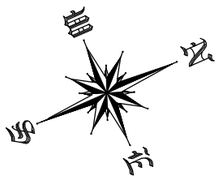
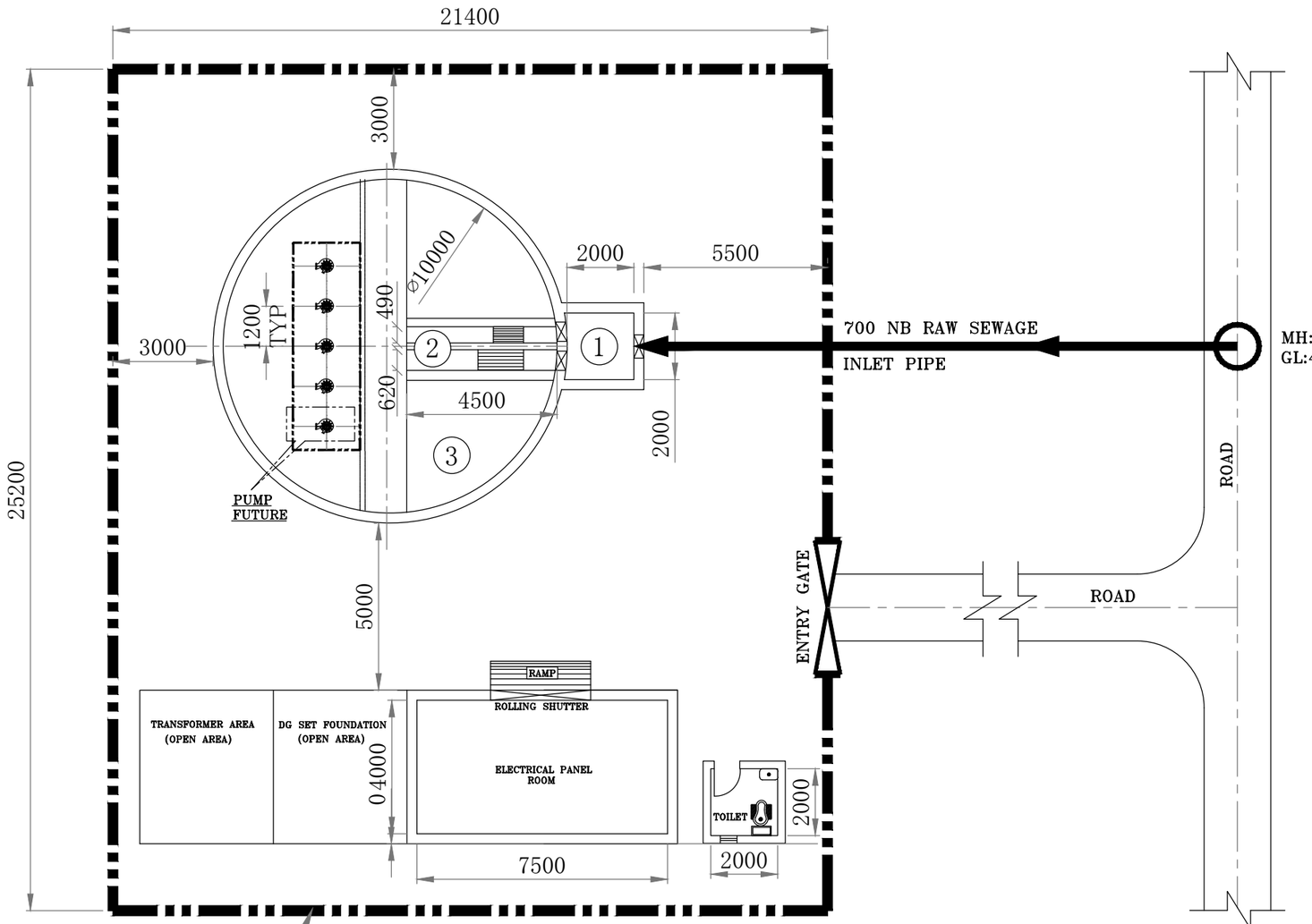
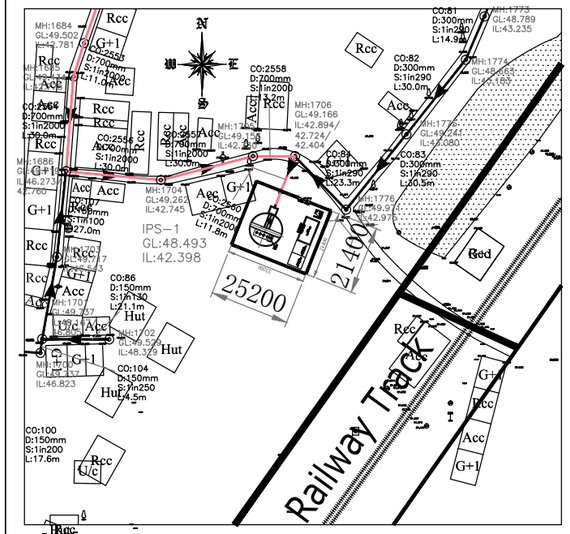




LAYOUT PLAN

HYDRAULIC FLOW DIAGRAM



KEY PLAN

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.0 x 2.0
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	10.0 ⌀ x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTE:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.

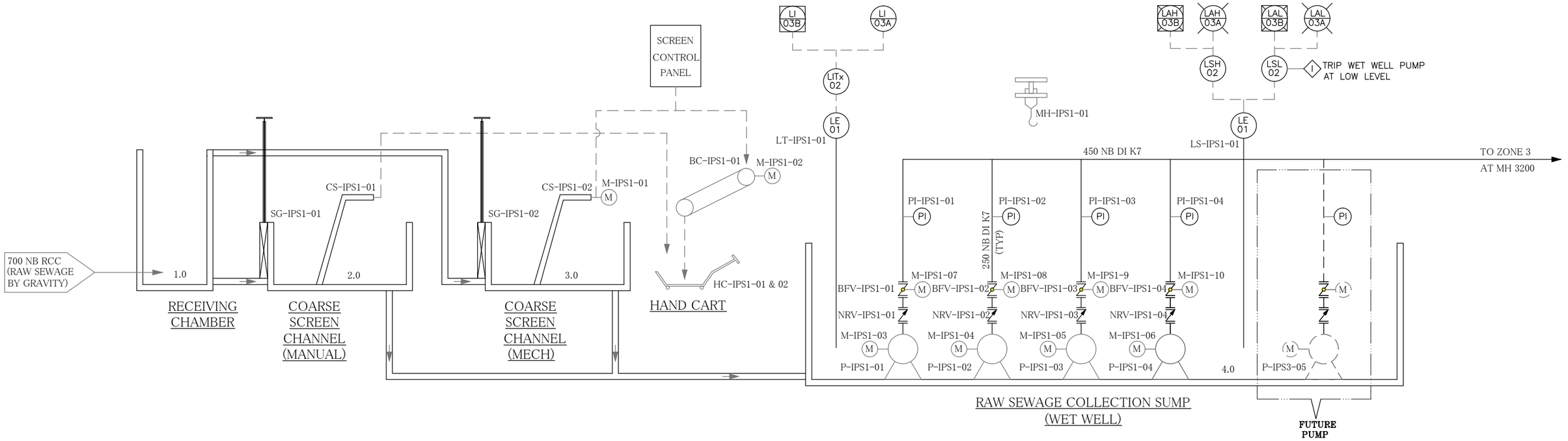
REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	12.08.14	SUBMISSION FOR APPROVAL	M.S.	AKS	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 12.08.14	TITLE: – IPS 1 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM			
DRAWN.: – M.S.				
CHKD.: – AKS	SCALE	SHEET	DRAWING NO.	REV.
APPD.: – AKS	AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS1/A06	0



UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.0 x 2.0 x 1.034 SWD + 6.768FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.49 x 0.979 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 0.62 x 0.979 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	10.0ø x 2.0 SWD + 8.102 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS1-01	MANUAL COARSE BAR SCREEN	0.29 W x 1.55 HT	1	SS 304
CS-IPS1-02	MECH COARSE BAR SCREEN	0.33 W x 9.273 HT	1	SS 304
BC-IPS1-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS1-01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS1-01/02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	210.0 M3/HR x 22.0 MWC	4	AS PER NIT
M-IPS1-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS1-01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	450 x 450	2	CI (AS PER NIT)
NRV-IPS1-01/02/03/04	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	250 NB	4	CI (AS PER NIT)
BFV-IPS1-01/02/03/04	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	250 NB	4	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS1-01/02/03/04	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	4	MFG STD
LS-IPS1-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS1-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

LEGENDS:-

	NON RETURN VALVE
M	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
I	HARD WIRE INTERLOCK
———	SEWAGE/WATER LINE
— — —	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-

EQUIPMENT NO.

IPS - 1

TYPE OF EQUIPMENT

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	12.08.14	SUBMISSION FOR APPROVAL	MS	MB	AKS

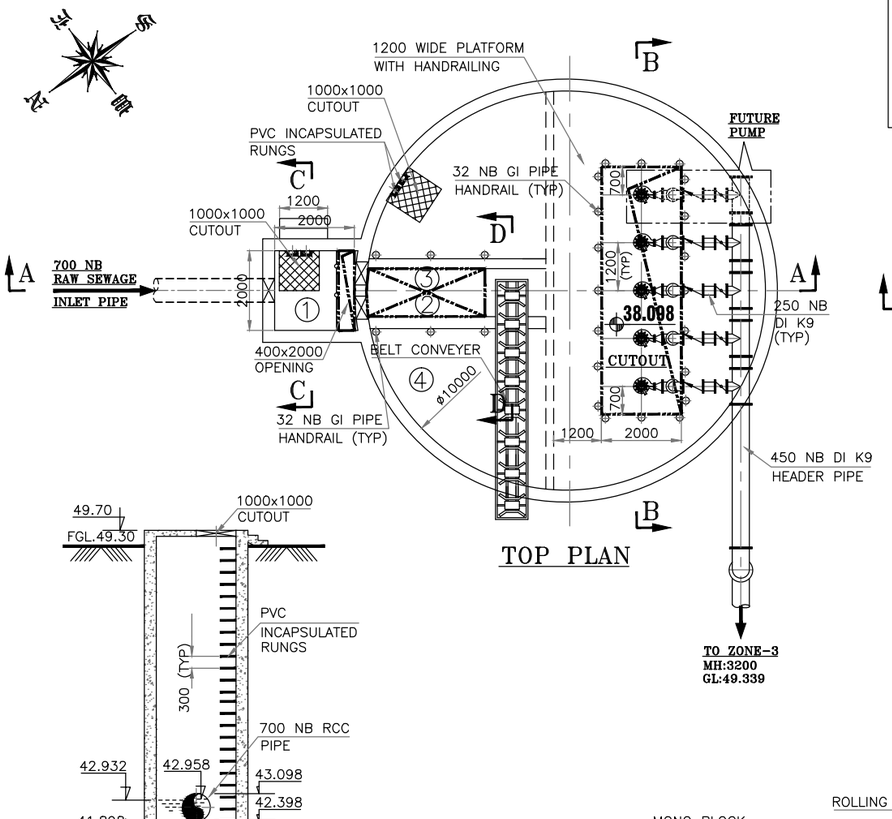
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

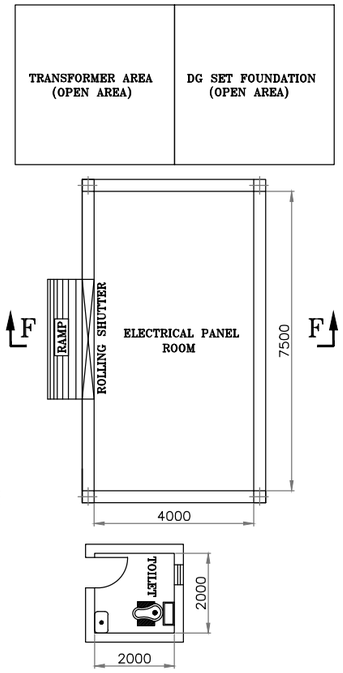
BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

