FEASIBILITY REPORT ON
DETAILED HYDROGRAPHIC SURVEY IN
RAVI RIVER (44.276 KM) FROM RANJIT SAGAR DAM AT BASOHLI TO CHAMERA DAM AT GANDHIAR (REGION-I, NW- 84)

Submitted To

INLAND WATERWAYS AUTHORITY OF INDIA
A-13, Sector-1,
NOIDA
DIST-Gautam Buddha Nagar
UTTAR PRADESH
PIN- 201 301(UP)
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Submitted By

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VOLUME – I
MAIN REPORT

23 December 2017

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MAIN REPORT

Survey Period: 29 April 2016 to 15 May 2016
23 December 2017

ACKNOWLEDGEMENT

Tojo Vikas International Pvt. Ltd. (TVIPL) express their gratitude to **Mrs. Nutan Guha Biswas, IAS, Chairperson,** for sparing their valuable time and guidance for completing this Project of "Detailed Hydrographic Survey in Ravi River." We would also like to thanks **Shri Pravir Pandey, Vice-Chairman (IA&AS), Shri Alok Ranjan, Member (Finance) and Shri S.K.Gangwar, Member (Technical).** We would also like to thanks Ranjit Sagar Water Resource Irrigation Department.

TVIPL wishes to express their gratitude to **Shri S.V.K. Reddy Chief Engineer-I, Cdr. P.K. Srivastava, Ex-Hydrographic Chief, IWAI** for his guidance and inspiration for this project. We would also like to thank **Shri Rajiv Singhal, A.H.S.** for invaluable support and suggestions provided throughout the survey period. TVIPL is pleased to place on record their sincere thanks to other staff and officers of IWAI for their excellent support and co-operation through out the survey period.

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List of Abbreviations:

BM	-	**Bench Mark**
CD	-	**Chart Datum**
DGPS	-	**Differential Geo Positioning System**
GTS	-	**Great Trigonometric Survey**
LAD	-	**Least Available Depth**
MSL	-	**Mean Sea Level**
PPK	-	**Post Processing Kinematics**
SD	-	**Sounding Datum**
RTK	-	**Real Time Kinematics**
TBM	-	**Temporary Bench Mark**
TS	-	**Total Station**

VOLUME –II: DRAWINGS

Drawing Title	Drawing Number	Sheet No.	Scale
Composite Map	TVIPL/IWAI/RAVI/FD/01	01 of 01	1:25,000
Detailed Hydrographic & Topographic Survey	TVIPL/IWAI/RAVI/FD/02	01 to09	1:5,000

SALIENT FEATURES AT A GLANCE

#	*Particulars*	*Details*
1.	Name of Consultant	Tojo Vikas International Pvt. Ltd.
2.	Region number & State(s)	Region-I State- Himachal Pradesh, Punjab and Jammu & Kashmir
3.	Waterway stretch, NW Number (From…. To, total length)	Waterway Stretch- Ravi River Waterway Name- NW- 84 Waterway Description- Ranjit Sagar Dam at Basohli Lat 32°26' 35.86"N, Long 75°43'45.19"E to Chamera Dam at Gandhiar 32°35' 51.27"N, Long 75°59'04.96"E Total Length- 44.276 km
4.	Navigability status	Navigable in Ranjit Sagar Dam Reservoir Area only (17 km Approx.)
a)	Tidal & non tidal portions	Non Tidal
b)	**LAD status** (w.r.t. CD) i) Survey period ii) < 1.2 m (km) iii) 1.2 m to 1.4 m (km) iv) 1.5 m to 1.7 m (km) v) 1.8 m to 2.0 m (km) vi) > 2.0 m (km)	

	0–17 km	**17– 25 km**	**25– 35 km**	**35- 44.276 km**	**Total**
Survey Period	29th April to 15th May 2016				
< 1.2 m (km)	0.6	8.00	10.00	9.276	27.876
1.2 m to 1.4 m (km)	0.2	0.0	0.0	0.0	0.2
1.5 m to 1.7 m (km)	0.2	0.0	0.0	0.0	0.2
1.8 m to 2.0 m (km)	0.2	0.0	0.0	0.0	0.2
> 2.0 m (km)	15.8	0.0	0.0	0.0	15.8
				Grand Total	44.276

c)	Cross structures i) Dams, weirs, barrages etc. (total number; with navigation locks or not) ii) Bridges, Power cables etc. [total number; range of horizontal and vertical clearances]	Dams- 2 Nos. Weirs- No Barrages-No Navigational Lock- Not Present Bridges- 4 Nos. Vertical Clearance w.r.t. HFL - 5 m to 49.19 m Horizontal Clearance - 70.50 m to 350.50m Power Cable- 11 Vertical Clearance w.r.t. HFL -10 m to 25m Horizontal Clearance - 124m to 136.50 m
d)	Avg. discharge & no. of days	2293 Cu.m/Sec
e)	Slope	Average bed Slope- 1:223
5.	Traffic potential	Not Available
a)	Present IWT operations, ferry services, tourism, cargo, if any	Not Present
b)	Important industries within 50 km	Not Present
c)	Distance of Rail & Road from Industry	Not Applicable
6.	Consultant's recommendation for going ahead with TEF / DPR preparation	Water sports and tourism may be developed in Ranjit Sagar Dam reservoir area.
7.	Any other information/ comment	

(Signature)

Date: Name of Consultant

1. INTRODUCTION

1.1 River Course

1.1.1 Background Information

Name of River	Ravi River
Origin	Kangra district of Himachal Pradesh, India
Mouth	Chenab River
Basin countries	India, Pakistan
Length	720 kilometers (450 mi)
Avg. discharge	267.5 cu m/s
Basin area	India and Pakistan
River system	Indus River System
Right tributaries	Siul

The main Ravi River flows through the base of Dalhousie hill, past the Chamba town. It is located at an elevation of 2,807 feet (856 m). It flows into the south-west, near Dalhousie, and then cuts a gorge in the Dhauladhar Range, before entering the Punjab plain near Madhopur and Pathankot. It then flows along the Indo–Pak border for 80 kilometers (50 mi) before entering Pakistan and joining the Chenab River. The total length of the river is about 720 kilometers (450 mi).

The Ravi River, a trans-boundary river of India and Pakistan, is an integral part of the Indus River Basin and forms the headwaters of the Indus basin. The waters of the Ravi River drain into the Indian Ocean through the Indus River in Pakistan. The river rises in the Bara Bhangal, District Kangra in Himachal Pradesh, India. The river drains a total catchment area of 14,442 square kilometers (5,576 sq mi) in India after flowing for a length of 720 kilometers (450 mi). Flowing westward, it is hemmed by the Pir Panjal and Dhauladhar ranges, forming a triangular zone.

1.1.2 Historical Information

According to ancient history traced to Vedas, the Ravi River was known as Iravati.

Part of the battle of the ten kings was fought on a River, which according to Yaska refers to the Iravati River (Ravi River) in the Punjab.

Ravi River is one of the six rivers of the Indus System in Punjab region (name of Punjab means "Five Rivers"). The waters of Ravi are allocated to India under Indus Water Treaty.

Under the Indus Waters Treaty of 1960, the waters of the Ravi and five other rivers are divided between India and Pakistan. Subsequently, the Indus Basin Project has been

developed in Pakistan and many inter-basin water transfers, irrigation, hydropower and multipurpose projects have been built in India.

1.2 Tributaries / Network of Rivers / Basin

Two of its major tributaries, the **Budhil** and **Nai** or **Dhona** join 40 miles (64 km) downstream from its source. The Budhil River rises in Lahul range of hills and is sourced from the Manimahesh Kailash Peak and the Manimahesh Lake (elevation 4,080 metres (13,390 ft)) below the peak, and both are visited as sacred Hindu pilgrimage sites. The second tributary, the Nai, rises at Kali Debi pass, flows for a length of 30 miles (48 km) from its source at Trilokinath up to its confluence with the Ravi. This valley was also exploited for its forest wealth during the British period.

Another major tributary that joins the Ravi River, just below Bharmour, the old capital of Chamba, is the **Seul River** from the northern direction. The valley formed by the river was also exploited for its rich timber trees. One more major tributary that joins the Ravi River near Bissoli is the **Siawa**. The valley is also formed by another major tributary that joins Seul River, the **Baira-Nalla**.

Tant Gari is another small tributary that raises from the subsidiary hill ranges of the Pir Panjal Range to the East of Bharmour. The valley formed by this stream is U-shaped with a river bed scattered with boulders and glacial morainic deposits.

1.3 State/ District through which River passes – Ravi River passes through the different states of India naming J&K, Himachal Pradesh and Punjab. It flows also in Pakistan.

State Wise Length

a) Jammu and Kashmir – 24.0 km
b) Punjab – 12.0 km
c) Himachal Pradesh – 20.267 km
Common between J & k and Punjab -12.0 km
Common between J & k and Himachal Pradesh- 12.0 km

