.80	0.00	0.00	0.00
306816.348	82.08	2.80	0.00	0.00	0.00
306894.378	78.03	1.80	0.00	0.00	0.00
306960.516	66.14	1.60	0.00	0.00	0.00
307006.010	45.49	1.00	0.20	5.20	118.29
307056.933	50.92	1.80	0.00	0.00	132.40
307087.733	30.80	2.50	0.00	0.00	0.00
307163.822	76.09	2.70	0.00	0.00	0.00
307205.724	41.90	1.90	0.00	0.00	0.00
307257.100	51.38	1.60	0.00	0.00	0.00
307329.453	72.35	1.00	0.20	5.20	188.12
307393.750	64.30	1.50	0.00	0.00	167.18
307444.546	50.80	2.00	0.00	0.00	0.00
307480.310	35.76	3.10	0.00	0.00	0.00
307583.234	102.92	3.20	0.00	0.00	0.00
307621.730	38.50	2.90	0.00	0.00	0.00
307695.277	73.55	1.80	0.00	0.00	0.00
307724.023	28.75	1.80	0.00	0.00	0.00
307773.786	49.76	0.60	0.60	16.80	418.02
307798.162	24.38	0.00	1.00	30.00	570.41
307854.076	55.91	0.00	1.00	30.00	1677.40
307869.781	15.71	0.00	1.00	30.00	471.18
307883.125	13.34	1.40	0.80	23.20	354.94
307900.853	17.73	1.60	0.60	16.80	354.56
307926.061	25.21	1.70	0.00	0.00	211.75
308047.786	121.73	1.40	0.00	0.00	0.00
308082.818	35.03	1.00	0.30	7.95	139.26
308155.379	72.56	1.30	0.00	0.00	288.43
308188.571	33.19	1.40	0.00	0.00	0.00
308216.325	27.75	1.70	0.00	0.00	0.00
308244.938	28.61	2.00	0.00	0.00	0.00
308265.247	20.31	2.40	0.00	0.00	0.00
308281.865	16.62	2.80	0.00	0.00	0.00
308314.290	32.42	1.70	0.00	0.00	0.00
308335.147	20.86	1.70	0.00	0.00	0.00
308402.276	67.13	1.90	0.00	0.00	0.00
308438.046	35.77	1.80	0.00	0.00	0.00
308462.862	24.82	2.00	0.00	0.00	0.00
308488.177	25.31	2.80	0.00	0.00	0.00
308508.331	20.15	1.70	0.00	0.00	0.00
308564.740	56.41	2.20	0.00	0.00	0.00
308586.474	21.73	1.50	0.00	0.00	0.00
308614.835	28.36	1.50	0.00	0.00	0.00
308643.031	28.20	0.20	0.40	10.80	152.27
308684.775	41.74	0.00	0.20	5.20	333.95
308723.786	39.01	0.00	0.30	7.95	256.50

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
308772.158	48.37	2.90	0.00	0.00	192.28
308903.651	131.49	3.40	0.00	0.00	0.00
308937.258	33.61	3.10	0.00	0.00	0.00
308979.988	42.73	3.70	0.00	0.00	0.00
309012.683	32.69	3.80	0.00	0.00	0.00
309081.137	68.45	4.10	0.00	0.00	0.00
309119.455	38.32	4.00	0.00	0.00	0.00
309157.960	38.50	4.20	0.00	0.00	0.00
309273.399	115.44	8.10	0.00	0.00	0.00
309327.144	53.75	6.80	0.00	0.00	0.00
309364.078	36.93	6.00	0.00	0.00	0.00
309512.406	148.33	2.80	0.00	0.00	0.00
309552.549	40.14	2.60	0.00	0.00	0.00
309592.956	40.41	2.40	0.00	0.00	0.00
309644.008	51.05	2.40	0.00	0.00	0.00
309677.340	33.33	1.70	0.00	0.00	0.00
309726.470	49.13	1.50	0.00	0.00	0.00
309789.715	63.24	1.90	0.00	0.00	0.00
309851.612	61.90	2.20	0.00	0.00	0.00
309868.224	16.61	2.60	0.00	0.00	0.00
309921.625	53.40	2.90	0.00	0.00	0.00
309969.442	47.82	3.00	0.00	0.00	0.00
310009.812	40.37	2.60	0.00	0.00	0.00
310042.634	32.82	2.20	0.00	0.00	0.00
310101.591	58.96	2.70	0.00	0.00	0.00
310125.288	23.70	2.80	0.00	0.00	0.00
310178.875	53.59	2.20	0.00	0.00	0.00
310213.524	34.65	2.30	0.00	0.00	0.00
310249.963	36.44	1.90	0.00	0.00	0.00
310285.909	35.95	1.70	0.00	0.00	0.00
310325.144	39.24	1.60	0.00	0.00	0.00
310370.819	45.67	1.50	0.00	0.00	0.00
310415.400	44.58	[illegible]	0.00	0.00	0.00
310462.455	47.05	1.40	0.00	0.00	0.00
310511.849	49.39	[illegible]	0.00	0.00	0.00
310557.843	45.99	[illegible]	0.10	2.55	58.65
310600.624	42.78	[illegible]	0.00	0.00	54.55
310650.257	49.63	[illegible]	0.00	0.00	0.00
310703.883	53.63	2.20	0.00	0.00	0.00
310741.471	37.59	2.10	0.00	0.00	0.00
310780.086	38.61	2.10	0.00	0.00	0.00
310792.466	12.38	2.20	0.00	0.00	0.00
310809.261	16.80	2.30	0.00	0.00	0.00
310847.646	38.38	1.90	0.00	0.00	0.00
310900.092	52.45	1.60	0.00	0.00	0.00
310934.745	34.65	[illegible]	0.40	10.80	187.13
310973.758	39.01	[illegible]	0.20	5.20	312.11
311017.210	43.45	[illegible]	0.00	0.00	112.98
311053.170	35.96	1.60	0.00	0.00	0.00
311082.742	29.57	1.50	0.00	0.00	0.00
311106.091	23.35	1.60	0.00	0.00	0.00
311139.752	33.66	1.80	0.00	0.00	0.00
311185.781	46.03	1.40	0.00	0.00	0.00
311236.391	50.61	1.60	0.00	0.00	0.00
311277.104	40.71	1.40	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
311311.041	33.94	1.60	0.00	0.00	0.00
311344.869	33.83	1.60	0.00	0.00	0.00
311372.129	27.26	1.60	0.00	0.00	0.00
311423.774	51.65	1.60	0.00	0.00	0.00
311461.418	37.64	1.60	0.00	0.00	0.00
311505.207	43.79	[illegible]	0.00	0.00	0.00
311554.949	49.74	[illegible]	0.20	5.20	129.33
311597.705	42.76	[illegible]	0.10	2.55	165.69
311654.620	56.92	1.70	0.00	0.00	72.57
311690.721	36.10	1.60	0.00	0.00	0.00
311734.600	43.88	[illegible]	0.00	0.00	0.00
311778.272	43.67	[illegible]	0.10	2.55	55.69
311822.286	44.01	[illegible]	0.00	0.00	56.12
311907.421	85.13	[illegible]	0.00	0.00	0.00
311968.259	60.84	1.70	0.00	0.00	0.00
312015.361	47.10	1.80	0.00	0.00	0.00
312070.421	55.06	1.70	0.00	0.00	0.00
312132.669	62.25	1.90	0.00	0.00	0.00
312180.797	48.13	1.80	0.00	0.00	0.00
312229.857	49.06	2.10	0.00	0.00	0.00
312299.769	69.91	2.30	0.00	0.00	0.00
312370.112	70.34	2.70	0.00	0.00	0.00
312416.334	46.22	2.80	0.00	0.00	0.00
312481.107	64.77	2.00	0.00	0.00	0.00
312521.083	39.98	2.20	0.00	0.00	0.00
312571.255	50.17	2.00	0.00	0.00	0.00
312599.757	28.50	1.70	0.00	0.00	0.00
312642.677	42.92	1.60	0.00	0.00	0.00
312736.619	93.94	1.60	0.00	0.00	0.00
312812.278	75.66	2.00	0.00	0.00	0.00
312844.813	32.53	2.00	0.00	0.00	0.00
312881.112	36.30	2.10	0.00	0.00	0.00
312936.027	54.91	1.80	0.00	0.00	0.00
313020.184	84.16	2.00	0.00	0.00	0.00
313097.382	77.20	2.00	0.00	0.00	0.00
313152.601	55.22	2.00	0.00	0.00	0.00
313200.025	47.42	1.90	0.00	0.00	0.00
313239.989	39.96	1.90	0.00	0.00	0.00
313302.252	62.26	1.90	0.00	0.00	0.00
313353.977	51.73	1.90	0.00	0.00	0.00
313431.040	77.06	1.80	0.00	0.00	0.00
313497.307	66.27	1.70	0.00	0.00	0.00
313538.762	41.46	1.50	0.00	0.00	0.00
313624.143	85.38	1.40	0.00	0.00	0.00
313660.096	35.95	1.40	0.00	0.00	0.00
313663.711	3.61	[illegible]	0.00	0.00	0.00
313714.890	51.18	[illegible]	0.00	0.00	0.00
313753.525	38.63	[illegible]	0.00	0.00	0.00
313794.919	41.39	1.60	0.00	0.00	0.00
313849.829	54.91	5.40	0.00	0.00	0.00
313910.696	60.87	2.50	0.00	0.00	0.00
313936.476	25.78	[illegible]	0.20	5.20	67.03
313956.754	20.28	1.90	0.00	0.00	52.73
313976.093	19.34	[illegible]	0.80	23.20	224.35
314055.296	79.20	[illegible]	0.70	19.95	1708.80

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
314091.830	36.53	[illegible]	0.50	13.75	615.60
314115.171	23.34	[illegible]	0.60	16.80	356.53
314140.984	25.81	[illegible]	0.00	0.00	216.83
314180.514	39.53	[illegible]	0.80	23.20	458.56
314217.358	36.84	[illegible]	0.60	16.80	736.88
314276.970	59.61	[illegible]	0.90	26.55	1292.11
314297.285	20.31	[illegible]	0.40	10.80	379.38
314315.545	18.26	[illegible]	0.60	16.80	252.00
314344.704	29.16	[illegible]	0.00	0.00	244.94
314376.811	32.11	2.40	0.00	0.00	0.00
314442.100	65.29	1.80	0.00	0.00	0.00
314473.359	31.26	1.80	0.00	0.00	0.00
314507.910	34.55	1.70	0.00	0.00	0.00
314528.076	20.17	1.50	0.00	0.00	0.00
314561.305	33.23	1.40	0.00	0.00	0.00
314592.710	31.41	[illegible]	0.00	0.00	0.00
314619.339	26.63	[illegible]	0.00	0.00	0.00
314662.022	42.68	[illegible]	0.00	0.00	0.00
314681.953	19.93	[illegible]	0.00	0.00	0.00
314703.819	21.87	[illegible]	0.10	2.55	27.88
314724.437	20.62	[illegible]	0.10	2.55	52.58
314753.645	29.21	[illegible]	0.00	0.00	37.25
314786.374	32.73	[illegible]	0.00	0.00	0.00
314813.625	27.25	[illegible]	0.00	0.00	0.00
314867.269	53.64	[illegible]	0.00	0.00	0.00
314890.505	23.24	1.40	0.00	0.00	0.00
314922.598	32.09	[illegible]	0.00	0.00	0.00
314995.280	72.68	[illegible]	0.00	0.00	0.00
315027.641	32.36	[illegible]	0.10	2.55	41.27
315067.997	40.36	[illegible]	0.20	5.20	156.38
315108.540	40.54	[illegible]	0.40	10.80	324.35
315154.748	46.21	[illegible]	0.40	10.80	499.05
315198.270	43.52	[illegible]	0.50	13.75	534.23
315233.172	34.90	[illegible]	0.70	19.95	588.10
315317.669	84.50	[illegible]	0.80	23.20	1823.03
315355.176	37.51	[illegible]	0.40	10.80	637.63
315388.504	33.33	[illegible]	0.40	10.80	359.94
315421.931	33.43	[illegible]	0.70	19.95	513.96
315481.753	59.82	[illegible]	0.20	5.20	752.26
315534.636	52.88	[illegible]	0.40	10.80	423.07
315557.474	22.84	[illegible]	0.10	2.55	152.45
315578.950	21.48	[illegible]	0.10	2.55	54.77
315610.920	31.97	[illegible]	0.00	0.00	40.77
315648.744	37.82	[illegible]	0.00	0.00	0.00
315685.448	36.70	[illegible]	0.10	2.55	46.80
315737.680	52.23	[illegible]	0.10	2.55	133.20
315789.034	51.35	[illegible]	0.20	5.20	199.00
315847.855	58.82	[illegible]	0.30	7.95	386.75
315883.581	35.73	[illegible]	0.20	5.20	234.90
315922.410	38.83	[illegible]	0.30	7.95	255.31
315958.363	35.95	[illegible]	0.30	7.95	285.83
316007.356	48.99	[illegible]	0.10	2.55	257.22
316035.891	28.53	[illegible]	0.20	5.20	110.58
316067.849	31.96	[illegible]	0.20	5.20	166.19
316105.046	37.20	[illegible]	0.30	7.95	244.57

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
316151.172	46.13	[illegible]	0.30	7.95	366.70
316220.260	69.09	[illegible]	0.40	10.80	647.71
316282.130	61.87	[illegible]	0.40	10.80	668.20
316331.012	48.88	[illegible]	0.20	5.20	391.06
316356.589	25.58	[illegible]	0.30	7.95	168.17
316397.881	41.29	[illegible]	0.40	10.80	387.12
316480.075	82.19	[illegible]	0.20	5.20	657.55
316528.248	48.17	[illegible]	0.60	16.80	529.91
316590.736	62.49	[illegible]	0.60	16.80	1049.81
316622.735	32.00	[illegible]	0.70	19.95	587.98
316650.612	27.88	[illegible]	0.50	13.75	469.73
316701.035	50.42	1.80	0.00	0.00	346.67
316816.954	115.92	2.50	0.00	0.00	0.00
316893.369	76.41	1.70	0.00	0.00	0.00
316967.817	74.45	[illegible]	0.10	2.55	94.93
317002.144	34.33	1.60	0.00	0.00	43.77
317061.640	59.50	[illegible]	0.00	0.00	0.00
317128.793	67.15	1.50	0.00	0.00	0.00
317341.701	212.91	[illegible]	0.10	2.55	271.46
317368.223	26.52	[illegible]	0.20	5.20	102.78
317442.013	73.79	1.50	0.00	0.00	191.86
317471.614	29.60	2.50	0.00	0.00	0.00
317500.938	29.32	[illegible]	0.20	5.20	76.25
317587.934	87.00	[illegible]	0.50	13.75	824.29
317632.007	44.07	2.20	0.00	0.00	303.01
317690.677	58.67	1.90	0.00	0.00	0.00
317871.414	180.74	2.40	0.00	0.00	0.00
317916.689	45.28	2.50	0.00	0.00	0.00
317976.387	59.70	2.30	0.00	0.00	0.00
318016.819	40.43	2.30	0.00	0.00	0.00
318051.342	34.52	2.30	0.00	0.00	0.00
318078.766	27.42	2.30	0.00	0.00	0.00
318120.909	42.14	2.20	0.00	0.00	0.00
318155.207	34.30	1.80	0.00	0.00	0.00
318205.594	50.39	1.60	0.00	0.00	0.00
318245.494	39.90	1.50	0.00	0.00	0.00
318268.754	23.26	1.60	0.00	0.00	0.00
318297.602	28.85	[illegible]	0.00	0.00	0.00
318363.972	66.37	[illegible]	0.00	0.00	0.00
318402.250	38.28	[illegible]	0.00	0.00	0.00
318444.106	41.86	[illegible]	0.20	5.20	108.83
318493.275	49.17	[illegible]	0.20	5.20	255.68
318521.989	28.71	[illegible]	0.20	5.20	149.32
318567.577	45.59	[illegible]	0.50	13.75	431.95
318608.181	40.60	[illegible]	0.80	23.20	750.16
318657.505	49.32	[illegible]	0.90	26.55	1226.94
318689.054	31.55	[illegible]	1.00	30.00	892.05
318712.097	23.04	[illegible]	0.90	26.55	651.53
318740.315	28.22	[illegible]	0.80	23.20	701.93
318758.661	18.35	[illegible]	0.70	19.95	395.82
318794.111	35.45	1.50	0.00	0.00	353.62
318856.746	62.64	1.70	0.00	0.00	0.00
318909.176	52.43	1.70	0.00	0.00	0.00
318965.913	56.74	1.50	0.00	0.00	0.00
319043.719	77.81	1.60	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
319100.190	56.47	1.70	0.00	0.00	0.00
319171.093	70.90	[illegible]	0.00	0.00	0.00
319211.816	40.72	1.40	0.00	0.00	0.00
319238.970	27.15	[illegible]	0.00	0.00	0.00
319260.355	21.38	[illegible]	0.00	0.00	0.00
319293.878	33.52	[illegible]	0.00	0.00	0.00
319349.577	55.70	[illegible]	0.20	5.20	144.82
319389.109	39.53	[illegible]	0.30	7.95	259.93
319448.505	59.40	[illegible]	0.40	10.80	556.85
319480.166	31.66	[illegible]	0.60	16.80	436.92
319542.474	62.31	[illegible]	0.90	26.55	1350.54
319565.299	22.82	[illegible]	1.10	33.55	685.89
319624.233	58.93	2.20	0.00	0.00	988.62
319698.740	74.51	2.00	0.00	0.00	0.00
319739.540	40.80	2.10	0.00	0.00	0.00
319976.007	236.47	2.90	0.00	0.00	0.00
320051.204	75.20	4.30	0.00	0.00	0.00
320103.839	52.63	[illegible]	1.00	30.00	789.53
320184.181	80.34	1.40	0.00	0.00	1205.14
320225.549	41.37	2.50	0.00	0.00	0.00
320250.730	25.18	2.40	0.00	0.00	0.00
320318.455	67.73	1.70	0.00	0.00	0.00
320360.923	42.47	1.60	0.00	0.00	0.00
320406.544	45.62	1.40	0.00	0.00	0.00
320452.469	45.93	1.50	0.00	0.00	0.00
320519.857	67.39	[illegible]	0.10	2.55	85.92
320549.574	29.72	[illegible]	0.30	7.95	156.02
320579.794	30.22	[illegible]	0.00	0.00	120.13
320611.192	31.40	1.50	0.00	0.00	0.00
320642.242	31.05	2.00	0.00	0.00	0.00
320682.287	40.04	2.60	0.00	0.00	0.00
320722.186	39.90	3.90	0.00	0.00	0.00
320739.585	17.40	2.60	0.00	0.00	0.00
320781.143	41.56	2.50	0.00	0.00	0.00
320817.507	36.36	2.80	0.00	0.00	0.00
320860.742	43.24	3.40	0.00	0.00	0.00
320939.609	78.87	3.10	0.00	0.00	0.00
320988.832	49.22	2.50	0.00	0.00	0.00
321057.197	68.37	3.30	0.00	0.00	0.00
321108.283	51.09	3.80	0.00	0.00	0.00
321171.235	62.95	7.70	0.00	0.00	0.00
321219.406	48.17	6.80	0.00	0.00	0.00
321250.479	31.07	7.20	0.00	0.00	0.00
321280.344	29.87	6.50	0.00	0.00	0.00
321327.753	47.41	4.70	0.00	0.00	0.00
321399.884	72.13	4.70	0.00	0.00	0.00
321441.026	41.14	2.30	0.00	0.00	0.00
321476.225	35.20	1.60	0.00	0.00	0.00
321529.789	53.56	[illegible]	0.40	10.80	289.25
321566.965	37.18	[illegible]	0.20	5.20	297.41
321595.981	29.02	[illegible]	0.30	7.95	190.79
321643.884	47.90	1.60	0.00	0.00	190.42
321696.511	52.63	1.70	0.00	0.00	0.00
321741.188	44.68	1.40	0.00	0.00	0.00
321781.443	40.26	[illegible]	0.00	0.00	0.00