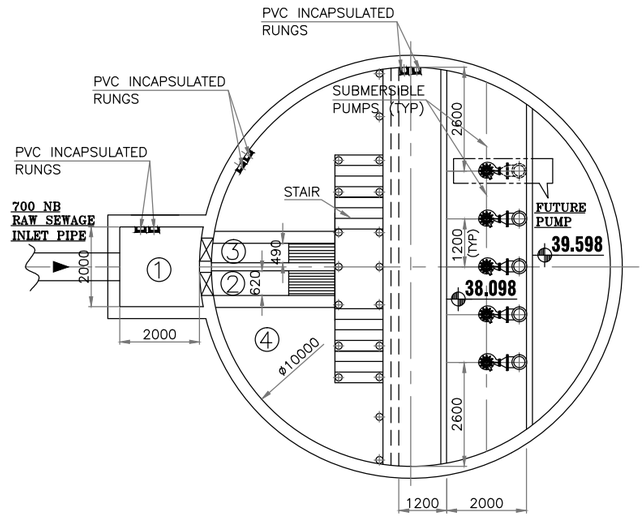
TITLE:- PROCESS & INSTRUMENTATION DIAGRAM IPS-1

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS1/A07	0

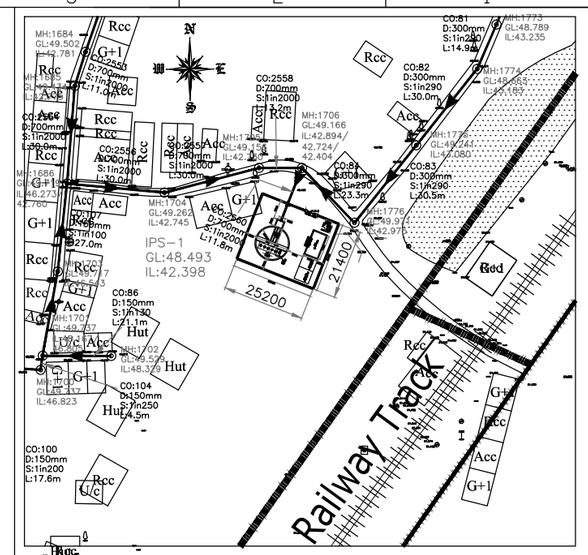


TOP PLAN



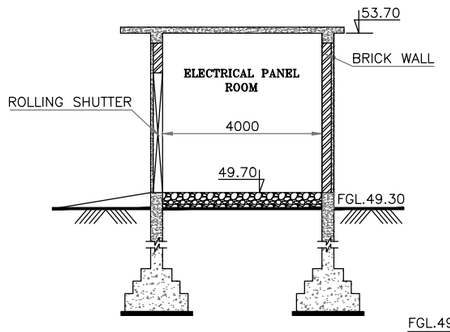


SECTION 'E-E'

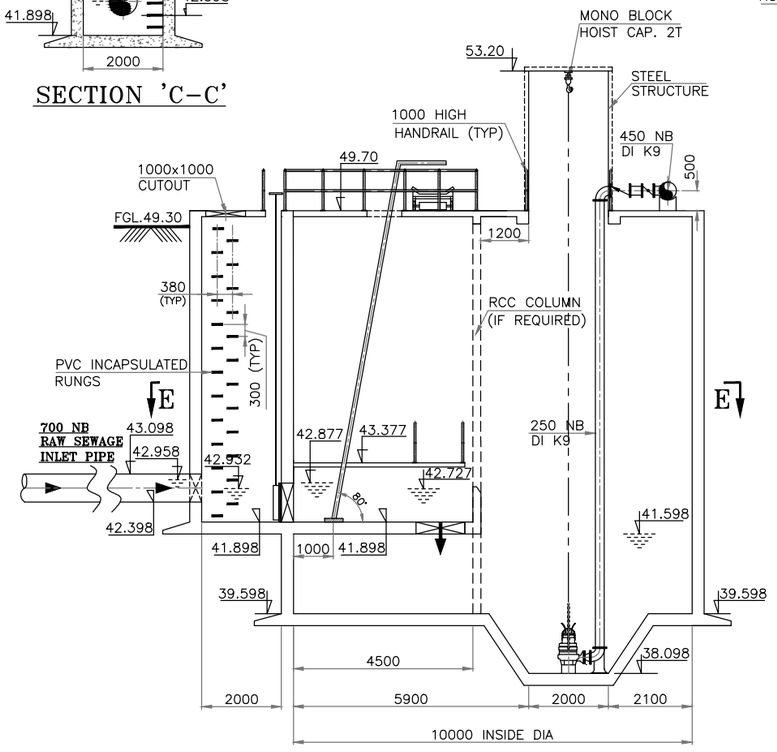


KEY PLAN

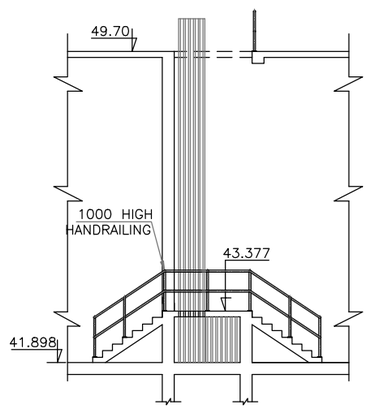
SECTION 'C-C'



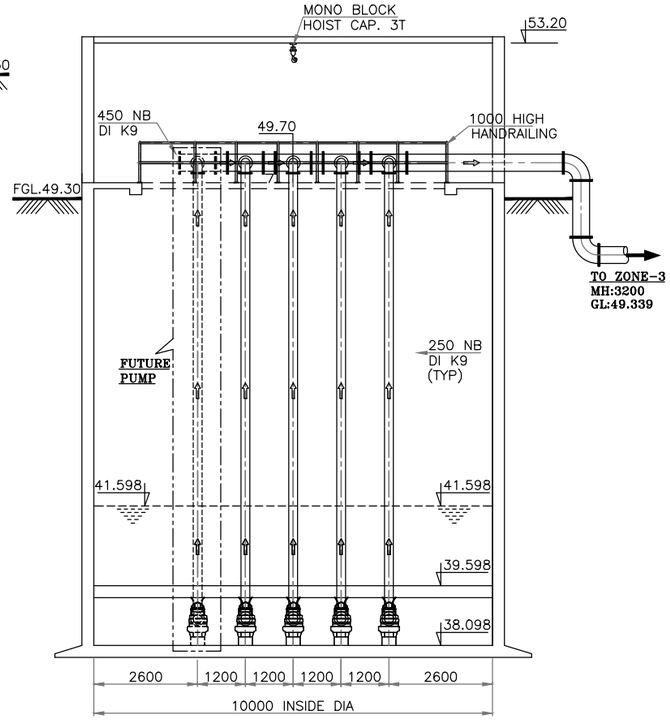
SECTION 'F-F'



SECTION 'A-A'



SECTION 'D-D'



SECTION 'B-B'

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.0 x 2.0
2	MECHANICAL COARSE SCREEN CHANNEL	4.5 x 0.62
3	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.49
4	RAW SEWAGE SUMP WET WELL	10.0 ø x 2.0 SWD
5	TRANSFORMER AREA	4.0 x 4.0
6	ELECTRICAL PANEL ROOM	4.0 x 7.5
7	DG SET FOUNDATION	4.0 x 4.0
8	TOILET	2.0 x 2.0

NOTES: –

1.) ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METRES.
2.) FINISHED GROUND LEVEL CONSIDERED 49.30 M.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	12.08.14	SUBMISSION FOR APPROVAL	MS	MB	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

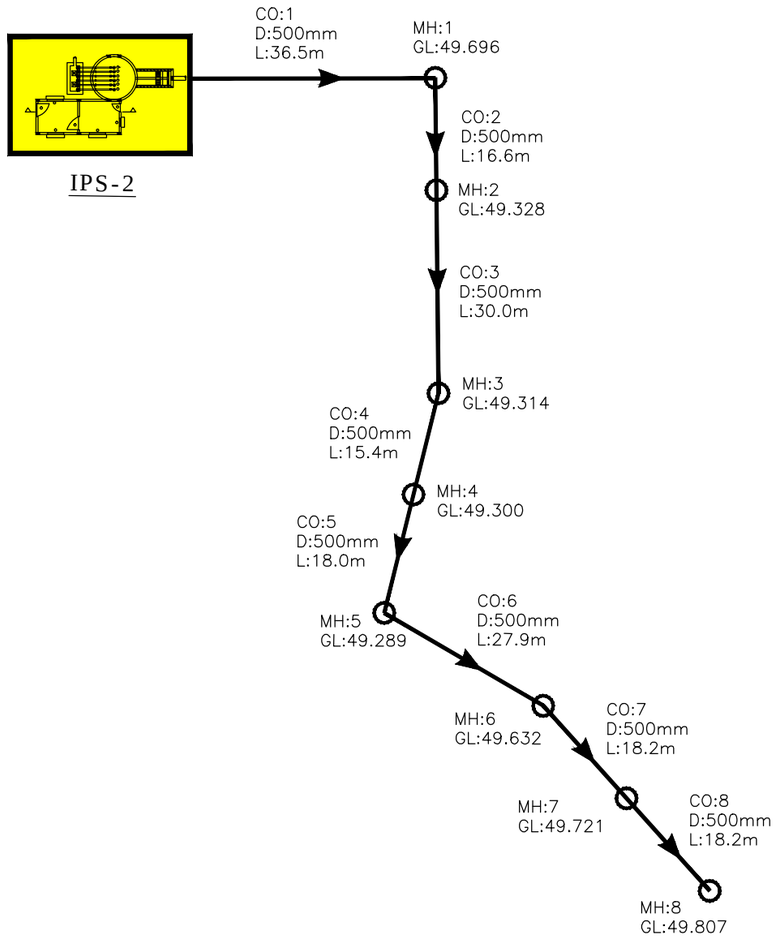
PROJECT: – 22.0 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

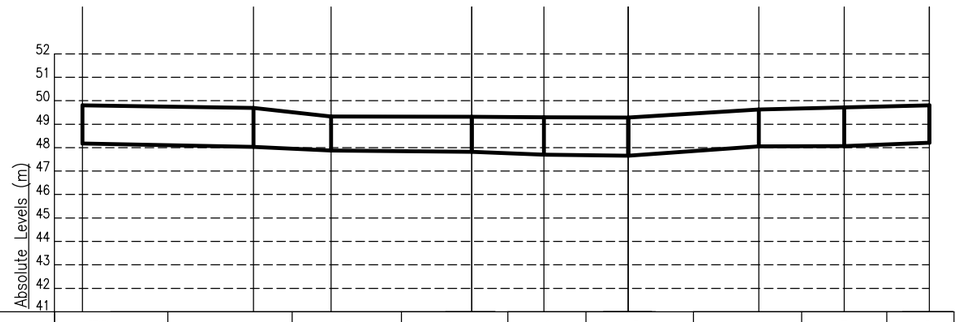
BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 12.08.14
DRAWN.: – M.S.
CHKD.: – MB
APPD.: – AKS

TITLE: – MECH. GA DRG. OF INTERMEDIATE PUMPING STATION-1

SCALE	SHEET	DRAWING NO.	REV.
1:100	1 OF 1	TT/BEI/HJ/1051/IPS1/B17	0





MH. NO	IPS-2	1	2	3	4	5	6	7	8
Chainage	0	36.5	53.1	83.1	98.5	116.5	144.4	162.6	180.8
Ground Level	49.700	49.696	49.328	49.314	49.300	49.289	49.632	49.721	49.807
Pipe Invert Level	48.168	48.164	47.796	47.782	47.768	47.757	48.100	48.189	48.275
Dia of Pipe	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-1
L.S. OF CO-1 TO CO-8
(MH NO. IPS2 TO 8)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

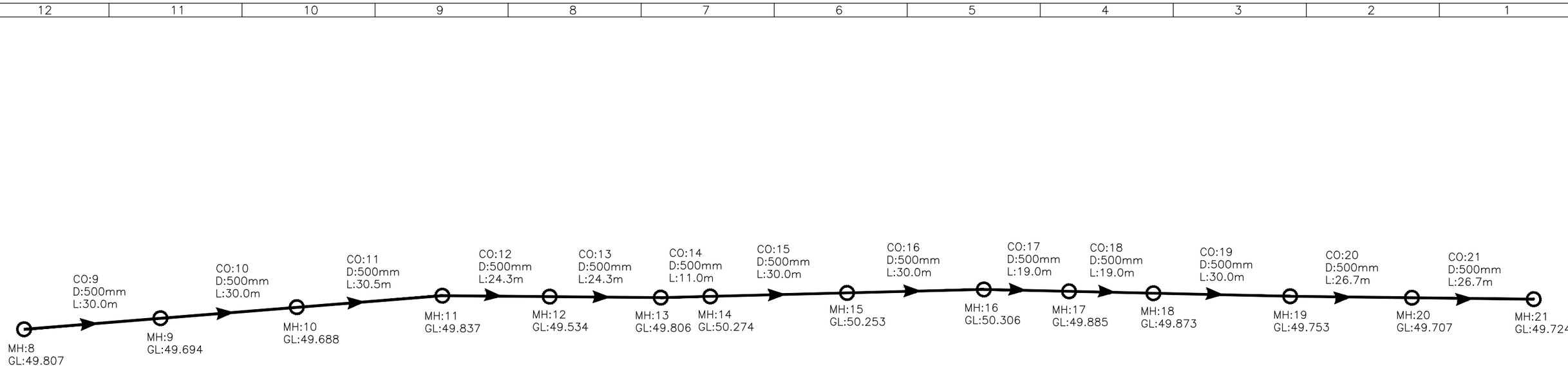
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