1.4 Map of River and Waterway –

Figure 1 – Map of Ravi River

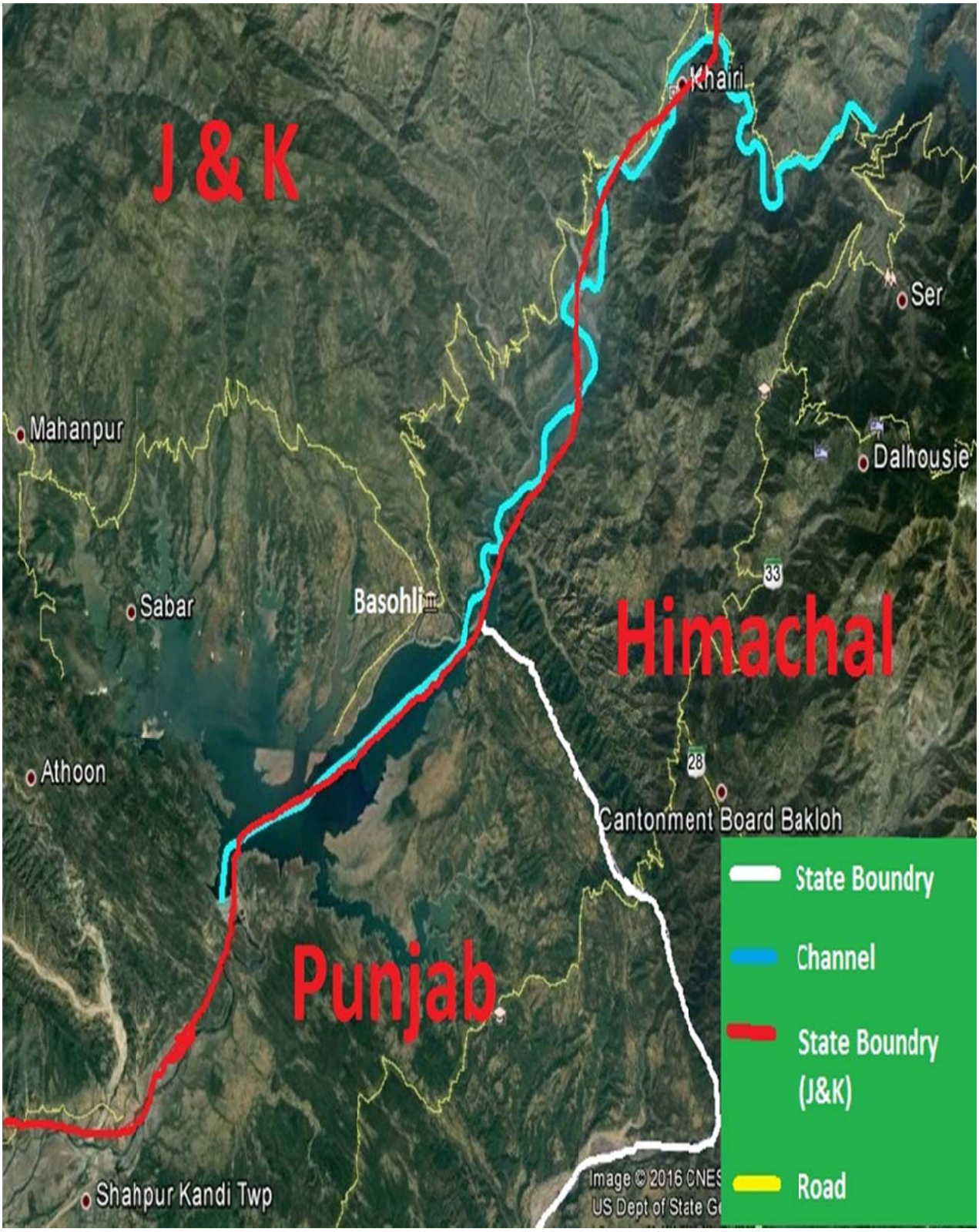


Figure 2 – Map of Ravi River waterway Stretch under study

1.5 Scope of Work

a) The detailed Hydrographic Survey to assess the Navigability of the River.
b) Estimate the Dredging Quantity for developing a Navigational river for Depths less than Class 1 (1.2m), Class 2 (1.4m), Class 3 (1.7m) and Class 4 (2.0m) (Stretch-wise).
c) Topographical Survey to assess the extent of land acquisition for 100m to 400mwide corridor and to locate the permanent structure within the corridor.
d) Construction of BMs at every 10 km and connecting the same with nearest GTS.
e) Measurement of Speed and Direction of River Water.
f) Collection and analysis of the Water and bottom samples at every 10 km interval along the river.
g) To carry out tidal observation during the survey period.
h) To prepare feasibility report
i) Collection of Topographical Features

2. METHODOLOGY ADOPTED

2.1 Survey by Tojo Vikas International Pvt. Ltd.

Tojo Vikas International Pvt. Ltd conducted a Bathymetric and Topographic Survey in stretch of about 44.276 KM of Ravi River from Ranjit Sagar Dam at Basohli Lat 32°26' 35.86"N, Long 75°43'45.19"E to Chamera Dam at Gandhiar 32°35' 51.27"N, Long 75°59'04.96"E.

The survey was carried out from 29th April, 2016 and to15th May, 2016.

The water depths encountered in the survey area varied from 0.5 m to 85 m.

2.2 Methodology to be elaborated

2.2.1 Topographic Survey

The topographic survey was conducted to ascertain following in the survey area:-

- Spot levels
- High bank Line
- Fixing of bridges and marks
- Assess the type of river bank
- Collection of local information along the river Banks

The spot levels along the River were obtained by using RTK/PPK and Electronic Total station (TS). Local terrain and limitation of line of sight visibility prohibited the use of optical techniques for obtaining spot levels. DGPS control was extended using the co-ordinates and height of the recovered from Bench Marks (BM), to various BMs in the respective stretches. These BMs were then used as reference stations for deriving the spot levels of the rover locations in the RTK/PPK method and Electronic Total Station. The data was post processed using Sokkia Spectrum Survey office software to get the correct position and height values of the rover locations visited during the day. The details of all spot levels are provided in the respective sheets being presented along-with this report. Additionally, a soft copy of the same in XYZ format is being handed over as deliverable data.

2.2.2 Bathymetry Survey

Bathy-500 DF was used to obtain soundings onboard the survey boat. A working frequency of 210 KHz was used for sounding operations. The digital output from the echo sounder was fed to the HYPACK data logging software for acquisition of survey data in real time. The performance of the echo sounder was found to be satisfactory during the entire duration of the survey.

Sound velocity set on the echo sounder was 1529 meters per second. The echo sounder transducer was mounted on the side of the boat, in all cases. The DGPS Receiver Antenna

was mounted exactly above the transducer without any offset to ensure accuracy in the position of soundings. The bar-checks were carried out before/after each sounding session. On all such occasions the error observed was zero or near zero. Therefore, no corrections were necessary.

The sounding lines were run perpendicular to the orientation of river flow (i.e. perpendicular to the orientation of depth contours) in respective stretches. To check the validity of sounding data logged by normal lines, Cross lines were run on an opportunistic basis wherever feasible

2.2.3 Equipment

Table 1 – Equipment Used

Equipment	Make	Qty. Deployed
Echo Sounder	Bathy 500 DF	1
DGNSS (Attached with Eco Sounder for Position)	C-Nav 1010	1
Tide Gauge	Manual (Pole type)	4
Grab Sampler	VanVeen	1
Bar Check Plate	Manual	1
Current Meter	River flow meter (Roorkee make)	1
DGPS Sets (TS Survey)	Sokkia GRX1	4
Auto Level	Leica	1
Software	HYPACK data acquisition	1
Software	AUTOCAD	1
Software	Microsoft Office	1
Software	Spectrum Survey office v.8	1

Photographs of equipment are in Annexure 08.

2.2.4 Calibration

Echo Sounder – Echo Sounder was calibrated on field every day evening and morning with the help of bar check plate. Bar check plate was lowered in water from 1 m, 2m……and so on to maximum depth. Value of depth in Echo Sounder on every meter was checked and to be corrected with the help of **Sound velocity** adjustment. The same procedure was followed up to maximum depth reaches.

C-Nav 1010 DGNSS- No need of Calibration.

Grab Sampler-Van Veen Grab Sampler was used for collecting Silt Samples from Ravi River. Calibration was not needed for Grab Sampler.

Current Meter-The equipment's used for the survey was calibrated by the equipment supplier. Tojo Vikas International Pvt. Ltd. using Cup Type Magnetic Current Meter Strd. (S. No. 1225) and it was calibrated from Hydraulic Research Station, Malikpur (Pathankot) under Irrigation and Power Research Institute, Department of Irrigation under Government of Punjab, PWD (I.B.)

DGPS-DGPS equipment's used for the survey was also calibrated by the equipment supplier. Tojo Vikas International Pvt. Ltd. using Sokkia GRX1.

Auto Level- Auto Level equipment used for the survey was also calibrated by the equipment supplier. Tojo Vikas International Pvt. Ltd. using Leica made Current Meter.

No Need of Calibration for other equipment and Software's.

Currently the equipment calibration certificates are placed at **Annexure-12** of this report.

2.3 Description of Reference Bench Mark used

The reference Bench Mark for Hydrography survey, Topographic survey and Pillars establishment is based on the information provided by officials of Ranjit Sagar dam authority. The reference bench mark was installed at right bank of Ravi River at Ranjit Sagar dam axis with Lat 32 ° 26' 32.00" N Long 75 ° 43' 30.66" E and level erected (562.158 m from MSL) on Bench Mark provided. Tide poles were set up along the River stretches, for the duration of survey. The tide poles remained vertical during the course of survey and no shift was observed in the poles for the duration of survey. New bench Mark Pillars (Naming as RV) were constructed and erected along the River stretches, Ranjit Sagar Dam to Chamera Dam.

MSL was the vertical datum used for deducing the heights for spot levels obtained as part of the topographic survey.

Figure 3 – Bench Mark at Ranjit Sagar Dam used for BM and Control Points

2.4 Methodology to fix Chart Datum / Sounding Datum in Tidal and Non-Tidal area

As per the discussion with IWAI officials for fixing of Chart Datum/ Sounding Datum, minimum 10 years of data needed from CWC gauge / Dam / Barrage / Weir / Anicut in between waterway area. Mean minimum Reservoir level for 15 years (in Table 2) is assumed as Sounding Datum497.437 m from MSL for Ranjit Sagar Dam at Ch. 0 km. Two more gauges were fixed in survey area at 10 km and 17 km. With reference to gauge of Ranjeet Sagar Dam (RSD), Continuous gauge reading on respective 3 locations at Ch. 0 km, 10 km and 17 km simultaneously was noted during whole survey period. So, the Chart datum/Sounding Datum is calculated on respective 10 km 498 m from MSL and 17 km 499 m from MSL by interpolation method with reference to Gauge of Ranjeet Sagar Dam. Sounding Datum after 17.00 km is calculated from minimum bottom levels on every km up to Chamera Dam at Ch. 44.276 km because of dry portion of this stretch of River.

