

DATA BOOK

3. RIVER SURVEY: LAKHANDEI RIVER

His Majesty's Government of Nepal
Department of Irrigation (DOI)
Japan International Co-operation Agency (JICA)

FINAL REPORT
ON
RIVER SURVEY
(LAKHANDEI RIVER)
FOR
THE STUDY ON FLOOD MITIGATION PLAN
FOR
SELECTED RIVERS IN THE TERAI PLAIN
IN
THE KINGDOM OF NEPAL

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**Survey Report
On
Lakhandei River
For
The Study on Flood Mitigation Plan for Selected Rivers in the Terai in the
Kingdom of Nepal**

1. BACKGROUND

Government of Nepal had requested the Government of Japan for assistance in undertaking flood control works in a few selected rivers. Accordingly JICA Study Team had initiated its work.

A contract was signed between JICA Study Team and TAEC Consult P. Ltd. on the day of 29th April 1998 to complete the following work of Lakhandei River, which is one of the selected rivers for the implementation of the programme.

50 km of river survey which includes:

- Longitudinal Survey (50 km)
- Cross-section Survey (every 1 km)
- Flood Marks Location Survey
- Establishment of Permanent Section Stakes.

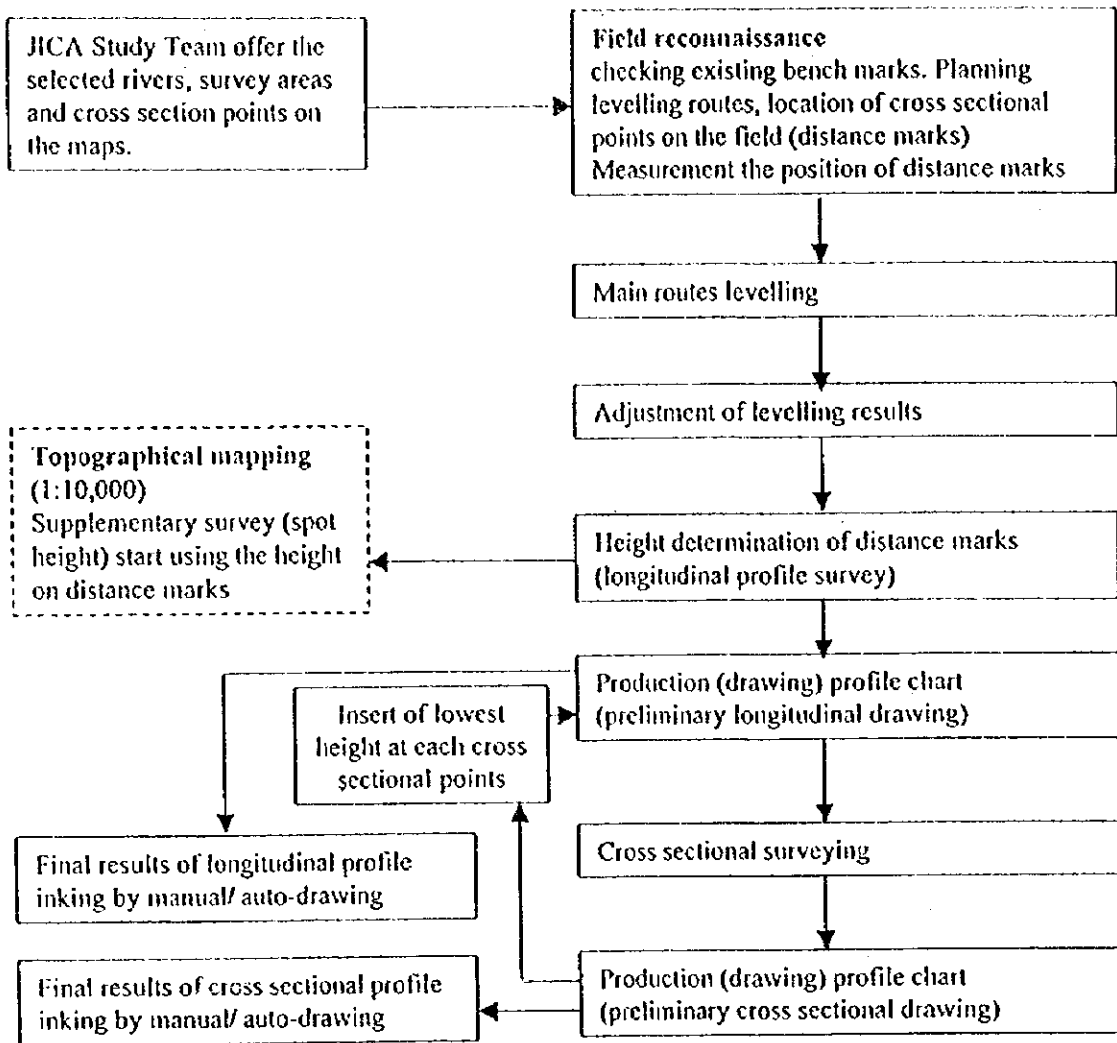
Planning -- Preliminary study:

- Collection of National Bench Marks/ Ground Control Points which are the National Datum
- Collection of 1:25,000 scale topographic maps covering the project area
- Planning the traverse route for location survey
- Planning the location of cross-section points in the topo-maps.

The river Lakhandei passes East West highway at Hariun and is flowing approximately North – South direction in the middle of Sarlahi district. Original 1:25,000 scale topo-map had been prepared by HMG, Survey Department in co-operation with FM-International of Finland during 1993 to 1995. This is taken as the base for the preparation of 1:10,000 scale topo-map of the project area

Preliminary study was carried out from 15th to 25th April 1998 i.e. before the agreement was signed. Preparation of 1:10,000 topo-map out of existing 1:25,000 scale topographic map was planned and a request letter from DOI had been forwarded to Topographic Survey Branch. The process camera available at the Topographic Survey Branch was out of order and need maintenance at the time of request and so the reproduced 1:10,000 scale topo-map has been made available to us only after 3 weeks of request.

Flow Chart of the Process Used for Longitudinal and Cross Sectional Survey



Levelling bench marks (national datum) necessary for longitudinal survey for the Lakhndei River area were found to be as follows:

- Alignment No. 104 BM No. 83, 84 and 85, Lakhndei Bridge
- Alignment No. 205 BM No. 50, 51 and 52
- Alignment No. 320 BM No. 09, 10 and 11

These bench marks description and height data were made available from the Geodetic Survey Branch after necessary revenue payment.

Ground control points necessary for location survey of section stakes and flood marks are as below:

- Grid Sheet No. 169 Trig. Point No. 113, 114, 115, 119, 131, 132, 10, 13, 12, 11, 133
- Grid Sheet No. 114 Trig. Point No. 37 & 38

The data of these triangular points were made available from Geodetic Survey Branch after the payment of revenue.

Map Sheets No. 2785 -- 15 C, 15 D, 2685 -- 03 A, 03C, 02B & 02D were available on direct purchase which have been used for marking the position of section stakes on the maps, planning round trip levelling routes on the maps.

Area to be covered is marked on the map and given it to process camera section for the production of 1:10,000 map.

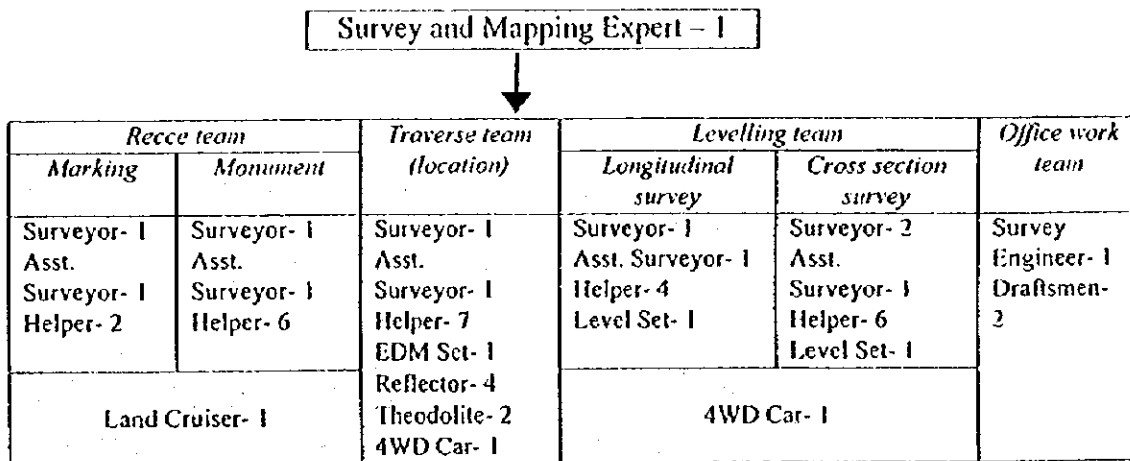
One member of survey team started to Sarlahi on 30th April 1998, to make survey marks (concrete mark) Based on specifications and available datas, the detailed plan was formulated. The formulation included, the method of location survey locating section stakes for cross sections, marking of the area to be surveyed on the base map etc.

A planning chart, with all the positions (approx.) of section stakes to be established and existing control points as well as bench marks had been prepared before field mobilisation.

2. RECONNAISSANCE SURVEY

The entire project area i.e. 50 km of Lakhandei river from the Nepal – India boudary was visited. The final positions of cross section points were fixed in the field. Existing control points (Trig. Points) and bench marks were checked and made ready for survey work. A few of them were found missing which we planned to use for our purpose. Levelling and location survey routes were thus finalised.

3. ORGANISATION



This whole team left Kathmandu on 1st May 1998 to Sarlahi project area and returned back after completion of the assigned task on 31 May 1998.

4. RECONNAISSANCE TEAM

This team had two senior surveyor and their assistants, one walked along the river side with base map and did enquiry regarding the flood level with local people. He also mark the past flood level and positions of every cross section points. Then after the next one come with concrete pillars of size 10cmx10cmx100cm to monument the cross section points. All the cross section points thus established were labelled by permanent enamel paint. Left side of the river stakes were labelled as A and that of the right side were labelled as B (example – cross section no. 10- has 10A and 10B points fixed) A total of 52 sections i.e. 104 concrete pillars have been monumented.

Section 17 and 18 have one each wooded peg extra monumented due to the shifting of river every year and local people have dispute regarding the river course. There is no permanent river line. Area from section-0 to section-18 is all flat area and there is no guarantee of the river flow line. During flood time all the area is covered by floodwater.

5. TRAVERSE TEAM

This team had 2 surveyors and their assistants who carried out location survey. Traverse was started from the National datum points no:- Grid sheet 114-37,38 and Grid sheet 169-40 which are located on the southern end of project area and closed on another points Grid sheet no: 169-115, 114, 113 which are located near by the east west highway inside the project area.

Traverse was carried out to fix the positions of the cross-section points and flood marks. There are two closed loops of traverse-one north of highway and another south of highway. The loop north of highway started from point no. 113,114,115 and closed back to the same points and the loop south of highway started from no. 37, 38 & 40 and closed on the points 113, 114 & 115.

Traverse computation has been carried out by using 3rd order accuracy of national standard of Geodetic Survey of Nepal and the accuracy of the traverse survey was found 1:40,000 scale. Another way of accuracy check was carried out by observing north star at the station no. 115. Which gave precise bearing accuracy of the traverse survey. These details are available in the field notes.

Thus established 104 section stakes are co-ordinated under national grid of 87E central meridian. List of co-ordinates is attached with this report.

Wild T-2 Theodolite and electronic distance meter was used to carry out traverse to fix the position of section stakes and flood works.

6. LEVELLING

6.1 Levelling Team

This team consisted of two parts of work: one is longitudinal levelling and the other is cross sectional levelling. Levelling was started from Bench mark No 320-10 and 320-09 and closed on Bench mark no. 104-084. Again north of highway another round trip levelling has been carried out starting and ending at the Bench mark no. 104-084. During longitudinal levelling, section stakes established by Recce team has been levelled using a Auto Level instrument. Ground height and the stake height both are available in the list of stakes. During longitudinal levelling survey, flood marks also were levelled and the height is given in the list. Accuracy of the first loop (BM-09, 10 to BM 104-084) is 4cm in 40 km of level distance and the second loop (BM 104-084 to 104-084 Back) is 1.2 cm is 20 km level distance. Which is well inside the permissible error.

Number of drawings prepared are 5 (five).

6.2 Cross Sectional Levelling

Cross section survey has been carried out by using AUTO LEVEL, steel tape and electronic distance measuring instrument wherever possible. A total of 56 sections are surveyed including bridge site and canal crossing site. Elevation of the stakes is taken as the bench mark level. Cross sections which are wider than 500 m are surveyed using Wild T-2 Theodolite along with electronic distances. Accuracy was checked by controlling the distance between stakes located to the left and the right both side of the river. Accuracy was found to be 1:750 to 1:1,000 in horizontal distance and 0.5 cm to 5 cm in vertical distance. Number of drawings prepared are 7 (seven).

7. OFFICE WORK

Longitudinal profile data have been taken from the levelling survey ground height at the stakes positions on either side of the river and flood marks. Lower river bed level was measured during cross section survey. Distance has been calculated on the basis of new maps prepared during updating. These data have been compiled and longitudinal section profiles are plotted and traced by permanent ink. Same as all the cross section data are used to plot cross section profile and traced by using permanent ink. All these longitudinal and cross section profile data have been entered in a Diskette (MS Excel) together with the section stake data.

8. CONCLUDING REMARKS

- The X, Y co-ordinates of the section stakes and flood marks have been based on national grid of 87E as the central meridian. List of co-ordinates is annexed as Appendix – 1.
- Height of the section stakes and flood marks are based on national height datum which is based on Indian Sea.
- Data for longitudinal profile is compiled from longitudinal levelling, cross section survey and from the map prepared during the implementation of this project. Data are annexed as Appendix – 2.
- Data for cross section profile are annexed as Appendix – 3.
- A diskette is ready containing all the data produced during river survey.
- Accuracy for round trip levelling has been found to be precise enough as compared to the specifications. Misclosure from BM 320 – 09 and 10 to BM 104 – 084, a level distance of about 40 km, is found 4 cm which is well within the permissible error.
- Accuracy for cross sections is found good enough because all sections have a misclosures variable only in MM. All cross sections are started levelling from left bank section stakes and end at the right bank section stakes which are levelled and given height during longitudinal survey. Planimetric accuracy is 1/1,000.
- Accuracy for the location survey is found 1/40,000 which is good enough for this project specification.
- Ground control points and level bench marks used for the river survey (Lakhandei river) are attached as Appendix – 4.

List of Personnel involved in River Survey

1. Expert – Survey & Mapping	Mr. Toya Nath Baral
2. Survey Engineer	Mr. P. N. Acharya
3. Civil Engineer	Mr. B. Ghimire
4. Senior Surveyor	Mr. B. K. Khadka
5. Senior Surveyor	Mr. M. K. Gurung
6. Senior Surveyor	Mr. D. P. Prasai
7. Senior Surveyor	Mr. S. Chalise
8. Asst. Surveyor	Mr. R. P. Lamichhane
9. Asst. Surveyor	Mr. I. Pyakurel
10. Asst. Surveyor	Mr. Siju Shrestha
11. Asst. Surveyor	Mr. B. K. Shrestha
12. Asst. Surveyor	Mr. R. Karkee
13. Draftsman	Mr. H. Shrestha
14. Draftsman	Mr. S. Maske
15. Office Assistance	Mr. G. Bhattarai
16. Office Assistance	Mr. Bhairab K. C.

APPENDICES

List of Section Stakes and Their Coordinates
(By Traverse and Levelling)

Appendix - 1

S. No.	S/S No.	Eastings	Northings	Level	
				Stake	Ground
1	0 A	351,284.13	2,967,330.93	76.378	75.7
2	0 B	351,209.84	2,967,326.38	76.221	75.7
3	1 A	351,337.24	2,967,954.40	77.028	76.5
4	1 B	351,293.49	2,967,978.81	76.846	76.6
5	2 A	351,517.70	2,968,488.20	77.941	77.4
6	2 B	351,480.22	2,968,514.81	77.522	77.2
7	3 A	351,356.25	2,969,329.86	78.413	77.7
8	3 B	351,359.38	2,969,266.60	78.195	77.5
9	4 A	351,214.65	2,969,558.18	78.657	78.1
10	4 B	351,176.71	2,969,593.14	78.457	78.3
11	5 A	350,798.43	2,969,359.20	78.693	78.2
12	5 B	350,814.00	2,969,330.81	78.817	78.3
13	6 A	350,549.66	2,970,141.89	79.373	78.8
14	6 B	350,451.81	2,970,138.66	79.702	79.2
15	7 A	350,777.80	2,971,007.60	80.583	79.9
16	7 B	350,728.57	2,970,990.27	79.945	79.6
17	8 A	350,802.99	2,971,917.45	80.604	80.2
18	8 B	350,761.40	2,971,901.78	80.627	80.4
19	9 A	350,459.86	2,972,415.26	81.511	81.2
20	9 B	350,385.70	2,972,400.60	81.345	81.1
21	10 A	350,473.45	2,973,308.30	82.071	81.8
22	10 B	350,441.79	2,973,359.16	82.221	82
23	11 A	350,732.80	2,974,217.23	82.955	82.7
24	11 B	350,661.11	2,974,210.34	83.322	83.1
25	12 A	350,487.08	2,974,846.21	83.308	83.1
26	12 B	350,434.18	2,974,795.22	83.364	83.2
27	13 A	350,482.38	2,975,739.72	84.412	84.2
28	13 B	350,388.37	2,975,762.54	83.866	83.6
29	14 A	350,930.62	2,976,080.23	84.816	84.4
30	14 B	350,879.57	2,976,066.67	84.698	84.5
31	15 A	351,443.21	2,976,306.82	85.124	85
32	15 B	351,369.20	2,976,343.52	85.547	85.2
33	16 A	351,763.23	2,977,286.14	86.185	86.1
34	16 B	351,701.21	2,977,297.88	86.355	86.4
35	17 A	351,366.18	2,978,064.85	87.44	87.2
	17	351,153.72	2,978,096.98	87.693	87.693
36	17 B	350,975.90	2,978,176.10	87.647	87.4
37	18 A	351,374.00	2,978,877.96	88.18	88.2
	18	351,153.89	2,978,923.74	88.826	88.826
38	18 B	350,991.09	2,978,959.02	89.073	88.8
39	19 A	351,259.88	2,979,587.99	89.473	89.2
40	19 B	351,178.80	2,979,611.22	89.701	89.4
41	20 A	351,350.96	2,980,533.10	90.803	90.4
42	20 B	351,114.03	2,980,577.95	90.518	90.3