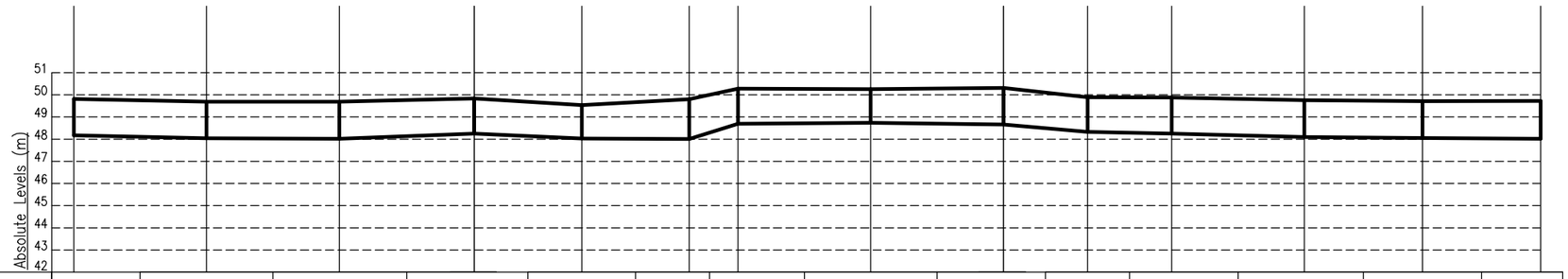
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	01 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Chainage	180.8	210.8	240.8	271.3	295.6	319.9	330.9	360.9	390.9	409.9	428.9	458.9	485.6	512.3
Ground Level	49.807	49.694	49.688	49.837	49.534	49.806	50.274	50.253	50.306	49.885	49.873	49.753	49.707	49.724
Pipe Invert Level	48.275	48.162	48.156	48.305	48.002	48.076	48.742	48.721	48.774	48.353	48.341	48.221	48.175	48.192
Dia of Pipe	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-2
L.S. OF CO-9 TO CO-21
(MH NO. 8 TO 21)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

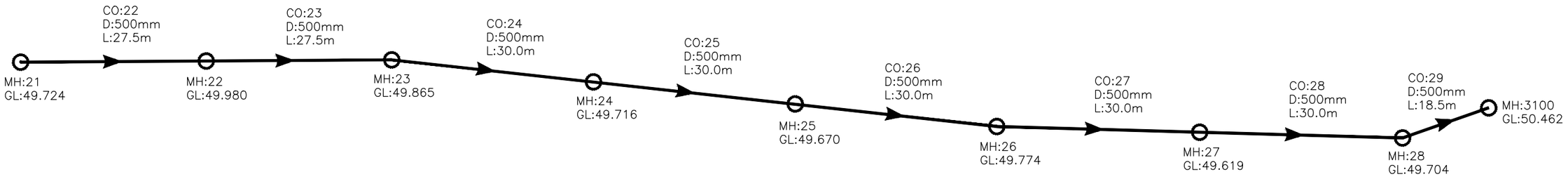
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

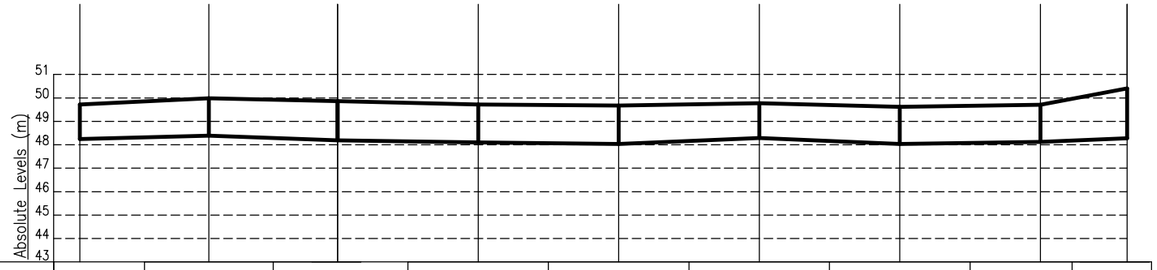
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	02 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	21	22	23	24	25	26	27	28	3100
Chainage	512.3	539.8	567.3	597.3	627.3	657.3	687.3	717.3	735.8
Ground Level	49.724	49.980	49.865	49.716	49.670	49.774	49.619	49.704	50.462
Pipe Invert Level	48.192	48.448	48.333	48.184	48.138	48.242	48.087	48.172	48.330
Dia of Pipe	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-3
L.S. OF CO-22 TO CO-29
(MH NO. 21 TO 3100)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

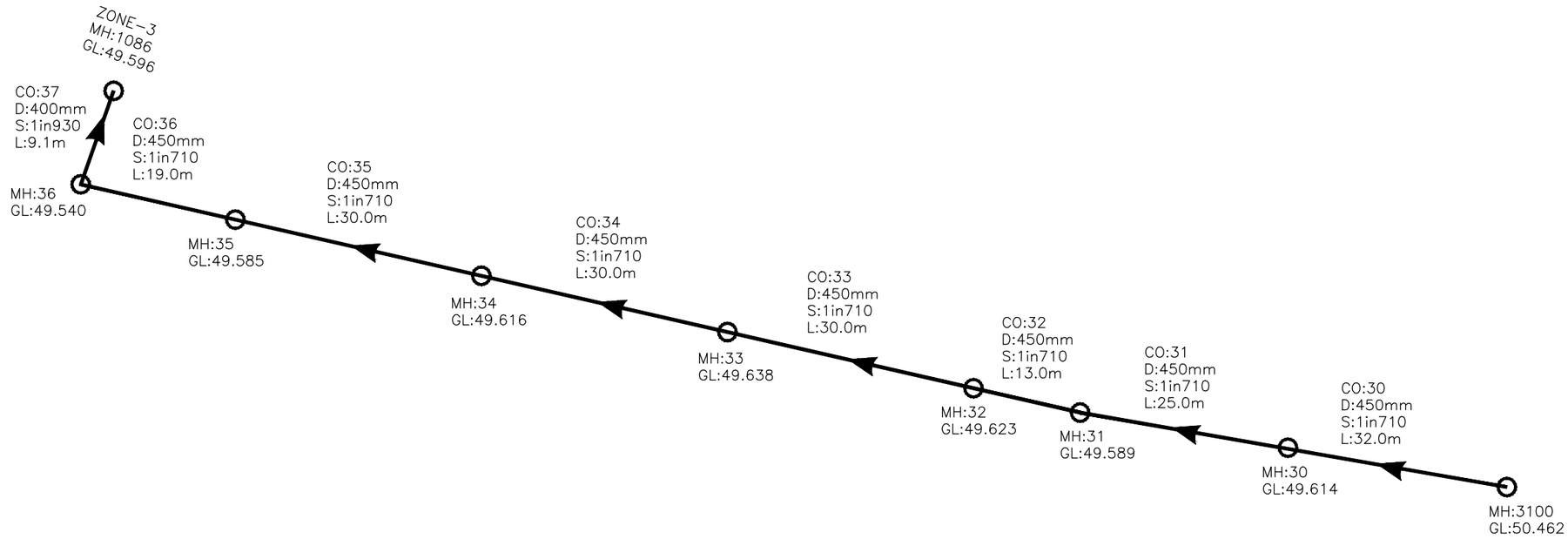
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

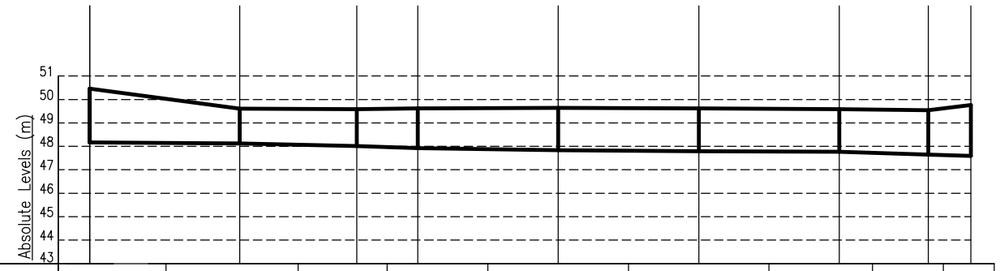
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	03 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	3100	30	31	32	33	34	35	36	1086
Chainage	735.8	767.8	792.8	805.8	835.8	865.8	895.8	914.8	923.9
Ground Level	50.462	49.614	49.589	49.623	49.638	49.616	49.585	49.540	49.596
Pipe Invert Level	48.130	48.085	48.049	48.030	47.987	47.944	47.901	47.874 47.674	47.664
Cutting Depth	2.332	1.529	1.540	1.593	1.651	1.672	1.684	1.666 1.866	1.932
Slope	710	710	710	710	710	710	710	710	930
Dia of Pipe	450	450	450	450	450	450	450	450	400
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L-SECTION NO:-4
L.S. OF CO-30 TO CO-37
(MH NO. 3100 TO 1086)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

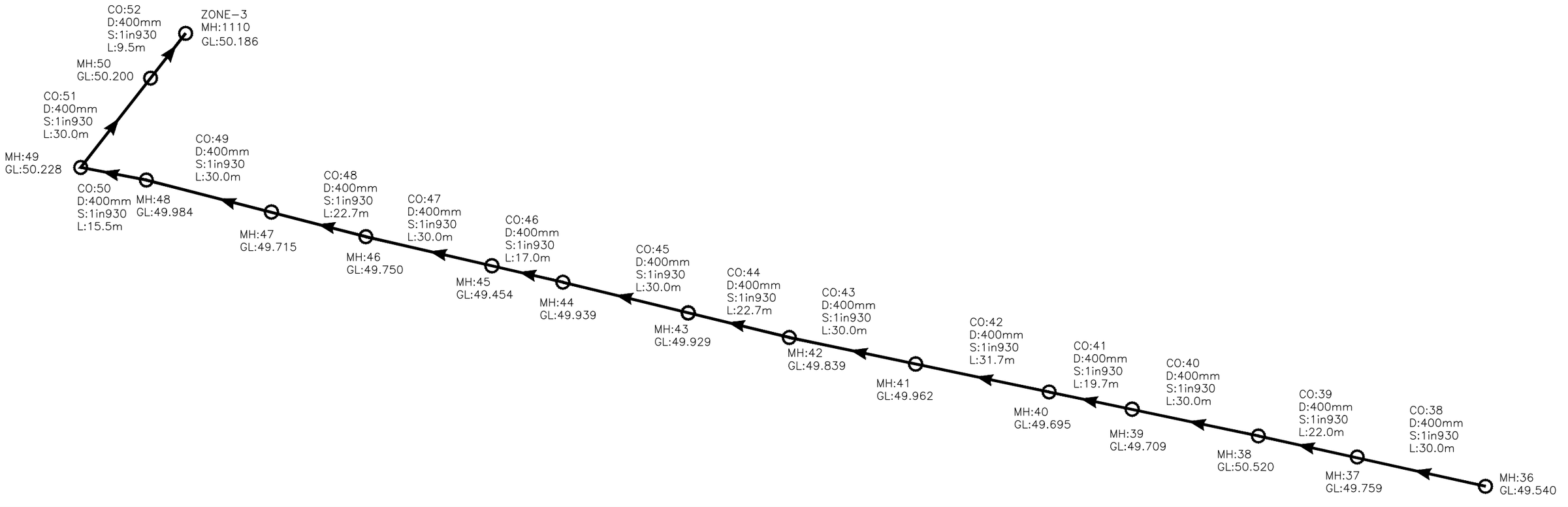
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

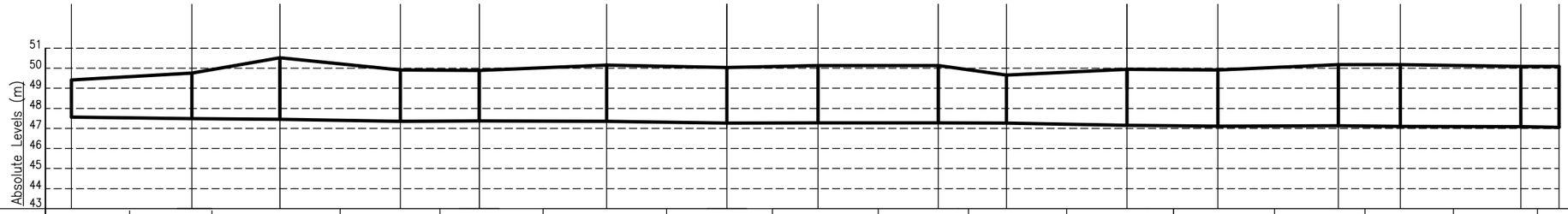
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	04 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	1110
Chainage	914.8	944.8	966.8	996.8	1016.5	1048.2	1078.2	1100.9	1130.9	1147.9	1177.9	1200.6	1230.6	1246.1	1276.1	1285.6
Ground Level	49.540	49.759	50.520	49.709	49.695	49.962	49.839	49.929	49.939	49.454	49.750	49.715	49.984	50.228	50.200	50.186
Pipe Invert Level	47.674	47.641	47.617	47.584	47.562	47.527	47.494	47.469	47.436	47.417	47.384	47.359	47.626	47.309	47.276	47.265
Cutting Depth	1.866	2.118	2.903	2.125	2.133	2.435	2.345	2.460	2.503	2.037	2.366	2.356	2.358	2.919	2.924	2.921
Slope	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930
Dia of Pipe	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L–SECTION NO:–5
L.S. OF CO–38 TO CO–52
(MH NO. 36 TO 1110)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

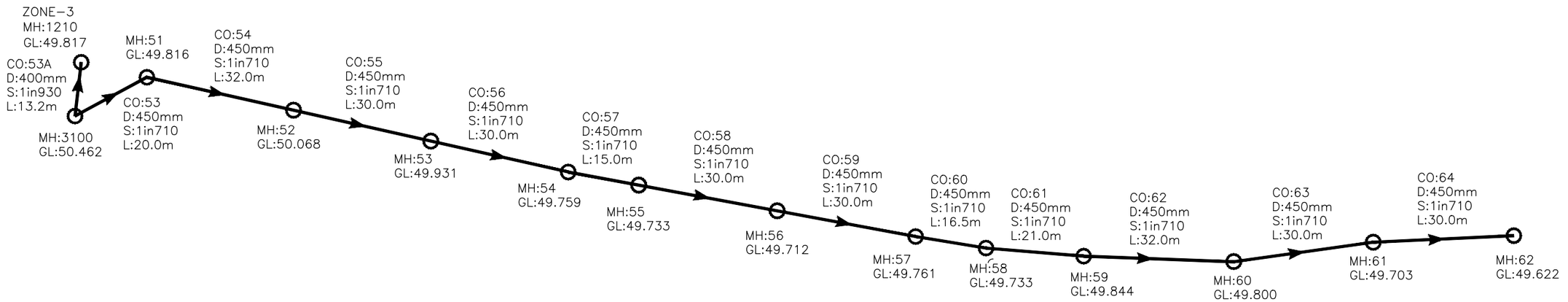
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

