FINAL FEASIBILITY REPORT ON

DETAILED HYDROGRAPHIC SURVEY IN BETWA RIVER (NW-19)

FROM

HAMIRPUR TO RIRWA BUZURG DARIYA (CHANDRSI)

67.050 KM

CLIENT

	INLAND WATERWAYS AUTHORITY OF INDIA **A-13, Sector-1,** **NOIDA** **DIST-Gautam Budha Nagar** **UTTAR PRADESH** **PIN- 201 301(UP)** **Email:** hc.iwai@nic.in **Web:** www.iwai.gov.in

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SURVEY PERIOD: 06 September 2016 to 15 November 2016

1. Acknowledgement

M/s New Horizon Surveys Pvt. Ltd., Navi Mumbai express its sincere gratitude to IWAI for awarding the work and guidance for completing this Project of detailed hydrographic survey and the feasibility report (67.050) in Region - IV (Betwa River) from Rerwa buzurg to confluence with Yamuna river.

We would like to use this opportunity to pen down our profound gratitude and appreciation to **Shri Amitabh Verma, IAS, ex-Chairman and Mrs. Nutan Guha Biswas, IAS, Chairperson** for spending their valuable time and guidance for completing this project of "Detailed Hydrographic and Topographic Survey in Betwa River."NHS would also like to thanks **Shri Pravir Pandey, Vice Chairman**, **IA&AS, Shri Alok Ranjan, Member (Finance) and Shri S.K. Gangwar, Member (Technical).**

NHS wishes to express their gratitude to **Cdr. P.K. Srivastava, ex-Hydrographic Chief, IWAI and Shri SVK Reddy, Chief Engineer-I (I/c Hydrographic Chief)** for his guidance and inspiration for this project. New Horizon would also like to thank **Shri Rajiv Singhal, A.H.S, IWAI** for his invaluable support and suggestions provided throughout the survey period. New Horizon is pleased to place on record our sincere thanks to other staff and officers of IWAI for their excellent support and co-operation throughout the survey period.

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SALIENT FEATURES AT A GLANCE

REGION-IV						
Consultant: New Horizon Surveys (I) Pvt. Ltd						
Name	BETWA RIVER			NW -19		
Length	67.05 km from HAMIRPUR TO RIRWA BUZURG DARIYA (CHANDRSI)					
State	Uttar Pradesh					
Survey Period	06 September 2016 to 15 November 2016					
Tidal / Non-tidal	Non Tidal					
Availability of reduced Depth (mtrs)						
	0– 15 km	15– 30 km	30– 45 km	45 – 60 km	60 – 67.05 km	**TOTAL**
<1.2	6.950	1.680	2.280	0.000	0.300	**11.210**
1.2-1.4	1.080	0.710	3.150	6.500	0.200	**11.640**
1.5-1.7	0.940	0.990	0.000	0.880	0.000	**2.810**
1.8-2	1.140	0.820	1.570	1.730	0.200	**5.460**
>2.0	4.890	10.800	8.000	5.890	6.350	**35.930**
TOTAL	**15.000**	**15.000**	**15.000**	**15.000**	**7.050**	**67.050**
Average Slope per KM (m)	0.016	0.33	0.27	0.10	0.16	
Width range (m)	275.4-538.78	271-512.9	155.3-527	147-551.9	323-571	
Average Vel (m/s)	0.114	0.189	0.225	0.171	0.231	
Discharge (Cu.m/sec.)	147.605	163.906	69.712	57.105	108.026	
Bathy Survey conducted for Length (Km)	67.05 km					
Dredging Quantity (Observed) cu.m.						
						TOTAL
Class 1	0	498.40	17,368.80	75,563.95	4,638.86	98,070.01
Class 2	349.35	1,557.45	55,986.96	1,64,047.80	9,955.33	2,31,896.88
Class 3	5,696.40	5,557.60	1,62,511.30	3,49,624.80	20,975.45	5,44,365.61
Class 4	15,646.89	17,790.82	2,93,006.78	5,24,949.92	42,176.72	8,93,571.13
Dredging Quantity (Reduced) cu.m.						
						TOTAL
Class 1	2,59,104.57	35,121.94	5,478.76	-	4,331.65	3,04,036.92
Class 2	4,16,147.03	67,171.97	25,077.12	13,355.62	9,489.59	5,31,241.33
Class 3	6,83,980.30	1,36,614.50	96,526.48	1,01,069.60	19,285.09	10,37,475.95
Class 4	9,74,864.06	2,12,600.14	1,96,293.10	2,22,705.50	30,899.60	16,37,362.30
No. Of Bridge						
2						
Clearances less than CLASS (no.)						
	Horizontal	**Vertical**				
Class 1	**27.5**	**1.5**				
Class 2	**27.5**	**1.5**				

Class 3	**27.5**	**1.5**				
Class 4	**27.5**	**1.5**	Vertical clearance of one no. HT line is 4m.			
No. of Dams, Barrages, Weirs, Anicut etc.						
0						
NUMBER OF DAYS WATER NOT AVAILABLE						
CWC Gauge	Mohana	Shahjina				
Chainage (km)	126.004	7.355				
class 1	289	174				
class 2	294	221				
class 3	306	265				
class 4	311	283				
Cargo availability						
Nil						
Passenger Movement						
Nil						
Present IWT use						
Nil						
Recommendation of the Consultant						
Sand mining is prominent in the river. Forest area on both the banks. No Existing Industry along Waterway. There are no any existing Ghats, jetties, Terminals and existing facilities for Navigation. There is no existing Cargo Movement presently.						
Viable or not-viable						
Transportation of sand through waterway is to be assessed.						

(Signature)

Date: -

New Horizon Surveys (I) Pvt. Ltd.

Section-1: Introductory Considerations

1.1 River Course Background Information, Historical Information, Origin, End.

HISTORY

In Sanskrit "Betwa" is Vetravati. This river is mentioned in the epic Mahabharata along with the Charmanwati river. Both are tributaries of Yamuna. Vetravati was also known as Shuktimati. The capital of Chedi Kingdom was on the banks of this river. The total length of the river from its origin to its confluence with Yamuna is 590 kilometers, out of which 232 kilometers lies in Madhya Pradesh and the balance of 358 kilometers in Uttar Pradesh. In accordance with an inter-state agreement between the states of Uttar Pradesh and Madhya Pradesh in 1973, Betwa River Board (BRB) was constituted under the Betwa River Board Act, 1976. The Union Minister of Ministry of Water Resources the Chairman of the Board and the Union Minister of Power, Union Minister of State for Water Resources, Chief Ministers and Ministers in-charge of Finance, Irrigation and Power of Uttar Pradesh and Madhya Pradesh are its Members.

Future

The region is important for migratory water birds. An ambitious project to link Ken and Betwa rivers has become a stage for unique man-animal conflict. Proponents of the project, led by the Union Water Ministry, say that the pro-posed Daudhan dam and the 2.5 km canal the key structures of the project that will transfer surplus water from the Uttar Pradesh section of the Ken to the Between Madhya Pradesh are critical to irrigate nearly 7,00,000hectares in drought-ravaged Bundelkhand.

1.2 Tributaries / Network of Rivers / Basin

Originating in the Kumra village in Raisen district of Madhya Pradesh the Betwa flows for 380km. After meandering through Madhya Pradesh, it enters the neighboring state Uttar Pradesh and joins the river Yamuna in Hamirpur. The Betwa takes along with it the water of the eastern Malwa plateau. The tributaries of Betwa are Bina, Yamini, and Dhasan. In ancient times, the Betwa was known as Vetrawati.

1.3 State/ District through which river passes

The **Betwa** or **Vetravati** is a river in Northern India and a tributary of the Yamuna. . The Betwa rises in the Vindhya Range just north of Hoshangabad in Madhya Pradesh and flows north-east through Madhya Pradesh and Orchha to Uttar Pradesh. Nearly half of its course, which is not navigable, runs over the Malwa Plateau. The confluence of the Betwa and the Yamuna Rivers is Hamirpur town in Uttar Pradesh, in the vicinity of Orchha.

1.4 Google Maps showing State through which it is passing with road and rail networks for

(i) MAP showing full course of the waterway.

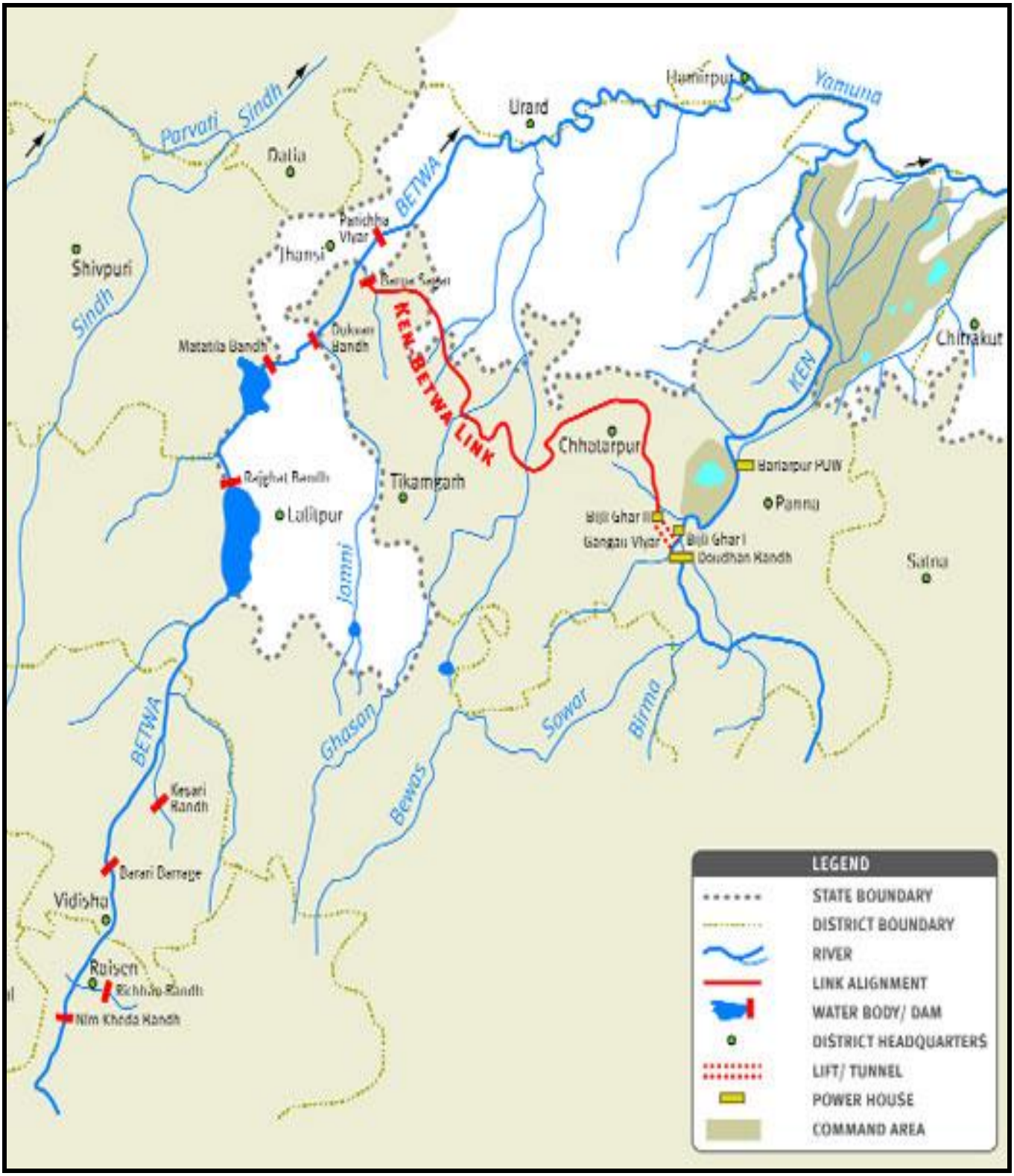
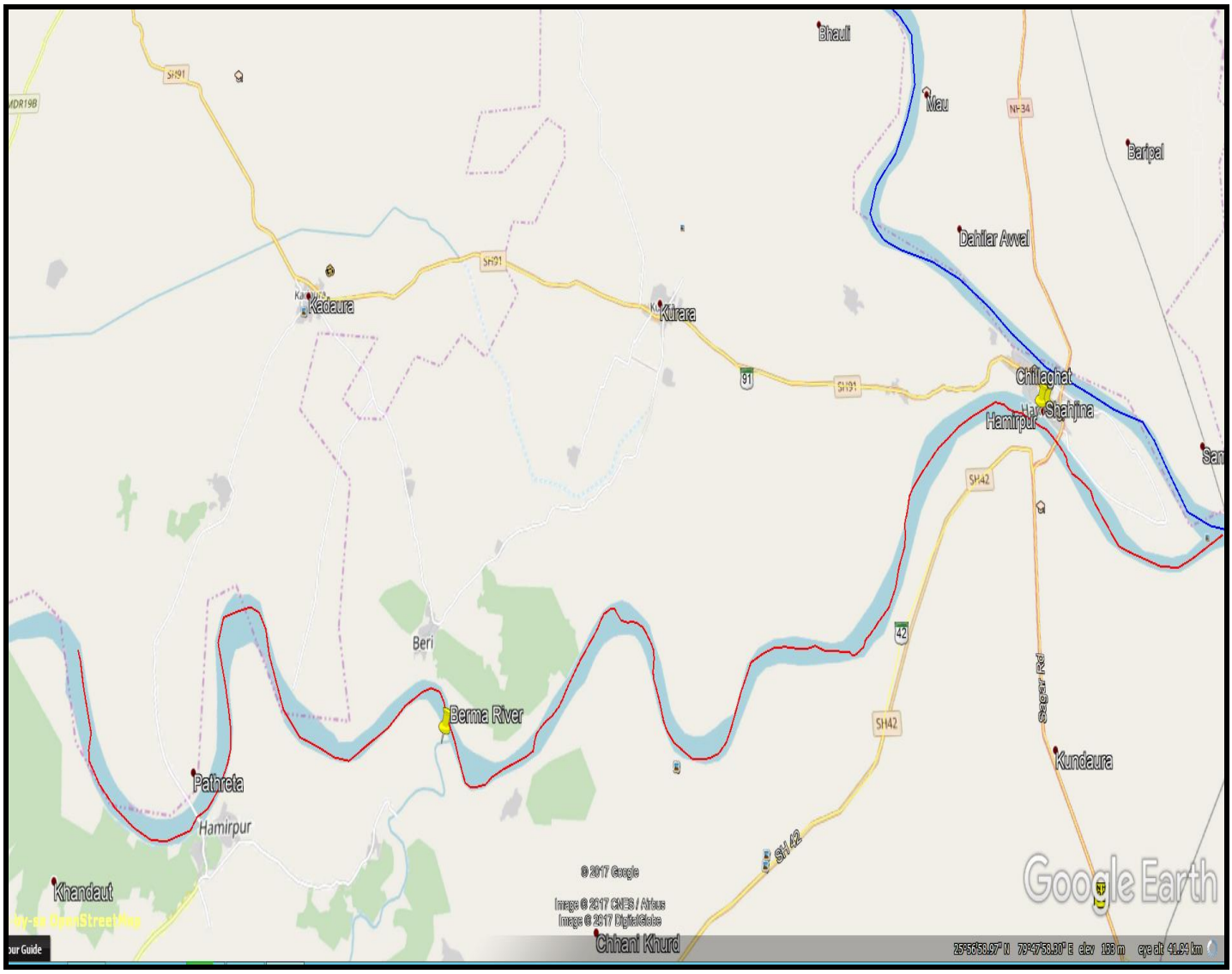


Figure 01- Full course of the waterway

1.5 Scope of work

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



Section-2: Methodology Adopted to undertake Study

2.1 Methodology Adopted in brief including Resources and Equipment used and calibration

The Hydrographic survey of Betwa River from HAMIRPUR TO RIRWA BUZURG DARIYA commenced on 06th September 2016 and completed on 15th November 2016. The area intended to be surveyed has been sounded completely, for the depths available for movement of inflatable boat, as per the required specifications. The shallow patches observed in the river stretch and area above the water levels were surveyed by the Trimble R3 system. The bathymetric survey was carried out using a small Rafting boat. The sounding of the River was carried out at a line spacing of 150 meter.

There were no interruptions during the survey period. The survey was carried out on WGS 84 Datum. The projection used was Transverse Mercator and the grid used was Universe Transverse Mercator Grid (Zone 44). Differential signal corrections for the DGPS system were automatically obtained by establishing high precision DGPS.

HYPACK Ver. 6.2b Hydrographic Survey Software developed by Coastal Oceanography INC., USA was used for the data logging during the survey and for data processing thereafter.

The data logging during the survey was achieved by interfacing both the echo sounder and DGPS Receiver to the HYPACK software on a laptop/PC carried on board the sounding boat. The entire system was supported by battery power and backed by an onboard small Honda generator. The position and depth data were logged in continuously during the survey, once every 500 millisecond. All digitally logged data were automatically stored in the assigned files. No significant difficulties were experienced in the operation of the digital surveying system during the survey.

- The detailed Hydrographic Survey of the River Betwa from HAMIRPUR TO RIRWA BUZURG DARIYA.
- Tide reading taken from tide poles established near BM BR- 01 and up to BM BR- 08 which are at the 10 km of interval.
- Measurement of currents of Water at interval of 10km.
- Collection and analysis of the Water and bottom samples at every 10 km interval along the river stretch.
- To carry out tidal observation during the entire survey period.

2.2 Description of Bench Marks (B.M.) / authentic Reference Level used, with photographs.

The transfer of Bench Marks was carried out from Hamirpur to Rirwa Buzurg Dariya

The Bench Marks of the survey area for Hydrographic survey is based on the datum level erected on gauge of Betwa River. The Bench mark of CWC (R46) was recovered at Yamuna River Bank at Hamirpur and was used to transfer of datum (MSL) to the BMs. The BM position for BR 08 near the confluence of Yamuna and Betwa River thus derived is:

Latitude:	**25° 55' 08.7892"N**
Longitude:	**080° 12' 33.5304" E**
RL Hgt:	**96.388m**

TBM was connected from (R-46) CWC Bench Mark at Yamuna River Bank Hamirpur.

Latitude:	**25° 57' 32.9327"N**
Longitude:	**080° 09' 11.6881"E**
RL Hgt:	**109.153m**

BM BR-8

CWC BM AT HAMIRPUR

2.3 Tidal Influence Zone and tidal variation in different stretches

Sounding Datum/Reduction factor

For establishing sounding datum, average of last six years minimum water level has been taken at two known station namely Yamuna Confluence at Hamirpur, Shahjina and also at Mohana. Sounding Datum at new established gauges namely TP-01 to TP-08 was thus derived by interpolation method.

Soundings were reduced to sounding datum after reductions applied in observed soundings

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

To start a project for civil or marine a Bench Mark is the main factor for that survey area. To transfer the sounding datum a known Bench Mark is required. The Bench Mark should be established by a government organization which is going to be used for transfer of sounding Datum. GTS Bench Mark is being considered good Bench Mark for any project.

Numbers of Sounding Datum is to be decided depends upon the area to be surveyed. Distance between two successive Bench Marks should be approx. 10 Km. Bench Mark can be transferred by Auto Level, Total Station or RTK. It depends upon the area.
Transfer of BM
RL of Know B M+ back sight=Ht of the Instrument
Ht of the Instrument- Fore sight= RL of new B M

In tidal area near to sea shore, where the tide is affected required to fix the tide pole in between 10 km of survey Area. With auto Level using height of collimation method, from Bench Mark to Tide pole leveling to be carried out and calculate the zero of the tide pole value. With the help of nearest BM, find out the level of water at particular time and place. Tide reading tide pole to be recorded at fix interval of time.

2.5 Yearly minimum and maximum Water Levels. Average of 06 years minimum Water Levels used to arrive at Chart Datum (CD) / Sounding Datum (SD).

Sounding Datum at Yamuna Confluence, Shahjina and Mohana was provided by IWAI.

2.6 Transfer of Sounding Datum table for Tidal rivers/canals

Betwa River is a non-tidal river.

2.7 Table indicating tidal variation at different observation points

Non-tidal river

2.8 Salient features of Dam, Barrages, Weirs, Anicut, Locks, and Aqueducts etc.

No dam, Barrages, weirs, Anicut, Locks, and Aqueducts found in whole stretch.