List of Section Stakes and Their Coordinates
(By Traverse and Levelling)

S. No.	S/S No.	Eastings	Northings	Level	
				Stake	Ground
43	21 A	351,357.70	2,981,413.50	91.924	91.6
44	21 B	350,748.85	2,981,613.03	92.726	92.2
45	22 A	351,414.75	2,982,406.18	94.643	94.4
46	22 B	351,007.73	2,982,435.07	93.887	93.5
47	23 A	351,732.07	2,983,319.60	95.531	95.3
48	23 B	351,142.40	2,983,428.52	95.571	95.4
49	24 A	352,098.65	2,984,106.34	97.336	97.1
50	24 B	351,799.34	2,984,315.66	98.819	98.6
51	25 A	352,486.03	2,984,851.62	98.925	98.7
52	25 B	352,161.10	2,984,999.72	99.488	99.2
53	26 A	352,889.94	2,985,719.25	100.119	99.8
54	26 B	352,565.07	2,985,869.98	101.433	101.2
55	27 A	353,329.94	2,986,293.65	102.335	101.6
56	27 B	353,050.94	2,986,709.71	102.259	102.4
57	28 A	354,362.86	2,986,887.35	106.517	106.3
58	28 B	353,827.89	2,987,125.48	103.76	103.5
59	29 A	354,868.56	2,987,390.53	107.833	107.6
60	29 B	354,338.87	2,987,852.84	105.473	105.3
61	30 A	355,349.47	2,987,809.12	107.351	107.1
62	30 B	355,078.86	2,988,232.40	107.795	107.2
63	31 A	356,018.75	2,988,508.45	111.02	110.7
	31 B	355,822.87	2,988,877.80	109.794	109.5
64	32 A	356,719.17	2,989,188.40	111.808	111.6
	32 B	356,327.28	2,989,735.00	111.288	111.1
65	33 A	357,356.65	2,989,771.71	115.915	115.6
66	33 B	357,136.58	2,990,085.29	113.773	113.6
67	34 A	358,101.96	2,990,418.42	116.135	115.9
68	34 B	357,470.29	2,990,632.50	116.811	116.5
69	35 A	358,672.96	2,991,215.13	118.378	118.1
70	35 B	358,014.68	2,991,582.28	119.206	118.9
71	36 A	359,243.45	2,992,082.52	121.097	120.9
72	36 B	358,757.93	2,992,225.99	121.305	121.1
73	37 A	359,114.65	2,993,010.44	125.851	125.6
74	37 B	358,432.59	2,992,857.65	123.53	123.2
75	38 A	358,395.56	2,993,960.32	126.71	126.5
76	38 B	357,913.42	2,993,456.05	126.941	126.6
77	39 A	358,137.95	2,994,399.24	128.441	128.2
78	39 B	357,529.43	2,994,619.04	128.464	128.2
79	40 A	358,590.18	2,995,206.42	132.043	131.8
80	40 B	357,891.17	2,995,503.07	131.637	131.4
81	41 A	359,053.66	2,995,629.30	135.145	134.9
82	41 B	358,886.08	2,996,269.32	136.883	136.5
83	42 A	359,956.67	2,996,076.90	140.339	140.1
84	42 B	359,891.07	2,996,429.75	141.412	141.2

**List of Section Stakes and Their Coordinates
(By Traverse and Levelling)**

S. No.	S/S No.	Eastings	Northings	Level	
				Stake	Ground
85	43 A	360,966.24	2,996,401.40	143.717	143.4
86	43 B	360,829.23	2,996,786.55	146.563	146.3
87	44 A	361,766.09	2,996,690.85	149.866	149.7
88	44 B	361,789.44	2,997,112.76	147.693	147.5
89	45 A	362,637.18	2,996,333.65	153.109	152.8
90	45 B	362,781.01	2,997,125.34	153.694	153.4
91	46 A	363,735.42	2,996,653.31	158.398	158.1
92	46 B	363,703.51	2,997,159.03	158.431	158.2
93	47 A	364,739.54	2,996,976.16	162.35	162.2
94	47 B	364,458.48	2,997,648.32	165.014	164.8
95	48 A	365,585.16	2,997,198.96	166.559	166.4
96	48 B	365,290.59	2,998,184.96	169.389	169.2
97	49 A	366,541.54	2,997,975.40	174.008	173.8
98	49 B	365,850.90	2,998,382.04	171.692	171.5
99	50 A	367,102.69	2,998,896.14	180.322	180.1
100	50 B	366,511.25	2,999,148.07	178.341	178.1
101	51 A	367,232.48	2,999,924.82	190.508	190.3
102	51 B	366,979.50	2,999,913.39	185.532	185.3
103	52 A	366,743.66	3,000,337.12	189.019	188.8
104	52 B	366,685.98	3,000,229.99	201.819	201.6

Note:

A = Left Bank

B = Right Bank

Level are taken from round trip levelling and Eastings and Northing are measured using Electronic Distance Measuring Equipment and 1" Theodolite.

Data for Longitudinal Profile (Round Trip Levelling)
Lakhandel River

Appendix - 2
1/1

No. of Cross Section	Right Bank G.H. (m)	Left Bank G.H. (m)	Lowest R. Bed Level G.H. (m)	Single Distance (m)	Distance from R. Mouth (m)	Past flood water level	Remarks
Section - 0	75.70	75.70	74.40	0	0	75.80	
Section - 1	76.60	76.50	75.20	820.00	820.00	76.70	
Section - 2	77.20	77.40	75.70	700.00	1,520.00	77.40	
Section - 3	77.50	77.70	76.40	920.00	2,440.00	78.00	
Section - 4	78.30	78.10	76.70	610.00	3,050.00	78.90	
Section - 5	78.30	78.20	77.60	580.00	3,630.00	79.50	
Section - 6	79.20	78.80	78.40	930.00	4,560.00	79.80	
Section - 7	79.60	79.90	79.20	980.00	5,540.00	80.50	
Section - 8	80.40	80.20	79.60	970.00	6,510.00	81.20	
Section - 9	81.10	81.20	80.20	790.00	7,300.00	81.60	Phulparasi (Hulaki R.
Section - (9+360)	86.60	86.60	80.20	360.00	7,660.00	82.00	Bridge
Section - 10	82.00	81.80	80.50	610.00	8,270.00	82.20	
Section - 11	83.10	82.70	81.20	1,020.00	9,290.00	82.50	
Section - 12	83.20	83.10	81.60	950.00	10,240.00	83.00	
Section - 13	83.60	84.20	82.30	960.00	11,200.00	84.00	
Section - 14	84.50	84.40	82.70	910.00	12,110.00	84.20	
Section - 15	85.20	85.00	83.30	980.00	13,090.00	85.00	
Section - 16	86.40	86.10	85.00	1,050.00	14,140.00	87.00	
Section - 17	87.40	87.20	86.60	1,260.00	15,400.00	87.50	
Section - 18	88.80	88.20	87.60	920.00	16,320.00	88.50	
Section - 19	89.40	89.20	88.20	770.00	17,090.00	89.40	
Section - 20	90.30	90.40	89.10	950.00	18,040.00	90.30	
Section - 21	92.20	91.60	90.70	1,470.00	19,510.00	92.40	
Section - 22	93.50	94.40	92.10	990.00	20,500.00	93.60	
Section - 23	95.40	95.30	93.90	1,010.00	21,510.00	95.50	
Section - 24	98.60	97.10	95.60	1,050.00	22,560.00	97.10	
Section - 25	99.20	98.70	97.20	850.00	23,410.00	98.70	
Section - 26	101.20	99.80	98.70	980.00	24,390.00	100.20	
Section - 27	102.40	101.60	100.20	860.00	25,250.00	101.70	
Section - 28	103.50	106.30	102.41	1,230.00	26,480.00	103.50	
Section - 29	105.30	107.60	104.10	1,000.00	27,480.00	105.70	
Section - 30	107.20	107.10	105.90	870.00	28,350.00	107.90	
Section - 31	109.50	110.70	107.20	950.00	29,300.00	110.30	
Section - 32	111.10	111.60	109.50	1,120.00	30,420.00	110.80	
Section - 33	113.60	115.60	111.60	880.00	31,300.00	115.40	
Section - 34	116.50	115.90	114.00	1,010.00	32,310.00	115.60	
Section - 35	118.90	118.10	116.60	1,050.00	33,360.00	118.50	
Section - 36	121.10	120.90	119.10	1,180.00	34,540.00	121.20	
Section - 37	123.20	125.60	121.20	930.00	35,470.00	123.20	
Section - (37+480)	126.30	126.20	122.20	480.00	35,950.00	125.20	Canal crossing
Section - 38	126.60	126.50	124.00	600.00	36,550.00	126.40	
Section - 39	128.20	128.20	127.10	860.00	37,410.00	128.60	
Section - 40	131.40	131.80	130.10	960.00	38,370.00	131.60	
Section - 41	136.50	134.90	133.50	1,040.00	39,410.00	135.10	
Section - (41+870)	142.00	142.00	137.40	870.00	40,280.00	139.50	Bridge
Section - 42	141.20	140.10	137.40	150.00	40,430.00	139.30	
Section - 43	146.30	143.40	141.70	1,070.00	41,500.00	143.20	
Section - 44	147.50	149.70	145.20	950.00	42,450.00	146.70	
Section - 45	153.40	152.80	150.00	950.00	43,400.00	151.50	
Section - 46	158.20	158.10	155.00	1,130.00	44,530.00	156.50	
Section - 47	164.80	162.20	160.09	980.00	45,510.00	161.60	
Section - 48	169.20	166.40	164.40	980.00	46,490.00	166.50	
Section - 49	171.50	173.80	170.50	900.00	47,390.00	171.60	
Section - 50	178.10	180.10	176.80	1,100.00	48,490.00	178.00	
Section - 51	185.30	190.30	182.70	960.00	49,450.00	184.00	
Section - 52	201.60	188.80	186.20	550.00	50,000.00	188.50	

Coordinates of Past Flood Level Position of Lakhandei River

Stake No.	Easting	Northing	Remarks
0	349,650.0	2,967,290.0	Road, south of Simara Village
1	349,920.0	2,968,060.0	Road, south of Simara Village
2, 3, 4, 5	349,200.0	2,969,160.0	Road, north of Simara Village
6	349,190.0	2,970,150.0	Road, south of Batraul Village
7	349,280.0	2,971,160.0	Road, north of Batraul Village
8, 9	349,630.0	2,972,360.0	Road, south of Phulparasi Village
10	348,430.0	2,973,140.0	Canal di, west of Laxmipur Village
11, 12	348,580.0	2,974,740.0	Canal di, north of Madhopur Village
13, 14	348,890.0	2,976,280.0	Road, S/W of Beihi Village
15	351,890.0	2,975,970.0	Road, east of Sundarpur Village
16	350,160.0	2,977,250.0	Road, east of Bethi Village
17	350,330.0	2,978,280.0	Road, east of Bethi Station
18	350,600.0	2,978,820.0	Road, east of Bethi Police Station
19	351,150.0	2,979,520.0	River bank, Lakhandei River: Sivanagar
20	351,060.0	2,980,410.0	Road, NW of Sivanagar Village
21	350,150.0	2,981,810.0	Road, east of Rampur Paterwa
22	351,040.0	2,982,370.0	River di, Lakhandei River
23	351,920.0	2,983,360.0	Road, Baheriya Village
24	352,100.0	2,984,170.0	River di, Lakhandei River
25	352,480.0	2,984,780.0	River di, Lakhandei River
26	352,860.0	2,985,720.0	River di, Lakhandei River
27	353,330.0	2,986,340.0	River di, Lakhandei River
28	353,690.0	2,987,290.0	Road, east of Gangapur Village
29	354,530.0	2,988,050.0	Road, east of Musahari Tole
30	355,370.0	2,987,760.0	Road, north of Pidari Village
31	355,510.0	2,989,080.0	Road, forest boundary
32	356,740.0	2,989,260.0	River di, Lakhandei River
33	357,040.0	2,990,380.0	Road, Lakha Tole
34	357,210.0	2,990,720.0	Road, Sakhuwamauje Village
35	357,840.0	2,991,480.0	Road, Sano Jagatpur Village
36	359,320.0	2,992,180.0	Road, Tallo Julpani Village
37	358,380.0	2,992,890.0	Track, south of Bagmati Canal
38	357,780.0	2,993,410.0	Road, Chhyana Tole
39	358,320.0	2,994,520.0	Road, west of Gauritole
40	357,960.0	2,995,590.0	River di, Lakhandei River
41	359,040.0	2,995,680.0	River di, Lakhandei River
42	359,950.0	2,996,080.0	Dike, Lakhandei River
43	360,780.0	2,996,120.0	Road, north of Nawalpur
44	351,840.0	2,997,060.0	River di, Lakhandei River
45	362,810.0	2,997,060.0	River di, Lakhandei River
46	363,800.0	2,997,130.0	River di, Lakhandei River
47	364,790.0	2,997,040.0	River di, Lakhandei River
48	365,110.0	2,998,050.0	River di, Lakhandei River
49	366,060.0	2,998,440.0	River di, Lakhandei River
50	366,180.0	2,999,240.0	Road, east of Jiyaghar
51	366,340.0	2,999,780.0	Kulo di, Syanbadanda Gaun
52	366,770.0	3,000,310.0	River di, Pathrkot