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
321817.678	36.24	[illegible]	0.10	2.55	46.20
321869.935	52.26	2.10	0.00	0.00	66.63
321908.754	38.82	1.80	0.00	0.00	0.00
321958.965	50.21	2.40	0.00	0.00	0.00
322002.038	43.07	2.70	0.00	0.00	0.00
322054.877	52.84	2.80	0.00	0.00	0.00
322083.591	28.71	3.40	0.00	0.00	0.00
322140.607	57.02	2.80	0.00	0.00	0.00
322192.172	51.56	3.00	0.00	0.00	0.00
322237.241	45.07	[illegible]	0.20	5.20	117.18
322301.002	63.76	[illegible]	0.60	16.80	701.38
322343.599	42.60	1.90	0.00	0.00	357.82
322392.502	48.90	2.10	0.00	0.00	0.00
322448.671	56.17	[illegible]	0.00	0.00	0.00
322475.870	27.20	[illegible]	0.00	0.00	0.00
322496.657	20.79	[illegible]	0.10	2.55	26.51
322523.545	26.89	[illegible]	0.00	0.00	34.29
322554.005	30.46	[illegible]	0.10	2.55	38.84
322622.086	68.08	[illegible]	0.30	7.95	357.43
322682.402	60.32	[illegible]	0.50	13.75	654.44
322719.945	37.54	[illegible]	0.70	19.95	632.60
322755.120	35.17	[illegible]	0.80	23.20	758.90
322789.900	34.78	[illegible]	0.80	23.20	806.90
322833.075	43.18	[illegible]	1.10	33.55	1225.10
322901.034	67.96	[illegible]	0.40	10.80	1507.01
322933.640	32.61	[illegible]	0.70	19.95	501.32
322973.880	40.24	[illegible]	0.60	16.80	739.42
323005.033	31.15	[illegible]	0.60	16.80	523.36
323048.767	43.73	[illegible]	0.20	5.20	481.08
323096.056	47.29	[illegible]	0.00	0.00	122.96
323148.009	51.95	1.40	0.00	0.00	0.00
323204.567	56.56	1.50	0.00	0.00	0.00
323234.679	30.11	1.50	0.00	0.00	0.00
323263.456	28.78	[illegible]	0.00	0.00	0.00
323311.027	47.57	[illegible]	0.00	0.00	0.00
323352.899	41.87	[illegible]	0.30	7.95	166.45
323387.990	35.09	[illegible]	0.20	5.20	230.73
323450.522	62.53	2.20	0.00	0.00	162.59
323512.840	62.32	2.10	0.00	0.00	0.00
323538.410	25.57	1.90	0.00	0.00	0.00
323565.777	27.37	1.60	0.00	0.00	0.00
323611.891	46.11	[illegible]	0.00	0.00	0.00
323645.263	33.37	[illegible]	0.10	2.55	42.55
323685.604	40.34	[illegible]	0.50	13.75	328.79
323723.500	37.90	[illegible]	0.70	19.95	638.55
323758.472	34.97	[illegible]	0.70	19.95	697.70
323788.902	30.43	[illegible]	0.80	23.20	656.54
323864.604	75.70	[illegible]	1.00	30.00	2013.67
323907.669	43.07	[illegible]	1.10	33.55	1368.40
323930.611	22.94	[illegible]	1.00	30.00	728.99
323962.424	31.81	[illegible]	0.80	23.20	846.23
324025.137	62.71	[illegible]	0.40	10.80	1066.13
324078.851	53.71	[illegible]	0.00	0.00	290.06
324165.117	86.27	[illegible]	0.00	0.00	0.00
324230.415	65.30	[illegible]	0.50	13.75	448.93

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
324252.037	21.62	[illegible]	0.90	26.55	435.69
324272.299	20.26	[illegible]	1.30	40.95	683.85
324293.903	21.60	[illegible]	1.00	30.00	766.41
324321.262	27.36	[illegible]	0.40	10.80	558.12
324352.847	31.59	1.50	0.00	0.00	170.56
324376.859	24.01	2.50	0.00	0.00	0.00
324420.095	43.24	2.30	0.00	0.00	0.00
324521.315	101.22	[illegible]	0.00	0.00	0.00
324589.265	67.95	[illegible]	0.60	16.80	570.79
324619.901	30.64	[illegible]	0.70	19.95	562.93
324662.968	43.07	[illegible]	0.90	26.55	1001.30
324701.518	38.55	[illegible]	0.90	26.55	1023.51
324728.897	27.38	[illegible]	0.10	2.55	398.38
324770.477	41.58	[illegible]	0.20	5.20	161.13
324802.549	32.07	1.50	0.00	0.00	83.39
324890.221	87.67	1.50	0.00	0.00	0.00
324927.214	36.99	1.80	0.00	0.00	0.00
324993.567	66.35	1.90	0.00	0.00	0.00
325035.509	41.94	[illegible]	0.50	13.75	288.35
325079.488	43.98	[illegible]	0.60	16.80	671.78
325170.478	90.99	1.80	0.00	0.00	764.32
325245.948	75.47	2.60	0.00	0.00	0.00
325276.743	30.79	2.30	0.00	0.00	0.00
325371.526	94.78	2.00	0.00	0.00	0.00
325441.321	69.80	1.80	0.00	0.00	0.00
325571.203	129.88	1.90	0.00	0.00	0.00
325604.784	33.58	1.60	0.00	0.00	0.00
325638.964	34.18	[illegible]	0.10	2.55	43.59
326025.694	386.73	2.90	0.00	0.00	493.09
326048.858	23.16	3.30	0.00	0.00	0.00
326091.474	42.62	2.70	0.00	0.00	0.00
326131.072	39.60	2.50	0.00	0.00	0.00
326173.254	42.18	2.40	0.00	0.00	0.00
326203.477	30.22	1.60	0.00	0.00	0.00
326240.480	37.00	[illegible]	0.50	13.75	254.40
326319.234	78.75	[illegible]	1.40	44.80	2305.51
326376.741	57.51	[illegible]	0.90	26.55	2051.58
326393.999	17.26	[illegible]	0.80	23.20	429.30
326412.252	18.25	[illegible]	0.60	16.80	365.05
326430.266	18.01	[illegible]	0.50	13.75	275.18
326433.267	3.00	[illegible]	0.50	13.75	41.27
326452.056	18.79	[illegible]	0.30	7.95	203.86
326489.475	37.42	1.80	0.00	0.00	148.75
326518.738	29.26	1.80	0.00	0.00	0.00
326542.344	23.61	1.70	0.00	0.00	0.00
326583.250	40.91	[illegible]	0.20	5.20	106.36
326634.349	51.10	[illegible]	0.00	0.00	132.86
326670.012	35.66	[illegible]	0.00	0.00	0.00
326715.434	45.42	1.40	0.00	0.00	0.00
326774.918	59.48	[illegible]	0.10	2.55	75.85
326817.925	43.01	1.50	0.00	0.00	54.84
326867.199	49.27	1.70	0.00	0.00	0.00
326914.986	47.79	2.00	0.00	0.00	0.00
326943.205	28.22	2.10	0.00	0.00	0.00
326998.000	54.80	[illegible]	1.20	37.20	1019.20

Annexure 4.3

Chainage (m)	Length (m)	Reduced Soundings w.r.t C.D. (m)	Depth of cutting (m)	Area (m^2)	Quantity (m^3)
1	2	3	4	5	6
327012.996	15.00	2.00	0.00	0.00	278.92
327035.450	22.45	2.20	0.00	0.00	0.00
327062.278	26.83	2.90	0.00	0.00	0.00
327123.557	61.28	1.60	0.00	0.00	0.00
327188.432	64.88	1.80	0.00	0.00	0.00
327259.011	70.58	1.80	0.00	0.00	0.00
327293.470	34.46	1.50	0.00	0.00	0.00
327334.899	41.43	1.70	0.00	0.00	0.00
327373.220	38.32	1.70	0.00	0.00	0.00
327457.015	83.80	1.90	0.00	0.00	0.00
327497.239	40.22	1.80	0.00	0.00	0.00
327531.691	34.45	1.60	0.00	0.00	0.00
327560.832	29.14	1.70	0.00	0.00	0.00
327604.829	44.00	2.00	0.00	0.00	0.00
327651.871	47.04	1.40	0.00	0.00	0.00
327775.904	124.03	2.50	0.00	0.00	0.00
327827.997	52.09	2.80	0.00	0.00	0.00
327876.827	48.83	1.90	0.00	0.00	0.00
327945.774	68.95	1.70	0.00	0.00	0.00
327984.827	39.05	1.50	0.00	0.00	0.00
328018.605	33.78	1.40	0.00	0.00	0.00
328071.340	52.73	1.60	0.00	0.00	0.00
			Total Quantity (m^3) =		1879291.2

CHAPTER - 5

PLANNING OF TERMINALS

CHAPTER-5

PLANNING OF TERMINALS

5.0 INTRODUCTION

The terminal planning and design includes selection of suitable sites in the vicinity of the cargo concentrations considering all the relevant technical factors, choosing the type of berthing facility and providing of covered/open storages, cargo handling systems and other ancillary facilities for efficient terminal operation. Once the type selection for the various facilities have been made the scale of facilities has been decided on the basis of anticipated traffic volume and the system throughputs and the type of cargo, selection of the requisite facilities will be made. The cost estimates capital and operating costs will be made for each of the proposed system at the respective terminals considering the system design and the annual throughput. These aspects are dealt in subsequent paras in the above mentioned sequence.

5.1 TERMINAL SITE SELECTION

Site selection is the most important factor as it dictates the investment for establishing the terminal facilities. Therefore utmost care is taken to select most reliable locations to minimise the capital and the recurring cost for the terminals.

5.1.1 CRITERIA FOR SELECTION OF SITE

- Traffic potentiality and commodity characteristics.
- Navigational safety.
- Optimum size of vessel expected to use the waterway.
- Cargo handling Technique.
- Availability of land required for infrastructure.
- Likely technological changes in the methods of cargo handling and vessel design etc.
- River morphology and behaviour, stable river channel, sufficient depth.
- Favourable hydraulic conditions for berthing and cargo handling.
- Low water line shall be close to High bank.

5.1.2 PLANNING CONSIDERATIONS

The terminal facilities recommended include:

- Berthing facilities for vessels.
- Cargo storage facilities.

- Cargo handling facilities.
- Other ancillary facilities.

5.1.3 PROPOSED TERMINAL SITES

River	Terminal Location
Gandak River	Vaishali
	Kalyanpur
	Bettiah
	Bagaha

5.1.4 PROJECTED TRAFFIC AT PROPOSED TERMINAL

TERMINAL	Base Year 2012-13 (Tons)	2025-26 (Tons)	2035-36 (Tons)
Vaishali	177277	378119	677154
Kalyanpur	209041	445869	798484
Bettiah	181999	388190	695189
Bagaha	1070530	2283364	4089157

5.2 DESCRIPTION OF SELECTED SITES

5.2.1 VAISHALI

The river terminal is proposed on the right bank of the river Gandak as shown in Drg.No.RITES/VAISHALI/01. The terminal is about 48 km away from Patna (Ganga confluence).The channel has sufficient water depth. The terminal is very near to Chhapra- Muzaffarpur(NH-102) and will be connected to other important places like Hajipur, Lalganj and Mahuwa etc. Nearby railway line is Hajipur-Muzaffarpur.

5.2.2 KALYANPUR

The river terminal is proposed on the left bank of the river Gandak as shown in Drg.No.RITES/KALYANPUR/01. The terminal is about 113 km away from Patna (Ganga confluence).The channel has sufficient water depth. The terminal is very near to Gopalganj–Muzaffarpur(NH-28) and will be connected to other important places like Areraj, Kesariya and Chakiya etc.

5.2.3 BETTIAH

The river terminal is proposed on the left bank of the river Gandak as shown in Drg.No.RITES/BETTIAH/01. The terminal is about 204 km away from Patna (Ganga confluence).The channel has sufficient water depth. The terminal is very near to Bagha–Motihari road and will be connected to other important places like Jogapatti, Majhwalia, Nautan etc. Nearby railway line is Pashchimi Champaran–Motihari.

5.2.4 BAGAHA

The river terminal is proposed on the left bank of the river Gandak as shown in Drg.No.RITES/BAGAHA/01.The terminal is about 286 km away from Patna (Ganga confluence). The channel has sufficient water depth. The terminal is very near to Bagaha–Bettiah road and will be connected to other important places like Nakatiaganj, Lauriya, Champaran etc.

5.3 TERMINAL FACILITIES

5.3.1 GENERAL

The type of cargo handling system required at the terminals is generally dependant on the type of cargo, the annual volume required to be handled and the size of the vessels deployed in the system. The various cargoes foreseen to be handled at the terminals have been classified primarily into two groups:

- Incoming cargoes, and
- Outgoing cargoes.

These two groups have been further sub-divided into bulk, bagged and other miscellaneous general cargo for the purpose of planning the cargo handling system requirements. The quantum and other cargo compositions will be finalised with the detailed traffic report which in progress.

- Bulk cargo (Construction Material–Sand, Stone, Bricks, Marble, Iron, Steel, Machinery–Light & Heavy; Mineral Ore–Lime stone, Iron and Copper ore; Conventional Fuels–Coal and Firewood).
- Bagged cargo (Construction Material–Cement; Chemicals-Fertilizer, Wine, Beverage & Soft Drink, Acids; Cereals/Cash crops–Wheat, Rice, Bajra, Gram, Pulses, Cotton etc).
- Miscellaneous general cargo (Consumer Goods, Animals, Oil Cake, Edible oil, Refined oil, Paper Products).

