FEASIBILITY REPORT ON
DETAILED HYDROGRAPHIC SURVEY IN
JHELUM RIVER (110.27 KM) FROM WULAR LAKE TO DANGPORA VILLAGE (REGION-I, NW- 49)

Submitted To

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VOLUME – I
MAIN REPORT

First Survey: 9 Jan to 5 May 2017
Revised Survey: 2 Dec 2017 to 25 Dec 2017

ACKNOWLEDGEMENT

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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/JLM/FD/01	01 of 01	1:00,000
Detailed Hydrographic & Topographic Survey	TVIPL/IWAI/JLM/FD/02	01 to 20	1:5,000

SALIENT FEATURES AT A GLANCE

#	Particulars	Details
1.	Name of Consultant	TojoVikas International Pvt. Ltd.
2.	Cluster Number and State(s)	Region- I and State- Jammu & Kashmir
3.	Waterway stretch, NW #	Waterway Stretch- Jhelum River Waterway Name- NW- 49 Waterway Description- Wular Lake (34°21'37.54"N, 74°36'37.16"E) to Dangpora Village (33°49'25.20"N, 75° 3'49.87"E). Total Length- 110.27 km
4.	Navigability status	The Jhelum River is partially used for navigation by Shikara and small boats for tourist.
a)	Tidal & non tidal portions	Non Tidal
b)	**LAD status** (Observed) Survey period (14th Dec 2016 to 11th Feb 2017) i) < 1.2 m (km) ii) 1.2 m to 1.4 m (km) iii) 1.5 m to 1.7 m (km) iv) 1.8 m to 2.0 m (km) v) > 2.0 m (km) **LAD status** (w.r.t. Reduced Depth) Survey period (14th Dec 2016 to 11th Feb 2017) i) < 1.2 m (km) ii) 1.2 m to 1.4 m (km) iii) 1.5 m to 1.7 m (km) iv) 1.8 m to 2.0 m (km) v) > 2.0 m (km)	

LAD (m) Observed	0–20 km	20-44.48 km	44.48-60 km	60-80 km	80-100 Km	100 – 110.270 Km	Total km
< 1.2 m (km)	0	0	0	0	0	0	0
1.2m to 1.4m (km)	0	0	0.2	0	0.2	0	0.4
1.5m to 1.7m (km)	0	0	0	0	0	0	0
1.8m to 2.0m (km)	0	0	0	0	0	0	0
> 2.0 m (km)	20	24.48	15.32	20	19.8	10.27	109.87
						Grand Total	**110.27**

LAD (m) Reduced	0–20 km	20-44.48 km	44.48-60 km	60-80 km	80-100 Km	100 – 110.270 Km	Total km
< 1.2 m (km)	8.9	22.1	5.9	14.1	0.4	0	51.4
1.2m to 1.4m (km)	1.5	1.0	0.1	0.5	0.8	0	3.9
1.5m to 1.7m (km)	0.8	0.4	0.2	0.7	0.	0	2.1
1.8m to 2.0m (km)	0.4	0.1	0	1.0	0	0	1.5
> 2.0 m (km)	8.4	0.88	9.32	3.7	18.8	10.27	51.37
						Grand Total	**110.27**

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- Not Present Weirs- 1 (Chattabal weir) Barrages- Not Present Navigational Lock- 1, Present at Chattabal weir Bridges- 42 Nos. Vertical Clearance wrt HFL: -3.13 m to 7.8 m Horizontal Clearance- 20m - 70 m Power Cable- 63 Nos. Vertical Clearance wrt HFL – 6.0 m to 20.0 m Horizontal Clearance- 65 m - 315 m
d)	Avg. discharge & no. of days	264 cu.m/sec
e)	Slope	Average bed Slope- 1:6147 (1m in 6.147 Km)
5.	Traffic potential	Navigational traffic by small boats and Shikara is present in the survey stretch of Jhelum River.
a)	Present IWT operations, ferry services, tourism, cargo, if any	There are no ferry and cargo services at Jhelum River. Only Ro-Ro and Tourist activities are present in some stretch of the Jhelum River.
b)	Important industries within 50 km	No Major industries in Srinagar Valley except MSME. HP Gas Plant, Pampore J&K Cement Industry, Khrew FCI & Floor Mill, Lethipora Saifco Cement Factory, Khanmo Saifco Mill, Frestabal
c)	Distance of Rail & Road from Industry	Srinagar is the major station located within 5km from the Area of interest. The other railway's stations near to the survey stretch are Avantipora, Panzgome, Kakapora, Pampore, Badgam, Sopore, Mazhom, Pattan The area is well connected with road network to other cities like Badgam, Avantipora, Anantnag and Srinagar.
6.	Any other information/ comment	NA

(Signature)

Date: Name of Consultant

1.0 INTRODUCTORY CONSIDERATIONS

1.1 River Course: Background Information

Name of River- Jhelum

Length of River – 725 Km

110.270 km length of the River from Wular Lake to Dangpora Village (National Waterway - 49)	**From: 34°21'37.54"N, 74°36'37.16"E**	**Up to: 33°49'25.20"N, 75° 3'49.87"E**

Jhelum River is a major river of India and Pakistan. It flows in the Indian and Pakistani controlled portions of Kashmir, and Punjab in Pakistan. It is a tributary of the Chenab River and has a total length of about 725 kilometers. The waters of the Jhelum are allocated to Pakistan under the terms of the Indus Waters Treaty.

The river Jhelum rises from Verinag Spring situated at the foot of the Pir Panjal in the south-eastern part of the valley of Kashmir. It flows through Srinagar and the Wular Lake before entering Pakistan through a deep narrow gorge. The Neelum River, the largest tributary of the Jhelum, joins it, at Domel Muzaffarabad, as does the next largest, the Kunhar River of the Kaghan valley. It also connects with rest of Pakistan and Pakistan occupied Kashmir on Kohala Bridge east of Circle Bakote. It is then joined by the Poonch River, and flows into the Mangla Dam reservoir in the district of Mirpur. The Jhelum enters the Punjab in the Jhelum District. From there, it flows through the plains of Pakistan's Punjab, forming the boundary between the Chaj and Sindh Sagar Doabs. It ends in a confluence with the Chenab at Trimmu in District Jhang. The Chenab merges with the Sutlej to form the Panjnad River which joins the Indus River at Mithankot.

The Sanskrit name of this river is **Vitasta**. The river's name is derived from the mythological incident regarding the origin of the river as explained in Nilamata Purana. Goddess Parvati was requested by sage Kasyapa to come to Kashmir for purification of the land from evil practices and impurities of Pisachas living there. Goddess Parvati then assumed the form of a river in the Nether World. Then Lord Shiva made a stroke with his spear near the abode of Nila (Verinag Spring). By that stroke of the spear, Goddess Parvati came out of the Nether World. Shiva himself named her as Vitasta. He had excavated with the spear a ditch measuring one Vitasti through which the river - gone to the Nether World - had come out, so she was given the name Vitasta by him.

The river was regarded as a god by the ancient Greeks, as were most mountains and streams; the poet Nonnus in the *Dionysiaca* makes the *Hydaspes* a titan-descended god, the son of the sea-god Thaumas and the cloud-goddess Elektra. He was the brother of Iris, the goddess of the rainbow, and half-brother to the Harpies, the *snatching* winds. Since the river is in a country foreign to the ancient Greeks, it is not clear whether they named the river after the god, or whether the god *Hydaspes* was named after the river. Alexander the Great and his army crossed the Jhelum in BC 326 at the Battle of the Hydaspes River where he defeated the Indian king, Porus. According to Arrian (*Anabasis*, 29), he built a city "on the spot whence he started to cross the river Hydaspes", which he named *Bukephala* (or *Bucephala*) to honour his famous horse Bukephalus or Bucephalus which was buried in Jalalpur Sharif. It is thought that ancient Bukephala was near the site of modern Jhelum City. According to a historian of Gujrat district, Mansoor Behzad Butt, Bukephalus was buried in Jalalpur Sharif, but the people of Mandi Bahauddin, a district close to Jhelum, believed that their tehsil Phalia was named after Bucephalus, Alexander's dead horse. They say that the name Phalia was the distortion of the word Bucephala. The waters of the Jhelum are allocated to Pakistan under the terms of the Indus Waters Treaty. India is working on a hydropower project on a tributary of Jhelum River to establish first-use rights on the river water over Pakistan as per the Indus waters Treaty.

The hydrology of the Jhelum River is largely controlled by snowmelt from the Karakoram and Himalaya ranges in the spring and the southwest monsoon on the Indian subcontinent that brings heavy rains from June to September. The highest flood discharges on the Jhelum exceed 1,000,000 cubic feet (28,300 cubic metres) per second. Little rain falls during the winter, so the river level is substantially lower than in the summer months.

The lower course of the Jhelum has been developed for irrigation and the production of hydroelectric power. The Mangla Dam and Reservoir irrigates about 3 million acres (1.2 million hectares) and has an installed hydroelectric capacity of some 1,000 megawatts. The Upper Jhelum Canal leaves the river at Mangla and runs eastward to the Chenab River at Khanki, and the Lower Jhelum Canal starts at Rasul. Both canals are used for irrigation.

1.2 Tributaries / Network of Rivers / Basin

The tributaries of the Jhelum River include Vishow, Romshi, Doodhganga, Sukhnag, Lidder, Ferozepora, Sindh, Pohru, Ningli, Sundran, Bringi, AripathErin, Madumati, Rambiara, Watalara & Aripal. River Jhelum is the part of Indus river system. It flows through India & Pakistan before merging with River Chenab & subsequently into Indus River before draining ito Arabian Sea through Indus delta.It finds its origin from a deep spring at Verinag, located in the south eastern side of Kashmir at the foot of Pir Panjal mountain range in J&K state. It is flowing from its source with varying velocity & discharge from southern Kashmir to northern west. It gets widened as it flows in characteristic loops, curves through the heart of Srinagar until it merges with Wular lake, the largest fresh water lake of Asia.

River Jhelum is the life line of Kashmir the entire basin is full of wet lands ranging from glaciated lake within the hills to floodplain lakes & marshes within the valley. The lakes are directly & indirectly connected with River Jhelum. Wular Lake, once the largest lake in Asia, has rich biodiversity & plays a significant role in hydrography of Kashmir. The lake with its associated wetlands supports rich biodiversity & provides important habitants for migratory water birds within central Asian flyway. The Jhelum basin extends to an overall area of 33,300 sq. Kms. Within India & Pakistan covers 3% of overall Indus basin area. Khadanyar gorge divides the entire area into two segments. The upper segment of basin has an area of 12,777 Sq.km. and the drains the entire valley of Kashmir.

The basin is shaped forming an elongated depression between the great Himalaya in the North east & the Pir panjal ranges & separate the basin from the great plains of Northern India. Whereas the great Himalayas separate the valley from Ladakh The highest mountain peak enclosing the basin have an elevation of more than EL-5300m on the Great Himalayan side & more than EL-5500m on the Pir Panjal side, important peaks surrounding the basin are Nanga Parbat and Tosa Maidan in the north, Mahadev, Gwash Brari, and Amarnath in the south, Kazi Nag on the north west and Harmukh on the east. The physiographic features of the basin change rapidly with the altitude. Several glaciated lakes including Tarsar, Mar Sar, Kaunsernag, Sheshnag and Gangbal etc. are located till about EL-4500m which serve as source of the streams and rivulets draining into Jhelum. The forests are mainly located between EL-1650 to EL-3500m with

margs and pastures. The rest of the basin area forms a vast plain consisting of Kashmir Vallay and its four side Valleys, Lolab, Lidder, Sindh and Kishanganga with an area of 4865 Sq. Km. and altitude ranging from EL-1400m to EL-1650m. The valley of Kashmir is the demographic and economic hub of the basin, in habited by more than 85% of its total population. The karewas having flat topped terraced features account for nearly 50% of the overall Valley area. The karewas on the left bank of the River Jhelum are extensive and massive till the northern west end. Whereas they are quite few in number and smaller in extension on the right bank these have alluvial land features. Precipitation patterns within the basin vary with orography. The Pir-Panjal range being in the direct pathway of the south west monsoons has more rainfall in the southern slopes than the Valley facing the northern slopes. Contrary to it, the Valley facing slopes of Himalayas receive more rainfall as compared to inner slopes. The higher altitudes of the basin, in general, receive more rainfall than lower altitudes.

River System:

The valley of Kashmir is a bowl shaped low level basin surrounded by high mountain and hills in all sides.it is believed that it was basically a large lake called “SATISAR. As a result of geomorphological transformation the huge lake got drained out through Baramulla and gave birth to a series of low level water bodies. Rakhs and wet lands with only one central drainage channel known as River Jhelum.River Jhelum is a part of Indus River System. It flows through India and Pakistan before merging with River Chenab and subsequently into Indus River before draining into arabian Sea through Indus Delta. It finds its origin from a deep spring at Verinag, located int he south eastern side of Kashmir at the foot of the great PirPanjal mountain range in J&K State. It is flowing from its source with a varying velocity and discharge from southern Kashmir to North West. It gets widened as it flows in characteristic loops, curves through the heart of srinagar until it merges with the Wular Lake, the largest fresh water lake of Asia.The River exhibits unique distinct character from the other rivers of the Himalayan Range. The 772 km long river of which 177 kms is covered in india. It is sheltered amidst the huge Himalayas and moves through the beautiful Kashmir valley along its meandering course. The Jhelum flows to a distance of 25.6 Kms to Khanabal like a nallah. From the place a number of tributaries join the Jhelum during its passage upto Wular Lake. South eastern part of PirPanjal mountains give birth to several streams which meet together

with the flow of Aripath from the north east, Bringi and Sandran from the south east to form River Jhelum at Khanabal. The liddernallah arises from Sheshnag lake Joins the Jhelum at Gur near Anantnag after flowing down Pahalgam Valley. Two tributaries Vishow and Rambiara, originate from Pansal mountains meet River Jhelum at sangam to its left bank. Vishaw arises from the Konsarnag Lake and before joining Jhelum carries the flow of all the streams arising from the norhtern slopes of Pir Panjal Mountains between sidav and banihal passes. The rambiara arises from the Nandansar and Beghsar lakes of the PirPanjal Mountains. The tributary Aripal next joins to its right bank at Charligund and Romshinallah meets its left bank.

Tschunti Khul connects Dal Lake receiving flow of Tarsar through Tailbal nallah with Main River at Srinagar. Doodhganga nallah originates from the eastern slopes of Pansal Mountains. Sindh nallah joins river Jhelum at Shadipora, downstream Srinagar. The sindhnallaharises from the Ganga Lake on Harmukh Mountains and flowing through Zojilla and Amarnath peaks and is the largest tributary of Jhelum. It splits up into various branches downstream forming extensive lakes and marshes of which Anchar lake is the largest. The sindhnallah joins Jhelum after leaving Anchar Lake. The River Jhelum thereafter flows through Wular Lake entering at Banyari and exiting at Sopore, between Asham and Banyari the river is connected through several small streams and nallahs draning Asham and Malgam marshes.

The Flood spil channel takes off from it at Padshahi bagh which is en-routed by different nallahs like Doodhganga, Sukhnag and Fairozepora nallah rising from palas, during its course upto entering into Wular Lake at Banayari. The River Jhelum covers a distance of 125.17Kms from Khanabal to Banayari, the Inlet of Wular Lake. This lake does not only function as delta for the river but, also, acts as a natural reservoir for flood moderation. It accommodates direct flow from Arin, Madumati and Flood Spill channel.

After emerging out from Wular lake the river is known as Out Fail Channel and is joined by Ninglinallah just downstream of Wular lake on its left bank. This rises in the Apharwat peak above Gulmarg. The pohrunallah, formed by the junction of Kehmil nallah and Lolabnallah at Mughalpur village, meets the Out Fall channel at its right bank at Doabgah downsream Sopore. About 15 Kms downstream Doabgah onwards the river is joined by Mundri and other streams of Buniyar along its left bank and Limber, Dakil and Vijnallahs etc. on its right bank.

The out Fall Channel flows in between high banks upto Baramulla and though high mountains thereafter. Besides, some small torrential nallahs and streams also join it along its course upto Khadanyar. After this the river enters the Khadanyar gorge after covering a distance of 28.8 kms from Wular Lake. The river thereafter follows a westerly course for 120 Kms joining Kishanganga, arises from the eastern and of Tilail Valley and flows through Gurez and Dawar before meeting Jhelum at Domail in Muzafferabad. Below Muzafferabad the Jhelum turns southwards and after being joined by Kunihar river continues and meets River Chenab at Jhang Pakistan. The River Chenab thereafter continues to flow till it meets Indus at Panjnail in Pakistan. The river finally falls into Arabian Sea.

FLOOD SPILL CHANNEL

In order to handle this natural disaster the flood spilt channel came into existence in 1903 in the regime of Maharaja Pratap Singh to divert an excess flood discharge of Jhelum through it at Padshahibagh and to allow an accommodate – able discharge to pass through city channel. The waters were led to low lying numbals of Batamallo, Aarth and Hokersar and thereafter drain these numbals through Parimpora nallah. The embankments similar to those constructed in the head reach were built below Hokersar during the year 1952 to 1957. The width of this channel varied from 91.50m at head reach to 152m in tail reach.

SALIENT FEATURES OF RIVER JHELUM

S. No.	Particulars	Description
A)	River Jhelum	
1	State	Jammu and Kashmir
2	District	Anantnag, Pulwama, Budgam, Srinagar, Ganderbal, Bandipora and Baramulla.
3	Source	Verinag Spring
4	Length of River	221.18 Kms (including length of Wular lake)
5	Grade of River	1:3500 to 1:23000
6	Offtake Point of Flood Spill Channel	Padshahibagh RD = 68.54 kms
B)	Flood Spill Channel	
7	Source	River Jhelum &itsTriibutaries
8	Length	49.309 kms
9	Bed Grade	1:4200 to 1:5000

1.3 State/ District through which River Passes

Jhelum River flows from India to Pakistan. It flows through Kashmir, India to Pakistan before merging with River Chenab & subsequently into Indus River before draining into Arabian Sea through Indus delta.

1.4 Map of River and Waterway

Figure 1 – Map of Jhelum River

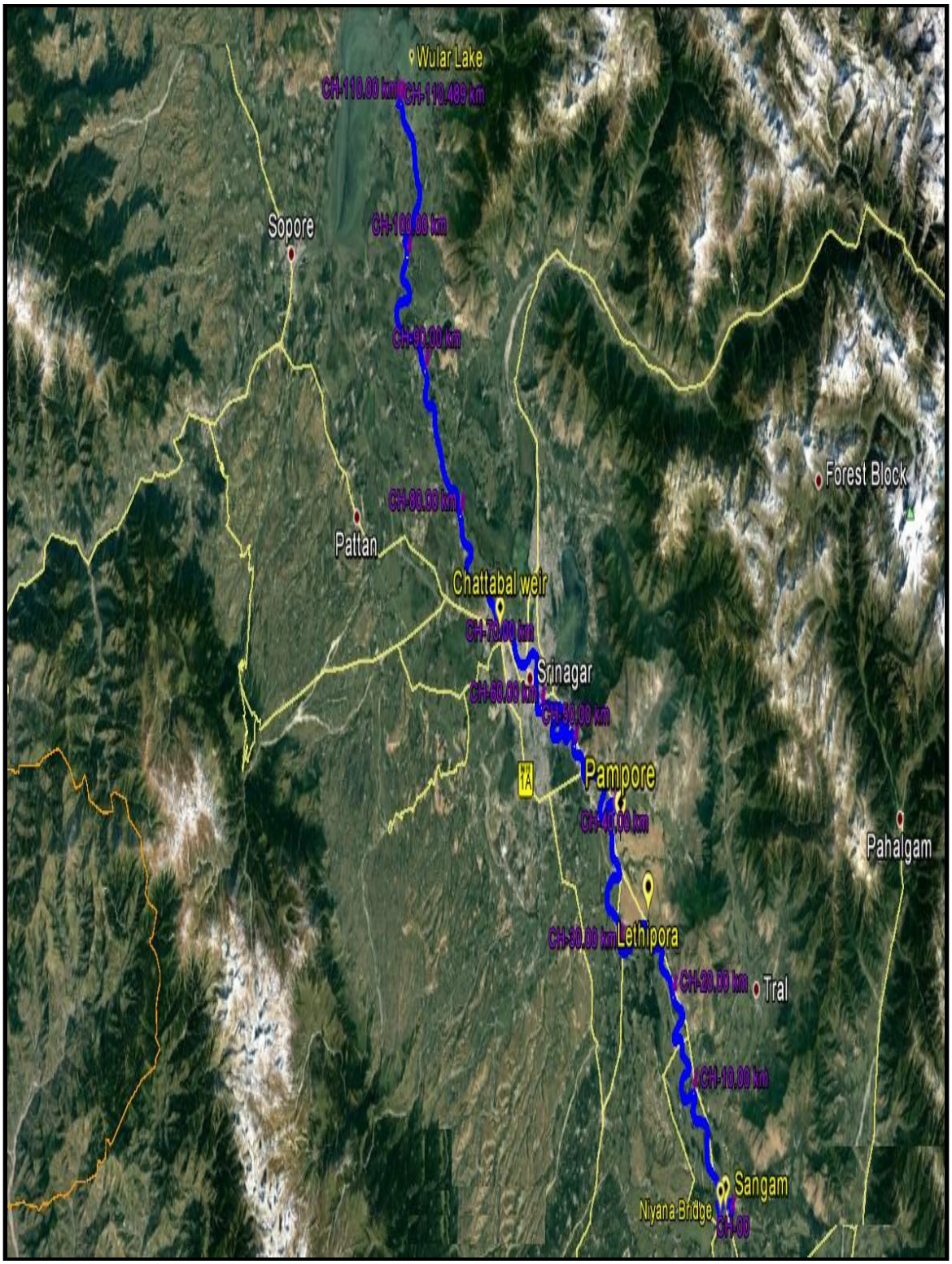


Figure 2 – Map of Waterways in Jhelum River

1.5 Scope of Work

The scope of the work is to conduct detailed hydrographic and topographic survey of about 110km length of the Jhelum River from Wular Lake (34°21'37.54"N, 74°36'37.16"E) to Dangpora Village (33°49'25.20"N, 75° 3'49.87"E).