Data for Cross - Section
Lakhandei River

Appendix - 3

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 0			
1	0.00	75.77	
2	20.00	75.82	
3	29.50	75.78	Left Bank
4	37.10	75.17	
5	40.60	74.45	Lowest Bed Level
6	42.40	74.70	
7	45.10	75.91	
8	50.00	75.84	Right Bank
9	74.90	75.66	
Section No. - 1			
1	0.00	76.55	
2	19.60	76.63	Left Bank
3	22.80	75.66	
4	23.60	75.19	Lowest Bed Level
5	26.20	75.23	
6	27.90	75.73	
7	35.80	75.73	
8	43.10	76.60	Right Bank
9	50.00	76.60	
Section No. - 2			
1	0.00	77.39	
2	11.20	77.38	Left Bank
3	13.90	76.25	
4	16.10	75.71	Lowest Bed Level
5	17.90	75.81	
6	18.90	76.75	
7	31.90	76.45	
8	50.00	77.25	Right Bank
9	56.00	77.33	
10	70.00	77.32	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 3			
1	0.00	77.76	
2	8.20	77.43	
3	20.20	77.12	Left Bank
4	22.70	76.59	
5	28.90	76.40	Lowest Bed Level
6	29.30	76.80	
7	36.50	76.70	
8	48.70	77.10	
9	50.00	77.78	Right Bank
10	63.56	77.76	
11	64.00	78.20	
12	70.00	77.56	
Section No. - 4			
1	0.00	78.14	
2	30.00	78.45	Left Bank
3	32.30	77.66	
4	53.10	77.44	
5	60.00	77.37	
6	62.50	76.89	
7	63.80	76.72	Lowest Bed Level
8	65.90	77.67	Right Bank
9	80.00	77.89	
10	80.00	78.29	
11	81.90	78.46	
12	95.00	78.04	
Section No. - 5			
1	0.00	78.29	
2	30.00	78.18	
3	30.00	78.57	Left Bank
4	36.90	78.11	
5	45.30	78.03	
6	47.30	77.67	Lowest Bed Level
7	51.00	77.72	
8	52.00	78.46	Right Bank
9	61.00	78.34	
10	62.10	78.61	
11	82.00	78.29	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 6			
1	0.00	78.77	
2	10.00	78.82	
3	10.25	79.13	
4	10.25	79.38	
5	30.00	78.87	Left Bank
6	31.80	78.45	
7	33.80	78.39	Lowest Bed Level
8	36.00	78.61	
9	36.80	78.41	
10	50.00	78.82	
11	51.40	79.14	Right Bank
12	59.20	79.24	
13	60.00	79.56	
14	60.00	79.70	
15	61.00	79.10	
16	81.00	80.00	
Section No. - 7			
1	0.00	79.46	
2	30.00	79.49	
3	30.40	80.33	Left Bank
4	31.40	79.93	
5	36.10	79.58	
6	48.80	79.61	
7	53.30	79.25	Lowest Bed Level
8	56.50	79.43	
9	58.00	79.63	Right Bank
10	65.30	79.58	
11	67.60	80.06	
12	68.40	79.67	
13	80.80	79.59	
14	82.50	79.94	
15	82.50	79.76	
16	98.00	79.41	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 8			
1	0.00	80.24	
2	30.00	80.24	
3	30.20	80.43	Left Bank
4	31.00	80.09	
5	40.70	80.34	
6	41.90	79.63	Lowest Bed Level
7	47.90	79.83	
8	56.70	79.91	
9	57.40	80.28	Right Bank
10	74.00	80.23	
11	74.40	80.38	
12	74.40	80.62	
13	75.00	80.32	
14	87.00	79.98	
Section No. - 9			
1	0.00	80.97	
2	10.90	81.17	
3	11.00	81.35	
4	11.00	81.51	
5	30.00	81.32	Left Bank
6	31.20	80.53	
7	41.60	80.58	
8	42.60	80.33	
9	50.00	80.22	Lowest Bed Level
10	51.00	80.91	
11	72.60	80.98	
12	73.60	81.22	Right Bank
13	85.50	81.15	
14	85.50	81.35	
15	86.00	80.89	
16	103.00	80.83	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 10			
1	0.00	81.56	
2	24.20	80.07	
3	24.20	81.78	
4	30.00	81.81	Left Bank
5	34.70	81.05	
6	50.00	81.14	
7	57.00	80.91	
8	58.30	80.69	
9	62.60	80.68	
10	67.10	80.57	Lowest Bed Level
11	70.80	80.69	
12	73.40	81.71	Right Bank
13	82.70	81.67	
14	83.90	82.22	
15	83.90	82.02	
16	85.00	81.90	
17	103.00	81.58	
Section No. - 11			
1	0.00	82.29	
2	28.50	82.47	
3	30.00	82.72	
4	30.00	82.96	Left Bank
5	31.00	82.35	
6	44.70	82.50	
7	50.00	81.98	
8	58.00	81.83	
9	63.00	81.30	
10	79.70	81.27	
11	87.80	81.21	Lowest Bed Level
12	89.40	82.37	Right Bank
13	100.00	83.09	
14	103.00	83.32	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 12			
1	0.00	83.02	
2	30.00	83.11	
3	30.00	83.31	Left Bank
4	37.10	82.73	
5	40.00	82.75	
6	50.00	82.11	
7	55.70	81.82	
8	70.80	81.78	
9	75.30	81.68	Lowest Bed Level
10	77.40	83.18	Right Bank
11	99.20	83.15	
12	99.20	83.37	
13	105.00	85.36	
14	106.50	85.34	
15	108.80	82.46	
Section No. - 13			
1	0.00	83.66	
2	28.70	83.51	
3	30.00	84.12	
4	30.40	84.18	Left Bank
5	32.70	83.82	
6	35.50	82.38	
7	38.80	82.71	
8	50.00	82.85	
9	63.10	82.50	
10	67.40	82.24	Lowest Bed Level
11	97.50	82.55	
12	100.00	83.35	Right Bank
13	127.50	83.87	
14	127.50	83.62	
15	130.00	83.35	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 14			
1	0.00	84.10	
2	29.60	84.30	
3	30.00	84.60	Left Bank
4	30.40	84.44	
5	37.20	83.83	
6	41.30	83.74	
7	42.00	83.47	
8	47.40	83.39	
9	48.80	82.99	
10	60.90	82.95	
11	72.60	82.78	Lowest Bed Level
12	74.20	83.50	Right Bank
13	78.30	84.08	
14	82.30	84.70	
15	82.30	84.49	
16	104.00	84.41	
Section No. - 15			
1	0.00	84.95	
2	6.00	84.99	
3	30.00	84.91	Left Bank
4	31.10	83.30	Lowest Bed Level
5	50.00	84.10	
6	73.20	84.38	
7	78.40	85.23	Right Bank
8	88.00	85.21	
9	88.00	85.55	
10	90.80	85.18	
11	108.00	85.21	
Section No. - 16			
1	0.00	86.03	
2	29.80	85.98	
3	30.00	86.14	Left Bank
4	30.20	86.00	
5	50.00	85.79	
6	55.90	85.71	
7	79.10	85.07	
8	91.60	84.97	Lowest Bed Level
9	93.40	86.28	Right Bank
10	93.40	86.37	
11	94.60	86.11	
12	130.00	86.00	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 17			
1	0.00	87.29	
2	30.00	87.16	Left Bank
3	37.00	86.75	
4	79.50	86.76	
5	119.50	87.01	
6	122.00	87.31	
7	170.00	87.36	
8	198.00	87.52	
9	260.00	87.42	
10	308.00	87.20	
11	310.00	86.91	
12	340.00	87.05	
13	395.00	86.66	Lowest Bed Level
14	400.00	86.79	Right Bank
15	408.00	87.35	
16	430.00	87.48	
Section No. - 18			
1	0.00	88.25	
2	30.00	87.90	Left Bank
3	31.50	87.56	Lowest Bed Level
4	68.50	88.11	
5	129.00	88.37	
6	200.00	88.53	
7	250.00	88.53	
8	324.00	88.54	
9	346.00	87.96	
10	384.00	87.75	
11	416.00	87.66	
12	417.00	88.76	Right Bank
13	422.00	88.81	
14	452.00	88.71	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 19			
1	0.00	89.36	
2	28.50	89.24	
3	30.00	89.15	Left Bank
4	33.60	88.53	
5	47.70	88.23	
6	60.00	88.19	Lowest Bed Level
7	100.00	88.63	
8	102.90	88.71	
9	108.10	89.48	Right Bank
10	112.90	89.44	
11	112.90	89.71	
12	113.00	89.28	
Section No. - 20			
1	0.00	90.42	
2	30.00	90.39	
3	34.30	90.33	Left Bank
4	37.70	89.36	
5	50.00	89.19	Lowest Bed Level
6	100.00	89.82	
7	129.00	90.28	Right Bank
8	150.00	90.46	
9	200.00	90.43	
10	250.00	90.45	
11	271.00	90.29	
12	306.00	90.83	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 21			
1	0.00	91.47	
2	30.00	91.62	Left Bank
3	31.00	91.31	
4	50.00	91.64	
5	100.00	91.53	
6	150.00	91.68	
7	175.00	91.81	
8	186.90	91.04	
9	188.30	90.82	
10	200.00	90.73	Lowest Bed Level
11	216.40	90.74	
12	218.00	90.92	
13	250.00	91.14	
14	300.00	91.44	
15	350.00	91.37	
16	400.00	91.63	
17	450.00	91.80	
18	500.00	92.02	
19	550.00	92.00	
20	600.00	91.66	
21	607.10	91.45	
22	609.20	91.44	
23	649.30	92.23	Right Bank
24	670.00	92.22	
Section No. - 22			
1	0.00	94.06	
2	24.70	94.01	
3	30.00	94.40	Left Bank
4	33.80	93.22	
5	50.00	93.02	
6	100.00	93.02	
7	150.00	92.78	
8	200.00	92.84	
9	214.90	92.68	
10	220.00	92.22	
11	250.00	92.26	
12	300.00	92.21	Lowest Bed Level
13	350.00	92.46	
14	352.00	93.30	
15	387.80	93.18	
16	438.00	93.57	Right Bank
17	439.00	93.51	
18	439.00	93.89	
19	470.00	93.46	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 23			
1	0.00	95.32	
2	1.50	95.05	
3	31.40	95.13	Left Bank
4	32.40	94.61	
5	50.00	94.88	
6	100.00	95.05	
7	150.00	94.70	
8	200.00	94.38	
9	206.00	94.15	
10	250.00	94.46	
11	300.00	94.54	
12	350.00	94.48	
13	388.60	94.47	
14	394.00	93.95	
15	400.00	93.95	
16	450.00	94.04	
17	500.00	93.96	
18	542.00	93.90	Lowest Bed Level
19	544.00	94.77	Right Bank
20	590.00	94.40	
21	591.90	95.12	
22	604.20	95.35	
23	630.00	95.36	
Section No. - 24			
1	0.00	97.12	
2	5.00	96.90	
3	40.50	96.79	Left Bank
4	42.00	96.01	
5	47.00	95.68	
6	50.00	95.66	
7	80.60	95.58	Lowest Bed Level
8	100.00	95.94	
9	150.00	95.97	
10	200.00	96.26	
11	250.00	96.44	
12	300.00	96.04	
13	329.60	96.19	
14	330.20	96.56	
15	350.00	96.67	
16	363.30	97.31	
17	366.40	98.56	Right Bank
18	367.70	98.48	
19	372.80	96.71	
20	396.00	96.71	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 25			
1	0.00	98.53	
2	9.20	98.72	
3	10.80	98.38	
4	30.00	98.50	Left Bank
5	32.90	97.60	
6	50.00	97.66	
7	100.00	97.75	
8	150.00	97.79	
9	180.70	97.75	
10	181.20	97.27	Lowest Bed Level
11	200.00	97.23	
12	250.00	97.38	
13	300.00	97.31	
14	310.50	98.14	
15	350.00	98.25	
16	368.00	98.33	
17	370.00	99.38	Right Bank
18	373.00	99.25	
19	374.00	97.76	
20	405.00	97.73	
Section No. - 26			
1	0.00	99.86	
2	50.00	99.69	
3	100.00	99.93	
4	130.10	99.78	Left Bank
5	132.00	99.18	
6	150.00	99.36	
7	175.00	99.13	
8	200.00	99.02	
9	250.00	98.91	
10	300.00	98.87	
11	327.10	98.75	Lowest Bed Level
12	331.50	99.59	
13	336.00	99.91	Right Bank
14	354.00	101.32	
15	358.00	101.22	
16	365.00	99.12	
17	395.00	99.18	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 27			
1	0.00	101.57	
2	12.20	101.28	
3	42.00	101.54	Left Bank
4	50.00	101.36	
5	99.00	100.91	
6	100.00	100.38	
7	150.00	100.17	Lowest Bed Level
8	173.00	100.25	
9	176.00	100.40	
10	200.00	100.50	
11	250.00	100.44	
12	300.00	100.46	
13	350.00	100.42	
14	398.00	100.39	
15	401.00	100.87	
16	419.40	100.95	
17	423.00	100.18	
18	450.00	100.22	
19	497.00	101.88	Right Bank
20	500.00	101.81	
21	503.00	102.41	
22	506.00	102.53	
23	510.00	101.34	
24	540.00	101.29	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 28			
1	0.00	103.82	
2	12.20	103.94	
3	13.20	103.04	
4	21.00	103.22	
5	29.50	106.26	
6	30.00	106.30	
7	32.00	106.24	Left Bank
8	38.00	103.41	
9	50.00	103.22	
10	100.00	103.19	
11	150.00	103.43	
12	200.00	103.38	
13	250.00	103.50	
14	271.70	103.47	
15	274.10	103.03	
16	300.00	103.02	
17	350.00	103.01	
18	400.00	102.86	
19	420.50	102.84	
20	421.40	102.62	
21	450.00	102.72	
22	500.00	102.63	
23	550.00	102.43	
24	585.30	102.41	Lowest Bed Level
25	586.00	103.22	Right Bank
26	600.00	103.38	
27	613.40	103.59	
28	614.00	103.48	
29	620.00	102.20	
30	640.00	102.10	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 29			
1	0.00	105.88	
2	26.00	105.38	
3	30.00	107.48	
4	31.00	107.57	
5	32.00	107.51	Left Bank
6	36.00	105.06	
7	50.00	105.30	
8	100.00	105.11	
9	143.00	104.90	
10	200.00	104.57	
11	208.20	104.78	
12	250.00	105.01	
13	300.00	104.92	
14	350.00	104.73	
15	388.00	104.86	
16	390.00	104.46	
17	400.00	104.44	
18	450.00	104.51	
19	500.00	104.37	
20	550.00	104.80	
21	552.00	104.63	
22	604.00	104.39	
23	605.00	104.85	
24	650.00	105.08	
25	700.00	104.53	
26	715.40	104.69	
27	716.20	104.15	Lowest Bed Level
28	734.90	105.29	Right Bank
29	760.00	105.18	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 30			
1	0.00	107.13	
2	1.00	106.44	
3	50.00	106.72	
4	61.30	107.05	Left Bank
5	100.00	106.76	
6	150.00	106.80	
7	171.30	106.64	
8	174.30	105.90	Lowest Bed Level
9	200.00	106.01	
10	250.00	106.05	
11	300.00	106.20	
12	350.00	106.18	
13	400.00	106.50	
14	450.00	106.37	
15	500.00	106.34	
16	502.00	107.24	Right Bank
17	504.30	107.23	
18	535.00	106.70	
Section No. - 31			
1	0.00	108.39	
2	27.00	108.36	
3	30.00	110.70	
4	32.00	110.72	
5	33.50	110.68	Left Bank
6	36.00	108.20	
7	50.00	107.99	
8	100.00	107.74	
9	150.00	107.97	
10	175.00	107.15	Lowest Bed Level
11	200.00	108.31	
12	250.00	108.20	
13	300.00	108.01	
14	311.00	108.00	
15	313.00	108.38	
16	333.00	108.08	
17	350.00	108.13	
18	380.00	108.37	
19	400.00	108.18	
20	440.00	108.23	
21	442.06	109.62	Right Bank
22	450.00	109.54	
23	480.00	109.40	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 32			
1	0.00	111.56	
2	1.50	111.04	
3	37.80	110.84	
4	41.00	111.73	Left Bank
5	50.00	111.29	
6	100.00	111.22	
7	150.00	111.14	
8	200.00	111.08	
9	211.00	111.04	
10	213.80	110.24	
11	235.06	110.77	
12	250.00	110.68	
13	300.00	110.81	
14	310.90	110.80	
15	315.00	110.20	
16	350.00	110.17	
17	400.00	110.72	
18	450.00	110.93	
19	500.00	110.68	
20	534.00	110.36	
21	550.00	110.06	
22	600.00	109.82	
23	650.00	109.48	Lowest Bed Level
24	655.00	111.00	Right Bank
25	675.00	111.08	
26	685.00	111.10	
Section No. - 33			
1	0.00	115.65	
2	20.60	115.38	
3	27.30	115.59	Left Bank
4	50.00	111.71	Lowest Bed Level
5	100.00	111.83	
6	139.80	111.94	
7	141.00	112.40	
8	150.00	112.05	
9	153.00	112.39	
10	200.00	112.50	
11	204.00	112.89	
12	250.00	112.91	
13	300.00	111.98	
14	311.00	112.80	
15	350.00	112.82	Right Bank
16	384.00	113.06	
17	384.50	113.56	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 34			
1	0.00	115.59	
2	19.90	115.91	
3	30.00	115.44	
4	38.60	115.06	Left Bank
5	40.70	114.16	
6	47.80	114.24	
7	50.00	114.53	
8	83.10	114.61	
9	88.70	114.22	
10	100.00	114.34	
11	150.00	114.09	
12	162.70	114.20	
13	200.00	114.20	
14	211.00	114.66	
15	250.00	115.00	
16	300.00	114.96	
17	350.00	114.64	
18	358.00	114.58	
19	359.00	115.37	
20	400.00	115.04	
21	450.00	115.04	
22	500.00	115.02	
23	550.00	115.09	
24	600.00	114.75	
25	603.00	114.25	
26	650.00	114.15	
27	670.00	113.99	Lowest Bed Level
28	673.00	116.49	Right Bank
29	700.00	116.98	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 35			
1	0.00	118.12	
2	1.00	117.87	
3	26.70	117.94	
4	27.30	117.72	
5	33.80	117.81	Left Bank
6	34.50	117.40	
7	50.00	117.58	
8	100.00	117.28	
9	113.00	117.47	
10	119.90	117.27	
11	125.30	117.47	
12	150.00	117.60	
13	200.00	117.56	
14	250.00	117.82	
15	300.00	117.76	
16	350.00	116.89	
17	380.00	117.08	
18	400.00	116.61	Lowest Bed Level
19	450.00	116.74	
20	500.00	116.96	
21	550.00	117.21	
22	576.40	117.02	
23	581.70	117.34	
24	600.00	117.65	
25	650.00	117.66	
26	700.00	117.61	
27	707.40	117.68	
28	709.30	116.94	
29	734.10	117.08	
30	736.50	117.63	
31	750.00	117.58	
32	753.00	118.93	
33	755.00	118.86	Right Bank
34	785.00	118.83	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 36			
1	0.00	120.89	
2	21.70	120.71	Left Bank
3	24.20	119.61	
4	50.00	119.10	Lowest Bed Level
5	70.00	119.12	
6	100.00	119.44	
7	150.00	119.71	
8	165.00	119.83	
9	200.00	120.31	
10	250.00	119.86	
11	300.00	119.75	
12	350.00	119.56	
13	372.90	119.23	
14	377.30	120.14	
15	388.00	119.98	
16	391.00	120.28	
17	400.00	120.24	
18	450.00	120.53	Right Bank
19	500.00	120.88	
20	506.50	121.08	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 37			
1	0.00	125.31	
2	15.00	125.24	
3	31.60	124.96	Left Bank
4	40.00	121.94	
5	48.10	121.63	
6	50.00	122.13	
7	91.50	121.89	
8	98.20	121.48	
9	100.00	121.48	
10	125.00	121.51	
11	127.00	121.74	
12	150.00	121.88	
13	200.00	121.53	
14	223.70	121.26	Lowest Bed Level
15	250.00	121.65	
16	300.00	121.97	
17	330.60	122.29	
18	336.00	122.61	
19	350.00	122.83	
20	400.00	122.76	
21	450.00	122.24	
22	500.00	122.78	
23	550.00	122.56	
24	564.00	122.62	
25	566.00	122.95	
26	600.00	122.94	
27	650.00	122.79	
28	700.00	122.24	
29	712.70	122.31	
30	713.40	123.28	Right Bank
31	730.20	123.21	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 38			
1	0.00	126.49	
2	2.00	126.06	
3	50.00	125.99	
4	51.20	125.37	
5	63.00	125.42	
6	64.60	126.05	Left Bank
7	92.70	125.94	
8	94.90	125.26	
9	100.00	125.40	
10	118.90	124.84	
11	124.20	125.34	
12	150.00	125.12	
13	200.00	125.26	
14	250.00	125.15	
15	300.00	125.15	
16	350.00	125.13	
17	400.00	125.30	
18	450.00	125.17	
19	500.00	124.80	
20	550.00	124.47	
21	600.00	124.31	
22	650.00	123.97	Lowest Bed Level
23	658.60	124.62	
24	660.00	126.36	Right Bank
25	698.00	126.64	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 39			
1	0.00	128.21	
2	33.90	127.98	Left Bank
3	50.00	127.87	
4	55.00	127.66	
5	64.00	127.08	
6	100.00	127.59	
7	135.00	127.57	
8	150.00	127.22	
9	200.00	127.08	Lowest Bed Level
10	250.00	127.34	
11	300.00	127.47	
12	350.00	127.71	
13	400.00	127.89	
14	450.00	127.90	
15	500.00	127.91	
16	550.00	127.92	
17	600.00	127.84	
18	645.00	127.89	
19	647.70	128.24	Right Bank
20	648.00	128.25	
21	680.00	128.33	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 40			
1	0.00	131.41	
2	9.00	131.55	
3	30.00	131.51	Left Bank
4	31.50	130.21	
5	50.00	130.43	
6	100.00	130.56	
7	150.00	130.69	
8	180.50	130.21	
9	200.00	130.48	
10	209.00	130.47	
11	236.50	130.18	
12	250.00	130.10	Lowest Bed Level
13	270.00	130.38	
14	271.40	130.92	
15	300.00	130.91	
16	350.00	130.85	
17	400.00	130.78	
18	450.00	130.30	
19	500.00	130.34	
20	550.00	130.22	
21	600.00	130.27	
22	650.00	130.11	
23	683.30	130.29	
24	685.00	130.97	
25	700.00	130.96	
26	750.00	130.47	
27	763.30	130.63	
28	767.00	131.37	Right Bank
29	787.00	131.24	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 41			
1	0.00	134.88	
2	5.20	134.44	
3	50.00	134.73	
4	60.00	134.76	Left Bank
5	61.00	134.60	
6	100.00	134.57	
7	150.00	134.44	
8	160.00	133.80	
9	200.00	134.12	
10	250.00	133.85	
11	300.00	134.55	
12	343.30	134.60	
13	350.00	134.15	
14	400.00	134.11	
15	432.00	134.28	
16	450.00	134.04	
17	475.00	133.49	Lowest Bed Level
18	500.00	133.80	
19	555.00	133.55	
20	557.00	134.27	
21	600.00	134.45	
22	604.00	133.62	
23	640.00	134.04	
24	648.00	136.20	Right Bank
25	662.00	136.54	
26	666.00	136.54	
27	678.00	135.87	
28	680.00	135.03	
29	715.00	135.06	
30	720.00	136.56	
31	740.00	136.60	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 42			
1	0.00	137.83	
2	25.00	137.87	
3	30.00	140.06	
4	35.40	139.92	Left Bank
5	40.30	138.55	
6	44.30	138.04	
7	45.50	137.48	
8	59.70	137.47	Lowest Bed Level
9	68.40	137.80	
10	85.20	137.88	
11	100.00	137.57	
12	150.00	137.97	
13	200.00	138.03	
14	231.10	137.93	
15	250.00	138.24	
16	300.00	137.87	
17	318.40	138.60	
18	350.00	137.81	
19	361.00	138.90	
20	372.10	139.07	
21	380.00	141.61	Right Bank
22	391.00	141.23	
23	400.00	139.14	
24	420.00	137.54	
Section No. - 43			
1	0.00	143.44	
2	46.00	143.25	Left Bank
3	51.00	142.17	
4	56.50	142.13	
5	100.00	142.22	
6	150.00	142.84	
7	181.10	143.15	
8	183.00	142.54	
9	200.00	142.56	
10	250.00	142.44	
11	300.00	142.48	
12	350.00	142.50	
13	352.00	141.70	Lowest Bed Level
14	397.00	141.92	
15	400.00	146.43	Right Bank
16	409.00	146.32	
17	420.00	146.28	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 44			
1	0.00	149.47	
2	30.00	149.66	Left Bank
3	38.00	147.19	
4	50.00	146.86	
5	93.50	146.80	
6	100.00	145.91	
7	150.00	145.80	
8	197.00	145.23	Lowest Bed Level
9	200.00	145.56	
10	250.00	146.36	
11	295.00	146.36	
12	300.00	146.85	Right Bank
13	453.00	147.48	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 45			
1	0.00	151.00	
2	25.00	150.87	
3	30.00	152.78	Left Bank
4	35.00	152.33	
5	40.00	150.86	
6	50.00	150.45	
7	80.60	150.59	
8	100.00	150.19	
9	116.90	150.36	
10	121.30	149.96	Lowest Bed Level
11	150.00	150.18	
12	200.00	150.31	
13	250.00	150.52	
14	300.00	150.77	
15	350.00	150.80	
16	384.40	150.66	
17	400.00	150.17	
18	450.00	150.87	
19	500.00	150.51	
20	550.00	151.17	
21	600.00	151.23	
22	635.00	151.62	
23	651.00	151.66	
24	681.00	151.20	
25	683.00	151.64	
26	700.00	151.37	
27	710.00	151.23	
28	717.00	151.26	
29	750.00	151.72	
30	800.00	151.87	
31	809.00	151.82	
32	814.00	153.57	Right Bank
33	836.00	153.47	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 46			
1	0.00	156.02	
2	20.00	156.44	
3	30.00	158.12	Left Bank
4	36.00	157.52	
5	42.60	156.21	
6	50.00	155.31	
7	87.30	155.31	
8	100.00	155.02	Lowest Bed Level
9	120.00	155.55	
10	150.00	155.53	
11	200.00	155.60	
12	250.00	155.95	
13	262.00	156.51	
14	296.00	156.21	
15	300.00	155.41	
16	350.00	155.60	
17	400.00	156.01	
18	450.00	156.24	
19	481.00	156.35	
20	500.00	156.19	
21	532.00	156.49	
22	533.00	158.08	Right Bank
23	557.00	158.23	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 47			
1	0.00	161.87	
2	20.93	162.35	Left Bank
3	21.42	161.59	
4	42.53	161.02	
5	60.99	161.07	
6	61.00	160.09	Lowest Bed Level
7	142.59	160.43	
8	200.53	160.59	
9	215.21	160.47	
10	354.95	160.96	
11	417.58	161.40	
12	447.98	160.84	
13	564.43	161.29	
14	582.66	161.36	
15	583.00	161.91	
16	639.09	161.21	
17	680.51	161.00	
18	730.21	160.88	
19	730.50	164.06	Right Bank
20	749.61	165.05	
21	776.54	164.56	
Section No. - 48			
1	0.00	165.76	
2	26.70	166.56	Left Bank
3	39.94	164.61	
4	147.92	164.45	Lowest Bed Level
5	237.16	165.74	
6	276.75	164.86	
7	412.79	165.72	
8	527.92	166.23	
9	645.93	166.25	
10	760.26	166.49	
11	838.65	166.76	
12	887.60	166.76	
13	901.11	166.05	
14	1,003.75	166.67	
15	1,034.24	166.91	
16	1,055.92	169.53	Right Bank
17	1,074.95	169.18	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 49			
1	0.00	173.70	
2	31.54	174.01	Left Bank
3	40.49	170.72	
4	100.88	171.46	
5	163.32	171.45	
6	234.80	170.82	
7	237.35	171.51	
8	352.28	171.06	
9	356.53	170.54	Lowest Bed Level
10	384.13	171.04	
11	449.62	171.00	
12	500.22	171.03	
13	506.58	171.47	
14	546.59	171.60	
15	571.24	171.01	
16	668.00	170.87	
17	770.07	170.75	
18	809.72	173.02	Right Bank
19	833.00	171.71	
20	870.42	171.45	
Section No. - 50			
1	0.00	180.88	
2	5.18	179.30	
3	55.12	178.80	
4	66.10	180.13	
5	84.49	180.32	Left Bank
6	89.10	179.77	
7	128.09	177.43	
8	187.67	176.83	Lowest Bed Level
9	226.06	177.14	
10	245.61	177.53	
11	289.73	177.49	
12	387.33	178.06	
13	417.53	177.43	
14	487.18	177.66	
15	496.49	178.38	
16	552.36	178.26	
17	604.12	177.88	
18	628.18	177.16	
19	707.11	177.63	
20	713.87	177.90	Right Bank
21	727.42	179.34	