5.3.2 BASIC ASSUMPTION FOR THE PLANNING OF FACILITIES

For the purposes of planning the terminal facilities and the infrastructure, the following assumptions have been made:

- Terminal facilities would be planned for the initial traffic projected for base year and would be expanded in the subsequent development phase upto the horizon year 2035-36. System will be planned in such a manner that any additions to the facilities will be possible for handling future traffic. Terminals layouts prepared will ensure that entire facilities can be expanded to meet the ultimate traffic projected for the year 2035-36.
- Number of days the berths are considered available for operation is 300 days per year.
- Navigation of vessels in the river includes day navigation except during flood season when operation would be suspended.
- Number of shifts for vessel loading/unloading operations and onshore facilities is considered as 1 per day.
- Average time required for to and fro movement from anchorage to berth, berthing time, other formalities etc. is considered as 1 hour per vessel.
- All hinterland transportation of material out of the facilities or into the facility is assumed to be by trucks.
- Since the distance between the loading and the unloading terminal is relatively large, the arrival pattern of the vessels at the terminals is expected to be random.
- Ratings of equipment as well as the storage facility requirements etc. have been planned considering the inter-arrival rate of vessels.
- Storage capacities provided at the facility will be adequate to guarantee loading or unloading of vessels even during disruption of road transportation of 5 days.
- Maximum truck size assumed is 10 Tonnes payload.
- Average vessel size is assumed as 100T with a full loaded draft of 1.0m. One vessel load will contain material for one destination only.
- All bulk cargoes, which are not affected by weather, will be stored in open stock pile. All bagged cargo will be stored in covered sheds.
- The storm water drainage provided at the terminals will discharge into the river.
- It is assumed that captive vessel fleet will be used for transportation of bulk, bagged and miscellaneous general cargo. This arrangement will help to reduce the turn-around time of vessels and also increase the

handling efficiency of the on-shore equipment. In the case of bulk cargo, the last few layers of material in the barge bottom, will require manual assistance to unload and thus will take considerable time for unloading in comparison to quantum of material to be unloaded in this manner.

- Customs clearance or any kind of security check is foreseen for the materials/cargo to be handled at these facilities.

5.3.3 TERMINAL PLANNING

Based on the above consideration and the traffic projections the terminal planning requirements have been evaluated for handling the various bagged, bulk and miscellaneous general cargoes and are summarized as per traffic study.

For the foreseen volumes of cargo required to be handled at different terminals at the various throughput development stages, terminal requirements have been worked out. The detailed description of each of the proposed terminals is as given below:

5.3.3.1 VAISHALI TERMINAL FACILITIES

Schematic Layout of IWT Terminal at Vaishali is given in Drg.No. RITES/VAISHALI/01. At this terminal, it is proposed to have one no. pontoon to meet the traffic of 2012-13 and three nos. pontoon to meet the projected traffic level in the period 2035-36.

In the proposed terminal site low water line is 35-40 m away from the high bank. Pontoon has been proposed 70m from the high bank to reduce the approach gangway length.

Considering the design vessel of 100Tonnes, the total pontoon length required is 35m with width of 9m. Also, one approach gangway of 70m in length and 2.5m width, suitable for movement of material to & from the pontoon.

For loading/unloading operation, one mobile crawler mounted crane of 5 tonnes capacity, with hook and grab options suitable for handling bagged and bulk cargo. The maximum outreach required for this crane is 18m.

Details of Berthing Facilities of Vaishali Terminal at river Gandak is given in Drg. No.RITES/VAISHALI/02.

The facilities proposed at the terminal back-up area is the following:

- Covered storage area of (40m X 15m) for cement, fertilizer, wheat, rice, bajra, gram, pulses, cotton, wine, beverage, soft drink, paper products etc. Proposed roof truss details is given in Drg.No.RITES/TERMINAL/SHED-05 (Typical).

- Open storage area of 1740 sqm for sand, stone, bricks, marble, iron–steel, light and heavy machinery, lime stone, Iron–copper, coal–firewood.
- Two lane access road of 5.000 km will be developed to connect the terminal with its hinterland District Vaishali and Patna-Muzaffarpur road.
- In addition to the above, the terminal facilities cover, the present & future requirements of truck parking area, office building cum canteen, watchman shed. Also, the terminal requirements include lighting, drainage, fencing and gate.

The phased developmental plan is as follows:

	Base Year 2012-13	2025-26	2035-36
Pontoon (35m X 9m)	1 no.	2 nos.	3 nos.
Gangway(70m X 2.5m)	1 no.	2 nos.	3 nos.
Crane 5T capacity (10cycles/hr,18m outreach)	1 no.	2 nos.	2 nos.
Dumper Truck	1 no.	3 nos.	5 nos.
Covered Storage (for bagged cargo)	40m X 15m	80m X 15m	125m X 15m
Open Storage (for bulk cargo)	1740 sqm.	3750 sqm.	7200 sqm.

The total area requirement for Vaishali Terminal is 60m X 39m in base year, 110m X 45m in 2025-26 and 165m X 55m in 2035-36. Future land will be procured in base year.

5.3.3.2 KALYANPUR TERMINAL FACILITIES

Schematic Layout of IWT Terminal at Kalyanpur is given in Drg.No. RITES/KALYANPUR/01. At this terminal, it is proposed to have one no. pontoon to meet the traffic of 2012-13 and four nos. pontoon to meet the projected traffic level in the period 2035-36.

In the proposed terminal site low water line is 35m away from the high bank. Pontoon has been proposed 70m from the high bank to reduce the approach gangway length.

Considering the design vessel of 100Tonnes, the total pontoon length required is 35m with width of 9m. Also, one approach gangway of 70m in

length and 2.5m width, suitable for movement of material to & from the pontoon.

For loading/unloading operation, one mobile crawler mounted crane of 5 tonnes capacity, with hook and grab options suitable for handling bagged and bulk cargo. The maximum outreach required for this crane is 18m.

Details of Berthing Facilities of Kalyanpur Terminal at river Gandak is given in Drg. No. RITES/KALYANPUR/02.

The facilities proposed at the terminal back-up area is the following:

- Covered storage area of (50m X 15m) for cement, fertilizer, wheat, rice, bajra, gram, pulses, cotton, wine, beverage, soft drink, paper products etc. Proposed roof truss details is given in Drg.No.RITES/TERMINAL/SHED-05 (Typical).
- Open storage area of 1980 sqm for sand, stone, bricks, marble, iron–steel, light and heavy machinery, lime stone, Iron–copper, coal–firewood.
- Two lane access road of 7.000 km will be developed to connect the terminal with its hinterland District Purba Champaran and Gopalganj-Champaran road.
- In addition to the above, the terminal facilities cover, the present & future requirements of truck parking area, office building cum canteen, watchman shed. Also, the terminal requirements include lighting, drainage, fencing and gate.

The phased developmental plan is as follows:

	Base Year 2012-13	**2025-26**	**2035-36**
Pontoon(35m X 9m)	1 no.	2 nos.	4 nos.
Gangway(70m X 2.5m)	1 no.	2 nos.	4 nos.
Crane 5T capacity (10cycles/hr,18m outreach)	1 no.	1 no.	2 nos.
Dumper Truck	1 no.	3 nos.	5 nos.
Covered Storage (for bagged cargo)	50m X 15m	90m X 15m	150m X 30m
Open Storage (for bulk cargo)	1980 sqm.	4500 sqm.	8750 sqm.

The total area requirement for Kalyanpur Terminal is 70m X 39m in base year, 130m X 45m in 2025-26 and 200m X 55m in 2035-36. Future land will be procured in base year.

5.3.3.3 BETTIAH TERMINAL FACILITIES

Schematic Layout of IWT Terminal at Bettiah is given in Drg.No. RITES/BETTIAH/01. At this terminal, it is proposed to have one no. pontoon to meet the traffic of 2012-13 and three nos. pontoon to meet the projected traffic level in the period 2035-36.

In the proposed terminal site low water line is 35m away from the high bank. Pontoon has been proposed 70m from the high bank to reduce the approach gangway length.

Considering the design vessel of 100Tonnes, the total pontoon length required is 35m with width of 9m. Also, one approach gangway of 70m in length and 2.5m width, suitable for movement of material to & from the pontoon.

For loading/unloading operation, one mobile crawler mounted crane of 5 tonnes capacity, with hook and grab options suitable for handling bagged and bulk cargo. The maximum outreach required for this crane is 18m.

Details of Berthing Facilities of Bettiah Terminal at river Gandak is given in Drg.No. RITES/BETTIAH/02.

The facilities proposed at the terminal back-up area is the following:

- Covered storage area of (40m X 15m) for cement, fertilizer, wheat, rice, bajra, gram, pulses, cotton, wine, beverage, soft drink, paper products etc. Proposed roof truss details is given in Drg.No.RITES/TERMINAL/SHED-05 (Typical).

- Open storage area of 1896sqm for sand, stone, bricks, marble, iron–steel, light and heavy machinery, lime stone, Iron–copper, coal–firewood.

- Two lane access road of 5.000 km will be developed to connect the terminal with its hinterland District Paschim Champaran and Bagha-Bettiah road.

- In addition to the above, the terminal facilities cover, the present & future requirements of truck parking area, office building cum canteen, watchman shed. Also, the terminal requirements include lighting, drainage, fencing and gate.

The phased developmental plan is as follows:

	Base Year 2012-13	2025-26	2035-36
Pontoon(35m X 9m)	1 no.	2 nos.	3 nos.
Gangway(70m X 2.5m)	1 no.	2 nos.	3 nos.
Crane 5T capacity (10cycles/hr,18m outreach)	1 no.	1 no.	2 nos.
Dumper Truck	1 no.	3 nos.	5 nos.
Covered Storage (for bagged cargo)	40m X 15m	80m X 15m	130m X 15m
Open Storage (for bulk cargo)	1896sqm.	3970sqm.	7400 sqm.

The total area requirement for Bettiah Terminal is 64m X 39m in base year, 110m X 47m in 2025-26 and 170m X 55m in 2035-36. Future land will be procured in base year.

5.3.3.4 BAGAHA TERMINAL FACILITIES

Schematic Layout of IWT Terminal at Bagaha is given in Drg.No. RITES/BAGAHA/01. At this terminal, it is proposed to have four nos. pontoon to meet the traffic of 2012-13 and fifteen nos. pontoon to meet the projected traffic level in the period 2035-36.

In the proposed terminal site low water line is 40m away from the high bank. Pontoon has been proposed 70m from the high bank to reduce the approach gangway length.

Considering the design vessel of 100Tonnes, the total pontoon length required is 35m with width of 9m. Also, one approach gangway of 70m in length and 2.5m width, suitable for movement of material to & from the pontoon.

For loading/unloading operation, two nos. mobile crawler mounted cranes of 5 tonnes capacity, with hook and grab options suitable for handling bagged and bulk cargo. The maximum outreach required for this crane is 18m.

Details of Berthing Facilities of Bagaha Terminal at river Gandak is given in Drg.No. RITES/BAGAHA/02.

The facilities proposed at the terminal back-up area is the following:

- Covered storage area of (200m X 15m) for cement, fertilizer, wheat, rice, bajra, gram, pulses, cotton, wine, beverage, soft drink, paper products etc. Proposed roof truss details is given in Drg.No.RITES/TERMINAL/SHED-05 (Typical).

- Open storage area of 11396sqm for sand, stone, bricks, marble, iron–steel, light and heavy machinery, lime stone, Iron–copper, coal–firewood.

- Two lane access road of 3.000 km will be developed to connect the terminal with its hinterland District Paschim Champaran and Bagaha-Bettiah road.

In addition to the above, the terminal facilities cover, the present & future requirements of truck parking area, office building cum canteen, watchman shed. Also, the terminal requirements include lighting, drainage, fencing and gate.

The phased developmental plan is as follows:

	Base Year 2012-13	**2025-26**	**2035-36**
Pontoon (35m X 9m)	4 nos.	10 nos.	15 nos.
Gangway(70m X 2.5m)	4 nos.	10 no.	15 nos.
Crane 5T capacity (10cycles/hr,18m outreach)	2 nos.	5 nos.	9 nos.
Dumper Truck	5 nos.	12 nos.	20 nos.
Covered Storage (for bagged cargo)	200m X 15m	300m X 30m	400m X 30m
Open Storage (for bulk cargo)	11396 sqm.	21400 sqm.	42000 sqm.

The total area requirement for Bagaha Terminal is 244m X 59m in base year, 380m X 80m in 2025-26 and 540m X 100m in 2035-36. Future land will be procured in base year.

5.3.3.5 PATNA TERMINAL FACILITIES

Gaighat-IWAI terminal which is being presently operated by IWAI for water transport, will be used for these waterways.

5.4 SELECTION OF BERTHING STRUCTURE

5.4.1 GENERAL

Among the numerous structural forms and layout available for terminal planning, only few are convenient to handle the designated cargo efficiently at moderate investment levels, with distinct operational advantage.

The two possible alternative berthing structure considered in the evaluation are:

- Floating pontoon with access bridge.
- Open type structure (R.C.C deck with piles for berth and approaches).

5.4.2 FLOATING PONTOON

This alternative is generally the most cost-effective form of berthing facility that can be provided at inland water terminals with less water level variations. However, as this arrangement at best can be operated as a semi-mechanized facility with suitable loading/unloading equipment located on the pontoon, the movement of cargo to & from the pontoon through the access bridge will necessary have to be a manual operation. The entire loading/unloading operation being semi-mechanized will handle lower cargo volume per pontoon berth annually & consequently require larger number of pontoon berths for a given throughput.

Also, in terminal locations with large difference between the high and low water levels, the length of the access bridge becomes the limiting factor, considering the normal gradients that are necessary to be provided for manual working.

In view of the above limitations, this alternative of floating pontoon with access-bridge is considered further in planning the terminal facilities even though this arrangement does not influence the hydraulic regime in the river. Floating pontoon arrangement has been considered for terminals in Gandak river.

5.4.3 OPEN TYPE STRUCTURE (R.C.C. Berth & Approach Jetty on Piles)

This alternative provides many favourable features and can comply with the project requirements with minimal implications on environment and project economics.

The jetty head is located inside the river basin and is connected to the bank by approach. The R.C.C deck structure will be supported by RCC piles.

The connecting approaches are made of RCC deck supported on piles. The slender pile for the berth and approaches would not disturb the hydraulic regime in the proximity of the terminals because of the open type construction with a minimum blockage to the river flow.

5.5 DETAILS OF FLOATING PONTOON

Steel Gangway and Pontoon system has been proposed for the river Terminals.

5.5.1 PONTOON AND GANGWAY SYSTEM

The river being wide enough to allow unhindered navigation, floating pontoon with steel gangway type with berthing face parallel to the main stream has been adopted at terminal sites. The option of providing RCC jetty with couple mechanical – handling system was considered in view of its inherent technical superiority, however it has not been recommended because its cost is too prohibitive to be economically viable. Besides this water level fluctuation is approx. 5m. The berthing face has been taken up to the reported stable low water line with adequate water depth. Shore connection to the berth has been provided by an approach steel gangway with trestle. The length of approach however depends on the availability of low water line during the lean period. 35m X 9m steel pontoon has been considered for all terminal considering vessel specification and quantam of cargo. 2 nos.-35m X 2.5m i.e. 70m length of steel gangway have been considered for Bagha, Bettiah, Kalyanpur, Vaishali terminals.

5.6 DESIGN CRITERIA

Some suitable assumptions have been made from our previous survey report.

Soil parameters summarized below are as obtained from first hand information geo-technical investigations and are based on suitable assumption at the terminal location sites are used in the design of the civil structures.

Angle of internal friction (φ) in degrees	Cohesion Kg/cm^2	Bulk Density t/m^3
32	0.0	1.5

The following considerations made for terminals.

River current Velocity : 3.0 m/sec. (Mean)

Berthing Force : 100 Tonnes vessel approaching at a velocity of 0.45m/sec at an angle of 10° to Berth

Relevant Indian Standards viz. IS: 4651, IS: 456, IS: 800, IS: 875, IS: 1893, IS: 2911, IS: 5, IS: 6, IS: 78 etc have been followed in the design.

Typical cross section of the access road is shown in Drg. No.RITES/TERMINAL/03.

Typical Bank protection (stone pitching) for terminal area is shown in Drg No. RITES/TERMINAL/04.