The scope of the work for the conduct of survey of Jhelum River includes:

1. Undertake a bathymetric and topographic survey of proposed waterway.
2. Establishing horizontal and vertical control stations.
3. Construction of benchmark pillars and establishing its reduced level w.r.to MSL.
4. Setting up and deployment of water level gauges.
5. Current velocity and discharge measurements.
6. Collection and analysis of water and bottom samples.
7. A collection of topographic features including existing cross structures.
8. Preparation of inventory of industries in the project influence area (PIA).
9. Analysis of survey data, including assessment of water availability for navigation.
10. Preparation of survey charts and detailed Hydrographic survey report.

2.0 METHODOLOGY ADOPTED TO UNDERTAKE STUDY

2.1 Survey Methodology and Resources

Tojo Vikas International Pvt. Ltd conducted a Hydrographic Survey in stretch of about 110.27 KM from Wular Lake to Dangpora Village (NW-49). The survey was carried out from 19th Jan 2017 to 5th May 2017. & Revised Survey 2nd Dec.17 to 25th Dec.2017

2.1.1 Survey Methodology

The survey team was mobilized on 16th Jan 2017 and the survey was commenced on 19th Jan 2017. The Survey was completed on 5th May, 2017.

The full survey team was utilized for transfer of sounding datum by establishing tide poles at different stretches, tide pole observation and emphasis was given for extension of horizontal and vertical control for the survey stretch of Jhelum River. The details of Horizontal and vertical control adopted for the survey of Jhelum River is placed at Annexure-VII to this report. The survey was undertaken as cross-section line spacing of 100m. The Plotting of the chart was done on UTM Projection at Zone 43N as per specifications.

2.1.2 Survey Launch

The local boats operating in the area were hired at different stretches of Jhelum River and mobilized for the single beam survey operations for that respective stretches.

2.1.3 Field Problems:

The mobilization of equipment & personnel and field work completion took much more time than anticipated due to interruption by security clearance, Weather condition (snow falls, heavy rains and flood), Strike and Local disturbances.

2.1.3 Equipment

Following Hydrographic and topographic equipment were employed for the Survey of Jhelum River and the photographs of the equipment used for the survey are placed at **Annexure VIII** to this report.

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	Van Veen	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

2.1.4 Topographic Survey

The Topographic survey was carried out from 19th Jan, 2017 to 5th May, 2017. & Revised Survey 2nd Dec.17 to 25th Dec.2017 The weather was sunny, rainy, cloudy and pleasant throughout the survey period. The survey was undertaken as per the approved line plan and the spot level points in the cross line were spaced at 15-20 m interval. The plotting of the chart was done on UTM Projection at Zone 43N. The spot levels along the river banks were obtained by using Sokia DGPS.

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. 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. 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. The details of bank protection and features across the river are placed at **Annexure V & VI,** respectively. Additionally, a soft copy of the same in XYZ format is being handed over as deliverable data.

2.1.5 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 set to a range of 1468 to 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.

The water depths encountered in the survey area varied from 1.0 m to 15 m.

2.1.6 Calibration

Echo Sounder – Eco 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 Eco 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.

The other equipment used for the survey was calibrated by the equipment supplier. The equipment calibration certificates are placed at **Annexure - XII** to this report.

2.2 Description of Bench Marks/ Authentic Reference Level used

The reference Bench Mark for Bathymetric survey, Topographic survey and Pillars establishment is based on the information provided by officials of Irrigation & Flood Control Kashmir (IFCK), Srinagar. The reference bench mark was installed at Suleiman complex right bank of Jhelum River by Irrigation & Flood Control Kashmir (IFCK) with Lat 34°04'33.05"N Long 74°49'52.45"E and level erected (1598.663 from MSL) on Bench Mark provided. Tide pole was set up at every 10 km interval, 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 JLM 01 IWAI to JLM 12 IWAI) were constructed and erected along the River stretches from Wular Lake to Dangpora village (Upstream of confluence point).

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

Figure 3 – IFCK Reference Bench Mark

Table 2 – Accepted Station Coordinates (WGS-84)

Sl. No.	Station	Chainage (km)	Latitude (N)	Longitude (E)	BM Height above MSL (m)	Source/ Type
1	BM (IFCK)	51.3	34°4' 33.00"N	74°49' 52.48"E	1598.664	48 Hrs Obs/Baseline Processed
2	JLM-01	108.152	33°50' 0.02"N	75°4' 6.71"E	1595.03	6 Hrs Obs/Baseline Processed
3	JLM-02	94.693	33°54' 34.15"N	75°0' 48.87"E	1591.166	6 Hrs Obs/Baseline Processed
4	JLM-03	83.213	33°57' 53.41"N	74°57' 0.36"E	1592.585	6 Hrs Obs/Baseline Processed
5	JLM-04	78.945	33°57' 54.09"N	74°55' 21.63"E	1590.056	6 Hrs Obs/Baseline Processed
6	JLM-05	69.904	34°1' 16.74"N	74°55' 2.60"E	1589.445	6 Hrs Obs/Baseline Processed
7	JLM-06	61.897	34°2' 38.89"N	74°52' 22.82"E	1586.653	6 Hrs Obs/Baseline Processed
8	JLM-07	51.081	34°4' 16.76"N	74°49' 22.47"E	1588.42	6 Hrs Obs/Baseline Processed
9	JLM-08	40.156	34°6' 40.88"N	74°45' 9.63"E	1583.937	6 Hrs Obs/Baseline Processed
10	JLM-09	32.336	34°8' 54.99"N	74°42' 43.26"E	1581.563	6 Hrs Obs/Baseline Processed
11	JLM-10	21.228	34°13' 27.49"N	74°39' 12.55"E	1581.916	6 Hrs Obs/Baseline Processed
12	JLM-11	10.520	34°17' 6.32"N	74°37' 30.62"E	1580.181	6 Hrs Obs/Baseline Processed
13	JLM-12	3.700	34°20' 12.27"N	74°38' 7.14"E	1580.182	6 Hrs Obs/Baseline Processed

2.3 Tidal influence Zone and Tidal Variation

Jhelum River is Non Tidal, so there is no need of indicating tidal variation at different observation 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 / IFCK/ Weir in between waterway area. The datum for calculation of dredge volume needs to be adopted as per the gradient of the River and the average water level observed for the River in total Stretch about 110.27km.

2.5 Yearly Minimum and Maximum Water Levels

Data Provided in Digital Format in Annexure-III

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

No Dam, Barrages, Anicut, Aqueducts was present on site. Only Chattabal Weir with Navigational lock was present on site.

2.9 Erected IWAI Benchmark Pillars

New bench Mark Pillars (12Nos) were constructed as per specification at suitable locations as specified in the contract. The extension of horizontal and vertical control was carried out by the baseline processing with the nearest reference station. The final accepted coordinates and a Reference Level value of IWAI BM Pillars are as below:-

The final co-ordinates of the Bench Marks are shown in Table -4

Table 3 – Accepted BM Coordinates w.r.t Established CD

BM no.	Location	Chainage (km)	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	BM Height above SD (m)	Established Sounding Datum W.r.t. MSL	BM Height above MSL (m)
JLM-01	KV Pora	108.152	34°4' 33.00"N	74°49' 52.48"E	484429.803	3770577.28	-9.57	1585.46	1595.03
JLM-02	Awantipora	94.693	33°50' 0.02"N	75°4' 6.71"E	506341.013	3743679.408	-6.826	1584.34	1591.166
JLM-03	Hatiwara	83.213	33°54' 34.15"N	75°0' 48.87"E	501255.167	3752120.325	-9.205	1583.38	1592.585
JLM-04	Samboora	78.945	33°57' 53.41"N	74°57' 0.36"E	495390.193	3758258.453	-7.026	1583.03	1590.056
JLM-05	Pampore	69.904	33°57' 54.09"N	74°55' 21.63"E	492856.312	3758280.777	-7.175	1582.27	1589.445
JLM-06	Athwagan	61.897	34°1' 16.74"N	74°55' 2.60"E	492373.181	3764522.674	-5.043	1581.61	1586.653
JLM-07	Jhelum View Park	51.081	34°2' 38.89"N	74°52' 22.82"E	488278.633	3767057.105	-7.89	1580.53	1588.42
JLM-08	Shalateng	40.156	34°4' 16.76"N	74°49' 22.47"E	483659.668	3770078.357	-5.447	1578.49	1583.937
JLM-09	Noor Bagh Road	32.336	34°6' 40.88"N	74°45' 9.63"E	477190.021	3774530.609	-3.463	1578.1	1581.563
JLM-10	Sumbal	21.228	34°8' 54.99"N	74°42' 43.26"E	473451.812	3778671.083	-4.376	1577.54	1581.916
JLM-11	Hakbara Village	10.520	34°13' 27.49"N	74°39' 12.55"E	468084.658	3787081.203	-3.481	1576.7	1580.181
JLM-12	Sadhunara Hasti Khan Village	3.700	34°17' 6.32"N	74°37' 30.62"E	465501.515	3793830.593	-3.972	1576.21	1580.182

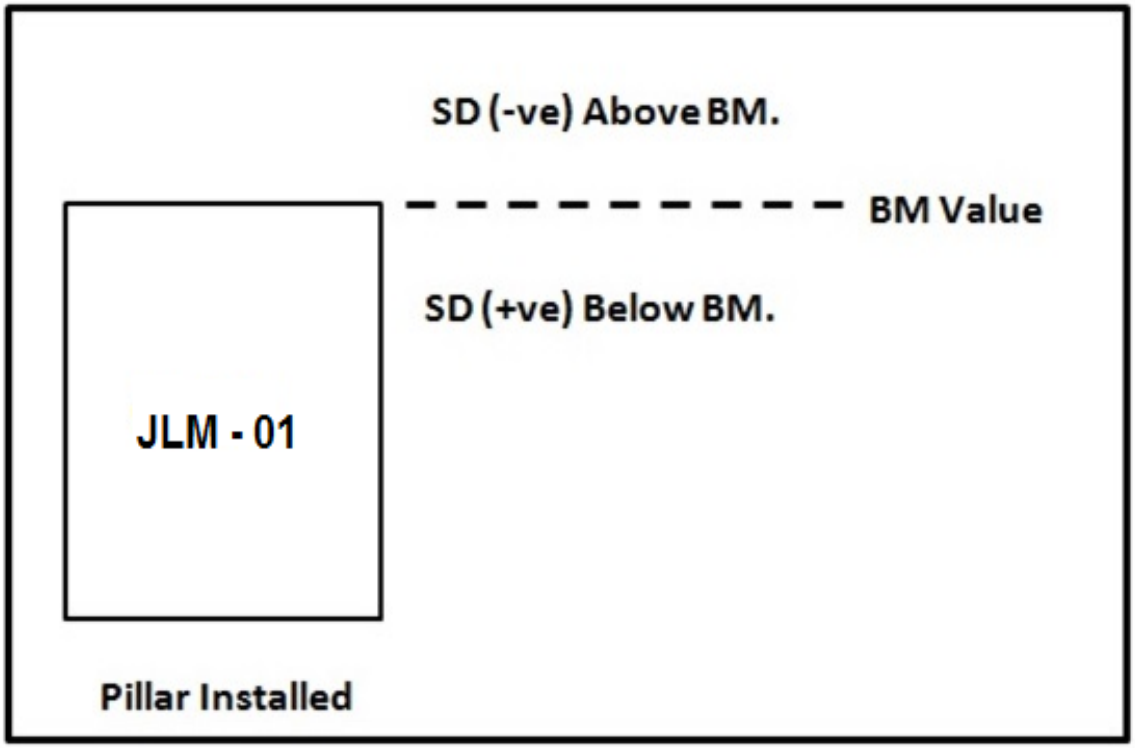


Figure 4 – Height of Bench Mark (BM) w.r.t Sounding Datum (SD)

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

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

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

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

2.10 Description of erected Tide Gauges

2 nos. of gauge was set during survey period. Details given below:-

Table 4 – Description of Erected Tide Pole

Tide Gauge no.	Location	Chainage (km)	Latitude	Longitude	Easting	Northing	Period of Observation	Zero of Tide Gauge w.r.t. MSL (m)
Tide Pole 1	Sangam	108.259	33°49' 54.79"N	75°4' 3.56"E	506260.1256	3743518.156	14 April 2017	1587.19
CWC gauge	Sangam	106.522	33°50'40.21"N	75° 3'22.82"E	505212.240	3744916.400	-	1585.32
Tide Pole 2	Gaad Hanjipora	94.68	33°54' 31.661"N	75°0' 36.4397"E	500935.7554	3752043.438	12 April 2017	1587.14
Tide Pole 3	Alchi Bagh	83.213	33°57' 53.41"N	74°57' 1.39"E	495416.3776	3758258.195	5 April 2017	1586.01
Tide Pole 4	Marhwal	78.943	33°57' 53.92"N	74°55' 20.42"E	492825.222	3758275.511	5 April 2017	1584.62
Tide Pole 5	Zooni pora	69.892	34°1' 17.34"N	74°55' 1.88"E	492354.4981	3764541.102	4 April 2017	1584.45
Tide Pole 6	Soitang	61.898	34°2' 37.35"N	74°52' 18.31"E	488162.7127	3767009.705	3 April 2017	1580.72
IFCK gauge	Ram Munshibagh	51.793	34° 4'14.40"N	74°49'48.90"E	484336.940	3770004.400	-	1580.77
Tide Pole 7	Ram Munshibagh	50.936	34°4' 14.4753"N	74°49' 15.7556"E	483487.4212	3770008.168	3 April 2017	1582.33
IFCK gauge	Chattabal D/s	44.335	34° 5'23.19"N	74°46'59.01"E	479986.990	**3772131.360**	-	1578.70
Tide Pole 9	**Sarai Dangerpora**	**32.361**	**34°8' 49.456"N**	**74°42' 42.5068"E**	**473431.9546**	**3778500.632**	**29 Apr 2017**	1578.40
Tide Pole 10	Sumbal	21.239	34°13' 27.19"N	74°39' 11.63"E	468060.9059	3787071.8	29 Apr 2017	1578.02
IFCK gauge	Asham	17.116	34°14'47.88"N	74°37'23.93"E	465314.620	3789566.910	-	1577.33
Tide Pole 11	Safapore	10.546	34°17' 5.63"N	74°37' 29.77"E	465479.6325	3793809.197	1 May 2017	1578.89
CWC gauge	Safapore	9.187	34°4' 27.888"N	74°38' 34.728"E	467123.3307	3788944.611	-	1576.60
Tide Pole 12	Gund Prang	3.704	34°20' 12.10"N	74°38' 7.05"E	466453.3567	3799549.238	1 May 2017	1578.02

2.11 Chart Datum / Sounding Datum and Reductions Details

As per discussion with IWAI officials, the Established gauge and newly erected tide pole were used for calculation of chart datum. The total of 05 establishes CD were available, with the help of these established datum the values of the erected tide pole was calculated. The same was cross verified with the available data of water level at different places.

Table 5 – Chart Datum / Sounding Datum

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	(50% stretch is to be selected on both side of tide gauge)		D +ve indicates above MSL -ve indicates below MSL	E	F = (E- WL data in MSL)	G = ((E- topo levels in MSL)
			From	To				
1	TIDE POLE-12	3.704	0	5.2		**1576.21**	**Details at Annexure-III**. (Data Provide in Digital Format)	A separate xyz file is to create (not to plot).
2	SAFAPORE CWC	9.187			1576.76	1576.60		
3	TIDE POLE-11	10.546	5.2	15.8		**1576.70**		
4	ASHAM IFCK	17.116			**1577.33**	**1577.33**		
5	TIDE POLE-10	21.239	15.8	26.8		**1577.54**		
6	TIDE POLE-09	32.361	26.8	36.2		**1578.10**		
7	TIDE POLE -08	40.09	36.2	45.5		**1578.49**		
8	CHATTABAL IFCK	44.335			**1578.7**	**1578.70**		
9	TIDE POLE-07	50.936	45.5	56.4		**1580.53**		
10	RAM MUNSHIBAGH IFCK	51.793			**1580.77**	**1580.77**		
11	TIDE POLE-06	61.898	56.4	65.8		**1581.61**		
12	TIDE POLE-05	69.892	65.8	74.4		**1582.27**		
13	TIDE POLE-04	78.943	74.4	81.1		**1583.03**		
14	TIDE POLE-03	83.213	81.1	88.94		**1583.38**		
15	TIDE POLE-02	94.68	89.94	101.46		**1584.34**		
16	SANGAM IFCK	106.522			**1585.32**	**1585.32**		
17	TIDE POLE-01	108.259	101.46	108.3		**1585.46**		

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

Data collected (Maximum Flood Level (MFL) and Minimum Water Levels (MWL) at Cross Structures in Jhelum River is purely based on field observations.