S. No.	Distance (m)	Ground Level (m)	Remarks
Section No. - 51			
1	0.00	192.29	
2	21.24	190.51	Left Bank
3	41.28	185.98	
4	66.38	184.11	
5	162.69	183.85	
6	197.51	182.67	Lowest Bed Level
7	238.11	183.20	
8	267.16	184.11	
9	275.87	185.10	Right Bank
10	280.62	184.55	
11	335.21	185.93	
Section No. - 52			
1	0.00	197.59	
2	7.39	192.57	
3	111.20	189.72	
4	196.70	187.54	Left Bank
5	197.99	187.31	
6	206.77	186.12	Lowest Bed Level
7	214.10	187.07	
8	231.49	202.05	Right Bank (Cliff)
9	232.71	201.60	
10	239.87	200.69	
11	260.90	193.62	
12	280.09	193.08	

S. No.	Distance (m)	Ground Level (m)	Remarks
Phulparasi Bridge (7+360)			
1	0.00	85.17	
2	16.26	86.07	
3	22.75	81.71	
4	26.54	80.04	
5	68.82	81.25	
6	76.00	85.84	
7	90.57	85.85	
Canal Crossing (37+480)			
1	0.00	126.23	
2	6.00	125.65	
3	11.11	123.44	
4	14.60	123.45	
5	16.20	122.28	
6	50.00	122.28	
7	100.00	123.03	
8	150.00	123.68	
9	200.00	123.99	
10	232.00	123.77	
11	250.00	126.31	
Highway Bridge (41+870)			
1	0.00	142.66	
2	19.34	142.21	
3	25.91	140.50	
4	30.55	139.96	
5	39.51	137.95	
6	214.77	138.44	
7	223.33	140.14	
8	230.36	141.60	
9	261.80	141.96	

Geodetic Control Points Used

1 Julpani 115	Easting:	359,502.10	Northing:	2,993,824.62
2 Phenara 37	Easting:	348,760.82	Northing:	2,966,241.52
3 Simara 38	Easting:	349,859.18	Northing:	2,968,023.28

Levelling Bench Marks Used

1 BM - 9	R. L.	87.78	Belhi
2 BM - 10	R. L.	85.92	Belhi
3 BM - 104 - 084	R. L.	142.44	Lakhandei Highway Bridge

DATA BOOK

4. RIVER SURVEY: BABAI RIVER

**His Majesty's Government of Nepal
Department of Irrigation
Japan International Cooperation Agency (JICA)**

**The Study on Flood Mitigation Plan for Selected
Rivers in the Terai Plain
in the Kingdom of Nepal**

**Report
on
Babai River Survey**

June 1998

**TECHDA
Technical Development Associates (P) Ltd.
Dhobighat, Lalitpur
Post Box 978; Ph: 532196, Fax: 523996**

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ANNEXES

Annex-A: Summary of Longitudinal Leveling

Annex-B: Cross-Section Data

Annex-C: Co-ordinates of Bank Stakes

Annex-D: Specifications

1.0 INTRODUCTION

1.1 Background

Flood problems in the form of loss of property and life are being faced along various river courses in Nepal. These problems are more severe in the flood plains of Terai. For preparing flood mitigation plan for selected rivers in the Terai plain, His Majesty's Government of Nepal (HMG/N) requested Government of Japan for technical co-operation, and accordingly, Japan International Co-operation Agency (JICA) Study Team has presently been involved in the overall study work.

Babai River of Bardiya District is one of the two rivers for which the JICA Study Team has been conducting detailed feasibility study of the flood mitigation works. In this context, survey of Babai River, covering about 50 km stretch between Nepal-India border East-West Highway, had been conducted by the consulting firm Technical Development Associates (P) Ltd. [TECHDA] for JICA Study Team in accordance with the agreement signed between the two on 29th April, 1998. Present report basically contains the results of the survey work carried out by TECHDA from May 5th to June 7th, 1998. Longitudinal and transverse profiles of the river stretch have been separately presented.

1.2 Location of the Study Area

The survey area is located at Bardia District of Bheri Zone, Mid-Western Development Region along the Babai River course between the East-West Highway and Indo-Nepal Border. The survey area had been shown in Figure 1.1

1.3 Objectives

The objectives of the survey work are:

To prepare profiles of the river so that feasibility study could be conducted based on them; and

To estimate tentatively the high flood levels at different sections based on observation of flood marks or local inquiry.

1.4 Scope of Work

The scope of work for the present survey work has been listed below. For the details, the specifications for the job are referred (Annex - D)

Fixing of cross-section lines at approximately 1 km interval on recent map (or aerial photographs) covering the river stretches from East-West Highway in the upstream and Indo-Nepal border in the downstream;

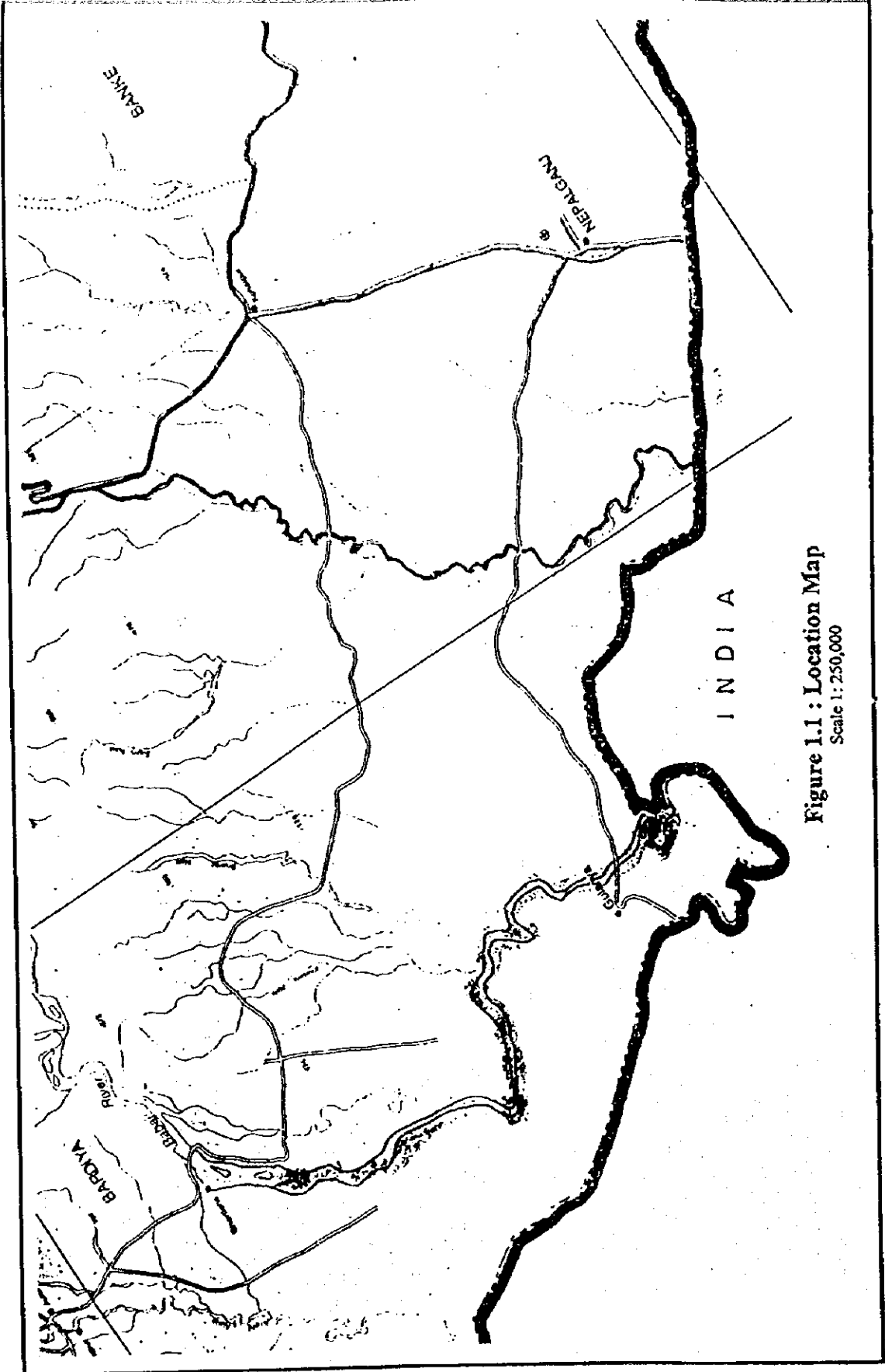


Figure 1.1 : Location Map
Scale 1: 250,000

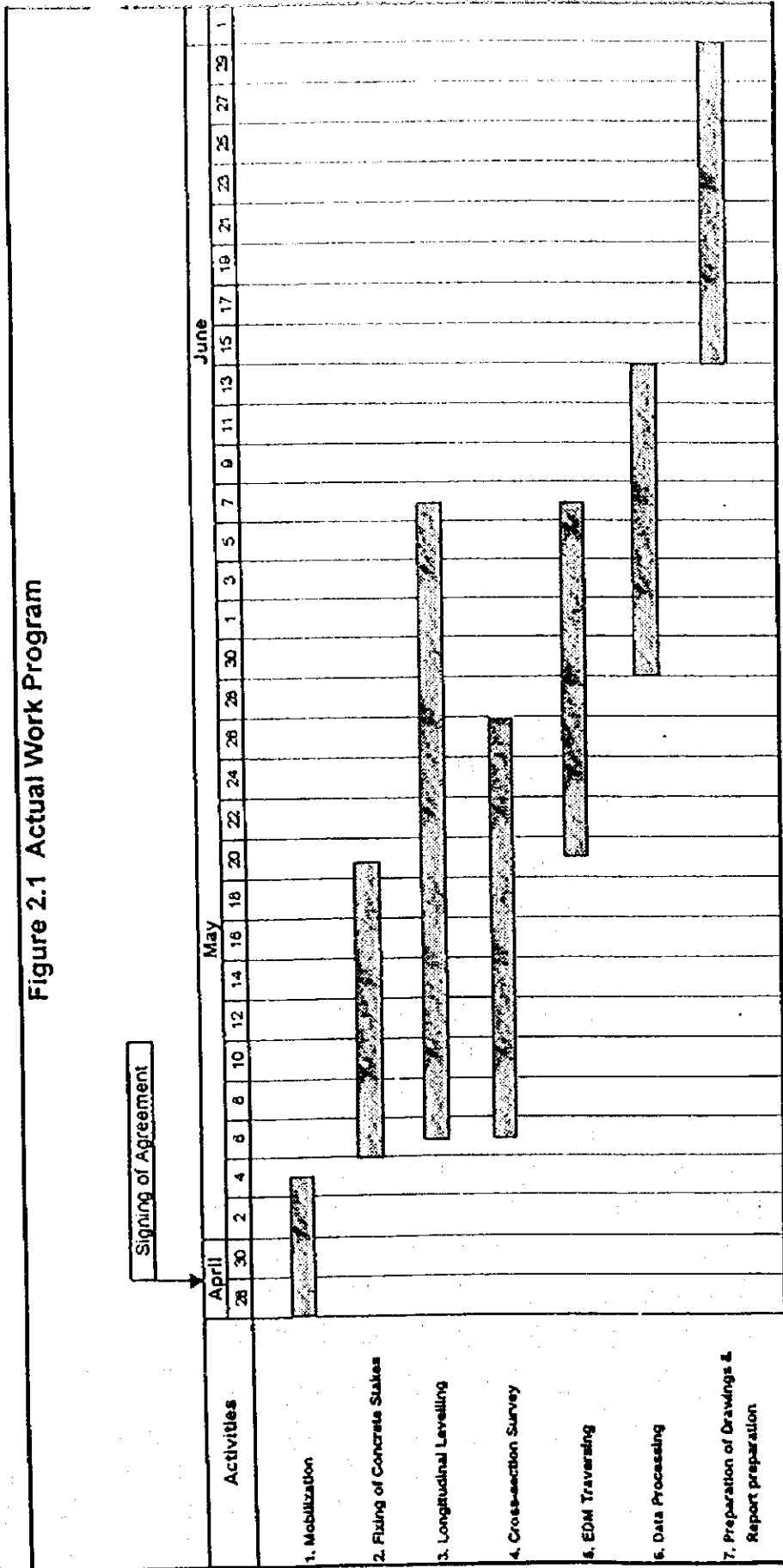
- ❖ Fixing of concrete bank stakes on both banks of the river at every cross-section;
- ❖ Longitudinal levelling of the river with the use of automatic Level connecting national benchmark with each bank stake top and corresponding ground point and flood marks;
- ❖ Cross-section survey using EDM for distance measurement and automatic level for elevation;
- ❖ Traversing of the river using EDM for determining the co-ordinates of each bank stake and corresponding flood mark; and
- ❖ Preparation of longitudinal and transverse profiles and plotting of bank stakes and flood marks on 1:10,000 map, which was prepared by JICA Study Team about the same time the present river survey was conducted.