2.9 Description of erected Bench mark Pillars:-

Bench Mark No. & Location	Chainage	Latitude	Longitude	Easting (m)	Northing (m)	BM Height above MSL (m)	BM Height above SD (m)
Rirwa (BR 01)	67.146	25° 54'19.2672"	079° 45' 11.7080"	375122.441	2865795.879	108.097	8.222
Pathreta Mauja (BR 02)	58.292	25° 52'40.5781"	079° 48' 26.8210"	380523.962	2862709.130	108.661	10.389
Beri (BR 03)	45.167	25° 53'25.4709"	079° 52' 30.5612"	387317.011	2864035.189	103.236	7.344
Para (BR 04)	34.195	25° 54'19.6310"	079° 57' 33.3296"	395758.193	2865627.081	95.853	1.954
Patara (BR 05)	25.890	25° 53'18.4401"	080° 00' 54.4114"	401339.010	2863701.359	98.778	7.378
Shahjina (BR 06)	14.890	25° 56'04.6602"	080° 05' 59.8126"	409872.789	2868753.930	100.312	9.091
Rameni Kadera (BR 07)	4.472	25° 55'19.7904"	080° 10' 49.9927"	417936.002	2867320.587	98.349	9.811
Hamirpur (BR 08)	1.208	25°55' 08.7892"	080° 12' 33.5304"	420814.314	2866964.456	96.388	8.358
Hamirpur (BR RBM)	9.582	25°57' 32.9327"	080° 09' 11.6881"	415227.704	2871433.960	109.153	10.804

2.10 Description of erected Tide Gauges.

Tide Gauge No. & Location	Chainage	Latitude	Longitude	Easting (m)	Northing (m)	Zero of Tide Gauge w.r.t. MSL (m)	Period of Observation
Rirwa TP-01	66.337	25° 54'15.9694"	079° 45' 09.0193"	375046.660	2865695.130	99.478	01 Days
Pathreta Mauja TP-02	57.499	25° 52'30.1742"	079° 48' 37.2214"	380810.520	2862386.420	97.383	02 Days
Beri TP-03	44.379	25° 53'15.0913"	079° 52' 34.3244"	387421.460	2863710.160	94.9625	01 Days
Para TP-04	33.392	25° 54'15.7773"	079° 57' 34.9297"	395801.770	2865508.170	93.595	01 Days
Patara TP-05	25.129	25° 53'18.0482"	080° 00' 56.8205"	401405.960	2863688.800	92.571	02 Days
Sahjana TP-06	14.168	25° 56'10.2713"	080° 05' 52.8180"	409679.410	2868927.890	91.932	02 Days
Rameni Kadera TP-07	3.767	25° 55'10.1637"	080° 10' 45.7171"	417815.200	2867025.180	91.551	02 Days
Hamirpur TP-08	0.419	25° 55'06.8343"	080° 12' 35.7929"	420876.890	2866903.940	91.339	02 Days

2.11 Chart Datum / Sounding Datum and Reductions details:-

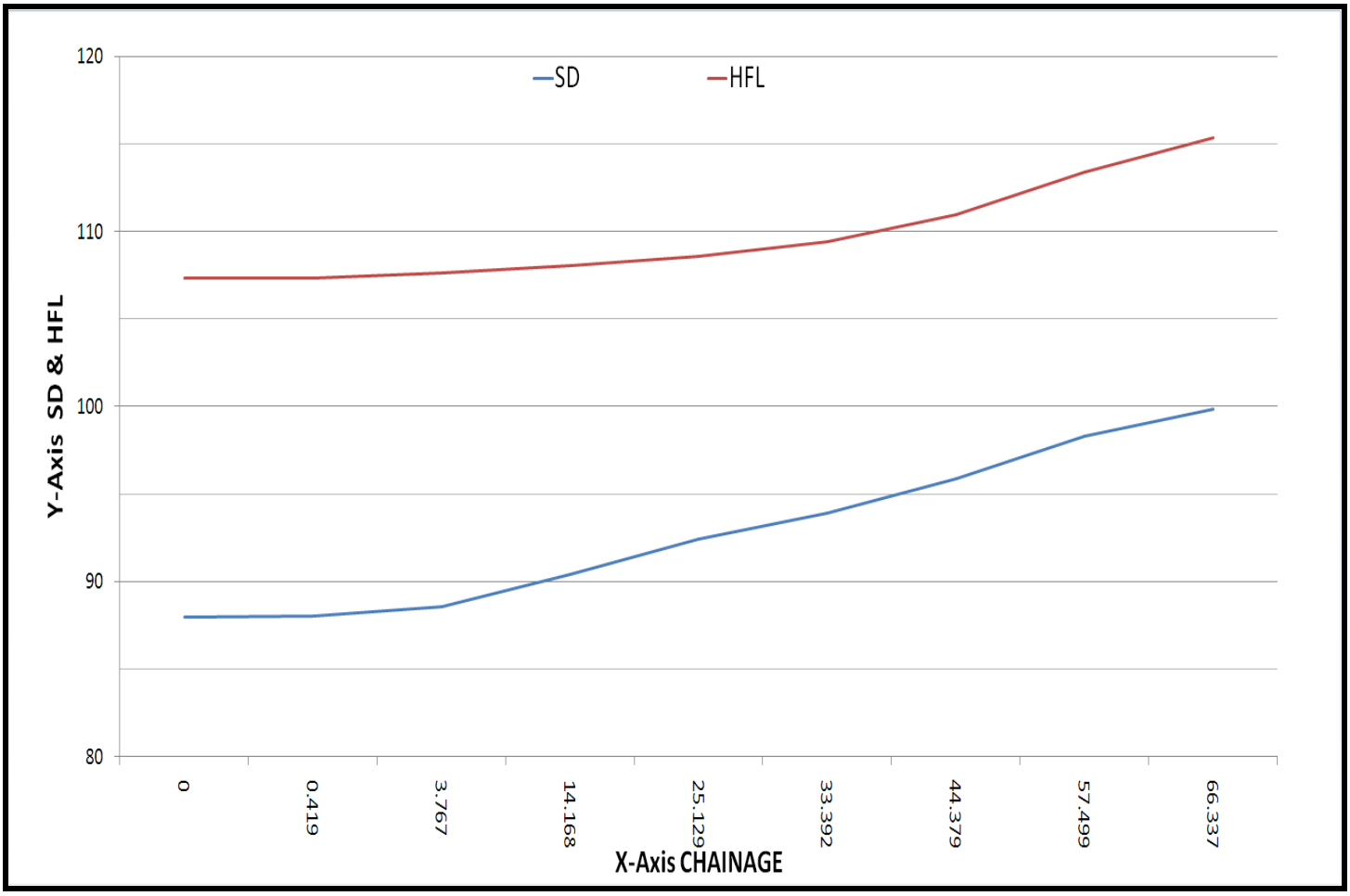
Sl. No	Location of CWC gauge / Dam / Barrage / Weir / Anicut / Bench Mark / tide gauges	Chainage (km)	Stretch for corrected soundings and topo levels (km)	Established Sounding Datum w.r.t. MSL (m) at col. A.	Sounding Datum of Tide Gauge wrt MSL (m)	Correction in WL data for Bathymetric survey (m)	Topo level data to be converted as depth for volume calculation wrt SD (m)
	A	B	C (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)
1	CWC Mohana	126.004	----	110.7	110.7	Nil	Nil
2	TP-1	66.337	62.5 to 67.05	99.875	99.875	DATA Provided in Annexure.	Data provided in soft copy.
3	TP-2	57.499	51.00 to 62.5	98.272	98.272		
4	TP-3	44.379	39.5 to 51.00	95.892	95.892		
5	TP-4	33.392	30.00 to 39.5	93.899	93.899		
6	TP-5	25.129	20.50 to 30.00	92.400	92.400		
7	TP-6	14.168	10.00 to 20.50	90.411	90.411		
8	CWC Shahjina	7.355	----	89.175	89.175		
9	TP-07	3.767	2.50 to 10.00	88.583	88.583		
10	TP-08	0.419	0.00 to 2.50	88.030	88.030		
11	CWC Yamuna Conf.	0.000	----	87.961	87.961		

2.12 High Flood Level (H.F.L.) at known gauge stations and cross-structures.

.Sl. No	Location and description of CWC gauge / Dam / Barrage / Weir / 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)
	A	B	C	D	E
1	Yamuna confluence		0		107.336
2	BM - 8		0.419		107.336
3	BM - 7		3.767		107.648
4	Hamirpur	High Tension Line	7.530		107.838
5	Hamirpur	Hamirpur Bridge	8.245	107.866	107.866
6	BM - 6		14.168		108.029
7	BM - 5		25.129		108.568
8	BM - 4		33.392		109.392
9	BM - 3		44.379		110.959
10	BM - 2		57.499		113.380
11	Jalalpur	Jalalpur Bridge	59.282		113.380

2.13 Graph: Sounding Datum and HFL vs Chainage

CH (km)	SD (m)	HFL (m)
0	87.961	107.336
0.419	88.030	107.336
3.767	88.583	107.648
14.168	90.411	108.029
25.129	92.400	108.568
33.392	93.899	109.392
44.379	95.892	110.959
57.499	98.272	113.380
66.337	99.875	115.364



2.14 Average Bed Slope

Reach		River / Canal Bed Level RL (m)	Length (km)	Slope
From	To			
Samuhi	Gimuha Danda	88.310-90.326	0-15	1:0.016
Gimuha Danda	Mamerejpur Daria	90.326-93.565	15-30	1:0.330
Mamerejpur Daria	Kupara	93.565-96.225	30-45	1:0.270
Kupara	Jalalpur	96.225-98.067	45-60	1:0.100
Jalalpur	Rirwa Buzurg Dariya	98.067-99.934	60-67.05	1:0.160

2.15 Details of Dam, Barrages, Weirs, Anicut, etc. w.r.t. MSL:-

No Dam, Barrages, Weirs & Anicut were found in whole stretch.

2.16 Details of Locks.

No Locks found in whole stretch.

2.17 Details of Aqueducts: -

No Aqueducts found in whole stretch.

2.18 Details of existing Bridges and Crossings over waterway: -

Sl No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)		Position (UTM) (m)		Length (m)	Width (m)	No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank	Right Bank	Left Bank	Right Bank						
01	Jalalpur	59.282	RCC	Jalalpur	25°52'15.2586" 079°48'04.479"	25°51'57.1656" 079°48'22.3676"	379895.030 2861935.820	380387.870 2861374.640	559.57	7.5	21	27.5	1.5	Completed & in use
02	Hamirpur	8.245	RCC	Hamirpur	25°56'41.0472" 080°09'20.5493"	25°56'26.2791" 080°09'03.2971"	415463.8425 2869836.1620	414981.0437 2869384.9390	690.00	7.5	15	44	1.56	Completed & in use

2.19 Details of other Cross structure, pipe-lines, and underwater cables.

No other Cross structure, pipe-lines, underwater cables.

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

Sl No	Type of line	Chainage (km)	Location	Position (Lat Long)		Position (UTM) (m)		Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL (m) For non tidal river	Remarks (complete / under - construction)
				Left Bank	Right Bank	Left Bank	Right Bank			
01	HT	7.530	Hamirpur	25° 56' 30.9049" 080° 09' 36.1900"	25° 55' 57.9482" 080° 09' 35.3106"	415895.4849 2869521.3571	415865.9126 2868507.6265	1014	4	Complete

2.21 Current Meter and Discharge details

Stretch No.	Chainage (km)	Position				Observed Depth (m) (D)	Velocity (m/sec.)	Average Velocity (m/sec.)	X-Sectional area (sq. m.)	Discharge (Cu.m/sec.)
		Latitude	Longitude	Easting (m)	Northing (m)		0.5 D			
5	67.075	25°54'14.8579"	079° 45'06.4316"	374974.330	2865661.620	2.2	0.302	0.231	467.647	108.026
4	58.227	25° 52'26.9090"	079° 48'44.5786"	381014.380	2862284.110	1.4	0.253	0.171	333.952	57.105
3	45.000	25° 53'15.8086"	079° 52'39.8572"	387575.620	2863730.910	1.7	0.117	0.096	373.511	35.857
3	34.223	25° 54'11.4357"	079° 57'36.0215"	395831.090	2865374.360	1.5	0.374	0.225	309.833	69.712
2	25.853	25° 53'17.1215"	080° 00'59.8916"	401491.210	2863659.650	3.7	0.258	0.189	867.228	163.906
1	14.950	25° 56'12.3973"	080° 05'49.9718"	409600.690	2868993.840	6.5	0.202	0.096	1946.642	186.877
1	4.510	25° 55'07.6234"	080° 10'43.9457"	417765.430	2866947.340	3.6	0.342	0.271	1251.486	339.152
1	1.150	25° 55'04.3016"	080° 12'37.7281"	420930.260	2866825.700	3.9	0.283	0.114	1294.788	147.605

2.22 (a) Soil Sample Locations

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Depth (m)
BR01	67.075	25°54'14.8579"	079° 45'06.4316"	374974.330	2865661.620	2.2
BR02	58.227	25° 52'26.9090"	079° 48'44.5786"	381014.380	2862284.110	1.4
BR 03	45.000	25° 53'15.8086"	079° 52'39.8572"	387575.620	2863730.910	1.7
BR 04	34.223	25° 54'11.4357"	079° 57'36.0215"	395831.090	2865374.360	1.5
BR 05	25.853	25° 53'17.1215"	080° 00'59.8916"	401491.210	2863659.650	3.7
BR 06	14.950	25° 56'12.3973"	080° 05'49.9718"	409600.690	2868993.840	6.5
BR 07	4.510	25° 55'07.6234"	080° 10'43.9457"	417765.430	2866947.340	3.6
BR 08	1.150	25° 55'04.3016"	080° 12'37.7281"	420930.260	2866825.700	3.9

(b) Water Sample Locations

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
BR 01	67.075	25°54'14.8579"	079° 45'06.4316"	374974.330	2865661.620	2.2	1.1
BR 02	58.227	25° 52'26.9090"	079° 48'44.5786"	381014.380	2862284.110	1.4	0.70
BR 03	45.000	25° 53'15.8086"	079° 52'39.8572"	387575.620	2863730.910	1.7	0.85
BR 04	34.223	25° 54'11.4357"	079° 57'36.0215"	395831.090	2865374.360	1.5	0.75
BR 05	25.853	25° 53'17.1215"	080° 00'59.8916"	401491.210	2863659.650	3.7	1.85
BR 06	14.950	25° 56'12.3973"	080° 05'49.9718"	409600.690	2868993.840	6.5	3.25
BR 07	4.510	25° 55'07.6234"	080° 10'43.9457"	417765.430	2866947.340	3.6	1.80
BR 08	1.150	25° 55'04.3016"	080° 12'37.7281"	420930.260	2866825.700	3.9	1.95

Section-3: Description of waterway

3.1 Stretch – 01 Samuhi to Gimuha Danda (Chainage 0.0 km - 15.0 km)

Google map showing chainage 0-5 km

Google map showing chainage 5-10 km

Google map showing chainage 10-15 km

Stretch	Stretch with less than < 1.2m depth	Stretch with depths between 1.2 to 1.4m(km)	Stretch with depths between 1.5 to 1.7m	Stretch with depths between 1.8m to 2m depth	Stretch with more than 2m depth
Samuhi to Gimuha Danda	6.950 km	1.080km	0.940 km	1.140 km	4.890km

Betwa River Stretch from Yamuna confluence towards upper Side Near the village Bada Gaon. Width of this stretch varies from 275.4mtr to 538.78mtr .Min and maximum depth varies from 2.9mtr to 6.6 mtr. A narrow Damar Road is approaching then Kachha Rasta is going and finished around 500 away from River. Agricultural land found from chainage 1.60Km to 5.8Km and 11.4Km to 25.000Km on both the bank. During Rainy season whole is flooded and covers a large area. Irrigation Dept is planning to make a bund on North Bank of River to save the villages & people from flood. So many times the Rescue team has been called for rescuing people from flood.

A temple is found at chainage 2.800km. From chainage 2.600Km to 3.600 maximum areas is dry. A village Rameni ka Dera is in NE Bank of River at chainnage-6.000 Km. A parallel road is going up to Hamirpur. A Temple is found at chainage 4.200 Km. BM BR 07 is established near the chainage 4.6km. Pump House is at Chainage 7.700Km and is further connected to irrigation canal on east bank of river. High tension line is crossing the river at chainage7.530 Km with horizontal and vertical clearance 1014mtrs and 04mtrs. A bridge is found at Hamirpur on Betwa River at chainage 8.245 Km connecting Mahoba to Kanpur. Two

Nalas are at Chainage 8.550Km and Chainage 9.550Km on east bank of river coming from Hamirpur city. Sand Mining also observed between chainage 5.200km to 6.200 Km. From main road, SH-42 road is running parallel on west bank of river. This road is normally used for transportation of sand from mining. Due to Heavy loaded vehicles this road is always found Damaged. BM Pillar 06 is established at chainage 14.9 KM near Sahjana Village. Due to mining in bulk quantity this area is known as Sahjana khadan. Kachha road is there.

Both the banks are unprotected except from chainage from 8.300Km to 8.800Km. This area is protected by making bund for safety of Hamirpur city. No obstruction found during the survey. Water quality is not good. Current is very less.

Betwa River from Samuhi to Sidra Daria (Chainage 0 km – 5 km)

Minimum & Maximum Depths in this stretch are -2.9m to 6.6m. Minimum & Maximum width of this stretch is 304.0mtr to 622.0mtr.Average current is 0.192m/sec. Average discharge is 243.378cu.m/sec.

Betwa River from Sidra Daria to Hamirpur (Chainage 5 km - 10 km)

Minimum & Maximum Depths in this stretch are -2.7m to 4.2m. Minimum & Maximum width of this stretch is 274.0 to 607mtr. Average current is 0.183m/sec. Average discharge is 236.014cu.m/sec

Betwa River from Hamirpur to Gimuha Danda (Chainage 10 km - 15 km)

Minimum & Maximum Depths in this stretch are -0.9m to 6.2m. Minimum & Maximum width of this stretch is 275.0m to 453.0mtr. Average current is 0.139m/sec. Average discharge is 211.508cu.m/sec

Betwa River from Samuhi to Gimuha Danda (Chainage 0.0 km - 15.0 km)

	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
Class	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	0	15	1.2	7.5	0	0.00	-0.2	5.3	10200	2,59,104.57
II	0	15	1.2	7.5	600	349.35	-0.2	5.3	11000	4,16,147.03
III	0	15	1.1	7.5	900	5,696.40	-0.3	5.3	12000	6,83,980.33
IV	0	15	1.0	7.5	1000	15,646.89	-0.3	5.3	12600	9,74,864.06

Figure No. - 06 High Tension Power Transmission Ch-7.530 km

Chainage (km)	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL (m) For non tidal river
7.530	1014	4.00

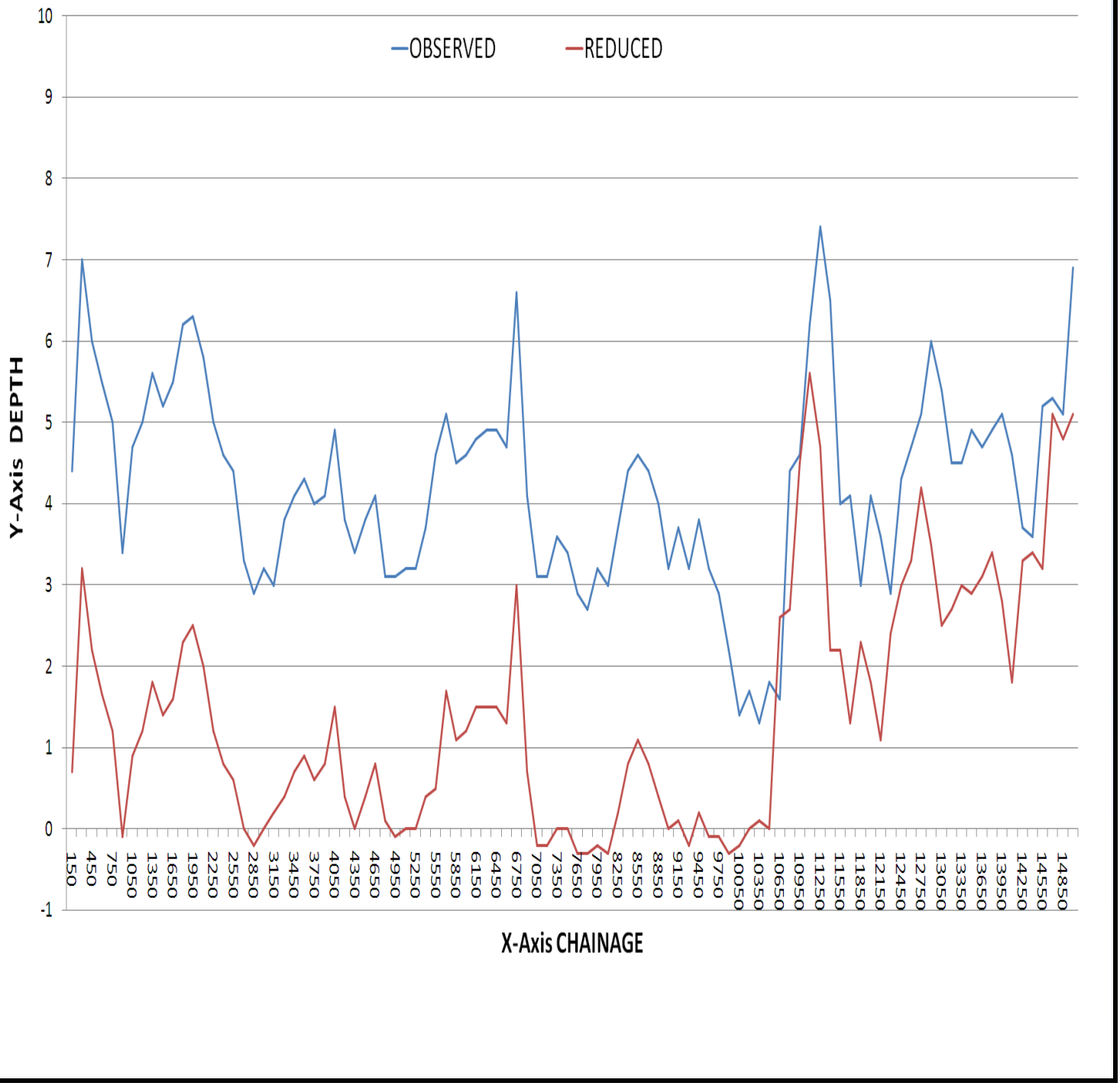
Figure No. - 07 Hamirpur Betwa Bridge CH 8.245 km

ength (m)	Width (m)	Height w.r.t. -(MSL) (m)	Present condition	H Clearance (m)	V Clearance(HFL) (m)
690.00	7.5	112.510	Good	27.5	1.5

Observed and reduced Bed Profile of the stretch-01 CH 00 km to Ch 15 km

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
150	4.4	0.7	7650	2.9	-0.3
300	7	3.2	7800	2.7	-0.3
450	6	2.2	7950	3.2	-0.2
600	5.5	1.66	8100	3	-0.3
750	5	1.2	8250	3.7	0.2
900	3.4	-0.1	8400	4.4	0.8
1050	4.7	0.9	8550	4.6	1.1
1200	5	1.2	8700	4.4	0.8
1350	5.6	1.8	8850	4	0.4
1500	5.2	1.4	9000	3.2	0
1650	5.5	1.6	9150	3.7	0.1
1800	6.2	2.3	9300	3.2	-0.2
1950	6.3	2.5	9450	3.8	0.2
2100	5.8	2	9600	3.2	-0.1