Table 6 – Maximum Flood Level (MFL) and Minimum Water Levels (MWL) at Cross Structures in Jhelum River

S. 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	Rakh Hajin	Hajin Bridge	9.183	1581.18	
2	Push Wari	Push Wari Bridge	17.139		1582.14
3	Sumbal	Sumbal Bridge	20.758	1582.48	
4	Bat Pora Dab	Shadipora Road Bridge	26.343	1582.84	
5	Takan Wari Pora	Takan Wari Pora Bridge	35.45		1583.00
6	Shalateng	Under Construction Bridge	40.097		-
7	Shalateng	Shalteng Palpora Pipe Line Crossing	40.13	1584.46	
8	Guri Pora	Parim Pora	41.109		1584.46
9	Shongli Pora	Cement kadal Bridge	43.916	1584.58	
10	Palayarbal	Weir Chattabal	44.484	1584.91	
11	Nalbandpora	Safa Kadal Bridge	45.191	1584.98	
12	Lokhriyaar	Nawa Kadal Bridge	45.925	1585.22	
13	Sokalipora	Ali Kadal Bridge	46.294	1585.47	
14	Maharajganj	Old Zaina Kadal Bridge	46.7		1585.58
15	Shamswari	New Zaina Kadil Bridge	46.82	1585.58	
16	Zaldagar	Old Fateh Kadal Bridge	47.248		1585.77
17	Chinkral Mohalla	Fathe Kadal-Bad Dem Bridge	47.381	1585.96	
18	kani Kadal	Old Habba Kadal Bridge	48.032		1585.96
19	Habba Kadal	Habba Kadal Bridge	48.087	1586.19	
20	Basant Bagh	MA Road Bridge	49.178		1586.19
21	Hari Sngh High Street	Amira Kadal Bridge	49.395	1586.56	
22	Lal Mandi	Foot Over Bridge	50.034	1586.63	
23	Munshi Bagh	Abdullah Bridge	51.568	1586.84	
24	Munshi Bagh	Zero Bridge	51.762	1587.36	
25	Aramwari	Sonwar Bagh Foot Bridge	52.601		1587.36
26	Soitang	Bridge under construction Bagandhar	59.829		
27	Athwagan	New Lasjan Bridge	62.451		1587.00
28	Athwagan	Lasjan Bridge	62.479		1587.00
29	Ali Abad	Ali Abad Bridge under construction	64.646		-
30	Pampore	Zooni Pora Bridge	70.271		1588.66

S. 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)
31	Pampore	Kadlabal Bridge	71.491	1588.66	
32	Kandizal	Bridge under construction Near Kandizal	80.588		1589.75
33	Kakapora	Kakapora Bridge	84.54	1589.75	
34	Bander Pora Cherat	Bridge connecting haji bal and lethapora	87.334		1589.75
35	Manwaji	Iron Bridge	88.389		
36	Kanil Bagh	Bridge Bridge under construction			
37	Kanil Bagh	Bridge under construction Near Kanil Bagh	88.416		
38	Near Padgampora	Padgampora bridge	94.674	1591.86	
39	Chersoo Awantipora	Chersoo awantipora Bridge	100	1593.28	
40	Sangam Village	Sangam Bridge	108.605	1594.99	
41	Sangam Village	Sangam Bridge	108.634	1595.00	
42	Niyana	Niyana Bridge	109.79		1595.00

2.13 Graph between Sounding Datum and HFL v/s Chainage

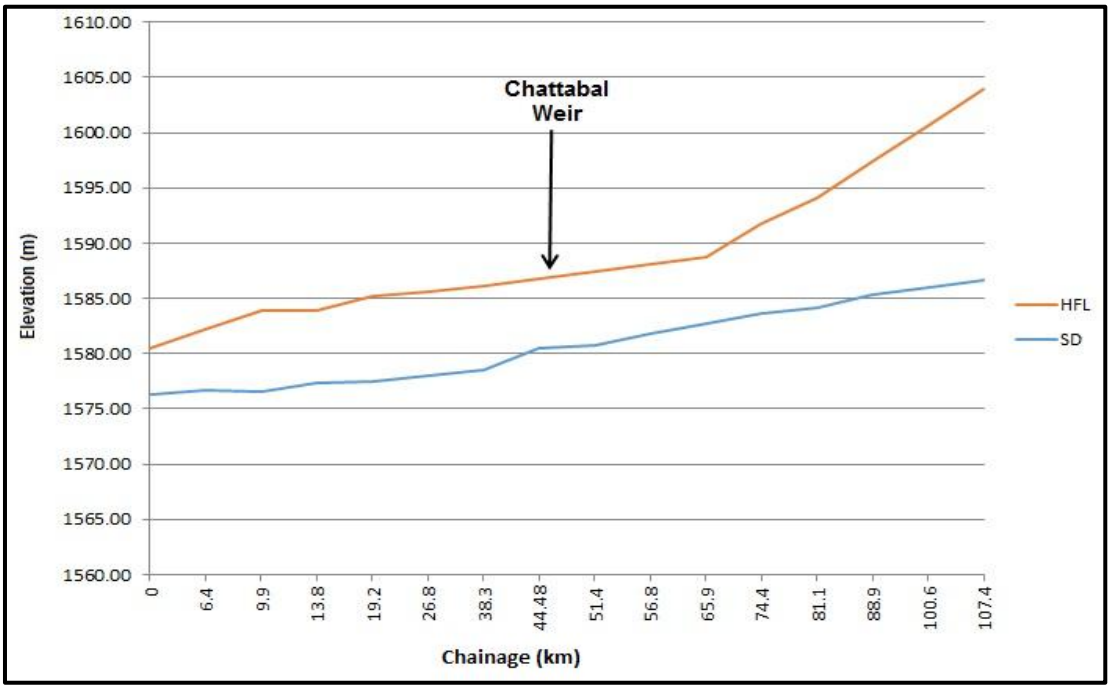


Figure 5 – Graphs between Sounding Datum and HFL v/s Chainage in Jhelum River

2.14 Average Bed Slope

Table 7 – Average Bed Slope

Reach (km)		River / Canal Bed Level Change (m)	Distance (km)	Slope
From	To			
0.00	20.00	1.612	20.00	1:12406
20.00	44.48	3.085	24.48	1:7935
44.48	60.00	6.444	15.52	1:2408
60.00	80.00	4.902	20.00	1:4079
80.00	100.00	0.067	20.00	1:298507
110.00	110.27	1.828	10.27	1:5618

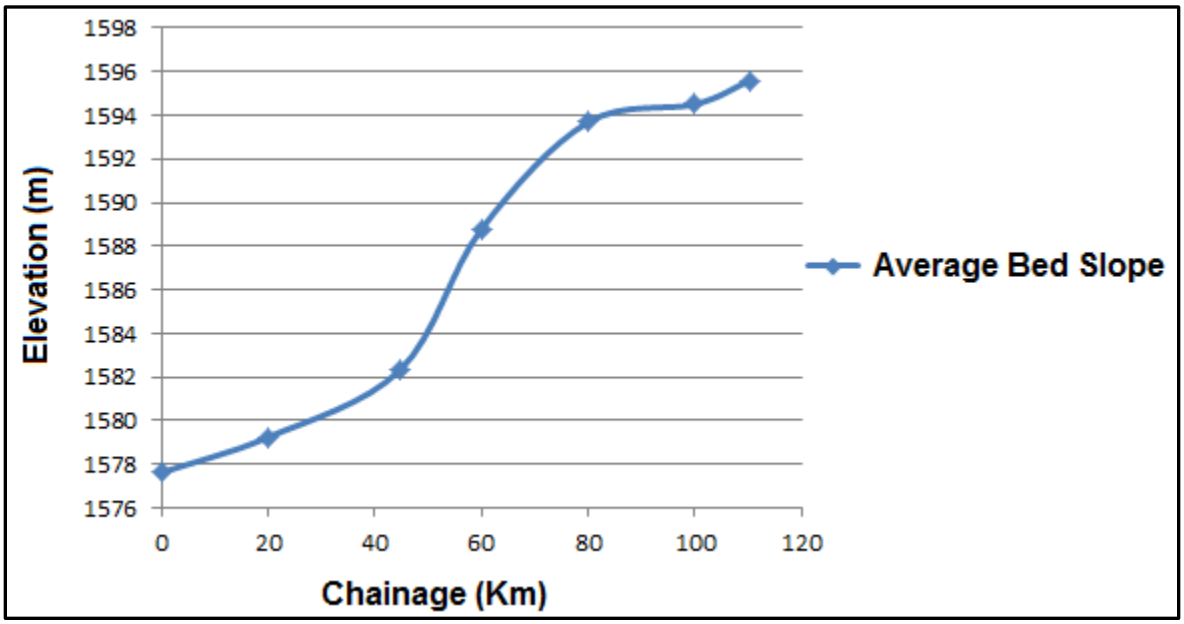


Figure 6 – Average Bed Slope of Jhelum River Stretch

2.15 Details of Dam, Barrages, Weirs, Anicut

Dam, Barrages, Anicut was not present in this whole stretch of waterway but Chattabal Weir was present.

2.16 Details of Locks

Navigational Lock was Present at Chattabal weir of waterway of Jhelum.

2.17 Details of Aqueducts

No Aqueduct Present in this whole stretch of waterway.

2.18 Details of Cross-structures in Jhelum River

Table 8 – Bridges and Cross Structure in Jhelum River

Sl No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)		Position (UTM)		Length (m)	Width (m)	No of Piers	Horizontal clearance (clear distance Between)	Vertical Clearance w.r.t HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank	Right Bank	Left Bank	Right Bank						
1	Hajin Bridge	9.183	RCC	Rakh Hajin	34°17' 45.60"N 74°37' 28.14"E	34°17' 41.42"N 74°37' 28.84"E	465442.725 3795040.677	465460.164 3794911.817	140	7	4	35	1.91	complete
2	Push Wari Bridge	17.139	RCC	Push Wari	34°14' 48.04"N 74°37' 25.16"E	34°14' 54.88"N 74°37' 26.98"E	465346.143 3789572.005	465393.492 3789782.257	220	4	4	60	0.95	complete
3	Sumbal Bridge	20.758	RCC	Sumbal	34°13' 41.96"N 74°39' 4.03"E	34°13' 43.91"N 74°39' 10.83"E	467868.051 3787527.659	468042.384 3787586.906	200	9	5	40	2.12	complete
4	Shadipora Road Bridge	26.343	RCC	Bat Pora Dab	34°11' 9.29"N 74°40' 23.82"E	34°11' 11.73"N 74°40' 31.72"E	469895.112 3782818.958	470090.073 3782889.531	220	8	6	35	2.16	complete
5	Takan Wari Pora Bridge	35.45	RCC	Takan Wari Pora	34°7' 42.01"N 74°43' 12.49"E	34°7' 46.48"N 74°43' 12.69"E	474194.171 3776421.229	474199.702 3776559.033	180	11	5	40	2.00	complete
6	Under Constructi on Bridge	40.097	RCC	Shalateng	34°6' 38.42"N 74°45' 3.65"E	34°6' 42.00"N 74°45' 7.81"E	477026.786 3774483.591	477143.516 3774565.246	-	-	-	-	-	under - construction
7	Shalteng Palpora Pipe Line Crossing	40.13	RCC	Shalateng	34°6' 38.56"N 74°45' 4.47"E	34°6' 51.60"N 74°45' 8.30"E	477057.766 3774459.477	477160.150 3774530.805	150	3	5	30	0.84	complete
8	Parim Pora	41.109	RCC	Guri Pora	34°6' 22.94"N 74°45' 37.16"E	34°6' 26.51"N 74°45' 36.38"E	477894.105 3773976.499	477874.253 3774086.558	110	4	4	30	1.13	complete
9	Cement kadal Bridge	43.916	RCC	Shongli Pora	34°5' 31.88"N 74°46' 45.35"E	34°5' 34.38"N 74°46' 48.33"E	479637.587 3772399.822	479714.102 3772476.754	135	6	4	30	2.41	complete
10	Weir Chattabal	44.484	RCC	Palayarbal	34°5' 22.66"N 74°47' 6.21"E	34°5' 27.56"N 74°47' 6.29"E	80171.458 3772114.651	480173.884 3772265.798	140	5	-	-	0.00	complete
11	Safa Kadal Bridge	45.191	RCC	Nalbandp ora	34°5' 26.78"N 74°47' 33.80"E	34°5' 29.24"N 74°47' 32.15"E	480878.862 3772240.292	480836.594 3772316.027	100	18	3	30	1.38	complete
12	Nawa Kadal Bridge	45.925	RCC	Lokhriyaar	34°5' 40.99"N 74°47' 56.33"E	34°5' 43.21"N 74°47' 55.17"E	481457.062 3772676.592	481427.341 3772745.092	80	10	4	20	1.46	complete
13	Ali Kadal Bridge	46.294	RCC	Sokalipora	34°5' 42.98"N 74°48' 9.16"E	34°5' 45.28"N 74°48' 10.24"E	481785.863 3772737.315	481813.777 3772808.142	82	10	3	30	1.75	complete
14	Old Zaina Kadal Bridge	46.7	RCC	Maharajga nj	34°5' 36.94"N 74°48' 22.04"E	34°5' 38.49"N 74°48' 24.54"E	482115.649 3772550.593	482179.646 3772598.262	100	9	3	30	1.64	complete
15	New Zaina Kadil Bridge	46.82	RCC	Shamswar i	34°5' 33.73"N 74°48' 24.25"E	34°5' 34.46"N 74°48' 26.45"E	482171.979 3772451.638	482228.410 3772474.152	100	17	4	27	1.33	complete
16	Old Fateh Kadal Bridge	47.248	RCC	Zaldagar	34°5' 20.59"N 74°48' 23.22"E	34°5' 20.34"N 74°48' 25.71"E	482144.870 3772047.072	482208.634 3772039.155	70	3.6	3	20	4.17	complete

Sl No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)		Position (UTM)		Length (m)	Width (m)	No of Piers	Horizontal clearance (clear distance Between)	Vertical Clearance w.r.t HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank	Right Bank	Left Bank	Right Bank						
17	Fathe Kadal-Bad Dem Bridge	47.381	RCC	Chinkral Mohalla	34°5' 16.14"N 74°48' 22.52"E	34°5' 15.85"N 74°48' 24.43"E	482126.761 3771910.159	482175.474 3771901.073	80	12	4	20	3.98	complete
18	Old Habba Kadal Bridge	48.032	RCC	kani Kadal	34°4' 55.18"N 74°48' 20.79"E	34°4' 55.20"N 74°48' 23.13"E	482080.985 3771264.436	482141.016 3771265.044	80	9	4	20	2.05	complete
19	Habba Kadal Bridge	48.087	RCC	Habba Kadal	34°4' 53.18"N 74°48' 20.65"E	34°4' 53.31"N 74°48' 22.47"E	482077.359 3771202.862	482124.015 3771207.011	140	12	3	44	1.82	complete
20	MA Road Bridge	49.178	RCC	Basant Bagh	34°4' 17.82"N 74°48' 22.35"E	34°4' 17.88"N 74°48' 25.61"E	482119.029 3770113.975	482202.431 3770115.519	94	26	2	43	1.46	complete
21	Amira Kadal Bridge	49.395	RCC	Hari Sngh High Street	34°4' 10.84"N 74°48' 22.99"E	34°4' 11.11"N 74°48' 27.3"E	482135.012 3769898.753	482246.494 3769907.045	110	14	4	20	3.86	damaged
22	Foot Over Bridge	50.034	RCC	Lal Mandi	34°4' 4.16"N 74°48' 45.81"E	34°4' 7.34"N 74°48' 43.90"E	482719.355 3769691.969	482670.777 3769789.893	120	4	3	35	0.75	complete
23	Abdullah Bridge	51.568	RCC	Munshi Bagh	34°4' 9.63"N 74°49' 39.91"E	34°4' 15.03"N 74°49' 41.26"E	484106.409 3769857.954	484141.371 3770024.364	180	10	6	50	3.30	complete
24	Zero Bridge	51.762	RCC	Munshi Bagh	34°4' 10.18"N 74°49' 48.04"E	34°4' 13.72"N 74°49' 48.31"E	484314.700 3769874.665	484321.854 3769983.645	160	12	4	40	1.35	complete
25	Sonwar Bagh Foot Bridge	52.601	Iron	Aramwari	34°4' 9.73"N 74°50' 19.84"E	34°4' 12.67"N 74°50' 21.10"E	485129.881 3769859.387	485162.386 3769949.829	120	1.6	4	26	1.14	complete
26	Bridge under constructi on Bagandha r	59.829	RCC	Soitang	34°3' 15.41"N 74°51' 31.93"E	34°3' 15.92"N 74°51' 36.86"E	486975.373 3768183.638	487101.634 3768199.258	-	-	-	-	-	under - construction
27	New Lasjan Bridge	62.451	RCC	Athwagan	34°2' 18.29"N 74°52' 16.17"E	34°2' 19.80"N 74°52' 22.71"E	488107.320 3766423.014	488274.943 3766469.238	200	8	6	40	2.50	complete
28	Lasjan Bridge	62.479	RCC	Athwagan	34°2' 17.42"N 74°52' 16.58"E	34°2' 18.92"N 74°52' 22.77"E	488117.712 3766396.215	488276.473 3766442.083	200	8	6	40	2.00	complete
29	Ali Abad Bridge under constructi on	64.646	RCC	Ali Abad	34°2' 7.07"N 74°53' 28.08"E	34°2' 11.92"N 74°53' 29.95"E	489950.687 3766075.272	489998.750 3766224.363	-	-	-	-	-	under - construction
30	Zooni Pora Bridge	70.271	RCC	Pampore	34°1' 12.55"N 74°54' 47.34"E	34°1' 8.94"N 74°54' 48.94"E	491981.712 3764394.005	492022.659 3764282.711	126	3.9	4	25	0.84	complete
31	Kadlabal Bridge	71.491	Iron	Pampore	34°0' 40.52"N 74°54' 32.03"E	34°0' 43.23"N 74°54' 36.41"E	491588.023 3763408.014	491700.430 3763491.190	148	7.6	2	70	4.34	complete
32	Bridge under constructi	80.588	RCC	Kandizal	33°59' 34.87"N 74°55' 9.61"E	33°59' 37.13"N 74°55' 15.74"E	492550.382 3761385.067	492707.767 3761454.506	200	9	3	60	-	under - construction

Sl No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)		Position (UTM)		Length (m)	Width (m)	No of Piers	Horizontal clearance (clear distance Between ...	Vertical Clearance w.r.t HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank	Right Bank	Left Bank	Right Bank						
	on Near Kandizal													
33	Kakapora Bridge	84.54	RCC	Kakapora	33°57' 6.33"N 74°55' 37.63"E	33°57' 12.03"N 74°55' 38.58"E	493265.900 3756809.454	493290.408 3756985.132	200	7.5	5	40	2.25	complete
34	Bridge co nnecting h aji bal and lethapora	87.334	Iron	Bander Pora Cherat	33°57' 40.52"N 74°57' 42.68"E	33°57' 41.41"N 74°57' 47.28"E	496475.864 3757860.767	496594.013 3757888.200	150	2.6	3	50	1.75	complete
35	Iron Bridge	88.389	Iron	Manwaji	33°56' 56.50"N 74°58' 50.94"E	33°56' 55.78"N 74°58' 54.53"E	498227.654 3756504.647	498319.756 3756482.363	130	2.5	3	45	1.25	complete
36	Bridge Bridge under constructi on		RCC	Kanil Bagh	33°56' 28.86"N 74°59' 11.48"E	33°56' 34.14"N 74°59' 14.13"E	498754.512 3755653.323	498822.603 3755815.759	-	-	-	-	-	under - construction
37	Bridge under constructi on Near Kanil Bagh	88.416	RCC	Kanil Bagh	33°56' 28.89"N 74°59' 12.32"E	33°56' 33.34"N 74°59' 14.54"E	498776.300 3755654.101	498833.082 3755791.323	200	14	4	50	-	under - construction
38	Padgamp ora bridge	94.674	RCC	Near Padgamp ora	33°54' 31.07"N 75°0' 32.06"E	33°54' 32.24"N 75°0' 36.49"E	500823.318 3752025.502	500937.272 3752061.489	200	7.5	4	50	6.14	complete
39	Chersoo awantipor a Bridge	100	RCC	Chersoo Awantipor a	33°52' 58.82"N 75°1' 30.32"E	33°53' 3.74"N 75°1' 30.70"E	502320.314 3749184.467	502329.945 3749335.808	165	4	5	30	3.61	complete
40	Sangam Bridge	108.605	RCC	Sangam Village	33°49' 48.54"N 75°4' 14.53"E	33°49' 51.832"N 75°4' 14.454"E	506542.285 3743326.082	506540.191 3743427.237 3743427.237	145	9	5	30	0.50	complete
41	Sangam Bridge	108.634	RCC	Sangam Village	33°49' 47.49"N, 75°4' 15.65"E	33°49' 51.86"N, 75°4' 15.5"E	506571.066, 3743293.687	506568.080,37 43428.220	135	8	5	30	2.20	complete
42	Naina Bridge	109.79	RCC	Niyana	33°49' 24.80"N 75°3' 46.77"E	33°49' 26.02"N 75°3' 52.35"E	505829.372 3742594.365	505972.788 3742632.144	135	9	2	50	-1.00	complete

2.19 Details of other Cross structures, pipe-lines, under water

There are no cross structures other than weir, water pipe line and Road Bridges.

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

HFL data collected at cross structures based on field observation is interpolated at each chainage of electric line crossings for the vertical clearance.