In the original specifications of the survey work, the co-ordinates of the bank stakes and flood marks had to be determined using GPS survey, but during the field work, high precision GPS instrument was not available for differential GPS survey. Therefore instead of a portable type instrument, which is less accurate, EDM traversing was resorted to, after discussing the matter with the JICA Expert-in-Charge of the survey work.

2.0 WORK SCHEDULE

Survey team was mobilised immediately after signing the agreement. The team started actual work from 5th of May. Only the EDM traversing was started late because of non-availability of GPS instrument and the time taken to replace the latter by the former. Fig. 2.1 provides the actual work program of different activities in the fields.

Figure 2.1 Actual Work Program



3.0 SURVEY WORK AND THE STANDARDS ADOPTED

3.1 Longitudinal Levelling /Benchmark

Description cards of several national benchmarks established in the survey area by the Department of Survey, HMG/N were acquired and taken to the field so that longitudinal levelling could be started from one end of the river and closed to the other end. However, only one of them located at the Babai Headwork site could be found in the field. Therefore, longitudinal levelling had to be closed in several loops. The loops, which were made in longitudinal levelling are --

- Loop 1: BM - L46 - L45 - L44 - L43 - R43 - R44 - R45 - R46 - BM
- Loop 2: L43 - L42 - L41 - L40 - R40 - R41 - R42 - R43
- Loop 3: L40 - L39 - L38 - L37 - R37 - R38 - R39 - R40
- Loop 4: L37 - L36 - L35 - L34 - R34 - R35 - R36 - R37
- Loop 5: L34 - L33 - L32 - L31 - L30 - R30 - R31 - R32 - R33 - R34
- Loop 6: L30 - L29 - L28 - L27 - R27 - R28 - R29 - R30
- Loop 7: L27 - L26 - L25 - L24 - R24 - R25 - R26 - R27
- Loop 8: L24 - L23 - L22 - L21 - R21 - R22 - R23 - R24
- Loop 9: L21 - L20 - L19 - L18 - R18 - R19 - R20 - R21
- Loop 10: L18 - L17 - L16 - L15 - L14 - R14 - R15 - R16 - R17 - R18
- Loop 11: L14 - L13 - L12 - L11 - L10 - L9 - R9 - R10 - R11 - R12 - R13 - R14
- Loop 12: L9 - L8 - L9
- Loop 13: R1 - R2 - R3 - L3 - TBM 101 - L3 - L2 - L1 - R1
- Loop 14: TBM 101 - L4 - L5, L6 & L7 - L8 - R8 - R7 - R6 - R5 - R4 - TBM 101

The number of the used benchmark is 124-045.6 with elevation 194.24 m above msl.

All the closing errors found in the above loops are almost within the permissible range of errors inspite of the rugged terrain of the survey area like that of a mountainous region. The summary of errors has been provided in Table 3.1 and the summary of longitudinal levelling has been provided in Annex-A.

Table 3.1 Summary of Errors in Longitudinal Levelling

Loop	Approx. Distance (km)	Closing Error (mm)	Permissible Error (mm)		Remarks
			Plain	Mountain	
1	8.0	-32	±28	±141	<p><i>For Plain</i> Permissible Error = $10\sqrt{S}$</p> <p><i>For Mountain</i> Permissible Error = $50\sqrt{S}$</p> <p>where, S is Distance in km.</p>
2	7.0	+40	±26	±132	
3	7.0	+8	±26	±132	
4	7.0	-70	±26	±132	
5	9.0	-49	±30	±150	
6	7.0	-65	±26	±132	
7	8.0	-52	±28	±141	
8	7.0	+73	±26	±132	
9	7.0	+68	±26	±132	
10	9.0	+88	±30	±150	
11	12.0	+20	±35	±173	
13	5.0	+16	±22	±112	
14	8.0	-50	±28	±141	

3.2 Cross-section Survey

Cross-section lines at all location were fixed beforehand on aerial photographs of scale 1:42,000 at an interval of 1 km. The same were transferred to the field. The river course has changed a lot in between the sections in the past few years. Hence, after the corresponding bank stakes were plotted in the new 1:10,000 scale map, it has been found that the interval was not uniform.

For precise distance measurement, EDM was used for cross-section survey. The distance measured during the cross-section survey very closely matched to that found by EDM traversing for determining co-ordinates of stakes. The left to right or vice versa level difference between the two bank stakes was also within the permissible range. At some sections, because of rugged terrain and intense summer heat causing refractive error, the difference has exceeded the limit. It is difficult to state whether the difference was due to errors in longitudinal levelling or due to cross-section levelling. The errors have been summarised in Table 3.2. The cross-section data consisting of distance and elevation of all surveyed points has been provided in Annex -B.

Table 3.2 Summary of Closing Errors in Cross-section Levelling

Section No	Distance (left to Right)	Longitudinal Levelling				Cross-section Levelling				Error (long-Cross)	Permissible Error (+)		Remarks
		Left Stake	Rt. Stake	Diff. (R-L)	RT. St.	Left St.	RT. St.	Diff. (R-L)	Flat		Mountain		
1	214.28	139.108	141.240	2.132	139.095	141.240	2.145	-0.013	0.093	0.489	For Flat Area Permissible Error = $2cm \cdot 5cm \cdot \text{SQRT}(10 \cdot S)$ For Mountainous Area Permissible Error = $5cm \cdot 30cm \cdot \text{SQRT}(10 \cdot S)$ where, S is distance in km.		
2	408.62	141.409	140.955	-0.454	141.409	141.047	-0.362	-0.092	0.121	0.656			
3	228.5	141.129	140.630	-0.499	141.309	140.630	-0.679	0.180	0.096	0.503			
4	625.28	140.377	140.165	-0.212	140.377	140.154	-0.223	0.011	0.145	0.800			
5	484.67	141.099	141.503	0.404	141.168	141.503	0.335	0.069	0.130	0.710			
6	641.68	141.099	141.149	0.050	141.161	141.149	-0.012	0.062	0.147	0.810			
7	646.24	141.099	142.036	0.937	141.048	142.036	0.988	-0.051	0.147	0.813			
8	382.05	141.168	140.524	-0.644	141.168	140.622	-0.546	-0.098	0.118	0.636			
9	242.56	139.677	142.129	2.452	139.639	142.129	2.490	-0.038	0.098	0.517			
10	424.27	140.858	142.369	1.511	140.842	142.369	1.527	-0.016	0.123	0.668			
11	422.81	142.373	141.296	-1.077	142.259	141.296	-0.963	-0.114	0.123	0.667			
12	241.97	143.349	142.994	-0.355	143.349	142.979	-0.370	0.015	0.098	0.517			
13	393.61	143.545	142.684	-0.861	143.545	142.576	-0.969	0.108	0.119	0.645			
14	486.88	141.675	143.920	2.245	141.744	143.920	2.176	0.069	0.130	0.712			
15	709.97	142.676	142.221	-0.455	142.710	142.221	-0.489	0.034	0.153	0.849			
16	750.46	144.136	144.617	0.481	144.209	144.617	0.408	0.073	0.157	0.872			
17	592.85	142.783	143.836	1.053	142.783	143.811	1.028	0.025	0.142	0.780			
18	222.86	146.309	143.739	-2.570	146.309	143.734	-2.575	0.005	0.095	0.498			
19	441.41	145.073	146.507	1.434	145.008	146.507	1.499	-0.065	0.125	0.680			
20	592.64	145.845	146.724	0.879	145.845	146.784	0.939	-0.060	0.142	0.780			
21	315.86	144.471	147.785	3.314	144.471	147.704	3.233	0.081	0.109	0.583			
22	494.53	146.733	147.180	0.447	146.733	147.210	0.477	-0.030	0.131	0.717			
23	404.07	147.288	148.193	0.905	147.288	148.336	1.048	-0.143	0.121	0.653			

Table 3.2 Contd.....

Section No	Distance (left to Right)	Longitudinal Levelling		Cross-section Levelling			Error		Permissible Error (±)		Remarks
		Left Stake	Rt. Stake	Diff. (R-L)	Left St.	RT. St.	Diff. (R-L)	(long-Cross)	Flat	Mountain	
24	646.66	148.902	147.801	-1.101	148.765	147.801	-0.964	-0.137	0.147	0.813	For Flat Area Permissible Error = $2cm+5cm \cdot \text{SQRT}(10 \cdot S)$
25	246.48	148.156	150.576	2.420	148.061	150.576	2.515	-0.095	0.098	0.521	
26	509.57	150.226	150.070	-0.156	150.226	150.262	0.036	-0.192	0.133	0.727	
27	316.82	151.518	150.343	-1.175	151.403	150.343	-1.060	-0.115	0.109	0.584	
28	383.38	152.042	149.662	-2.380	152.201	149.662	-2.539	0.159	0.118	0.637	
29	299.28	152.106	151.020	-1.086	152.106	151.142	-0.964	-0.122	0.106	0.569	
30	354.55	152.415	153.331	0.916	152.486	153.331	0.845	0.071	0.114	0.615	For Mountainous Area Permissible Error = $5cm+30cm \cdot \text{SQRT}(10 \cdot S)$ where, S is distance in km.
31	974.84	153.546	152.883	-0.663	153.566	152.883	-0.683	0.020	0.176	0.987	
32	402.14	155.908	155.153	-0.755	155.908	155.323	-0.585	-0.170	0.120	0.652	
33	644.52	156.655	157.230	0.575	156.505	157.230	0.725	-0.150	0.147	0.812	
34	552.9	156.976	156.876	-0.100	156.976	156.930	-0.046	-0.054	0.138	0.755	
35	637.51	159.620	168.372	8.752	159.448	168.372	8.924	-0.172	0.146	0.807	
36	685.15	161.276	170.281	9.005	161.276	170.464	9.188	-0.183	0.151	0.835	
37	676.24	163.557	164.080	0.523	163.592	164.080	0.488	0.035	0.150	0.830	
38	972.92	164.449	169.758	5.309	164.449	169.781	5.332	-0.023	0.176	0.986	
39	1413	169.329	169.086	-0.243	169.615	169.086	-0.529	0.286	0.208	1.178	
40	811.88	171.401	172.856	1.455	171.401	173.034	1.633	-0.178	0.162	0.905	
41	808.5	174.900	174.590	-0.310	174.735	174.590	-0.145	-0.165	0.162	0.903	
42	1269.87	176.223	175.318	-0.905	176.173	175.318	-0.855	-0.050	0.198	1.119	
43	1276.45	178.774	178.287	-0.487	178.600	178.287	-0.313	-0.174	0.199	1.122	
44	1188.08	180.787	184.280	3.493	180.592	184.280	3.688	-0.195	0.192	1.084	
45	478.44	185.486	188.623	3.137	185.366	188.623	3.257	-0.120	0.129	0.706	
46	374.81	189.345	205.000	15.655	189.345	205.118	15.773	-0.118	0.117	0.631	

3.3 Traversing with EDM

For determining co-ordinates of bank stakes and flood marks in UTM system, EDM traversing consisting of five loops was conducted. The trigonometrical stations with known co-ordinates, which were used in the present survey work, are nos. 034-104 and 034-105 (third order) having co-ordinates 534110.422 (Easting), 3118793.350 (Northing) and 535075.861(Easting), 3117745.447(Northing) respectively. Flood marks, which were surveyed, are only tentative and mostly located on the basis of local inquiry. Some of the flood marks were far away from the bank, particularly in areas prone to inundation, hence, they could not be surveyed. The co-ordinates of all the surveyed points have been provided in Annex-C.

4 CONCLUSION

The survey of Babai River has been conducted successfully with utmost care and in a professional manner. In spite of intense heat during the fieldwork, the errors have been brought within control. It is expected that the data and drawings would be very much useful for further study and planning of mitigating works in the concerned reach of the river.

Annex - A
Summary of Longitudinal Levelling

Babai River Survey
Summary of Longitudinal Levelling

Section No	Distance	Cum. Distance	Left Stake	Rt. Stake	Left St. G.L.	Rt. St. G.L.	Left Bank	Right Bank	Thalweg	Flow Depth	LFL	HFL	Remarks
1	0	0	139.108	141.240	138.949	141.160	140.806	141.160	134.172	0.570	134.742	140.108	
2	800	800	141.409	140.955	141.299	140.845	141.299	141.047	134.175	0.840	134.815	140.868	
3	800	1600	141.129	140.630	141.035	140.518	141.215	139.518	134.201	0.830	135.031	141.63	
Bridge	460	2060					145.925	145.746	134.015	1.750	135.765	141.78	
4	1100	3160	140.377	140.165	140.216	140.105	140.211	139.980	134.239	0.900	135.139	141.88	
5	790	3950	141.099	141.593	140.985	141.388	139.485	141.388	134.83	0.700	135.53	142.24	
6	730	4680	141.099	141.149	140.985	141.079	140.098	141.110	135.239	0.495	135.734	142.6	
7	750	5430	141.099	142.036	140.985	141.887	140.446	142.354	135.33	0.400	135.73	142.63	
8	1300	6730	141.168	140.524	140.970	140.412	140.953	139.548	135.38	0.880	136.26	142.67	
9	1100	7830	139.677	142.129	139.546	142.045	139.659	142.035	136.004	0.350	136.354	142.85	
10	1300	9130	140.858	142.369	140.750	142.248	140.734	142.248	136.009	0.850	136.859	143.03	
11	575	9705	142.373	141.296	142.216	141.147	142.102	141.147	136.692	0.350	137.042	143.21	
12	825	10530	143.349	142.994	143.195	142.835	143.195	142.820	136.935	0.435	137.37	143.39	
13	1090	11620	143.545	142.684	143.471	142.557	143.366	142.449	137.039	0.728	137.767	143.57	137.814 m at Rt. Channel
14	820	12440	141.675	143.920	141.518	143.780	141.587	139.774	137.697	0.900	138.597	143.75	
15	1340	13780	142.676	142.221	142.586	142.108	142.021	142.108	138.191	0.710	138.901	143.94	
16	910	14690	144.136	144.617	143.929	144.597	144.022	141.695	138.61	0.860	139.47	144.120	139.494 m at Rt. Channel
17	1090	15780	142.783	143.836	142.586	143.703	142.586	144.811	138.99	1.000	139.99	144.3	139.793 m at left channel
18	1380	17160	146.309	143.739	146.134	143.612	146.074	143.604	140.012	0.850	140.862	144.48	
19	1130	18290	145.073	146.507	144.873	146.375	143.346	145.951	141.616	0.600	142.216	144.66	142.121 m at Dhobi Khola (tnp)
20	1550	19840	145.845	146.724	145.740	146.626	145.504	147.388	142.147	0.370	142.517	144.85	142.532 m for two left channels
21	900	20740	144.471	147.785	144.371	147.660	144.371	147.579	142.184	0.840	143.024	145.79	for both channels
22	910	21650	146.733	147.180	146.571	146.973	146.571	147.003	142.836	0.680	143.516	146.16	
23	410	22060	147.288	148.193	147.100	148.093	147.310	148.306	143.409	0.900	144.309	146.46	143.569 m for the 2 left channels

Note : Distances and elevations expressed in meter

Babai River Survey

Summary of Longitudinal Levelling

Section No	Distance	Cum. Distance	Left Stake	Rt. Stake	Left St. GL	RT. St. GL	Left Bank	Right Bank	Thaiweg	Flow Depth	LFL	HFL	Remarks
24	2010	24070	148.902	147.801	148.731	147.684	148.633	149.417	143.993	0.42	144.413	147.45	
25	1050	25120	148.156	150.576	148.062	150.475	148.292	150.470	144.093	0.46	144.553	148.44	144.299 m at left channel
26	1990	27110	150.226	150.070	150.127	149.968	150.355	150.160	145.118	0.39	145.508	150.23	
27	1110	28220	151.518	150.343	151.385	150.249	151.270	150.401	145.609	0.65	146.259	151.52	
28	930	29150	152.042	149.662	151.963	149.545	150.228	149.545	146.482	0.69	147.172	152.04	146.927m for Rt. Channel
29	820	29970	152.106	151.020	151.916	150.790	152.142	151.965	147.092	0.45	147.542	152.210	147.566 for Rt. Channels
30	620	30590	152.415	153.331	152.303	153.191	151.916	150.912	147.1	0.83	147.93	152.38	148.243 for left channel
31	1310	31900	153.546	152.883	153.426	152.797	153.326	152.797	147.944	1.25	149.194	153.55	This section onward provide
32	1160	33060	155.908	155.153	155.781	155.013	155.769	155.245	150.124	0.46	150.584	153.66	equal LFL for all channels
33	1000	34060	156.655	157.230	156.516	157.152	156.378	157.223	151.364	0.6	151.964	155.42	
34	1630	35690	156.976	156.876	156.883	156.805	157.689	156.859	153.562	0.6	154.162	155.91	
35	1390	37080	159.620	168.372	159.512	168.207	159.548	168.112	153.622	0.6	154.222	156.59	
36	1010	38090	161.276	170.281	161.135	170.148	161.135	170.463	156.738	0.37	157.108	161.1	
37	1390	39480	163.557	164.080	163.452	163.967	163.487	163.870	158.985	0.65	159.635	163.45	
38	940	40420	164.449	169.758	164.355	169.620	164.132	169.319	161.066	0.59	161.656	163.76	
39	1410	41830	169.329	169.086	169.249	168.954	169.438	168.954	163.596	1.75	165.346	166.59	
40	1350	43180	171.401	172.856	171.304	172.744	171.304	172.922	167.901	0.44	168.341	170.86	
41	1190	44370	174.900	174.590	174.792	174.475	174.643	174.590	169.656	0.9	170.555	174.21	
42	910	45280	176.223	175.318	176.123	175.218	176.278	175.203	171.907	0.63	172.537	175.11	
43	925	46205	178.774	178.287	178.674	178.187	178.500	178.287	174.66	0.7	175.36	177.37	
44	1210	47415	180.787	184.280	180.687	184.180	180.590	184.180	178.593	0.65	179.243	181.79	
45	1210	48625	185.486	188.623	185.386	188.523	185.246	187.750	181.309	1.35	182.659	184.6	
46	900	49525	189.345	205.000	189.245	204.900	189.295	208.045	183.612	0.7	184.312	188.93	