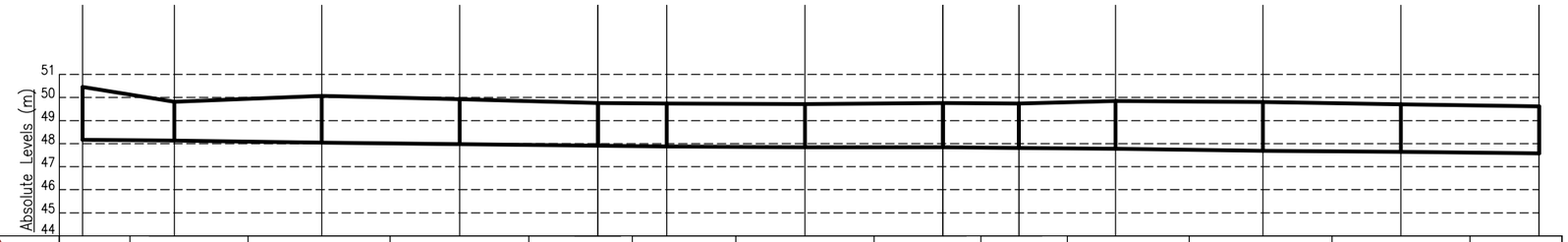
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

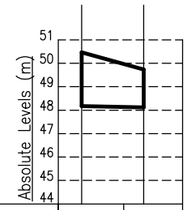
SCALE	SHEET	DRAWING NO.	REV.
1:1000	05 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	3100	51	52	53	54	55	56	57	58	59	60	61	62
Chainage	735.8	755.8	787.8	817.8	847.8	862.8	892.8	922.8	939.3	960.3	992.3	1022.3	1052.3
Ground Level	50.462	49.816	50.068	49.931	49.759	49.733	49.712	49.761	49.733	49.844	49.800	49.703	49.622
Pipe Invert Level	48.130	48.101	48.055	48.012	47.970	47.948	47.905	47.862	47.838	47.808	47.763	47.720	47.627
Cutting Depth	2.332	1.715	2.625	1.919	1.789	1.785	1.807	1.899	1.895	2.036	2.037	1.983	1.995
Slope	710	710	710	710	710	710	710	710	710	710	710	710	710
Dia of Pipe	450	450	450	450	450	450	450	450	450	450	450	450	450
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L–SECTION NO:–6
L.S. OF CO–53 TO CO–64
(MH NO. 3100 TO 62)



MH. NO	3100	1210
Chainage	735.8	749
Ground Level	50.462	49.817
Pipe Invert Level	48.130	48.116
Cutting Depth	2.332	1.701
Slope	930	930
Dia of Pipe	400	400
Pipe Material/Class	NP4	NP4

L–SECTION NO:–7
L.S. OF CO–53A
(MH NO. 3100 TO 1210)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

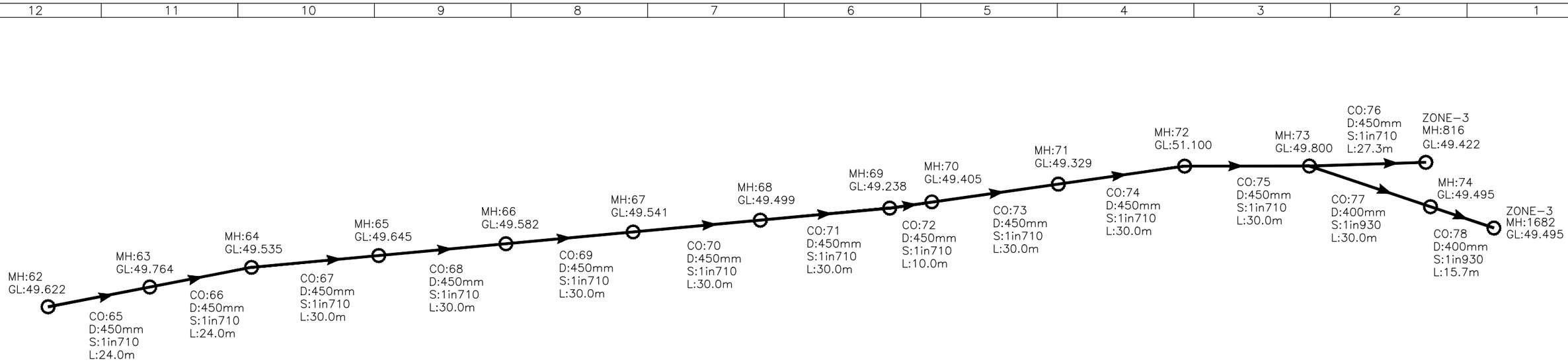
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

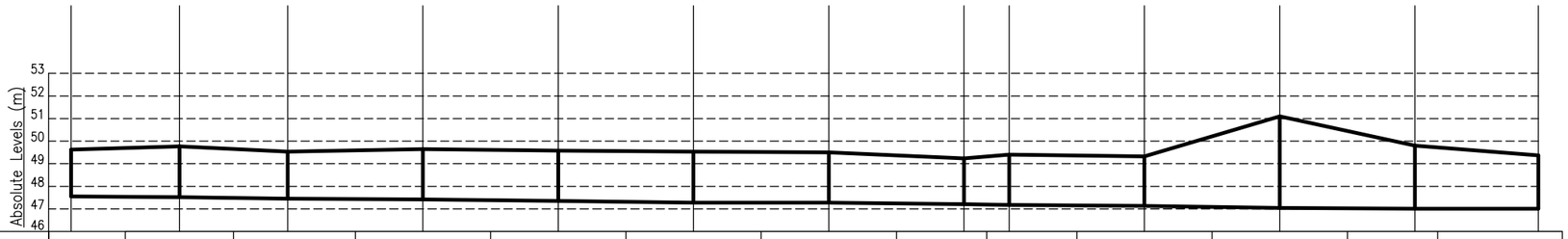
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

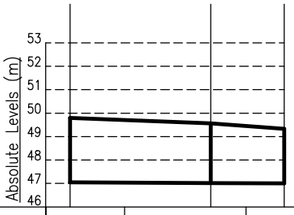
SCALE	SHEET	DRAWING NO.	REV.
1:1000	06 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	62	63	64	65	66	67	68	69	70	71	72	73	816
Chainage	1052.3	1076.3	1100.3	1130.3	1160.3	1190.3	1220.3	1250.3	1260.3	1290.3	1320.3	1350.3	1377.6
Ground Level	49.622	49.764	49.535	49.645	49.582	49.541	49.499	49.238	49.405	49.329	51.100	49.800	49.422
Pipe Invert Level	47.627	47.643	47.609	47.566	47.523	47.480	47.437	47.394	47.379	47.336	47.293	47.250 47.050	47.020
Cutting Depth	1.995	2.121	1.926	2.080	2.059	2.061	2.062	1.844	2.026	1.993	3.807	2.550 2.750	2.402
Slope	710	710	710	710	710	710	710	710	710	710	710	710	710
Dia of Pipe	450	450	450	450	450	450	450	450	450	450	450	450	450
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L-SECTION NO:-8
L.S. OF CO-65 TO CO-76
(MH NO. 62 TO 816)



MH. NO	73	74	1682
Chainage	1350.3	1380.3	1396
Ground Level	49.800	49.600	49.495
Pipe Invert Level	47.050	47.017	47.000
Cutting Depth	2.750	2.583	2.495
Slope	930	930	930
Dia of Pipe	400	400	400
Pipe Material/Class	NP4	NP4	NP4

L-SECTION NO:-9
L.S. OF CO-77 TO CO-78
(MH NO. 73 TO 1682)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

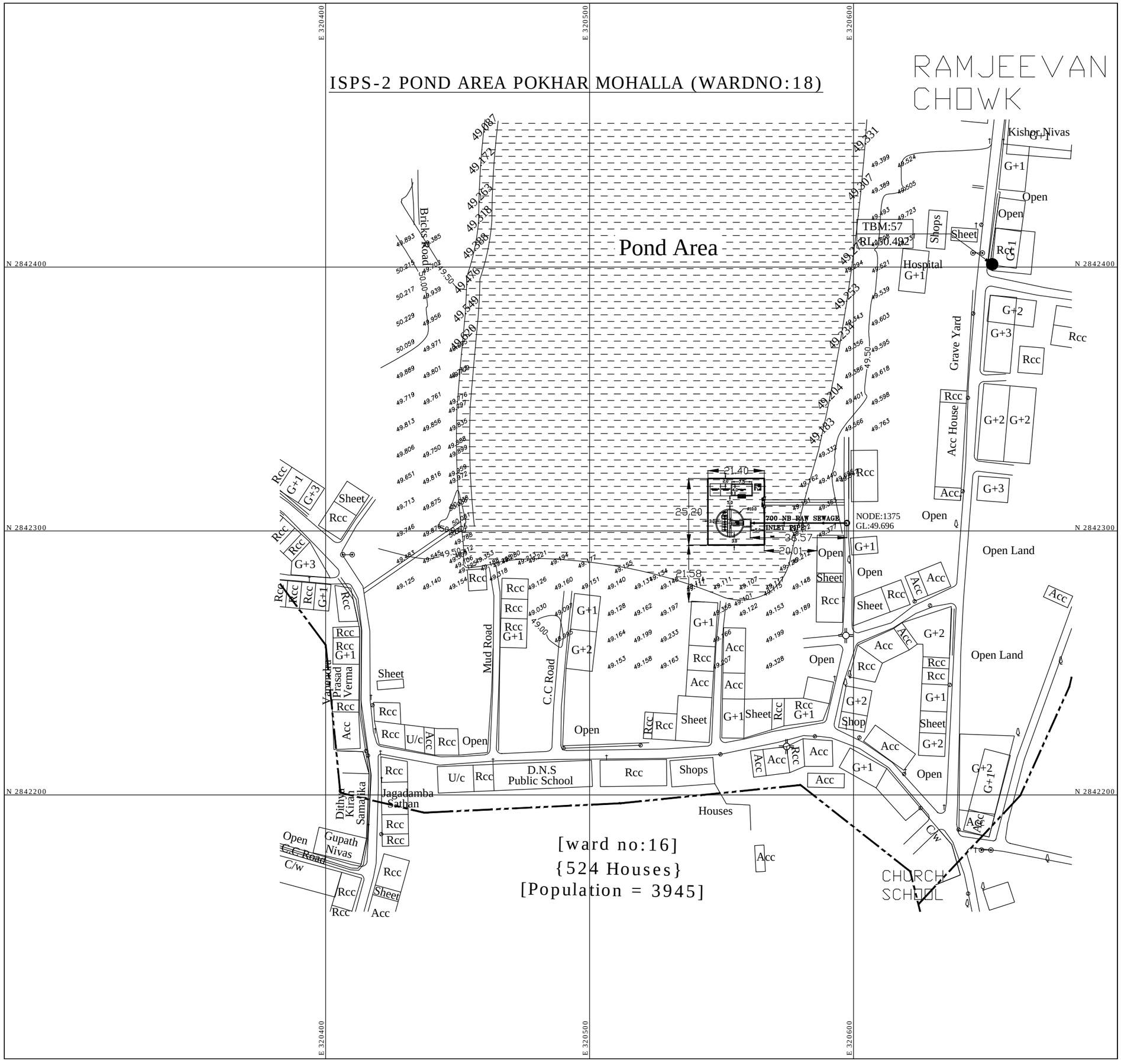
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	07 OF 07	HJ /1051/SEW/LS/02-A	0

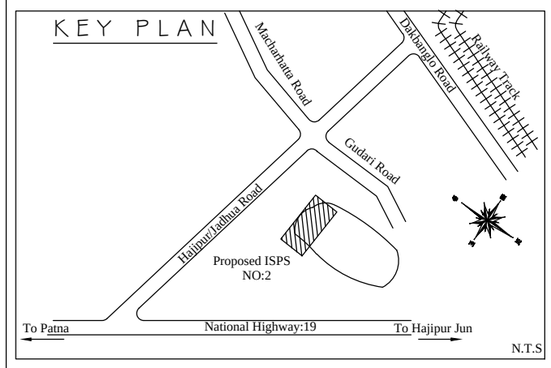
ISPS-2 POND AREA POKHAR MOHALLA (WARDNO:18)



LEGEND

1. ASPHALT ROAD, MUD ROAD/METALLED ROAD.
2. TREE, CULVERT, LAMP POST
3. BORE WELL, MAN HOLE
4. RIVER, STREAM, NALA, FENCE, ROW STONE
5. BOULDERS, ROCKYGROUND, TRANSFORMER, TELEPHONE POLE
6. POWER LINE PYLON (HIGHTENSION LINE)
7. KILOMETER & FURLONG STONE, SPOT HEIGHT.
8. BUSHES, BENCH MARK, TRAVERSE POINT — PBM:1 □12.826 GS-5C ⊕26.555