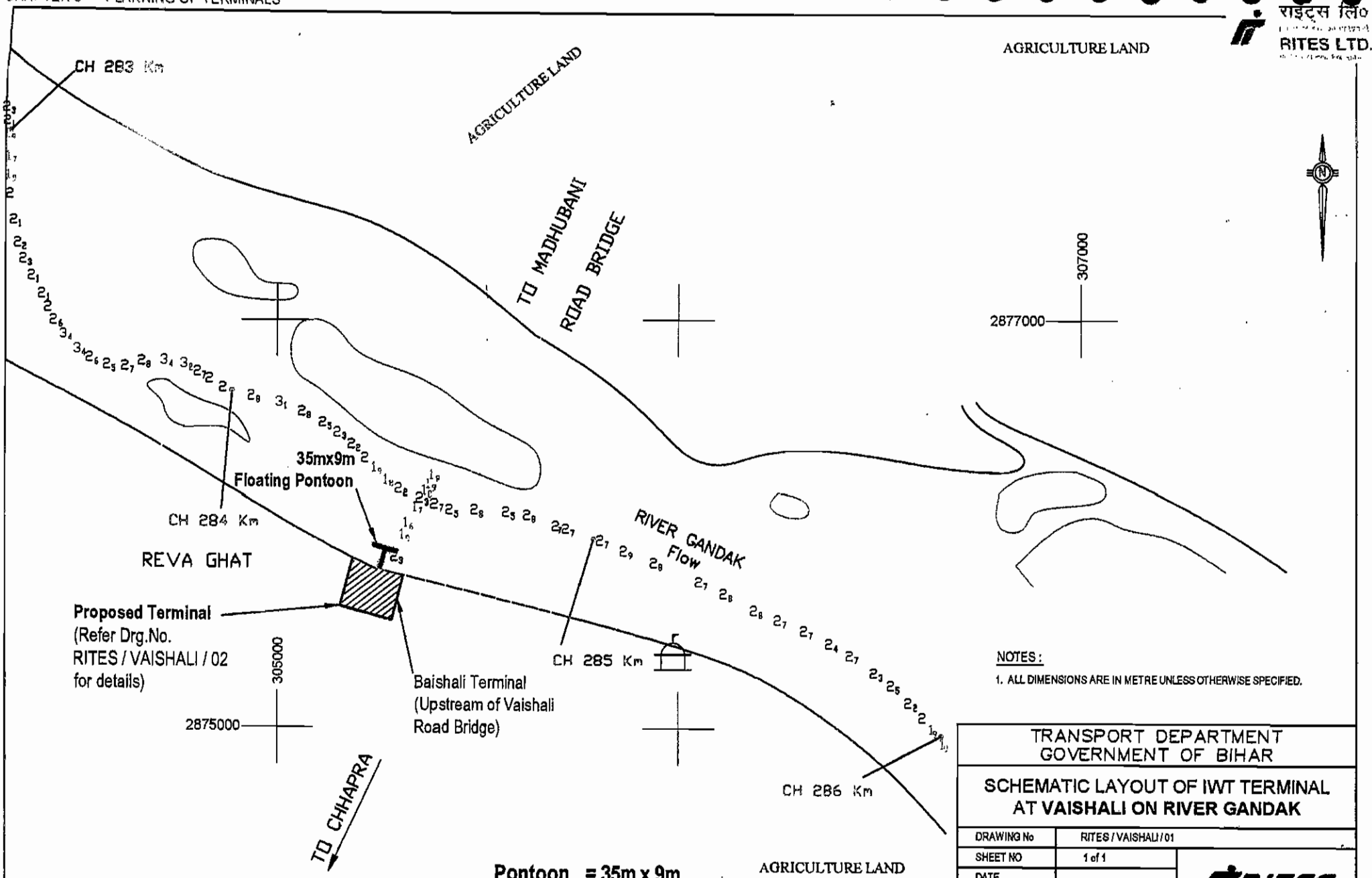
TABLE – 5.1 : PONTOON AND CRANE REQUIREMENTS

Terminal	2012-13		2035-36	
			←Additional→	
	No. of Pontoon	Crane Required Cycles/hour	No. of Pontoon	Crane Required Cycles/hour
Vaishali -Unloading -Loading	1	1 5T X 10C/hr	2	2 5T X 10 C/hr
Kalyanpur -Unloading -Loading	1	1 5T X 10C/hr	3	2 5T X 10 C/hr
Bettiah -Unloading -Loading	1	1 5T X 10C/hr	2	2 5T X 10 C/hr
Bagaha -Unloading -Loading	4	2 5T X 10C/hr	11	9 5T X 10 C/hr

TABLE 5.2

Manpower Requirements At Each Terminal in Base Year

S.No.	Item	No. of Personnel Required
1	Crane Operators	1
2	Fork lift Truck Operator	1
3	Pay loader Operator	1
4	Dumper Truck Operator	6
5	Electrical Supervisor	1
6	Weigh Bridge Operator	1
7	Maintenance Staff	
	-Mechanical	1
	-Electrical	1
	-Civil	2
	-Skilled	3
	-Unskilled	3
8	Office staff	
	-Terminal Manager/Supervisor	1
	-Clerical Staff	2
9	Security Staff	3
	TOTAL	**27**

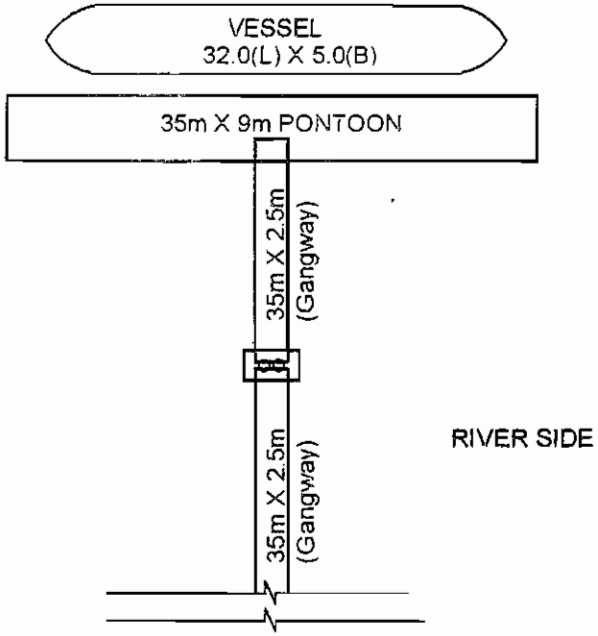


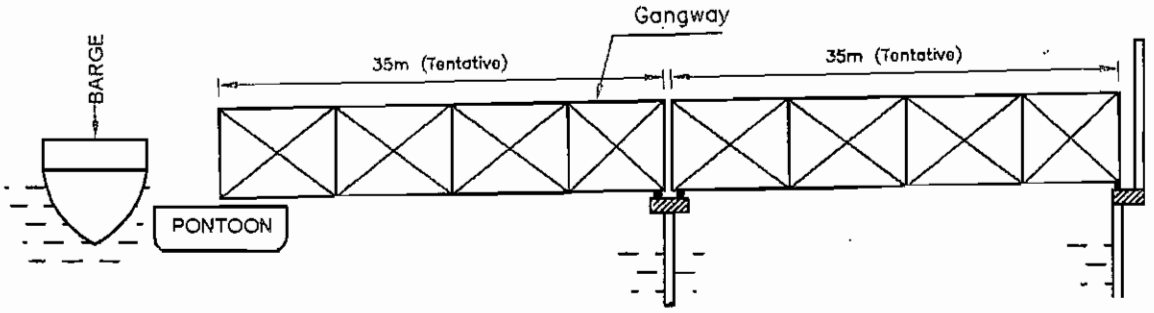
NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

TRANSPORT DEPARTMENT GOVERNMENT OF BIHAR	
SCHEMATIC LAYOUT OF IWT TERMINAL AT **VAISHALI ON RIVER GANDAK**	
DRAWING No	RITES / VAISHALI / 01
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 250M 500M

RITES THE INFRASTRUCTURE PEOPLE





SECTION

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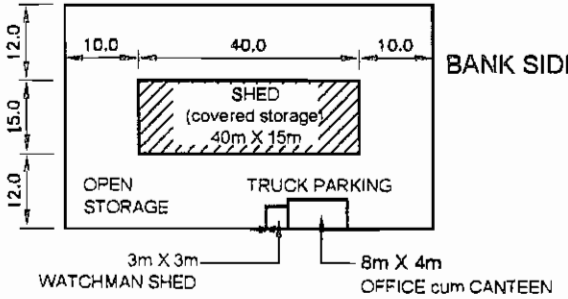


PLAN

(SCALE 1: 1000)

LEGEND :

(A) SHIP DESIGN SPECIFICATION

1. LENGTH OF VESSEL = 32.00mtr
2. BEAM (WIDTH OF SHIP) = 5.00mtr. (Approx)
3. DRAUGHT = 1.0mtr
4. CARGO CARRYING ~ 100 tons (D=1.0m)

(B) PONTOON AND GANGWAY SPECIFICATION

1. PONTOON = 35m (L) X 9m (W)
2. GANGWAY = 35m (L) X 2.5m (W) X 2Nos

NOTES :

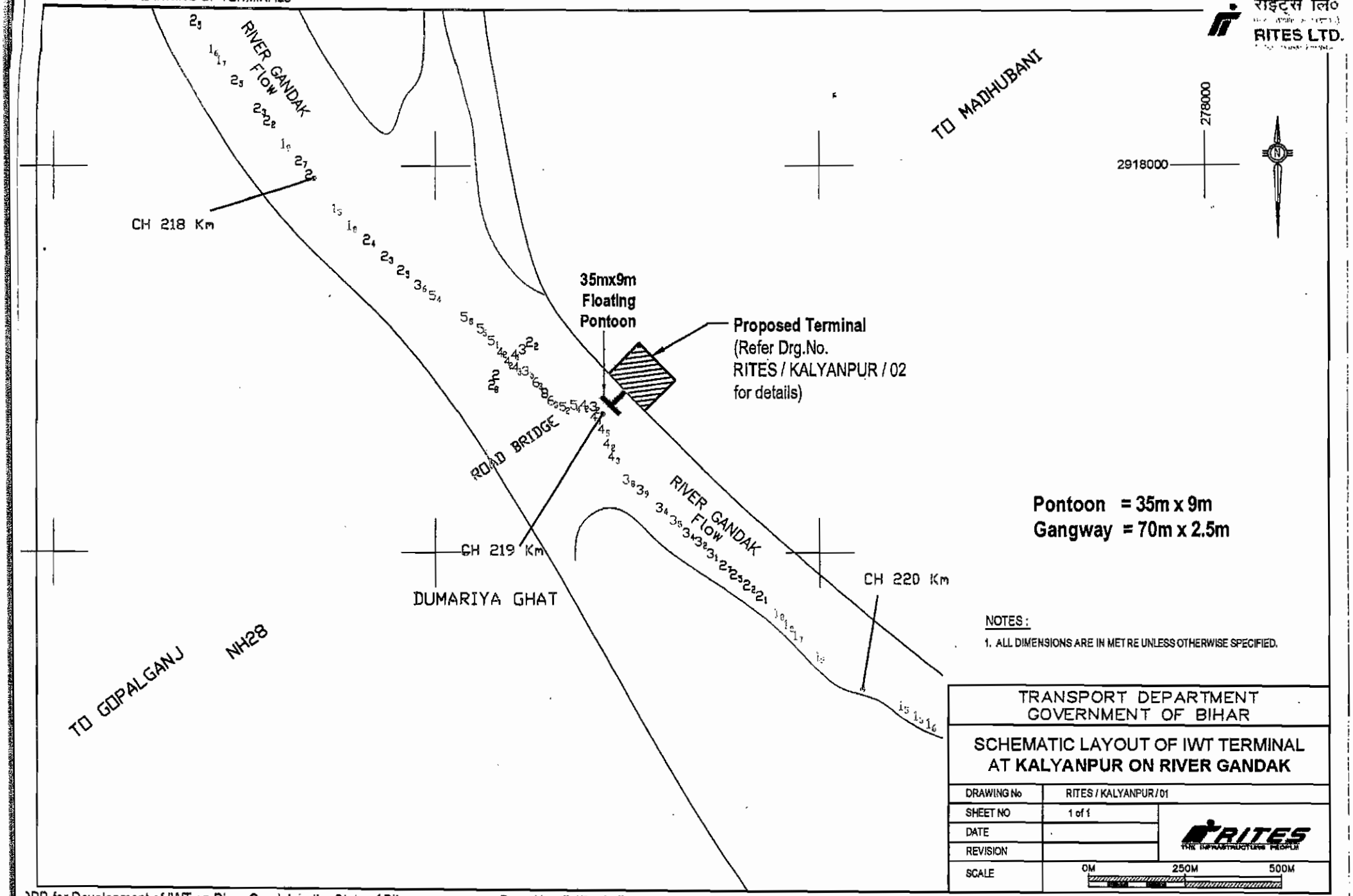
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

DETAILS OF BERTHING FACILITIES OF VAISHALI ON RIVER GANDAK

DRAWING No	RITES / VAISHALI / 02
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 25M 50M

RITES
THE INFRASTRUCTURE PEOPLE



NOTES :

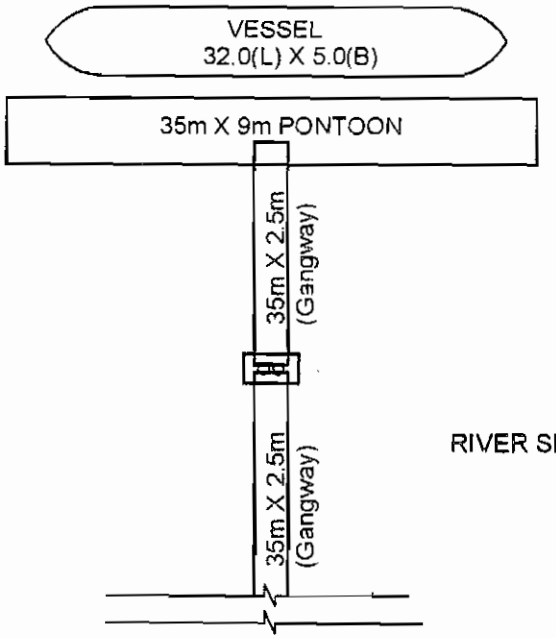
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

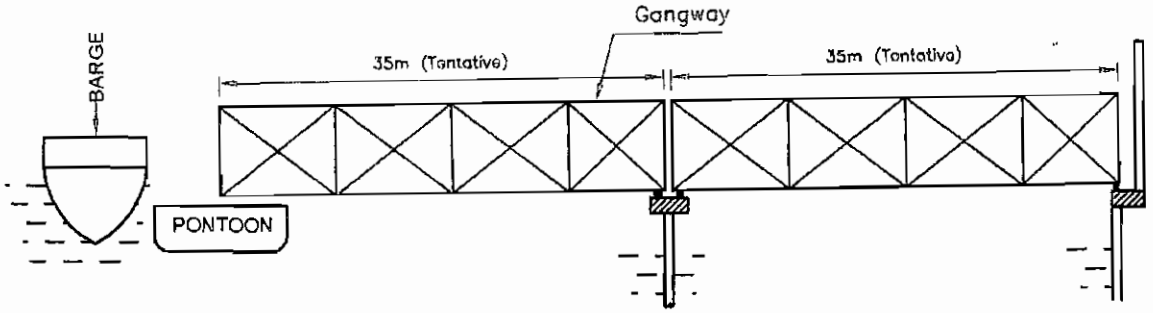
TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

SCHEMATIC LAYOUT OF IWT TERMINAL AT KALYANPUR ON RIVER GANDAK

DRAWING No	RITES / KALYANPUR / 01
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 250M 500M

RITES
THE INFRASTRUCTURE PEOPLE





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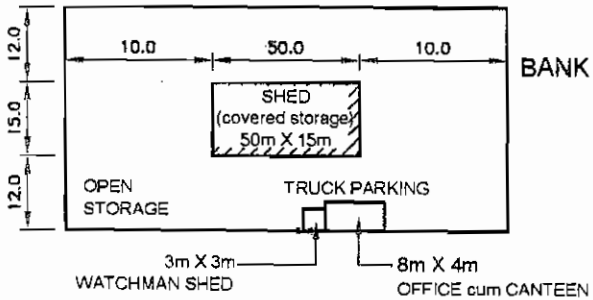


PLAN

(SCALE 1: 1000)

NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

LEGEND :

(A) SHIP DESIGN SPECIFICATION

1. LENGTH OF VESSEL	= 32.0mtr.
2. BEAM (WIDTH OF SHIP)	= 5.0mtr. (Approx)
3. DRAUGHT	= 1.0mtr.
4. CARGO CARRYING	~ 100 tons (D=1.0m)

(B) PONTOON AND GANGWAY SPECIFICATION

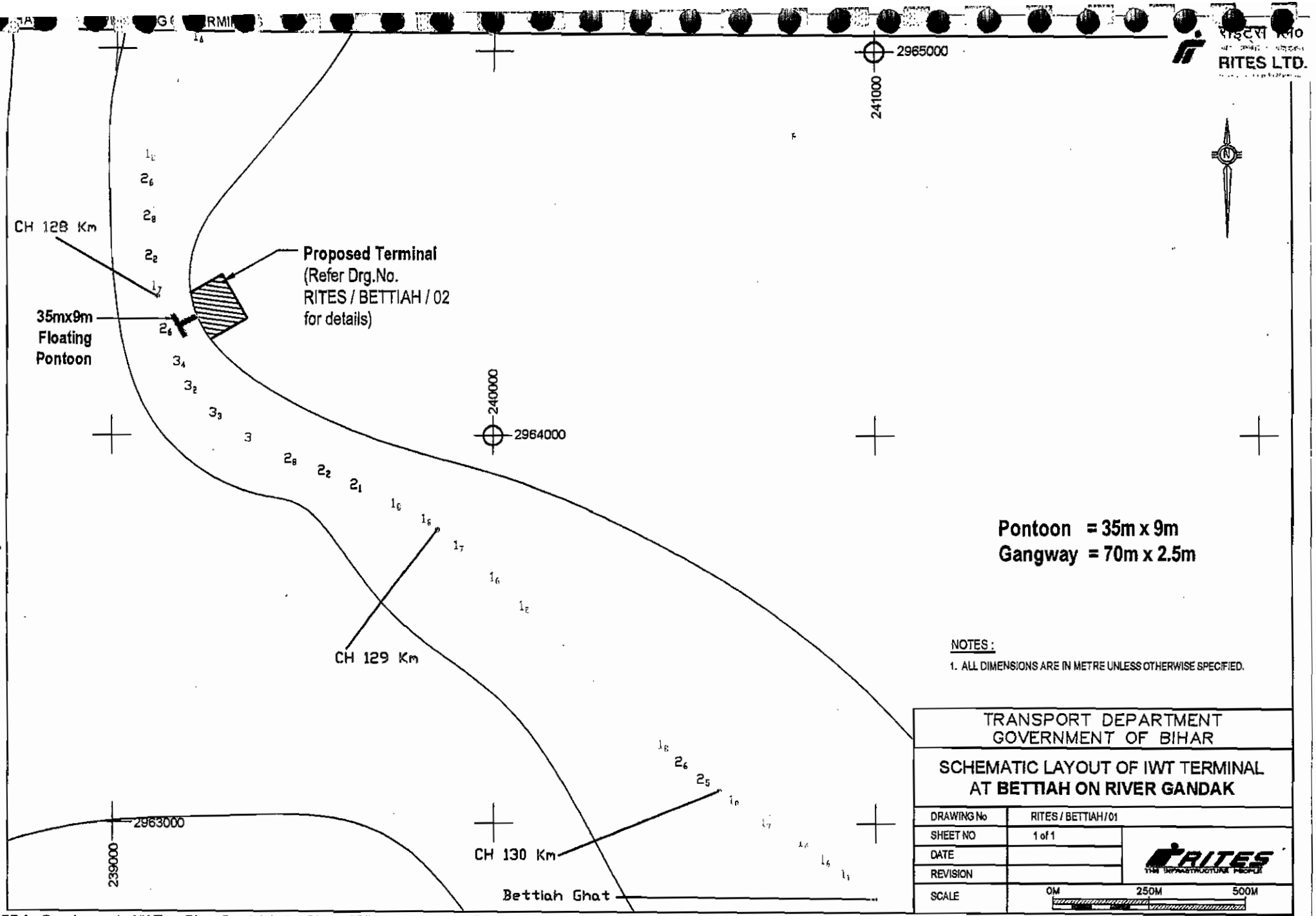
1. PONTOON	= 35m (L) X 9m (W)
2. GANGWAY	= 35m (L) X 2.5m (W) X 2Nos

TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

DETAILS OF BERTHING FACILITIES OF KALYANPUR ON RIVER GANDAK

DRAWING No	RITES /KALYANPUR / 02
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 25M 50M

RITES
THE INFRASTRUCTURE PEOPLE



NOTES :

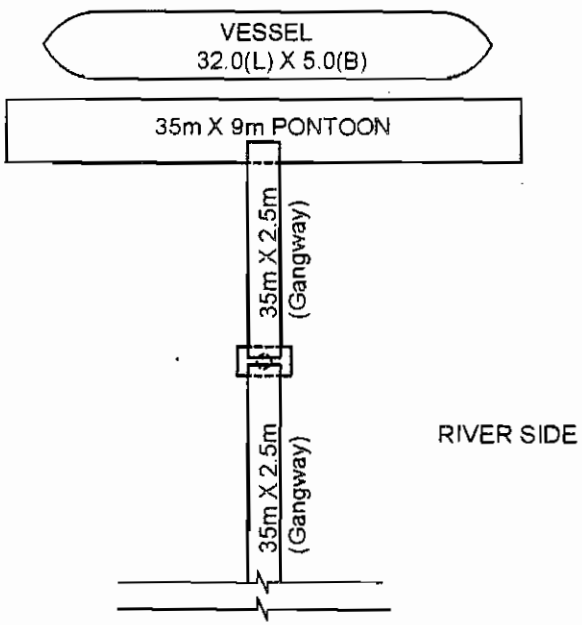
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

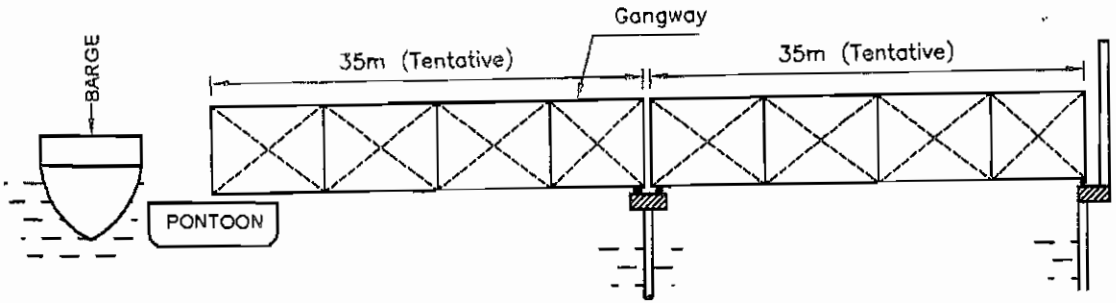
TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

SCHEMATIC LAYOUT OF IWT TERMINAL
AT **BETTIAH ON RIVER GANDAK**

DRAWING No	RITES / BETTIAH / 01
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 250M 500M

RITES
THE INFRASTRUCTURE PEOPLE





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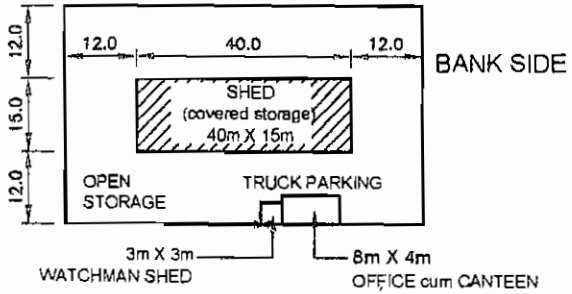


PLAN

(SCALE 1: 1000)

NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

LEGEND :

(A) SHIP DESIGN SPECIFICATION

1. LENGTH OF VESSEL	= 32.0mtr.
2. BEAM (WIDTH OF SHIP)	= 5.0mtr. (Approx)
3. DRAUGHT	= 1.0mtr.
4. CARGO CARRYING	~ 100 tons (D=1.0m)

(B) PONTOON AND GANGWAY SPECIFICATION

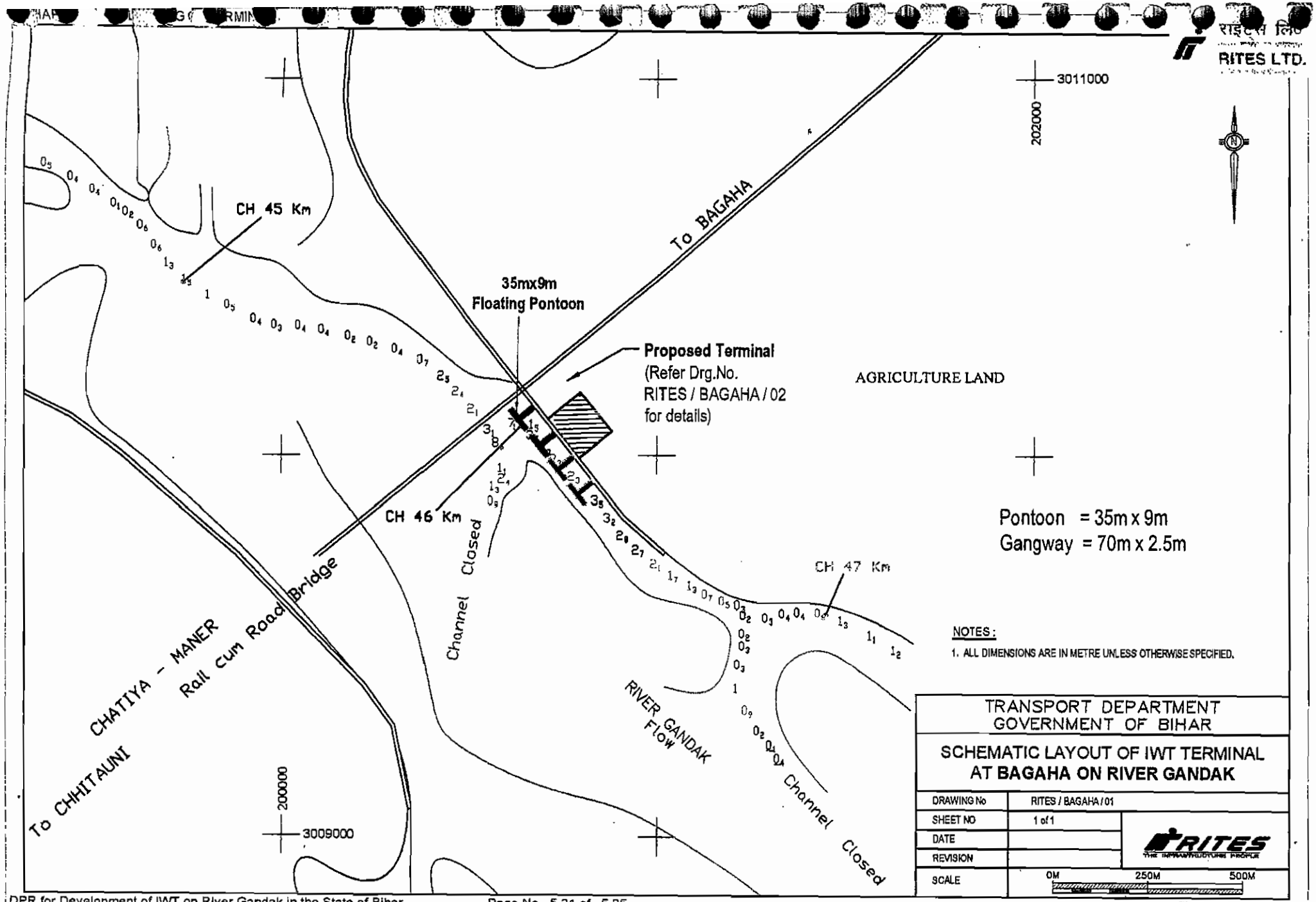
1. PONTOON	= 35m (L) X 9m (W)
2. GANGWAY	= 35m (L) X 2.5m (W) X 2Nos

TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

DETAILS OF BERTHING FACILITIES OF BETTIAH ON RIVER GANDAK

DRAWING No	RITES /BETTIAH / 02
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 25M 50M

RITES
THE INFRASTRUCTURE PEOPLE


RITES LTD.
3011000
202000
CH 45 Km
To BAGAHA
35mx9m
Floating Pontoon
Proposed Terminal
(Refer Drg.No.
RITES / BAGAHA / 02
for details)
AGRICULTURE LAND
CH 46 Km
Channel Closed
CH 47 Km
Pontoon = 35m x 9m
Gangway = 70m x 2.5m
CHATIYA - MANER
Rail cum Road Bridge
To CHHITAUNI
RIVER GANDAK
Flow
Channel Closed
200000
3009000
NOTES :
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.
TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR
SCHEMATIC LAYOUT OF IWT TERMINAL
AT BAGAHA ON RIVER GANDAK
DRAWING No
RITES / BAGAHA / 01
SHEET NO
1 of 1
DATE
REVISION
SCALE
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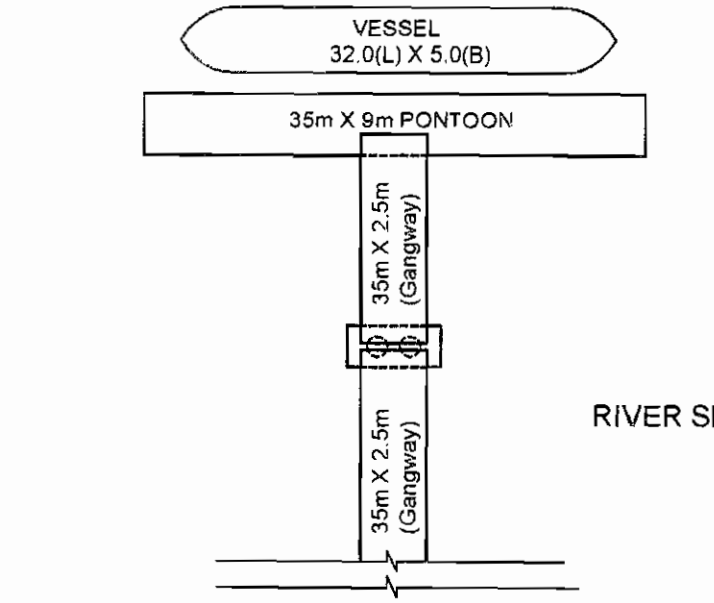
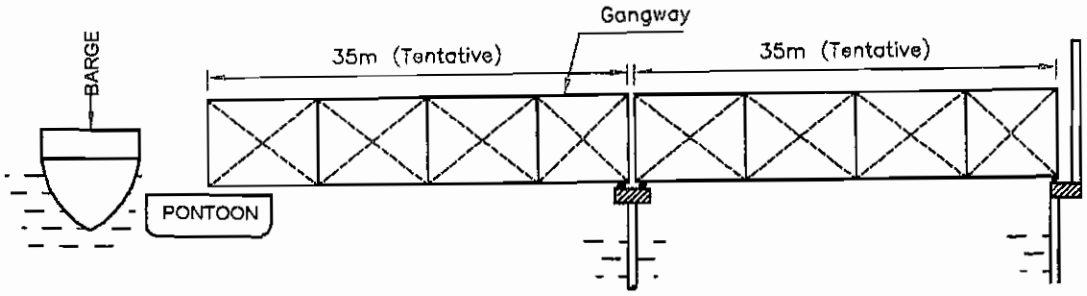


RIVER SIDE



SECTION

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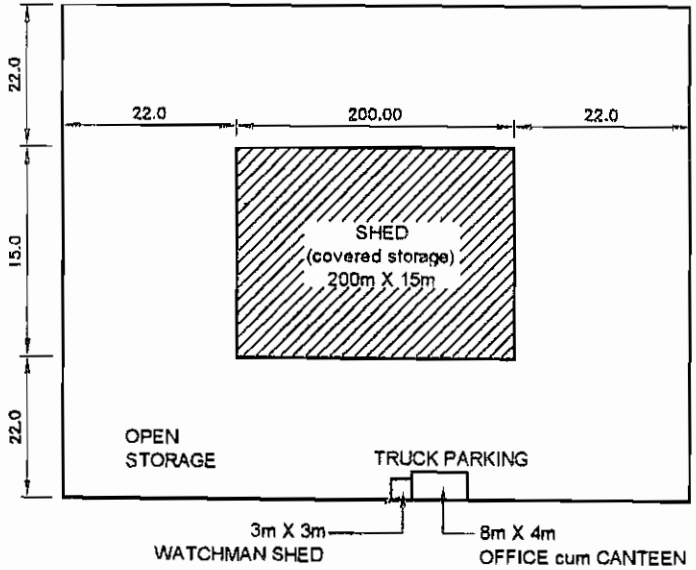


PLAN

(SCALE 1: 1000)

BANK SIDE

NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE SPECIFIED.

LEGEND :

(A) SHIP DESIGN SPECIFICATION

1. LENGTH OF VESSEL	=	32.0mtr
2. BEAM (WIDTH OF SHIP)	=	5.0mtr. (Approx)
3. DRAUGHT	=	1.0mtr.
4. CARGO CARRYING	~	100 tons (D=1.0m)

(B) PONTOON AND GANGWAY SPECIFICATION

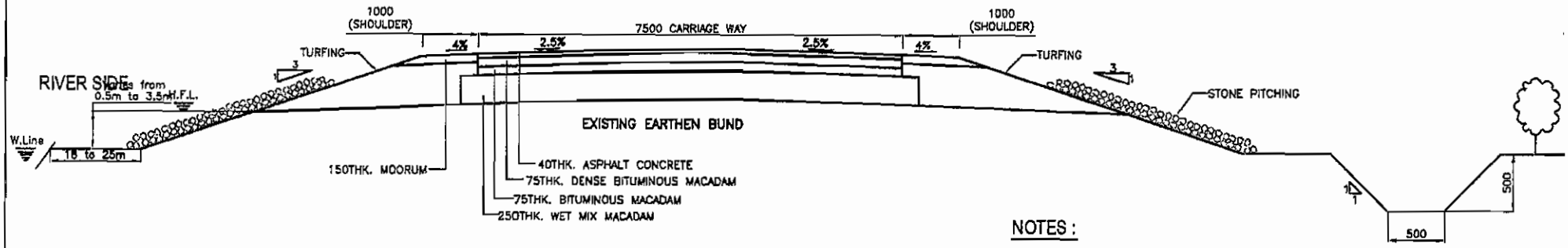
1. PONTOON	=	35m (L) X 9m (W)
2. GANGWAY	=	35m (L) X 2.5m (W) X 2Nos

TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

DETAILS OF BERTHING FACILITIES OF BAGAHA ON RIVER GANDAK

DRAWING No	RITES /BAGAHA /02
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0M 25M 50M

RITES
THE INFRASTRUCTURE PEOPLE

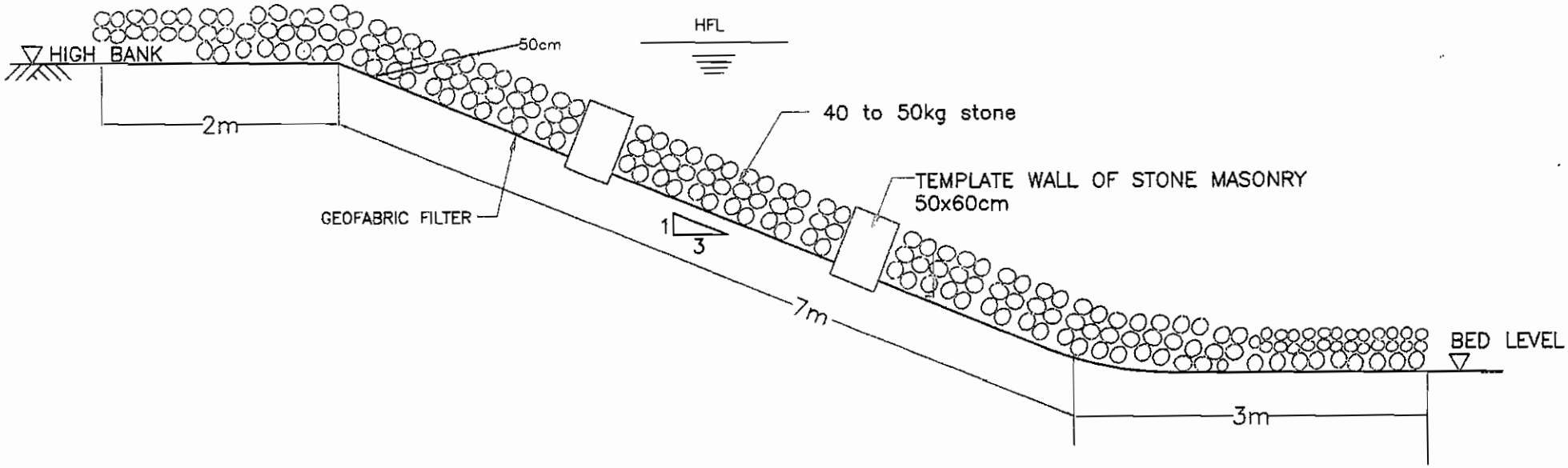


NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

TRANSPORT DEPARTMENT GOVERNMENT OF BIHAR		
TYPICAL CROSS SECTION OF ACCESS ROAD		
DRAWING No	RITES / TERMINAL / 03	
SHEET NO	1 of 1	RITES THE INFRASTRUCTURE PEOPLE
DATE		
REVISION		
SCALE	0mm 2500mm 5000mm	

राइट्स लि०
RITES LTD.



TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

BANK PROTECTION (STONE PITCHING)

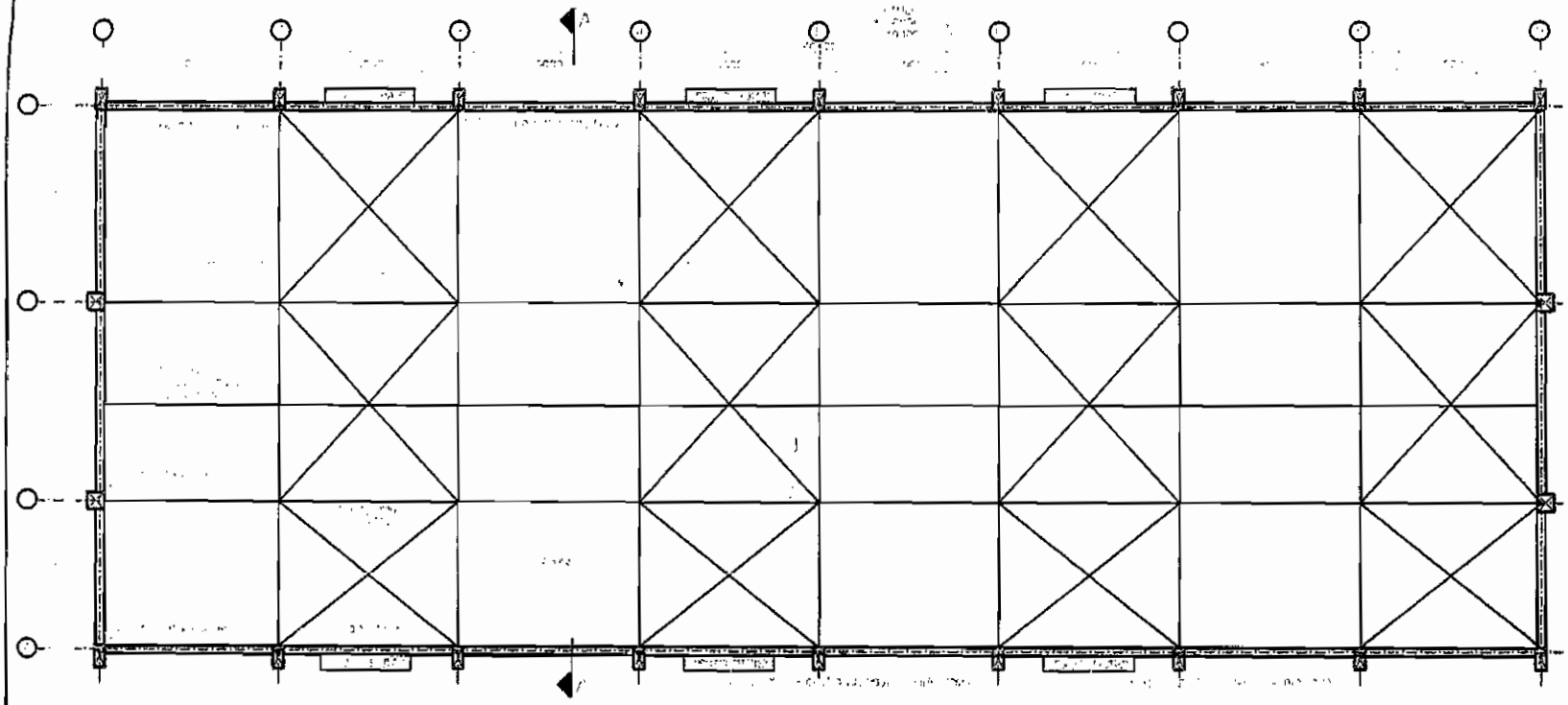
DRAWING No	RITES / TERMINAL / 04
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	

RITES
THE INFRASTRUCTURE PEOPLE

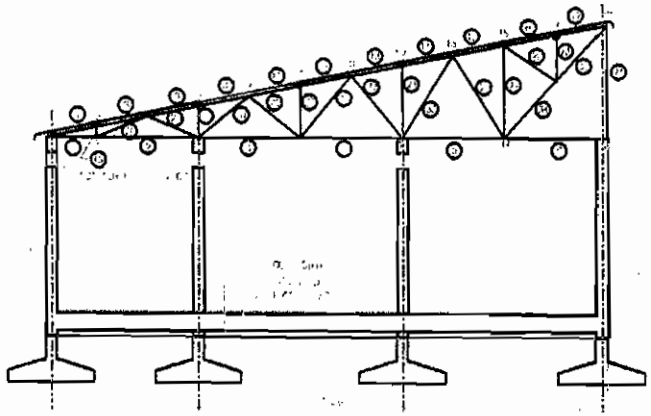
NOTES :

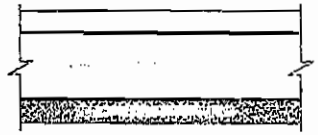
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

RITES LTD



TIE	1	100mm O.D. LIGHT TUBE
TIE	2	100mm O.D. LIGHT TUBE
TIE	3	100mm O.D. LIGHT TUBE
TIE	4	100mm O.D. LIGHT TUBE
TIE	5	80mm O.D. LIGHT TUBE
TIE	6	80mm O.D. LIGHT TUBE
RAFTER	7	100mm O.D. LIGHT TUBE
RAFTER	8	100mm O.D. LIGHT TUBE
RAFTER	9	100mm O.D. LIGHT TUBE
RAFTER	10	100mm O.D. LIGHT TUBE
RAFTER	11	100mm O.D. LIGHT TUBE
RAFTER	12	100mm O.D. LIGHT TUBE
RAFTER	13	100mm O.D. LIGHT TUBE
RAFTER	14	50mm O.D. LIGHT TUBE
RAFTER	15	50mm O.D. LIGHT TUBE
RAFTER	16	50mm O.D. LIGHT TUBE
RAFTER	17	50mm O.D. LIGHT TUBE
WEB	18	25mm O.D. LIGHT TUBE
WEB	19	20mm O.D. MEDIUM TUBE
WEB	20	20mm O.D. MEDIUM TUBE
WEB	21	25mm O.D. LIGHT TUBE
WEB	22	32mm O.D. LIGHT TUBE
WEB	23	20mm O.D. MEDIUM TUBE
WEB	24	50mm O.D. LIGHT TUBE
WEB	25	32mm O.D. LIGHT TUBE
WEB	26	32mm O.D. LIGHT TUBE
WEB	27	32mm O.D. LIGHT TUBE
WEB	28	50mm O.D. LIGHT TUBE
WEB	29	20mm O.D. MEDIUM TUBE
WEB	30	32mm O.D. LIGHT TUBE
WEB	31	25mm O.D. LIGHT TUBE
WEB	32	32mm O.D. LIGHT TUBE
WEB	33	40mm O.D. LIGHT TUBE
WEB	34	65mm O.D. LIGHT TUBE
WEB	35	65mm O.D. LIGHT TUBE





TRANSPORT DEPARTMENT
GOVERNMENT OF BIHAR

STORAGE SHED - ROOF TRUSS DETAILS
(15 m SPAN)

DRAWING No	RITES / TERMINALS / SHED-05
SHEET NO	1 of 1
DATE	
REVISION	
SCALE	0mm 2500mm 5000mm

CHAPTER - 6

PROJECT COST

CHAPTER – 6

PROJECT COST

6.1 INTRODUCTION

The project cost estimates for development of the Inland Water Transport system as well as for maintenance of the system have been worked out. The cost estimates for development of the system are termed as capital cost while for operation of the system is termed as maintenance or operating cost.

6.2 CAPITAL COSTS

The capital costs have been worked out primarily for development of the following system components:

6.2.1 DEVELOPMENT OF THE WATERWAY

Capital dredging has been envisaged initially since adequate depths are not available for round the year navigation and river was silted up over the years. Since siltation is a recurring phenomenon, a provision has been made in the operating cost for maintenance of the channel. Besides, the dredged channel is required to be identified with channel marking. Aids to navigation are also required for smooth and safe sailing of the vessel. The capital costs to procure equipment for aids to navigation and channel markers have been worked out besides maintenance cost for the items.

6.2.2 CONSTRUCTION OF IWT TERMINALS

Under this item all capital cost towards construction of terminals for berthing of vessels and loading and unloading cargo handling equipment into vessels and other costs such as land acquisition, surfacing and ground leveling, gate / fencing, wharf / berthing, office, workshop, roads and payments, water supply, sewerage, firefighting, electrical , telecommunication etc. are considered.

6.3 OPERATING COSTS

The cost estimate for operating the system is essential to run the system developed. The operating or maintenance cost of the systems has also two components.

6.3.1 OPERATING COST OF WATERWAY

The maintenance cost of waterway for various items of work like dredging / desiltation, bank protection, fencing, brushwood turfing, channel markers and aids to navigation equipment.

6.3.2 OPERATING COST OF IWT TERMINALS

The terminals operating costs have been worked out based on certain standard percentage of capital costs in respect of civil works, mechanical works, electrical works, man power and fuel.

6.4 BASIS OF COSTS

The basis of cost estimates worked out is as follows:

- The standard schedule of rates for various works of Government of Bihar.
- The consultants experience on various projects sites proximity to the project area.
- Local enquiries at the time of conducting surveys.
- Market surveys and enquiries.
- Judgement based on consultants experience.

6.5 PROJECT SCHEDULE

The time schedule for construction activities of the project is considered as three years. The capital cost of the project will be incurred in phases during the construction period. Accordingly the phasing of the expenditure has been worked out and used in the cost benefit analysis. The annual maintenance cost will start after completion of the construction period.

COST OF TERMINALS

TABLE – 6.1 INLAND WATER TERMINAL AT VAISHALI

CAPITAL COSTS 2012-13: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	1 no.	110 lakhs	110.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	1 no.	100 lakhs	100.00
3	Retaining Wall (For Gangway on the ground portion)	1 no.	60 lakhs	60.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	1 no.	90 lakhs	90.00
5	Fork lift Trucks (3 T Capacity)	1 no.	10 lakhs	10.00
6	Pay loaders	-	30 lakhs	0
7	Dumper Trucks	1 no.	30 lakhs	30.00
8	Covered Storage Shed (for bagged cargo)	40m X 15m	15000/ Sq.m.	90.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	1740 sqm	2500 / Sq.m	43.50
10	Reclamation of storage area	2340sqm X 4m X 1.2	180 / Cu.m	20.21
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9075 sqm	2500 /sqm	226.87
20	Access Road	5000m	17500/m	875.00
			TOTAL	**1808.01**
			Detailed Engineering 2%	**36.16**
			Construction Supervision 8%	**147.53**
			Total Capital Cost	**1991.70**

Table – 6.1(a)

Gangway – Pontoon:

			Amount (Rs. in lakhs)
A. Pontoon – 1 (new) @ (35m X 9m)		=	1 X 40 = 40.0
35% Escalation		=	14.0
In year 2000	**Total**	=	54.0
In year 2012 = 54.0 X $(1.05)^{12}$		=	97.0
			Say, **110.0 lakhs**
B. Gangway – 1 (new) @ (43.5m X 2.5m)		=	1 X 20 = 20.0
35% Escalation		=	7.0
In year 2000	**Total**	=	27.0
In year 2012 = 27.0 X $(1.05)^{12}$		=	48.0
			Say, **60.0 lakhs**

For (70m X 2.5m) walkway @ 35m each 2 nos. gangway

$$= 60 \times \frac{(70 \times 2.5)}{(43.5 \times 2.5)}$$

= 96.55 lakh

Say, **100.0 lakhs**

TABLE – 6.1(i) INLAND WATER TERMINAL AT VAISHALI

CAPITAL COSTS 2025-26: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	2 nos.	110 lakhs	220.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	2 nos.	100 lakhs	200.00
3	Retaining Wall (For Gangway on the ground portion)	2 nos.	60 lakhs	120.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	2 nos.	90 lakhs	180.00
5	Fork lift Trucks (3 T Capacity)	2 nos.	10 lakhs	20.00
6	Pay loaders	1 no.	30 lakhs	30.00
7	Dumper Trucks	3 nos.	30 lakhs	90.00
8	Covered Storage Shed (for bagged cargo)	80m X 15m	15000/ Sq.m.	180.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	3750 sqm	2500 / Sq.m	93.75
10	Reclamation of storage area	4950sqm X 4m X 1.2	180 / Cu.m	42.76
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9075sqm	2500 / sqm	226.87
20	Access Road	5000m	17500/m	875.00
TOTAL				**2430.81**
Detailed Engineering 2%				**48.62**
Construction Supervision 8%				**198.35**
Total Capital Cost				**2677.78**

TABLE-6.1(ii) INLAND WATER TERMINAL AT VAISHALI

CAPITAL COSTS 2035-36: **(In Rs. lakhs)**

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	3 nos.	110 lakhs	330.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	3 nos.	100 lakhs	300.00
3	Retaining Wall (For Gangway on the ground portion)	3 nos.	60 lakhs	180.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	2 nos.	90 lakhs	180.00
5	Fork lift Trucks (3 T Capacity)	2 nos.	10 lakhs	20.00
6	Pay loaders	2 nos.	30 lakhs	60.00
7	Dumper Trucks	5 nos.	30 lakhs	150.00
8	Covered Storage Shed (for bagged cargo)	125m X 15m	15000/ Sq.m.	281.25
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	7200 sqm	2500 / Sq.m	180.00
10	Reclamation of storage area	9075sqm X 4m X 1.2	180 / Cu.m	78.40
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9075sqm	2500 / sqm	226.87
20	Access Road	5000m	17500/m	875.00
			TOTAL	**3013.95**
			Detailed Engineering 2%	**60.28**
			Construction Supervision 8%	**245.94**
			Total Capital Cost	**3320.17**

TABLE – 6.2 INLAND WATER TERMINAL AT KALYANPUR

CAPITAL COSTS 2012-13: **(In Rs. lakhs)**

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	1 no.	110 lakhs	110.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	1 no.	100 lakhs	100.00
3	Retaining Wall (For Gangway on the ground portion)	1 no.	60 lakhs	60.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	1 no.	90 lakhs	90.00
5	Fork lift Trucks (3 T Capacity)	1 no.	10 lakhs	10.00
6	Pay loaders	1 no.	30 lakhs	30.00
7	Dumper Trucks	1 no.	30 lakhs	30.00
8	Covered Storage Shed (for bagged cargo)	50m X 15m	15000/ Sq.m.	112.50
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	1980 sqm	2500 / Sq.m	49.50
10	Reclamation of storage area	5850sqm X 4m X 1.2	180 / Cu.m	50.54
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	11000 sqm	2000 /sqm	220.00
20	Access Road	7000m	17500/m	1225.00
			TOTAL	**2239.97**
			Detailed Engineering 2%	**44.80**
			Construction Supervision 8%	**182.78**
			Total Capital Cost	**2467.55**