Note : Distances and elevations expressed in meter

Annex - B
Cross-section Data

BABAI RIVER SURVEY
CROSS SECTION DATA

Distance measured from the left bank stake at all sections

X-SEC No. 1			X-SEC No. 2			X-SEC No. 3		
Distance	Elevation	Remarks	Distance	Elevation	Remarks	Distance	Elevation	Remarks
-30.000	140.806		-30.000	141.191		-30.000	141.239	
-21.800	139.588		0.000	141.409	stake top	0.000	141.309	stake top
0.000	139.095	stake top	0.000	141.299	stake ground	0.000	141.215	stake ground
0.000	138.936	stake ground	41.980	139.136		12.450	138.850	
19.400	138.156		74.360	138.773		22.020	138.125	
34.700	137.855		132.340	139.604		25.270	137.535	
37.400	135.091		224.780	138.551		93.850	137.455	
41.200	134.172		261.200	138.064		149.330	136.302	
44.200	134.521		280.430	137.651		172.070	135.031	
69.640	134.945		288.440	136.264		175.070	134.760	
80.040	135.114		342.150	135.419		218.670	134.201	
134.680	135.619		369.090	135.244		218.947	134.632	
168.480	136.066		396.030	134.175		221.947	135.316	
194.920	136.934		396.030	135.424		222.671	137.487	
199.380	138.278		400.720	140.707		222.900	140.526	
209.580	140.789		408.620	141.047	stake top	228.500	140.630	stake top
212.880	140.839		408.620	140.937	stake ground	228.500	139.518	stake ground
214.280	141.240	stake top	438.620	140.925		258.500	140.592	
214.280	141.160	stake ground						
244.280	140.952							

Bridge Cross-Section								
Distance	Act. El.	Remarks	Distance	Act. El.	Remarks	Distance	Act. El.	Remarks
-30.000	145.675		83.150	145.000	Pier	172.400	145.000	Pier
0.000	145.925		83.150	136.397		173.400	145.000	Pier
0.700	142.261		93.150	136.562		173.400	136.670	
3.150	142.182		104.650	136.588		174.900	136.049	
13.000	139.852		104.650	145.000	Pier	174.900	135.745	
15.800	137.695		105.650	145.000	Pier	179.150	134.406	LFL
23.000	136.600		105.650	135.984		183.400	135.756	
23.000	145.000	Pier	108.850	135.396		189.500	136.301	
23.800	145.000	Pier	108.850	136.156		189.500	136.896	
23.800	136.777		111.750	136.118		192.500	136.402	
37.200	136.479		111.750	135.765	LFL	194.750	136.558	
41.000	135.486		119.750	134.015		194.750	145.000	Pier
41.000	145.000	Pier	127.300	134.967		195.750	145.000	Pier
42.000	145.000	Pier	127.300	145.000	Pier	195.750	136.600	
42.000	136.128		128.300	145.000	Pier	201.350	136.835	
49.500	136.351		128.300	136.630		217.800	138.319	
55.800	136.062		130.700	135.803		217.800	145.000	Pier
59.300	135.475		148.000	135.879		218.800	145.000	Pier
59.300	145.000	Pier	149.900	135.681		218.800	138.072	
60.300	145.000	Pier	149.900	145.000	Pier	236.000	139.899	
60.300	135.852		150.900	145.000	Pier	240.200	140.941	
66.750	136.455		150.900	136.040		241.800	145.746	
75.450	136.468		152.600	135.753	LFL	270.200	145.057	
79.000	135.720		155.600	135.232				
79.000	136.228		162.500	135.714				
92.150	136.283		172.400	135.598				
92.150	145.000	Pier						

X-SEC No. 4		
Distance	Elevation	Remarks
-30.000	140.167	
0.000	140.377	stake top
0.000	140.216	stake ground
7.930	140.211	
13.430	135.139	
16.930	134.239	
32.710	134.594	
48.490	135.124	
55.990	135.625	
55.990	136.146	
105.740	136.291	
150.340	135.506	
177.160	136.233	
267.020	136.294	
289.190	135.696	
356.420	137.001	
417.660	139.115	
458.030	139.980	
511.030	140.165	
596.090	140.342	
625.280	140.154	stake top
625.280	140.094	stake ground
655.280	139.676	

X-SEC No. 5		
Distance	Elevation	Remarks
-30.000	140.965	
0.000	141.168	stake top
0.000	141.054	stake ground
39.460	139.890	
68.500	140.177	
92.840	140.061	
113.390	139.184	
150.910	140.087	
166.150	140.221	
176.000	139.485	
200.340	139.815	
223.670	139.362	
246.580	139.571	
290.010	138.569	
303.110	137.805	
316.410	137.975	
342.960	137.628	
352.470	137.087	
357.770	137.286	
420.000	136.523	
430.320	135.604	
433.320	135.366	
434.020	134.830	
466.710	134.830	
468.410	135.248	
471.410	135.530	
473.810	137.420	
477.310	140.936	
484.670	141.503	stake top
484.670	141.388	stake ground
514.670	141.176	

X-SEC No. 6		
Distance	Elevation	Remarks
-30.000	140.559	
0.000	141.161	stake top
0.000	141.001	stake ground
37.540	140.208	
97.050	140.138	
172.100	140.098	
323.530	138.091	
356.110	138.455	
366.890	137.480	
386.260	138.423	
493.740	138.426	
493.740	137.038	
508.850	136.655	
542.600	136.183	
542.600	135.734	
545.450	135.239	
557.905	135.469	
603.820	135.777	
603.820	136.280	
622.550	136.497	
629.550	140.359	
635.565	140.487	
635.565	141.110	
641.650	141.149	stake top
641.650	141.079	stake ground
671.650	141.003	

X-SEC No. 7		
Distance	Elevation	Remarks
-30.000	139.836	
0.000	141.048	stake top
0.000	140.932	stake ground
35.750	140.429	
110.420	140.446	
124.420	136.268	
152.270	136.170	
227.720	135.795	
280.340	135.730	
283.340	135.550	
283.540	135.330	
322.140	135.330	
322.740	135.344	
325.780	136.184	
340.320	137.146	
530.210	137.251	
637.010	137.607	
641.110	138.127	
641.810	142.354	
646.240	142.036	stake top
646.240	141.887	stake ground
676.240	141.754	

X-SEC No. 8		
Distance	Elevation	Remarks
-30.000	141.017	
0.000	141.168	stake top
0.000	140.970	stake ground
6.200	140.953	
10.000	136.260	
14.000	135.380	
31.560	135.460	
53.120	136.286	
67.310	136.491	
81.500	136.293	
85.935	136.163	
90.370	136.305	
100.350	136.818	
110.460	138.394	
164.080	138.904	
202.460	138.596	
260.420	139.548	
378.100	140.263	
382.050	140.622	stake top
382.050	140.510	stake ground
412.050	140.613	

X-SEC No. 9		
Distance	Elevation	Remarks
-30.000	141.164	
-15.400	141.414	
-9.200	140.153	
0.000	139.639	stake top
0.000	139.508	stake ground
19.990	139.498	
61.600	139.659	
63.525	136.354	
63.603	136.004	
75.530	136.004	
75.880	137.593	
137.230	136.403	
170.290	136.460	
179.370	136.366	
207.800	136.667	
210.900	138.166	
230.360	139.979	
235.860	142.035	
242.560	142.129	stake top
242.560	142.045	stake ground
254.560	141.975	

X-SEC No. 10		
Distance	Elevation	Remarks
-30.000	142.104	
-25.000	142.079	
-20.000	140.444	
0.000	140.842	stake top
0.000	140.734	stake ground
40.880	139.756	
79.710	138.524	
94.560	137.752	
94.560	137.390	
122.840	137.484	
122.840	137.862	
140.310	138.180	
233.340	137.677	
236.760	136.947	
283.150	137.570	
295.910	136.915	
319.510	137.329	
354.170	136.859	
384.850	136.009	
415.529	136.864	
415.529	137.309	
417.690	141.631	
424.270	142.369	stake top
424.270	142.248	stake ground
454.270	142.334	

X-SEC No. 11		
Distance	Elevation	Remarks
-30.000	142.097	
0.000	142.259	stake top
0.000	142.102	stake ground
11.670	142.097	
15.230	138.034	
18.230	136.844	
42.100	136.692	
65.970	136.851	
68.970	137.042	
93.590	138.225	
146.350	138.771	
320.100	140.647	
422.810	141.296	stake top
422.810	141.147	stake ground
452.810	141.099	

X-SEC No. 12		
Distance	Elevation	Remarks
-30.000	142.630	
0.000	143.349	stake top
0.000	143.195	stake ground
3.090	143.215	
14.100	137.433	
37.970	137.833	
106.460	137.460	
130.340	137.370	
156.325	136.935	
182.310	137.410	
185.580	139.779	
222.640	141.222	
238.980	141.424	
241.970	142.979	stake top
241.970	142.820	stake ground
271.970	142.959	

X-SEC No. 13		
Distance	Elevation	Remarks
-30.000	143.526	
0.000	143.545	stake top
0.000	143.471	stake ground
33.080	143.366	
43.280	137.767	
48.955	137.039	
54.630	137.769	
66.210	137.819	
86.435	137.629	
102.360	137.294	
106.660	137.814	
106.660	138.484	
145.380	138.234	
159.490	138.964	
204.330	138.899	
214.510	139.699	
271.810	141.635	
347.140	141.787	
389.98	141.037	
393.61	142.576	stake top
393.61	142.449	stake ground
423.61	143.744	

X-SEC No. 14		
Distance	Elevation	Remarks
-30.000	141.594	
0.000	141.744	stake top
0.000	141.587	stake ground
116.450	139.668	
126.500	141.338	
139.560	141.048	
254.960	140.700	
265.960	138.595	
291.250	139.741	
300.750	138.762	
405.630	138.693	
408.630	138.474	
429.280	137.697	
450.030	138.344	
453.030	138.597	
453.130	139.774	
454.830	143.772	
486.880	143.920	stake top
486.880	143.780	stake ground
516.880	143.663	

X-SEC No. 15		
Distance	Elevation	Remarks
-30.000	142.700	
0.000	142.710	stake top
0.000	142.620	stake ground
61.430	142.021	
67.550	138.901	
73.550	138.191	
87.510	138.831	
107.470	138.889	
107.470	139.251	
156.140	138.916	
203.720	139.566	
249.120	141.336	
293.220	140.631	
352.840	141.268	
493.570	141.215	
558.010	140.348	
594.850	140.526	
642.640	140.446	
694.610	139.813	
706.738	140.818	
707.200	141.943	
709.970	142.221	stake top
709.970	142.108	stake ground
739.970	142.068	

X-SEC No. 16		
Distance	Elevation	Remarks
-30.000	143.747	
0.000	144.209	stake top
0.000	144.002	stake ground
7.688	141.850	
53.220	141.550	
204.560	140.316	
204.560	139.836	
293.860	139.568	
293.860	139.494	
307.355	139.344	
320.850	139.543	
323.850	141.606	
352.490	141.230	
351.090	140.682	
468.610	140.321	
481.270	139.470	
511.730	138.610	
524.190	139.470	
588.850	140.480	
611.500	140.873	
679.050	142.097	
682.32	141.517	
712.78	141.590	
748.480	141.695	
750.460	144.617	stake top
750.460	144.597	stake ground
780.46	144.253	

X-SEC No. 17		
Distance	Elevation	Remarks
-30.000	142.508	
0.000	142.783	stake top
0.000	142.586	stake ground
39.450	142.202	
96.750	142.602	
160.160	142.009	
301.950	141.602	
329.040	142.212	
362.940	141.395	
383.780	141.705	
437.450	141.153	
438.029	139.995	
446.360	139.793	
454.960	139.983	
503.580	139.990	
541.065	138.990	
578.550	140.050	
583.240	141.498	
583.850	143.226	
592.850	143.811	stake top
592.850	143.678	stake ground
622.850	144.811	

X-SEC No. 19		
Distance	Elevation	Remarks
-37.200	142.161	
-27.000	141.571	
-16.800	142.123	
-10.800	142.726	
-10.800	144.773	
0.000	145.008	stake top
0.000	144.808	stake ground
6.300	144.791	
6.300	143.346	
14.140	141.654	
14.140	143.195	
44.930	143.916	
48.170	142.216	
130.000	141.616	
211.830	142.221	
293.290	143.244	
409.060	142.094	
410.990	145.951	
441.410	146.507	stake top
441.410	146.375	stake ground
471.41	146.214	

X-SEC No. 18		
Distance	Elevation	Remarks
-30.000	145.960	
0.000	146.309	stake top
0.000	146.134	stake ground
3.900	146.074	
23.270	141.780	
23.480	141.783	
42.990	141.030	
57.940	140.892	
92.850	140.012	
127.780	140.882	
148.350	142.052	
176.130	142.540	
222.860	143.734	stake top
222.860	143.604	stake ground
252.860	143.311	

X-SEC No. 20		
Distance	Elevation	Remarks
-30.000	145.598	
0.000	145.845	stake top
0.000	145.740	stake ground
75.760	145.504	
75.760	144.962	
122.020	144.012	
154.090	144.977	
203.280	145.137	
244.750	145.283	
296.800	144.899	
310.670	144.347	
337.180	144.536	
337.180	143.494	
382.140	142.524	
390.505	142.424	
398.870	142.428	
404.370	142.432	
409.87	142.532	
434.33	142.517	
474.195	142.147	
514.06	142.527	
519.78	143.859	
553.74	143.217	
576.86	143.465	
586.86	145.129	
592.64	146.784	stake top
592.64	146.686	stake ground
596.64	147.388	
609.14	146.611	
622.64	147.337	

Annex-B

X-SEC No. 21		
Distance	Elevation	Remarks
-30.000	145.295	
0.000	144.471	stake top
0.000	144.371	stake ground
100.430	144.451	
190.060	143.048	
200.230	142.674	
210.400	143.014	
258.180	143.024	
274.580	142.184	
290.980	143.622	
294.640	145.098	
310.940	146.502	
311.000	147.530	
315.860	147.704	stake top
315.860	147.579	stake ground
345.86	147.573	

X-SEC No. 22		
Distance	Elevation	Remarks
-30.000	146.672	
0.000	146.733	stake top
0.000	145.571	stake ground
19.100	145.656	
75.310	144.982	
284.990	144.784	
363.360	143.516	
388.430	142.836	
413.500	143.845	
491.040	147.001	
494.530	147.210	stake top
494.530	147.003	stake ground
524.530	146.951	

X-SEC No. 23		
Distance	Elevation	Remarks
-30.000	147.310	
-20.000	146.661	
0.000	147.288	stake top
0.000	147.100	stake ground
5.820	146.857	
6.435	145.527	
76.980	145.759	
93.020	145.622	
103.930	145.142	
103.930	144.737	
126.960	145.105	
182.540	143.592	
274.060	143.569	
307.590	143.516	
382.700	143.409	
395.080	143.431	
397.517	148.306	
404.070	148.336	stake top
404.070	148.236	stake ground
437.070	147.844	

X-SEC No. 24		
Distance	Elevation	Remarks
-30.000	148.633	
0.000	148.765	stake top
0.000	148.594	stake ground
6.000	148.633	
8.860	143.993	
70.230	144.047	
172.960	145.051	
328.960	144.730	
329.960	145.111	
338.370	145.713	
582.570	146.585	
659.660	146.899	
664.660	147.801	stake top
664.660	147.684	stake ground
667.560	147.895	
694.660	149.417	

X-SEC No. 25		
Distance	Elevation	Remarks
-30.000	149.421	
-12.000	147.953	
-12.000	148.665	
0.000	148.061	stake top
0.000	147.967	stake ground
6.700	148.292	
10.190	146.649	
32.710	146.236	
92.520	145.126	
136.530	144.572	
152.180	144.299	
167.830	144.552	
173.550	144.553	
182.050	144.303	
206.280	144.093	
222.010	144.553	
230.180	146.406	
246.480	150.576	stake top
246.480	150.475	stake ground
255.480	147.193	
276.480	150.423	

X-SEC No. 26		
Distance	Elevation	Remarks
-30.000	150.355	
0.000	150.226	stake top
0.000	150.127	stake ground
5.670	150.050	
6.670	150.050	
7.670	147.438	
13.170	145.508	
40.870	145.118	
68.570	145.569	
123.670	146.539	
182.120	147.654	
273.980	148.134	
396.580	148.254	
493.920	150.059	
503.370	149.999	
509.570	150.262	stake top
509.570	150.160	stake ground
539.570	150.001	

Annex-B

X-SEC No. 27

Distance	Elevation	Remarks
-30.000	151.203	
0.000	151.403	stake top
0.000	151.270	stake ground
9.380	151.286	
16.340	146.515	
60.100	146.809	
60.500	146.459	
140.970	146.574	
204.300	146.259	
222.190	145.609	
239.100	146.221	
239.830	146.661	
254.500	146.331	
256.000	149.091	
312.820	149.454	
316.820	150.343	stake top
316.820	150.249	stake ground
323.820	149.798	
334.820	150.401	