KEY PLAN



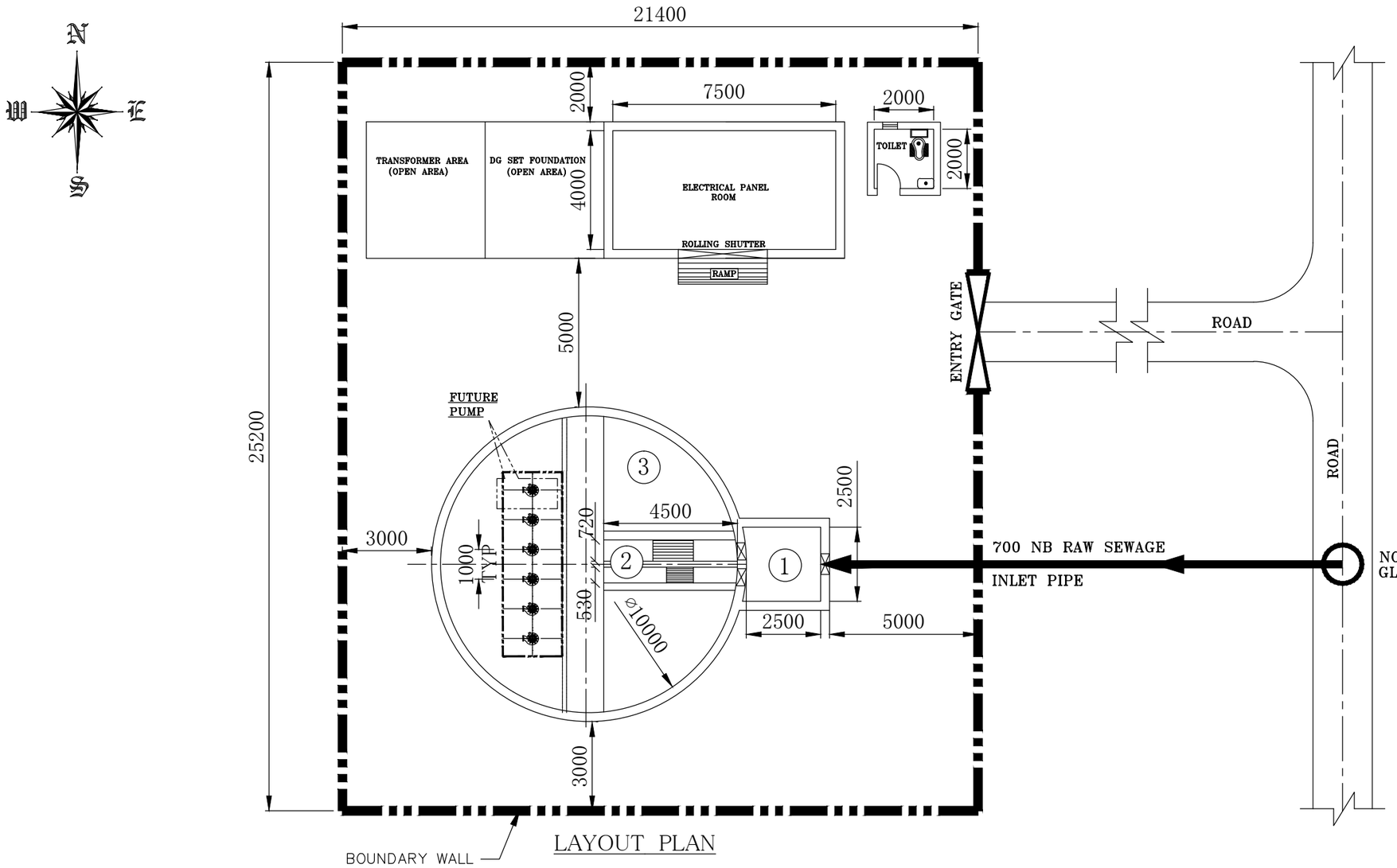
NOTE:-

1. ALL LEVELS ARE IN METERS. UNLESS OTHER WISE MENTIONED.
2. ALL LEVELS ARE CARRIED FROM THE BENCH MARK LOCATED ON SOMPUR BRIDGE OF GANDAK RIVER.

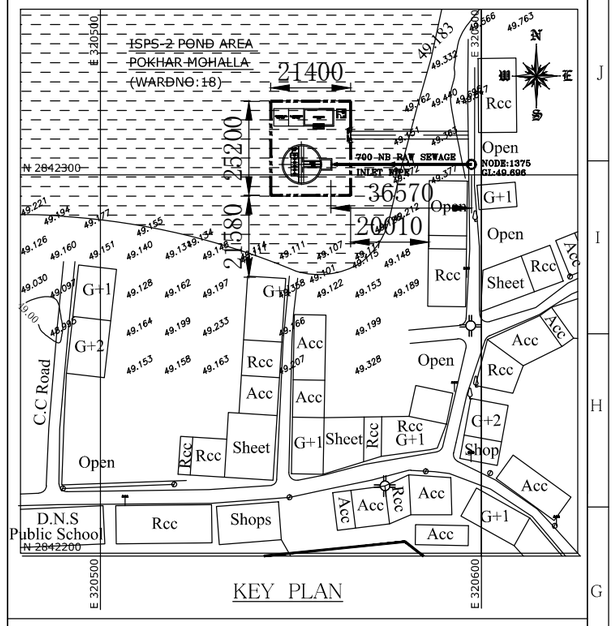
SHEET 1 OF 1

CLIENT	TRI-TECH Tri-Tech Infrastructure (India) Pvt.Ltd.
TITLE	TOPOGRAPHICAL SURVEY OF IPS-2 SITE
ORIGN CLIENT	**BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.** (A Govt. of Bihar Undertaking)
SURVEYED & PREPARED BY	RADIAN SURVEYS #715, OM PLAZA, 3RD FLOOR, 3RD MAIN DR.MODI HOSPITAL ROAD, MAHALAKSHMIPURAM,BANGALORE 86 E-mail : rdnsurveys@gmail.com PH:080-23194839

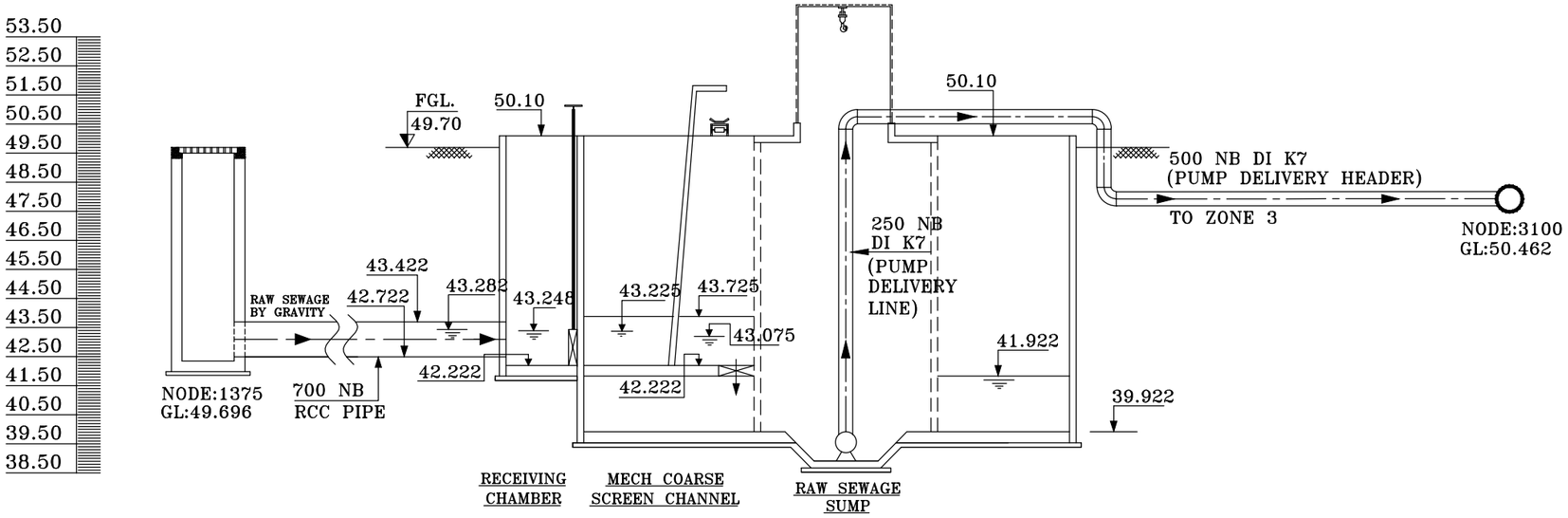
SCALE: 1:1000	SEASON : 03/06/2014	R0	DRG. NO. HJ/1051/IPS2/SURVEY/01



LAYOUT PLAN



KEY PLAN



HYDRAULIC FLOW DIAGRAM

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	10.0 ø x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTE:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	M.S.	AKS	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 03.06.14

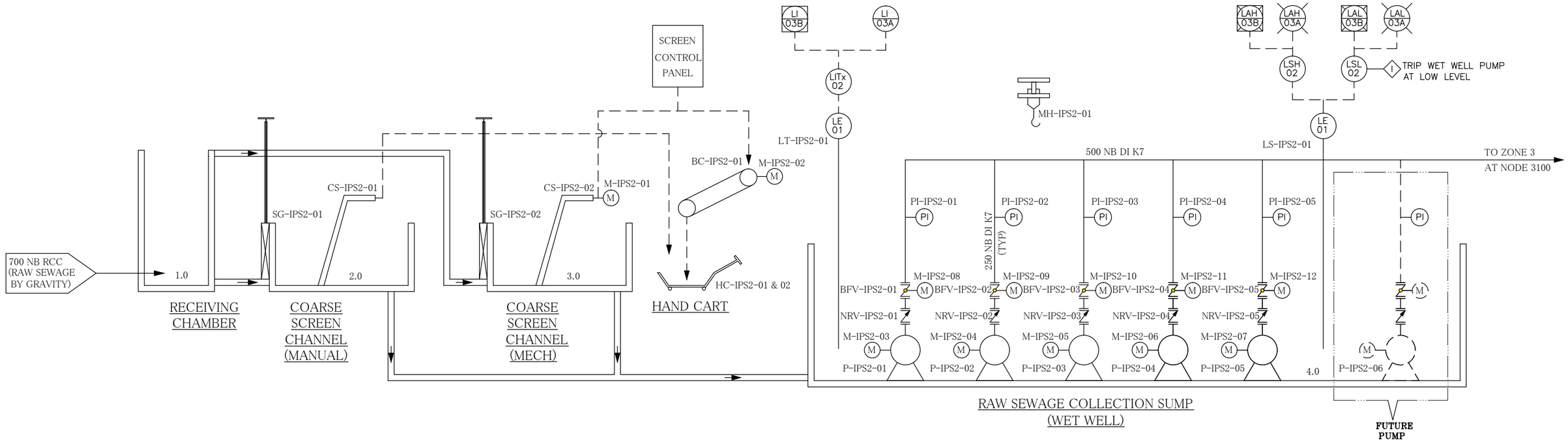
DRAWN.: – M.S.

CHKD.: – AKS

APPD.: – AKS

TITLE: – IPS 2 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A06	0



UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.5 x 2.5 x 1.026 SWD + 6.852FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.53 x 1.003 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 0.72 x 1.003 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	10.0ø x 2.0 SWD + 8.178 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS2-01	MANUAL COARSE BAR SCREEN	0.325 W x 1.55 HT	1	SS 304
CS-IPS2-02	MECH COARSE BAR SCREEN	0.43 W x 9.5 HT	1	SS 304
BC-IPS2-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS2--01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS2-01/02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	240.0 M3/HR x 16.0 MWC	5	AS PER NIT
M-IPS2-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS2--01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	300 x 1200 MM	2	CI (AS PER NIT)
NRV-IPS2-01/02/03/04/05	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	250 NB	5	CI (AS PER NIT)
BFV-IPS2-01/02/03/04/05	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	250 NB	5	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS2-01/02/03/04/05	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	5	MFG STD
LS-IPS2-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS2-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

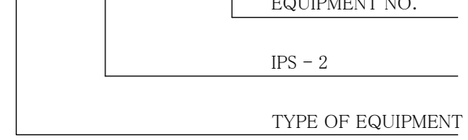
LEGENDS:-

	NON RETURN VALVE
M	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
I	HARD WIRE INTERLOCK
———	SEWAGE/WATER LINE
— — —	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-



REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	MS	A.K.S.	A.K.S.