2.5 Yearly minimum and maximum Water Levels

Table 2 – Maximum and Minimum and Minimum Reservoir Level of RSD – Project up to 22.09.2015

Maximum Reservoir Level						Minimum Reservoir Level					
Year	Date	Level in Mtr.	Mean Inflow in cs.	Mean Outflow in cs.	Indent in cs.	Year	Date	Level in Mtr.	Mean Inflow in cs.	Mean Outflow in cs.	Indent in cs.
2001	07.09.2001	518.66	8285	7765	7200	2001	07.03.2001	493.60	1680	….	1000
2002	11.10.2002	510.89	5046	4030	4200	2002	13.07.2002	489.60	8754	5402	11300
2003	26.09.2003	510.84	4187	4764	10900	2003	17.02.2003	497.38	1161	3803	2600
2004	22.08.2004	506.03	11665	11624	13300	2004	06.03.2004	491.68	2981	3724	3900
2005	30.09.2005	521.44	5200	4629	5100	2005	02.02.2005	495.23	520	1384	….
2006	10.09.2006	523.33	10840	12575	3000	2006	21.02.2006	495.79	2771	1590	3000
2007	21.05.2007	521.67	10110	5775	10800	2007	10.02.2007	498.10	1645	4042	…..
2008	18.08.2008	521.76	11170	13166	1850	2008	21.03.2008	496.18	4765	7465	5100
2009	15.06.2009	503.99	7325	6334	6950	2009	19.03.2009	496.30	3505	3608	2850
2010	26.09.2010	524.11	10136	10221	5100	2010	12.04.2010	496.82	2385	4605	4800
2011	17.09.2011	525.20	32583	19425	3825	2011	18.03.2011	503.56	5907	7158	7500
2012	02.10.2012	521.23	4859	3606	4500	2012	01.04.2012	496.78	1058	1325	4350
2013	22.08.2013	524.30	12893	14961	850	2013	17.04.2013	505.88	4865	7976	6300
2014	22.06.2014	521.49	15417	9471	12233	2014	31.12.2014	506.70	1617	3180	3455
2015	12.08.2015	524.76	35233	19707	10263	2015	31.12.2015	497.96	1408	2583	6580

2.6 Transfer of Sounding Datum table for tidal rivers / canals

River is Non Tidal so there is no need to transfer of sounding datum for tidal river.

2.7 Table indicating tidal variation at different observation points

River is Non Tidal so there is no need of indicating tidal variation at different observation points.

2.8 Salient features of Dam, Barrages, Weirs, Anicut, Locks, Aqueducts

Table 3 – Data Collected from Ranijt Sagar Dam Authority (RSD)

Ranjit Sagar Dam Salient Features			
a)	probable maximum flood	EL	535.62 m
b)	Spillway design flood	EL	532.73 m
c)	Standard project flood	EL	530.96 m
d)	Normal reservoir level	EL	527.91 m
Live storage capacity			2344 million cum
Gross storage capacity			3280 million cum
Maximum reservoir depth			131.62 m
Reservoir Surface area at maximum reservoir level			9625 hectares.
Approximate reservoir length at maximum water level			22 km.
Level upto which land to be Submerged			530.96 m
Area of land to be submerged in the reservoir up to EL 530.96 m EL 527.91 m			 8760 hectares. 8145 hectares.
Silting up of the reservoir			212 years.
Period for the silting up of entire dead storage capacity.			125 years

2 nos. of Dams are present one is Ranjit Sagar Dam and another is Chamera Dam. Full length reservoir of Ranjit Sagar Dam fall under waterway stretch. Length of Ranjit Sagar Reservoir is 22 KM at Maximum Water level 530.96 km. At the end of waterway stretch Chamera dam is present. Waterway stretch ends at downstream of Chamera dam so there is no need of salient features of Chamera dam.

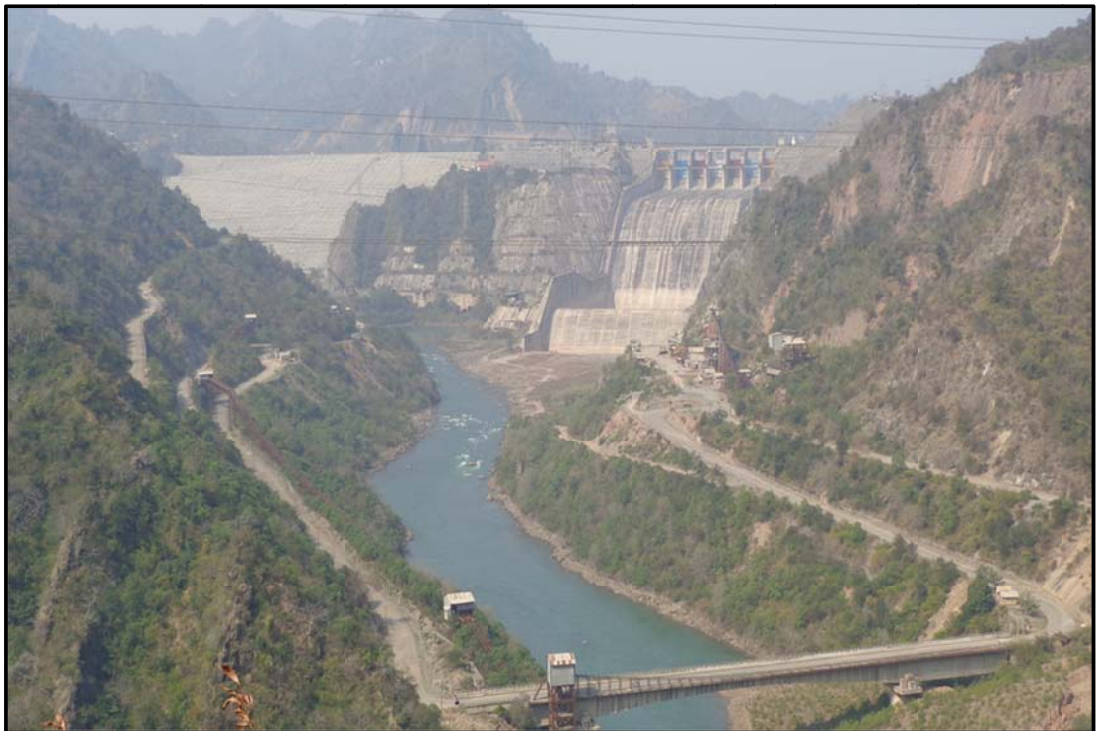


Figure 4 – Ch.0.00km Ranjit Sagar Dam

2.9 Description of Reference Bench Mark used

The final co-ordinates of these Bench Marks are shown in Table -2.

Table 4 – Final BM Coordinates

BM no.	Location	Chainage (KM)	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	Height above MSL (m)	Sounding DatumSD (m)	Height w.r.t. SD (m)
RV-01	Basohli Road	13.815	32°31' 31.9787"	75°48' 30.5513"	575928.138	3598979.371	628.095	499.000	-129.095
RV-02	Near Chuhn Village	22.216	32°33' 48.0757"	75°51' 34.0277"	580680.852	3603207.762	563.223	511.300	-51.923
RV-03	Near Khairi Village	30.663	32°36' 40.1931"	75°54' 3.6381"	584537.380	3608540.217	666.070	555.000	-111.07
RV-04	Near Sherpur Village	39.917	32°35' 28.6374"	75°56' 57.3248"	589083.935	3606376.105	702.201	615.200	-87.001

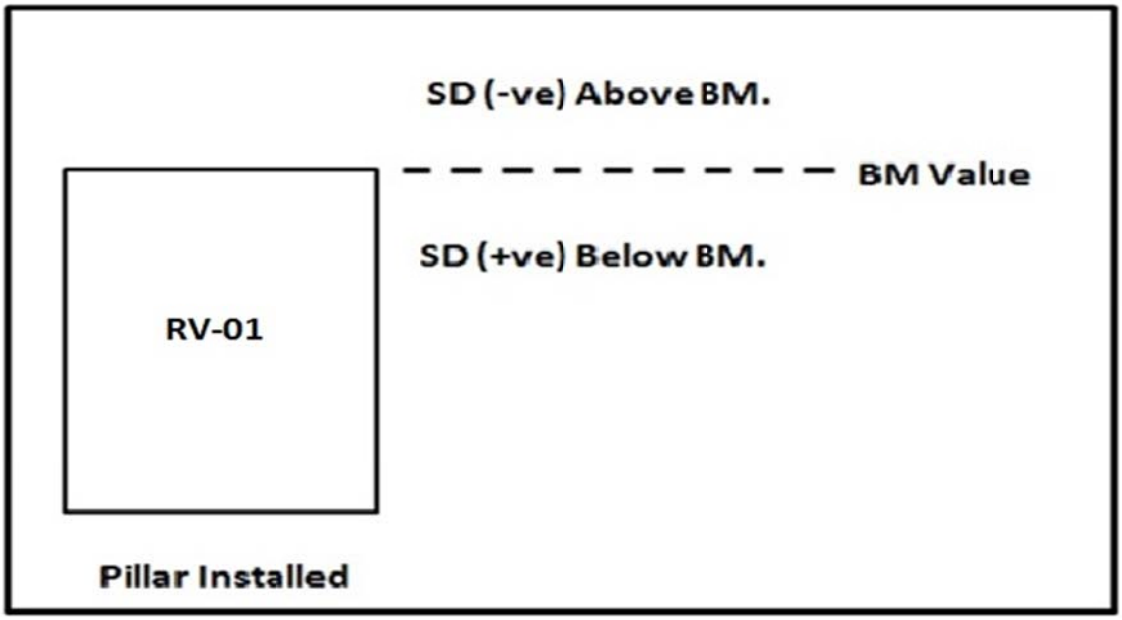


Figure 5– Height of Bench Mark (BM) w.r.t Sounding Datum (SD)

Note: - Height of Bench Mark (BM) w.r.t. sounding Datum (SD) indicates

A) Positive value indicate that BM value below SD value
B) Negative value indicate that BM value above SD Value

Station description of all bench marks in Ravi River is placed at **Annexure- 09** of this report.

2.10 Chart Datum / Sounding Datum and Reductions details

Table 5 – Sounding Datum (Chart Datum) Calculation for Ravi River

S.No.	CWC gauge / Dam / Barrage / Weir / Anicut / Bench Mark / tide gauges	Chainage (km)	Stretch for corrected soundings and topo levels (km) C		Established Sounding Datum w.r.t. MSL (m)	Sounding Datum (m) from MSL	Correction in WL data for Bathymetric survey (m)	Topo level data to be converted as depth for volume calculation wrt SD (m)
	A	B	From	To	D	E	F = (E- WL data in MSL)	G = ((E- topo levels in MSL)
1	Ranjit Sagar Dam	0	0	5	497.437	497.437	Details at Annexure-3.	A separate xyz file is to create (not to plot).
2	Near Basohli Bridge	10	5	13.5	498	498		
3	Near Chuhn	17	13.5	18.4	499	499		
4		18.4	18.4	18.7		499.588		
5		19	18.7	19.5		501		
6		20	19.5	20.5		503		
7		21	20.5	21.5		507		
8		22	21.5	22.5		511.3		
9		23	22.5	23.5		513.3		
10		24	23.5	24.5		518.2		
11		25	24.5	25.5		522.3		
12		26	25.5	26.5		525		
13		27	26.5	27.5		532.2		
14		28	27.5	28.5		541		
15		29	28.5	29.5		544.5		
16		30	29.5	30.5		548.8		
17		31	30.5	31.5		555		
18		32	31.5	32.5		560		
19	Khairi Bridge	33	32.5	33.5	564.5	564.5		
20		34	33.5	34.5		573		
21		35	34.5	35.5		579.4		
22		36	35.5	36.5		589.5		
23		37	36.5	37.5		600.5		
24		38	37.5	38.5		605.5		
25		39	38.5	39.5		610.5		
26	Sherpur Bridge	40	39.5	40.5	615.2	615.2		
27		41	40.5	41.5		623.6		
28	Chauhra Bridge	42	41.5	42.5	628	628		
29		43	42.5	43.59		631.8		
30	Chamera Dam	44.17	43.59	44.276	636.5	636.5		

2.11 High Flood Level (H.F.L.) and Maximum WL/Full Reservoir Level (MWL/FRL)

High Flood Level (H.F.L.) at known gauge stations and cross-structures. FSL (Full Supply Level) in case of Canals. Maximum WL/Full Reservoir Level (MWL/FRL) at Dam, Barrages, Weirs, Anicut, Locks, Aqueducts as HFL.MHWS (Mean High Water Springs) is to be taken in tidal stretches and HFL in non-tidal stretches.