Table 9 – Electric Lines in Jhelum River

Sl No	Type of line	Chainage (km)	Location	Position (Lat Long)		Position (UTM)		No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction)
				Left Bank	Right Bank	Left Bank	Right Bank				
1	Electric Line	**1.66**	**Gund Prang**	34°21' 1.89"N 74°37' 16.13"E	34°20' 58.68"N 74°37' 13.38"E	465158.209 3801087.852	465087.459 3800989.083	2	230	10.000	complete
2	HT Line	**2.26**	**Gund Prang**	34°20' 49.93"N 74°37' 34.64"E	34°20' 46.87"N 74°37' 31.89"E	465629.706 3800717.575	465559.054 3800623.592	2	115	13.000	complete
3	Electric Line	3.19	Gund Prang	34°20' 27.95"N 74°38' 1.63"E	34°20' 26.55"N 74°37' 55.35"E 74°37' 16.13"E	466316.666 3800038.160	466156.091 3799995.661	2	160	10.000	complete
4	Electric Line	3.19	Gund Prang	34°20' 27.87"N 74°38' 1.66"E	34°20' 26.47"N 74°37' 55.38"E	466317.499 3800035.527	466156.924 3799993.028	2	160	10.000	complete
5	HT Line	3.2	Gund Prang	34°20' 27.50"N 74°38' 1.64"E	34°20' 26.10"N 74°37' 55.33"E	466316.843 3800024.332	466155.713 3799981.648	2	165	12.000	complete
6	Electric Line	3.31	Gund Prang	34°20' 24.65"N 74°38' 3.66"E	34°20' 23.01"N 74°37' 57.46"E	466368.322 3799936.119	466209.736 3799886.199	2	160	10.000	complete
7	Electric Line	5.08	Madwan	34°19' 29.33"N 74°38' 18.92"E	34°19' 27.94"N 74°38' 14.33"E	466751.973 3798230.909	466634.676 3798188.383	2	120	12.000	complete
8	HT Line	5.48	Madwan	34°19' 17.52"N 74°38' 22.79"E	34°19' 15.30"N 74°38' 19.29"E	466849.611 3797866.678	466759.979 3797798.693	2	110	12.000	complete
9	Electric Line	7.34	Near Rakh Hajin	34°18' 25.12"N 74°38' 10.00"E	34°18' 28.78"N 74°38' 4.72"E	466516.979 3796254.074	466382.562 3796367.101	2	170	10.000	complete
10	Electric Line	9.43	Hajan Bus Station	34°17' 39.02"N 74°37' 21.12"E	34°17' 42.24"N 74°37' 17.93"E	465262.413 3794838.752	465181.155 3794938.003	2	125	11.000	complete
11	Electric Line	9.72	Hajan Bus Station	34°17' 33.48"N 74°37' 21.87"E	34°17' 31.04"N 74°37' 15.54"E	465281.013 3794668.013	465118.836 3794593.197	2	175	10.000	complete
12	Electric Line	10.28	Hajan Bus Station	34°17' 15.32"N 74°37' 30.43"E	34°17' 15.54"N 74°37' 19.87"E	465497.793 3794107.737	465227.735 3794115.404	2	265	10.000	complete
13	Electric Line	10.64	Hajan Bus Station	34°17' 2.19"N 74°37' 28.81"E	34°17' 5.63"N 74°37' 16.92"E	465454.765 3793703.518	465151.202 3793810.450	2	315	10.000	complete
14	Electric Line	10.64	Hajan Bus Station	34°16' 49.21"N 74°37' 17.95"E 74°37' 28.81"E	34°16' 53.06"N 74°37' 12.81"E 74°37' 16.92"E	465175.796 3793304.687 3793703.518	465044.741 3793423.727 3793810.450	2	175	11.000	complete
15	Electric Line	11.45	Hajan Bus Station	34°16' 40.75"N 74°37' 8.37"E	34°16' 41.67"N 74°37' 5.04"E	464929.673 3793045.098	464844.724 3793073.756	2	90	10.000	complete
16	HT Line	14.69	Vij Pora	34°15' 44.31"N 74°36' 47.72"E	34°15' 48.81"N 74°36' 44.25"E	464395.093 3791308.656	464307.035 3791447.684	2	160	13.000	complete
17	HT Line	15.76	Near Push Wari	34°15' 17.35"N 74°36' 46.27"E	34°15' 14.28"N 74°36' 39.50"E	464354.876 3790478.254	464181.457 3790384.554	2	190	12.000	complete
18	Electric Line	16.05	Near Push Wari	34°15' 10.71"N 74°36' 52.54"E	34°15' 5.51"N 74°36' 45.53"E	464514.532 3790273.312	464334.671 3790113.863	2	230	11.000	complete
19	Electric Line	16.22	Near Push Wari	34°15' 7.36"N 74°36' 56.54"E	34°15' 1.83"N 74°36' 51.48"E	464616.504 3790169.525	464486.419 3789999.867	2	210	10.000	complete

Sl No	Type of line	Chainage (km)	Location	Position (Lat Long)		Position (UTM)		No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction)
				Left Bank	Right Bank	Left Bank	Right Bank				
20	HT Line	17.03	Push Wari	34°14' 55.91"N 74°37' 22.81"E	34°14' 48.60"N 74°37' 20.74"E	465286.973 3789814.366	465233.334 3789589.620	2	225	13.000	complete
21	Electric Line	19.22	Gulshan Pora	34°14' 26.57"N 74°38' 42.01"E	34°14' 24.13"N 74°38' 34.39"E	467309.497 3788903.595	467114.353 3788828.904	2	205	10.000	complete
22	Electric Line	24.91	Sheikh Zoo	34°11' 53.37"N 74°40' 6.25"E	34°11' 50.02"N 74°40' 0.25"E	469449.027 3784177.507	469295.112 3784074.895	2	180	9.000	complete
23	Electric Line	28.33	Narayan Bagh	34°10' 28.32"N 74°41' 18.74"E	34°10' 22.23"N 74°41' 18.22"E	471296.295 3781552.002	471282.419 3781364.694	2	185	10.000	complete
24	Electric Line	30.44	Hajin Ghat	34°9' 35.54"N 74°42' 6.70"E	34°9' 33.51"N 74°41' 59.67"E	472519.400 3779922.892	472339.070 3779860.924		190	11.000	complete
25	Electric Line	34.33	Abraq Pora	34°7' 59.82"N 74°42' 36.10"E	34°7' 56.88"N 74°42' 30.39"E	473263.555 3776972.359	473117.250 3776882.414	2	165	10.000	complete
26	Electric Line	40.12	Shalateng	34°6' 41.97"N 74°45' 9.27"E	34°6' 38.42"N 74°45' 3.65"E	477180.874 3774564.221	477036.608 3774455.224	2	175	6.000	complete
27	Electric Line	40.53	Shalateng	34°6' 30.96"N 74°45' 17.95"E	34°6' 27.86"N 74°45' 13.92"E	477402.494 3774224.695	477298.985 3774129.314	2	140	6.000	complete
28	Electric Line	46.35	Ali Kadal Bridge	34°5' 44.35"N 74°48' 12.56"E	34°5' 42.55"N 74°48' 11.22"E	481873.212 3772779.301	481838.728 3772724.198	2	65	15.000	complete
29	Electric Line	59.87	Soitang	34°3' 14.20"N 74°51' 36.11"E	34°3' 14.24"N 74°51' 32.17"E	487082.477 3768146.134	486981.532 3768147.744	2	100	15.000	complete
30	Electric Line	62.51	Lasjan Bridge	34°2' 18.21"N 74°52' 23.16"E	34°2' 16.58"N 74°52' 18.12"E	488286.385 3766420.331	488157.055 3766369.999	2	135	12.000	complete
31	Electric Line	63.03	Golpora	34°2' 10.50"N 74°52' 32.62"E	34°2' 3.53"N 74°52' 32.95"E	488528.656 3766182.295	488536.807 3765967.785	2	210	12.000	complete
32	Electric Line	63.34	Golpora	34°2' 12.71"N 74°52' 41.50"E	34°2' 9.01"N 74°52' 45.14"E	488756.582 3766250.126	488849.601 3766136.082	2	145	18.000	complete
33	Electric Line	63.87	Golpora	34°2' 20.43"N 74°53' 1.75"E	34°2' 16.78"N 74°52' 59.96"E	489275.997 3766487.403	489230.073 3766375.029	2	115	18.000	complete
34	Electric Line	67.1	Bagh Shokr Shah	34°1' 17.47"N 74°53' 45.63"E	34°1' 18.28"N 74°53' 40.94"E	490399.135 3764546.968	490278.877 3764572.102	2	120	16.000	complete
35	Electric Line	67.42	Bagh Shokr Shah	34°1' 9.06"N 74°53' 47.14"E	34°1' 6.67"N 74°53' 43.13"E	490437.600 3764287.861	490334.601 3764214.329	2	125	15.000	complete
36	Electric Line	67.9	Bagh Shokr Shah	34°1' 5.27"N 74°53' 58.88"E	34°0' 58.01"N 74°54' 0.51"E	490738.472 3764170.827	490780.149 3763947.334	2	225	15.000	complete
37	Electric Line	68.83	Zooni Pora	34°1' 23.70"N 74°54' 25.17"E	34°1' 19.44"N 74°54' 27.64"E	491413.455 3764737.803	491476.524 3764606.590	2	140	15.000	complete
38	Electric Line	69.12	Zooni Pora	34°1' 28.24"N 74°54' 36.33"E	34°1' 23.85"N 74°54' 36.03"E	491699.786 3764877.419	491691.761 3764742.170	2	130	16.000	complete
39	Electric Line	69.17	Zooni Pora	34°1' 28.47"N 74°54' 37.75"E	34°1' 24.30"N 74°54' 37.92"E	491736.114 3764884.575	491740.314 3764756.280	2	130	12.000	complete

Sl No	Type of line	Chainage (km)	Location	Position (Lat Long)		Position (UTM)		No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction)
				Left Bank	Right Bank	Left Bank	Right Bank				
40	Electric Line	69.42	Zooni Pora	34°1' 27.74"N 74°54' 47.76"E	34°1' 24.56"N 74°54' 47.40"E	491992.657 3764862.017	491983.502 3764764.068	2	100	16.000	complete
41	Electric Line	70.48	Zooni Pora	34°1' 6.74"N 74°54' 41.29"E	34°1' 10.00"N 74°54' 39.29"E	491826.291 3764215.154	491775.110 3764315.688	2	110	18.000	complete
42	Electric Line	70.58	Zooni Pora	34°1' 4.89"N 74°54' 38.06"E	34°1' 8.92"N 74°54' 36.04"E	491743.530 3764158.340	491691.632 3764282.331	2	130	14.000	complete
43	Electric Line	71.56	Kadlabal Bridge	34°0' 41.32"N 74°54' 37.46"E	34°0' 38.60"N 74°54' 33.82"E	491727.335 3763432.255	491633.968 3763348.774	2	125	18.000	complete
44	Electric Line	72.02	NEAR Kadlabal Bridge	34°0' 27.90"N 74°54' 46.36"E	34°0' 25.39"N 74°54' 40.74"E	491955.412 3763018.776	491811.060 3762941.642	2	160	16.000	complete
45	HT Line	73.69	NEAR Kadlabal Bridge	33°59' 41.33"N 74°55' 11.60"E	33°59' 38.59"N 74°55' 7.06"E	492601.644 3761583.855	492485.115 3761499.835	2	140	14.000	complete
46	Electric Line	73.9	NEAR Kadlabal Bridge	33°59' 36.74"N 74°55' 15.57"E	33°59' 33.02"N 74°55' 13.10"E	492703.394 3761442.670	492639.831 3761327.887	2	130	20.000	complete
47	Electric Line	76.54	Chadoora-Pampora Road	33°58' 44.95"N 74°54' 20.86"E	33°58' 45.48"N 74°54' 16.56"E	491298.412 3759848.606	491188.082 3759864.999	2	110	16.000	complete
48	HT Line	76.59	Chadoora-Pampora Road	33°58' 43.35"N 74°54' 21.17"E	33°58' 44.21"N 74°54' 16.49"E 74°54' 16.49"E	491306.335 3759799.390	491186.205 3759825.831	2	120	13.000	complete
49	Electric Line	80.55	Kakapora	33°57' 11.49"N 74°55' 37.04"E	33°57' 6.14"N 74°55' 36.79"E	493250.888 3756968.557	493244.328 3756803.617	2	160	12.000	complete
50	HT Line	80.63	Kakapora	33°57' 11.70"N 74°55' 40.83"E	33°57' 5.99"N 74°55' 39.29"E	493348.159 3756975.043	493308.634 3756799.044	2	175	13.000	complete
51	Electric Line	84.24	Bander Pora Cherat	33°57' 51.26"N 74°57' 41.64"E	33°57' 47.80"N 74°57' 37.33"E	496449.486 3758191.738	496338.854 3758085.259	2	150	10.000	complete
52	Electric Line	86.18	Reshi Pora Cherat	33°57' 18.12"N 74°58' 29.36"E	33°57' 15.03"N 74°58' 29.26"E	497673.843 3757170.501	497671.189 3757075.516	2	90	10.000	complete
53	Electric Line	86.84	Owdi Pora	33°57' 13.06"N 74°58' 54.73"E	33°57' 9.71"N 74°58' 51.69"E	498324.918 3757014.713	498246.796 3756911.361	2	125	7.000	complete
54	Electric Line	89.77	Jawbrara	33°55' 59.78"N 74°59' 48.72"E	33°55' 57.84"N 74°59' 43.84"E	499710.644 3754757.640	499585.349 3754697.867	2	130	10.000	complete
55	Electric Line	91.52	Awantipora	33°55' 26.19"N 75°0' 37.31"E	33°55' 24.19"N 75°0' 33.83"E	500958.158 3753723.029	500868.796 3753661.490	2	110	13.000	complete
56	Electric Line	94.8	padgampora bridge	33°54' 28.08"N 75°0' 37.15"E	33°54' 26.84"N 75°0' 33.35"E	500954.079 3751933.240	500856.456 3751894.970	2	100	16.000	complete
57	Electric Line	95.35	Near padgampora bridge	33°54' 11.81"N 75°0' 44.52"E	33°54' 8.44"N 75°0' 35.56"E	501143.384 3751432.091	500913.301 3751328.299	2	245	8.000	complete
58	HT Line	95.4	Near padgampora bridge	33°54' 10.85"N 75°0' 45.95"E	33°54' 7.12"N 75°0' 37.06"E	501180.102 3751402.625	500951.857 3751287.819	2	250	15.000	complete
59	Electric Line	95.83	Near padgampora bridge	33°54' 2.08"N 75°0' 55.82"E	33°53' 58.03"N 75°0' 52.65"E	501433.824 3751132.442	501352.189 3751007.888	2	145	12.000	complete

Sl No	Type of line	Chainage (km)	Location	Position (Lat Long)		Position (UTM)		No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction)
				Left Bank	Right Bank	Left Bank	Right Bank				
60	HT Line	95.94	Near padgampora bridge	33°53' 59.98"N 75°0' 59.54"E	33°53' 56.90"N 75°0' 56.69"E	501529.214 3751067.890	501456.164 3750973.102	2	120	13.000	complete
61	Electric Line	95.96	Near padgampora bridge	33°53' 59.59"N 75°1' 0.40"E 75°1' 0.40"E	33°53' 56.52"N 75°0' 57.55"E 75°0' 57.55"E	501551.423 3751055.876 3751055.876	501478.278 3750961.247 3750961.247	2	115	10.000	complete
62	Electric Line	101.91	Reshi Pora	33°52' 18.16"N 75°1' 51.46"E	33°52' 10.97"N 75°1' 46.36"E	502863.493 3747932.213	502732.691 3747710.864	2	250	11.000	complete
63	Electric Line	102.83	Reshi Pora	33°52' 13.96"N 75°2' 25.71"E	33°52' 9.74"N 75°2' 24.32"E	503743.508 3747803.235	503707.921 3747673.314	2	130	10.000	complete

2.21 Current Meter and Discharge Details

Table 10 – Current Meter and Discharge Details

Stretch No.	Chainage (km)	Observed Depth (m) (D)	Velocity (m/sec.)	Average Velocity (m/sec.)	X-Sectional area (sq. m.)	Discharge (Cum/sec)
			0.5 D			
1	0.75	5.32	0.716	0.716	501.13	358.8082
2	10.50	4.86	0.477	0.477	630.22	300.6134
3	21.22	4.06	1.073	1.073	588.36	631.3143
4	32.29	4.38	0.873	0.873	322.59	281.6228
5	40.09	4.26	0.954	0.954	340.48	324.8181
6	50.05	4.58	0.418	0.418	401.71	167.9167
7	61.88	8.05	0.150	0.150	670.63	100.5949
8	69.91	6.57	0.496	0.496	578.64	287.0041
9	78.93	3.98	0.418	0.418	666.71	278.6861
10	83.34	5.52	0.387	0.387	432.41	167.343
11	94.71	4.04	0.477	0.477	340.63	162.4815
12	108.24	7.29	0.180	0.180	593.28	106.7903

2.22 (A) Soil Sample Locations

Table 11 – Soil Sample Location in Jhelum River

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Depth (m)
1	0.75	34°21' 27.23"N	74°37' 2.04"E	464801.159	3801869.635	5.32
2	10.50	34°17' 8.14"N	74°37' 25.42"E	465368.802	3793887.039	4.86
3	21.22	34°13' 28.50"N	74°39' 8.55"E	467982.281	3787112.648	4.06
4	32.29	34°8' 48.69"N	74°42' 39.38"E	473351.991	3778477.298	4.38
5	40.09	34°6' 40.90"N	74°45' 5.22"E	477076.932	3774531.546	4.26
6	50.05	34°4' 6.24"N	74°48' 45.01"E	482699.162	3769756.093	4.58
7	61.88	34°2' 37.05"N	74°52' 15.92"E	488101.529	3767000.768	8.05
8	69.91	34°1' 17.35"N	74°54' 59.52"E	492294.01	3764541.584	6.57
9	78.93	33°57' 53.64"N	74°55' 17.17"E	492741.865	3758267.047	3.98
10	83.34	33°57' 52.45"N	74°57' 6.09"E	495537.192	3758228.588	5.52
11	94.71	33°54' 30.31"N	75°0' 34.04"E	500874.359	3752001.843	4.04
12	108.24	33°49' 53.83"N	75°4' 1.45"E	506206.042	3743488.564	7.29

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

(B) Water Sample Locations

Table 12 – Water Sample: Location in Jhelum River

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
1	0.75	34°21' 27.23"N	74°37' 2.04"E	464801.159	3801869.635	5.32	2.7
2	10.50	34°17' 8.14"N	74°37' 25.42"E	465368.802	3793887.039	4.86	2.4
3	21.22	34°13' 28.50"N	74°39' 8.55"E	467982.281	3787112.648	4.06	2.0
4	32.29	34°8' 48.69"N	74°42' 39.38"E	473351.991	3778477.298	4.38	2.2
5	40.09	34°6' 40.90"N	74°45' 5.22"E	477076.932	3774531.546	4.26	2.1
6	50.05	34°4' 6.24"N	74°48' 45.01"E	482699.162	3769756.093	4.58	2.3
7	61.88	34°2' 37.05"N	74°52' 15.92"E	488101.529	3767000.768	8.05	4.0
8	69.91	34°1' 17.35"N	74°54' 59.52"E	492294.01	3764541.584	6.57	3.3
9	78.93	33°57' 53.64"N	74°55' 17.17"E	492741.865	3758267.047	3.98	2.0
10	83.34	33°57' 52.45"N	74°57' 6.09"E	495537.192	3758228.588	5.52	2.8
11	94.71	33°54' 30.31"N	75°0' 34.04"E	500874.359	3752001.843	4.04	2.0
12	108.24	33°49' 53.83"N	75°4' 1.45"E	506206.042	3743488.564	7.29	3.6

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

3.0 DESCRIPTION OF WATERWAYS:

Hydrographic Survey was done for whole River reach. One navigational lock present at Chattabal weir 44.48km. There were no hindrances along the Jhelum River to doing hydrographic survey. 42 bridges were present and height of these bridges was enough to cross the boat during survey. We have divided waterways of Jhelum River into 6 different stretches and details of stretches given below from Para 3.1 to 3.5.

3.1 Wular Lake to Sumbal (Ch. 00.00 km – 20.00 km)

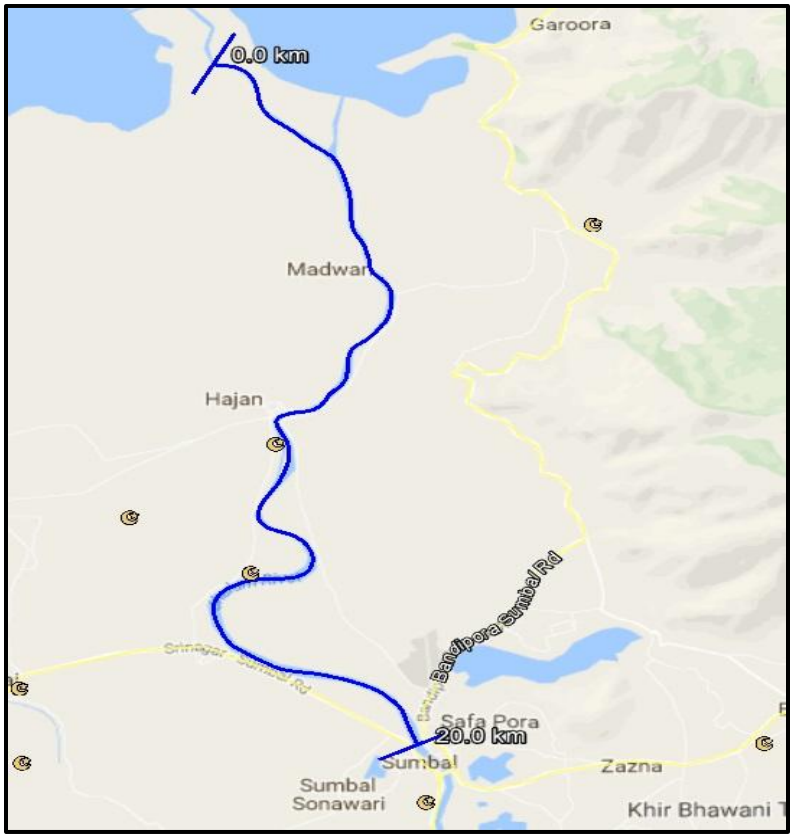


Figure 7 – Wular Lake to Sumbal

Table 13 – Dredging Quantity of Stretch 1, Wular Lake to Sumball

Class	Chainage		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.)
I	0.00	20.00	0.10	9.30	0.20	266.54	-0.30	7.09	1.80	21136.05
II	0.00	20.00	0.10	9.30	0.90	2771.92	-0.30	5.46	5.30	40024.07

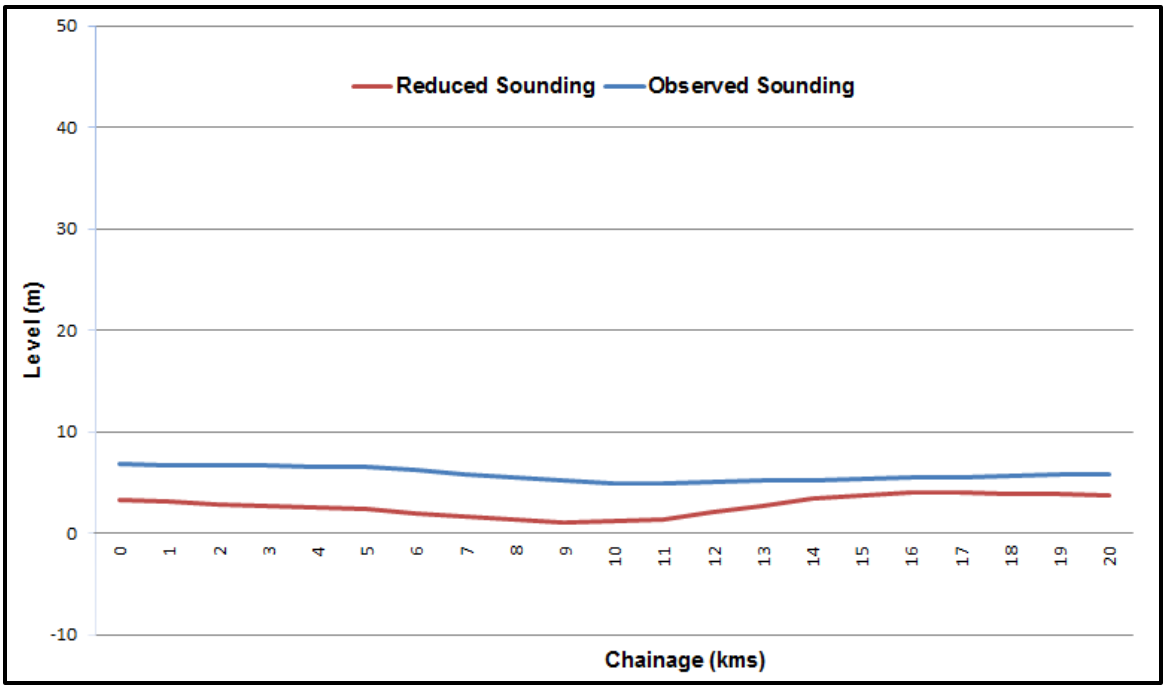


Figure 8 – Bed Profile of Wular Lake to Sumbal

This stretch is from Wular Lake to Sumbal (0 to 20 km at Jhelum River). The river bed is flat and sandy in nature. The width of the river in this stretch varying 55m to 135m and a depth observed is 0.1m to 9.3 m of deepest channel. The river banks are unprotected, but firm in nature. The gradient of the river is very gentle and there are no rapids or obstructions in this stretch.