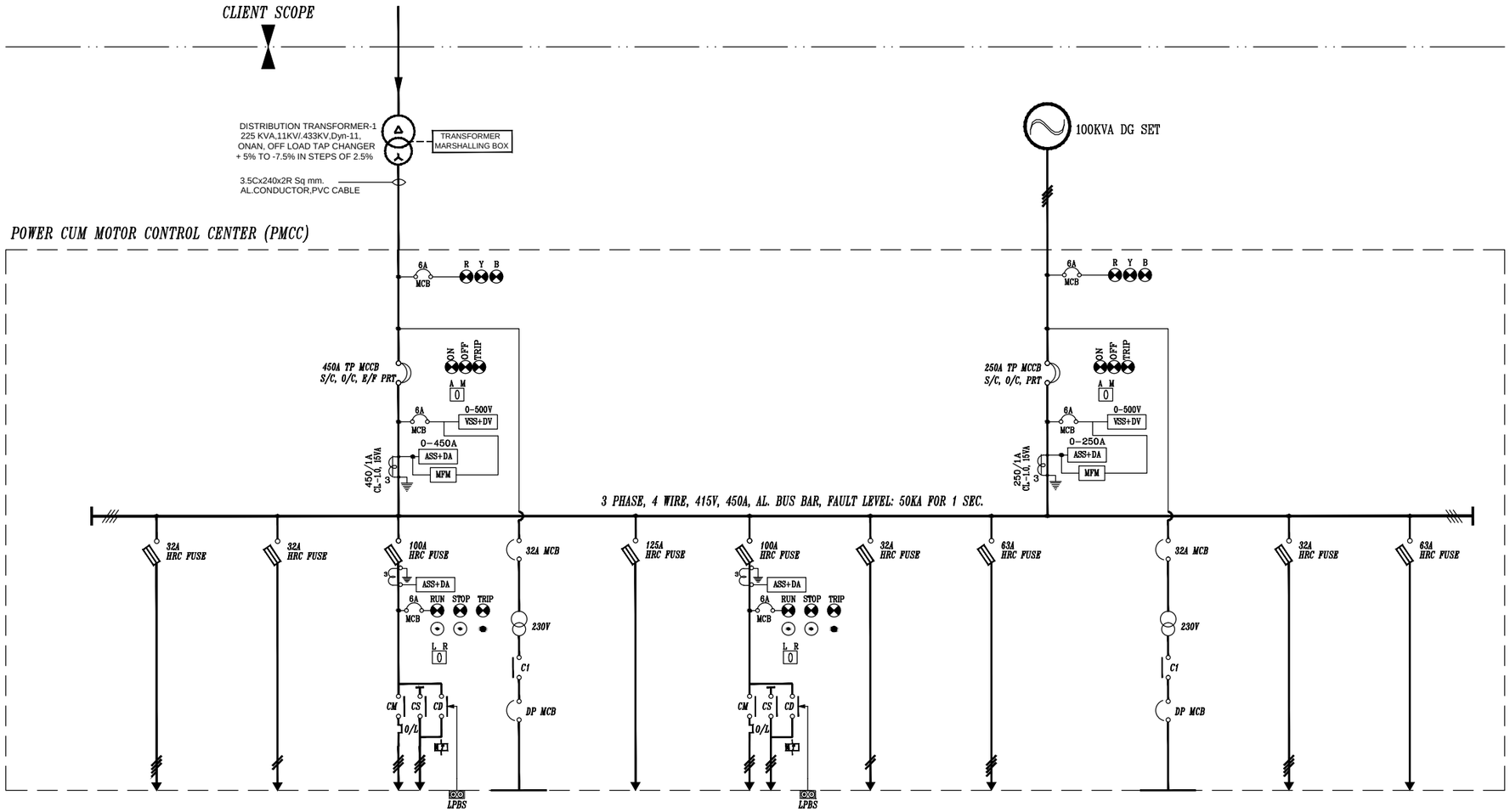
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- PROCESS & INSTRUMENTATION DIAGRAM IPS-2

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A07	0



FEEDER RATING	*32A*	*32A*	*37KW*	*32A*	*125A*	*37KW*	*32A*	*63A*	*32A*	*32A*	*63A*
FEEDER TYPE	*SFU*	*SFU*	*S/D*	*SFU*	*SFU*	*S/D*	*SFU*	*SFU*	*SFU*	*SFU*	*SFU*
FEEDER DESCRIPTION	*POWER SUPPLY FOR COARSE SCREEN PANEL*	*POWER SUPPLY FOR PLC CONTROL PANEL*	*RAW SEWAGE PUMP-1/2*	*CONTROL BUS*	*CAP BANK*	*RAW SEWAGE PUMP-3/4/5*	*POWER SUPPLY FOR UPS*	*POWER SUPPLY FOR LDB*	*CONTROL BUS*	*POWER SUPPLY FOR VENTILATION SYSTEM*	*SPARE*
QTY. OF FEEDER	*1NO.*	*1NO.*	*2NO.*	*1NO.*	*1NO.*	*3NO.*	*1NO.*	*1NO.*	*1NO.*	*1NO.*	*1NO.*

NOTES:-

1. ALL METERING, PROTECTION & CONTROL SYSTEM SHALL BE AS PER NIT.
2. THE EQUIPMENT SHOWN ARE TENTATIVE AND WILL BE FINALIZED DURING DETAIL ENGINEERING.
3. BUIDCO WILL TERMINATE 33/11 KV HT CABLE CONNECTION TO HT END OF TRANSFORMER.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVEL	D.S.R.	A.K.SONI	A.DUTT

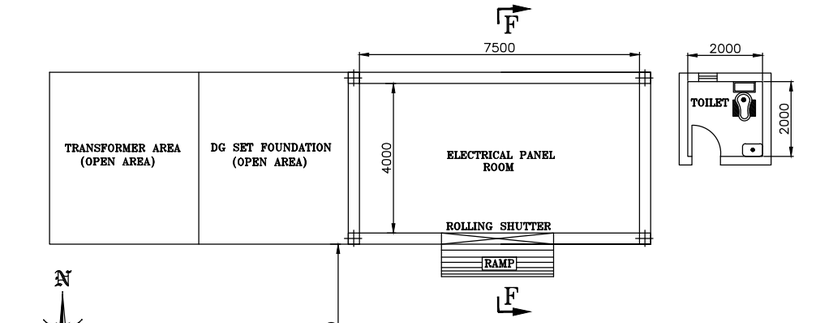
CLIENT:-
BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

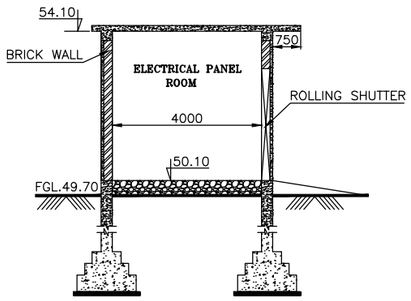
PROJECT:-
SEWERAGE NETWORK & STP, HAJIPUR

BIDDERS NAME:-
TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

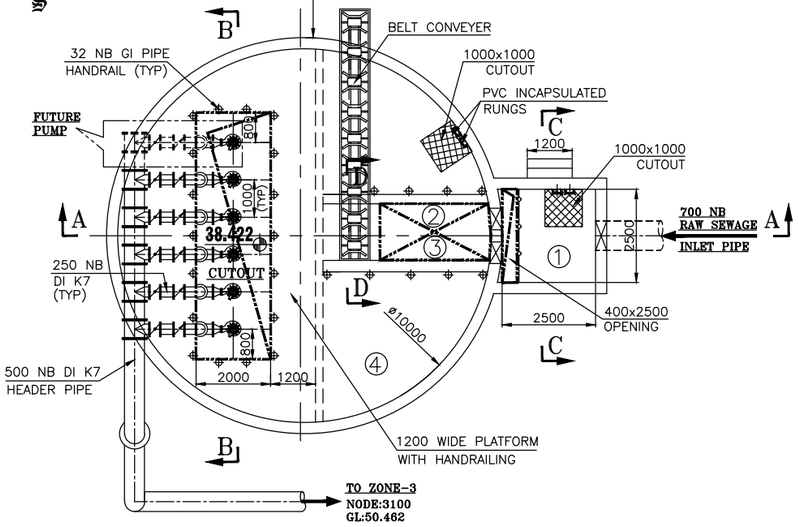
TITLE:-
SINGLE LINE DIAGRAM OF
POWER CUM MOTOR CONTROL CENTER IPS-2

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A08	0

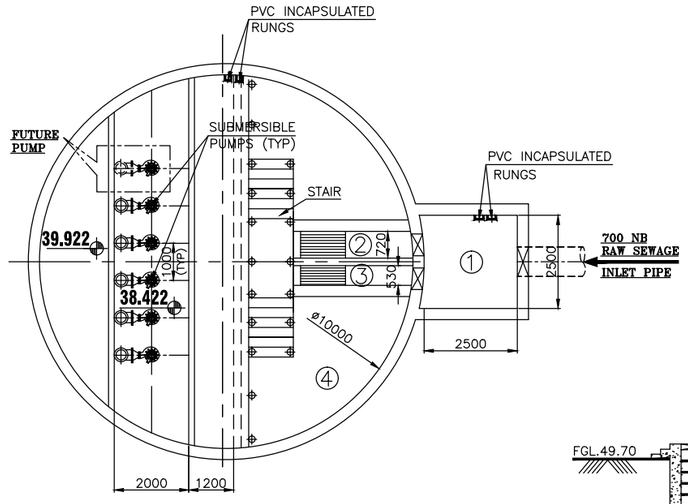




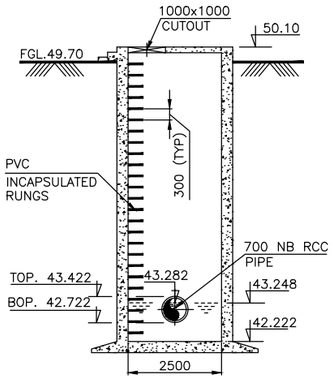
SECTION 'F–F'



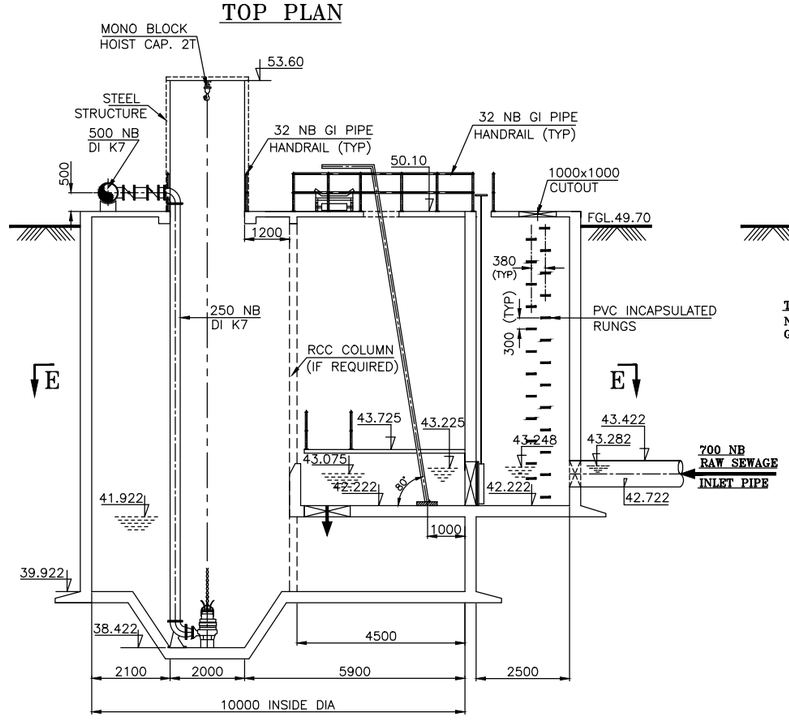
TOP PLAN



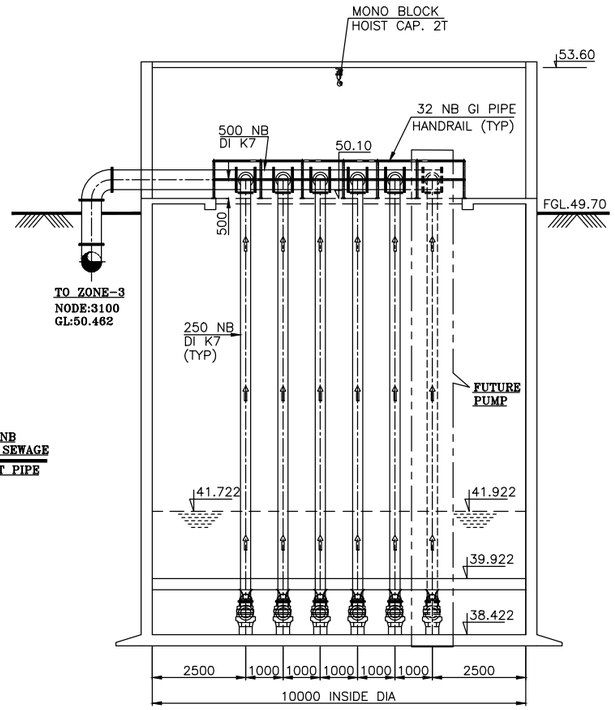
SECTION 'E–E'



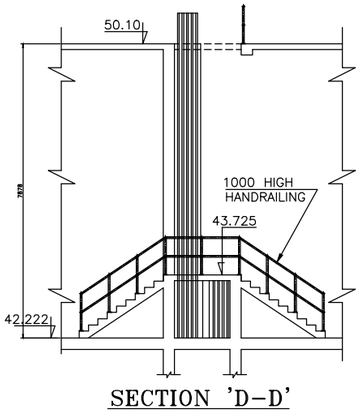
SECTION 'C–C'