Table 6 – Maximum Reservoir Level (MFL) at Cross Structure in Ravi River

Sl No	Location and description of CWC gauge / Dam / Barrages / Weirs / Anicut / Locks / Aqueducts / BM	Cross-structure details	Chainage (km)	Established HFL / MHWS / FSL / MWL / FRL w.r.t. MSL (m)	Computed HFL at Cross-Structures w.r.t. MSL (m)
1	Ranjit Sagar Dam	Dam	0.00	527.91	527.91
2	Basohli Bridge	Bridge	11.198	527.91	527.91
3	Khairi Bridge	Bridge	32.517	571.34	571.34
4	Sherpur Bridge	Bridge	41.126	630.62	630.62
5	Chauhra Bridge	Bridge	42.691	641.50	641.50
6	Chamera Dam	Dam	44.276	-	-

2.12 Graph between Sounding Datum and HFL v/s Chainage Elevation

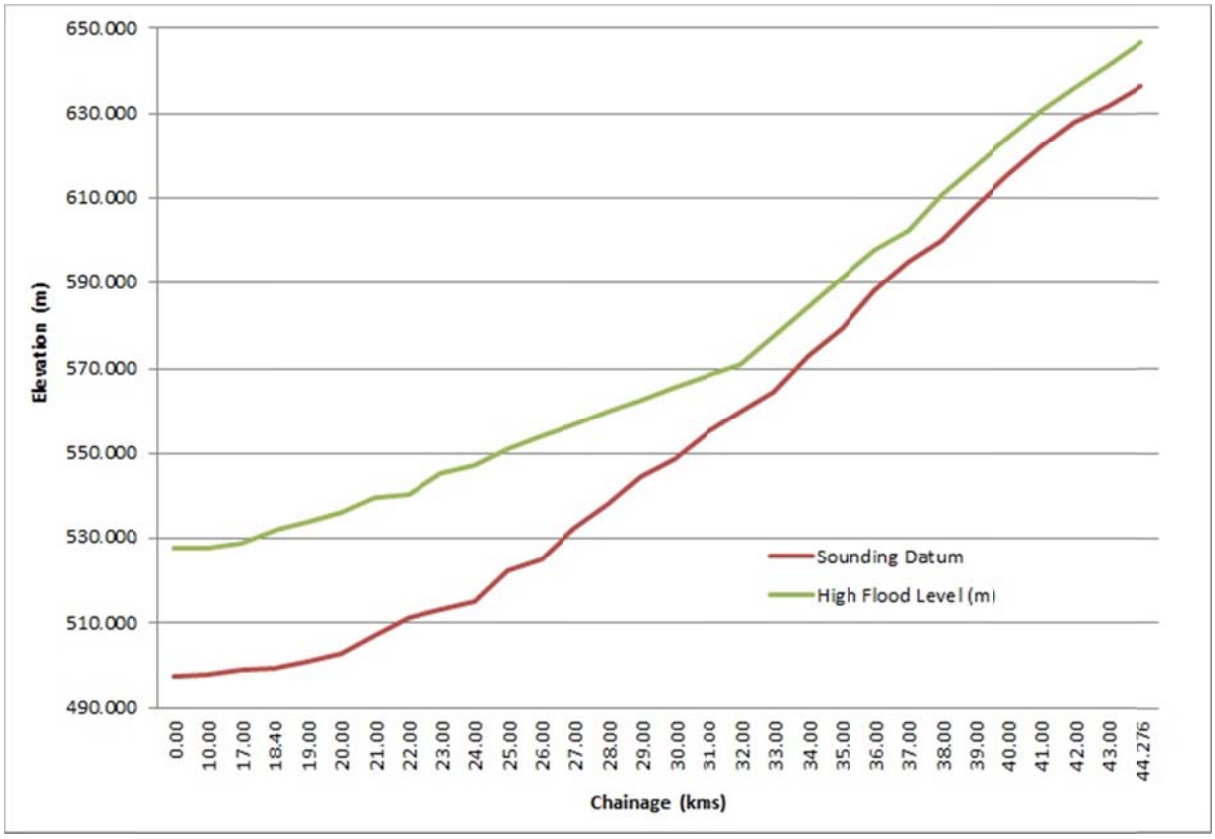


Figure 6 – Graphs between Chainage and Sounding Datum (SD) in Ravi River

2.13 Average Bed Slope

Bed Slope is based on observed bed level and observed spot levels on field.

Table 7 – Average Bed Slope

Reach (km)		River / Canal Bed Level Change (m)	Distance (km)	Slope
From	To			
0	17	85.10	17	1:202
17	25	22.725	8	1:352
25	35	54.196	10	1:184
35	44.276	59.708	9.276	1:155

2.14 Details of Dam, Barrages, Weirs, Anicut

Table 8 – Details of Dam, Barrages, Weirs, Anicut

S. No.	Structure Name	Chainage (Km)	Position (Lat Long)		Position (UTM)		Length (m)	Width (m)	Height w.r.t .Bed Level (m)	**Present condition**
			Left Bank	Right Bank	Left Bank	Right Bank				
1	RanjitSagar Dam	0.000	32°26' 38.5479"N 75°44' 4.7837"E	32°26' 32.2574"N 75°43' 31.999"E	569057.1242 3589893.8870	568202.3434 3589694.2721	640.00	8.00	160	navigational Lock not present
6	Chamera Dam	44.276	32°35' 45.3357"N 75°59' 7.5923"E	32°35' 53.2276"N 75°59' 11.6207"E	592473.3660 3606922.3347	592577.9701 3607165.2212	271.00	7.00	226	navigational Lock not present

2.15 Details of Locks

No Lock Present in this stretch of waterway.

2.16 Details of Aqueducts

No Aqueduct Present in this stretch of waterway.

2.17 Details of Cross-structures in Ravi River

Table 9 – Bridges and Cross Structure in Ravi River

S. No.	Structure Name	Chainage (Km)	Position (Lat Long)		Position (UTM)		Length (m)	Width (m)	No. of Piers	Horizontal clearance (m)	Vertical Clearance w.r.t HFL (m)	Remarks
			Left Bank	Right Bank	Left Bank	Right Bank						
1	Basohli Road Bridge	11.198	32°29' 33.2855"N 75°49' 33.3634"E	32°29' 47.2406"N 75°49' 17.0043"E	577595.5241 3595338.2697	577162.5280 3595759.7230	608.00	12.00	No Pillars in Between Both bank of River		16.38	Newly Constructed and in use
2	Khairi Road Bridge	32.517	32°36' 53.6879"N 75°55' 15.3731"E	32°36' 58.3036"N 75°55' 14.0559"E	586403.3118 3608971.8236	586367.6776 3609113.4510	145.00	7.50			15.63	Good condition and in use
3	Sherpur Foot over Bridge	41.126	32°35' 23.2947"N 75°57' 39.6834"E	32°35' 26.719"N 75°57' 39.6033"E	590189.7376 3606221.6391	590186.6647 3606326.9847	107.00	2.50			5.13	Not good condition and In use
4	Chauhra Road Bridge	42.691	32°35' 53.7384"N 75°58' 26.5132"E	32°35' 54.8462"N 75°58' 24.178"E	591402.5470 3607168.1630	591340.7564 3607203.6535	70.50	2.50			49.19	Good condition and in use

2.18 Details of other Cross structures, pipe-lines, underwater

There are no cross structures other than Dam, Road Bridges, Power Cable and High Tension Line.

2.19 Details of High Tension Lines / Electric lines / Tele-communication lines

Table 10 – High Tension Lines / Electric Lines / Tele-communication Lines

S. No.	Features Name	Chainage (Km)	Position (Lat, Long)		Position (UTM)		Vertical Clearance w.r.t HFL (m)	Remarks
			Left Bank	Right Bank	Left Bank	Right Bank		
1	HT Line Cross	32.25	32°36' 53.4239"N 75°55' 12.4884"E	32°36' 57.4566"N 75°55' 12.074"E	586328.329 3608963.021	586316.453 3609087.109	25.00	Complete
2	Electric Line Cross	32.27	32°36' 53.6647"N 75°55' 13.3388"E	32°36' 58.0467"N 75°55' 12.8168"E	586350.427 3608970.626	586335.655 3609105.451	15.00	Complete
3	Electric Line Cross	32.28	32°36' 53.6758"N 75°55' 13.5035"E	32°36' 58.0743"N 75°55' 13.0076"E	586354.718 3608971.007	586340.621 3609106.344	18.00	Complete
4	Electric Line Cross	32.28	32°36' 53.6897"N 75°55' 13.7085"E	32°36' 58.0966"N 75°55' 13.2336"E	586360.057 3608971.482	586346.504 3609107.081	10.00	Complete
5	Electric Line Cross	32.29	32°36' 53.7028"N 75°55' 13.9014"E	32°36' 58.1143"N 75°55' 13.4133"E	586365.082 3608971.928	586351.183 3609107.666	13.00	Complete
6	Electric Line Cross	32.29	32°36' 53.7118"N 75°55' 14.0344"E	32°36' 58.1323"N 75°55' 13.5964"E	586355.951 3609108.263	586368.544 3608972.236	12.00	Complete
7	Electric Line Cross	32.34	2°36' 53.8698"N 75°55' 16.0806"E	32°36' 58.2531"N 75°55' 15.4449"E	586421.831 3608977.563	586404.095 3609112.400	10.00	Complete
8	Electric Line Cross	32.35	32°36' 53.8806"N 75°55' 16.1895"E	2°36' 58.2527"N 75°55' 15.6187"E	86424.666 3608977.919	586408.623 3609112.425	15.00	Complete
9	Electric Line Cross	32.35	32°36' 53.8936"N 75°55' 16.3207"E	32°36' 58.2521"N 75°55' 15.8294"E	586428.083 3608978.348	586414.115 3609112.455	15.00	Complete
10	Electric Line Cross	32.36	32°36' 53.9057"N 75°55' 16.4431"E	32°36' 58.2517"N 75°55' 15.9895"E	586431.270 3608978.749	586418.286 3609112.478	10.00	Complete
11	Electric Line Cross	32.36	32°36' 53.9153"N 75°55' 16.5408"E	32°36' 58.2511"N 75°55' 16.1911"E	586433.813 3608979.068	586423.542 3609112.507	10.00	Complete