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
2250	5	1.2	9750	2.9	-0.1
2400	4.6	0.8	9900	2.2	-0.3
2550	4.4	0.6	10050	1.4	-0.2
2700	3.3	0	10200	1.7	0
2850	2.9	-0.2	10350	1.3	0.1
3000	3.2	0	10500	1.8	0
3150	3	0.2	10650	1.6	2.6
3300	3.8	0.4	10800	4.4	2.7
3450	4.1	0.7	10950	4.6	4.5
3600	4.3	0.9	11100	6.2	5.6
3750	4	0.6	11250	7.4	4.7
3900	4.1	0.8	11400	6.5	2.2
4050	4.9	1.5	11550	4	2.2
4200	3.8	0.4	11700	4.1	1.3
4350	3.4	0	11850	3	2.3
4500	3.8	0.4	12000	4.1	1.8
4650	4.1	0.8	12150	3.6	1.1
4800	3.1	0.1	12300	2.9	2.4
4950	3.1	-0.1	12450	4.3	3
5100	3.2	0	12600	4.7	3.3
5250	3.2	0	12750	5.1	4.2
5400	3.7	0.4	12900	6	3.5
5550	4.6	0.5	13050	5.4	2.5
5700	5.1	1.7	13200	4.5	2.7
5850	4.5	1.1	13350	4.5	3
6000	4.6	1.2	13500	4.9	2.9
6150	4.8	1.5	13650	4.7	3.1
6300	4.9	1.5	13800	4.9	3.4
6450	4.9	1.5	13950	5.1	2.8
6600	4.7	1.3	14100	4.6	1.8
6750	6.6	3	14250	3.7	3.3
6900	4.1	0.7	14400	3.6	3.4
7050	3.1	-0.2	14550	5.2	3.2
7200	3.1	-0.2	14700	5.3	5.1
7350	3.6	0	14850	5.1	4.8
7500	3.4	0	15000	6.9	5.1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REDUCED
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X-Axis CHAINAGE
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1950
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13350
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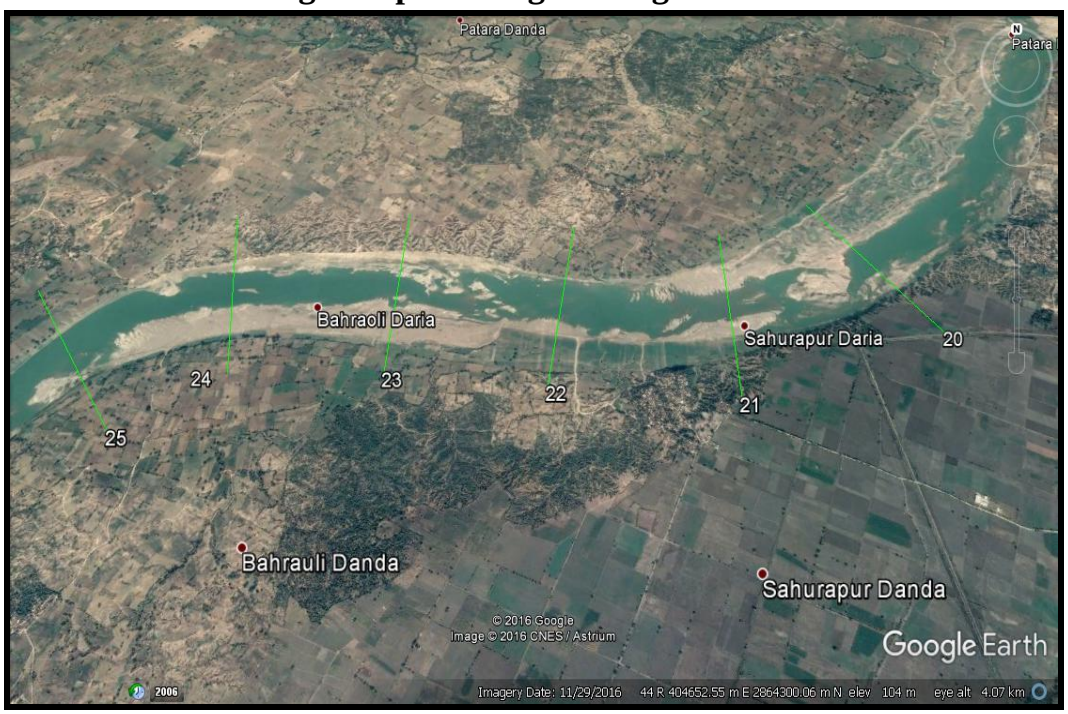
14250
14550
14850

3.2 Stretch – 02 Gimuha Danda to Mamerejpur Daria (Chainage 15 km - 30 km)

Google map showing chainage 15-20 km



Google map showing chainage 20-25 km

Google map showing chainage 25-30 km

Stretch	Stretch with less than < 1.2m depth	Stretch with depths between 1.2 to 1.4m(km)	Stretch with depths between 1.5 to 1.7m	Stretch with depths between 1.8m to 2m depth	Stretch with more than 2m depth
Gimuha Danda to Mamerejpur Daria	1.680 km	0.710 km	0.990 km	0.820 km	10.800 km

Minimum & maximum width of this stretch varies from 271.0mtrs to 512.9mtrs. Minimum & maximum depth found during the servey-1.2mtrs and 8.0mtrs. A temple is present on west bank of River at chainage 15.8km. A Pump House is at Chainage 24.9Km and is connected to irrigation canal on east bank of river. Water quality is good. Current is very less as water is stopped in Rajghat Reservoir in MP. Water level is increasing when water is released to maintain the water level. Fishing activities are found in some places in the stretch. BM pillar BR 05 is established at chainage 25.9km. This is Patara khadan area. After water reaches minimum level else after January khadaan starts day and night unofficially. Khadan area stretches from 26.00 KM to 30.00 KM. Agricultural land found on north Bank of River, at chainage from 25.00 Km to 30.00 Km. BM BR 03 is established at chainage 45.00km on North bank of river. Both the Banks are

unprotected. Current is very less. Water quality is good as there is no factory or any dirty water incoming to river. Fishing activities are found where ever water is available. No obstruction found during the survey. Possibilities are very less for waterway as water is available in rainy season only.

Betwa River from Gimuha Danda to Patara Danda (Chainage 15 km - 20 km)

Minimum & Maximum Depths in this stretch are -1.3m to 5.8m. Minimum & Maximum width of this stretch is 363.0 to 458.0m. Average current is 0.119m/sec. Average discharge is 181.134cu.m/sec

Betwa River from Patara Danda to Bahrauli Danda (Chainage 20 km - 25 km)

Minimum & Maximum Depths in this stretch are -1.3m to 8.0m. Minimum & Maximum width of this stretch is 265.0mtr to 577.0mtr. Average current is 0.165m/sec. Average discharge is 169.675cu.m/sec

Betwa River from Bahrauli Danda to Mamerejpur Daria (Chainage 25 km - 30 km)

Minimum & Maximum Depths in this stretch are -0.6m to 6.0m. Minimum & Maximum width of this stretch is 265.0mtr to 566.0mtr. Average current is 0.198m/sec. Average discharge is 140.357cu.m/sec

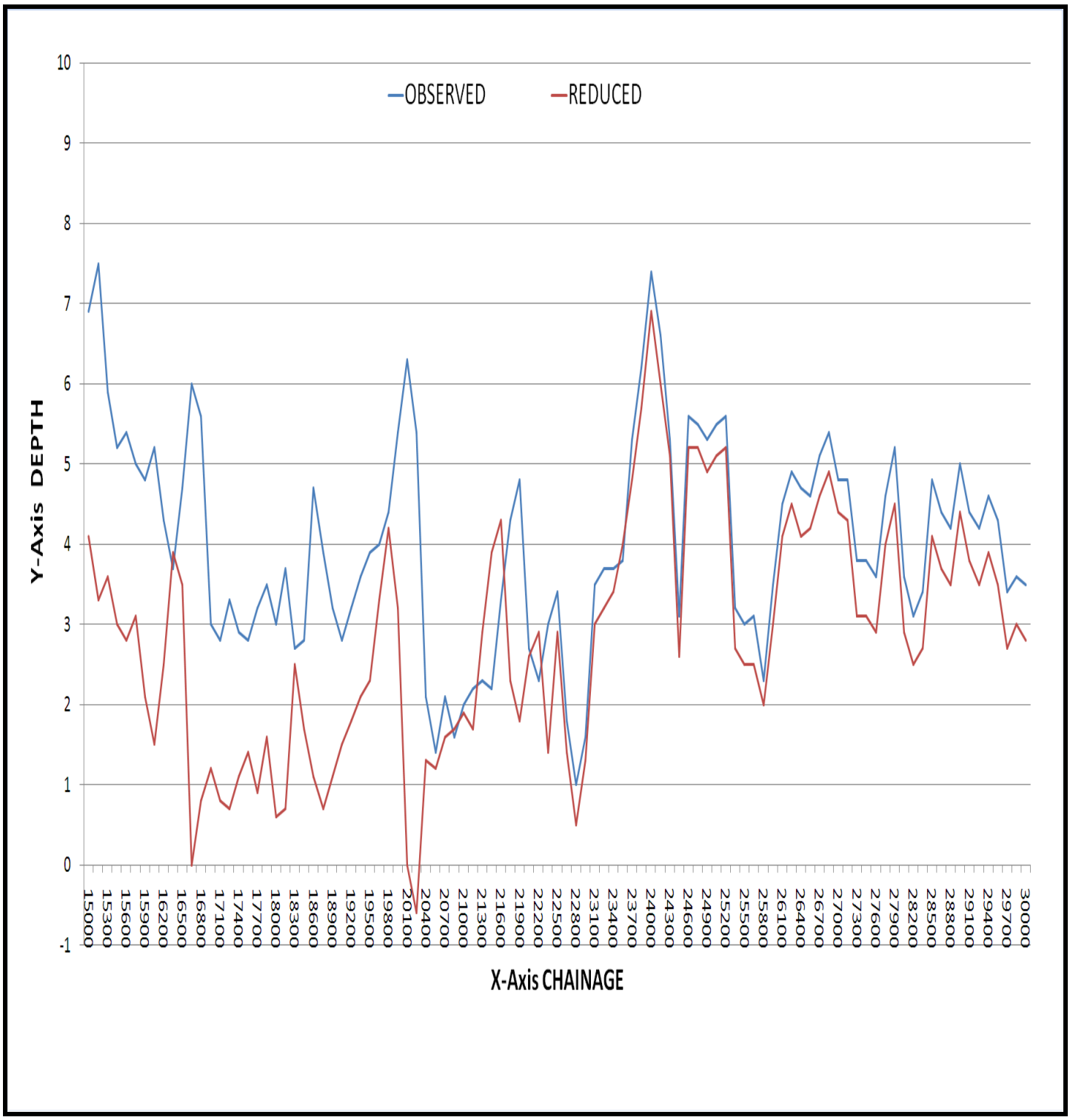
Betwa River from Gimuha Danda to Mamerejpur Daria (Chainage 15 km - 30 km)

	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
Class	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	15	30	0.9	8	300	498.40	-0.3	7.5	3550	35,121.94
II	15	30	0.9	8	450	1,557.45	-0.3	7.5	4150	67,171.97
III	15	30	0.8	8	1500	5,557.6	-0.3	7.5	5850	1,36,614.5
IV	15	30	0.8	8	1800	17,790.82	-0.3	7.5	6000	2,12,600.14

Observed and reduced Bed Profile of the stretch-02 CH 15 to CH 30 km

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
15000	6.9	4.1	22650	1.8	1.4
15150	7.5	3.3	22800	1	0.5
15300	5.9	3.6	22950	1.6	1.3
15450	5.2	3	23100	3.5	3
15600	5.4	2.8	23250	3.7	3.2
15750	5	3.1	23400	3.7	3.4
15900	4.8	2.1	23550	3.8	4
16050	5.2	1.5	23700	5.3	4.8

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
16200	4.3	2.5	23850	6.2	5.7
16350	3.7	3.9	24000	7.4	6.9
16500	4.7	3.5	24150	6.6	6
16650	6	0	24300	5.3	5.1
16800	5.6	0.8	24450	3.1	2.6
16950	3	1.2	24600	5.6	5.2
17100	2.8	0.8	24750	5.5	5.2
17250	3.3	0.7	24900	5.3	4.9
17400	2.9	1.1	25050	5.5	5.1
17550	2.8	1.4	25200	5.6	5.2
17700	3.2	0.9	25350	3.2	2.7
17850	3.5	1.6	25500	3	2.5
18000	3	0.6	25650	3.1	2.5
18150	3.7	0.7	25800	2.3	2
18300	2.7	2.5	25950	3.5	3
18450	2.8	1.7	26100	4.5	4.1
18600	4.7	1.1	26250	4.9	4.5
18750	3.9	0.7	26400	4.7	4.1
18900	3.2	1.1	26550	4.6	4.2
19050	2.8	1.5	26700	5.1	4.6
19200	3.2	1.8	26850	5.4	4.9
19350	3.6	2.1	27000	4.8	4.4
19500	3.9	2.3	27150	4.8	4.3
19650	4	3.3	27300	3.8	3.1
19800	4.4	4.2	27450	3.8	3.1
19950	5.4	3.2	27600	3.6	2.9
20100	6.3	0	27750	4.6	4
20250	5.4	-0.6	27900	5.2	4.5
20400	2.1	1.3	28050	3.6	2.9
20550	1.4	1.2	28200	3.1	2.5
20700	2.1	1.6	28350	3.4	2.7
20850	1.6	1.7	28500	4.8	4.1
21000	2	1.9	28650	4.4	3.7
21150	2.2	1.7	28800	4.2	3.5
21300	2.3	2.9	28950	5	4.4
21450	2.2	3.9	29100	4.4	3.8
21600	3.3	4.3	29250	4.2	3.5
21750	4.3	2.3	29400	4.6	3.9
21900	4.8	1.8	29550	4.3	3.5
22050	2.7	2.6	29700	3.4	2.7
22200	2.3	2.9	29850	3.6	3
22350	3	1.4	30000	3.5	2.8
22500	3.4	2.9			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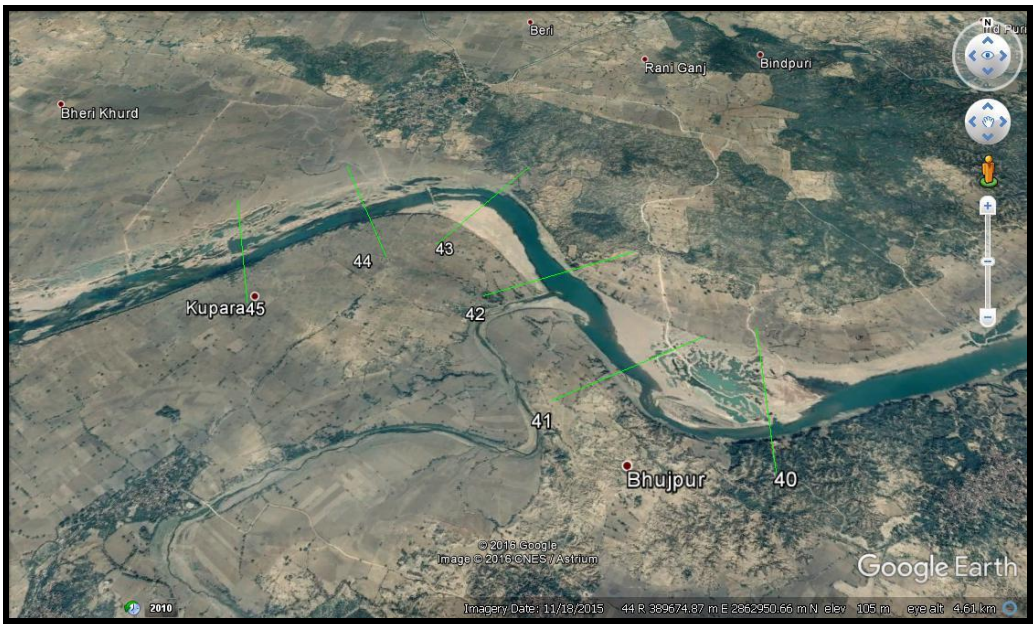
3.3 Stretch – 03 Mamerejpur Daria to Kupara (Chainage 30 km - 45 km)

Google map showing chainage 35-40 km



Google map showing chainage 40-45 km

Stretch	Stretch with less than < 1.2m depth	Stretch with depths between 1.2 to 1.4m(km)	Stretch with depths between 1.5 to 1.7m	Stretch with depths between 1.8m to 2m depth	Stretch with more than 2m depth
Mamerejpur Daria to Kupara	2.280 km	3.150 km	0.000 km	1.570 km	8.000 km

Minimum and Maximum width of this stretch varies from 155.3mtr and 527.0mtr. Minimum & maximum depths are 0.7mtr & 8.9mtr. In this stretch sufficient water is available. A temple is found on West Bank of river at chainage 31.7km. BM Pillar BR- 04 established at chainage 34.20km. Both the sides of Banks are having steep cut. Agricultural land found from chainage 32.6 Km to 34.6 Km and 32.600Km to 34.600 forest areas, 35.800 Km to 37.800 Agricultural lands and 38.800 Km to 39.200 Km Forest areas found on South Bank of river. Area around BM Pillar is also being used for mining. They make temporary kachha road for transportation of red sand. Due to mining, day by day condition of river is becoming worst. Water level is going down. Erosion of bank is also continuing in rainy season. A temple is found at chainage 36.4km on SE Bank and at 40.7km on NE Bank. A Berma River is connecting at chainage 41.7.km. It starts from Swami Brahmanand Sagar Dam. No Road connectivity found to River. Water quality is good as there is no any polluted water is discharged in the river in this stretch. Fishing activities are found in some places. Current observed is very less due to water is stopped in MP. No obstruction found during the survey.

Betwa River from Mamerejpur Daria to Bajehta Dariya (Chainage 30 km - 35 km)

Minimum & Maximum Depths in this stretch are 0.8m to 2.9m. Minimum & Maximum width of this stretch is 159.0mtr to 441.0mtr. Average current is 0.216m/sec. Average discharge is 93.260cu.m/sec

Betwa River from Bajehta Dariya to Bhujpur (Chainage 35 km - 40 km)

Minimum & Maximum Depths in this stretch are 0.7m to 8.3m. Minimum & Maximum width of this stretch is 176.0mtr to 527.0mtr. Average current is 0.193m/sec. Average discharge is 61.248cu.m/sec

Betwa River from Bhujpur to Kupara (Chainage 40 km - 45 km)

Minimum & Maximum Depths in this stretch are 1.2m to 8.9m. Minimum & Maximum width of this stretch is 174.0mtr to 418.0mtr. Average current is 0.128m/sec. Average discharge is 44.323cu.m/sec

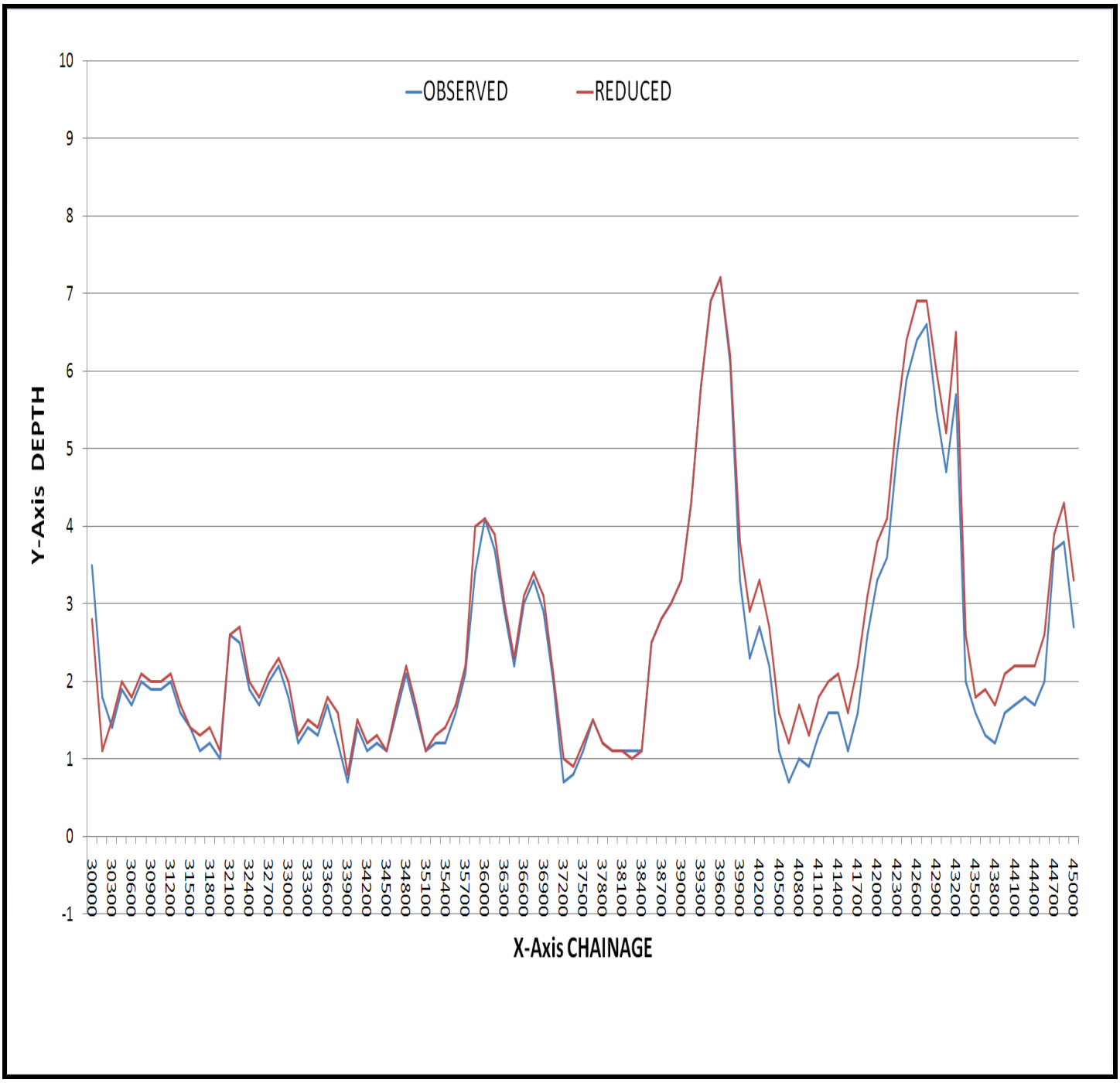
Betwa River from Mamerejpur Daria to Kupara (Chainage 30 km - 45 km)

	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
Class	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	30	45	0.7	8	5800	17,368.8	0.6	4.3	2850	5,478.76
II	30	45	0.7	8	7600	55,986.96	0.6	4.3	5350	25,077.12
III	30	45	0.6	8	10150	1,62,511.3	0.4	4.3	8500	96,526.48
IV	30	45	0.5	8	11600	2,93,006.78	0.3	4.3	9500	1,96,293.10