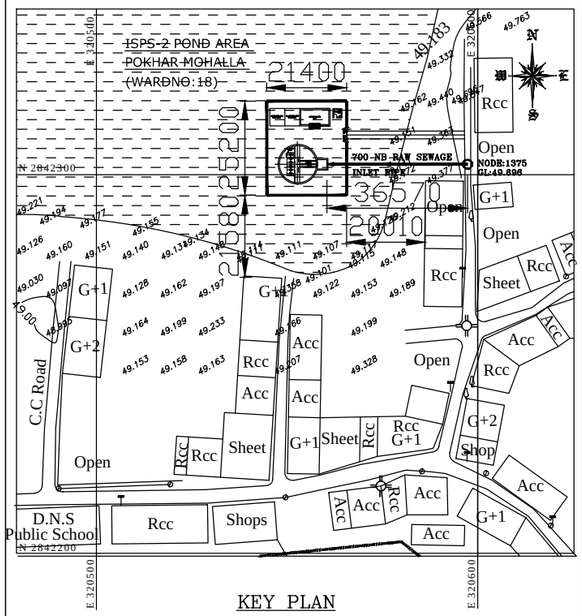
SECTION 'A–A'



SECTION 'B–B'



SECTION 'D–D'



KEY PLAN

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	MECHANICAL COARSE SCREEN CHANNEL	4.5 x 0.72
3	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.53
4	RAW SEWAGE SUMP WET WELL	10.0 ø x 2.0 SWD
5	TRANSFORMER AREA	4.0 x 4.0
6	ELECTRICAL PANEL ROOM	4.0 x 7.5
7	DG SET FOUNDATION	4.0 x 4.0
8	TOILET	2.0 x 2.0

NOTES: –

1.) ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METRES.
2.) FINISHED GROUND LEVEL CONSIDERED 49.70 M.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	MS	AKS	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22.0 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI–TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 03.06.14
DRAWN.: – M.S.
CHKD.: – AKS
APPD.: – AKS

TITLE: – MECH. GA DRG. OF INTERMEDIATE PUMPING STATION–2

SCALE	SHEET	DRAWING NO.	REV.
1:100	1 OF 1	TT/BEI/HJ/1051/IPS2/B18	0

M/S TRI-TECH(BEIJING) CO. LTD.

BIHAR URBAN INFRASTRUCTURE DEVELOPMENT

CORPORATION LTD., PATNA BIHAR

DESIGN BASIS REOPRT OF IPS-3 FOR HAJIPUR

3/12/2014

Documents details the design concept and philosophy considered for IPS-3 Design of Hajipur Town.

Contents

I. Background

Hajipur is the headquarters of Vaishali district in the Indian state of Bihar, comes under the Patna Administration Division. Hajipur became the Municipality in the year 2002. The municipal area of Hajipur is about 19.64 sq. km. It is famous for producing bananas.

The town Hajipur is situated on the banks of River Gandak. The river Gandak flows from North to South Direction.

1 Topography, Rainfall, Geography and climate

The topography of the town is that of a flat plain area. The mean annual rainfall is 1203 mm mostly confined to monsoon season and with maximum temperature during summer between 41.7^{0}C and minimum temperature of 5.6^{0}C during winter season.

2 Salient Features of the project at a glance

Programme:	**National Ganga River Basin Authority (NGRBA)**		
Project:	**Sewerage Project, Hajipur**		
Project Town:	**Hajipur**	District:	**Vaisali**
Area:	**1993.23 Ha**	Population, 2001:	**119,412**
Av Annual Rainfall:	**1203 mm**	Households:	**17050**
Max Temperature:	**41.7oC**	Min Temperature:	**5.6^{o}C**

3 Proposed Network Layout

Keeping the concept of minimum depth, as per the Tender Document concept, town is divided in Five Zones. Ward wise population are given below table.

Zone 1

It will receive wastewater from whole of the north-western area and South-Western area. In node diagram, Pumping Station No 1 is proposed at node 2535. The wastewater collected from this zone is pumped to Node No 26 of zone-3. In this zone there are 8 wards are there i.e., 1, 2, 3, 4, 5, 6, 7& 8. The collected wastewater is pumped to zone 3.

Zone 2

It will receive wastewater from southern area of town. Pumping Station No 2 is proposed at node 1593. The wastewater collected from this zone is pumped to Node No 816 of zone-3. This is a big zone compare to all other zones, in this zone there are 17 wards are there i.e., 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 24, 27, 29, 30, 31 & 33.

Zone 3

It will received combined sewage generated from Zone 1/ 2/ 3. Pumping Station No 3 is proposed at node 2549. The wastewater collected from this zone is pumped to Node No 41in Zone 5. In this zone there are 6 wards are there i.e., 19, 20, 21, 22, 23, & 25

Zone-4

It will receive wastewater from southern area of town. Pumping Station No 4 is proposed at node 1869. The wastewater collected from this zone is pumped to Node No 2322B in zone no 5. In this zone there are 7 wards are there i.e., 28, 32, 34, 35, 36, 37, 38 &39

Zone-5

This zone is contains only 2 wards that is ward no: 25 and ward no: 38, the ward no:25 is partially covered in this zone. It will receive wastewater from whole of the north-East area.

4 Sewer generation

According to the CPHEO manual **Para 3.2.4,** of manual stipulate that generally 80% of the water supply may be expected to reach the sewers unless there is data available to the contrary.

- Per capita water supply figure of 135 LPCD with 80% contributing to wastewater is adopted to arrive at expected wastewater flows in sewers.

5 Contributory Population Peak flow

Sl. No	Contributing Population	Peak Factor
1	Up to 20,000	3

2	20,000 – 50,000	2.5
3	50,000 – 75,0000	2.25
4	Above 75,0000	2

6 Flow calculation:

Average flow = Total population x 135 x 0.8/3600/24

Peak flow = (Average flow*PF + GWI)

7 IPS-3 Details

Man hole No just before receiving chamber : (N-2549c)

GL of 2549c : 48.29M

GL of IPS-3 : 47.737M

GL of disposing point manhole 41B (at Zone-5) : 50.000M

Outfall Sewer to Receiving Chamber Invert Level: 42.548M

Outfall Sewer Diameter : 1000 mm

Raw Sewage Sump Invert Level : 39.948M

Population Projection:

For complete Town (Including all 5 zones)

S.N.	Year	Population projection	Factor of increment of Population
1	2011	152979	-
2	2026	217992	1.424
3	2041	305494	1.4

Multiple Factor by which population increase form year 2011 to year of 2026 = 1.424

POPULATION FOR ZONE-3:

S.N.	Year	Population (as per Approved zone-4)	GWI	Design Average flow	Design Peak flow	
1	2011	112167	5.626	141.106	323.115	Peak flow =
2	2026	**159726**	**5.626**	**199.657**	**404.94**	(Avg flow*pf+GWI)
3	2041	223708	5.626	281.978	640.077	

7.1 Ground Water Infiltration and leakage (GWI)

Some quantity of ground water or subsoil water may infiltrate into sewers through defective joints, broken pipes etc. This is significant when water table is high and head of ground water is more than the head of sewage in sewers. Some quantity of sewage may leak out from defective joints and defective pipes when head of sewage is more in sewers than head of ground water outside. Infiltration and leakage mainly depends on quality of construction and water table levels. Infiltration can be considered, **Para 3.2.7** Manual, 5000-50000 liters per day per hectare or 500-5000 liters per day per km length of sewers or 250-500 liters per day per manhole for sewers laid below ground water level.

As the project town is situated on the banks of River Ganga, the water table in the town is very much near the ground. Looking to possibility of infiltration of ground water, it is proposed to adopt strict quality control measures for material & workmanship. However, a provision of infiltration in sewers is adopted as 500 litre/manhole/day.

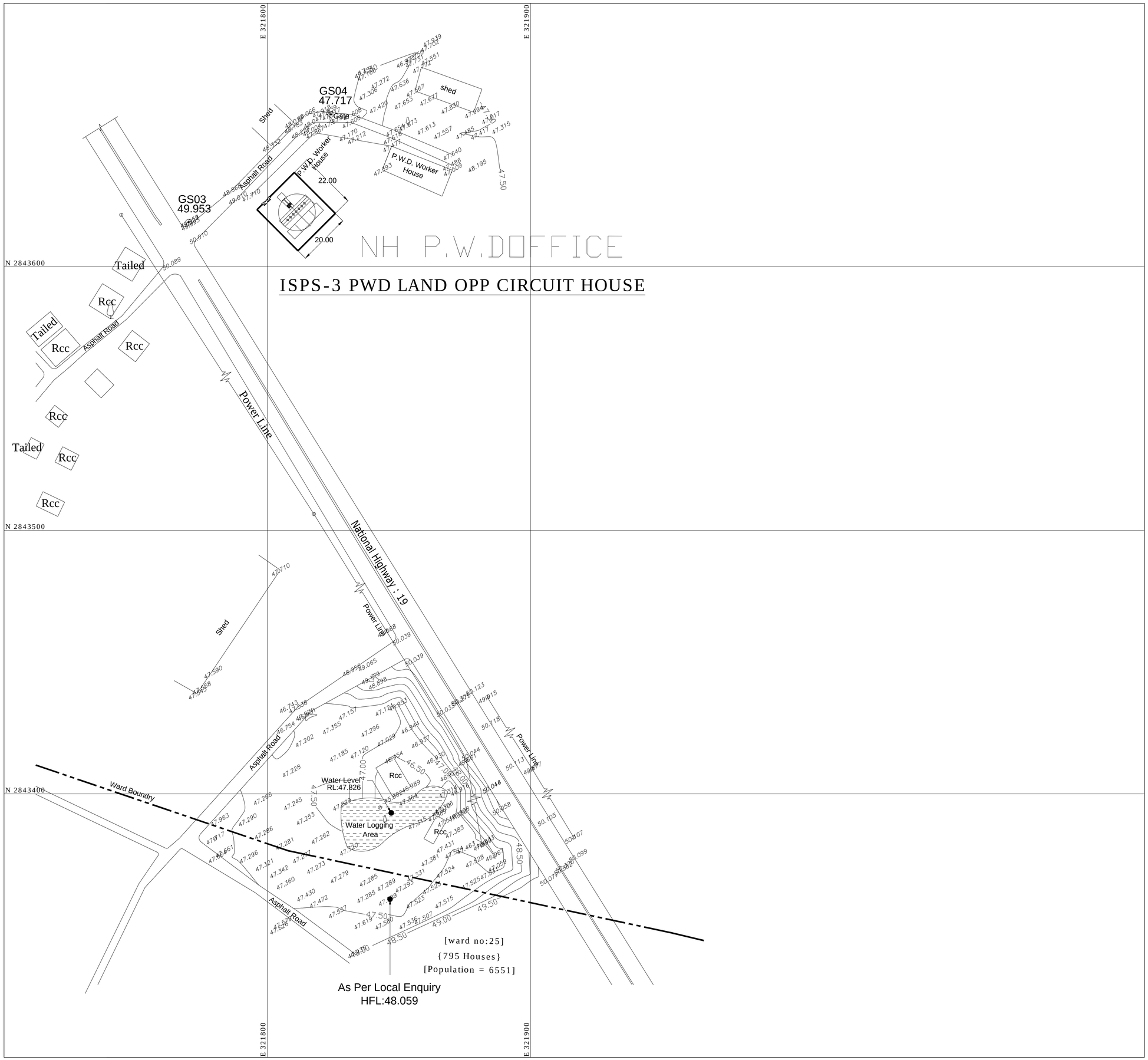
8 Design Period of Sewerage Pumping station

Sl. No	Design Component	Design Period	Remarks
1	Pumping mains	30 Years	Cost may be economical
2	Pumping Stations-Civil Work	30 Years	
3	Pumping Machinery	15 Years	Life of pumping machinery is 15 years

9 Coefficient of friction

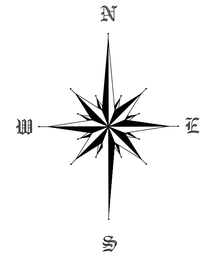
Sr. No.	Type of fitting	K value
1	Bend	**0.32**
2	NRV	**2.5**
3	VALVES	**0.8**
4	EXPANDOR	0.5

Coefficient of roughness for DI pipe (C) : 140



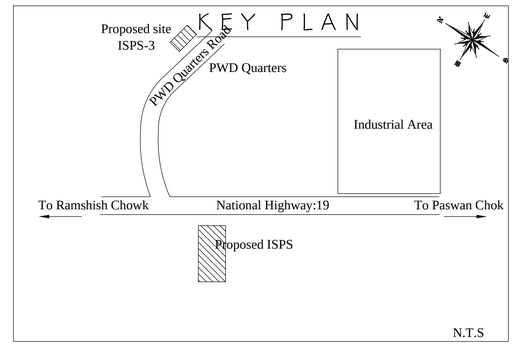
NH P.W.DOFFICE

ISPS-3 PWD LAND OPP CIRCUIT HOUSE



LEGEND

1. ASPHALT ROAD, MUD ROAD/METALLED ROAD.
2. TREE, CULVERT, LAMP POST
3. BORE WELL, MAN HOLE — BW
4. RIVER, STREAM, NALA, FENCE, ROW STONE
5. BOULDERS, ROCKYGROUND, TRANSFORMER, TELEPHONE POLE
6. POWER LINE,PYLON (HIGHTENSION LINE)
7. KILOMETER & FURLONG STONE, SPOT HEIGHT.
8. BUSHES, BENCH MARK, TRAVERSE POINT — PBM:1□612.826 GS–5C ⊗626.555