2.20 Current Meter and Discharge details

Table 11 – Current Meter and Discharge Details

Stretch No.	Chainage (km)	Position				Observed Depth (m)	Velocity (m/sec.)			Average Velocity (m/sec.)	Area (Sq.m)	Discharge (Cu.m/sec)
		Latitude (N)	Longitude (E)	Easting (m)	Northing (m)		0.3 D	0.5 D	0.9 D			
1	0.727	32°26' 57.3078"	75°43' 43.6654"	568501.696	3590467.439	87.5	0.11	0.12	0.14	0.12	28344.1	3401.294
2	14.119	32°30' 49.4592"	75°50' 5.1919"	578407.375	3597689.083	16.7	0.39	0.42	0.43	0.41	2891.71	1185.601

2.21 (A) Soil Sample Locations

Table 12 – Soil Sample Locations in Ravi River

S. No.	Chainage (km)	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	Depths (m)
1	0.727	32°26' 57.3078"	75°43' 43.6654"	568501.696	3590467.439	5.0
2	14.119	32°30' 49.4592"	75°50' 5.1919"	578407.375	3597689.083	4.0
3	30.013	32°36' 11.0804"	75°54' 22.7103"	585042.109	3607647.94	0.2
4	42.551	32°35' 53.4541"	75°58' 25.9974"	591388.576	3607161.22	0.2

A detailed report on Soil sample analysis is placed at **Annexure-10** of this report.

(B) Water Sample Locations

Table 13 – Water Sample Locations in Ravi River

S. No.	Chainage (km)	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
1	0.727	32°26' 57.3078"	75°43' 43.6654"	568501.696	3590467.439	5.0	2.5
2	14.119	32°30' 49.4592"	75°50' 5.1919"	578407.375	3597689.083	4.0	2.0
3	30.013	32°36' 11.0804"	75°54' 22.7103"	585042.109	3607647.94	0.2	0.1
4	42.551	32°35' 53.4541"	75°58' 25.9974"	591388.576	3607161.22	0.2	0.1

A detailed report on Water sample analysis is placed at **Annexure -11** of this report

3. DESCRIPTION OF WATERWAY FOR RAVI RIVER

Hydrographic Survey was done on selected River stretch. Only some bridges were present and height of these bridges (Except 1 Nos. at Ch. 41.216) was enough to cross survey boat. We have divided our survey area of Ravi River into 4 different stretches and details of stretches given below from Para 3.1 to 3.4.

3.1 Ranjit Sagar Dam to near Lahri Village (Ch. 00.00 km – 17.00 km)

Figure 7 – Ranjit Sagar Dam to Lahri Village

Table 14 – Minimum – Maximum Reduce Depths, Ranjit Sagar Dam to near Lahri Village

Class	Chainage		Reduced w.r.t. Sounding Datum			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	0.00	17.00	0.82	88.2	1.00	3434.94
II	0.00	17.00	0.7	88.2	1.00	8479.80
III	0.00	17.00	0.68	88.2	1.20	16538.80
IV	0.00	17.00	0.68	88.2	1.20	27471.99

Table 15 – Minimum – Maximum Observed Depths, Ranjit Sagar Dam to Near Lahri Village

Class	Chainage		Observed			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	0.00	17.00	2.3	88.3	0.00	0.00
II	0.00	17.00	2.1	88.3	0.00	0.00
III	0.00	17.00	2.1	88.4	0.00	0.00
IV	0.00	17.00	2.1	88.4	0.00	0.00

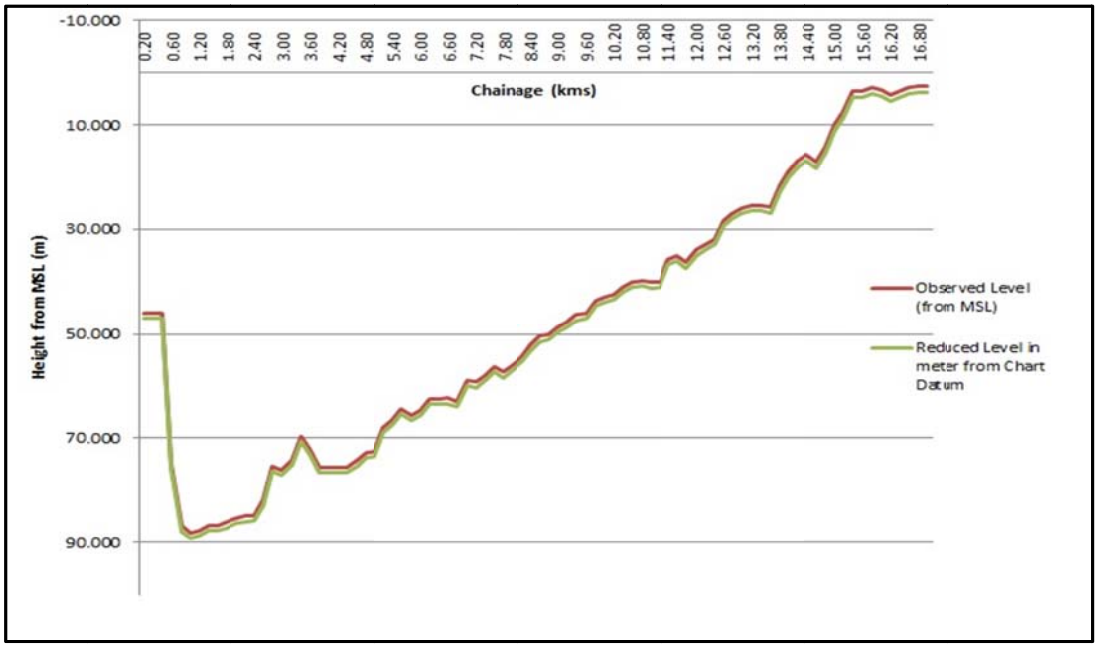


Figure 8 – Observed and Reduced Bed Profile of Ranjit Sagar Dam to Lahri

First stretch (Ch. 0.00 to 17.00 km) start from Ranjit Sagar Dam axis to Lahri Village. Bathymetry Survey was done for whole length of this Stretch. Length of whole reservoir of Ranjit Sagar Dam is 22.00 km at maximum water level (527.91m from MSL). This dam is mainly used for electricity generation under government of Punjab. Navigation is possible in this this stretch of the River in any season because depth required for navigational channel is quite good and horizontal and vertical clearance of basohli bridge (Ch. 11.198 km) of this stretch is also quit suitable. Reservoir of Ranjit Sagar Dam joins two states, main dam and right bank of Reservoir under Punjab state and left back of reservoir under Jammu And Kashmir State. One bridge is present in this stretch of River of name Basohli Bridge which is newly constructed and inaugurated in 2016. Main villages in this stretch are Ucha Thara, Phagota, Kothi, Basohli and Darbahn. All area of this stretch is surrounded by hills having hard rocks and boulders. Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues etc. are not present in this stretch. Land is generally used for agriculture purpose on both bank of river. Forest land is also present on both bank of river. No Industries along this stretch of waterway. There was one jettie seen on right bank of river below the Basohli Bridge. No Terminals seen in this stretch. Main city is Pathankot (downstream of Ranjit Sagar Dam axis). It is well connected via road to this stretch of river. There are no Passenger ferry services and no water sport recreational facilities are present in this stretch of waterway. At the Chainage of 17.00 km sand mining area is present. Transportation of sand from this mining area to basohli through boat.