Depth required for navigational channel is quite good and horizontal and vertical clearance of Bridges is quite suitable. There is no encroachment of waterway present.

Total 2 Bridges are present in this stretch of River of names given in Table- 7 (List of Cross structures). Main villages in this stretch are Asham, Gundbun, Rakhhajin. Apple garden present on both bank of the river. Land is generally used for agriculture and Residential area. Photographs of field observation and cross structure are available in Annexure -XIII.

Hamre railway station in vicinity of this stretch. Land use is generally private land and some land under forest Department.

Sand mining is prominent in this stretch. Water is fresh and used for drinking and Irrigation purpose.

Figure 9 – Ch. 09.18 Km Hajin Bridge

Figure 10 – Ch.17.14 Km Push Wari Bridge

3.2 Sumbal to Chattabal Weir (Ch. 20.00 km – 44.48 km)

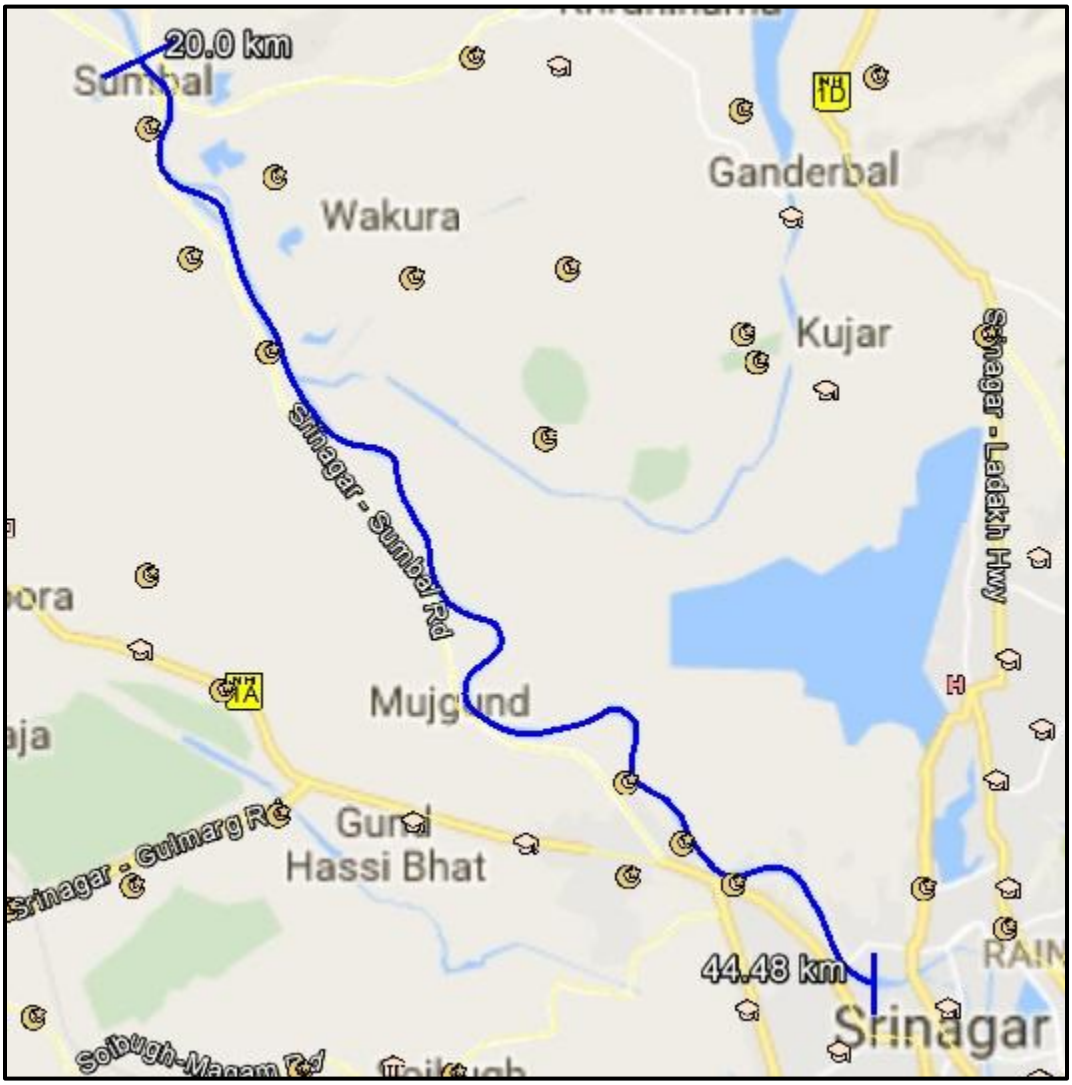


Figure 11 Sumbal to Chattabal Weir (Ch.20.00 Km -44.48 Km)

Table 14 – Dredging Quantity of Stretch 2, Sumbal to Chattabal Weir

Class	Chainage		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.)
I	20.00	44.48	0.20	8.40	4.00	3926.67	-0.30	9,03	11.10	112002.69
II	20.00	44.48	0.20	8.40	4,3	13453.49	-0.30	7.47	14.50	224974.15

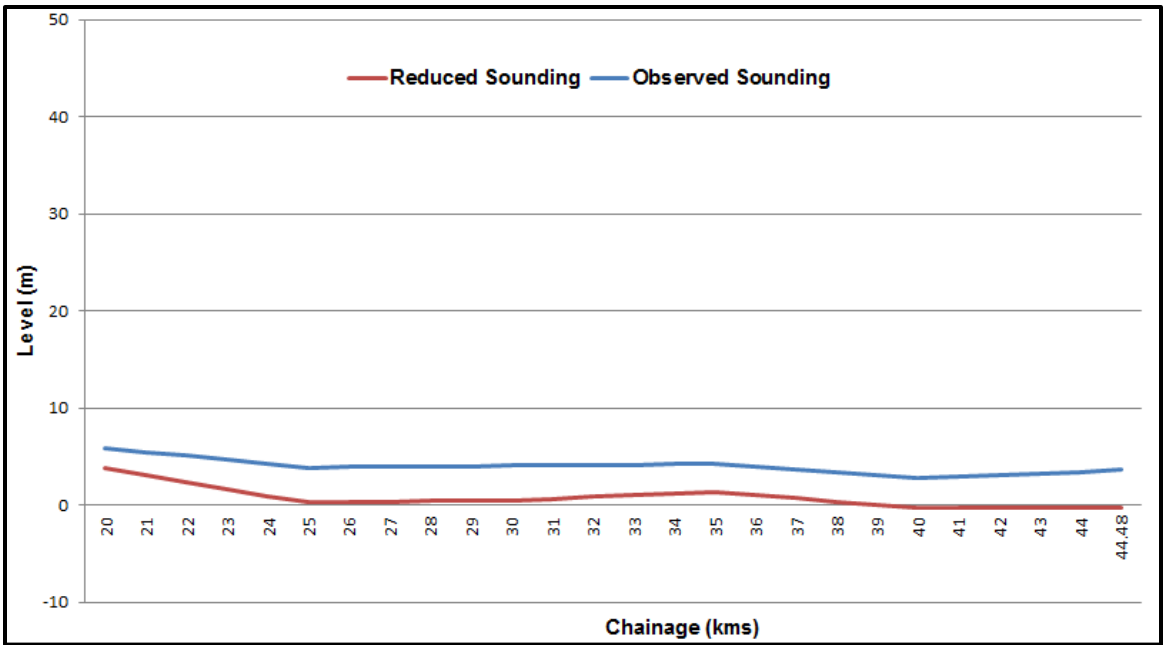


Figure 12 – Reduced & Observed Bed Profile Sumbal to Chattabal Weir

This stretch starts from Sumbal to Chattabal Weir. At the start of this stretch, Sumbal is present. Chattabal weir is present at end of this stretch (44.48km). Navigational lock is present at Chattabal weir. Outlet was present on this stretch for supply of fresh water to Srinagar City and Irrigation purpose. 7 Bridges and 1 pipe Line Bridge are present in this stretch of River of names given in Table- 7 (List of Cross structures). Horizontal and vertical clearance of Bridges is not sufficient as per designed class-I and Class-II for navigation. Width of the river varies from 165 to 190m and depths observed are 0.3 m to 8.45m of deepest channel of the river. Water current is quite low. Discharges are high in monsoon season and low in lean period. Banks are partially unprotected but firm. There is no encroachment of waterway present. This stretch of river is well connected via road. Main villages in this stretch are Batwina, Kharbag, Shabipora, Panzinara, Sarai danagarpora, Mujgund. Main city in this stretch are Mustafabad, Kumarwadi and Srinagar. Land is generally used for Residential area. There was Number of Irrigational water lift tank present on parallel to the both bank of the river. Photographs of field observation and cross structure are available in **Annexure -XIII.** Pattan, Mazhom and Badgam railway station are available in this stretch. Apple garden, dry fruits and rice are main crops near the stretch. Fishing of fresh water is available on small scale. Drainage filtering plant is present at 44.5km on right bank of the river. Sand mining are present in this stretch.

Figure 13 – Ch.20.76 Km Sumbal Bridge

Figure 14 – Ch. 26.34 Km Shadipora Road

Figure 15 – Ch. 35.45 Km Takan Wari Pora Bridge

Figure 16 – Ch. 37.69 Km Under Construction Bridge

Figure 17 – Ch.40.13 Km Shalteng Palopora Pipe Line Crossing

Figure 18 – Ch.40.14 Km Under Construction Bridge

Figure 19 – Ch.41.11 Km Parim Pora

Figure 20 – Ch.43.92 Km Cement Kadal Bridge

Figure 21 – Ch,44.49 Km Chattabal Weir

3.3 Stretch 3 Chattabal Weir to Soitang (Ch. 44.8.00 km – 60.00 km)

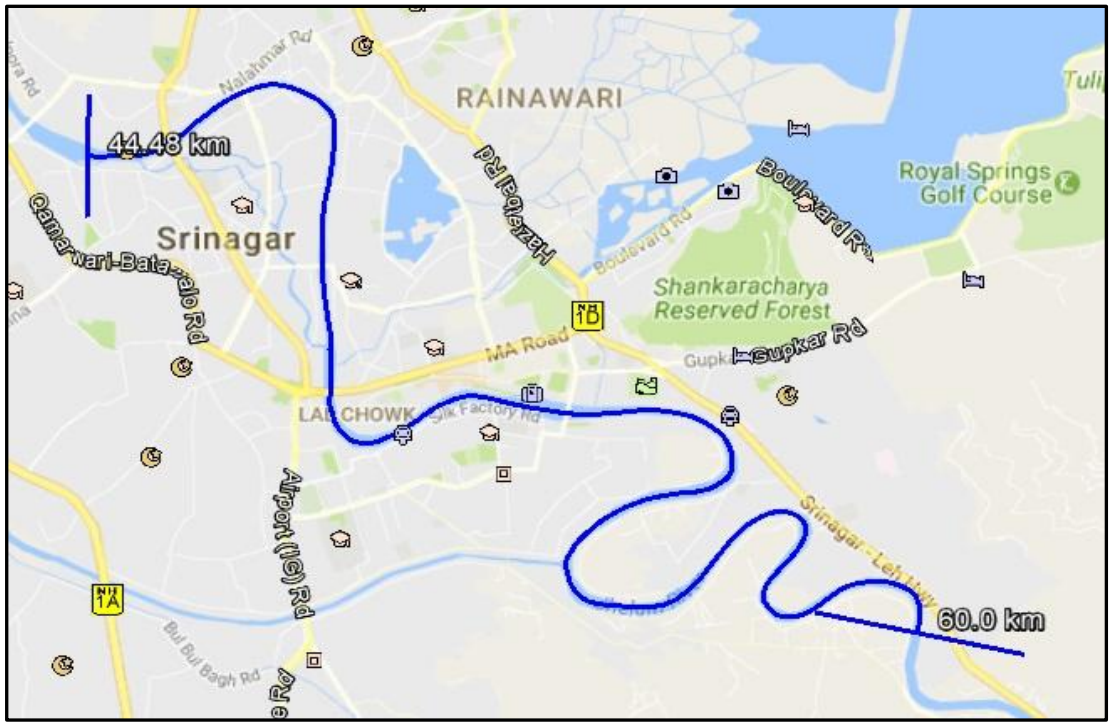


Figure 22 – Chattabal Weir to Soitang

Table 15 – Dredging Quantity of Stretch 3, Chattabel Weir to Soitang

Class	Chainage		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.)
I	44.48	60.00	0.30	13.92	3.00	15657.35	-0.30	16.94	7.80	255131.88
II	44.48	60.00	0.30	13.92	3.00	29598.13	-0.30	15.32	6.70	424246.76

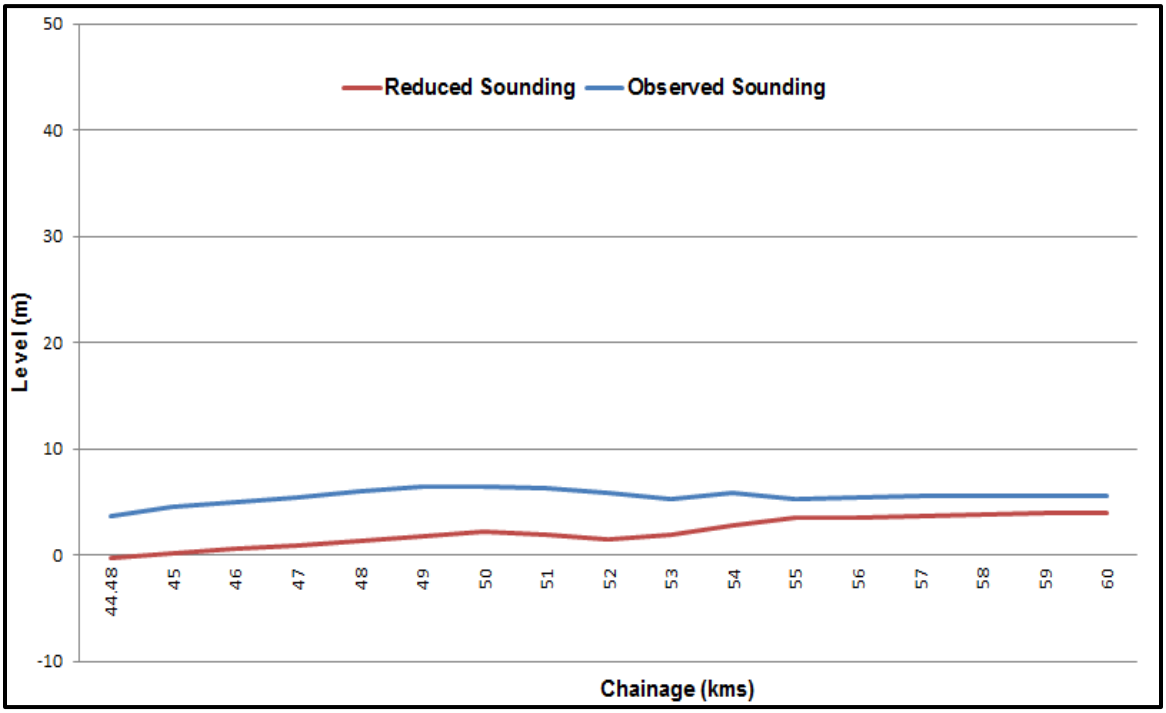


Figure 23 – Bed Profile for Chattabal Weir to Soitang

This stretch starts from Chattabal weir and end at Soitang. Horizontal and vertical clearance of Bridges is not suitable for Navigation. Width of river from 50m to 180 m. and depths observed is 0.3m to 13.9m of deepest channel of the river. Water current is very low in this stretch of the river. Discharges are high in monsoon season and low in lean period. Banks are mainly unprotected but firmed. There is no encroachment of waterway present. This stretch of river is well connected via road. National Highway No. 1D is along this stretch. 16 nos. of bridges are present in this stretch of River of names given in Table- 7 (List of Cross structures).

This stretch exists in the Srinagar city. Maximum Land is residential and army cantonment along this stretch. There was Number of Irrigational water lift tank and water treatment plant present on parallel to the both bank of river. Photographs of field observation and cross structure are available in **Annexure -XIII**. Srinagar Railway station in vicinity of this stretch. Shikara and small boat ferry are present in this stretch for tourist. Water is fresh and used for drinking; Irrigation and industries purpose Outlet was present for supply of drinking water, Irrigation purpose to surrounding areas. Many Nalas are present which are directly put water into this stretch of river. Nature park, amusement park and picnic spot are present near to this stretch.