TABLE-6.2(i) INLAND WATER TERMINAL AT KALYANPUR

CAPITAL COSTS 2025-26: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	2 nos.	110 lakhs	220.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	2 nos.	100 lakhs	200.00
3	Retaining Wall (For Gangway on the ground portion)	2 nos.	60 lakhs	120.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	1 no.	90 lakhs	90.00
5	Fork lift Trucks (3 T Capacity)	1 no.	10 lakhs	10.00
6	Pay loaders	1 no.	30 lakhs	30.00
7	Dumper Trucks	3 nos.	30 lakhs	90.00
8	Covered Storage Shed (for bagged cargo)	90m X 15m	15000/ Sq.m.	202.50
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	4500 sqm	2500 / Sq.m	112.50
10	Reclamation of storage area	5850sqm X 4m X 1.2	180 / Cu.m	50.54
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	11000sqm	2000/sqm	220.00
20	Access Road	7000m	17500/m	1225.00
			TOTAL	**2722.97**
			Detailed Engineering 2%	**54.46**
			Construction Supervision 8%	**222.19**
			Total Capital Cost	**2999.62**

TABLE – 6.2(ii) INLAND WATER TERMINAL AT KALYANPUR

CAPITAL COSTS 2035-36: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	4 nos.	110 lakhs	440.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	4 nos.	100 lakhs	400.00
3	Retaining Wall (For Gangway on the ground portion)	4 nos.	60 lakhs	240.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	2 nos.	90 lakhs	180.00
5	Fork lift Trucks (3 T Capacity)	2 nos.	10 lakhs	20.00
6	Pay loaders	2 nos.	30 lakhs	60.00
7	Dumper Trucks	5 nos.	30 lakhs	150.00
8	Covered Storage Shed (for bagged cargo)	150m X 15m	15000/ Sq.m.	337.50
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	8750 sqm	2500 / Sq.m	218.75
10	Reclamation of storage area	11000sqm X 4m X 1.2	180 / Cu.m	95.04
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	11000sqm	2000 / sqm	220.00
20	Access Road	7000m	17500/m	1225.00
			TOTAL	**3738.72**
			Detailed Engineering 2%	**74.77**
			Construction Supervision 8%	**305.08**
			Total Capital Cost	**4118.57**

TABLE – 6.3 INLAND WATER TERMINAL AT BETTIAH

CAPITAL COSTS 2012-13: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	1 no.	110 lakhs	110.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	1 no.	100 lakhs	100.00
3	Retaining Wall (For Gangway on the ground portion)	1 no.	60 lakhs	60.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	1 no.	90 lakhs	90.00
5	Fork lift Trucks (3 T Capacity)	1 no.	10 lakhs	10.00
6	Pay loaders	1 no.	30 lakhs	30.00
7	Dumper Trucks	1 no.	30 lakhs	30.00
8	Covered Storage Shed (for bagged cargo)	40m X 15m	15000/ Sq.m.	90.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	1896 sqm	2500 / Sq.m	47.40
10	Reclamation of storage area	2496sqm X 4m X 1.2	180 / Cu.m	21.56
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9350sqm	2000/sqm	187.00
20	Access Road	5000m	17500/m	875.00
			TOTAL	**1803.39**
			Detailed Engineering 2%	**36.07**
			Construction Supervision 8%	**147.16**
			Total Capital Cost	**1986.62**

TABLE – 6.3(i) INLAND WATER TERMINAL AT BETTIAH

CAPITAL COSTS 2025-26: **(In Rs. lakhs)**

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	2 nos.	110 lakhs	220.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	2 nos.	100 lakhs	200.00
3	Retaining Wall (For Gangway on the ground portion)	2 nos.	60 lakhs	120.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	1 no.	90 lakhs	90.00
5	Fork lift Trucks (3 T Capacity)	1 no.	10 lakhs	10.00
6	Pay loaders	1 no.	30 lakhs	30.00
7	Dumper Trucks	3 nos.	30 lakhs	90.00
8	Covered Storage Shed (for bagged cargo)	80m X 15m	15000/ Sq.m.	180.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	3970 sqm	2500 / Sq.m	99.25
10	Reclamation of storage area	5170sqm X 4m X 1.2	180 / Cu.m	44.66
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9350sqm	2000 /sqm	187.00
20	Access Road	5000m	17500/m	875.00
			TOTAL	**2298.34**
			Detailed Engineering 2%	**45.97**
			Construction Supervision 8%	**187.54**
			Total Capital Cost	**2531.85**

TABLE – 6.3(ii) INLAND WATER TERMINAL AT BETTIAH

CAPITAL COSTS 2035-36: **(In Rs. lakhs)**

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	3 nos.	110 lakhs	330.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	3 nos.	100 lakhs	300.00
3	Retaining Wall (For Gangway on the ground portion)	3 nos.	60 lakhs	180.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	2 nos.	90 lakhs	180.00
5	Fork lift Trucks (3 T Capacity)	2 nos.	10 lakhs	20.00
6	Pay loaders	2 nos.	30 lakhs	60.00
7	Dumper Trucks	5 nos.	30 lakhs	150.00
8	Covered Storage Shed (for bagged cargo)	130m X 15m	15000/ Sq.m.	292.50
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	7400 sqm	2500 / Sq.m	185.00
10	Reclamation of storage area	9350sqm X 4m X 1.2	180 / Cu.m	80.78
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	9350sqm	2000/sqm	187.00
20	Access Road	5000m	17500/m	875.00
			TOTAL	**2992.71**
			Detailed Engineering 2%	**59.85**
			Construction Supervision 8%	**244.20**
			Total Capital Cost	**3296.76**

TABLE – 6.4 INLAND WATER TERMINAL AT BAGAHA

CAPITAL COSTS 2012-13: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	4 nos.	110 lakhs	440.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	4 nos.	100 lakhs	400.00
3	Retaining Wall (For Gangway on the ground portion)	4 nos.	60 lakhs	240.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	2 nos.	90 lakhs	180.00
5	Fork lift Trucks (3 T Capacity)	2 nos.	10 lakhs	20.00
6	Pay loaders	2 nos.	30 lakhs	60.00
7	Dumper Trucks	5 nos.	30 lakhs	150.00
8	Covered Storage Shed (for bagged cargo)	200m X 15m	15000/ Sq.m.	450.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	11396 sqm	2500 / Sq.m	284.90
10	Reclamation of storage area	14396sqm X 4m X 1.2	180 / Cu.m	124.38
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	54000sqm	2000/sqm	1080.00
20	Access Road	3000m	17500/m	525.00
			TOTAL	**4106.71**
			Detailed Engineering 2%	**82.13**
			Construction Supervision 8%	**335.11**
			Total Capital Cost	**4523.95**

TABLE – 6.4(i) INLAND WATER TERMINAL AT BAGAHA

CAPITAL COSTS 2025-26: (In Rs. lakhs)

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	10 nos.	110 lakhs	1100.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	10 nos.	100 lakhs	1000.00
3	Retaining Wall (For Gangway on the ground portion)	10 nos.	60 lakhs	600.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	5 nos.	90 lakhs	450.00
5	Fork lift Trucks (3 T Capacity)	4 nos.	10 lakhs	40.00
6	Pay loaders	3 nos.	30 lakhs	90.00
7	Dumper Trucks	12 nos.	30 lakhs	360.00
8	Covered Storage Shed (for bagged cargo)	300m X 30m	15000/ Sq.m.	1350.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	21400 sqm	2500 / Sq.m	535.00
10	Reclamation of storage area	30400sqm X 4m X 1.2	180 / Cu.m	262.65
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1 no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	54000sqm	2000/sqm	1080.00
20	Access Road	3000m	17500/m	525.00
			TOTAL	**7545.08**
			Detailed Engineering 2%	**150.90**
			Construction Supervision 8%	**615.68**
			Total Capital Cost	**8311.66**

TABLE – 6.4(ii) INLAND WATER TERMINAL AT BAGAHA

CAPITAL COSTS 2035-36: **(In Rs. lakhs)**

Sl. No.	Item	Quantity	Unit Rate	Amount
1	Floating Pontoon (35m X 9m)	15 nos.	110 lakhs	1650.00
2	Approach Gangway 2 nos. @ (35m X 2.5m)	15 nos.	100 lakhs	1500.00
3	Retaining Wall (For Gangway on the ground portion)	15 nos.	60 lakhs	900.00
4	Cranes 5T Capacity (10cycles/hr,18m outreach)	9 nos.	90 lakhs	810.00
5	Fork lift Trucks (3 T Capacity)	7 nos.	10 lakhs	70.00
6	Pay loaders	6 nos.	30 lakhs	180.00
7	Dumper Trucks	20 nos.	30 lakhs	600.00
8	Covered Storage Shed (for bagged cargo)	400m X 30m	15000/ Sq.m.	1800.00
9	Open Storage Area (for building material, steel, and timber) including Truck Parking Area.	42000 sqm	2500 / Sq.m	1050.00
10	Reclamation of storage area	54000sqm X 4m X 1.2	180 / Cu.m	466.56
11	Office Building	8m X 4m	15000 / Sq.m	4.80
12	Weigh Bridges	1no.	15 lakhs	15.00
13	Watch and Ward	3m X 3m	7000 / Sq.m	0.63
14	Internal Roads		L.S.	20.00
15	Security Fencing (2m high)		L.S.	12.00
16	Water Supply and Drainage		L.S.	20.00
17	Fire fighting Arrangement		L.S.	10.00
18	Electrical System including Terminal Lighting		L.S.	70.00
19	Land Cost	54000sqm	2000 / sqm	1080.00
20	Access Road	3000m	17500/m	525.00
			TOTAL	**10783.99**
			Detailed Engineering 2%	**215.68**
			Construction Supervision 8%	**879.97**
			Total Capital Cost	**11879.64**

TABLE – 6.5

Vaishali Terminal Facilities – Annual Operating Requirements

2012-13: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	32.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 27.32 10.50 3.20
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	123.42
6.	Annual throughput in tonnes	177277
7.	Unit cost / tonne in Rs.	69.62

2025-26: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	38.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 35.98 17.70 8.80
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	150.88
6.	Annual throughput in tonnes	378119
7.	Unit cost / tonne in Rs.	39.90

2035-36: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	42.00
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 45.84 19.50 13.60
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	170.94
6.	Annual throughput in tonnes	677154
7.	Unit cost / tonne in Rs.	25.24

TABLE – 6.6

Kalyanpur Terminal Facilities – Annual Operating Requirements

2012-13: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	32.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 35.50 12.30 3.20
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	133.40
6.	Annual throughput in tonnes	209041
7.	Unit cost / tonne in Rs.	63.82

2025-26: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	34.80
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 43.96 12.30 8.00
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	149.06
6.	Annual throughput in tonnes	445869
7.	Unit cost / tonne in Rs.	33.43

2035-36: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	40.80
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 60.47 19.50 13.60
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	184.37
6.	Annual throughput in tonnes	798484
7.	Unit cost / tonne in Rs.	23.09

TABLE – 6.7
Bettiah Terminal Facilities – Annual Operating Requirements

2012-13: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	32.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 27.43 12.30 3.20
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	125.33
6.	Annual throughput in tonnes	181999
7.	Unit cost / tonne in Rs.	68.86

2025-26: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	34.80
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 36.13 12.30 8.00
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	141.23
6.	Annual throughput in tonnes	388190
7.	Unit cost / tonne in Rs.	36.38

2035-36: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	40.80
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 46.21 19.50 13.60
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	170.11
6.	Annual throughput in tonnes	695189
7.	Unit cost / tonne in Rs.	24.47

TABLE – 6.8
Bagaha Terminal Facilities – Annual Operating Requirements

2012-13: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	32.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 50.63 19.50 13.60
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	166.13
6.	Annual throughput in tonnes	1070530
7.	Unit cost / tonne in Rs.	15.52

2025-26: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	48.00
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 108.80 37.50 32.00
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	276.30
6.	Annual throughput in tonnes	2283364
7.	Unit cost / tonne in Rs.	12.10

2035-36: **(In Rs. Lakhs)**

Sl. No.	Item	Amount
1.	Man Power cost	56.40
2.	O & M cost -Civil works (2%) -Mech. & Elec. Eqpt. (6%) -Transportation Eqpt.(8%)	 159.18 64.50 53.60
3.	Power cost	5.0
4.	Fuel cost	45.0
5.	Total Operating cost	383.68
6.	Annual throughput in tonnes	4089157
7.	Unit cost / tonne in Rs.	9.38

Note : (i) Av. Man power cost considered as Rs. 1,20,000 per annum per personnel.

(ii) Annual maintenance cost considered are
- For civil works : 2% of Installation Cost.
- For mech & elec works : 6% of Installation Cost.
- For Transportation eqpt : 8% of Installation Cost.

(iii) Cost of Rs. 5/Kwh is considered for power.

(iv) Cost of fuel considered as Rs.45/litre.

6.6 CAPITAL AND OPERATING COST OF WATERWAY DEVELOPMENT

Table-6.9: Capital cost for Waterway Development

Sl No	Description	Quantity	Unit	Rate (Rs)	Amount (in lakhs)
1	Dredging				
	a) 100T Vessel (as per Annexure 4.3)	1879291	m^3	150	2818.94
2	Aids to navigation				80.00
3	Sub total (100T vessel)				2898.94
	Contingencies 3%				86.97
	Supervision 5%				144.95
	Total (100T vessel)				3130.85

Table-6.10: Operating cost for Waterway Development

Sl No	Description	Total Amount (in lakhs)	Rate of %	Amount (in lakhs)
1	Dredging			
	a) 100T Vessel	3130.85	10	313.085
2	Aids to navigation	80.00	5	4.00
3	Waterway Maintenance Management			50.00
			Total (in Lakhs)	367.09

CHAPTER - 7

IMPLEMENTATION SCHEDULE & IMPLEMENTATION MECHANISM

CHAPTER – 7

IMPLEMENTATION SCHEDULE & IMPLEMENTATION MECHANISM

7.1 PROJECT IMPLEMENTATION SCHEDULE

The project implementation schedule has been prepared and presented in Annexure – 7.1. The schedule has been prepared taking into account the tentative time taken for obtaining approvals for IWT project, field surveys and investigations, Design of Terminals and other structures, tendering, procurement and execution of the project. As per the schedule, it will take about 3½ year for completion of all activities and commencement of navigational activities in the river Gandak in the identified stretch of 328km. If some slippages are there in obtaining any statutory approvals, it will take about 4 years time.

7.2 PROJECT IMPLEMENTATION MECHANISM

In order to establish a monitoring mechanism for implementation of IWT project, it is recommended that a High Level Committee/ an Advisory Committee under the Chairmanship of Transport Secretary, IWAI Officer and/ or Secretary of Department of Industrial Policy & Promotion, comprising Secretaries of the Ministries/Departments of Revenue, IWT Department Govt of Bihar, Banking and Insurance Sector, Representative of Planning Commission, would be constituted. High level committee would monitor the project in all respect.

The underlying assumptions in planning the implementation mechanism of the project are:

- The Government would bear the capital cost of development of water ways and would not charge any amount on usage of waterway path from the operator
- The subsidy on the flotilla cost to the extent of 30% would be available from the Government
- The private party undertakes construction of terminals, procurement of flotilla, O & M of terminal, waterways and fleet.

The Consultants are of the view that the present trend in infrastructure sector with public-private partnerships (PPP) can be adopted for implementing the project. The initial investment and initiative being taken by the state sector would give start to the project. Since private sector would not able to take the initiative of provision of infrastructure and operate the services on its own. The State Government should take investment decision to develop the said facility. Then private sector could be expected to take participation in the project. Once the proposed services are operated by private sector, the FIRR may further improve because they would undertake intensive marketing efforts and relate it to utilizations of vessels and terminals facilities. Private participation in operating the IWT services may be considered in detail after investment decision is taken by the Govt. of Bihar to implement the project.

Annexure - 7.1

PROJECT IMPLEMENTATION SCHEDULE - DEVELOPMENT OF IWT ON RIVER GANDAK IN BIHAR

Sl. No.	Activity	Time in Months
1	Submission of Report to Govt of Bihar	
2	Approvals from Govt of Bihar	
3	Submission of Report to IWAI for sanction/Approval	
4	Approvals of Project from IWAI	
5	Fixing of consultant for preparation of Detailed Design of Terminals and Other Infrastructure ect.	
6	Preparation of Detailed Design of Terminals and Other Infrastructure	
7	Approval of Terminals/ Structure Design by IWAI/ Govt. of Bihar	
8	Land allotment for 4 nos of Terminals by Govt of Bihar	
9	Preparation of Tender documents for River Training Works & Approvals	
10	Tendering for River Training Works	
	a) Package 1:- Stretch From Confluence of River Ganga to Kalyanpur (113km)	
	b) Package 2:- Stretch From Kalyanpur to Bettiah (91km)	
	c) Package 3:- Stretch From Bettiah to Bagaha(84km)	
11	Award of contract and commencement of River Training works for Navigation Channel	
12	Preparation of Tender documents for All Terminals and Other Infrastructure & Approvals	
13	Tendering for All Terminals and Other Infrastructure	
14	Award of contract and commencement of construction works of Terminals and others infrastructure facilities Package 1 a) Vaishali & b) Kalyanpur Package 2 a) Bettiah Package 3 a) Bagaha	
15	**Activities for Terminals/Floating Pontoon Jetties (Started Simultaneously all 4 Terminals)**	
I	Site preparation, Fencing, Grading, filling and compaction	
II	Procurement of River Boat for supervision of construction work	
III	Construction of bank Protection works from both side of Terminals	
IV	Construction of Terminals/Floating Pontoon Jetty	
V	Construction of Terminals buildings, Connecting Road, Warehouses, Canteen and other civil works	
VI	Procurement and Mobilization of Dredgers, Dredging equipments	
VII	Dredging of connecting Navigation channel with Terminals	
VIII	Utilities for Terminal(water, sewerage, firefighting etc)	
IX	Electrical works of Terminals	
X	Workshop for Repairing / Mainteinance of Machine	
XI	Procurement and installation of other loading / unloading equipments	
XII	Procurement of Permanent Navigation Aids for Terminal and Navigation Channel and installations	
XIII	Commencement of Terminals operations	
16	Award of contract to Installations Navigation Aids in Gandak River and Maintained the Navigation Channel	
17	Commencement of Operations of Project	

CHAPTER - 8

COST BENEFIT ANALYSIS

CHAPTER – 8

COST BENEFIT ANALYSIS

8.0 INTRODUCTION

The cost benefit analysis and economic analysis is carried out to gauge the viability of the investment on the proposed development of Inland Water Transport (IWT) on the identified river stretches duly taking into account the various benefits likely to accrue to the IWT users as well as the different types of stakeholders in the project influence area. Further, in economic analysis project costs and benefits are assessed from the point of view of the economy. Given the base year traffic estimates and traffic forecasts during the design life of the project (Chapter 2), this chapter presents methodology, inputs and results of economic appraisal.