Figure 9 – Ch. 0.00 Km Ranjit Sagar Dam Axis View from Upstream Side

Figure 10 – Ch.2.00 km Rock Formation on Bank of Reservoir

Figure 4 – Ch. 11.198 km Basohli Bridge

Figure 5 – Ch. 10.00 Km Gauge Fixing During Survey Period

Figure 6 – Ch. 16.50 Km Rock Formation on Bank of Reservoir

3.2 Lahri Village to Chuhn Village (Ch. 17.00 km – 25.00 km)

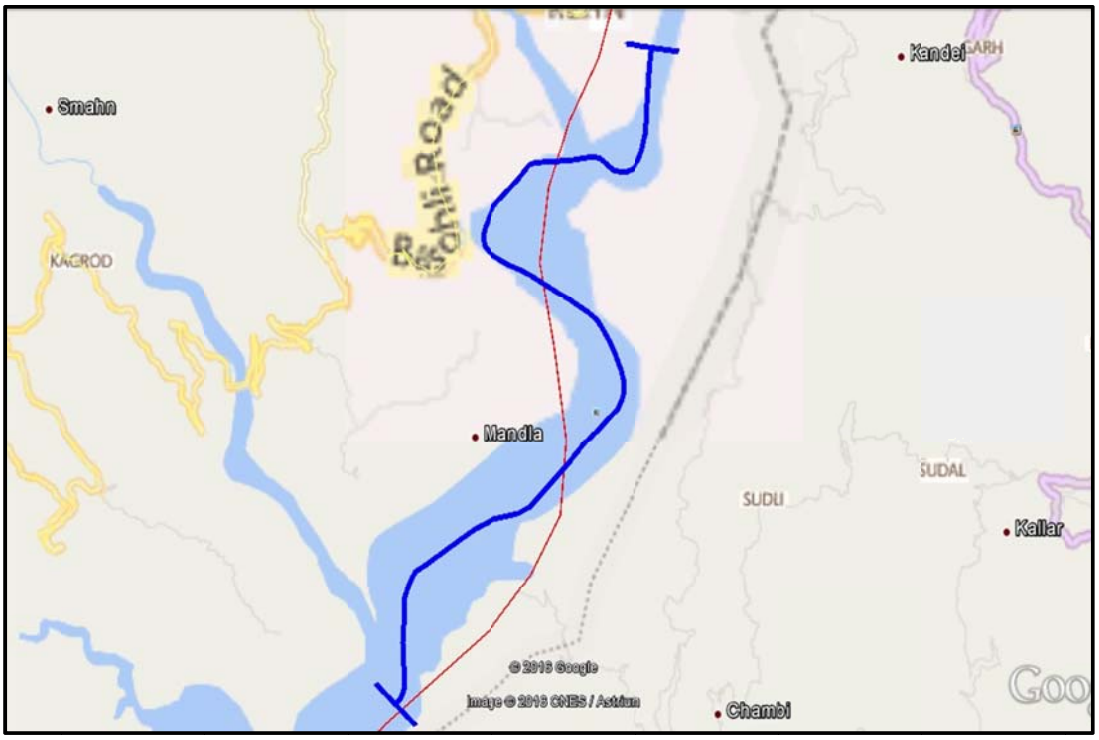


Figure 7 – Near Lahri Village to Chuhn Village

Table 16 – Minimum – Maximum Reduce Depths, Lahri Village to Chuhn Village

Class	Chainage		Reduced w.r.t. Sounding Datum			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	17.00	25.00	-0.30	3.85	8.00	389526.47
II	17.00	25.00	-0.30	3.85	8.00	470060.44
III	17.00	25.00	-0.30	3.85	8.00	855322.33
IV	17.00	25.00	-0.30	3.85	8.00	1010964.21

Table 177 – Minimum – Maximum Reduce Depths, Lahri Village to Chuhn Village

Class	Chainage		*Observed*			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	17.00	25.00	0.0	5.0	7.20	287182.10
II	17.00	25.00	0.0	5.0	7.20	441968.55
III	17.00	25.00	0.0	5.0	7.20	664848.76
IV	17.00	25.00	0.0	5.0	7.20	805777.70

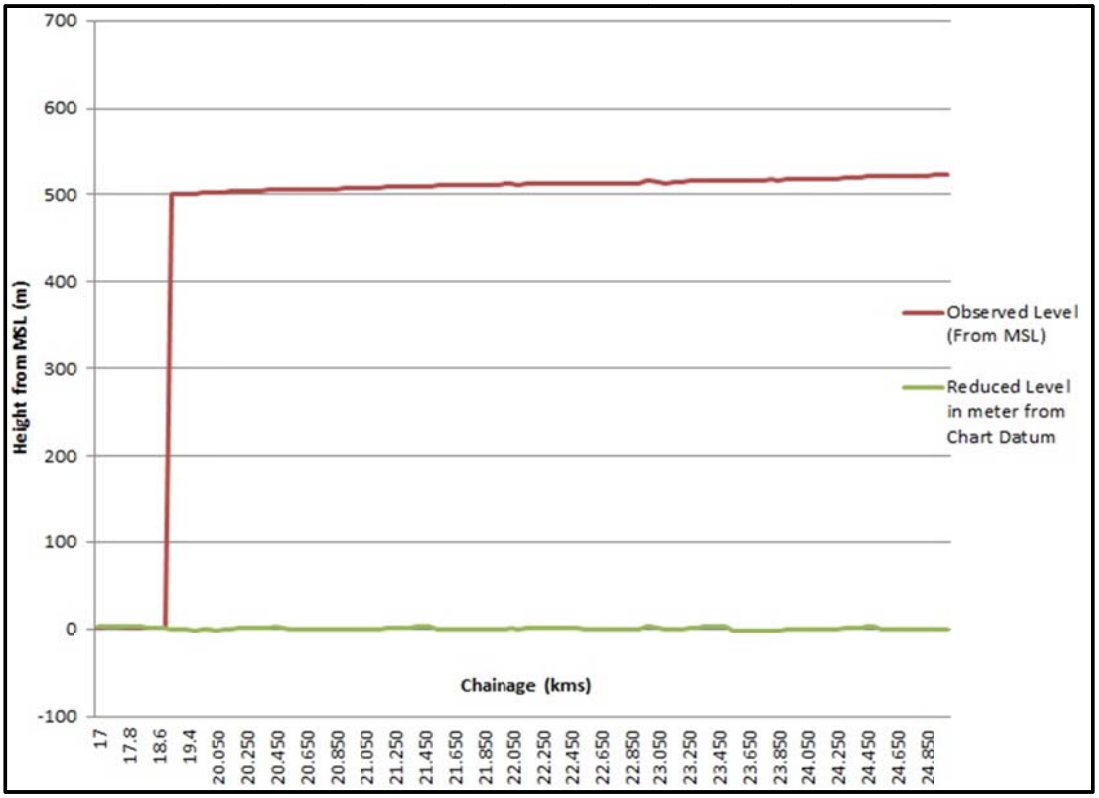


Figure 8 – Observed and Reduced bed Profile Near Lahri Village to Chuhn Village

Second stretch (Ch. 17.00 to 25.00 km) starts from Lahri Village. Bathymetry Survey was done only for 1.40 km of length remaining portion was completed with topographic survey. This Stretch is navigable from 17 km to 22 km when water level of Ranjit Sagar Dam reaches 527.91 m. Remaining 3 km (from 22.00 km to 25.00 km) not navigable due to insufficient water. No bridge is present in this stretch of River. Main villages in this stretch are Mandla, Sandar and Kandei. All area of this stretch is surrounded by hills having hard rocks and boulders. Hyacinth, rocks, rapid waterfalls, forest, wild-life sanctuary, security issues etc. are not present in this stretch. Land is generally used for agriculture purpose on both bank of river. Forest land is also present on both bank of river. No Industries along this stretch of waterway. There was no jetties seen. No Terminals seen in this stretch. There are no Passenger ferry services and no water sport recreational facilities are present in this stretch of waterway. At the Chainage of 17.00 km sand mining area is present. Transportation of sand from this mining area to Basohli through boat.

Figure 9 – Ch. 19.00 Km Boulders and Right Bank View of River

Figure 10 – Ch. 21.25 km View of River

Figure 11 – Ch.21.25 km View of River

3.3 Chuhn Village to Sanjap Parchhi (Ch. 25.00 km – 35.00 km)

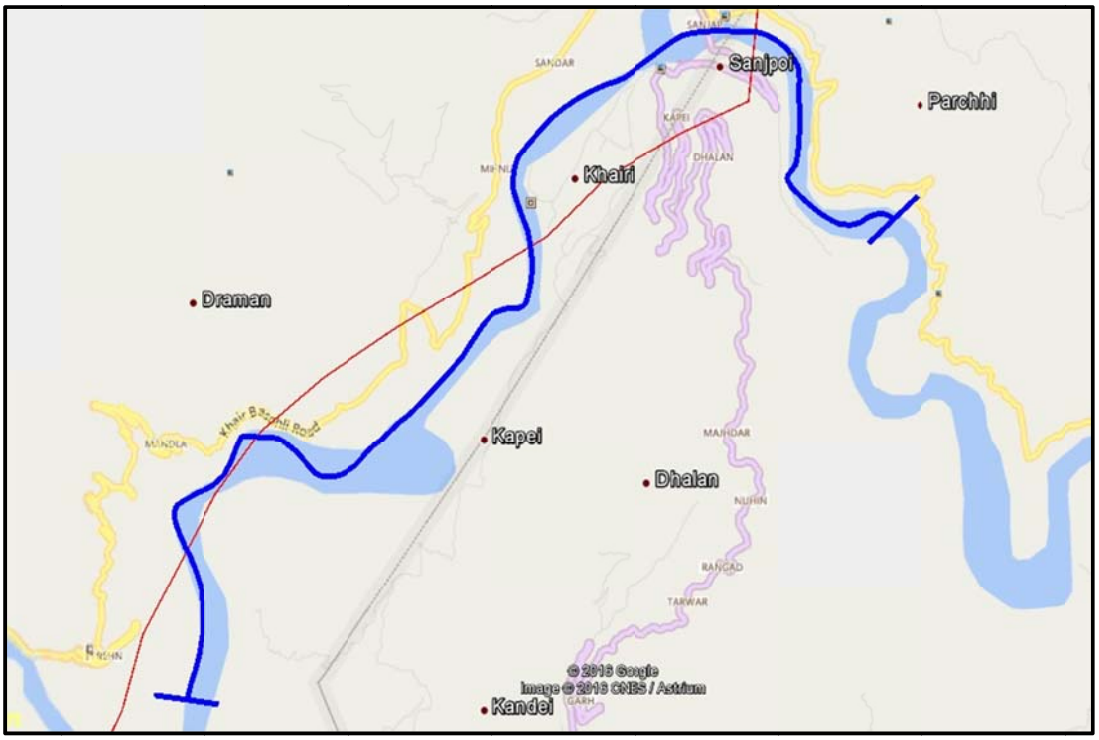


Figure 12 – Chuhn Village to Village Sanjap

Table 18 – Minimum – Maximum Reduce Depths, Chuhn Village to Village Sanjap

Class	Chainage		Reduced w.r.t. Sounding Datum			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	25.00	35.00	-0.30	0.00	10.00	549009.29
II	25.00	35.00	-0.30	0.00	10.00	654107.67
III	25.00	35.00	-0.30	0.00	10.00	1176239.85
IV	25.00	35.00	-0.30	0.00	10.00	1369276.13

Table 19 – Minimum Observe Depths, Chuhn Village to Village Sanjap

Class	Chainage		Observed			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	25.00	35.00	0.0	0.0	10.00	426286.22
II	25.00	35.00	0.0	0.0	10.00	648292.22
III	25.00	35.00	0.0	0.0	10.00	978482.42
IV	25.00	35.00	0.0	0.0	10.00	1171514.34