Figure 24 – Ch. 45.20 Km Safa Kadal Bridge

Figure 25 – Ch.45.93.Km Nawa Kadal Bridge

Figure 26 – Ch. 46.30 Km Ali Kadal Bridge

Figure 27 – Ch. 46.70 Km Old Zaina Kadal Bridge

Figure 28 – Ch. 46.83 Km New Zaina Kadal Bridge

Figure 29 – Ch. 47.25 Km Old Fathe Kadal Bridge

Figure 30 – 47.39 Km Fathe Kadal Bad Bridge

Figure 31 – 48.04 Km Old Habba Kadal Bridge

Figure 32 – 48.10 Km Habba Kadal Bridge

Figure 33 – Ch. 49.20 Km MA Road Bridge

Figure 34 – Ch. 49.40 Km Amira Kadal Bridge

Figure 35 – Ch. 50.03 Km Foot Over Bridge

Figure 36 – Ch. 51.57 Km Abdullah Bridge

Figure 37 – Ch.51.77 Km Zero Bridge

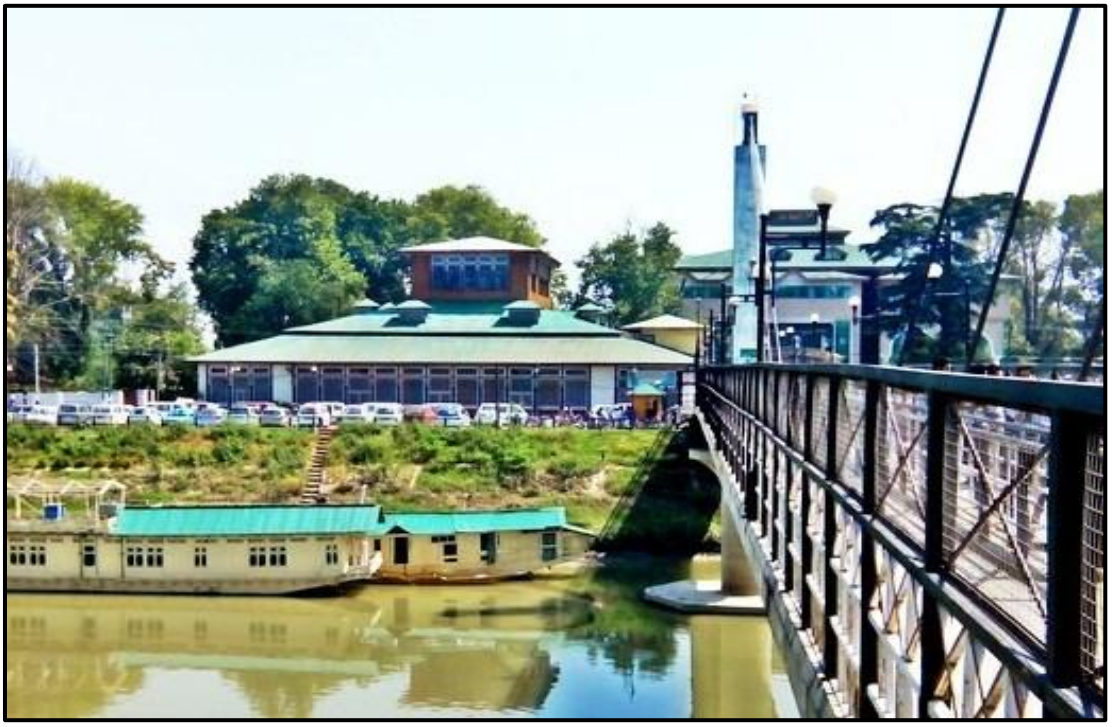


Figure 38 – Ch. 52.60 Km Sonwar Bagh Foot Bridge

Figure 39 – Ch. 59.83 Km Under Construction Bridge

3.4 Soitang to Kandizal (Ch. 60.00 km – 80.00 km)

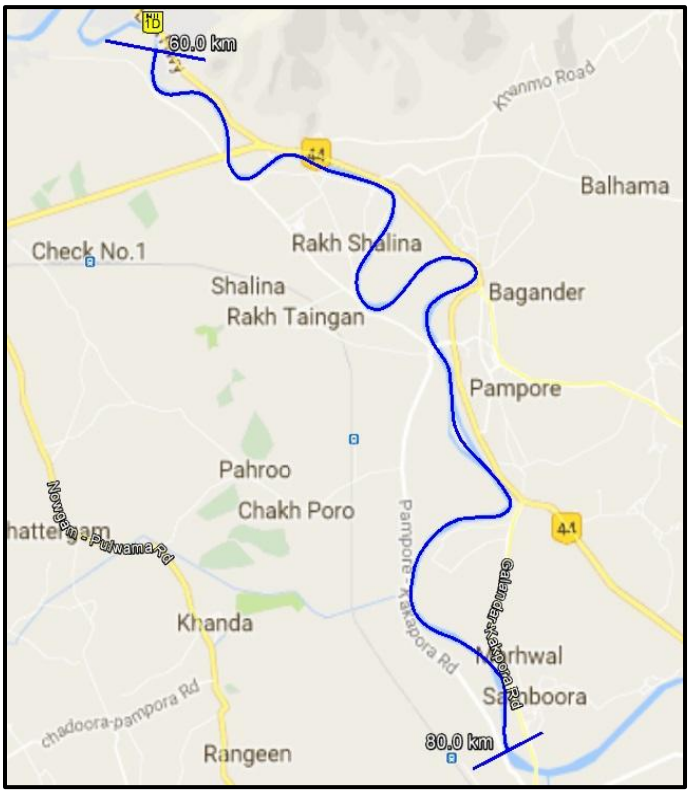


Figure 40- Soitang to Kandizal

Table 16 – Dredging Quantity for stretch 4, Soitang to Kandizal

Class	Chainage		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.)
I	60.00	80.00	0.40	10.30	1.30	6754.89	-0.30	10.71	7.00	55817.34
II	60.00	80.00	0.40	10.30	1.90	13050.73	-0.30	10.29	8.50	105671.02

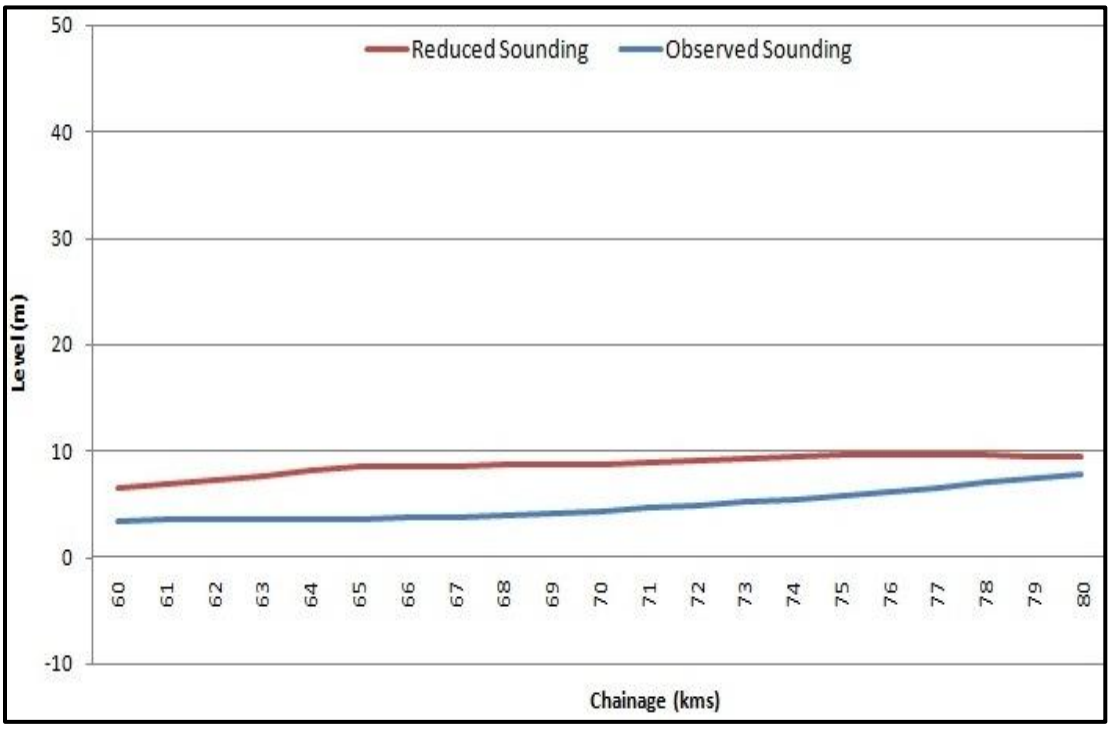


Figure 41 – Reduced & Observed Bed Profile of Soitang to Kandizal

This stretch starts from Soitang to Kandizal. Horizontal and vertical clearance of Bridges is quite suitable for Navigation. Width of river from 80m to 165 m. and depths observed is 0.4m to 10.3m of deepest channel of the river. Banks are mainly unprotected but firm. There is no encroachment of waterway present. 5 nos. of bridge crossing were present in this stretch of River, names are given in Table-7 (List of Cross structures) with details. NH-1A cross the river in this stretch at 62.5km.

Main town is Pampore and Main villages in this stretch are Aliabad, Rakhshalina, Zoonipora, Patalbag and Samboora. Maximum Land is residential, agricultural and army cantonment along this stretch. Land is generally used for Agriculture. Corn, fruits (apple, cherry, grapes,

pomegranates), and rice are main crops near to this stretch. There was some Irrigational water lift tank present in this stretch of the river. This stretch of river is well connected via road. Photographs of field observation and cross structure are available in **Annexure -XII.**

Srinagar, Pampore and Kakapora railway station are available in this stretch. Fishing of fresh water is available on small scale. Sand mining is present in this stretch. Full availability Bulk/Construction materials as cement factories (Saifco cement, Khyber cement and J&K cement factory) are present near to this stretch.

Figure 42 – Ch.62.46 Km Lasjan Bridge

Figure 43 – Ch. 62.48 Km New Lasjan Bridge

Figure 44 – Ch. 64.65 Km Ali Abad Bridge

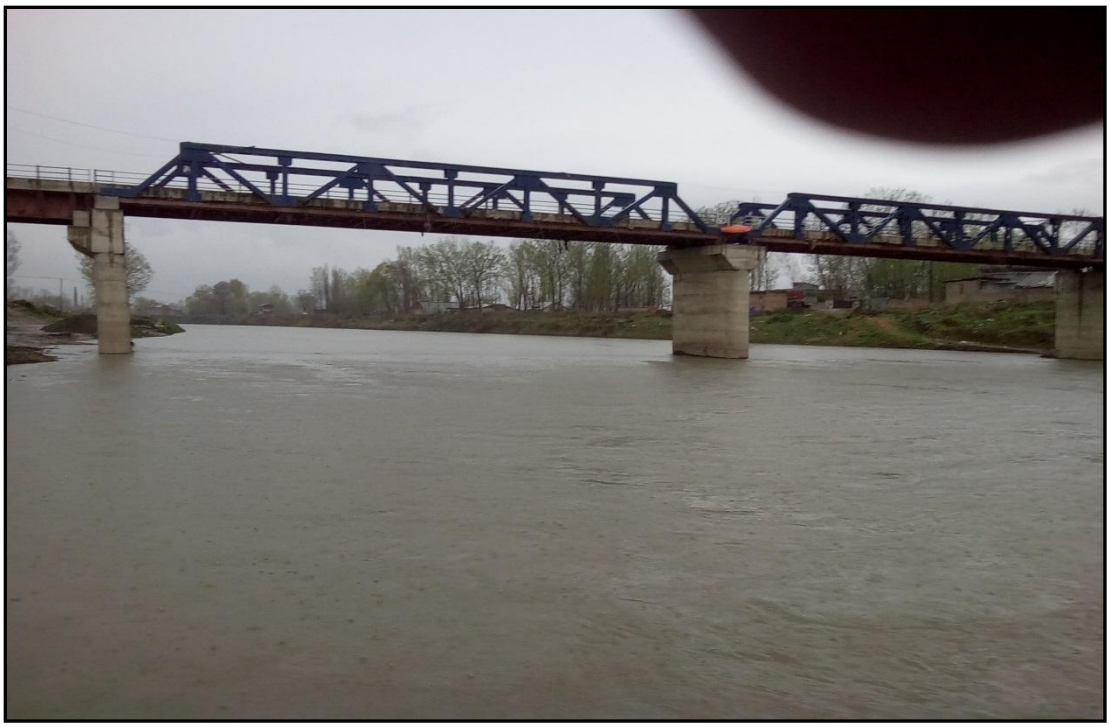


Figure 45 – Ch.70.27 Km Zooni Pura Bridge

Figure 46 – Ch.71.49 Km Kadlabal Bridge

3.5 Kandizal to Chersoo Awantipora (Ch. 80.00 km – 100 km)

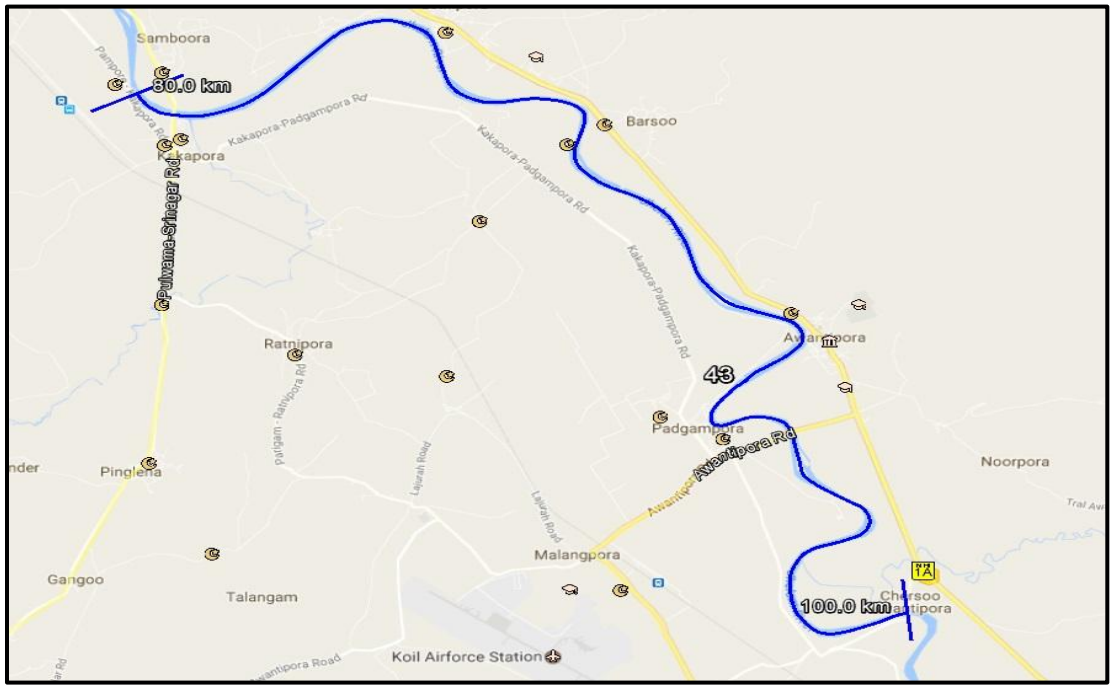


Figure 47 – Kandizal to Chersoo Awantipora

Table 17 – Dredging Quantity for Stretch 5, Kandizal to Chersoo Awantipora

Class	Chainage		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.)
I	80.00	100.00	1.3	11.10	0.00	0.00	-0.30	11.08	1.20	238046.56
II	80.00	100.00	1.00	11.10	0.60	499.32	-0.30	12.36	5.00	534645.23

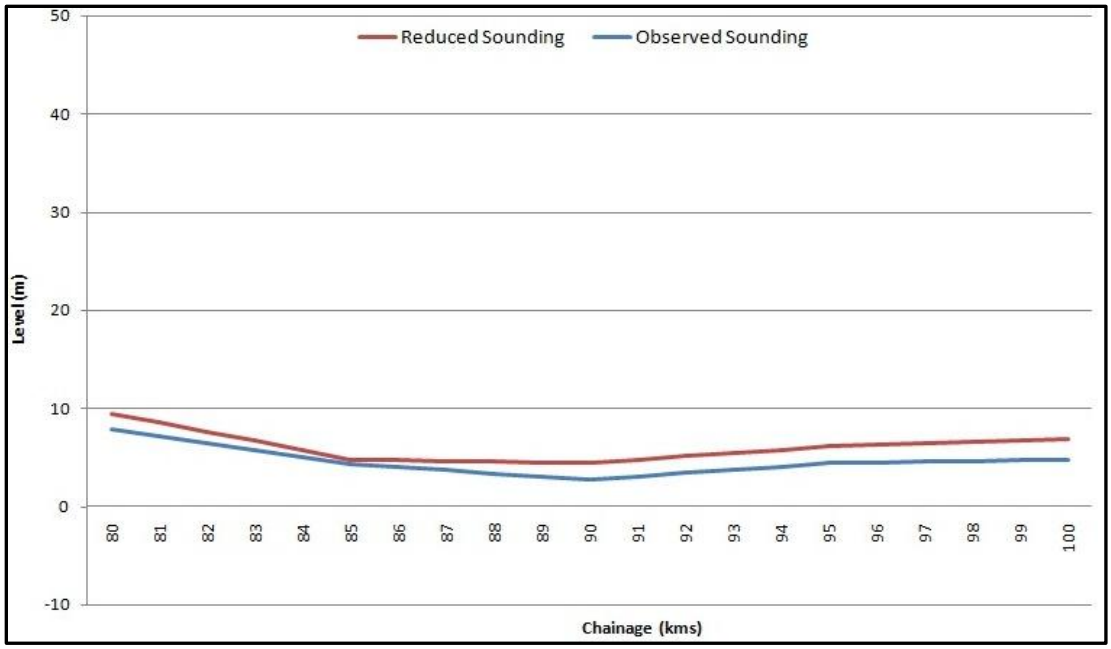


Figure 48 – Reduced & Observed Bed Profile of Kandizal to Chersoo Awantipora

This stretch starts from Kandizal and end at Chersoo Awantipora. Horizontal and vertical clearance of Bridges is not sufficient for Navigation. Width of river from 75m to 210m and depths observed is 1.2m to 11.1m of deepest channel of the river. Banks are mainly unprotected but firm. There is no encroachment of waterway present. 8 nos. of bridge crossing were present in this stretch of River, names are given in Table-7 (List of Cross structures) with details. NH-1A along the right bank of the river in this stretch.

Main town is Pampore & Avantipora and Main villages in this stretch are Lethipora, Reshipora, Barsoo, Kanilbagh, Gadd Hanjipora. Maximum Land is agricultural and army cantonment along this stretch. Land is generally used for Agriculture. Corn, fruits (apple, cherry, grapes, pomegranates), and rice are main crops near to this stretch. There was some Irrigational water lift tank present in this stretch of the river. Sand mining is present in this stretch. This stretch of river is well connected via road. Photographs of field observation and cross structure are available in **Annexure -XIII.**

Avantipora a railway station is available in this stretch. Army air strip present on left bank of the river.

Figure 49 – Ch.84.54 Km Kakapora Bridge

Figure 50 – Ch.87.33 Km Bridge Connecting Hajibal to Lethapora

Figure 51 – Ch.88.40 Km Iron Bridge

Figure 52 – Ch.92.76 Km Under Construction Bridge

Figure 53 – Ch.94.68 Km Padgampora Bridge

3.6 Chersoo Awantipora Bridge to Dangpora (Ch. 100.00 km – 110.270)

Figure 54 – Chersoo Awantipora Bridge to Dangpora

Table 18 – Dredging Quantity for Stretch 6, Chersoo Awantipora Bridge to Dangpora

Class	Chainage		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	100.00	110.27	0.80	9.80	0.50	1766.60	-0.30	10.67	1.20	36612.60
2	100.00	110.27	0.80	9.80	1.60	8794.35	0.41	12.09	1.60	77036.58

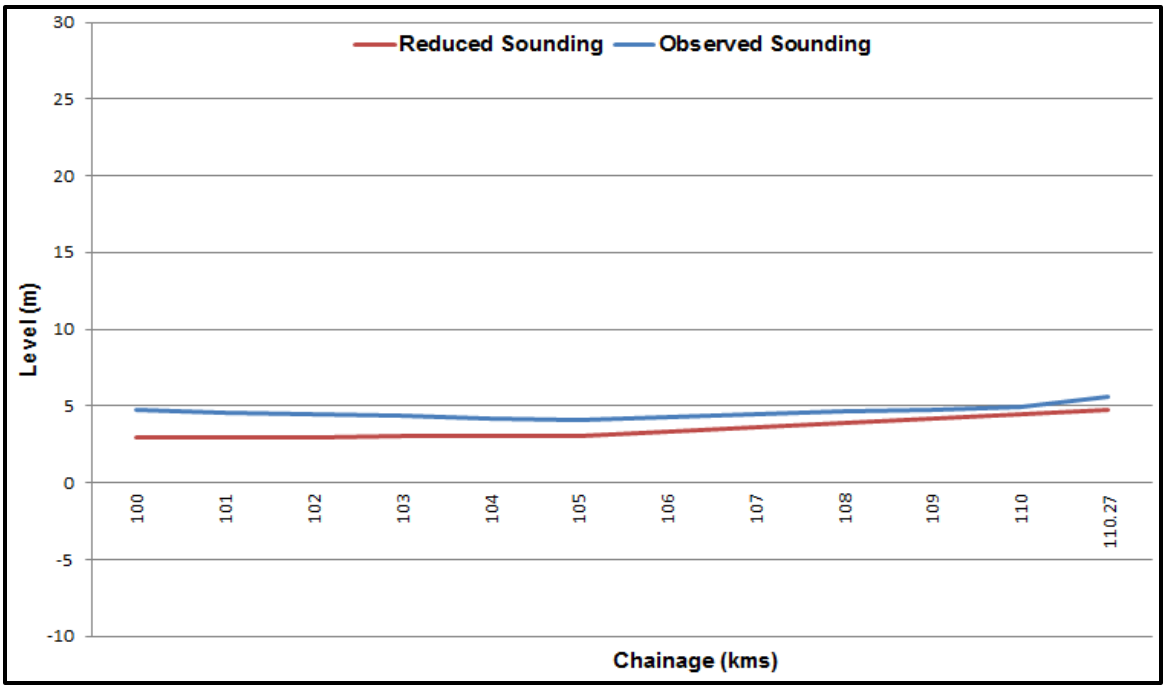


Figure 55 – Reduced & Observed Bed Profile of Chersoo Awantipora Bridge to Dangpora

This stretch starts from Chersoo Awantipora Bridge and end at Dangpora. Horizontal and vertical clearance of Bridges is not sufficient for Navigation. Width of river from 50m to 150m. and depths observed is 0.1 to 11m of deepest channel of the river. Banks are mainly unprotected but firm. 2 nos. of bridge crossing were present in this stretch of River, names are given in Table-7 (List of Cross structures) with details. NH-1A along the right bank of the river in this stretch.