X-SEC No. 28

Distance	Elevation	Remarks
-30.000	151.911	
0.000	152.201	stake top
0.000	152.122	stake ground
19.300	152.157	
23.790	148.273	
35.780	148.033	
47.770	150.228	
66.740	146.482	
85.710	147.172	
123.740	146.927	
143.405	146.687	
163.070	147.313	
231.560	148.213	
374.426	147.911	
375.140	149.339	
383.380	149.662	stake top
383.380	149.545	stake ground
413.380	149.920	

X-SEC No. 29

Distance	Elevation	Remarks
-30.000	152.142	
0.000	152.106	stake top
0.000	151.916	stake ground
8.160	147.722	
16.340	147.542	
44.255	147.092	
72.170	147.566	
95.905	147.336	
119.640	147.692	
152.780	147.592	
185.920	147.775	
197.530	147.667	
209.140	147.767	
256.980	149.020	
286.080	150.395	
299.280	151.142	stake top
299.280	150.912	stake ground
318.480	147.092	
329.280	151.965	

X-SEC No. 30

Distance	Elevation	Remarks
-30.000	153.147	
-22.000	152.541	
-21.244	151.413	
-12.300	151.028	
-4.317	151.583	
-3.900	152.418	
0.000	152.486	stake top
0.000	152.364	stake ground
73.670	150.331	
107.700	148.243	
140.505	147.744	
173.310	148.463	
245.780	149.081	
311.260	147.930	
323.890	147.100	
336.500	147.969	
346.085	150.519	
346.950	152.249	
354.550	153.331	stake top
354.550	153.191	stake ground
384.550	153.161	

X-SEC No. 31

Distance	Elevation	Remarks
-30.000	153.558	
0.000	153.566	stake top
0.000	153.446	stake ground
32.600	150.781	
49.760	153.326	
52.810	149.894	
81.785	147.944	
110.760	149.908	
125.510	149.468	
140.260	149.922	
156.630	150.857	
224.410	151.002	
285.880	150.616	
298.630	149.645	
309.760	149.090	
320.89	149.630	
350.300	149.415	
613.190	152.593	
773.120	151.417	
863.180	151.008	
925.830	149.313	
933.605	149.003	
941.380	149.870	
957.700	150.870	
974.840	152.883	stake top
974.840	152.797	stake ground
1004.840	152.753	

X-SEC No. 32

Distance	Elevation	Remarks
-30.000	155.832	
0.000	155.908	stake top
0.000	155.769	stake ground
3.000	155.525	
11.200	152.428	
18.300	150.879	
26.050	150.579	
33.800	150.980	
82.480	152.606	
210.880	152.128	
245.390	150.736	
285.775	150.124	
317.160	150.584	
395.410	153.249	
398.840	153.908	
402.140	155.323	stake top
402.140	155.245	stake ground
432.140	155.063	

X-SEC No. 33		
Distance	Elevation	Remarks
-30.000	156.345	
0.000	156.505	stake top
0.000	156.378	stake ground
9.150	156.473	
13.400	154.230	
42.290	153.345	
81.905	152.745	
121.520	153.375	
186.570	153.970	
425.560	153.395	
472.580	152.457	
484.580	152.207	
493.080	151.847	
501.580	152.212	
504.940	153.342	
584.720	152.927	
587.150	152.352	
595.150	151.744	
610.995	151.364	
626.840	151.752	
641.920	152.158	
644.520	157.230	stake top
644.520	157.090	stake ground
674.520	157.223	

X-SEC No. 36		
Distance	Elevation	Remarks
-30.000	160.883	
0.000	161.276	stake top
0.000	161.135	stake ground
21.920	160.966	
22.353	160.100	
107.100	159.950	
211.020	158.408	
224.570	157.108	
270.085	156.738	
315.600	157.169	
364.260	158.891	
619.640	158.702	
662.930	157.750	
685.150	170.464	stake top
685.150	170.331	stake ground
715.150	170.463	

X-SEC No. 34		
Distance	Elevation	Remarks
-30.000	157.689	
0.000	156.976	stake top
0.000	156.883	stake ground
17.220	156.591	
17.992	155.047	
54.820	155.206	
138.620	155.936	
139.660	153.855	
300.000	153.876	
335.080	154.742	
455.640	154.547	
456.133	153.562	
527.770	153.876	
533.400	156.742	
552.900	156.930	stake top
552.900	156.859	stake ground
582.900	156.833	

X-SEC No. 37		
Distance	Elevation	Remarks
-30.000	163.063	
0.000	163.592	stake top
0.000	163.487	stake ground
2.500	163.340	
3.800	161.677	
31.680	159.135	
41.380	158.985	
51.080	159.302	
107.080	160.065	
153.970	159.982	
212.870	159.332	
271.770	160.002	
367.390	162.582	
587.360	160.477	
667.380	160.234	
669.180	163.870	
676.240	164.080	stake top
676.240	163.967	stake ground
692.240	163.507	
697.240	163.760	
706.240	163.975	

X-SEC No. 35		
Distance	Elevation	Remarks
-30.000	159.548	
0.000	159.448	stake top
0.000	159.340	stake ground
75.890	159.243	
154.140	159.014	
240.560	159.239	
339.630	157.774	
417.640	155.340	
422.640	155.222	
482.024	154.622	
541.408	155.276	
563.408	157.470	
563.930	159.514	
633.050	159.287	
637.510	168.372	stake top
637.510	168.207	stake ground
667.510	168.112	

X-SEC No. 38		
Distance	Elevation	Remarks
-30.000	164.552	
0.000	164.449	stake top
0.000	164.355	stake ground
77.700	164.385	
77.710	164.385	
128.240	161.522	
170.283	162.474	
171.080	164.068	
237.610	164.132	
238.110	163.294	
298.460	162.692	
341.410	161.066	
412.590	163.536	
504.760	162.517	
549.470	162.255	
570.810	163.079	
682.050	162.381	
725.800	163.991	
741.440	162.065	
794.460	163.420	
794.850	162.657	
850.790	162.335	
887.460	162.477	
887.460	162.332	
962.920	169.319	
972.920	169.781	stake top
972.920	169.643	stake ground
973.920	169.793	
974.436	168.762	
981.920	167.613	
991.913	168.293	
992.420	169.308	
1002.920	169.075	

X-SEC No. 39		
Distance	Elevation	Remarks
-30.000	169.308	
0.000	169.615	stake top
0.000	169.535	stake ground
11.200	169.438	
11.200	169.275	
125.000	167.017	
137.510	164.690	
222.260	166.829	
323.090	167.811	
366.490	166.151	
416.710	165.913	
479.800	164.643	
510.800	167.405	
527.910	166.727	
590.640	167.809	
726.680	166.876	
744.150	165.410	
754.260	166.703	
832.700	167.578	
914.880	167.207	
924.890	166.227	
934.560	167.196	
1016.100	166.954	
1063.180	166.426	
1064.180	164.626	
1136.470	165.456	
1253.000	165.346	
1317.110	163.596	
1381.220	166.096	
1391.090	166.996	
1404.230	167.116	
1413.000	169.086	stake top
1413.000	168.954	stake ground
1443.000	168.881	

X-SEC No. 40		
Distance	Elevation	Remarks
-30.000	171.185	
-15.500	171.530	
-11.000	170.659	
-9.000	170.671	
-7.500	171.089	
0.000	171.401	stake top
0.000	171.304	stake ground
4.260	171.339	
5.800	169.849	
87.050	168.377	
123.850	168.699	
124.350	168.408	
183.910	169.685	
184.410	170.458	
248.820	171.637	
395.980	171.437	
398.080	168.724	
572.720	168.930	
608.990	167.901	
616.110	167.981	
648.620	168.421	
782.000	169.797	
782.250	169.314	
782.500	169.801	
811.880	173.034	stake top
811.880	172.922	stake ground
841.880	172.753	

X-SEC No. 41		
Distance	Elevation	Remarks
-30.000	174.653	
0.000	174.735	stake top
0.000	174.635	stake ground
15.000	174.843	
15.000	171.889	
27.760	171.889	
27.760	171.389	
112.510	170.993	
112.510	171.793	
147.510	173.123	
216.340	171.056	
216.340	172.086	
289.600	170.698	
289.600	173.646	
406.700	173.398	
406.700	171.964	
489.660	171.163	
530.880	170.505	
579.470	169.656	
598.070	170.556	
631.710	171.490	
653.650	170.628	
694.070	169.928	
734.070	170.720	
734.070	173.208	
806.330	173.601	
806.330	174.474	
808.500	174.590	stake top
808.500	174.490	stake ground
838.500	174.361	

X-SEC No. 42								
Distance	Elevation	Remarks	Distance	Elevation	Remarks	Distance	Elevation	Remarks
-30.000	176.278		608.410	173.192		1242.230	173.520	
0.000	176.173	stake top	731.490	173.701		1248.370	173.934	
0.000	176.065	stake ground	847.090	173.709		1248.370	172.745	
7.530	175.427		887.180	172.876		1256.650	172.892	
7.530	173.429		887.180	174.476		1256.650	173.595	
10.180	173.429		907.020	174.420		1263.790	173.336	
10.180	172.809		959.020	173.628		1263.790	175.215	
41.190	172.808		999.120	174.205		1269.870	175.318	stake ground
41.520	173.439		1026.890	172.999		1269.870	175.203	stake top
218.790	174.455		1040.930	173.469		1299.870	175.183	
220.290	175.575		1067.970	173.214				
391.540	175.614		1107.830	172.301				
412.960	174.633		1189.650	173.029				
458.470	173.721		1203.550	173.091				
556.510	173.351		1219.030	171.907				
561.470	172.562		1220.660	172.418				
606.470	172.562		1242.230	172.470				

X-SEC No. 43		
Distance	Elevation	Remarks
-30.000	177.830	
0.000	178.600	stake top
0.000	178.500	stake ground
25.180	177.181	
149.520	176.938	
169.280	176.838	
176.490	176.998	
211.610	176.818	
303.110	175.360	
318.720	174.660	
348.700	176.313	
372.740	177.968	
420.290	177.016	
635.560	176.280	
710.640	176.006	
746.200	175.806	
760.640	176.006	
801.260	177.453	
889.880	176.008	
914.060	176.715	
945.120	176.191	
954.950	175.212	
963.920	176.402	
1016.450	176.960	
1185.610	175.182	
1219.520	175.472	
1267.710	178.094	
1276.450	178.287	stake top
1276.450	178.187	stake ground
1306.450	178.547	

X-SEC No. 44		
Distance	Elevation	Remarks
-30.000	180.230	
0.000	180.592	stake top
0.000	180.362	stake ground
49.000	180.590	
49.000	178.593	
172.330	178.811	
272.330	179.461	
477.090	179.163	
502.740	178.853	
525.940	179.153	
559.810	181.236	
591.970	182.310	
633.200	182.483	
663.650	182.528	
680.960	181.194	
704.750	182.147	
787.950	181.336	
840.390	182.635	
906.420	183.051	
922.260	182.980	
942.260	180.991	
963.690	181.231	
1016.400	182.562	
1066.870	182.776	
1081.780	181.696	
1094.980	182.426	
1164.960	183.525	
1188.080	184.280	stake top
1188.080	184.180	stake ground
1218.080	183.710	

X-SEC No. 45		
Distance	Elevation	Remarks
-30.000	183.266	
0.000	185.366	stake top
0.000	185.246	stake ground
17.780	182.653	
143.670	181.631	
159.300	183.772	
175.280	182.203	
219.550	183.703	
264.770	182.639	
317.715	181.899	
370.660	182.609	
393.095	181.309	
415.530	182.977	
464.260	185.297	
478.440	188.623	stake top
478.440	187.750	stake ground
508.440	187.342	

X-SEC No. 46		
Distance	Elevation	Remarks
-43.054	189.045	
-8.218	187.851	
-4.168	189.295	
0.000	189.345	stake top
0.000	189.245	stake ground
5.400	187.607	
31.040	186.837	
46.880	184.312	
58.880	183.612	
71.240	183.651	
92.340	183.642	
113.907	183.870	
132.990	185.181	
239.360	183.788	
352.380	188.233	
374.810	205.118	stake top
374.810	205.018	stake ground
377.810	208.045	

Annex - C

Co-ordinates of Bank Stakes and Flood Mark in UTM System

CO-ORDINATE BY TRAVERSE

GRID SHEET NO.	ORDER	NO. OF STATIONS	
34	5	34	
Sum of distances (m)	f _y (m)	f _x (m)	f _{beta}
12187.480	+1.273	-1.618	0.00134

Station No.	Angle	Distance	Coordinate(Y)	Coordinate(X)
R 40	291.7529	498.275	532392.243	3142890.274
W 13	183.5213	573.900	532658.626	3143311.332
R 41	213.9309	283.959	532831.065	3143858.656
W 14	194.6634	550.851	532973.149	3144104.491
R 42	239.1921	593.878	533207.873	3144602.784
W 15	195.7545	414.971	533724.754	3144895.260
R 43	285.4307	526.639	534071.499	3145123.238
W 16	151.2110	610.341	534453.224	3144760.295
W 17	181.7590	405.918	535063.617	3144764.009
W 18	166.8073	96.179	535452.307	3144881.096
W 19	259.6611	345.100	535518.344	3144951.019
W 20	157.1959	152.285	535860.872	3144908.627
R 44	218.5455	327.298	535990.766	3144988.120
R 45	223.3289	487.037	536307.263	3145071.597
W 21	170.4865	473.241	536791.491	3145018.836
R 46	321.5405	373.530	537235.243	3145183.349
L 46	292.1316	634.673	537241.568	3144809.823
W 1	179.6485	233.867	536613.208	3144720.906
L 45	204.9993	147.618	536403.687	3144617.028
W 2	211.4447	1144.320	536266.701	3144562.037
W 3	150.0560	124.219	535145.724	3144332.517
L 44	272.7986	114.634	535077.198	3144228.901
W 4	149.2290	508.881	534963.990	3144246.832
L 43	260.7546	76.914	534555.968	3143942.733
W 5	157.8770	262.806	534482.823	3143966.480
W 6	183.6493	259.504	534235.767	3143876.909
W 7	150.0083	119.522	534022.276	3143729.388
L 42	267.7121	463.186	534000.768	3143611.803
W 8	170.8116	99.824	533562.047	3143463.342
L 41	232.2049	172.183	533491.417	3143392.797
W 9	164.7153	371.220	533325.899	3143345.396
W 10	197.6553	166.836	533076.235	3143070.659
W 11	150.0415	573.871	532968.652	3142943.137
L 40	349.4831	4000.000	533016.740	3142317.203

Co-ordinates by Traverse				2nd Loop	
Grid Sheet No.	Order	No. of Stations			
34	5	46			
Sum of distance (m)	FY (m)	FX (m)	FBETA		
22881.2	+2.777	-0.112	-0.06050		
Station No.	Angle	Distance	Coordinate (Y)	Coordinate (X)	
W33	203.41700	926.491	530223.708	3133939.396	
R31	273.68850	460.811	529905.038	3134809.313	
W34	159.68450	436.932	530237.657	3135128.291	
W35	189.63125	62.035	530312.909	3135558.701	
R32	190.00740	326.864	530313.543	3135620.733	
W36	163.00830	530.816	530265.749	3135944.076	
W37	174.11060	131.317	529912.648	3136340.355	
R33	275.91350	568.931	529793.642	3136395.835	
W38	205.65350	375.796	529826.603	3136963.812	
W39	171.12825	233.458	529881.562	3137235.572	
W40	46.29150	89.817	529811.069	3137558.123	
R34	368.85020	997.106	529774.432	3137476.122	
W41	183.23325	448.856	529705.794	3138470.760	
R35	300.22125	661.98	529559.384	3138895.045	
W42	145.29450	493.654	530185.958	3139108.873	
R36	326.41310	267.124	530370.300	3139566.838	
W43	78.98500	400.482	530556.925	1339375.687	
W44	121.78435	133.451	530737.404	3139733.219	
R37	313.91000	313.353	530645.362	3139829.834	
W45	186.95500	81.286	530913.721	3139991.677	
W23	120.39025	979.439	530973.337	3140046.945	
R38	270.30950	777.899	530567.498	3140938.287	
W22	175.02435	518.733	531054.942	3141544.598	
R39	242.70225	1056.93	531200.717	3142042.443	
W12	199.26265	405.328	532063.934	3142652.501	
R40	284.06075	811.975	532392.243	3142890.274	
L40	289.07745	1103.33	533016.740	3142371.203	
L39	265.58575	281.742	532466.768	3141414.793	
W24	157.22115	776.865	532185.109	3141409.550	
W25	164.70535	294.069	531586.334	3140914.697	
L38	212.92990	336.928	531492.244	3140636.098	
W26	174.07380	315.447	531322.272	3140345.207	
W27	177.91515	162.919	531284.025	3140032.091	
L37	259.63025	1251.82	531320.431	3139873.286	
W28	191.76910	40.042	530503.248	3138925.114	
L36	223.02450	412.796	530481.237	3138891.668	
L35	171.39500	568.917	530147.006	3138649.474	
W29	118.96190	317.68	529877.081	3138148.702	
L34	246.33135	959.577	530100.190	3137922.514	
W30	163.07060	415.194	530148.928	3136964.165	
L33	258.58385	452.608	530393.849	3136628.865	
W31	131.62405	593.508	530264.715	3136195.084	
L32	242.08295	1150.57	530684.122	3135775.069	
W32	182.57640	63.903	530826.057	3134633.266	
L31	274.89835	892.475	530850.788	3134574.339	
W33	172.88085	0	530223.708	3133939.396	

CO-ORDINATE BY TRAVERSE

3rd Loop

GRID SHEET NO.	ORDER	NO. OF STATIONS	
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34