8.1 APPROACH AND METHODOLOGY

For the purpose of economic appraisal two mutually exclusive project scenarios have been considered, namely "*without the project*" and "*with the project*". Under *without the project* scenario only do-minimum situation (i.e. maintaining the existing inland waterways in their present condition and allowing the present traffic movement pattern) has been assumed. In the w*ith the project* scenario the inland waterways with all the proposed improvements/ developments have been be considered. In this methodology, while the cost of w*ith the project* scenario (i.e. capital, replacement, maintenance cost of channel and terminals) represents the project cost, the total cost of moving the same traffic by alternate modes in the *without the project scenario* connotes project benefits. These project costs and benefits have been worked out for each year of the project life and discounted to arrive at Economic Internal Rate of Return (EIRR). The cost and benefit streams have been worked out for 30 years commencing from the year 2010-11. While the first three years relate to construction period, the remaining 27 years represent project economic life or operating years. In the last year of operations, due credit is given to the residual value of the assets. In case the economic life of an asset is less than 30 years, its replacement cost is provided in the year in which it is due.

In economic appraisal, all the project costs and benefits are expressed in their economic terms (or in terms true cost of resource consumption) rather than financial / market prices which are used in financial appraisal. This is because the market/ financial prices of a commodity/ services do not reflect their true value to the economy due to market distortions traceable to administered prices, taxes, subsidies, etc. Another important factor in economic appraisal is the ***discount rate*** (***or cut-off rate***) used for discounting future economic costs and benefits of the project to their present values. The discount rate represents *opportunity cost of capital* in economic appraisal.

8.2 GANDAK RIVER STRETCHES CONSIDERED FOR FINANCIAL AND ECONOMIC APPRAISAL

Based on the traffic forecasts presented in Chapter 2, the following Gandak river stretches have been considered for financial and economic appraisal.

S. No.	Name of the Waterway	Length (Km)
Gandak River		
1	Patna – Vaishali	54
2	Vaishali – Kalyanpur	66
3	Kalyanpur- Bettiah	88
4	Bettiah – Bagha	69
5	Bagha – Nepal	62

8.3 PROJECT COSTS AND BENEFITS

Various items of project cost for the IWT alternative include incremental expenditure for i) the development of infrastructure facilities (waterway and terminal) and their operation and maintenance (O &M), and ii) user costs – mainly cost of additional handlings and local haulage at both (originating as well as terminating) IWT terminals. The project benefits comprise the cost of next best alternative foregone (in this case road transport) in case the IWT project is taken up. Details of project costs and benefits are as under:

8.3.1 Project Costs

a) Capital Costs

Assumptions and Parameter for Estimates the Capital costs for Waterway and terminals

S. No.	Cost Category	Detailed Items of Cost
1	***Waterway***	1.1 Land Acquisition
		1.2 Dredging
		1.3 Bank Protection
		1.4 Aids to Navigation
		1.5 Modifications of Bridges and locks
		1.6 Miscellaneous
2	***Terminal***	2.1 Civil Works including Land Acquisition
		2.2 Mechanical Handling Facilities
		2.3 Miscellaneous

A summary picture of the capital costs and their phasing for the Gandak River stretch considered for financial and economic appraisal is presented in **Table 8.1.**

Table 8.1: Capital Cost Estimates for IWT Development For Gandak River

S.No.	Name of River	Capital Cost (in Rs. lakhs)					
		Total Cost	2010-11	2011-12	2012-13	2025-26	2035-36
(i)	Waterway	3130.85	939.26	1252.34	939.26		
(ii)	Terminal :	10969.82	3290.95	4387.93	3290.95		
	Total	14100.67	4230.21	5640.27	4230.21	5551.09	6094.23

A summary of the percentage share of capital cost on waterway and terminal is given in **Table 8.2.**

Table 8.2: Percentage Composition of Capital Cost for IWT Development For Gandak River

Waterway	Terminal	Total
22.20%	77.80%	100.0%

b) Operating and Maintenance (O&M) Costs:

These costs refer to various items of costs that are required for maintenance and operation of the capital assets referred to above. By nature, these costs are recurring in nature and are estimated on annual basis. Major items of the O&M costs are:

i) Manpower
ii) Repair & maintenance
iii) Fuel & consumables
iv) Overheads

The assumptions and parameter estimates underlying the O&M costs for terminals are presented in Project costs chapter. Summary estimates of O&M costs are given in **Table 8.3.** As the construction period is 3 years , operating cost will be incurred from 2013-14.

Table 8.3: Summary Estimates of O&M Costs

S.No.	Year	Operation and Maintenance cost/year In Lakh
1	2012 - 24	915.37
2	2025 - 34 (Additional Cost)	169.19
3	2035 – 41 (Additional Cost)	191.63

8.3.2 Project Benefits

The introduction of the IWT will yield tangible and non-tangible savings due to equivalent reduction in road traffic and certain socio-economic benefits. These include savings in road construction and maintenance, vehicle operating costs, travel time and other socio-economic benefits of travel time, better accessibility, better comfort and quality of life, increase in mobility etc. The direct and indirect benefits of the project are following

- Reduced road stress
- Better accessibility to facilities in the influence area
- Economic stimulation in the micro region of the infrastructure
- Increased business opportunities
- Overall increased mobility
- Facilitating better planning and up-gradation of influence area
- Savings in vehicle operating costs of buses and other vehicles that are using the existing transport network after the IWT is introduced due to decongestion effect on road stress.
- Savings in time of passengers of existing modes, because of reduced congestion on roads.
- Saving on account of reduction of vehicular pollution .

For the purpose of the study only savings in vehicle operating cost of moving goods by road vehicles has been considered.
As indicated earlier, the project benefits comprise the total cost of moving the same traffic by the next best alternate mode (i.e. road transport in the present case) in case the IWT is not developed on the identified river stretches. The cost of moving the project IWT traffic by road has been worked out taking to account. The recent Total Transport study carried by RITES for Planning Commission has been worked out the economic cost of different commodity on different roads. The study has been worked out that the economic cost of the normal commodity movement in State Highway of two lanes is **one rupees and eighty three paise per tonne per km.** The same cost has been considered for the economic analysis.

8.3.3 Shadow Pricing

The value of Project cost and benefits have been expressed in terms of market prices. These prices, however, do not reflect the real resource cost and value of benefits derived from the project to the economy. The market prices are distorted due to variety of factors. These factors could be controlled/administered prices of inputs, monopolistic market of inputs, tax structure etc. The factors used for converting project inputs and output to economic costs are given in following **Table 8.4.**

Table 8.4 Shadow Pricing

S.NO	ITEM	FACTOR
1	Capital cost	0.85
2	Operations & maintenance cost	0.85

8.4 Financial Internal Rate of Return (FIRR)

The revenue has been worked out by considering the traffic of commodity movement by IWT as Rupees one per tonne per km. The cost and revenue streams of Financial Analysis are presented in **Table 8.5.** The FIRR for the Gandak River stretch of IWT system is worked out which is **32.34%.** This Analysis shows that the project is financially viable on the basis of tariff of commodities traffic alone.

Table 8.5 FIRR For Inland Water Transport System for Gandak River

SN	Year	Capital Cost	Additional cost	O&M Expenses	Total Out Flow	Estimated Traffic	Revenue generation in IWT	Net Cash flow (Financial)
1	2010-2011	42.30			42.30			-42.30
2	2011-2012	56.40			56.40			-56.40
3	2012-2013	42.30			42.30			-42.30
4	2013-2014			9.15	9.15	58.33	58.33	49.18
5	2014-2015			9.15	9.15	61.83	61.83	52.68
6	2015-2016			9.15	9.15	65.54	65.54	56.39
7	2016-2017			9.15	9.15	69.47	69.47	60.32
8	2017-2018			9.15	9.15	73.64	73.64	64.49
9	2018-2019			9.15	9.15	78.06	78.06	68.91
10	2019-2020			9.15	9.15	82.74	82.74	73.59
11	2020-2021			9.15	9.15	87.71	87.71	78.56
12	2021-2022			9.15	9.15	92.97	92.97	83.82
13	2022-2023			9.15	9.15	98.55	98.55	89.40
14	2023-2024			9.15	9.15	104.46	104.46	95.31
15	2024-2025			9.15	9.15	110.73	110.73	101.58
16	2025-2026		55.51	9.15	64.66	117.37	117.37	52.71
17	2026-2027			10.84	10.84	124.41	124.41	113.57
18	2027-2028			10.84	10.84	131.88	131.88	121.04
19	2028-2029			10.84	10.84	139.79	139.79	128.95
20	2029-2030			10.84	10.84	148.18	148.18	137.34
21	2030-2031			10.84	10.84	157.07	157.07	146.23
22	2031-2032			10.84	10.84	166.49	166.49	155.65
23	2032-2033			10.84	10.84	176.48	176.48	165.64
24	2033-2034			10.84	10.84	187.07	187.07	176.23
25	2034-2035			10.84	10.84	198.30	198.30	187.46
26	2035-2036		60.94	10.84	71.78	210.19	210.19	138.41
27	2036-2037			12.75	12.75	222.81	222.81	210.06
28	2037-2038			12.75	12.75	236.17	236.17	223.42
29	2038-2039			12.75	12.75	250.34	250.34	237.59
30	2039-2040			12.75	12.75	265.37	265.37	252.62
31	2040-2041			12.75	12.75	281.29	281.29	268.54
							FIRR	32.34%

8.5 Economic Internal Rate of Return (EIRR)

Based on the traffic forecasts, estimated project costs and benefits in economic cost terms, cost and benefit streams have been worked out for the entire project life including 3 years of construction period for Gandak River stretch. The cash detailed of cost and benefit streams of Economic Analysis is presented in **Table 8.6.** The EIRRs for the Gandak River stretch of IWT system is worked out is **56.22 %** which is more than the norm of planning commission of 12 %. Therefore for the point of view of national economy the project may be taken up for implementation.

Table 8.6 EIRR for Inland Water Transport System For Gandak River

S N	Year	Capital Cost	Additional cost	O&M Expenses	Total Out Flow	estimated Traffic	Saving in Road Transport	Net Cash flow (economic)
1	2010-2011	35.95			35.95			-35.95
2	2011-2012	47.94			47.94			-47.94
3	2012-2013	35.95			35.95			-35.95
4	2013-2014			7.78	7.78	58.33	106.74	98.97
5	2014-2015			7.78	7.78	61.83	113.15	105.37
6	2015-2016			7.78	7.78	65.54	119.94	112.16
7	2016-2017			7.78	7.78	69.47	127.13	119.36
8	2017-2018			7.78	7.78	73.64	134.76	126.98
9	2018-2019			7.78	7.78	78.06	142.85	135.07
10	2019-2020			7.78	7.78	82.74	151.42	143.64
11	2020-2021			7.78	7.78	87.71	160.50	152.73
12	2021-2022			7.78	7.78	92.97	170.13	162.36
13	2022-2023			7.78	7.78	98.55	180.34	172.56
14	2023-2024			7.78	7.78	104.46	191.16	183.38
15	2024-2025			7.78	7.78	110.73	202.63	194.85
16	2025-2026		47.18	7.78	54.96	117.37	214.79	159.83
17	2026-2027			9.21	9.21	124.41	227.68	218.46
18	2027-2028			9.21	9.21	131.88	241.34	232.12
19	2028-2029			9.21	9.21	139.79	255.82	246.60
20	2029-2030			9.21	9.21	148.18	271.17	261.95
21	2030-2031			9.21	9.21	157.07	287.44	278.22
22	2031-2032			9.21	9.21	166.49	304.68	295.47
23	2032-2033			9.21	9.21	176.48	322.96	313.75
24	2033-2034			9.21	9.21	187.07	342.34	333.13
25	2034-2035			9.21	9.21	198.30	362.88	353.67
26	2035-2036		51.80	9.21	61.01	210.19	384.66	323.64
27	2036-2037			10.84	10.84	222.81	407.73	396.90
28	2037-2038			10.84	10.84	236.17	432.20	421.36
29	2038-2039			10.84	10.84	250.34	458.13	447.29
30	2039-2040			10.84	10.84	265.37	485.62	474.78
31	2040-2041			10.84	10.84	281.29	514.76	503.92
							EIRR	56.22%

CHAPTER - 9

CONCLUSIONS AND RECOMMENDATIONS

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9.1 CONCLUSIONS AND RECOMMENDATIONS

The viability of Inland Water Transport project for introduction of navigation on any waterway can be judged by both technically and commercially. The technical viability of the project can be assessed based on availability of discharges to maintain navigable depths in a design channel suitable to ply design vessel. The commercial viability of the project can be gauged based on traffic potential and its growth over the project period and return on investments made besides several other socio-economic benefits such as employment generation, poverty alleviation in rural areas and so on. The recommendations for implementation of the project are based on the tradeoff between costs to be incurred and benefits derived.

The traffic surveys conducted in the hinterland of river Gandak have shown that about 66.16 lakhs of the traffic has been identified for movement in the base year (2008-09) and the projected traffic for the year 2035-36 will be 319 lakhs. Inland Water Transport terminals are recommended at four locations viz., Vaishali, Kalyanpur, Bettiah and Bagaha to handle the traffic.

The hydrographic surveys and hydrological investigations carried out on river Gandak, a length of about 300 km from Bhaisalotan barrage near Tribeni Ghat to Ganga confluence at Hazipur have revealed that the waterway is feasible for navigation for about 300 days in a year (80% of the days per annum) and the discharge in the river observed during the lean period (January to May) is of the order of about 100 cumecs. The design channel recommended for development is with a depth of 1.2 m, bottom width 25 m which is suitable to ply 100 tons vessel.

The capital cost for development of the system components of the project viz., development of the design waterway, construction of IWT terminals has been worked out as Rs 141.00 crores and the estimated operating cost per annum is Rs. 9.15 crores.

The cost benefit analysis and financial internal rate of return (FIRR) on investments have revealed that the returns on the project are positive. However, the economic internal rate of return (EIRR) on the project is worked out as 56.22%. The economic appraisal and the resultant EIRR clearly indicate that investment on development of IWT on River Gandak will be economically viable just meeting the cut of rate 12% as set out by the planning commission considering the inherent advantages of IWT

mode of transport. The results need to be interpreted and used with care, especially because of the various non-quantifiable benefits of IWT.

The consideration of the project for implementation may be viewed from the point to the fact that if investments are made in the development of IWT- a fuel efficient mode, the associated cost of moving the projected traffic volumes by IWT instead of road transport would cost less to the economy. The following advantages of IWT need to be given due weightage while taking appropriate investment decisions.

i) Higher unit capacity per unit fuel consumption of IWT vis-à-vis road
ii) Pollution levels created by IWT for moving a unit quantity are much less when compared to road
iii) IWT is almost accident free

Further the Gandak waterway can be developed as international waterway since the river also traverses in Nepal territory. From this angle, the bilateral trade between India and Nepal would be developed for which certain traffic has already been identified and considered in the study. Another important aspect need to be considered is that the Gandak river will become a feeder waterway to National Waterway No. 1 (Ganga-Bhagirathi-Hooghly river system) if developed.

In the context of ever increasing fuel demand in the transport sector, mainly road transport which is least fuel efficient, there is pressing need to promote fuel efficient modes like IWT and recommend measures to increase its share in the total freight movement. This will go a long way in containing energy demand and saving scarce foreign exchange reserves.

In the light of the above, it is recommended that the Gandak waterway should be developed for IWT operations in consultation with Inland Waterways Authority of India, the apex body for development of waterways in India. The integrated Gandak waterway with National Waterway 1 from Allahabad to Haldia may further enhance its viability.

Given the above, it is recommended that the IWT systems, hitherto a neglected mode of transport, should be taken up for development of local/regional economy as this mode has great potential in terms of employment generation and other related developments.