Main town is Avantipora and Main villages in this stretch are Dogripora, Nynagund baba Khalil, KV pora, Sangam and Dangpora. Maximum Land is agricultural Land is generally used for Agriculture. Corn, fruits (apple, cherry, grapes, pomegranates), and rice are main crops near to this stretch. There was some Irrigational water lift tank present in this stretch of the river. Sand mining is present in this stretch. This stretch of river is well connected via road. Photographs of field observation and cross structure are available in **Annexure -XIII.**

Avantipora & Panjgam railway station is available in this stretch.

Figure 56 – Ch.100 Km Charsoo Awantipora Bridge

Figure 57 – Ch. 108.64 Km Sangam Bridge

Figure 58 – Ch.109.79 Km Naina Bridge

4.0 TERMINALS

4.1 Locations for Terminal Construction

Total 04 (Four) location are proposed for construction of terminals along the Jhelum River stretch. 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

Table 19 – Terminal Locations

Sl. No.	Chainage (km)	Location	Position			
			Latitude (E)	Longitude (N)	Easting (m)	Northing (m)
1	0.39	Near Wular Lake	74°36' 37.18"E	34°21' 35.61"N	E 464167.00	N 3802130.00
2	51.81	Zero Bridge	74°49' 50.08"E	34°4' 9.68"N	E 484367.00	N 3769859.00
3	80.00	Oukhoo Kakapora	74°55' 14.98"E	33°57' 18.24"N	E 492685.00	N 3757177.00
4	108.50	Sangam Bridge	75°4' 10.59"E	33°49' 47.31"N	E 506441.00	N 3743288.01

4.2 Terminal 1 (Near Wular Lake at Ch. 0.39 km):

The suggested location is near to Wular Lake on left bank of Jhelum River. Depth for berthing of vessel is quite suitable. 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. Land use is private and presently using for agriculture purpose by farmer.

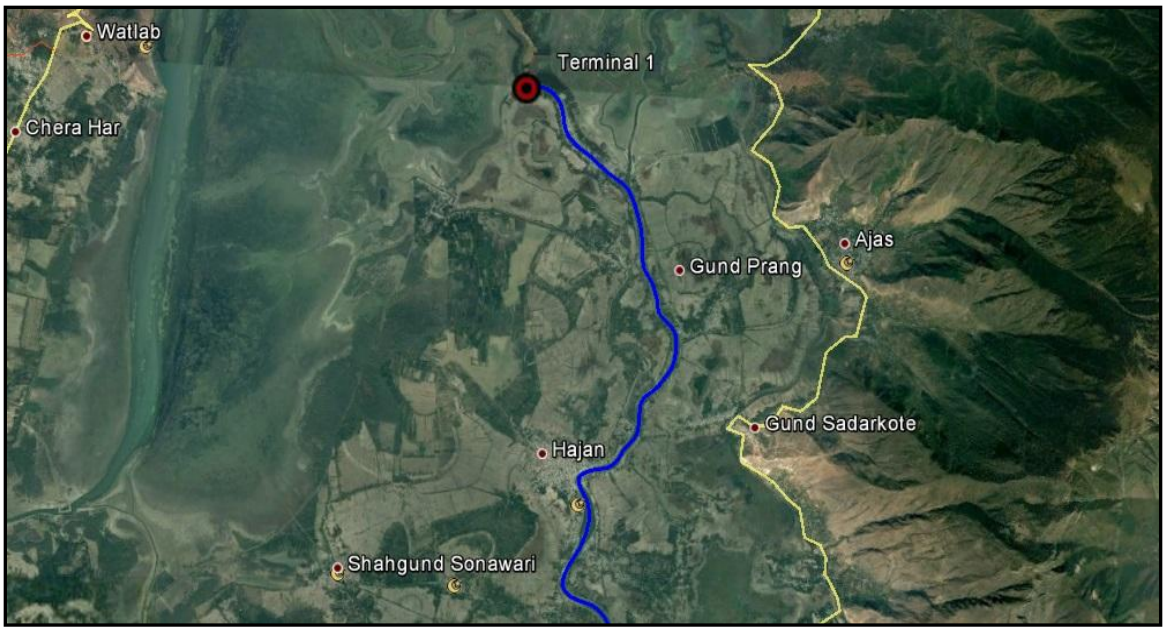


Figure 59 – Overview, Terminal Location (Terminal 1)

4.3 Terminal 2 (Zero Bridge at Ch. 51.81 km):

The suggested location is near zero bridge on left bank of Jhelum River. Depth for berthing of vessel is quite suitable. 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. Land use is under J&K Govt.

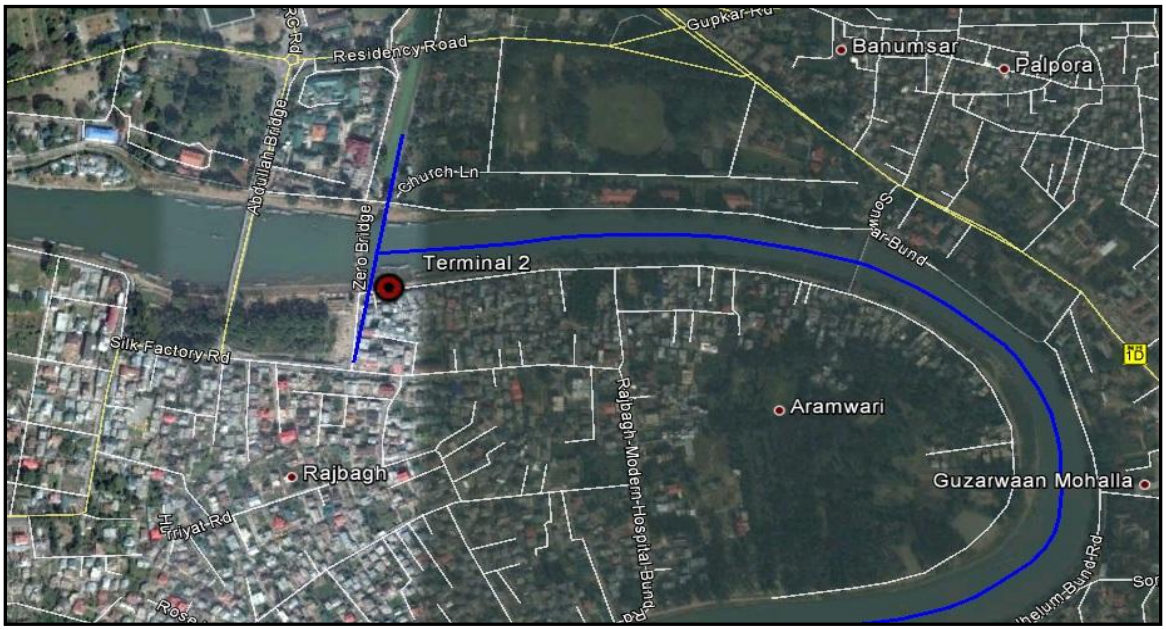


Figure 60 – Overview, Terminal Location (Terminal 2)

4.4 Terminal 3 (Oukhoo Kakapora Ch. 80.00 km):

The suggested location is near to Kakrapora on left bank of Jhelum River. Depth for berthing of vessel is quite suitable. The location is well connected with road and can be developed as a start/end point terminal. The location has potential to be developed into a major terminal in future. Land use is private and used for agriculture purpose.

Figure 61 – Overview, Terminal Location (Terminal 3)

4.5 Terminal 4 (Sangam Bridge at Ch. 108.50 km):

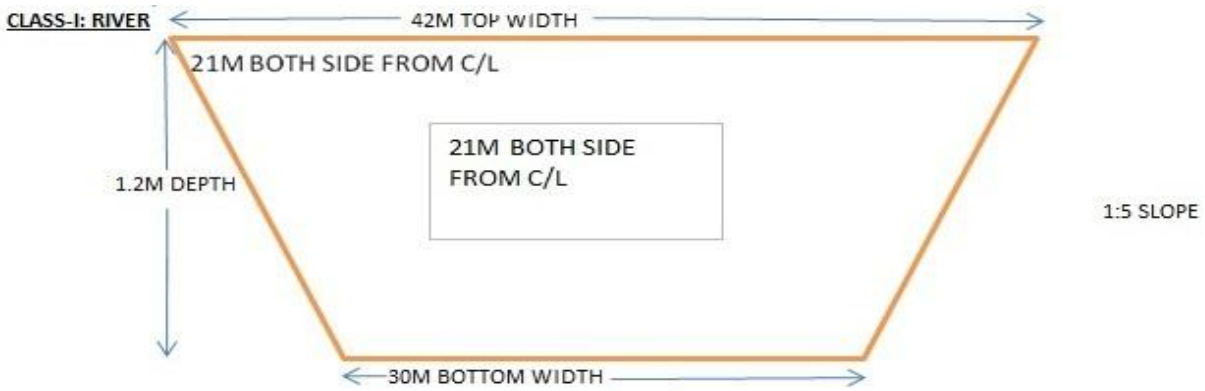
The suggested location is at Sangam Bridge on left bank of Jhelum River. Depth for berthing of vessel is quite suitable. The location is well connected to road and can be developed as a start/end point terminal. The location has potential to be developed into a major terminal in future. Land use is private and used for agriculture purpose.

Figure 62 – Overview, Terminal Location (Terminal 4)

5.0 FAIRWAY DEVELOPMENT

As per the client requirement, fairway dimension of channel has made of 2 types.

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



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

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

5.1 Dredging Sections and Fairway Dimensions

The Dredging sections of different stretches are prepared for the calculation of final dredge volume. The dredging channel is designed by linking deepest sounding of each cross sections and the dredging quantity is estimated for developing a navigable channel with the following dimension. The best suitable dredging channel class for the survey stretch of Jhelum River is identified as Class-I and the dredge volume for the Class II is

also calculated for the entire survey stretch. The details of Fairway channel dimension used for the dredging calculation are as follows:-

Table 20 – Dimension of Dredging Channel

Class of Waterway Rivers	Minimum Depth	Bottom Width	Bend Radius	Vertical Clearance	Horizontal Clearance
Class-I	1.2 m	30 m	300 m	4 m	30 m
Class-II	1.4 m	40 m	500 m	5 m	40 m

5.2 Calculation of Dredging Quantity

The dredge volume calculations were accomplished u1sing the HYPACK dredge volume computation utility. For clarity and ease of calculations, the complete channel profile was divided into segments of 1 km each (enclosed at Annexure-2). The Tin v/s Channel volume with Hypack Standard algorithm was used to calculate the dredge volume in each segment. The stretch wise summary of the dredge volume for a different class of fairway is as follows:-

Table 21 – Dredging Volume Summary in Jhelum River for Class – I

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (1.2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	0	1	1	11	11	0.1	6.9	100	82.57	82.57	1.3	5.54	0	0	0
	1	2	12	21	10	1.3	5.7	0	0	82.57	1.54	3.91	0	0	0
	2	3	22	31	10	1.5	5.2	0	0	82.57	1.28	3.34	0	0	0
	3	4	32	41	10	1.5	5.1	0	0	82.57	1.95	3.29	0	0	0
Gund Prang	4	5	42	51	10	1.8	7.1	0	0	82.57	1.84	5.48	0	0	0
	5	6	52	61	10	2.3	7.7	0	0	82.57	1.66	6.17	0	0	0
	6	7	62	71	10	4.4	7.9	0	0	82.57	1.91	6.8	0	0	0
	7	8	72	81	10	3.3	8.6	0	0	82.57	1.43	6.43	0	0	0
	8	9	82	91	10	4.5	8.2	0	0	82.57	1.49	6.11	0	0	0
Hajan	9	10	92	101	10	0.5	9	100	183.97	266.54	-0.12	6.6	400	7821.83	7821.83
	10	11	102	111	10	1.8	5.5	0	0	266.54	-0.3	3.08	300	4241.48	12063.31
	11	12	112	121	10	1.3	9.3	0	0	266.54	1.49	7.09	0	0	12063.31
	12	13	122	131	10	1.3	5.4	0	0	266.54	0.29	3.35	300	878.85	12942.16
	13	14	132	141	10	3.2	5.7	0	0	266.54	0.57	3.26	200	212.35	13154.51

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (1.2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	14	15	142	151	10	3.9	6.3	0	0	266.54	1.2	3.91	0	0	13154.51
	15	16	152	161	10	1.5	7.8	0	0	266.54	-0.15	5.91	400	7411.15	20565.66
	16	17	162	171	10	2.8	4.2	0	0	266.54	2.36	3.65	200	570.39	21136.05
Asham	17	18	172	181	10	1.5	4.7	0	0	266.54	1.22	4.39	0	0	21136.05
	18	19	182	191	10	3.9	6.1	0	0	266.54	3.02	5.67	0	0	21136.05
Stretch-1	19	20	192	201	10	1.2	6.3	0	0	266.54	2.44	6.98	0	0	21136.05
Sumbal	20	21	202	211	10	3.6	8.4	0	0	266.54	1.3	7.65	0	0	21136.05
	21	22	212	221	10	2.7	7.4	0	0	266.54	1.63	9.03	0	0	21136.05
	22	23	222	231	10	0.2	5.3	300	516.87	783.41	0.8	5.15	100	41.55	21177.6
	23	24	232	243	12	0.3	5.8	500	299.09	1082.5	1.1	5.37	100	1.57	21179.17
Shilwat	24	25	244	253	10	3.4	5.5	0	0	1082.5	2.4	3.97	0	0	21179.17
	25	26	254	263	10	3.0	5.3	0	0	1082.5	2.06	5.63	0	0	21179.17
	26	27	264	273	10	1.3	4.9	200	1.91	1084.41	1.71	4.49	0	0	21179.17
Shadi Pora	27	28	274	283	10	1.0	5.0	0	0	1084.41	1.26	4.34	0	0	21179.17
	28	29	284	293	10	0.8	6.2	200	854.11	1938.52	1.1	4.97	100	163.39	21342.56
	29	30	294	303	10	2.9	5.4	0	0	1938.52	1.39	5.42	0	0	21342.56
	30	31	304	313	10	1.1	4.8	100	4.93	1943.45	0.78	5.38	200	855.37	22197.93
	31	32	314	323	10	0.8	5.6	700	4.86	1948.31	-0.37	5.86	700	3980.81	26178.74
	32	33	324	333	10	0.6	4.9	500	0.63	1948.94	-0.27	4.46	500	2135.64	28314.38
	33	34	334	343	10	1.1	4.8	200	18.3	1967.24	0.58	3.41	400	3057.87	31372.25
Abdullah Pora	34	35	344	353	10	2.1	7.9	0	0	1967.24	0.38	5.78	500	763.09	32135.34
	35	36	354	363	10	1.9	5.0	0	0	1967.24	0.03	2.75	900	9415.93	41551.27
Takan Wari Pora	36	37	364	373	10	1.6	4.1	0	0	1967.24	-0.3	3.66	1000	9957.27	51508.54
	37	38	374	383	10	1.6	6.6	0	0	1967.24	-0.37	6.38	700	6494.06	58002.6
	38	39	384	393	10	1.1	6.4	0	0	1967.24	-0.14	5.4	900	4491.62	62494.22
	39	40	394	403	10	2.4	3.8	0	0	1967.24	0.03	3.26	1000	10189.97	72684.19
	40	41	404	413	10	0.6	4.2	700	1535.15	3502.39	0.46	4.21	1000	18415.77	91099.96
	41	42	414	423	10	0.7	3.9	500	690.82	4193.21	-0.3	2.26	1000	15713.9	106813.86
Chhatabal Wier	42	43	424	433	10	1.3	3.2	100	0	4193.21	-0.3	1.72	1000	17074.05	123887.91
Stretch-2	43	44	434	443	10	1.6	4.5	0	0	4193.21	-0.19	2.65	1000	9250.83	133138.74

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (1.2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	44	45	444	453	10	1.5	4.1	0	0	4193.21	-0.3	4.17	1000	5333.42	138472.16
	45	46	454	463	10	0.3	7.6	700	1883.32	6076.53	-0.3	6.26	800	9230.51	147702.67
	46	47	464	473	10	0.4	6.2	1000	4244.69	10321.22	-0.3	4.78	800	31119.38	178822.05
	47	48	474	483	10	0.7	2.0	400	270.53	10591.75	-0.3	5.15	300	2270.4	181092.45
Habba Kadal	48	49	484	493	10	1.1	6.8	200	4320	14911.75	-0.22	5.01	700	4064.92	185157.37
	49	50	494	503	10	1.3	5.5	0	0	14911.75	-0.04	5.67	800	3613.22	188770.59
Lal Mandi	50	51	504	513	10	2.3	5.4	0	0	14911.75	-0.3	4.77	400	35462.75	224233.34
	51	52	514	523	10	1.1	7.6	0	0	14911.75	-0.3	4.94	500	41623.19	265856.53
	52	53	524	533	10	1.0	5.8	500	4297.21	19208.96	-0.3	3.48	500	32719.4	298575.93
	53	54	534	543	10	1.4	8.3	0	0	19208.96	-0.3	5.85	500	32490.6	331066.53
	54	55	544	553	10	0.3	5.9	200	641.6	19850.56	-0.3	2.31	700	36747.27	367813.8
	55	56	554	563	10	3.4	6.6	0	0	19850.56	-0.3	3.39	600	19526.99	387340.79
	56	57	564	573	10	3.2	6.4	0	0	19850.56	-0.3	7.28	200	929.83	388270.62
	57	58	574	583	10	2.0	6.9	0	0	19850.56	1.97	8.11	0	0	388270.62
	58	59	584	593	10	2.8	13.9	0	0	19850.56	2	16.9	0	0	388270.62
Stretch-3	59	60	594	603	10	1.7	7.6	0	0	19850.56	1.97	10.1	0	0	388270.62
	60	61	604	613	10	2.9	6.8	0	0	19850.56	2.4	8.57	0	0	388270.62
	61	62	614	623	10	0.9	8.3	200	823.78	20674.34	1.1	9.31	200	1111.46	389382.08
	62	63	624	633	10	2.3	7.9	0	0	20674.34	1.97	10.6	0	0	389382.08
Golpora	63	64	634	643	10	1.8	6.9	0	0	20674.34	1.97	10.7	0	0	389382.08
	64	65	644	653	10	2.4	7.2	0	0	20674.34	1.97	8.28	0	0	389382.08
	65	66	654	663	10	1.8	7.3	0	0	20674.34	-0.3	8.22	1000	307.34	389689.42
	66	67	664	673	10	1.3	6.0	0	0	20674.34	-0.3	3.81	1000	3095.29	392784.71
	67	68	674	683	10	0.7	4.2	200	27.38	20701.72	-0.3	2.72	1000	15478.45	408263.16
	68	69	684	693	10	0.6	7.6	400	1583.01	22284.73	-0.3	5.35	700	13529.68	421792.84
	69	70	694	703	10	1.4	7.6	0	0	22284.73	-0.3	5.94	800	6139.18	427932.02
Zooni Pora	70	71	704	713	10	0.8	5.7	200	2.14	22286.87	-0.3	3.04	900	3173.74	431105.76
	71	72	714	723	10	2.1	8.5	0	0	22286.87	1.3	10.1	0	0	431105.76
	72	73	724	733	10	1.5	8.4	0	0	22286.87	1.4	7.89	0	0	431105.76
Pampore	73	74	734	743	10	0.4	5.7	300	4318.58	26605.45	-0.92	5.03	900	11658.83	442764.59
	74	75	744	753	10	2.8	8.2	0	0	26605.45	1.65	8.62	0	0	442764.59