5

41

Sum of distances (m)	fy(m)	fx(m)	fbeta
18016.997	+9.490	+5.372	0.15981

Station No.	Angle	Distance	Coordinate(Y)	Coordinate(X)
R 22	307.6384	448.048	532079.970	3127981.146
R 23	245.6771	238.399	531726.763	3128256.643
W 66	146.0823	756.066	531681.526	3128490.757
W 67	185.9212	385.689	531030.510	3128874.774
W 68	180.2148	428.631	530663.558	3128993.011
R 24	248.5576	317.216	530235.153	3128993.344
W 69	170.5865	670.988	530006.095	3129212.714
R 25	201.0430	118.650	529365.666	3129411.969
W 63	209.8130	717.296	529253.012	3129449.055
W 62	304.5999	1121.108	528614.430	3129775.221
R 26	258.5499	108.513	529195.240	3130734.841
W 61	153.5307	271.297	529303.188	3130746.476
W 55	188.3040	443.470	529485.004	3130948.043
R 27	164.5073	950.499	529717.039	3131326.241
R 28	200.7742	464.371	530004.469	3132232.681
W 54	169.9347	338.368	530150.267	3132673.790
R 29	318.0756	67.473	530098.727	3133008.283
W 46	77.9494	503.512	530165.662	3132999.524
R 30	236.2693	477.325	530058.067	3133491.498
W 33	351.7343	481.012	530223.708	3133939.396
L 30	261.5170	283.208	530413.191	3133497.313
W 47	142.7803	365.555	530262.430	3133257.746
L 29	240.5013	752.722	530383.436	3132912.841
W 48	111.7708	223.800	530161.843	3132193.822
L 28	299.5640	250.477	530360.029	3132089.698
W 49	191.6084	721.035	530245.071	3131867.302
L 27	221.9075	1057.882	530001.194	3131189.114
W 50	127.4228	120.736	529328.600	3130373.353
L 26	309.4166	291.590	529381.215	3130264.689
W 51	164.8251	470.923	529103.010	3130177.935
W 52	80.8027	272.505	528794.206	3129822.752
W 53	191.4567	331.842	529043.799	3129713.133

W	56	115.4358	47.275	529362.881	3129621.488
L	25	295.4925	454.825	529386.502	3129662.468
W	57	155.9095	675.087	529795.935	3129464.043
L	24	245.2681	836.034	530451.901	3129625.236
W	58	218.6488	964.736	531197.619	3129246.653
W	59	143.2065	63.674	531895.267	3128580.074
L	23	254.1001	414.042	531958.446	3128588.278
W	60	94.1432	111.118	532269.698	3128315.109
L	22	394.6195	0.000	532335.122	3128405.000

CO-ORDINATE BY TRAVERSE

4th Loop

GRID SHEET NO.	ORDER	NO. OF STATIONS	
34	5	47	

Sum of distances (m)	fy(m)	fx(m)	fbeta
24187.340	+7.414	+4.724	0.00846

Station No.	Angle	Distance	Coordinate(Y)	Coordinate(X)
R 9	374.4574	64.376	536193.537	3121674.739
W 84	141.8698	808.445	536232.019	3121726.374
W 85	261.7495	505.843	536014.469	3122505.087
R 10	292.8471	513.770	536339.407	3122892.992
W 86	184.0428	193.658	536767.950	3122609.462
R 11	139.3829	286.678	536950.954	3122545.983
R 12	138.9690	907.151	537184.696	3122712.142
W 87	246.5945	107.816	537179.643	3123619.455
R 13	85.5729	111.450	537251.255	3123700.102
W 78	214.3693	276.271	537153.451	3123753.498
R 14	225.7781	1182.427	536946.769	3123936.782
R 15	260.3539	235.898	536442.679	3125006.434
W 77	191.2473	202.243	536557.351	3125212.671
R 16	119.1402	250.817	536630.508	3125401.282
W 76	197.7991	725.326	536434.058	3125557.173
R 17	302.9361	152.676	535850.717	3125988.071
W 75	139.2110	1235.080	535947.001	3126106.626
R 18	185.5004	112.361	535614.520	3127296.248
W 74	182.0318	696.915	535560.623	3127394.841
R 19	232.9429	94.661	535069.284	3127889.009
W 73	98.8730	1255.344	535044.483	3127980.374
R 20	227.1317	908.954	533839.501	3127629.935
R 21	233.9064	411.766	532940.111	3127759.707
W 65	152.7093	540.354	532618.940	3128017.313
R 22	338.7631	494.566	532079.970	3127981.146
L 22	307.5040	529.227	532335.122	3128405.000
W 64	159.9948	223.518	532753.504	3128080.800
L 21	194.5940	664.052	532976.982	3128073.875
W 70	186.6881	363.032	533640.279	3128109.670
L 20	252.3009	245.950	533990.955	3128204.065
W 71	151.6208	1078.514	534199.582	3128073.739
L 19	279.4533	1162.872	535256.662	3128289.524

L 18	202.6844	1218.843	535838.843	3127282.899
L 17	148.0780	681.805	536404.017	3126203.054
L 16	282.3781	1195.661	537060.710	3126019.103
W 72	185.6009	111.530	537065.160	3124823.682
L 15	188.7647	452.150	537090.577	3124715.101
L 14	189.7778	697.220	537269.320	3124299.810
L 13	242.4616	247.976	537643.808	3123711.699
W 79	211.4865	964.857	537619.045	3123465.018
L 12	259.1795	769.810	537351.989	3122538.130
L 11	310.4863	233.462	536631.882	3122266.776
W 80	107.5695	125.806	536586.551	3122495.826
L 10	161.6060	402.727	536461.154	3122486.196
W 81	130.2898	311.244	536148.107	3122233.069
W 82	151.1837	232.238	536211.295	3121928.347
L 9	328.1274	0.000	536403.058	3121797.287

CO-ORDINATE BY TRAVERSE

5th Loop

GRID SHEET NO.	ORDER	NO. OF STATIONS		
34	5	32		
Sum of distances (m)	f _y (m)	f _x (m)	f _{beta}	
14568.852	-0.683	+0.864	-0.00978	
Station No.	Angle	Distance	Coordinate(Y)	Coordinate(X)
105	97.2497	792.433	535075.861	3117745.443
W 98	198.0385	207.549	535634.889	3118307.092
R 3	176.5888	842.696	535776.705	3118458.636
W 39	154.1926	96.295	536092.820	3119239.828
R 4	196.4029	179.268	536061.161	3119330.777
W 100	112.8413	185.433	535992.754	3119496.494
R 5	243.9048	820.464	535810.641	3119461.529
R 6	299.4202	756.240	535090.538	3119854.858
R 7	300.4403	575.064	535446.937	3120521.876
W 89	122.7180	487.611	535952.207	3120247.367
W 88	142.0356	368.817	536319.981	3120567.537
R 8	235.2669	137.036	536299.342	3120935.799
W 83	151.1006	641.769	536364.797	3121056.197
R 9	283.5063	242.731	536193.537	3121674.739
L 9	321.3827	1098.307	536403.058	3121797.287
L 8	270.5522	1090.051	536613.974	3120719.498
W 90	154.6478	117.859	535750.026	3120054.812
L 56,7	104.9245	833.746	535726.311	3119939.369
W 91	217.9885	66.094	536527.569	3119709.083
L 4	304.3400	1012.271	536583.478	3119673.840
W 92	157.3041	354.658	535986.531	3118856.341
L 3	166.1087	651.966	536000.705	3118501.988
L 2	178.9233	543.424	536353.806	3117953.977
W 93	221.7454	88.506	536780.625	3117617.686
L 1	273.7690	214.303	536827.775	3117542.793
R1 (000)	290.9263	741.183	536707.313	3117365.557
R2(002)	155.5613	139.829	536041.290	3117690.888
W 94	129.1483	318.179	535905.586	3117657.157
W 95	283.4683	333.941	535837.949	3117346.266
W 96	237.3313	426.626	535504.338	3117331.091
W 97	245.7217	204.503	535138.591	3117550.783
105	172.4411	0.000	535075.861	3117745.443

Coordinates of Bank Stakes and Flood Marks in UTM System

FM Near	Inst. St.	Coordinates		Ref. St.	Coordinates		X2-X1	Y2-Y1	Theta-1	Theta-2	Semi. Angle	Theta	Dist.	Easting	Northing
		Easting	Northing		Easting	Northing									
L46	L46	537241.568	3144809.623	R46	537235.240	3145183.349	-8.325	373.526	-1.554	1.588	387.0460	-4.60319	537239.545	3144850.566	
L45	L45	536403.087	3144617.028	W1	536813.208	3144720.906	209.521	103.878	0.460	0.460	335.2060	-4.80513	536404.893	3144823.992	
L44	L44	535077.198	3144428.901	W3	535145.724	3144332.517	68.526	-98.384	-0.953	5.330	308.4380	0.48551	535103.086	3144442.560	
L43	L43	534555.966	3143942.733	W4	534963.990	3144246.832	408.022	304.099	0.640	0.640	340.3230	-4.70529	534555.837	3143981.183	
L42	L42	534000.768	3143611.803	W7	534022.276	3143729.388	21.508	117.585	1.390	1.390	320.9060	-3.65090	533994.489	3143615.304	
L41	L41	533491.417	3143392.797	W8	533562.047	3143483.342	70.630	70.545	0.785	0.785	289.2300	-3.75826	533468.615	3143408.961	
L40	L40	533018.740	3142971.200	W11	532968.852	3142843.137	-48.088	571.924	-1.487	1.655	339.3090	-3.67517	533011.161	3142374.499	
R40	R40	532392.243	3142860.274	L40	533018.740	3142971.203	624.497	-519.071	-0.693	5.590	391.0430	-0.55277	532408.861	3142891.243	
R31	R31	529905.038	3134809.313	W33	530223.708	3133959.396	319.670	-899.917	-1.220	5.064	358.3060	-0.53334	529912.116	3134805.134	
R32	R32	530313.543	3135620.733	W35	530312.999	3135558.701	-0.634	-82.032	1.581	4.702	294.0280	0.08359	530317.669	3135621.079	
R33	R33	529739.642	3136095.835	W37	529912.848	3136340.355	173.008	-55.480	-0.310	5.973					
R34	R34	529774.433	3137476.122	W40	529811.069	3137558.123	34.638	82.001	1.151	1.151					
R35	R35	529559.364	3136895.045	W41	529705.794	3138470.760	146.410	-424.285	-1.239	5.045					
R36	R36	530370.300	3139566.838	W42	530185.958	3139108.873	-184.342	-457.965	1.188	4.330					
R37	R37	530645.362	3139829.834	W44	530737.404	3139733.219	92.042	-96.815	-0.810	5.474					
R41	R41	532831.065	3143858.658	W13	532658.626	3143311.332	-172.439	-547.324	1.266	4.407					
R42	R42	533207.873	3144802.784	W14	532973.149	3144104.491	-234.724	-498.293	1.131	4.272					
R43	R43	534071.499	3145123.238	W15	533724.754	3144895.280	-349.745	-227.378	0.582	3.723					
R44	R44	535990.766	3144986.120	W20	535860.872	3144908.627	-129.894	-79.463	0.549	3.691					
R45	R45	536307.263	3145071.597	R44	535990.766	3144986.120	-316.497	-83.477	0.258	3.399					
R38	R38	530567.498	3140938.487	W23	530973.337	3140048.945	405.639	-891.342	-1.144	5.140					
R39	R39	531200.717	3142042.443	W22	531054.942	3141544.598	-145.775	-497.845	1.286	4.428					
L39	L39	532468.768	3141414.763	L40	533018.740	3142971.203	849.972	966.410	1.049	1.049					
L38	L38	531492.244	3140638.098	W25	531588.334	3140914.697	94.990	178.599	1.245	1.245					
L37	L37	531320.431	3139873.286	W27	531284.025	3140032.091	-36.408	258.805	1.345	1.796					
L38	L38	530481.237	3138891.668	W28	530503.248	3138925.114	22.011	33.446	0.989	0.989					
L35	L35	530147.006	3138349.474	L38	530481.237	3138891.668	334.231	542.194	1.018	1.018					

Babar River Survey

FM Near	Incl. St.	Coordinates		Ref. St.	Coordinates		X2-X1	Y2-Y1	Theta-1	Theta-2	Solid. Angle	Theta	Dist.	Easting	Northing
		Easting	Northing		Easting	Northing									
L34	L34	530100.190	3137922.511	W29	31398148.702	-223.109	228.191	-0.792	2.349	307.6430	-2.48311	20.14	530084.261	3137910.187	
L33	L33	530393.849	3136628.865	W30	3136964.165	-244.921	335.300	-0.940	2.202	341.0650	-3.46898	14.00	530380.503	3136623.367	
L32	L32	530684.122	3135775.069	W31	3136195.084	-419.407	420.015	-0.786	2.355	337.6440	-2.94923	6.58	530677.665	3135773.806	
L31	L31	530850.788	3134574.339	W32	3134633.266	-24.731	58.927	-1.173	1.968	315.6970	-2.96080	50.50	530800.861	3134568.753	
R22	R22	532079.970	3127981.146	L22	3128405.000	255.152	423.854	1.029	1.029	330.5850	0.42795	3.93	531730.339	3128258.274	
R23	R23	531726.763	3128256.643	R22	3127981.146	353.207	-275.497	-0.662	5.621	336.1500	1.00218	9.27	530240.145	3129001.156	
R24	R24	530235.153	3128993.344	W68	3128993.011	420.405	-0.333	-0.001	6.282	303.4140	1.21554	10.57	529369.341	3128421.874	
R25	R25	529365.666	3129411.963	W69	3130006.095	640.429	-199.255	-0.302	5.982	342.2740	-2.03347	47.47	535235.474	3128247.045	
L19	L19	535256.662	3128289.524	W71	3134199.582	-1057.080	-215.785	0.201	3.343	341.3760	-3.26718	8.09	535830.817	3127283.912	
L18	L18	535838.843	3127282.859	L19	3128289.524	-582.181	1008.625	-1.048	2.095	330.9360	-2.32989	94.10	536539.252	3128134.788	
L16	L16	537060.710	3126019.103	L17	3126303.054	-658.693	183.961	-0.273	2.868	330.9360	-2.32989	94.10	537060.577	3124715.101	
L15	L15	537090.577	3124715.101										537090.577	3124715.101	
L14	L14	537269.320	3124299.810										537269.320	3124299.810	
L13	L13	537643.808	3123711.699	L14	3124299.810	-374.488	588.111	-1.004	2.138	334.8320	-3.12172	35.92	537607.865	3123710.585	
L12	L12	537351.969	3122538.130	W79	3123465.018	287.058	928.888	1.250	1.290	339.6030	-4.04420	7.16	537347.553	3122543.750	
L11	L11	536631.882	3122266.776	L12	3122538.130	720.107	271.354	0.360	0.360	402.3260	-5.95935	10.87	536642.187	3122270.225	
L10	L10	536461.154	3122488.196	W80	3122485.826	125.397	9.830	0.077	0.077	499.8160	-7.75874	27.60	536463.779	3122459.721	
L9	L9	536403.058	3121797.287	W82	3121928.347	-191.763	131.060	-0.600	2.542	325.6080	-2.57258	62.38	536350.524	3121783.687	
R9	R9	536193.537	3121674.739	L9	3121797.287	209.521	122.548	0.529	0.529	437.2040	-6.33834	8.97	536202.483	3121674.244	
R10	R10	536339.407	3122892.992	W85	3122505.087	-324.938	-387.905	0.874	4.015	321.2850	-1.03164	8.87	536343.858	3122885.552	
R11	R11	536950.954	3122545.983	W86	3122609.462	-183.004	63.479	-0.334	2.808	284.3920	-0.70785	35.64	537211.776	3122688.977	
R12	R12	537184.696	3122712.142	R11	3122545.983	-233.742	-168.159	0.618	3.760	267.6120	1.35422	13.54	536946.769	3123036.782	
R14	R14	536946.769	3123936.782	W78	3123753.498	208.741	-183.284	-0.725	5.558	341.5880	-0.21287	6.01	536448.553	3125005.164	
R15	R15	536442.679	3125006.434	R14	3123936.782	504.090	-1689.652	-1.130	5.153	215.1600	0.98286	6.49	536634.216	3125006.608	
R16	R16	536630.508	3125401.282	W77	3125212.671	-73.157	-188.611	1.201	-4.342	301.6740	0.90829	25.51	535866.408	3125008.184	
R17	R17	535950.717	3125968.071	W76	3125557.173	588.341	-430.898	-0.836	5.647	278.5530	1.15083	31.84	536082.185	3127217.900	
R18	R18	535614.520	3127206.248			491.339	-494.168	-0.788	5.495	332.8600	-4.94553	13.97	535842.590	3127642.543	
R19	R19	535069.264	3127889.009	W74	3127394.341	1204.982	350.499	0.283	0.283	298.0040	1.49027	23.56	532942.006	3127783.151	
R20	R20	533839.501	3127629.935	W73	3127980.374	899.390	-129.772	-0.143	6.140						
R21	R21	532940.111	3127759.707	R20	3127629.935										

Babar River Survey

FM Near	Inst. St.	Coordinates		Ref. St.	Coordinates		X2-X1	Y2-Y1	Theta-1	Theta-2	Sboid. Angle	Theta	Dist	Easing	Northing
		Easting	Northing		Easting	Northing									
R3	R3	535776.705	3118458.636	W98	535634.889	3117745.443	-141.816	-713.193	1.375	4.516				536061.161	3119330.777
R4	R4	536061.161	3119330.777											536061.161	3119330.777
R5	R5	535810.641	3119481.529	W100	535992.754	3118498.494	182.113	34.965	0.190	0.190	299.2440	-4.51093	9.28	535808.783	3119470.622
R6	R6	535090.539	3119854.858		535810.841	3119481.529	720.103	-393.329	-0.500	5.783	354.2120	0.21931	35.65	535125.334	3119862.614
R7	R7	535446.937	3120521.876												
R8	R8	536299.342	3120935.799											536299.342	3120935.799
L8	L8	536613.974	3120719.498	L9	536403.068	3121797.287	-210.916	1077.789	-1.378	1.764	332.6180	-3.46070	5.61	536608.647	3120721.258
L5;L6;L7	L5;L6;L7	535726.311	3119939.369											535726.311	3119939.369
L4	L4	536563.478	3119873.940	W91	536527.569	3119709.083	-55.909	35.243	-0.562	2.579	320.2340	-2.45108	10.292	536575.544	3119667.285
L3	L3	536000.705	3118501.988	W92	535988.531	3118858.341	-14.174	354.353	-1.531	1.611	315.0780	-3.33846	13.57	535987.397	3118504.642
L2	L2	536353.808	3117953.977												
L1	L1	536827.775	3117542.793	W93	536780.625	3117617.686									
R1	R1	536707.313	3117385.557	L1	536827.775	3117542.793	120.462	177.238	0.974	0.974	398.8600	-5.13435	13.308	536712.763	3117377.698
R2	R2	536041.290	3117690.888												