Observed and reduced Bed Profile of the stretch-03 CH 30 to CH 45 km

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
30000	3.5	2.8	37650	1.5	1.5
30150	1.8	1.1	37800	1.2	1.2
30300	1.4	1.5	37950	1.1	1.1
30450	1.9	2	38100	1.1	1.1
30600	1.7	1.8	38250	1.1	1
30750	2	2.1	38400	1.1	1.1
30900	1.9	2	38550	2.5	2.5
31050	1.9	2	38700	2.8	2.8
31200	2	2.1	38850	3	3
31350	1.6	1.7	39000	3.3	3.3
31500	1.4	1.4	39150	4.3	4.3
31650	1.1	1.3	39300	5.8	5.8
31800	1.2	1.4	39450	6.9	6.9
31950	1	1.1	39600	7.2	7.2
32100	2.6	2.6	39750	6.1	6.2
32250	2.5	2.7	39900	3.3	3.8
32400	1.9	2	40050	2.3	2.9
32550	1.7	1.8	40200	2.7	3.3
32700	2	2.1	40350	2.2	2.7
32850	2.2	2.3	40500	1.1	1.6
33000	1.8	2	40650	0.7	1.2
33150	1.2	1.3	40800	1	1.7
33300	1.4	1.5	40950	0.9	1.3
33450	1.3	1.4	41100	1.3	1.8
33600	1.7	1.8	41250	1.6	2
33750	1.2	1.6	41400	1.6	2.1
33900	0.7	0.8	41550	1.1	1.6
34050	1.4	1.5	41700	1.6	2.2
34200	1.1	1.2	41850	2.6	3.1
34350	1.2	1.3	42000	3.3	3.8
34500	1.1	1.1	42150	3.6	4.1
34650	1.6	1.7	42300	4.9	5.4
34800	2.1	2.2	42450	5.9	6.4
34950	1.6	1.7	42600	6.4	6.9
35100	1.1	1.1	42750	6.6	6.9
35250	1.2	1.3	42900	5.5	6
35400	1.2	1.4	43050	4.7	5.2
35550	1.6	1.7	43200	5.7	6.5
35700	2.1	2.2	43350	2	2.6
35850	3.4	4	43500	1.6	1.8
36000	4.1	4.1	43650	1.3	1.9
36150	3.7	3.9	43800	1.2	1.7
36300	2.9	3	43950	1.6	2.1

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
36450	2.2	2.3	44100	1.7	2.2
36600	3	3.1	44250	1.8	2.2
36750	3.3	3.4	44400	1.7	2.2
36900	2.9	3.1	44550	2	2.6
37050	2	2.1	44700	3.7	3.9
37200	0.7	1	44850	3.8	4.3
37350	0.8	0.9	45000	2.7	3.3
37500	1.1	1.2			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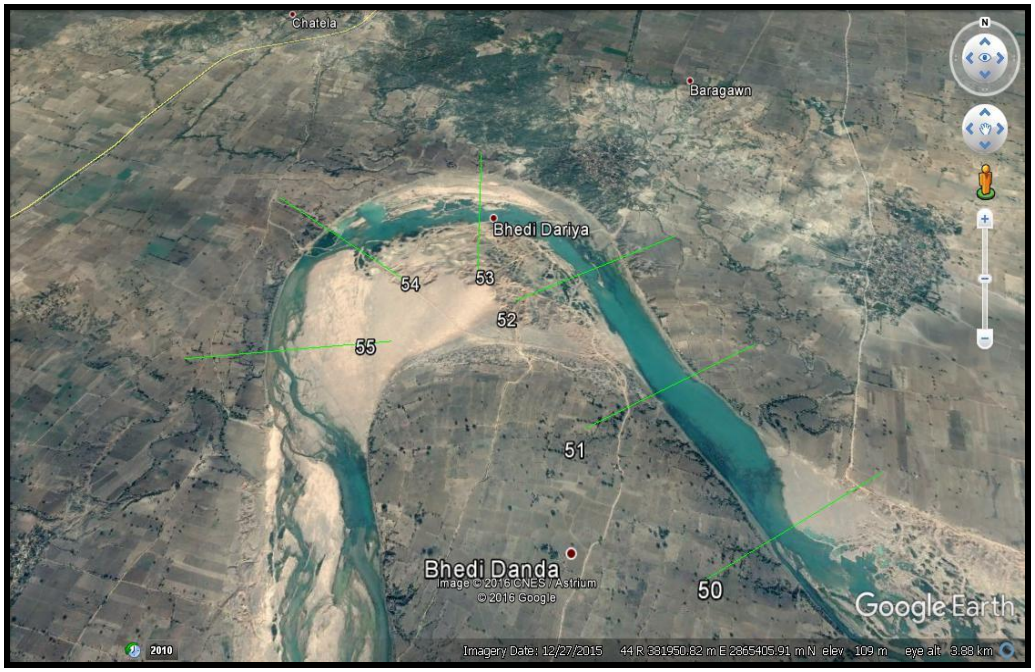
3.4 Stretch – 04 Kupara to Jalalpur (Chainage 45 km - 60 km)

Google map showing chainage 45-50km



Google map showing chainage 50-55 km

Google map showing chainage 55-60 km

Stretch	Stretch with less than < 1.2m depth	Stretch with depths between 1.2 to 1.4m(km)	Stretch with depths between 1.5 to 1.7m	Stretch with depths between 1.8m to 2m depth	Stretch with more than 2m depth
Kupara to Jalalpur	0.000 km	6.500 km	0.880 km	1.730 km	5.890km

Minimum and Maximum width of this stretch varies from 147.0 mtr. and 551.90. Minimum & maximum depths are. 1.2mtr & 6.1mtr. BM Pillar BR 03 is established at chainage 45.200Km. A temple is at chainage 47.3km. Bheri Khurd village is at chainage 47.5Km.There was a king of Bheri Khurd. Now there is only a Fort, a sign of king's kingdom. It is also a famous mining area. Agricultural land is found on both the banks of river. Fishing activities are seen some places in this stretch.BM Pillar BR-02 is established at chainage 58.2Km. A Bridge is at chainage 59.4km and connecting from Hojipur to Jalalpur. In olden time there was water transportation by big boat /barge for transportation of seasonal food grains and other items from Jalalpur. Business men were used to load the food grains and other items from Jalalpur. This bridge is good approach to the river. A temple is found near the bridge on south Bank of river. Water quality is good. No obstruction found during the survey. Both the banks are unprotected.

Betwa River from Kupara to Bhedi Danda (Chainage 45 km - 50 km)

Minimum & Maximum Depths in this stretch are 1.2m to4.2m. Minimum & Maximum width of this stretch is 136.0mtr to 390.0mtr. Average current is 0.115m/sec. Average discharge is 41.169cu.m/sec

Betwa River from Bhedi Danda to Hajipur Saliya (Chainage 50 km - 55 km)

Minimum & Maximum Depths in this stretch are 1.1m to 6.1m. Minimum & Maximum width of this stretch is 256.0mtr to 425.0mtr. Average current is 0.152m/sec. Average discharge is 51.793cu.m/sec

Betwa River from Hajipur Saliya to Jalalpur (Chainage 55 km - 60 km)

Minimum & Maximum Depths in this stretch are 0.7m to 5.9m. Minimum & Maximum width of this stretch is 162.0mtr to 550.0mtr. Average current is 0.186m/sec. Average discharge is 69.835cu.m/sec

Betwa River from Kupara to Jalalpur (Chainage 45 km - 60 km)

	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
Class	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	45	60	0.7	4.7	8500	75,563.95	0.2	3.2	0	0.00
II	45	60	0.7	4.7	10000	1,64,047.8	0.2	3.2	6500	13,355.62
III	45	60	0.6	4.7	11100	3,49,624.8	0.1	3.2	9300	1,01,069.6
IV	45	60	0.5	4.7	13600	5,24,949.92	-0.1	3.2	11200	2,22,705.50

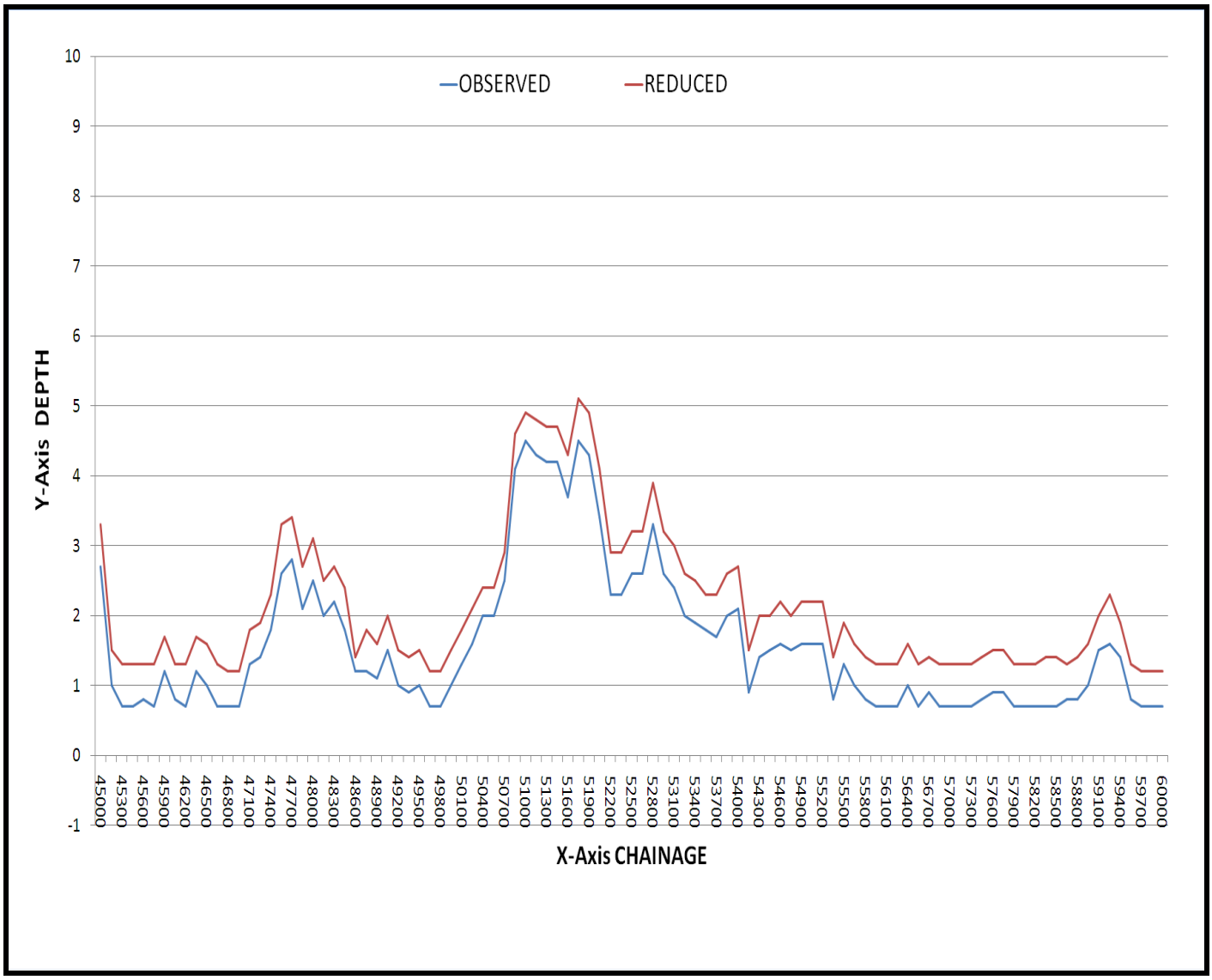
Figure No. - 08 Jalalpur Bridge CH 59.282 km

Length (m)	Width (m)	Height w.r.t. -- (MSL) (m)	Present condition	H Clearance (m)	V Clearance w.r.t. HFL (m)
690.00	7.5	118.051	Good	44	1.0

Observed and reduced Bed Profile of the stretch-04 CH 45 to CH 60 km

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
45000	2.7	3.3	52650	2.6	3.2
45150	1	1.5	52800	3.3	3.9
45300	0.7	1.3	52950	2.6	3.2
45450	0.7	1.3	53100	2.4	3
45600	0.8	1.3	53250	2	2.6
45750	0.7	1.3	53400	1.9	2.5
45900	1.2	1.7	53550	1.8	2.3
46050	0.8	1.3	53700	1.7	2.3
46200	0.7	1.3	53850	2	2.6
46350	1.2	1.7	54000	2.1	2.7
46500	1	1.6	54150	0.9	1.5
46650	0.7	1.3	54300	1.4	2
46800	0.7	1.2	54450	1.5	2
46950	0.7	1.2	54600	1.6	2.2
47100	1.3	1.8	54750	1.5	2
47250	1.4	1.9	54900	1.6	2.2

CH (m)	OBSERVED (m)	REDUCED (m)	CH (m)	OBSERVED (m)	REDUCED (m)
47400	1.8	2.3	55050	1.6	2.2
47550	2.6	3.3	55200	1.6	2.2
47700	2.8	3.4	55350	0.8	1.4
47850	2.1	2.7	55500	1.3	1.9
48000	2.5	3.1	55650	1	1.6
48150	2	2.5	55800	0.8	1.4
48300	2.2	2.7	55950	0.7	1.3
48450	1.8	2.4	56100	0.7	1.3
48600	1.2	1.4	56250	0.7	1.3
48750	1.2	1.8	56400	1	1.6
48900	1.1	1.6	56550	0.7	1.3
49050	1.5	2	56700	0.9	1.4
49200	1	1.5	56850	0.7	1.3
49350	0.9	1.4	57000	0.7	1.3
49500	1	1.5	57150	0.7	1.3
49650	0.7	1.2	57300	0.7	1.3
49800	0.7	1.2	57450	0.8	1.4
49950	1	1.5	57600	0.9	1.5
50100	1.3	1.8	57750	0.9	1.5
50250	1.6	2.1	57900	0.7	1.3
50400	2	2.4	58050	0.7	1.3
50550	2	2.4	58200	0.7	1.3
50700	2.5	2.9	58350	0.7	1.4
50850	4.1	4.6	58500	0.7	1.4
51000	4.5	4.9	58650	0.8	1.3
51150	4.3	4.8	58800	0.8	1.4
51300	4.2	4.7	58950	1	1.6
51450	4.2	4.7	59100	1.5	2
51600	3.7	4.3	59250	1.6	2.3
51750	4.5	5.1	59400	1.4	1.9
51900	4.3	4.9	59550	0.8	1.3
52050	3.4	4.1	59700	0.7	1.2
52200	2.3	2.9	59850	0.7	1.2
52350	2.3	2.9	60000	0.7	1.2
52500	2.6	3.2			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3.5 Stretch – 05 Jalalpur to Rirwa Buzurg Dariya (Chainage 60 km – 67.050 km)

Google map showing chainage

Stretch	Stretch with less than < 1.2m depth	Stretch with depths between 1.2 to 1.4m(km)	Stretch with depths between 1.5 to 1.7m	Stretch with depths between 1.8m to 2m depth	Stretch with more than 2m depth
Jalalpur to Rirwa Buzurg Dariya	0.300 km	0.200 km	0.000 km	0.200 km	6.350 km

Minimum and Maximum width of this stretch varies from 323.0mtr and 571.0mtr. Minimum & maximum depths are. 0.7mtr & 5.9mtr. A Pump house is at Chainage 65.280 and connected to irrigation canal. BM Pillar BR-01 is established at chainage 67.2Km. A Rirua village is at chainage 67.200km. It is very famous mining area. At the time of recky survey, we have seen lot of dump of red sand in this area. After rainy season there was a big flood and everything has been washed out. Both the sides are steep cut. Current is very less. Both the Banks are unprotected. Water quality is good as there is no any factory or any dirty water coming to river. Fishing activities are found where ever water is available. No obstruction found during the survey.

Betwa River from Jalalpur to Rirwa Buzurg Dariya (Chainage 60 km – 67.050 km)

Minimum & Maximum Depths in this stretch are 1.2m to 3.6m. Minimum & Maximum width of this stretch is 339.0mtr to 565.0mtr. Average current is 0.216m/sec. Average discharge is 95.295cu.m/sec

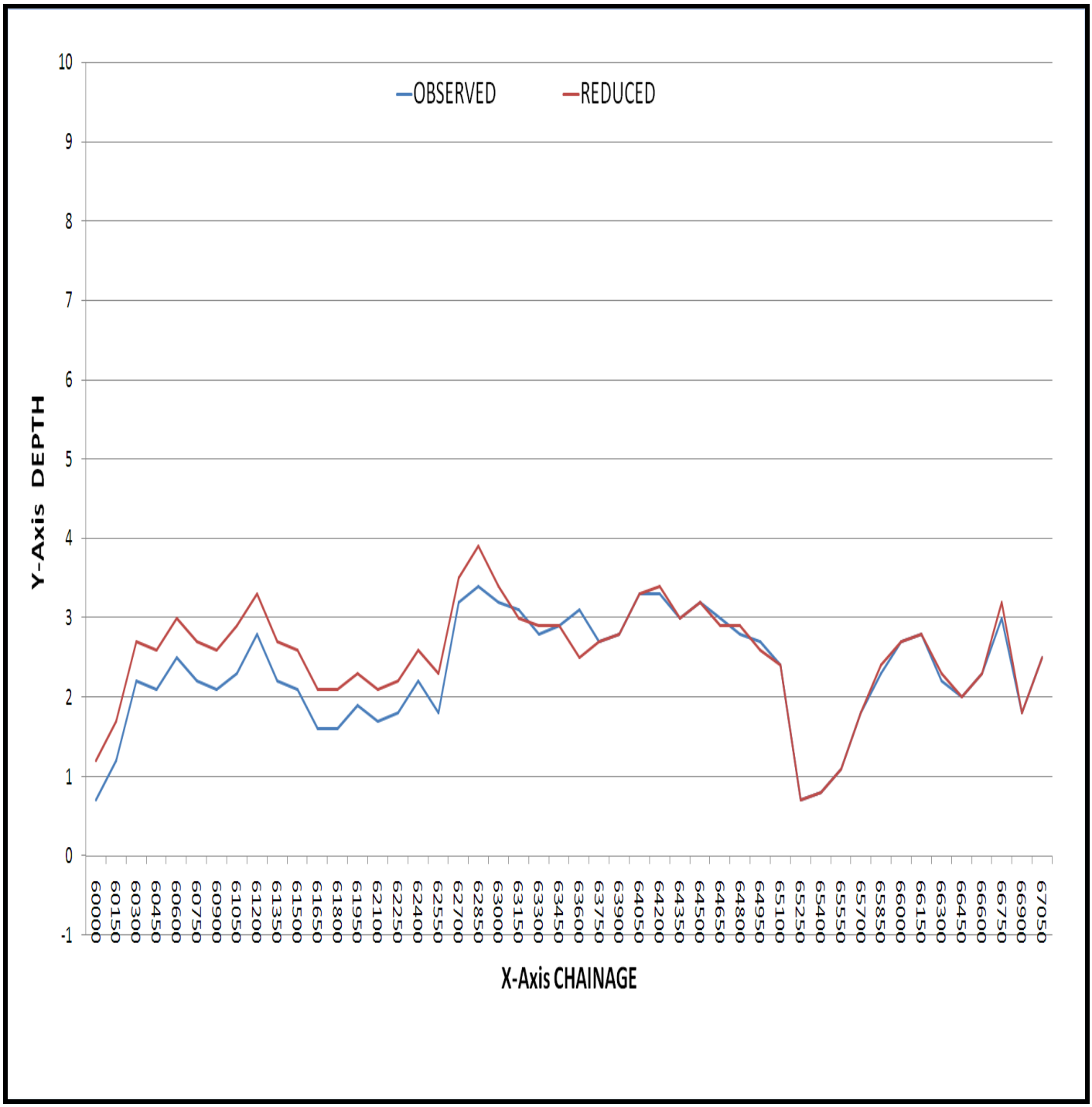
Betwa River from Jalalpur to Rirwa Buzurg Dariya (Chainage 60 km – 67.050 km)

	Chainage (km)		Observed				Reduced w.r.t. Sounding Datum			
Class	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)
I	60	67.050	0.7	3.7	600	4,638.86	0.4	2.7	600	4,331.65
II	60	67.050	0.7	3.7	600	9,955.33	0.4	2.7	600	9,489.59
III	60	67.050	0.6	3.7	2400	20,975.45	0.3	2.7	1350	19,285.09
IV	60	67.050	0.5	3.7	3000	42,176.72	0.3	2.7	2500	30,899.60

Observed and reduced Bed Profile of the stretch-05 CH 60 to CH 67.050 km

CH (m)	OBSERVED (m)	REDUCED (m)	CH(m)	OBSERVED (m)	REDUCED (m)
60000	0.7	1.2	63600	3.1	2.5
60150	1.2	1.7	63750	2.7	2.7
60300	2.2	2.7	63900	2.8	2.8
60450	2.1	2.6	64050	3.3	3.3
60600	2.5	3	64200	3.3	3.4
60750	2.2	2.7	64350	3	3
60900	2.1	2.6	64500	3.2	3.2
61050	2.3	2.9	64650	3	2.9
61200	2.8	3.3	64800	2.8	2.9
61350	2.2	2.7	64950	2.7	2.6
61500	2.1	2.6	65100	2.4	2.4
61650	1.6	2.1	65250	0.7	0.7
61800	1.6	2.1	65400	0.8	0.8
61950	1.9	2.3	65550	1.1	1.1
62100	1.7	2.1	65700	1.8	1.8
62250	1.8	2.2	65850	2.3	2.4

CH (m)	OBSERVED (m)	REDUCED (m)	CH(m)	OBSERVED (m)	REDUCED (m)
62400	2.2	2.6	66000	2.7	2.7
62550	1.8	2.3	66150	2.8	2.8
62700	3.2	3.5	66300	2.2	2.3
62850	3.4	3.9	66450	2	2
63000	3.2	3.4	66600	2.3	2.3
63150	3.1	3	66750	3	3.2
63300	2.8	2.9	66900	1.8	1.8
63450	2.9	2.9	67050	2.5	2.5



Bathymetry Survey

Stretch No	Chainage	From	To	Bathymetric Survey	Total Length KM
Stretch -01	0 to 15 Km	Samuhi	Gimuha Danda	Carried Out	15
Stretch -02	15 to 30 Km	Gimuha Danda	Mamerejpur Daria	Carried Out	15
Stretch -03	30 to 45 Km	Mamerejpur Daria	Kupara	Carried Out	15
Stretch -04	45 to 60 Km	Kupara	Jalalpur	Carried Out	15

Stretch-05	60 to 67.05 Km	Jalalpur	Rirwa Buzurg Dariya	Carried Out	7.05
		TOTAL			**67.05 km**

Topographic Survey was carried out only on banks.

Stretch No	Chainage (km)	From	To	Topographic Survey	Total Length (km)
Stretch -01	0 to 15 Km	Samuhi	Gimuha Danda	Carried Out	15
Stretch -02	15 to 30 Km	Gimuha Danda	Mamerejpur Daria	Carried Out	15
Stretch -03	30 to 45 Km	Mamerejpur Daria	Kupara	Carried Out	15
Stretch -04	45 to 60 Km	Kupara	Jalalpur	Carried Out	15
Stretch-05	60 to 67.05 Km	Jalalpur	Rirwa Buzurg Dariya	Carried Out	7.05

.