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (1.2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	75	76	754	763	10	1.9	7.7	0	0	26605.45	1.1	7.33	100	31	442795.59
	76	77	764	773	10	1.8	9.0	0	0	26605.45	0.28	8.58	100	23.02	442818.61
	77	78	774	783	10	1.9	10.3	0	0	26605.45	-0.38	8.79	0	0	442818.61
Samboora	78	79	784	793	10	3.5	4.3	0	0	26605.45	-0.3	7.59	100	3.77	442822.38
Stretch-4	79	80	794	803	10	2.1	8.7	0	0	26605.45	-0.3	7.17	200	1265.58	444087.96
	80	81	804	813	10	2.9	5.8	0	0	26605.45	-0.06	4.77	0	0	444087.96
	81	82	814	823	10	2.6	6.3	0	0	26605.45	1.71	5.31	0	0	444087.96
	82	83	824	833	10	1.6	8.2	0	0	26605.45	-0.43	6.51	300	4866.21	448954.17
	83	84	834	843	10	2.7	7	0	0	26605.45	-0.89	4.57	0	1737.93	450692.1
Lethipora	84	85	844	853	10	1.6	11.1	0	0	26605.45	-0.3	10.9	0	2762.62	453454.72
	85	86	854	863	10	2.9	8.8	0	0	26605.45	-0.3	6.2	0	6790.64	460245.36
	86	87	864	873	10	2.4	5.9	0	0	26605.45	-0.97	6.17	0	5408.23	465653.59
	87	88	874	883	10	1.6	10.4	0	0	26605.45	-0.34	11.1	0	2878.25	468531.84
Manwaji	88	89	884	893	10	1.3	8.7	0	0	26605.45	-0.3	8.48	0	1109.67	469641.51
Jawbrara	89	90	894	903	10	2	9.2	0	0	26605.45	-0.3	6.67	0	11824.47	481465.98
	90	91	904	913	10	2	5.6	0	0	26605.45	-0.3	3.9	0	33964.87	515430.85
	91	92	914	923	10	1.6	7.1	0	0	26605.45	-0.3	5.53	0	7715.13	523145.98
	92	93	924	933	10	1.3	5.2	0	0	26605.45	-0.3	3.18	100	43549.75	566695.73
	93	94	934	943	10	1.3	6.2	0	0	26605.45	-0.3	3.24	100	30748.75	597444.48
Gaad Hanjipora	94	95	944	953	10	1.2	7.8	0	0	26605.45	-0.3	6.64	100	8874.76	606319.24
	95	96	954	963	10	1.8	9.1	0	0	26605.45	-0.3	6.5	0	3065.16	609384.4
	96	97	964	973	10	1.5	8.1	0	0	26605.45	-0.3	5.92	100	6198.01	615582.41
	97	98	974	983	10	1.3	4.7	0	0	26605.45	-0.3	1.43	100	32444.95	648027.36
	98	99	984	993	10	1.3	5.7	0	0	26605.45	-0.3	3.62	200	24767.76	672795.12
Stretch-5	99	100	994	1003	10	2	10	0	0	26605.45	-0.3	8.95	200	9339.4	682134.52
Chersoo Awantipora	100	101	1004	1013	10	1.1	8	300	302.39	26907.84	-0.13	5.17	200	8051.46	690185.98
	101	102	1014	1023	10	2	7	0	0	26907.84	-0.3	5.09	400	10704.21	700890.19
	102	103	1024	1033	10	2.1	8	0	0	26907.84	1.35	6.29	0	0	700890.19
	103	104	1034	1043	10	2.1	7	0	0	26907.84	-0.3	5.27	100	67.32	700957.51
	104	105	1044	1053	10	2.7	6.3	0	0	26907.84	1.25	4.43	0	0	700957.51
	105	106	1054	1063	10	2.6	5	0	0	26907.84	1.3	3.67	0	0	700957.51

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (1.2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	106	107	1064	1073	10	2.4	5.9	0	0	26907.84	1.39	4.93	0	0	700957.51
	107	108	1074	1083	10	2.3	4.7	0	0	26907.84	1.25	3	0	0	700957.51
Sangam	108	109	1084	1093	10	1.3	9.8	0	0	26907.84	-0.3	10.7	200	1515.89	702473.4
Dangpora	109	110	1094	1103	10	0.08	6.5	100	1421.67	28329.51	-0.3	4.87	200	12192.6	714666
Stretch-6	110	110.27	1104	1106	3	1.3	6.5	100	42.54	28372.05	0.94	6.25	100	4081.12	718747.12

Table 22 – Dredging Volume Summary in Jhelum River for Class – II

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	0	1	1	11	11	0.1	6.9	600	1539.93	1539.93	-0.3	3.36	300	329.41	329.41
	1	2	12	21	10	1.3	5.7	100	132.69	1672.62	-0.3	1.68	500	135.74	465.15
	2	3	22	31	10	1.5	5.2	0	0	1672.62	1.62	1.21	0	0	465.15
	3	4	32	41	10	1.5	5.1	0	0	1672.62	-0.25	0.98	700	226.16	691.31
Gund Prang	4	5	42	51	10	1.8	7.1	0	0	1672.62	1.49	2.98	0	0	691.31
	5	6	52	61	10	2.3	7.7	0	0	1672.62	1.65	4.08	0	0	691.31
	6	7	62	71	10	4.4	7.9	0	0	1672.62	1.55	5.03	0	0	691.31
	7	8	72	81	10	3.3	8.6	0	0	1672.62	1.69	4.57	0	0	691.31
	8	9	82	91	10	4.5	8.2	0	0	1672.62	1.72	4.8	0	0	691.31
Hajan	9	10	92	101	10	0.5	9	200	1099.3	2771.92	0.1	5.36	400	11847.53	12538.84
	10	11	102	111	10	1.8	5.5	0	0	2771.92	-0.3	1.41	600	8224.79	20763.63
	11	12	112	121	10	1.3	9.3	0	0	2771.92	0.78	5.46	200	164.67	20928.3
	12	13	122	131	10	1.3	5.4	0	0	2771.92	0.26	1.38	400	2344.19	23272.49
	13	14	132	141	10	3.2	5.7	0	0	2771.92	-0.3	1.57	600	1114.13	24386.62

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	14	15	142	151	10	3.9	6.3	0	0	2771.92	1.53	4.45	100	0	24386.62
	15	16	152	161	10	1.5	7.8	0	0	2771.92	-0.3	4.45	700	14380.86	38767.48
	16	17	162	171	10	2.8	4.2	0	0	2771.92	-0.3	1.79	600	1249.81	40017.29
Asham	17	18	172	181	10	1.5	4.7	0	0	2771.92	-0.13	2.59	200	6.78	40024.07
	18	19	182	191	10	3.9	6.1	0	0	2771.92	1.62	4.45	0	0	40024.07
Stretch-1	19	20	192	201	10	1.2	6.3	0	0	2771.92	1.42	5.27	0	0	40024.07
Sumbal	20	21	202	211	10	3.6	8.4	0	0	2771.92	1.52	7.47	0	0	40024.07
	21	22	212	221	10	2.7	7.4	0	0	2771.92	155	6.26	0	0	40024.07
	22	23	222	231	10	0.2	5.3	300	1835.44	4607.36	-0.3	1.95	100	591.1	40615.17
	23	24	232	243	12	0.3	5.8	500	1258.17	5865.53	-0.3	2.26	600	371.73	40986.9
Shilwat	24	25	244	253	10	3.4	5.5	0	0	5865.53	1.53	1.12	0	0	40986.9
	25	26	254	263	10	3.0	5.3	0	0	5865.53	1.65	2.06	0	0	40986.9
	26	27	264	273	10	1.3	4.9	200	276.03	6141.56	1.57	1.07	0	0	40986.9
Shadi Pora	27	28	274	283	10	1.0	5.0	0	0	6141.56	-0.3	1.65	700	1.75	40988.65
	28	29	284	293	10	0.8	6.2	200	2032.1	8173.66	0.19	2.13	400	1374.66	42363.31
	29	30	294	303	10	2.9	5.4	0	0	8173.66	1.49	2.07	0	0	42363.31
	30	31	304	313	10	1.1	4.8	0	176.41	8350.07	-0.3	3.68	600	2263.56	44626.87
	31	32	314	323	10	0.8	5.6	700	306.28	8656.35	-0.3	4.31	700	11766.53	56393.4
	32	33	324	333	10	0.6	4.9	500	284.02	8940.37	-0.3	3.25	500	5630.51	62023.91
	33	34	334	343	10	1.1	4.8	200	657.34	9597.71	-0.3	1.8	700	5449.15	67473.06
Abdullah Pora	34	35	344	353	10	2.1	7.9	0	0	9597.71	-0.3	4.44	600	3762.76	71235.82
	35	36	354	363	10	1.9	5.0	0	0	9597.71	-0.3	1.14	900	18353.93	89589.75
Takan Wari Pora	36	37	364	373	10	1.6	4.1	0	0	9597.71	-0.3	1.33	1000	18088.34	107678.09
	37	38	374	383	10	1.6	6.6	0	0	9597.71	-0.3	4.82	800	14180.32	121858.41
	38	39	384	393	10	1.1	6.4	400	75.43	9673.14	-0.3	3.1	900	12039.24	133897.65
	39	40	394	403	10	2.4	3.8	0	0	9673.14	-0.3	1.42	1000	20669.97	154567.62

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	40	41	404	413	10	0.6	4.2	700	3997	13670.14	-0.3	2.22	1000	31543.82	186111.44
	41	42	414	423	10	0.7	3.9	500	2542.08	16212.22	-0.3	0.13	1000	28631.99	214743.43
	42	43	424	433	10	1.3	3.2	100	13.19	16225.41	-0.3	-0.21	1000	31483.07	246226.5
Chhatabal Wier	43	44	434	443	10	1.6	4.5	0	0	16225.41	-0.3	0.63	1000	18771.72	264998.22
Stretch-2	44	45	444	453	10	1.5	4.1	0	0	16225.41	-0.3	2.01	1000	15725.85	280724.07
	45	46	454	463	10	0.3	7.6	700	3475.44	19700.85	-0.3	4.33	800	15628.8	296352.87
	46	47	464	473	10	0.4	6.2	1000	10129.25	29830.1	-0.3	2.73	800	49002.64	345355.51
	47	48	474	483	10	0.7	2.0	400	1175.14	31005.24	-0.3	3.16	400	6764.28	352119.79
Habba Kadal	48	49	484	493	10	1.1	6.8	0	6580.0	37585.24	-0.3	3.08	800	9622.65	361742.44
	49	50	494	503	10	1.3	5.5	200	226.6	37811.84	-0.3	3.83	800	6178.87	367921.31
Lal Mandi	50	51	504	513	10	2.3	5.4	0	0	37811.84	-0.3	7.96	400	50498.43	418419.74
	51	52	514	523	10	1.1	7.6	0	0	37811.84	0.85	8.19	700	66281.17	484700.91
	52	53	524	533	10	1.0	5.8	500	6614.7	44426.54	0.96	6.79	600	53520.24	538221.15
	53	54	534	543	10	1.4	8.3	0	0	44426.54	0.8	8.32	500	51507.62	589728.77
	54	55	544	553	10	0.3	5.9	200	1397	45823.54	0.8	6.12	500	59791.17	649519.94
	55	56	554	563	10	3.4	6.6	0	0	45823.54	1.23	6.49	300	35086.58	684606.52
	56	57	564	573	10	3.2	6.4	0	0	45823.54	1.2	5.58	100	4638.46	689244.98
	57	58	574	583	10	2.0	6.9	0	0	45823.54	2.6	6.38	0	0	689244.98
	58	59	584	593	10	2.8	13.92	0	0	45823.54	1.63	15.32	0	0	689244.98
Stretch-3	59	60	594	603	10	1.7	7.6	0	0	45823.54	1.57	6.92	0	0	689244.98
	60	61	604	613	10	2.9	6.8	0	0	45823.54	1.49	7.09	0	0	689244.98
	61	62	614	623	10	0.9	8.3	200	1855.59	47679.13	-0.3	3.54	500	2314.12	691559.1
	62	63	624	633	10	2.3	7.9	0	0	47679.13	1.65	4.45	0	0	691559.1
Golpora	63	64	634	643	10	1.8	6.9	0	0	47679.13	1.51	2.34	0	0	691559.1
	64	65	644	653	10	2.4	7.2	0	0	47679.13	1.56	2.22	0	0	691559.1
	65	66	654	663	10	1.8	7.3	0	0	47679.13	-0.3	2.42	200	1570.45	693129.55

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	66	67	664	673	10	1.3	6.0	200	135.39	47814.52	-0.3	0.68	1000	9366.71	702496.26
	67	68	674	683	10	0.7	4.2	200	472.72	48287.24	-0.3	0.1	1000	30139.66	732635.92
	68	69	684	693	10	0.6	7.6	400	3507.4	51794.64	-0.3	2.53	800	20442.7	753078.62
	69	70	694	703	10	1.4	7.6	400	141.94	51936.58	-0.3	2.83	800	11768.26	764846.88
Zooni Pora	70	71	704	713	10	0.8	5.7	200	311.17	52247.75	-0.3	0.68	900	6865.85	771712.73
	71	72	714	723	10	2.1	8.5	0	0	52247.75	1.48	3.64	0	0	771712.73
	72	73	724	733	10	1.5	8.4	0	0	52247.75	-0.3	4.48	600	125.93	771838.66
Pampore	73	74	734	743	10	0.4	5.7	300	6626.52	58874.27	-0.3	1.81	900	19502.18	791340.84
	74	75	744	753	10	2.8	8.2	0	0	58874.27	-0.3	4.59	600	71.4	791412.24
	75	76	754	763	10	1.9	7.7	0	0	58874.27	-0.3	5.1	300	451.19	791863.43
	76	77	764	773	10	1.8	9.0	0	0	58874.27	1.25	9.46	400	406.87	792270.3
	77	78	774	783	10	1.9	10.3	0	0	58874.27	1.21	10.29	100	63.51	792333.81
Samboora	78	79	784	793	10	3.5	4.3	0	0	58874.27	1.2	8.91	100	131.45	792465.26
Stretch-4	79	80	794	803	10	2.1	8.7	0	0	58874.27	1.32	7.96	300	2450.74	794916
	80	81	804	813	10	2.9	5.8	0	0	58874.27	1.24	5.63	100	65.27	794981.27
	81	82	814	823	10	2.6	6.3	0	0	58874.27	1.29	6.29	100	84.94	795066.21
	82	83	824	833	10	1.6	8.2	0	0	58874.27	-0.3	7.59	300	8011.19	803077.4
	83	84	834	843	10	2.7	7	0	0	58874.27	-0.3	6.49	100	4894.45	807971.85
Lethipora	84	85	844	853	10	1.6	11.1	0	0	58874.27	0.71	12.36	100	8078.31	816050.16
	85	86	854	863	10	2.9	8.8	0	0	58874.27	1.15	8.16	600	12005.3	828055.46
	86	87	864	873	10	2.4	5.9	0	0	58874.27	1.3	8.36	700	13537.57	841593.03
	87	88	874	883	10	1.6	10.4	0	0	58874.27	0.9	12.13	100	7644.16	849237.19
Manwaji	88	89	884	893	10	1.3	8.7	100	0.04	58874.31	1.12	10.41	100	2932.05	852169.24
Jawbrara	89	90	894	903	10	2	9.2	0	0	58874.31	1.21	9.04	400	18448.03	870617.27
	90	91	904	913	10	2	5.6	0	0	58874.31	1.27	6.29	500	51637.03	922254.3
	91	92	914	923	10	1.6	7.1	0	0	58874.31	1.3	7.63	300	13873.78	936128.08

Location	Chainage (kms)		Dredging Section		No. Of Dredging Section	Observed					Reduced Depth (m) w.r.t. Sounding Datum (Avg. LWL)				
			from	to		Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD	Min (m)	Max (m)	Length of Shoal (2m)	Dredging Qty. (cu.m.) w.r.t. SD (Avg. LWL)	Accumulated Dredging Qty. (Cu. M.) w.r.t. SD
	92	93	924	933	10	1.3	5.2	100	218.67	59092.98	1.06	4.68	200	66051.33	1002179.41
	93	94	934	943	10	1.3	6.2	200	98.89	59191.87	0.43	4.6	200	50028.68	1052208.09
Gaad Hanjipora	94	95	944	953	10	1.2	7.8	200	181.72	59373.59	-0.23	6.89	200	14370.84	1066578.93
	95	96	954	963	10	1.8	9.1	0	0	59373.59	0.34	7.86	200	9053.77	1075632.7
	96	97	964	973	10	1.5	8.1	0	0	59373.59	0.9	7.28	200	12564.03	1088196.73
	97	98	974	983	10	1	4.7	0	0	59373.59	0.45	2.79	200	53386.99	1141583.72
	98	99	984	993	10	1.3	5.7	0	0	59373.59	-0.16	4.5	200	43508.84	1185092.56
Stretch-5	99	100	994	1003	10	2	10	0	0	59373.59	-0.3	8.06	200	16924.84	1202017.4
Chersoo Awantipora	100	101	1004	1013	10	1.1	8	300	1066.51	60440.1	0.8	7.27	200	16116.61	1218134.01
	101	102	1014	1023	10	2	7	0	0	60440.1	1.2	5.98	300	18395	1236529.01
	102	103	1024	1033	10	2.1	8	0	0	60440.1	2.07	7.12	0	0	1236529.01
	103	104	1034	1043	10	2.1	7	0	0	60440.1	1.3	6.13	200	979.4	1237508.41
	104	105	1044	1053	10	2.7	6.3	0	0	60440.1	1.26	5.14	100	127.6	1237636.01
	105	106	1054	1063	10	2.6	5	0	0	60440.1	2.1	4.29	0	0	1237636.01
	106	107	1064	1073	10	2.4	5.9	0	0	60440.1	2.4	5.72	0	0	1237636.01
	107	108	1074	1083	10	2.3	4.7	0	0	60440.1	1.09	3.95	100	17.84	1237653.85
Sangam	108	109	1084	1093	10	1.3	9.8	200	300.38	60740.48	0.41	12.09	100	5839.44	1243493.29
Dangpora	109	110	1094	1103	10	0.08	6.5	1000	6620.89	67361.37	0.95	6.4	200	27864.16	1271357.45
Stretch-6	110	110.27	1104	1106	3	1.3	6.5	100	806.57	68167.94	0.94	6.25	400	7696.53	1279053.98

6.0 CONCLUSION

6.1 Description of Waterways

The surveyed stretch of Jhelum River is partially utilized by shikara/ small boat for navigational purpose and the waterway can be best utilized for cargo transfer and passenger ferry service on improving the depth of existing waterway. There exist many cross structures in the waterways, which are presently in use. The capital dredging on the Waterway of Jhelum River will improve the depth of the channel for navigational requirement.

All stretches are navigable for small fishing boats at different stretches. The River banks are well connected with the road network and are moderately connected with Railway Network. The road is near about to waterways stretch.

6.2 Methods for Making Waterway Feasible

The waterway may be developed as a Class I and Class-II navigational river by carrying out minimal dredging to achieve the navigability. The navigational lock may be modified at Chattabal weir having a continuous gradient to retain the water availability in those stretches.

42 Bridges are present in this stretch of river. Vertical & horizontal clearances of bridges are not suitable for navigational channel so modification of maximum bridges is required in this stretch for waterways feasible.

6.3 Modifications/ Improvement Measures

Improvement measures for design and depth improvement are required on the first phase of the development. River banks are mainly unprotected but firm and no major signs of erosion of the river banks are found in the entire stretch of Jhelum River. The limitation for improvement of navigational aspects includes non-availability of required horizontal and vertical clearance on some cross structures as per the designed channel requirement. The navigational lock will be modified on Chattabal weir for continuous navigation of vessels.

The purpose of the survey was for assessing the river stretch from Wular Lake to Dangpora for the development of water transport facilities in the new National Waterway (NW-49).

6.4 Class wise total Dredging quantity of Jhelum River:

Class wise total Dredging quantities of Jhelum River for Class I and Class II are given in Table-23.

Table 23 – Dredging Summary of Jhelum 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.)
I	00	110.270	0.1	13.92	9.0	28,372.050	-0.3	16.94	30.10	718,747.120
II	00	110.270	0.1	13.92	8.0	68,167.940	-0.3	15.32	41.60	1,279,053.98

6.5 Recommendation:

There are no major Industries along this stretch of river except MSME, so there is no transportation of industrial items through this stretch of River. This is mainly Army cantonment area and near to this stretch so the transportation of Military instruments through cargo is possible. Also the transportation with cargo of agriculture items like wheat, Corn, fruits (apple, cherry, grapes, pomegranates), and rice are main crops is quite feasible through this waterway. This waterway is not feasible for passenger ferry or RO-RO facility because road going parallel to whole length of our survey area and bridges on every 3 km (Approx.) are presents on Jhelum River. This stretch will only to be devolved as tourism hub because there is tourist place in vicinity of our survey area. The river is running mostly throughout the year. Water availability for different periodis quite good. Agricultural land exists on both banks of the river in the stretch.

Minimal dredging is required in few stretches of Jhelum River. Navigational locks at Chattabal weir need to be modified for further navigation. Modifications of numbers of bridges are also required for navigation purpose. Jhelum River has sufficient width for navigational channel. Jhelum river can be developed for class - I waterway, as sufficient horizontal clearance is not available at bridges.

7.0 ANNEXURES

Annexure - I	Data Collected From Various Agencies
Annexure - II	Dredge Volume
Annexure - III	Details of Collected Water level
Annexure - IV	Details of Bathymetric and Topographic Surveys Carried Out
Annexure - V	Details of Bank Protection
Annexure - VI	Details of Features across the Bank
Annexure – VII	Detailed Methodology for Horizontal and Vertical Control
Annexure – VIII	Photographs of Equipment
Annexure – IX	Details of Bench Marks
Annexure – X	Soil Sample Report
Annexure – XI	Water Sample Report
Annexure – XII	Calibrations Certificates
Annexure - XIII	Field Photographs