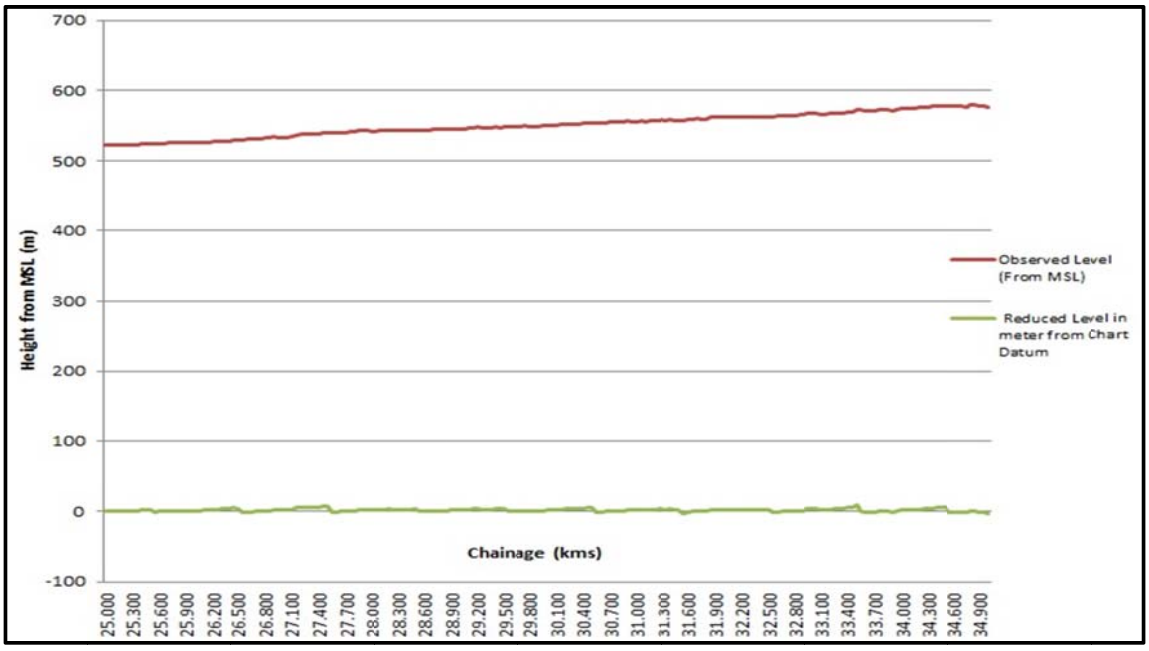


Figure 13 – Observed and Reduced bed profile for Chuhn Village to Village Sanjap

Main villages in this stretch are Draman, Kapei, Khairi, Sanjpoi and Parchhi. Only Topographic Survey was done for this stretch of waterway due to insufficient quantity of water for bathymetry survey. River goes narrow in this stretch of river. Approach road on right bank of River is constructed & in use. Banks of river are not protected. Hyacinth, rocks, rapid water falls are present in this stretch. Gradient of River is very steep. No railway line and railway station in vicinity of this stretch of Ravi River. Land is generally used for agriculture purpose on both bank of River. Forest land also present on both bank of river. No Industries along this stretch of waterway. There are no Jetties and Terminals seen in this stretch. There are no prominent cities in this stretch of waterway. There is no ferry Passenger ferry services and no water sport recreational facilities are present in this stretch of waterway. 1 Bridge is crossing the River. Chamera dam is present at the end of this stretch. Height of this bridge is sufficient for Waterway make navigational. Soil type is mostly sandy with boulder and gravels mix. Wheat and corn is main crop. There is no Encroachment in this stretch. High hills were present. Steep slope of river banks are present in some areas.

Figure 14 – Ch.29.25 Km River View

Figure 15 – Ch.32.517 Km Khairi Bridge

Figure 16 – Ch.32.67 Km Dry River Near Khairi Bridge

3.4 Village Sanjapto Chamera Dam (Ch. 35.00 km – 44.276 km)

Figure 17 – Village Sanjap to Chamera Dam

Table 20 – Minimum – Maximum Reduce Depths, Village Sanjap to Chamera Dam

Class	Chainage		Reduced w.r.t. Sounding Datum			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	35.00	44.276	-0.30	0.0	9.276	503367.46
II	35.00	44.276	-0.30	0.0	9.276	599927.17
III	35.00	44.276	-0.30	0.0	9.276	1078455.04
IV	35.00	44.276	-0.30	0.0	9.276	1255774.00

Table 21–Minimum – Maximum Observe Depths, Village Sanjap to Chamera Dam

Class	Chainage		Observed			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
I	35.00	44.276	0.0	0.0	9.276	387209.49
II	35.00	44.276	0.0	0.0	9.276	586786.44
III	35.00	44.276	0.0	0.0	9.276	897138.11
IV	35.00	44.276	0.0	0.0	9.27	1074452.97

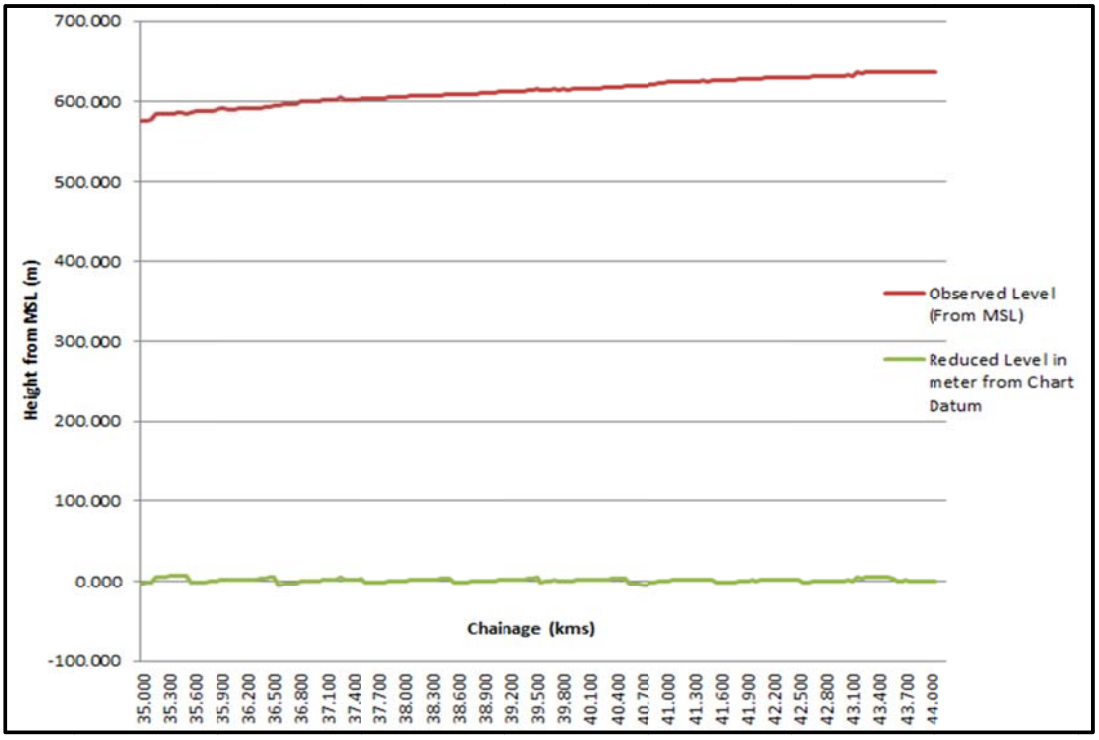


Figure 18 – Observed and Reduced bed profile of Village Sanjap to Chamera Dam

Main villages in this stretch are Sanjap, Khajura, Janoli, Jandrera, Sherpur, Chuhra and Gandhiar. Only Topographic Survey was done for this stretch of waterway due to insufficient quantity of water for bathymetry survey. River goes narrow in this stretch of

river. Approach road on right bank of River is constructed & in use. Banks of river are not protected. Hyacinth, rocks, rapid waterfalls are present in this stretch. Gradient of River is very steep. No railway line and railway station in vicinity of this stretch of Ravi River. Land is generally used for agriculture purpose on both bank of River. Forest land also present on both bank of river. No Industries along this stretch of waterway. There are no Jetties and Terminals seen in this stretch. There are no prominent cities in this stretch of waterway. There is no ferry Passenger ferry services and no water sport recreational facilities are present in this stretch of waterway. 2 Bridges are crossing the River. Chamera dam is present at the end of this stretch. Heights of Sherpur bridge is not sufficient for Waterway make navigational. Soil type is mostly sandy with boulder and gravels mix. Wheat and corn is main crop. There is no Encroachment in this stretch. Erosion of bank was present near chuhn village. Boulders, Gravels, Pebbles and Sand are main composition of river deposit on river bed and flooded zone. High hills were present. Steep slope of river banks are present in some areas.

Figure 19 – Ch. 35.63 Km DGPS Base

Figure 20 – Ch.41.126 Km Sherpur Bridge

Figure 21 – Ch.42.691 Km Chauhn Bridge

Figure 22 – Ch.44.276 Km Chamera Dam at Gandhiar

Figure 23 – Ch.44.276 Km Road Tunnel on Chamera Dam at Gandhiar

4. LOCATIONS FOR TERMINAL CONSTRUCTION

Total 01 (one) location are proposed for construction of terminals along the Ravi River stretch. This is only the ingle location where Terminal construction is feasible. U/S from Ranjit Sagar Reservoir, feasibility of making terminal in minimal because of narrow vally and high hills. The location has been proposed based on following considerations:-

- Availability of suitable depths for vessel berthing
- Availability of land for construction of terminal
- Connectivity to hinterland
- Distance from city traffic limits
- Possibility of future expansion
- Possibility of new industrial setup along the river stretch in future

4.1 Terminal 1 (at Ranjit Sagar Dam of Ch. 0.51 km):

The suggested location is in the Ranjit Sagar Dam Reservoir near dam axis. The location is well connected to road and can be developed as a start/end point terminal. The location has potential to be developed into a major terminal in future. Depths are quite suitable and land can be easily available.

Figure 24 – Overview, Terminal Location (Terminal 1)

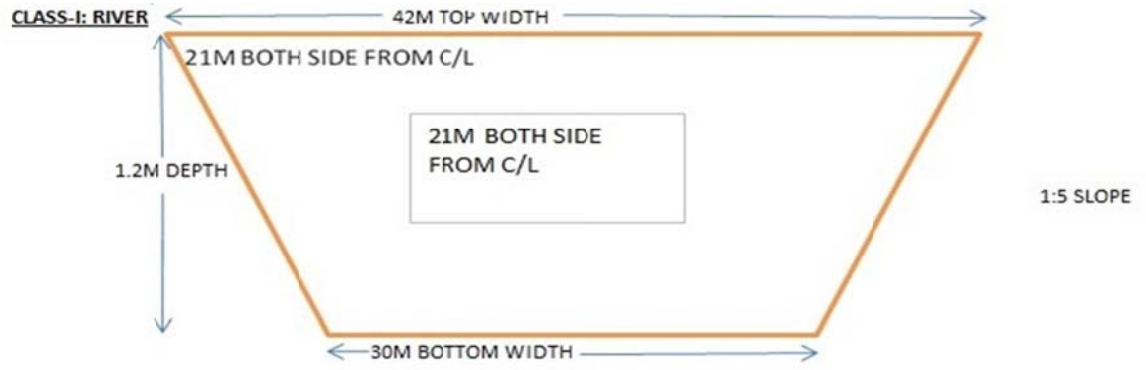
Table 22 – Terminal Location

Stretch No.	Chainage (km)	Location	Position			
			Latitude (N)	Longitude (E)	Easting (m)	Northing (m)
1	0.51	RANJIT SAGAR DAM	32°26' 48.3032"N	75°43' 56.7602"E	E 568845.500	N 3590192.500

5. FAIRWAY DEVELOPMENT

As per the client requirement, fairway dimension of channel has made of 4 types.