Minimum and Maximum Width

Stretch -01 0 to 15 km		Stretch -02 15 to 30 km		Stretch -03 30 to 45 km		Stretch -04 45 to 60 km		Stretch-05 60 to 67.050 km	
Minimum width (m)	Maximum width (m)	Minimum width (m)	Maximum width (m)	Minimum width (m)	Maximum width (m)	Minimum width (m)	Maximum width (m)	Minimum width (m)	Maximum width (m)
275.400	538.780	271.000	512.900	155.300	527.000	147.000	551.900	323.000	571.000

Average Width

Stretch -01 0 to 15 km	Stretch -02 15 to 30 km	Stretch -03 30 to 45 km	Stretch -04 45 to 60 km	Stretch-05 60 to 67.050 km
Average width (m)	Average width (m)	Average width (m)	Average width (m)	Average width (m)
407.090	391.950	341.150	349.450	447.000

Section 4: Terminals

4.1 Terminal is proposed at Yamuna Confluence and Jalalpur Bridge.

4.2 Details of Land use, owner etc.

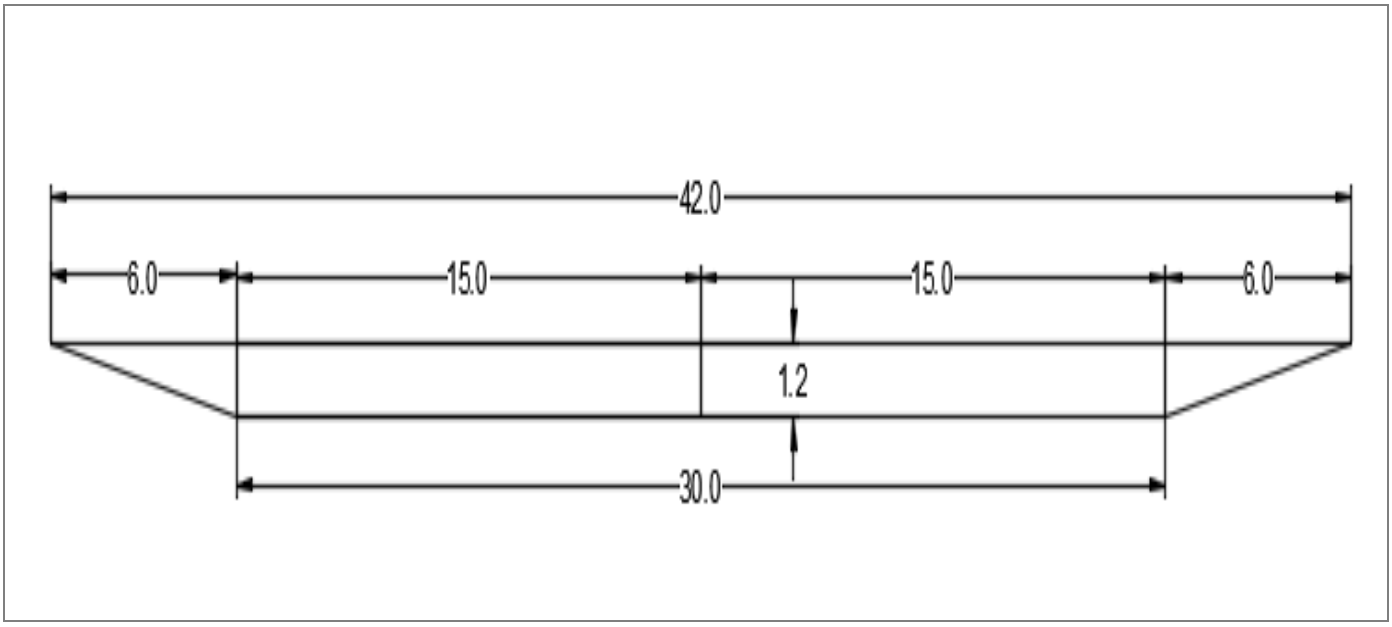
The Land use is mostly agriculture along the banks.

Section 5: Fairway development

Dredging sections, summary of depths and dredging quantity for different classification of waterways (stretch-wise)

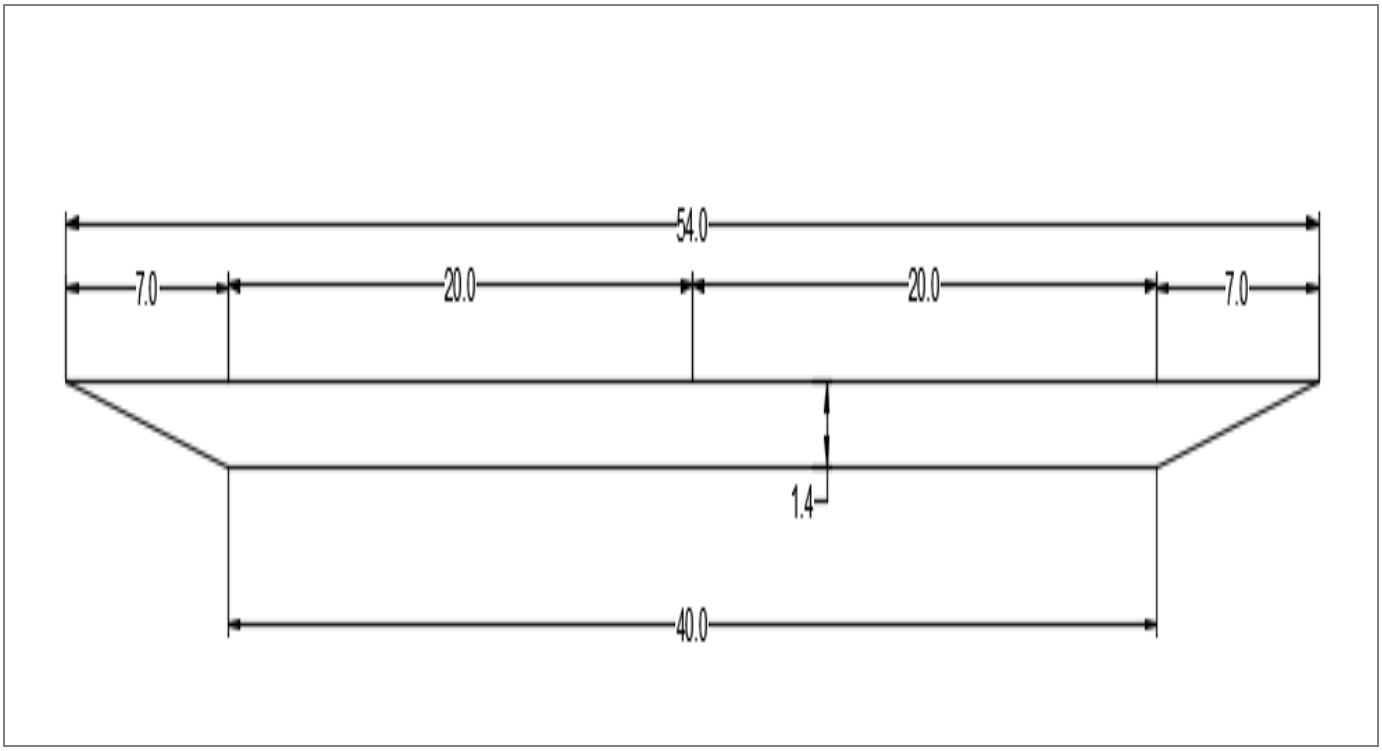
Betwa River from Hamirpur to Rirwa Buzurg Dariya (Chain age 0.0 km – 67.050 km)

Class- I 1.2m



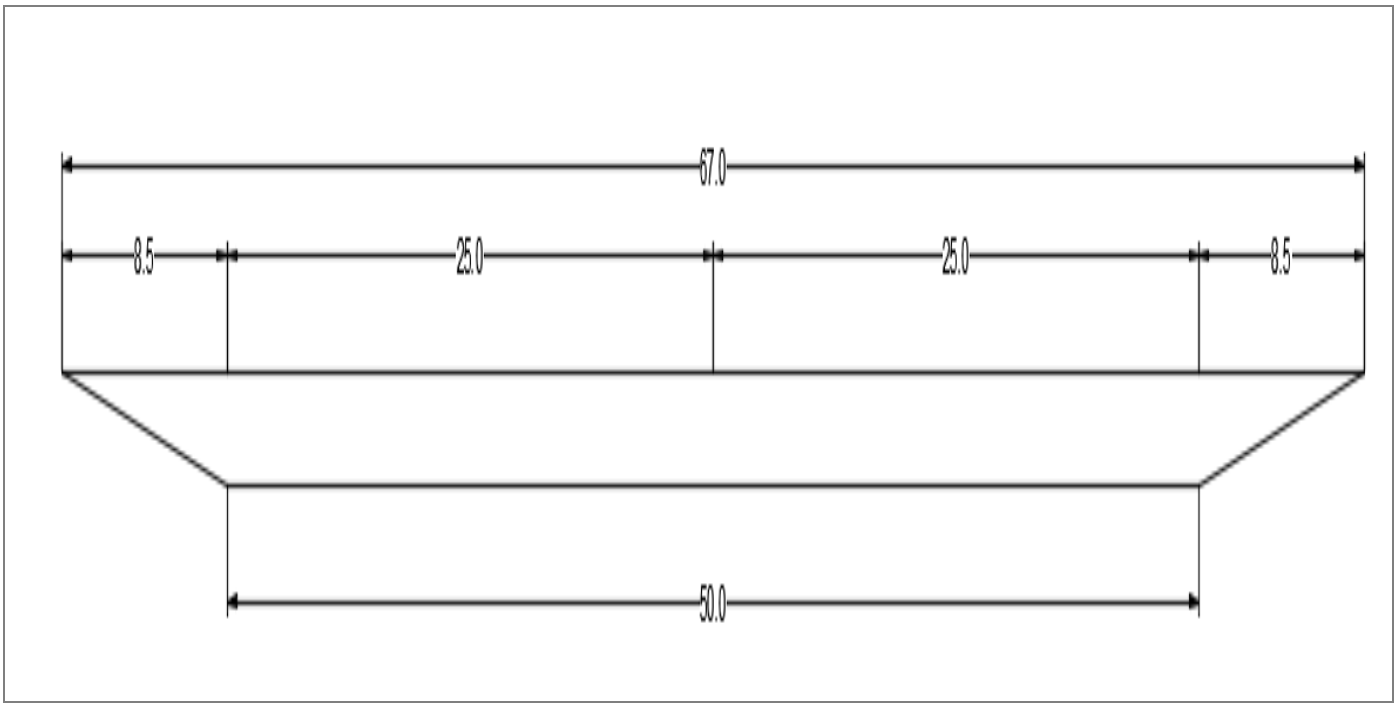
Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)
0	15	1.2	7.5	0	0	0	-0.2	5.3	10200	2,59,104.57	2,59,104.57
15	30	0.9	8	300	498.4	498.4	-0.3	7.5	3550	35,121.94	2,94,226.51
30	45	0.7	8	5800	17,368.8	17,867.2	0.6	4.3	2850	5,478.76	2,99,705.27
45	60	0.7	4.7	8500	75,563.95	93,431.15	0.2	3.2	0	0	2,99,705.27
60	67.05	0.7	3.7	600	4,638.86	98,070.01	0.4	2.7	600	4,331.65	3,04,036.92

Betwa River from Hamirpur to Rirwa Buzurg Dariya (Chain age 0.0 km – 67.050 km)
Class- II 1.4m



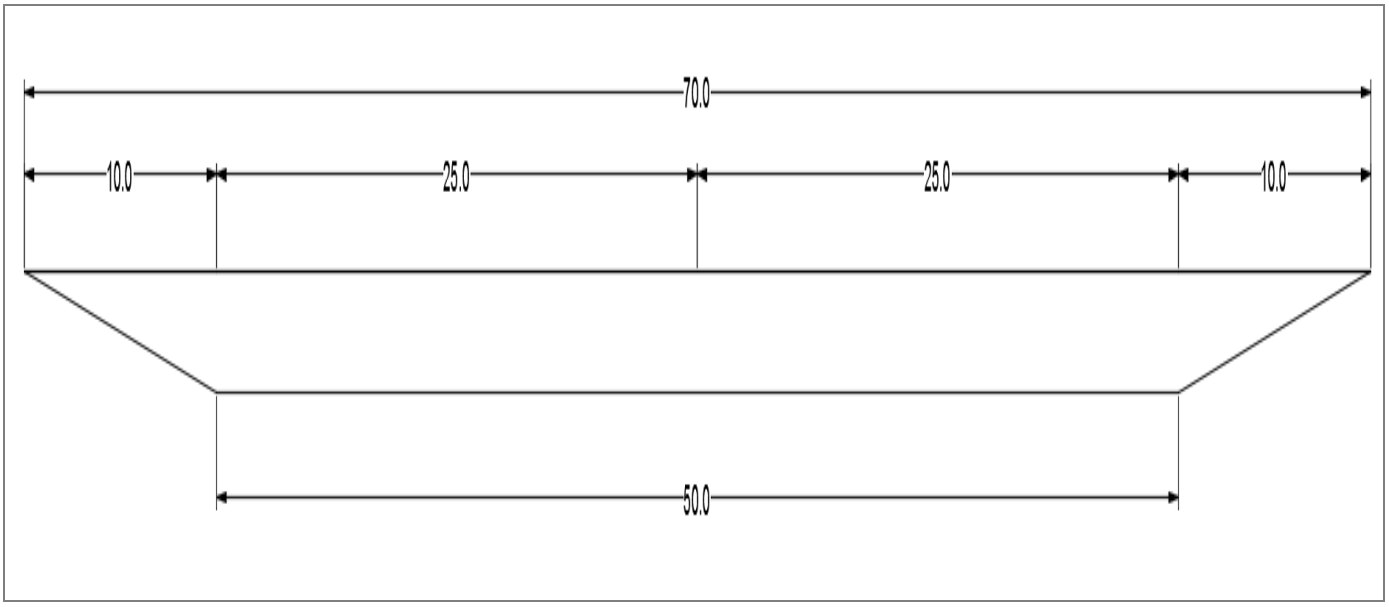
Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)
0	15	1.2	7.5	600	349.35	349.35	-0.2	5.3	11000	4,16,147.03	4,16,147.03
15	30	0.9	8	450	1,557.45	1,906.8	-0.3	7.5	4150	67,171.97	483,319.00
30	45	0.7	8	7600	55,986.9	57,893.76	0.6	4.3	5350	25,077.12	5,08,396.12
45	60	0.7	4.7	10000	1,64,047.	2,21,941.55	0.2	3.2	6500	13,355.62	5,21,751.74
60	67.050	0.7	3.7	600	9,955.33	2,31,896.88	0.4	2.7	600	9,489.59	5,31,241.33

Betwa River from Hamirpur to Rirwa Buzurg Dariya (Chain age 0.0 km – 67.050 km)
Class- III 1.7m



Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)
0	15	1.1	7.5	900	5,696.4	5,696.40	-0.3	5.3	12000	6,83,980.3	6,83,980.33
15	30	0.8	8	1500	5,557.6	11,254.00	-0.3	7.5	5850	1,36,614.5	8,20,594.82
30	45	0.6	8	10150	1,62,511.	1,73,765.30	0.4	4.3	8500	96,526.48	9,17,121.30
45	60	0.6	4.7	11100	3,49,624.	5,23,390.16	0.1	3.2	9300	1,01,069.6	10,18,190.9
60	67.050	0.6	3.7	2400	20,975.4	5,44,365.61	0.3	2.7	1350	19,285.09	10,37,475.95

Betwa River from Hamirpur to Rirwa Buzurg Dariya (Chain age 0.0 km – 67.050 km)
Class- IV 2.0m



Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Quantity (cu.m.)
0	15	1	7.5	1000	15,646.8	15,646.89	-0.3	5.3	12600	9,74,863.96	9,74,863.96
15	30	0.8	8	1800	17,790.8	33,437.71	-0.3	7.5	6000	2,12,600.14	11,87,464.10
30	45	0.5	8	11600	2,93,012.	3,26,444.49	0.3	4.3	9500	1,96,293.10	13,83,757.20
45	60	0.5	4.7	13600	5,24,950.	8,51,394.41	-0.1	3.2	11200	2,22,705.50	16,06,462.70
60	67.050	0.5	3.7	3000	42,176.7	8,93,571.13	0.3	2.7	2500	30,899.60	16,37,362.30

Section 6: Conclusion

An undertaking between MP and UP states. The Detailed hydrographic survey was carried out for the length of 67.05 from Hamirpur to Rirwa Buzurg Dariya. The survey was conducted during the period from September 2016 to December 2016.

Following are the observations:-

- Average width of the river is 387.328m
- Average slope of the river is 1:0.1752
- Average discharge of the river is 138.530 Cu.m/s.
- Total 02 numbers of bridges were found and 02 no's of bridges required to be modified for development of declared waterway as Class III waterway.
- There is no jetty, cargo or tourism facilities are available in entire river stretch.
- There is no Major Industries along the river.
- The Probable water availability in the river is for 191days and 6-7 months only.
- The dredging required for different classes are as follow.

Class	Reduced (Cu.m)
Class I	3,04,036.92
Class II	5,31,241.33
Class III	10,37,475.95
Class IV	16,37,362.30

Sand mining is very prominent in different stretches of the river so a traffic study may be carried out for assessing the transportation of sand through waterway. Depth is available for 6-7 months. Waterway may be developed for class III.

Annexure – 1

Min. / max. depth, length of shoal per km-wise for different classification in the designed dredged channel

Class-I for maintaining 1.2 m. Depth.

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (km)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
0	1	3.1	7.4	0	-	-	-0.2	3.5	450	8,512.02	8,512.02
1	2	4.4	7	0	-	-	0.7	3.1	350	1,140.21	9,652.23
2	3	2.7	5.8	0	-	-	-0.3	2	850	29,131.98	38,784.21
3	4	3	4.6	0	-	-	-0.2	1.6	1000	14,906.50	53,690.71
4	5	2.8	5.1	0	-	-	-0.2	1.7	1000	31,142.65	84,833.36
5	6	2.4	5.5	0	-	-	-0.3	2.2	850	13,731.39	98,564.75
6	7	2.7	7.3	0	-	-	-0.3	3.6	1000	17,353.74	115,918.49
7	8	2.2	3.6	0	-	-	-0.3	0.1	1000	51,721.88	167,640.37
8	9	2.7	4.7	0	-	-	-0.2	1.1	1000	18,377.68	186,018.05
9	10	1.4	3.9	0	-	-	-0.3	0.3	1000	50,361.35	236,379.40
10	11	1.2	6.3	0	-	-	-0.3	4.5	650	21,889.51	258,268.91
11	12	3	7.3	0	-	-	1.1	5.3	400	18.42	258,287.33
12	13	2.5	6	0	-	-	0.7	4.2	250	648.84	258,936.17
13	14	4.1	5.7	0	-	-	0.7	3.8	150	84.20	259,020.37
14	15	1.2	7.5	0	-	-	-0.2	5.3	250	84.20	259,104.57
15	16	4.4	7.6	0	-	-	2.5	5.7	0	-	259,104.57
16	17	2.6	6.1	0	-	-	0.5	4	400	3,391.34	262,495.91
17	18	2.6	4.5	0	-	-	0.5	2.3	1000	7,080.79	269,576.70
18	19	2.7	4.7	0	-	-	0.5	2.6	850	6,036.26	275,612.96
19	20	2.8	6.6	0	-	-	0.7	4.4	100	309.33	275,922.29
20	21	1.4	6	0	-	-	-0.3	4	650	15,026.90	290,949.19
21	22	2	5	0	-	-	1.5	4.5	0	-	290,949.19
22	23	0.9	4.1	300	498.40	498.40	0.5	3.6	250	2,807.24	293,756.43
23	24	3.1	8	0	-	498.40	2.6	7.5	0	-	293,756.43
24	25	2.9	6.8	0	-	498.40	2.5	6.3	0	-	293,756.43
25	26	1.7	6	0	-	498.40	1.6	5.5	0	-	293,756.43
26	27	4.2	5.7	0	-	498.40	3.7	5.2	0	-	293,756.43
27	28	3.1	5.2	0	-	498.40	2.5	4.7	0	-	293,756.43
28	29	3.3	5.6	0	-	498.40	2.6	5.2	0	-	293,756.43

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
29	30	1.2	8	0	-	498.40	-0.3	7.5	300	470.08	2,94,226.51
30	31	1.2	2	0	-	498.40	1.2	2.2	0	-	2,94,226.51
31	32	0.9	2.8	600	926.37	1,424.77	1	2.8	600	417.65	2,94,644.16
32	33	1	2.4	300	39.08	1,463.85	1.2	2.5	0	-	2,94,644.16
33	34	0.7	1.8	750	1,522.77	2,986.62	0.8	2	300	943.73	2,95,587.89
34	35	0.8	2.2	750	797.29	3,783.91	0.9	2.3	600	296.85	2,95,884.74
35	36	1.2	4.1	0	-	3,783.91	1.4	4.3	0	-	2,95,884.74
36	37	0.7	3.4	300	2,898.30	6,682.21	0.6	3.5	300	1,603.18	2,97,487.92
37	38	0.7	1.6	1000	2,551.77	9,233.98	0.8	1.6	900	2,041.02	2,99,528.94
38	39	0.7	6.3	150	283.34	9,517.32	0.8	6.3	150	176.33	2,99,705.27
39	40	1.9	8	0	-	9,517.32	2.4	8	0	-	299,705.27
40	41	0.7	2.2	900	4,379.34	13,896.66	1.2	2.7	0	-	2,99,705.27
41	42	0.9	5.2	300	362.30	14,258.96	1.5	5.7	0	-	2,99,705.27
42	43	1.9	7.4	0	-	14,258.96	2.4	7.9	0	-	2,99,705.27
43	44	1	2.1	300	100.75	14,359.71	1.4	2.6	0	-	2,99,705.27
44	45	0.7	8	450	3,507.49	17,867.20	1.4	4.3	0	-	2,99,705.27
45	46	0.7	1.3	1000	9,038.48	26,905.68	1.2	1.9	0	-	2,99,705.27
46	47	0.7	2.3	750	6,806.46	33,712.14	1.2	2.8	0	-	2,99,705.27
47	48	1.4	3.3	0	-	33,712.14	1.8	4	0	-	2,99,705.27
48	49	0.7	1.8	900	3,232.31	36,944.45	1.2	2.4	0	-	2,99,705.27
49	50	0.7	2.2	600	5,302.13	42,246.58	1.2	2.7	0	-	2,99,705.27
50	51	1.8	4.6	0	-	42,246.58	2.3	5.2	0	-	2,99,705.27
51	52	2.1	4.6	0	-	42,246.58	2.7	5.2	0	-	2,99,705.27
52	53	1.5	3.3	0	-	42,246.58	2.1	3.9	0	-	2,99,705.27
53	54	0.8	2.4	300	1,277.24	43,523.82	1.3	3.1	0	-	2,99,705.27
54	55	0.8	2.1	450	983.99	44,507.81	1.3	2.6	0	-	2,99,705.27
55	56	0.7	1.4	1000	10,558.29	55,066.10	1.3	1.9	0	-	2,99,705.27
56	57	0.7	0.9	1000	12,465.72	67,531.82	1.3	1.4	0	-	2,99,705.27
57	58	0.7	1.1	1000	12,465.41	79,997.23	1.3	1.7	0	-	2,99,705.27
58	59	0.7	1.6	600	4,836.45	84,833.68	1.3	2.3	0	-	2,99,705.27
59	60	0.7	4.7	900	8,597.47	93,431.15	1.2	3.2	0	-	2,99,705.27
60	61	1.8	3	0	-	93,431.15	2.2	3.5	0	-	2,99,705.27
61	62	1.5	2.4	0	-	93,431.15	1.9	2.8	0	-	2,99,705.27
62	63	1.9	3.9	0	-	93,431.15	2.3	4.2	0	-	2,99,705.27
63	64	2.1	3.7	0	-	93,431.15	1.8	3.8	0	-	2,99,705.27
64	65	0.7	3.2	600	4,638.86	98,070.01	0.7	3.3	600	4,331.65	3,04,036.92
65	66	2.9	1.6	0	-	98,070.01	1.6	2.9	0	-	3,04,036.92
66	67	1.2	3.7	0	-	98,070.01	1.4	2.7	0	-	3,04,036.92
Total Quantity (Cu.m.)					**98,070.01**		Total Quantity (Cu.m.)			**3,04,036.92**	

Class-II for maintaining 1.4m Depth.

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
0	1	3.2	7.5	0	-	-	-0.2	3.5	600	14,492.58	14,492.58
1	2	4.4	7	0	-	-	0.6	3.2	750	3,836.38	18,328.96
2	3	2.6	6	0	-	-	-0.3	2.2	1000	46,071.95	64,400.91
3	4	3	5.1	0	-	-	-0.3	1.7	1000	26,677.53	91,078.44
4	5	2.4	5.1	0	-	-	-0.2	1.7	1000	49,461.72	1,40,540.16
5	6	2.4	5.5	0	-	-	-0.3	2.1	1000	25,186.83	1,65,726.99
6	7	2.5	7.4	0	-	-	-0.3	3.8	1000	29,561.16	1,95,288.15
7	8	2.3	3.7	0	-	-	-0.3	0.1	1000	77,224.70	2,72,512.85
8	9	2.6	4.7	0	-	-	-0.2	1.3	1000	31,789.05	3,04,301.90
9	10	1.4	4	0	-	-	-0.3	0.5	1000	75,343.89	3,79,645.79
10	11	1.2	6.4	600	349.35	349.35	-0.3	4.5	600	32,919.40	4,12,565.19
11	12	2.4	7.3	0	-	349.35	1.1	5.2	300	437.81	4,13,003.00
12	13	2.5	6	0	-	349.35	0.7	4.2	300	2,223.57	4,15,226.57
13	14	4	5.7	0	-	349.35	2.2	3.9	150	354.85	4,15,581.42
14	15	1.4	7.5	0	-	349.35	-0.2	5.3	300	565.61	4,16,147.03
15	16	4	7.6	0	-	349.35	2.2	5.7	0	-	4,16,147.03
16	17	2.6	6.1	0	-	349.35	0.5	4	450	7,342.24	4,23,489.27
17	18	2.5	4.5	0	-	349.35	0.4	2.3	1000	15,904.58	4,39,393.85
18	19	2.7	4.7	0	-	349.35	0.5	2.6	750	12,213.08	4,51,606.93
19	20	2.8	6.6	0	-	349.35	0.7	4.5	300	1,002.77	4,52,609.70
20	21	1.4	6.2	0	-	349.35	-0.3	4.1	750	23,539.14	4,76,148.84
21	22	1.9	5	0	-	349.35	1.5	4.5	0	-	4,76,148.84
22	23	0.9	4.1	300	1,436.89	1,786.24	0.5	3.6	600	5,014.20	4,81,163.04
23	24	3.1	8	0	-	1,786.24	2.7	7.6	0	-	4,81,163.04
24	25	2.9	6.9	0	-	1,786.24	2.5	6.3	0	-	4,81,163.04
25	26	1.8	6	0	-	1,786.24	1.5	5.5	0	-	4,81,163.04
26	27	4	5.7	0	-	1,786.24	3.6	5.2	0	-	4,81,163.04
27	28	3.1	5.2	0	-	1,786.24	2.5	4.7	0	-	4,81,163.04
28	29	3.3	5.6	150	-	1,786.24	2.6	5.2	0	-	4,81,163.04

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
29	30	0.9	8	150	120.56	1,906.80	-0.3	7.5	300	2,155.96	4,83,319.00
30	31	1.2	2.1	750	120.56	2,027.36	1.2	2.2	150	100.77	4,83,419.77
31	32	0.9	2.7	750	3,697.87	5,725.23	0.9	2.8	600	2,609.64	4,86,029.41
32	33	1	2.3	1000	1,008.89	6,734.12	1.2	2.4	450	435.36	4,86,464.77
33	34	0.7	1.8	1000	5,937.16	12,671.28	0.8	2	750	3,268.74	4,89,733.51
34	35	0.7	2.2	150	5,369.24	18,040.52	0.9	2.3	900	3,057.70	4,92,791.21
35	36	1.2	4.1	150	423.54	18,464.06	1.3	4.3	150	30.92	4,92,822.13
36	37	0.7	3.4	300	5,610.06	24,074.12	0.8	3.5	300	3,934.02	4,96,756.15
37	38	0.7	1.6	1000	10,300.97	34,375.09	0.8	1.6	1000	9,104.94	5,05,861.09
38	39	0.7	6.3	150	1,087.82	35,462.91	0.7	6.3	150	853.36	5,06,714.45
39	40	1.8	8	0	-	35,462.91	2.3	8	0	-	5,06,714.45
40	41	0.7	2.2	1000	11,951.56	47,414.47	1.2	2.8	600	1,014.49	5,07,728.94
41	42	0.9	5.4	300	1,845.59	49,260.06	1.4	5.9	0	-	5,07,728.94
42	43	1.8	7.7	150	134.12	49,394.18	2.4	8.2	0	-	5,07,728.94
43	44	0.9	2.1	450	1,495.34	50,889.52	1.5	2.7	0	-	5,07,728.94
44	45	0.7	8	450	7,004.24	57,893.76	0.6	4.3	300	667.18	5,08,396.12
45	46	0.7	1.5	1000	20,326.45	78,220.21	1.2	2	1000	1,408.24	5,09,804.36
46	47	0.7	2.5	1000	14,729.45	92,949.66	1.2	3	600	1,929.36	5,11,733.72
47	48	1.2	3.5	150	0.59	92,950.25	1.6	4.1	0	-	5,11,733.72
48	49	0.7	1.9	1000	10,719.66	1,03,669.91	1.2	2.4	300	394.39	5,12,128.11
49	50	0.7	2.3	750	12,020.30	1,15,690.21	1.2	2.7	450	1,573.33	5,13,701.44
50	51	1.8	4.7	0	-	1,15,690.21	2.3	5.4	0	-	5,13,701.44
51	52	2.1	4.6	0	-	1,15,690.21	2.7	5.2	0	-	5,13,701.44
52	53	1.4	3.3	0	-	1,15,690.21	2	3.9	0	-	5,13,701.44
53	54	0.7	2.5	450	3,146.53	1,18,836.74	1.3	2.9	300	5.16	5,13,706.60
54	55	0.8	2.1	1000	2,602.86	1,21,439.60	1.6	2.7	0	-	5,13,706.60
55	56	0.7	1.4	1000	22,368.26	1,43,807.86	1.3	2	900	1,209.64	5,14,916.24
56	57	0.7	0.9	1000	24,686.84	1,68,494.70	1.3	1.4	1000	1,856.94	5,16,773.18
57	58	0.7	1.2	1000	25,585.66	1,94,080.36	1.3	1.6	900	1,346.29	5,18,119.47
58	59	0.7	1.7	750	10,670.27	2,04,750.63	1.2	2.3	450	370.60	5,18,490.07
59	60	0.7	4.7	900	17,190.92	2,21,941.55	1.2	3.2	600	3,261.67	5,21,751.74
60	61	1.6	3.1	0	-	2,21,941.55	2.1	3.6	0	-	5,21,751.74
61	62	1.4	2.5	0	-	2,21,941.55	1.9	2.8	0	-	5,21,751.74
62	63	1.8	4.1	0	-	2,21,941.55	2.3	4.5	0	-	5,21,751.74
63	64	1.7	3.7	0	-	2,21,941.55	1.6	3.9	0	-	5,21,751.74
64	65	0.7	3.3	600	9,955.33	2,31,896.88	0.7	3.3	600	9,489.59	5,31,241.33
65	66	1.6	3	0	-	2,31,896.88	1.6	2.9	0	-	5,31,241.33
66	67	1.4	3.7	0	-	2,31,896.88	1.4	2.7	0	-	5,31,241.33
Total Quantity (Cu.m.)					2,31,896.88		Total Quantity (Cu.m.)				5,31,241.33

Class-III for maintaining 1.7m Depth.

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
0	1	3.2	7.5	0	-	-	-0.2	3.5	900	27,381.78	27,381.78
1	2	4.3	7	0	-	-	0.4	3.2	1000	12,550.67	39,932.45
2	3	2.6	6.1	0	-	-	-0.3	2.3	1000	74,356.57	1,14,289.02
3	4	3	5.1	0	-	-	-0.2	1.7	1000	48,123.57	1,62,412.59
4	5	1.9	5.1	0	-	-	-0.3	1.7	1000	79,701.17	2,42,113.76
5	6	2.4	5.5	0	-	-	-0.3	2.1	1000	47,406.62	2,89,520.38
6	7	2.5	7.5	0	-	-	-0.3	3.9	1000	52,184.36	3,41,704.74
7	8	2.3	3.7	0	-	-	-0.3	0.1	1000	1,14,285.40	4,55,990.14
8	9	2.6	4.9	0	-	-	-0.2	1.4	1000	54,897.15	5,10,887.29
9	10	1.3	4.1	300	1,870.06	1,870.06	-0.3	0.6	1000	1,11,953.80	6,22,841.13
10	11	1.1	6.4	600	3,826.34	5,696.40	-0.3	4.5	750	49,853.93	6,72,695.06
11	12	2.3	7.4	0	-	5,696.40	1.1	5.3	600	2,595.23	6,75,290.29
12	13	2.5	6	0	-	5,696.40	0.7	4.2	300	5,371.99	6,80,662.28
13	14	3.9	5.7	0	-	5,696.40	2	3.9	150	928.19	6,81,590.47
14	15	1.7	7.5	0	-	5,696.40	-0.3	5.3	300	2,389.86	6,83,980.33
15	16	4	7.6	0	-	5,696.40	2.2	5.8	0	-	6,83,980.33
16	17	2.6	6.1	0	-	5,696.40	0.7	4	750	15,936.66	6,99,916.99
17	18	2.3	4.5	0	-	5,696.40	0.5	2.3	1000	34,809.17	7,34,726.16
18	19	2.7	4.8	0	-	5,696.40	0.5	2.6	1000	24,623.18	7,59,349.34
19	20	2.8	6.7	0	-	5,696.40	0.7	4.4	600	3,920.65	7,63,269.99
20	21	1.2	6.3	600	1,099.10	6,795.50	-0.3	4.1	1000	39,599.23	8,02,869.22
21	22	1.9	5	0	-	6,795.50	1.5	4.5	300	97.43	8,02,966.65
22	23	0.9	4.1	600	3,590.46	10,385.96	0.7	3.6	600	11,651.64	8,14,618.29
23	24	3.1	7.9	0	-	10,385.96	2.6	7.7	0	-	8,14,618.29
24	25	2.9	7	0	-	10,385.96	2.5	6.4	0	-	8,14,618.29
25	26	1.7	6	0	-	10,385.96	1.3	4.1	300	29.05	8,14,647.34
26	27	3.8	5.7	0	-	10,385.96	3.4	5.2	0	-	8,14,647.34
27	28	3	5.2	0	-	10,385.96	2.4	4.7	0	-	8,14,647.34
28	29	3.3	5.7	0	-	10,385.96	2.6	5.2	0	-	8,14,647.34

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
29	30	0.8	8	300	868.04	11,254.00	-0.3	7.5	300	5,947.48	8,20,594.82
30	31	1.2	2.3	1000	1,490.93	12,744.93	1.2	2.3	600	822.55	8,21,417.37
31	32	0.9	2.7	900	13,496.11	26,241.04	1	2.6	900	10,800.26	8,32,217.63
32	33	1	2.3	1000	8,137.36	34,378.40	1.2	2.5	1000	5,173.07	8,37,390.70
33	34	0.7	1.9	1000	19,735.63	54,114.03	0.8	2	1000	14,494.97	8,51,885.67
34	35	0.7	2.2	1000	17,924.51	72,038.54	0.8	2.3	1000	13,396.00	8,65,281.67
35	36	1	4.1	300	2,256.50	74,295.04	1.2	4.3	300	1,066.84	8,66,348.51
36	37	0.7	3.4	450	10,688.43	84,983.47	0.8	3.5	300	8,406.71	8,74,755.22
37	38	0.7	1.6	1000	28,800.78	1,13,784.25	0.8	1.6	1000	27,212.46	9,01,967.68
38	39	0.7	6.3	150	2,681.44	1,16,465.69	0.7	6.3	150	2,395.70	9,04,363.38
39	40	1.7	8	0	-	1,16,465.69	2.3	8	0	-	9,04,363.38
40	41	0.7	2.4	1000	27,665.49	1,44,131.18	1.2	2.9	900	6,680.18	9,11,043.56
41	42	0.9	5.4	450	5,829.78	1,49,960.96	1.4	5.9	300	607.46	9,11,651.02
42	43	1.7	7.9	150	755.04	1,50,716.00	2.3	8.3	150	203.60	9,11,854.62
43	44	0.9	2.1	1000	8,861.23	1,59,577.23	1.4	2.7	450	436.63	9,12,291.25
44	45	0.6	8	750	14,188.09	1,73,765.32	0.4	4.3	450	4,830.05	9,17,121.30
45	46	0.7	1.8	1000	42,388.86	2,16,154.18	1.2	2.1	1000	12,455.67	9,29,576.97
46	47	0.7	2.6	1000	30,569.45	2,46,723.63	1.2	2.9	1000	10,004.68	9,39,581.65
47	48	0.9	3.6	150	349.45	2,47,073.08	1.7	4.1	0	-	9,39,581.65
48	49	0.7	1.8	1000	29,141.26	2,76,214.34	1.2	2.4	1000	5,926.73	9,45,508.38
49	50	0.7	2.3	900	26,451.80	3,02,666.14	1.2	2.7	750	8,406.26	9,53,914.64
50	51	1.8	4.9	0	-	3,02,666.14	2.2	5.6	0	-	9,53,914.64
51	52	2.1	4.6	0	-	3,02,666.14	2.7	5.2	0	-	9,53,914.64
52	53	1.3	3.4	300	141.27	3,02,807.41	1.9	3.9	0	-	9,53,914.64
53	54	0.7	2.6	1000	9,257.87	3,12,065.28	1.3	3.1	450	1,659.36	9,55,574.00
54	55	0.8	2.2	1000	12,228.17	3,24,293.45	1.5	2.8	600	580.00	9,56,154.00
55	56	0.7	1.5	1000	44,858.50	3,69,151.95	1.3	2.1	1000	12,905.87	9,69,059.87
56	57	0.7	0.9	1000	46,206.73	4,15,358.68	1.3	1.4	1000	15,988.20	9,85,048.07
57	58	0.7	1.2	1000	49,185.68	4,64,544.36	1.3	1.8	1000	14,737.98	9,99,786.05
58	59	0.7	1.6	1000	28,578.06	4,93,122.42	1.3	2.2	750	6,176.88	10,05,962.93
59	60	0.6	4.7	750	30,267.74	5,23,390.16	1.2	3.2	750	12,227.93	10,18,190.86
60	61	1.3	3.1	600	5.52	5,23,395.68	1.9	3.6	0	-	10,18,190.86
61	62	1.3	2.5	750	1,110.07	5,24,505.75	1.8	2.9	0	-	10,18,190.86
62	63	1.7	4.2	0	-	5,24,505.75	2.1	4.6	150	0.32	10,18,191.18
63	64	1.7	3.7	0	-	5,24,505.75	1.3	3.9	150	0.33	10,18,191.51
64	65	0.7	3.4	600	19,822.90	5,44,328.65	0.7	3.4	600	19,256.66	10,37,448.17
65	66	1.7	2.9	150	20.96	5,44,349.61	1.7	2.9	150	20.97	10,37,469.14
66	67	0.6	3.7	300	16.00	5,44,365.61	0.3	2.7	300	6.81	10,37,475.95
Total Quantity (Cu.m.)					**5,44,365.61**		**Total Quantity (Cu.m.)**				**10,37,475.95**

Class-IV for maintaining 2.0m Depth.

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
0	1	3.2	7.5	0	-	-	-0.2	3.5	500	41,536.55	41,536.55
1	2	4.3	7	0	-	-	0.4	3.2	600	23,777.05	65,313.60
2	3	2.6	6.1	0	-	-	-0.3	2.3	1000	95,991.94	1,61,305.54
3	4	3	5.1	0	-	-	-0.2	1.7	1000	65,140.43	2,26,445.97
4	5	2	5.1	0	-	-	-0.3	1.7	1000	1,07,425.00	3,33,870.93
5	6	2.4	5.5	0	-	-	-0.3	2.1	1000	74,457.33	4,08,328.26
6	7	2.5	7.5	0	-	-	-0.3	3.9	1000	78,817.45	4,87,145.71
7	8	2.3	3.7	0	-	-	-0.3	0.1	1000	1,56,382.70	6,43,528.37
8	9	2.6	4.9	0	-	-	-0.2	1.4	1000	75,616.74	7,19,145.11
9	10	1.3	4.1	200	6,151.46	6,151.46	-0.3	0.6	1000	1,70,134.40	8,89,279.49
10	11	1.1	6.4	200	9,495.43	15,646.89	-0.3	4.5	1000	63,848.44	9,53,127.93
11	12	2.3	7.4	0	-	15,646.89	1.1	5.3	100	6,584.26	9,59,712.19
12	13	2.5	6	0	-	15,646.89	0.7	4.2	100	8,553.63	9,68,265.82
13	14	3.9	5.7	0	-	15,646.89	2	3.9	100	1,807.56	9,70,073.38
14	15	2.0	7.5	0	-	15,646.89	-0.3	5.3	200	4,790.58	9,74,863.96
15	16	4	7.6	0	-	15,646.89	2.2	5.8	0	-	9,74,863.96
16	17	2.6	6.1	0	-	15,646.89	0.7	4	500	24,687.96	9,99,551.92
17	18	2.3	4.5	0	-	15,646.89	0.5	2.3	500	51,925.58	10,51,477.50
18	19	2.7	4.8	0	-	15,646.89	0.5	2.6	400	37,368.00	10,88,845.50
19	20	2.8	6.7	0	-	15,646.89	0.7	4.4	100	9,368.90	10,98,214.40
20	21	1.2	6.3	200	5,339.87	20,986.76	-0.3	4.1	500	57,678.80	11,55,893.20
21	22	1.9	5	100	0.28	20,987.04	1.5	4.5	100	2,272.90	11,58,166.10
22	23	0.9	4.1	300	8,170.92	29,157.96	0.7	3.6	200	18,977.60	11,77,143.70
23	24	3.1	7.9	0	-	29,157.96	2.6	7.7	0	-	11,77,143.70
24	25	2.9	7	0	-	29,157.96	2.5	6.4	0	-	11,77,143.70
25	26	1.5	6	100	246.09	29,404.05	2.3	4.1	100	587.50	11,77,731.20
26	27	3.8	5.7	0	-	29,404.05	3.4	5.2	0	-	11,77,731.20
27	28	3	5.2	0	-	29,404.05	2.4	4.7	0	-	11,77,731.20
28	29	3.3	5.7	0	-	29,404.05	2.6	5.2	0	-	11,77,731.20
29	30	0.8	8	200	4,033.66	33,437.71	-0.3	7.5	100	9,732.90	11,87,464.10
30	31	1.2	2.3	300	11,477.01	44,914.72	1.2	2.3	100	6,716.00	11,94,180.10
31	32	0.9	2.7	400	25,010.53	69,925.25	1	2.6	300	21,461.90	12,15,642.00
32	33	1	2.3	300	18,449.07	88,374.32	1.2	2.5	200	10,459.00	12,26,101.00
33	34	0.7	1.9	500	34,130.43	1,22,504.75	0.8	2	400	31,549.10	12,57,650.10
34	35	0.7	2.2	500	32,293.88	1,54,798.63	0.8	2.3	300	26,249.30	12,83,899.40
35	36	1	4.1	100	5,536.51	1,60,335.14	1.2	4.3	100	4,001.80	12,87,901.20
36	37	0.7	3.4	100	15,614.22	1,75,949.36	0.8	3.5	200	12,649.70	13,00,550.90
37	38	0.7	1.6	1000	46,649.75	2,22,599.11	0.8	1.6	500	44,989.60	13,45,540.50
38	39	0.7	6.3	600	4,010.05	2,26,609.16	0.7	6.3	100	3,716.80	13,49,257.30
39	40	1.7	8	100	61.06	2,26,670.22	2.3	8	0	-	13,49,257.30
40	41	0.7	2.4	500	43,144.77	2,69,814.99	1.2	2.9	200	17,390.30	13,66,647.60
41	42	0.9	5.4	600	11,567.75	2,81,382.74	1.4	5.9	100	3,112.40	13,69,760.00
42	43	1.7	7.9	100	1,978.16	2,83,360.90	2.3	8.3	100	758.60	13,70,518.60
43	44	0.9	2.1	400	21,031.03	3,04,391.93	1.4	2.7	100	3,277.00	13,73,795.60

Class-IV for maintaining 2.0m Depth.

Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulative Drg. Qty. (cu.m.)
44	45	0.5	8	400	22,052.56	3,26,444.49	0.3	4.3	200	9,961.60	13,83,757.20
45	46	0.7	1.8	600	60,768.18	3,87,212.67	1.2	2.1	300	28,067.10	14,11,824.30
46	47	0.7	2.6	500	44,544.94	4,31,757.61	1.2	2.9	300	20,362.30	14,32,186.60
47	48	0.9	3.6	100	1,619.61	4,33,377.22	1.5	4.1	100	93.90	14,32,280.50
48	49	0.7	1.8	300	46,307.28	4,79,684.50	1.2	2.4	300	18,711.50	14,50,992.00
49	50	0.7	2.3	300	40,525.78	5,20,210.28	1.2	2.7	300	18,566.60	14,69,558.60
50	51	1.8	4.9	100	135.44	5,20,345.72	2.2	5.6	0	-	14,69,558.60
51	52	2.1	4.6	0	-	5,20,345.72	2.7	5.2	0	-	14,69,558.60
52	53	2.0	3.4	0	1,139.97	5,21,485.69	2.3	3.9	0	-	14,69,558.60
53	54	0.7	2.6	300	20,248.10	5,41,733.79	1.3	3.1	100	4,229.00	14,73,787.60
54	55	0.8	2.2	300	27,613.93	5,69,347.72	1.5	2.8	100	3,771.80	14,77,559.40
55	56	0.7	1.5	600	63,056.21	6,32,403.93	1.3	2.1	300	27,995.10	15,05,554.50
56	57	0.7	0.9	600	62,656.10	6,95,060.03	1.3	1.4	400	30,836.40	15,36,390.90
57	58	0.7	1.2	600	67,719.56	7,62,779.59	1.3	1.8	400	31,433.40	15,67,824.30
58	59	0.7	1.6	600	46,216.27	8,08,995.86	1.3	2.2	300	16,149.00	15,83,973.30
59	60	0.5	4.7	750	42,398.55	8,51,394.41	-0.1	3.2	400	22,489.40	16,06,462.70
60	61	1.3	3.1	200	987.27	8,52,381.68	2.1	3.6	0	-	16,06,462.70
61	62	1.3	2.5	200	9,535.39	8,61,917.07	1.8	2.9	100	45.50	16,06,508.20
62	63	1.7	4.2	100	152.82	8,62,069.89	2.1	4.6	100	131.30	16,06,639.50
63	64	1.4	3.7	100	11.75	8,62,081.64	1.3	3.9	100	131.20	16,06,770.70
64	65	0.7	3.4	600	28,527.51	8,90,609.15	0.7	3.4	300	27,889.50	16,34,660.20
65	66	1.7	2.9	100	1,300.77	8,91,909.92	1.7	2.9	100	1,246.20	16,35,906.40
66	67	0.5	3.7	100	1,661.21	8,93,571.13	0.3	2.7	100	1,455.90	16,37,362.30
Total Quantity (Cu.m.)					**8,93,571.13**		**Total Quantity (Cu.m.)**				**16,37,362.3**

Annexure - 2

Details of collected Water level of different gauge stations w.r.t. MSL:-

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
06.09.2016	Rerua TP-01	66.337	8:00	0.39	99.478	99.868	99.875	0.007
			9:00	0.39	99.478	99.8675	99.875	0.007
			10:00	0.39	99.478	99.8675	99.875	0.007
			11:00	0.39	99.478	99.868	99.875	0.007
			12:00	0.39	99.478	99.8675	99.875	0.007
			13:00	0.39	99.478	99.8675	99.875	0.007
			14:00	0.39	99.478	99.8675	99.875	0.007
			15:00	0.39	99.478	99.8675	99.875	0.007
			16:00	0.39	99.478	99.8675	99.875	0.007
			17:00	0.39	99.478	99.8675	99.875	0.007

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
06.09.2016	Pathreta Mauja TP-02	57.499	8:00	0.50	97.383	97.883	98.272	0.389
			9:00	0.50	97.383	97.883	98.272	0.389
			10:00	0.50	97.383	97.883	98.272	0.389
			11:00	0.50	97.383	97.883	98.272	0.389
			12:00	0.50	97.383	97.883	98.272	0.389
			13:00	0.50	97.383	97.883	98.272	0.389
			14:00	0.50	97.383	97.883	98.272	0.389
			15:00	0.50	97.383	97.883	98.272	0.389
			16:00	0.50	97.383	97.883	98.272	0.389
			17:00	0.50	97.383	97.883	98.272	0.389

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
07.09.2016	Pathreta Mauja TP-02	57.499	8:00	0.40	97.383	97.783	98.272	0.489
			9:00	0.40	97.383	97.783	98.272	0.489
			10:00	0.40	97.383	97.783	98.272	0.489
			11:00	0.40	97.383	97.783	98.272	0.489
			12:00	0.40	97.383	97.783	98.272	0.489
			13:00	0.40	97.383	97.783	98.272	0.489
			14:00	0.40	97.383	97.783	98.272	0.489
			15:00	0.40	97.383	97.783	98.272	0.489
			16:00	0.40	97.383	97.783	98.272	0.489
			17:00	0.40	97.383	97.783	98.272	0.489

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
08.09.2016	Pathreta Mauja TP-02	57.499	8:00	0.30	97.383	97.683	98.272	0.589
			9:00	0.30	97.383	97.683	98.272	0.589
			10:00	0.30	97.383	97.683	98.272	0.589
			11:00	0.30	97.383	97.683	98.272	0.589
			12:00	0.30	97.383	97.683	98.272	0.589
			13:00	0.30	97.383	97.683	98.272	0.589
			14:00	0.30	97.383	97.683	98.272	0.589
			15:00	0.29	97.383	97.673	98.272	0.599
			16:00	0.29	97.383	97.673	98.272	0.599
			17:00	0.29	97.383	97.673	98.272	0.599

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
08.09.2016	Beri TP-03	44.379	8:00	0.50	94.9625	95.463	95.892	0.429
			9:00	0.50	94.9625	95.4625	95.892	0.429
			10:00	0.50	94.9625	95.4625	95.892	0.429
			11:00	0.50	94.9625	95.4625	95.892	0.429
			12:00	0.48	94.9625	95.4425	95.892	0.449
			13:00	0.48	94.9625	95.4425	95.892	0.449
			14:00	0.48	94.9625	95.4425	95.892	0.449
			15:00	0.46	94.9625	95.4225	95.892	0.469
			16:00	0.46	94.9625	95.4225	95.892	0.469
			17:00	0.46	94.9625	95.4225	95.892	0.469

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
09.09.2016	Beri TP-03	44.379	8:00	0.40	94.9625	95.363	95.892	0.529
			9:00	0.40	94.9625	95.3625	95.892	0.529
			10:00	0.40	94.9625	95.3625	95.892	0.529
			11:00	0.40	94.9625	95.3625	95.892	0.529
			12:00	0.40	94.9625	95.3625	95.892	0.529
			13:00	0.40	94.9625	95.3625	95.892	0.529
			14:00	0.39	94.9625	95.3525	95.892	0.539
			15:00	0.39	94.9625	95.3525	95.892	0.539
			16:00	0.39	94.9625	95.3525	95.892	0.539
			17:00	0.39	94.9625	95.3525	95.892	0.539

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
09.09.2016	Para TP-04	33.392	8:00	0.30	93.595	93.895	93.899	0.004
			9:00	0.30	93.595	93.895	93.899	0.004
			10:00	0.30	93.595	93.895	93.899	0.004
			11:00	0.30	93.595	93.895	93.899	0.004
			12:00	0.30	93.595	93.895	93.899	0.004
			13:00	0.29	93.595	93.885	93.899	0.014
			14:00	0.29	93.595	93.885	93.899	0.014
			15:00	0.28	93.595	93.875	93.899	0.024
			16:00	0.28	93.595	93.875	93.899	0.024
			17:00	0.28	93.595	93.875	93.899	0.024

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
10.09.2016	Para TP-04	33.392	8:00	0.20	93.595	93.795	93.899	0.104
			9:00	0.20	93.595	93.795	93.899	0.104
			10:00	0.20	93.595	93.795	93.899	0.104
			11:00	0.20	93.595	93.795	93.899	0.104
			12:00	0.20	93.595	93.795	93.899	0.104
			13:00	0.20	93.595	93.795	93.899	0.104
			14:00	0.19	93.595	93.785	93.899	0.114
			15:00	0.19	93.595	93.785	93.899	0.114
			16:00	0.19	93.595	93.785	93.899	0.114
			17:00	0.19	93.595	93.785	93.899	0.114

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
10.09.2016	Patara TP-05		8:00	0.50	92.571	93.071	92.4	-0.671
			9:00	0.50	92.571	93.071	92.4	-0.671
			10:00	0.50	92.571	93.071	92.4	-0.671
			11:00	0.50	92.571	93.071	92.4	-0.671
			12:00	0.50	92.571	93.071	92.4	-0.671
			13:00	0.50	92.571	93.071	92.4	-0.671
			14:00	0.50	92.571	93.071	92.4	-0.671
			15:00	0.50	92.571	93.071	92.4	-0.671
			16:00	0.49	92.571	93.061	92.4	-0.661
			17:00	0.49	92.571	93.061	92.4	-0.661

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
11.09.2016	Patara TP-05		8:00	0.30	92.571	92.871	92.4	-0.471
			9:00	0.30	92.571	92.871	92.4	-0.471
			10:00	0.30	92.571	92.871	92.4	-0.471
			11:00	0.30	92.571	92.871	92.4	-0.471
			12:00	0.30	92.571	92.871	92.4	-0.471
			13:00	0.30	92.571	92.871	92.4	-0.471
			14:00	0.30	92.571	92.871	92.4	-0.471
			15:00	0.28	92.571	92.851	92.4	-0.451
			16:00	0.28	92.571	92.851	92.4	-0.451
			17:00	0.27	92.571	92.841	92.4	-0.441

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
11.09.2016	Sahjana TP-06	14.168	8:00	0.60	91.932	92.532	90.411	-2.121
			9:00	0.60	91.932	92.532	90.411	-2.121
			10:00	0.60	91.932	92.532	90.411	-2.121
			11:00	0.60	91.932	92.532	90.411	-2.121
			12:00	0.60	91.932	92.532	90.411	-2.121
			13:00	0.60	91.932	92.532	90.411	-2.121
			14:00	0.60	91.932	92.532	90.411	-2.121
			15:00	0.60	91.932	92.532	90.411	-2.121
			16:00	0.60	91.932	92.532	90.411	-2.121
			17:00	0.60	91.932	92.53	90.411	-2.121

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
12.09.2016	Sahjana TP-06	14.168	8:00	0.30	91.932	92.232	90.411	-1.821
			9:00	0.30	91.932	92.232	90.411	-1.821
			10:00	0.30	91.932	92.232	90.411	-1.821
			11:00	0.30	91.932	92.232	90.411	-1.821
			12:00	0.30	91.932	92.232	90.411	-1.821
			13:00	0.30	91.932	92.232	90.411	-1.821
			14:00	0.30	91.932	92.232	90.411	-1.821
			15:00	0.30	91.932	92.232	90.411	-1.821
			16:00	0.30	91.932	92.232	90.411	-1.821
			17:00	0.30	91.932	92.23	90.411	-1.821

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
12.09.2016	Rameni Kadera TP-07	3.767	8:00	0.60	91.551	92.151	88.583	-3.568
			9:00	0.60	91.551	92.151	88.583	-3.568
			10:00	0.60	91.551	92.151	88.583	-3.568
			11:00	0.60	91.551	92.151	88.583	-3.568
			12:00	0.60	91.551	92.151	88.583	-3.568
			13:00	0.60	91.551	92.151	88.583	-3.568
			14:00	0.60	91.551	92.151	88.583	-3.568
			15:00	0.58	91.551	92.131	88.583	-3.548
			16:00	0.58	91.551	92.13	88.583	-3.548
			17:00	0.58	91.551	92.13	88.583	-3.548

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
13.09.2016	Rameni Kadera TP-07	3.767	8:00	0.40	91.551	91.951	88.583	-3.368
			9:00	0.40	91.551	91.951	88.583	-3.368
			10:00	0.40	91.551	91.951	88.583	-3.368
			11:00	0.35	91.551	91.901	88.583	-3.318
			12:00	0.35	91.551	91.901	88.583	-3.318
			13:00	0.30	91.551	91.851	88.583	-3.268
			14:00	0.30	91.551	91.851	88.583	-3.268
			15:00	0.30	91.551	91.851	88.583	-3.268
			16:00	0.30	91.551	91.85	88.583	-3.268
			17:00	0.30	91.551	91.85	88.583	-3.268

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
13.09.2016	Hamirpur TP-08	0.419	8:00	0.50	91.339	91.839	88.03	-3.809
			9:00	0.50	91.339	91.839	88.03	-3.809
			10:00	0.50	91.339	91.839	88.03	-3.809
			11:00	0.50	91.339	91.839	88.03	-3.809
			12:00	0.40	91.339	91.739	88.03	-3.709
			13:00	0.40	91.339	91.739	88.03	-3.709
			14:00	0.40	91.339	91.739	88.03	-3.709
			15:00	0.40	91.339	91.739	88.03	-3.709
			16:00	0.40	91.339	91.74	88.03	-3.709
			17:00	0.35	91.339	91.69	88.03	-3.659

DATE	Tide Pole name	Chainage (km)	TIME	Tide Reading (m)	Zero of TP w.r.t. MSL (m)	Tide reading w.r.t. MSL (m)	SD value w.r.t. MSL (m)	CORRECTED TIDE (m)
				A	B	C = A+B	D	E = D-C
19.09.2016	Hamirpur TP-08	0.419	8:00	0.50	91.339	91.839	88.03	-3.809
			9:00	0.50	91.339	91.839	88.03	-3.809
			10:00	0.50	91.339	91.839	88.03	-3.809
			11:00	0.50	91.339	91.839	88.03	-3.809
			12:00	0.50	91.339	91.839	88.03	-3.809
			13:00	0.50	91.339	91.839	88.03	-3.809
			14:00	0.50	91.339	91.839	88.03	-3.809
			15:00	0.45	91.339	91.789	88.03	-3.759
			16:00	0.45	91.339	91.79	88.03	-3.759
			17:00	0.45	91.339	91.79	88.03	-3.759

Annexure - 3

Details of bathymetric/topographic surveys carried out: -

Date of Survey	Type of Survey	Chainage	
		From (km)	To (km)
06 September 2016	Bathymetric/Topographic	61.450	67.050
07 September 2016	Bathymetric/Topographic	59.000	61.450
08 September 2016	Bathymetric/Topographic	49.400	59.000
09 September 2016	Bathymetric/Topographic	37.150	49.400
10 September 2016	Bathymetric/Topographic	27.000	37.150
11 September 2016	Bathymetric/Topographic	15.600	27.000
12 September 2016	Bathymetric/Topographic	6.900	15.600
13 September 2016	Bathymetric/Topographic	0.750	6.900
19 September 2016	Bathymetric/Topographic	0.000	0.750

Annexure - 4

Details of bank Protection along the Bank

Both the banks are unprotected except Bund protection has been made from chainage 8.300KM to 8.800 KM.

Annexure - 5

Details of Features across the Bank

Hamirpur Dist/city is at chainage 9.500 km. High Tension Line at chainage 7.530 km, A Bridge at Hamirpur at chainage 8.245 km and Jalalpur Bridge at 59.282km.

Annexure - 6

Detailed methodology adopted for carrying out survey. Horizontal Control and Vertical Control

Horizontal Control

The survey boat used for the survey operations throughout the project was positioned by the Differential Global Positioning System (DGPS). Differential signal corrections for the DGPS system were automatically obtained by establishing high precision DGPS.

The Trimble DGPS Receiver was used for positioning of the depths. The position correction details were received from the high precision DGPS and position data were found to be in differential mode, and in order.

For topographic survey horizontal control was carried out from Bench Mark situated at Yamuna River Bank Hamirpur. The Trimble base station was set up at same station and 24 hours observation was carried out. Raw data was collected and converted to Trimble RTX format for on line processing system. The BM position of BR 08, at confluence thus derived is:

Latitude:	**25° 55' 08.7892"N**
Longitude:	**080° 12' 33.5304" E**
RL Hgt:	**96.388m**

TBM was connected from the CWC Bench Mark at Yamuna River Bank Hamirpur, value is 109.153 w.r.t. MSL.

Vertical Control

Vertical control was started from CWC Bench Mark at Yamuna River Bank Hamirpur value is 109.153m w.r.t. MSL.Graduated Tide Pole was installed at 10 Kilometre interval along the River as per specifications. Water levels were measured at 60-minute interval during entire survey period.

At site, reference marks were also made and checked regularly during the survey period to ensure that the tide pole was not disturbed / dis-levelled.

Instrument used

Positioning System

1 X Trimble DGPS system

Navigation & Data Logging System

To provide on-line route guidance, log navigation data, provide QC of navigation data, etc. The system comprises the following equipment:

1 X HP Laptop

1 X Hypack Max version 6.2b Navigation & Data Logging Software

1 X Positioning & sensor interfaces Sufficient Paper Rolls

The survey was conducted in WGS-84 spheroid with no datum transformation.

Spheroid	WGS-84
Datum Transformation	None
Semi-major axis (a)	6378137.0000 m
Semi-minor axis (b)	6356752.3142 m
Eccentricity	0.0818 191909 28906
Inverse flattening (1/f)	298.257223563
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Central Meridian (CM)	75 ^{o} East (Zone 44)
Origin Latitude (False Lat)	0.0^{o}
Hemisphere	North
False Easting (FE)	500000.0 m
False Northing (FN)	0.0 m
Scale Factor on CM	0.999600
Units	International Metres

Single Beam Echo Sounder System

1 X Bathy 500 dual frequency Echo Sounder.
1 X Dual frequency transducer 33 kHz
& 210 kHz + mounting bracket & base plate.

Current Meter

1 X 2D Falmouth current meter.

Water Sampler & Bottom Sampler

1 X Water Sampler
1 X Van veen Grab

Topographic Survey

3 X Trimble PPK Controllers.
1 X Trimble PPK base.
1 X Nikon Auto level with tacky stave.
2 X Tide station

Methodology of Trimble *R3*

The Trimble® R3 GPS system is a complete L1 GPS post processed solution from the industry leader in GPS surveying technology. Combining an L1 GPS receiver and antenna, rugged handheld controller, and easy-to-use field and office software, the Trimble R3 system brings precise sub centimeter control to our site, establishes new localized control, and collects topographic data.

The base station is located at the known point which transmits the signals for handheld controllers. The controller observes the points for default 1 Hour time Period which is manually operated and stores that points.

Survey Vessel

A small Gemini boat made of inflatable rubber with draught 0.4 meter was used for collecting bathymetry data.

Annexure - 7

Photographs of equipment

Figure No.-09 Trimble DGPS

Figure No.- 10 Bathy Echo Sounder

Figure No.- 11 2D Falmouth current meter

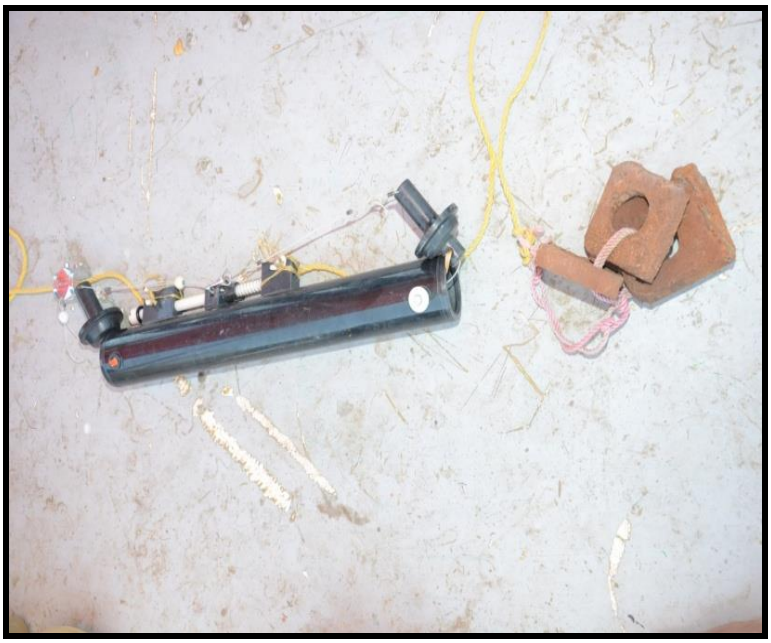


Figure No. - 12 Water Sampler

Figure No.- 13 Van veen Grab

Figure No. - 14 Trimble R3

Figure No.- 15 Sokkia Automatic Level

Annexure – 8

Bench Mark Forms
BR – 1 CH – 67.075

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-1	2865795.879	375122.441	25° 54'19.2672"N	079° 45' 11.7080"E	108.097	8.222
	Pillar Established by : - New horizon surveys Date of Establishment – 01 September 2016					
	Station Description :-					
	Benchmark is located near Rerua. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 01" and BM No. can be seen on the face of the pillar.  					
Life of Station : 15Yrs	Datum: - WGS 84			**ZONE :44**		

BR – 02 CH – 58.227

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-2	2862709.130	380523.962	25° 52'40.5781"N	079° 48' 26.8210"E	108.661	10.389
	Pillar Established by : - New horizon surveys Date of Establishment – 01 September 2016					
	Station Description :-					
	Benchmark is located near Pathreta Mauja. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 02" and BM No. can be seen on the face of the pillar.  					
Life of Station : 15Yrs	Datum: - WGS 84			**ZONE :44**		

BR – 03 CH – 45.000

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-3	2864035.189	387317.011	25° 53'25.4709"N	079° 52' 30.5612"E	103.236	7.344
	Pillar Established by : - New horizon surveys Date of Establishment – 02 September 2016					
	Station Description :-					
	Benchmark is located near Beri. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 03" and BM No. can be seen on the face of the pillar.  					
Life of Station : 15Yrs		Datum: - WGS 84				**ZONE :44**

BR – 04 CH – 34.233

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-4	2865627.081	395758.193	25° 54'19.6310"N	079° 57' 33.3296"E	95.853	1.954

Pillar Established by : - New horizon surveys
Date of Establishment – 02 September 2016

Station Description :-

Benchmark is located near Para. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.
The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 04" and BM No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84		**ZONE :44**

BR – 05 CH – 25.853

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-5	2863701.359	401339.010	25° 53'18.4401"N	080° 00' 54.4114"E	98.778	7.378
	Pillar Established by : - New horizon surveys Date of Establishment – 03 September 2016					
	Station Description :-					
	Benchmark is located near Patara. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 05" and BM No. can be seen on the face of the pillar.  					
Life of Station : 15Yrs	Datum: - WGS 84			**ZONE :44**		

BR – 06 CH – 14.950

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-6	2868753.930	409872.789	25° 56'04.6602"N	080° 05' 59.8126"E	100.312	9.091

Pillar Established by : - New horizon surveys
Date of Establishment – 03 September 2016

Station Description :-

Benchmark is located near Sahjana. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.
The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 06" and BM No. can be seen on the face of the pillar.