1) 30m x 1.2m with Side slope of 1:5, along the deepest route.



Dredging quantity for the depths of **2.0 m, 1.7 m, 1.4 m and 1.2** is calculated stretch wise. The dredge volume calculations were accomplished using the HYPACK dredge volume computation utility (Standard Hypack method).The stretch wise results of the dredge volume are as given:-

Table 23 - Dredging Volume Summary in River Class -1

Dredging Volume Summary in Ravi River at 1.2 M depth											
Chainage		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated Drg Qty. (cu.m)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated drg. qty. (cu.m.)
0.00	17.00	2.3	88.3	0.00	0.00	0.00	0.82	88.2	1.00	3434.940	3434.940
17.0	25.00	0.0	5.0	7.20	287182.10	287182.10	-0.30	3.85	8.00	389526.470	392961.410
25.0	35.00	0.0	0.0	10.00	426286.22	713468.32	-0.30	0.00	10.00	549009.290	941970.700
35.0	44.276	0.0	0.0	9.276	382932.84	1100677.81	-0.30	0.00	9.276	503367.460	1445338.160
		Total			1,100,677.81		Total			1,445,338.16	

2) 40m x 1.4m with Side slope of 1:5, along the deepest route.

Table 24 – Dredging Volume Summary in Ravi River Class -2

Dredging Volume Summary in Ravi River at 1.4 M depth											
Chainage		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated Drg Qty. (cu.m)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated Drg. qty. (cu.m.)
0.00	17.00	2.1	88.3	0.00	0.000	0.000	0.7	88.2	1.00	8479.800	8479.800
17.00	25.00	0.0	5.0	7.20	441968.550	441968.550	-0.30	3.85	8.00	470060.440	478540.240
25.00	35.00	0.0	0.0	10.00	648292.220	1090260.770	-0.30	0.00	10.00	654107.670	1132647.910
35.00	44.276	0.0	0.0	9.276	586786.440	1677047.210	-0.30	0.00	9.276	599927.170	1732575.080
		Total			1,677,047.21		Total			1,732,575.08	

3) 50m x 1.7m with Side slope of 1:5, along the deepest route.

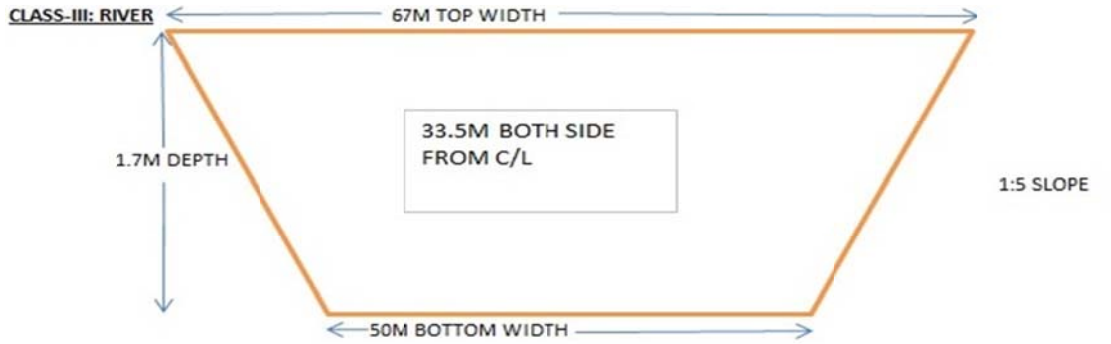


Table 25 – Dredging Volume Summary in Ravi River at Class -3

Dredging Volume Summary in Ravi River at 1.7 M depth											
Chainage		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated Drg Qty. (cu.m)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated drg. qty. (cu.m.)
0.00	17.00	2.1	88.4	0.00	0.00	0.000	0.68	88.2	1.20	26648.75	26648.75
17.00	25.00	0.0	5.0	7.20	664848.76	664848.760	-0.30	3.85	8.00	855322.33	881971.08
25.00	35.00	0.0	0.0	10.00	978482.42	1643331.180	-0.30	0.00	10.00	1176239.85	2058210.93
35.00	44.276	0.0	0.0	9.276	897138.11	2540469.290	-0.30	0.00	9.276	1078455.04	3136665.97
		Total			2,540,286.58					3,136,665.97	

4) 50m x 2.0m with Side slope of 1:5, along the deepest route.

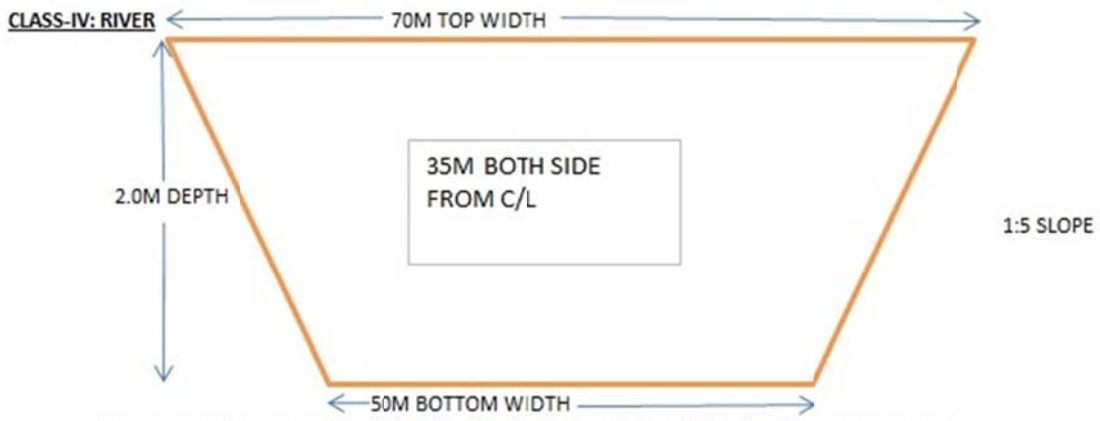


Table 26 – Dredging Volume Summary in Ravi River Class -4

Dredging Volume Summary in Ravi River at 2.00 M depth											
Chainage		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Acumulative drg. qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulated drg. qty. (cu.m.)
0.00	17.00	2.9	88.4	0.00	0.00	0.000	0.68	88.2	1.20	45979.68	45979.68
17.00	25.00	0.0	5.0	7.20	805777.70	805777.70	-0.30	3.85	8.00	1010964.21	1056943.89
25.00	35.00	0.0	0.0	10.00	1171514.34	1977292.04	-0.30	-0.30	10.00	1369276.13	2426220.02
35.00	44.276	0.0	0.0	9.276	1074452.97	3051745.01	-0.30	0.00	9.276	1255774.00	3681994.02
	Total				3,051,745.01					3,681,994.02	

Dredging quantity, minimum & maximum depths and length of shoal have also been calculated per km wise and the same is at Annexure-2

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
1	5.111	32°54' 27.4992"N	74°46' 16.3584"E	478605.191	3641071.036	1.17	0.59
2	16.069	32°58' 14.1795"N	74°47' 33.9135"E	480633.485	3648047.322	0.63	0.32
3	34.221	33°5' 5.0086"N	74°48' 9.1673"E	481572.348	3660696.915	1.21	0.61

6. CONCLUSION

IWAI has marked as National Waterways (NW-84) from Ranjit Sagar Dam to Chamera Dam at Gandhiar for the stretch of 44.276 km of length.

The aim of survey was to conduct a survey for assessing the river stretch from Ranjit Sagar Dam to Chamera Dam at Gandhiar, for surface navigation by vessels. The area has been adequately sounded and all conspicuous objects within and in the vicinity of the survey area has been fixed. The deliverable sheets contain shoal based depth information, important landmarks with state of the river banks. The survey is considered complete in all respects.

In the present form, the river is navigable between Ranjit Sagar Dam to downstream of Chuhn village (Ch. 17.0 km) without dredging requirement. This will also result into ensuring the navigability for 365 days in a year. Full reservoir level (FRL-527.91 m from MSL) length of reservoir goes up to Chuhn village (Ch. 22.00 km) so the navigability is possible up to Ch. 22.00 km at full reservoir level (FRL). To assess the feasibility of navigation beyond downstream of Chuhn village (Ch. 17.0 km) to upstream, capital dredging would be required up to Chamera Dam at Gandhiar (Ch. 44.276 km).

Tojo Vikas recommend for no need of preparation of TEF study / DPR.

One Terminal may be developed on Ravi River for facilitation of cargo.

Table 27 - Dredging Summary of Ravi River

Class	Observed						Reduced w.r.t. Sounding Datum			
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)
1	00	44.276	0	88.3	26.476	1,100,677.81	-0.3	88.2	28.726	1,445,338.16
2	00	44.276	0	88.3	26.476	1,677,047.21	-0.3	88.2	28.726	1,732,575.08
3	00	44.276	0	88.4	26.476	2,540,469.29	-0.3	88.2	28.726	3,136,665.97
4	00	44.276	0	88.4	26.476	3,051,745.01	-0.3	88.2	28.726	3,681,994.02

7. DETAILS OF ANNEXURES

Annexure - I	Data collected from various agencies
Annexure - II	Dredge Volume
Annexure - III	Observed Water level, Reduction and Corrected Water Levels
Annexure - IV	Details of Bathymetric Survey carried out
Annexure - V	Details of Bank Protection
Annexure - VI	Details of Features across the Bank
Annexure – VII	Details methodology adopted for Horizontal Control and Vertical Control
Annexure – VIII	Photographs of Equipment
Annexure – IX	Details of Bench Marks
Annexure – X	Silt Sample Report
Annexure – XI	Water Sample Report
Annexure – XII	Calibrations Certificates
Annexure - XIII	Field Photographs