Life of Station : 15Yrs	Datum: - WGS 84		**ZONE :44**

BR – 07 CH – 4.510

M Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-7	2867320.587	417936.002	25° 55'19.7904"N	080° 10' 49.9927"E	98.349	9.811

Pillar Established by : - New horizon surveys
Date of Establishment – 04 September 2016

Station Description :-

Benchmark is located near Rameni Kadera. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm.
The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 07" and BM No. can be seen on the face of the pillar.

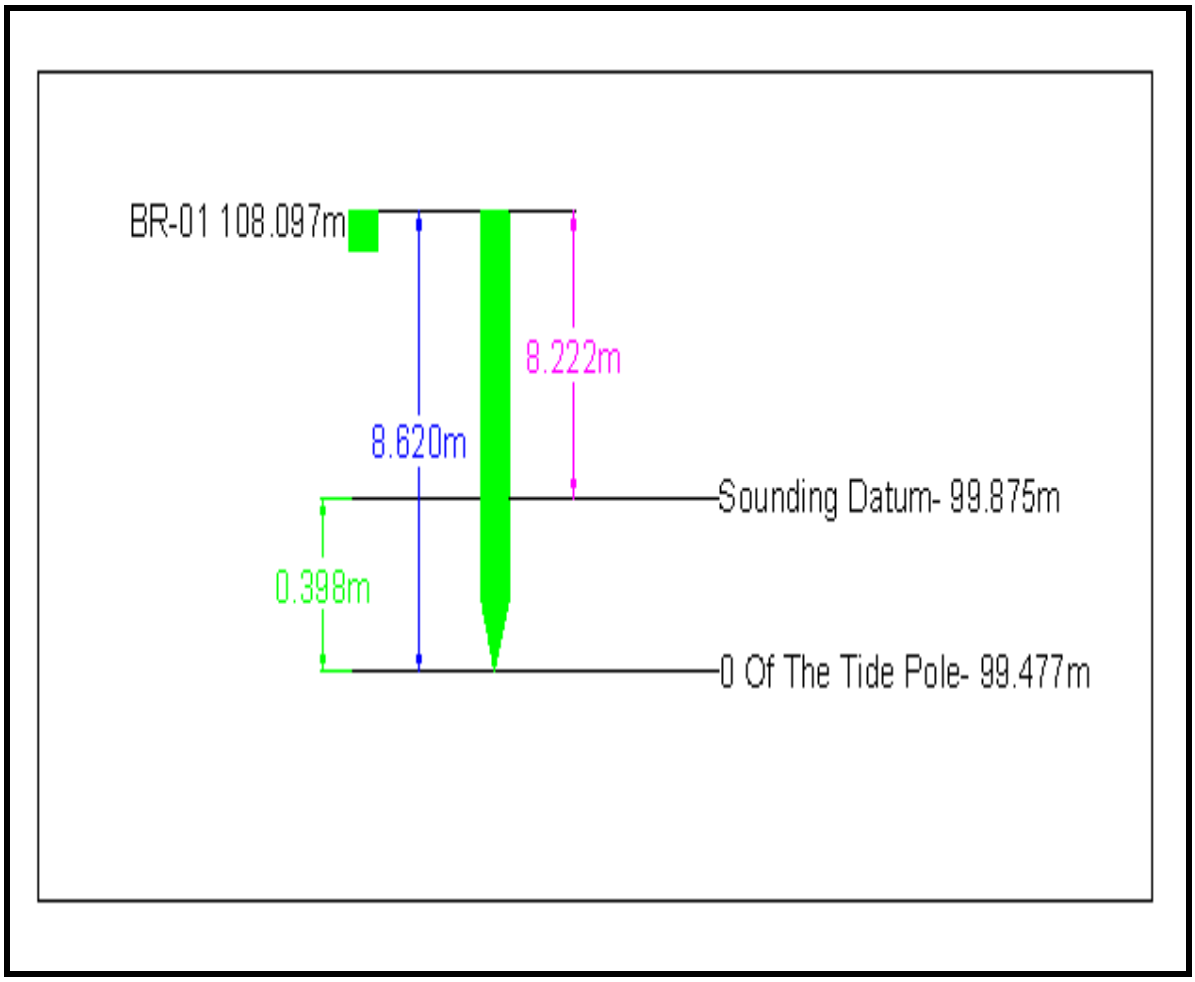
Life of Station : 15Yrs	Datum: - WGS 84		ZONE :44

BR – 08 CH – 1.150

BM Name	Northing(m)	Easting(m)	Latitude(N)	Longitude(E)	RL w.r.t. MSL(m)	Value w.r.t of SD (m)
BR-8	2866964.456	420814.314	25°55' 08.7892"N	080° 12' 33.5304"E	96.388	8.358
	Pillar Established by : - New horizon surveys Date of Establishment – 04 September 2016					
	Station Description :-					
	Benchmark is located near Hamirpur. The BM is denoted by a "." mark engraved on a plate. The plate is fixed on a 5cm diameter GI pipe. The GI pipe is cemented with construction pillar of 30cmX30cmX150cm. The pillar extends 60.cms above ground level. Inscription "IWAI", "BR 08" and BM No. can be seen on the face of the pillar. 					
Life of Station : 15Yrs	Datum: - WGS 84			**ZONE :44**		

Annexure – 9

Levelling calculations and Levelling Diagram



06.09.2016						
Leveling From B.M. 01 to Tide Pole						
						Bench Mark Value = 108.097
Back Site				**Forward Site**		
T	0.409			T	3.832	
C		0.341		C		3.7785
B	0.273			B	3.725	
T	0.237			T	3.83	
C		0.2135		C		3.79
B	0.19			B	3.75	
T	0.7			T	1.312	
C		0.6575		C		1.263
B	0.615			B	1.214	
Back Site Total		**1.212**		**Forward Site Total**		**8.8315**
Bench Mark Value		108.097		Tachystave kept at 1.0m at Tide Pole		1
add : Back Site Total		1.212		add : Forward Site Total		8.8315
		----------				----------
		109.309				9.8315
zero of the Tide Pole	=	109.309	-	9.8315		
	=	99.4775				
Water Level	=	99.4775	+	0.39		
	=	99.8675				

06.09.2016						
						Bench Mark Value = 108.661
Leveling From B.M. 02 to Tide Pole						
Back Site				**Forward Site**		
T	0.414			T	3.364	
C		0.2655		C		3.2795
B	0.117			B	3.195	
T	0.607			T	3.245	
C		0.552		C		3.1605
B	0.497			B	3.076	
T	0.562			T	3.794	
C		0.453		C		3.742
B	0.344			B	3.69	
T	0.292			T	1.408	
C		0.196		C		1.3225
B	0.1			B	1.237	
Back Site Total		**1.4665**		**Forward Site Total**		**11.5045**
Bench Mark Value		108.661		Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		1.4665		add : Forward Site Total		11.5045
		110.1275				12.7445
zero of the Tide Pole	=	110.1275	-	12.7445		
	=	97.383				
Water Level	=	97.383	+	0.5		
	=	97.883				

08.09.2016						
						Bench Mark Value = 103.236
Leveling From B.M. 03 to Tide Pole						
Back Site				**Forward Site**		
T	1.523			T	3.36	
C		1.2375		C		3.0245
B	0.952			B	2.689	
T	1.204			T	1.028	
C		0.9865		C		0.997
B	0.769			B	0.966	
T	0.154			T	3.481	
C		0.124		C		3.414
B	0.094			B	3.347	
T	0.117			T	2.095	
C		0.083		C		2.029
B	0.049			B	1.963	
T	1.345			T	1.544	
C		1.242		C		1.436
B	1.139			B	1.329	
T	1.555			T	1.362	
C		1.451		C		1.257
B	1.347			B	1.152	
Back Site Total		**5.124**		**Forward Site Total**		**12.157**
Bench Mark Value		103.236		Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		5.124		add : Forward Site Total		12.157
		108.36				13.3975
zero of the Tide Pole	=	108.36	-	13.3975		
	=	94.9625				
Water Level	=	94.9625	+	0.5		
	=	95.4625				

09.09.2016						
						Bench Mark Value = 95.853
Leveling From B.M. 04 to Tide Pole						
Back Site				**Forward Site**		
T	1.727			T	2.755	
C		1.6595		C		2.6775
B	1.592			B	2.6	
Back Site Total		**1.6595**		**Forward Site Total**		**2.6775**
Bench Mark Value		95.853		Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		1.6595		add : Forward Site Total		2.6775
		----------				----------
		97.5125				3.9175
zero of the Tide Pole	=	97.5125	-	3.9175		
	=	93.595				
Water Level	=	93.595	+	0.3		
	=	93.895				

10.09.2016						
						Bench Mark Value = 98.778
Leveling From B.M. 05 to Tide Pole						
Back Site				**Forward Site**		
T	0.306			T	3.391	
C		0.256		C		3.2905
B	0.206			B	3.19	
T	0.213			T	2.142	
C		0.1385		C		2.071
B	0.064			B	2	
Back Site Total		**0.3945**		**Forward Site Total**		**5.3615**
Bench Mark Value		98.778		Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		0.3945		add : Forward Site Total		5.3615
		----------				----------
		99.1725				6.6015
zero of the Tide Pole	=	99.1725	-	6.6015		
	=	92.571				
Water Level	=	92.571	+	0.5		
	=	93.071				

11.09.2016						
						Bench Mark Value = 100.312
Leveling From B.M. 06 to Tide Pole						
Back Site				**Forward Site**		
T	0.532			T	3.215	
C		0.4485		C		3.114
B	0.365			B	3.013	
T	0.664			T	2.559	
C		0.531		C		2.416
B	0.398			B	2.273	
T	0.534			T	3.081	
C		0.3725		C		2.962
B	0.211			B	2.843	
Back Site Total		**1.352**		**Forward Site Total**		**8.492**
Bench Mark Value		100.312		Tachystave kept at 1.240m at Tide Pole		1.24
add : Back Site Total		1.352		add : Forward Site Total		8.492
		----------				----------
		101.664				9.732
zero of the Tide Pole	=	101.664	-	9.732		
	=	91.932				
Water Level	=	91.932	+	0.6		
	=	92.532				

12.09.2016					
					Bench Mark Value = 98.349
Leveling From B.M. 07 to Tide Pole					
Back Site			**Forward Site**		
T	0.872		T	2.265	
C		0.737	C		2.0995
B	0.602		B	1.934	
T	0.519		T	3.055	
C		0.404	C		2.955
B	0.289		B	2.855	
T	0.736		T	2.107	
C		0.5955	C		1.969
B	0.455		B	1.831	
T	1.013		T	1.24	
C		0.9175	C		1.1885
B	0.822		B	1.137	
Back Site Total		**2.654**	**Forward Site Total**		**8.212**
Bench Mark Value		98.349	Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		2.654	add : Forward Site Total		8.212
		101.003			9.452
zero of the Tide Pole	=	101.003	9.452		
	=	91.551			
Water Level	=	91.551	0.6		
	=	92.151			

13.09.2016						
						Bench Mark Value = 96.388
Leveling From B.M. 08 to Tide Pole						
Back Site				**Forward Site**		
T	0.386			T	2.801	
C		0.309		C		2.709
B	0.232			B	2.617	
T	0.557			T	1.957	
C		0.4955		C		1.9045
B	0.434			B	1.852	
Back Site Total		**0.8045**		**Forward Site Total**		**4.6135**
Bench Mark Value		96.388		Tachystave kept at 1.24m at Tide Pole		1.24
add : Back Site Total		0.8045		add : Forward Site Total		4.6135
		----------				----------
		97.1925				5.8535
zero of the Tide Pole	=	97.1925	-	5.8535		
	=	91.339				
Water Level	=	91.339	+	0.5		
	=	91.839				

Annexure - 10

Soil Sample

Sl No.	Specific Gravity	Fine Gravel In % (20 mm to 4.75 mm)	Coarse Sand In % (4.75 mm to 2.00 mm)	Cu	Cc	Silt Size In % (0.075 mm to 0.002 mm)	Clay Size In % (<0.002 mm)
BR 01	2.65	4	70	127.778	15.459	19	7
BR 02	2.64	0	0	-	-	52	48
BR 03	2.66	0	0	-	-	56	44
BR 04	2.67	0	3	-	-	63	34
BR 05	2.66	0	1	-	-	58	41
BR 06	2.67	0	4	-	-	40	56
BR 07	2.66	5	16	-	-	25	54
BR 08	2.65	0	0	-	-	56	44

Annexure – 11

Water Samples

S.NO	pH	UNITS	TOTAL DEPTH (m)	SEDIMENT CONCENTRATION (ppm)
				AT MID-DEPTH
BR 01	7.03	1	2.2	110
BR 02	7.42	1	1.4	580
BR 03	6.99	1	1.7	157
BR 04	7.25	1	1.5	375
BR 05	7.36	1	3.7	876
BR 06	7.68	1	6.5	128
BR 07	7.72	1	3.6	657
BR 08	7.22	1	3.9	408

Annexure 12

Calibration Certificate

N.K.TRADING CO.

Scientific & survey instrument repairers & suppliers

Automatic Level, Dumpy Level, Tilting Level, Transite Theodolite; Micro; Optic Theodolite
Impoted Instrument Sokkia, Wild, Kern, Zeiss & Civil Lab Equipment

A-1, Om Shivsai C.H.S.,Near Fish Market,Vasantrao Naik Highway,Sion(E),Mumbai No.-400 022
Tel.:24013926 Mob.9821341462 E-mail: nkt1975@gmail.com

Ref: NKT/1215 DATE:01.03.2016

TEST REPORT

= AUTO LEVEL =

CLIENT	M/S NEW HORIZON SURVEYS
EQUIPMENT DETAILS	AUTO LEVEL
MAKE	TOPCON
TYPE	ATG6
SR NO	8F3898
DATE OF CALIBRATION	01.03.2016
VALIDITY	06 month's time
DUE DATE OF CALIBRATION	01.08.2016

THIS IS TO CERTIFY THAT NIL WAS CHECKED BY AS ORDER

1) AUTO LEVEL WAS KEPT ON ADJUSTABALE STAND.

2) READING CHECKED BY FOCUSSING TELESCOPE ON COLLIMATOR "A" SIDE.

3) INSTRUMENT ROTATED 180 DEGREES.

4) READING CHECKED BY FOCUSSING ON COLLIMATOR "B" SIDE.

5) ERROR FOUND NIL –HENCE INSTRUMENT IN PERFECT WORKING CONDITION.

N.K. TRADING CO. MUMBAI-22 Tel: 24093926 Mob: 9821341462

N.K. TRADING CO.

Test

PROPRIETOR

Standard Product Certificate Report

S/N: 1992

1400 RT. 28A, CATAUMET, MA 02534-0315

Date : 11.12.2015

CERTIFICATE OF COMPLIANCE

This is to certify that the subject system has been electrically and mechanically tested and inspected in compliance to applicable drawings.

Subject system was produced in accordance with Quality procedures and practices at FSI.

PART #	Description
2ACM-CBP-S	2DACM 200DBAR

- ☒ Final Acceptance Test
- ☒ Compass Calibration
- ☒ Tilt Calibration
- ☒ Velocity Calibration
- ☒ Sea Temperature Calibration
- ☒ Certification of Instrument Functioning

FALMOUTH SCIENTIFIC INC.

QUALITY ASSURANCE — 11.12.2015 DATE

Annexure - 13

Field Photographs

Fig No. 16 Yamuna Betwa Sangam CH 0.750 km

Fig No. 17 Right side steep cut CH 1.000 to 2.000 km

Fig No. 18 Steep cut Right side CH 2.000 to 2.700 km

Fig No. 19 High Tension CH 7.530 km

Fig No. 20 Hamirpur Betwa Bridge CH 8.245 km

Fig No. 21 Sandchur CH 9.000 km

Fig No. 22 Pump House CH 25.000 km

Fig No. 23 Sandchur CH 23.600 km

Fig No. 24 Sandchur CH 26.720 km

Fig No. 25 Steep cut Right side CH 27.000 km

Fig No. 26 Sandchur CH 27.900 km

Fig No. 27 Sandchur CH 40.700 km

Fig No. 28 Steep cut Right side CH 42.700 km

Fig No. 29 Steep cut Right side CH 46.500 to 48.000 km

Fig No. 30 Steep cut Right side CH 48.000 km

Fig No. 31 Steep cut Right side CH 49.000 km

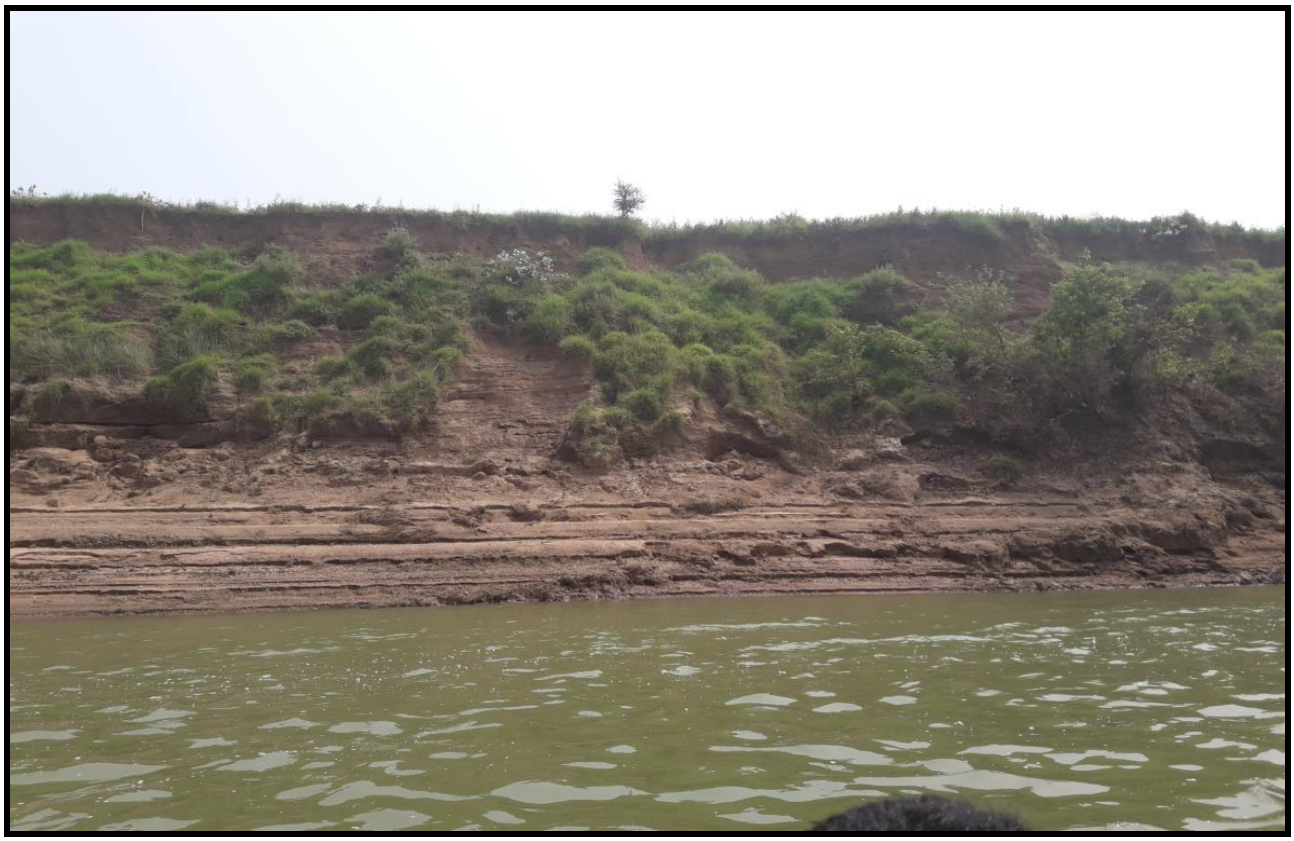


Fig No. 32 Steep cut Left side CH 56.000 km

Fig No. 33 Temple Left side CH 60.220 km

Fig No. 34 Jalalpur Bridge CH 59.282 km

Fig No. 35 Pump House Left Side CH 65.000 km

Annexure – 14

Survey Chart Scheming Index and chart details:-

Sl. No.	Chart No.	Chainage (from ..... km to .... km)	Location (from .... to .....)	Scale	Size of the Chart
01	NHS/IWAI/BR/2016-17/01	0.000 to 3.000	Yamuna Confi. To Hamirpur	1:5000	A0
02	NHS/IWAI/BR/2016-17/01	2.000 to 8.000	Hamirpur to Rameni Kadera	1:5000	A0
03	NHS/IWAI/BR/2016-17/01	7.000 to 13.000	Rameni Kadera to Sahjana	1:5000	A0
04	NHS/IWAI/BR/2016-17/01	13.000 to 17.000	Sahjana to Kundaura	1:5000	A0
05	NHS/IWAI/BR/2016-17/01	17.000 to 23.000	Kundaura to Patara Danda	1:5000	A0
06	NHS/IWAI/BR/2016-17/01	23.000 to 29.000	Patara Danda to Mora Kander	1:5000	A0
07	NHS/IWAI/BR/2016-17/01	29.000 to 37.000	Mora Kander to Bajehta Danda	1:5000	A0
08	NHS/IWAI/BR/2016-17/01	37.000 to 44.000	Bajehta Danda to Kakrau	1:5000	A0
09	NHS/IWAI/BR/2016-17/01	44.000 to 49.000	Kakrau to Bhedi Danda	1:5000	A0
10	NHS/IWAI/BR/2016-17/01	49.000 to 57.000	Bhedi Danda to Pathreta Mauja	1:5000	A0
11	NHS/IWAI/BR/2016-17/01	57.000 to 62.000	Pathreta Mauja to Kana Khera	1:5000	A0
12	NHS/IWAI/BR/2016-17/01	62.000 to 67.050	Kana Khera to Rirwa Buzurg Dariya	1:5000	A0
13	NHS/IWAI/BR/2016-17/01	0.000 to 67.050	Yamuna Confi. to Rirwa Buzurg Dariya	1:50000	A0