NOTE:-

1. ALL LEVELS ARE IN METERS. UNLESS OTHER WISE MENTIONED.
2. ALL LEVELS ARE CARRIED FROM THE BENCH MARK LOCATED ON SOMPUR BRIDGE OF GANDAK RIVER.
3. TOTAL SURVEYED = 9445.803 SQMTS
   2.334 ACRES
   2 Acres 13.36 GUNTAS
   101675.00 SQFTS

SHEET 1 OF 1

CLIENT	TRI-TECH Tri-Tech Infrastructure (India) Pvt.Ltd.
TITLE	TOPOGRAPHICAL SURVEY OF IPS-3 SITE
ORIGN CLIENT	**BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.** (A Govt. of Bihar Undertaking)
SURVEYED & PREPARED BY	RADIAN SURVEYS #715, OM PLAZA, 3RD FLOOR, 3RD MAIN DR.MODI HOSPITAL ROAD, MAHALAKSHMIPURAM,BANGALORE 86 E-mail : rdnsurveys@gmail.com PH:080-23194839

SCALE: 1:1000	SEASON : 12/11/2012	R3	DRG. NO. HJ/1051/IPS3/SURVEY/01

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**		
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**		
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**		
Doc. Name	**: Sizing Calculation for IPS-3**		
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A01**	**REV. 03**	**DT. 13.03.2014**

1.0 SEWAGE GENERATION

Intermediate Pumping Station No. 3 is designed for the following sewage flow rate:

Design Year 2026

Average Flow Rate	:	(Avg. design flow + Infiltration) (199.657+5.657) LPS i.e. 0.205 M^3/s
	:	738 M^3/Hour
	:	17712 M^3/Day i.e. 17.712 MLD
Peak Flow Rate	:	(Peak design flow + Infiltration) (199.657*2.0+5.657)=404.9LPS i.e. 0.405 M^3/s
	:	**1458.0 M^3/Hour**

Design Year 2041

Average Flow Rate	:	(Avg. design flow + Infiltration) (281.98+5.626) LPS i.e. 0.288 M^3/s
	:	1036.8 M^3/Hour
Peak Flow Rate	:	(Peak design flow + Infiltration) 640.077 LPS i.e. 0.640 M^3/s
	:	2304.0 M^3/Hour
	:	M^3/Day i.e. 55.296 MLD

2.0 RECEIVING CHAMBER

No.	:	1
Material of Construction	:	RCC
Year 2041 Peak Flow Rate	:	0.640 M^3/s
Plan Dimensions	:	2.5 M x 2.5 M
Side Water Depth	:	1.24 M
Volume	:	2.5 x 2.5 x 1.24 i.e. 7.75 M^3
Hydraulic Retention Time	:	7.75 / 0.640 i.e. 12.12 s

3.0 MECHANICAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Working)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0.640 M^3/s
Angle of Inclination	:	80^0
Length	:	4.5 M
Side Water Depth	:	1.2 M
Inclined Submerged Screen Length	:	(1.2 / Sin 80^0) i.e. 1.22 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.0 M/s
Clear Width	:	0.640 M^3/s / (1.22 M x 1.0 M/s)
	i.e.	0.525 M
Clear Spacing	:	25 MM
No. of Openings	:	0.525 M/ 0.025 M
	i.e.	20.98, say 21
No. of Bars	:	21 + 1 i.e. 22
Bar Size	:	10 MM x 50 MM
Screen Channel Width (Minimum)	:	(20 x 0.025) + (21 x 0.01)
	i.e.	0.71, say **0.710 M**
Side Margin for Operating Mechanism	:	0.29 M
Screen Channel Width (Overall)	:	0.610 + 0.29 i.e. 1.**00 M**
Screen Height	:	SWD (U/s) + FB (U/s) + Conveyor Height + 0.5 M + 0.3 M (Safety Factor) i.e. 1.2+7.039 + 0.6 + 0.5 + 0.3 = 9.45 M **say 9.5 M** (Minimum)
Head Loss (Design)	:	0.15 M
Operation	:	Automatic (Timer Controlled)
Service	:	Continuous/ Intermittent
Accessory Equipment	:	Electric Motor/ Drive Mechanism w/ Mechanical Travelling Rakes/ Control Panel/ Belt Conveyor (w/ Electric Motor and Drive Arrangement)/ MSEP/ FRP Wheel Barrows (2 Nos.)

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well). The Conveyor Belt will be installed at the Raw Sewage

Collection Sump (Wet Well) Top of Structure Level i.e. 0.5 M above Ground Level.

2. Screenings will be mechanically collected on to a Conveyor Belt and then disposed off mechanically by gravity to Wheel Barrow at Ground Level.
3. The Belt will start automatically when the Mechanical Screen starts and will stop automatically after a lag period of 60 seconds after the Mechanical Screen stops.
4. Height of Screen/ Conveyor Belt are subject to modification depending on Manufacturer Specifications.

Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron
Peak Flow Rate	:	0.640 M^3/s
Size	:	800 MM x 800 MM
Velocity (at Peak Flow)	:	0.640 / (0.8 x 0.8) i.e. 1.00 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gates are not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

4.0 MANUAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Stand-By)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0.640 M^3/s
Angle of Inclination	:	60^0
Length	:	4.5 M
Side Water Depth	:	1.2 M
Inclined Submerged Screen Length	:	(1.2 / Sin 60^0) i.e. 1.385 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.0 M/s
Clear Width	:	0.640 M^3/s / (1.385 M x 1.0 M/s)
	i.e.	0.462 M
Clear Spacing	:	25 MM
No. of Openings	:	0.462 M/ 0.025 M
	i.e.	18.48, say 19
No. of Bars	:	19 + 1 i.e. 20
Bar Size	:	10 MM x 50 MM

Screen Channel Width	:	(19 x 0.025) + (20 x 0.01)
	i.e.	0.675,
Consider side margin for Operation	:	0.2 M
Total Screen channel width	:	0.675 +0.2 i.e. 0.875M **say 0.88 M**
Screen Height	:	SWD (U/s) + FB (U/s) i.e. 1.2 + 0.5 = 1.7 M
Head Loss (Design)	:	0.15 M
Operation	:	Manual
Service	:	Intermittent
Accessory Equipment	:	MSEP Rakes (2 Nos.)/ Bucket Chain Pulley Screenings Removal Arrangement

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well).
2. Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Raw Sewage Collection Sump (Wet Well) Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.

Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron
Peak Flow Rate	:	0.640 M^3/s
Size	:	800 MM x 800 MM
Velocity (at Peak Flow)	:	0.640 / (0.8 x 0.8) i.e. 1.00 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gate is not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

5.0 RAW SEWAGE PUMPING STATION

Raw Sewage Collection Sump (Wet Well)

No.	:	1
Material of Construction	:	RCC
Peak Flow Rate	:	0.640 M^3/s
Hydraulic Retention Time (at Peak Flow)	:	7.5 Minutes
Volume (Required)	:	0.640 x 60 x 7.5 i.e. 288 M^3
Let Side Water Depth	:	2 M
Plan area required for wet well	:	144.0 M^2
Diameter required for wet well	:	13.50 M
Diameter (Provided)	:	**14.0 M**
Volume (Provided)	:	∏/4 x 14.0 x 14.0 x 2 i.e. 307.8 M^3
Hydraulic Retention Time (at Peak Flow)	:	307.8/ (0.640 x 60) i.e. 8.0 Min, i.e. OK
Accessory	:	Ultrasonic Level Sensor (Linked to PLC/ SCADA)

Raw Sewage Transfer Pumps

Nos.	:	5 (4 Working + 1 Stand-By – Peak Flow)
	:	5 (2 Working + 3 Stand-By –Average Flow)
Design Basis	:	Year 2026 Peak Flow i.e. **1458.0** M^3/Hour
Capacity	:	**1458.0** / 4 i.e. 364.5 say **365.0 M^3/Hour**
Discharge Head	:	14.0 MWC
Type	:	Submersible Non Clog, Wet Well Installation
Operation	:	Automatic (Controlled by Ultrasonic Level Sensor, linked to PLC/ SCADA)
Material of Construction		
Casing	:	Cast Iron
Impeller	:	Stainless Steel ASTM A 743 CF8M
Shaft/ Fasteners/ Foundation Bolts	:	Stainless Steel 316
Guide Rail	:	Stainless Steel SS 304
Accessory Equipment	:	Submersible Electric Motors/ Lifting Chains/ Guide Rails

Individual Pump Delivery Lines

Size	:	300 NB
Design Velocity	:	365.0/3600/ (Π/4 x 0.3 x 0.3) i.e. 1.44 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Non Return Valve/ Butterfly Valve

(Electrically Actuated)/ Pressure Gauge

Combined Pump Delivery Header

Design Flow	:	365.0 x 4 i.e. 1460.0 M^3/Hour
Size	:	700 NB
Design Velocity	:	1460.0/ 3600/ (Π/4 x 0.7 x 0.7)
	i.e.	1.05 M/s
Material of Construction	:	DI K7

Dry Well

Note: The Dry Well be constructed above the Raw Sewage Collection Sump (Wet Well) and will be used for access to the Submersible Pumps for operation and maintenance as required.

No.	:	1
Material of Construction	:	RCC Slabs/ Walkways w/ Hand Railing
Accessory	:	3.0 Ton Capacity Manual Chain Pulley Hoist with ISMB

Pump House Electric Panel Room

No.	:	1
Material of Construction	:	RCC Slabs/ Columns, Brick Masonry Side Walls as applicable
Plan Dimensions	:	4.0 M x 7.5 M
Height	:	4.0 M

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**		
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**		
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**		
Doc. Name	**: Hydraulic Design Calculation for IPS-3**		
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A02**	**REV. 03**	**DT. 12.03.2014**

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Peak Flow Rate, Q_P	:	55.296	MLD
		:	2304.000	M^3/Hr
		:	0.640	M^3/s
2.0	**RECEIVING CHAMBER**			
	Outfall Sewer to Receiving Chamber Invert Level	:	42.548	M
	Say	:	42.548	M
	Outfall Sewer Diameter	:	1.000	M
	Outfall Sewer Soffit Level	:	43.548	M
	IPS 3 Finished Ground Level (Considered)	:	50.000	M
	Height, Top of Receiving Chamber	:	0.300	M
	Receiving Chamber Top of Structure Level	:	50.300	M
	Outfall Sewer Capacity, Q_P	:	2304.000	M^3/Hr
		:	0.640	M^3/s
	Sewage Level in Outfall Sewer (Considered)	:	80.000	%
		:	0.800	M
	Outfall Sewer Top Water Level	:	**43.348**	M
	Outfall Sewer Wetted Cross Section Area, A			
	Triangle Portion			
	Triangle Height, H	:	0.300	M
	Subtended Angle, $\theta = \cos^{-1}(H/(D/2))$	:	53.130	^{0}

S.NO.	PARAMETER		VALUE	UNIT
	Triangle Base, B = ((((D/2)^2) - (H^2))^0.5)*2	:	0.800	M
	Triangle Area, A_1 = 0.5 * H * B	:	0.120	M^2
	Circle Segment Portion			
	Subtended Angle, $\theta_1 = 360^0 - (\theta * 2)$	:	253.740	^{0}
	Outfall Sewer Wetted Circular Cross Section Area, A_2	:	0.554	M^2
	Outfall Sewer Wetted Cross Section Area, $A = A_1+A_2$	:	0.674	M^2
	Outfall Sewer Design Flow Rate, Q_D	:	0.640	M^3/s
	Outfall Sewer Velocity, $V = Q_D / A$	:	0.950	M/s
	Velocity Head, $V^2/2g$	:	0.046	M
	Exit Head Loss Co-Efficient, K	:	1.000	
	Exit Head Loss, $K * V^2/2g$	:	0.046	M
	Receiving Chamber Top Water Level	:	43.302	M
	Say	:	**43.302**	M
	Gap, Sewer Pipeline IL - Receiving Chamber IL	:	0.500	M
	Receiving Chamber Invert Level	:	**42.048**	M
	Receiving Chamber Side Water Depth	:	**1.254**	M
	Free Board	:	6.998	M

3.0 MECHANICAL COARSE SCREEN CHANNEL

	Inlet Sluice Gate Width, W	:	0.800	M
	Inlet Sluice Gate Side Water Depth, Z	:	0.800	M
	Velocity (across Sluice Gate), $V = Q_P / W*Z$	:	1.000	M/s
	Velocity Head $V^2 / 2g$	:	0.051	M
	kkkm	:	0.800	
	Head Loss across Sluice Gate, $K * V^2 / 2g$	:	0.041	M
	Say	:	0.041	M
	Coarse Screen Channel Top Water Level (U/s)	:	43.261	M
	Say	:	**43.261**	

S.NO.	PARAMETER		VALUE	UNIT
	Coarse Screen Channel Invert Level	:	**42.048**	M
	Coarse Screen Channel Side Water Depth (U/s)	:	**1.213**	M
	Head Loss across Coarse Screen (Refer Process Calculations)	:	0.150	M
	Coarse Screen Channel Top Water Level (D/s)	:	**43.111**	M
	Free Board (To Top of Screen Channel)	:	0.500	M
	Coarse Screen Channel Top of Structure Level	:	43.761	M
	Wet Well Top of Structure Level	:	50.300	M
	Free Board (To Top of Wet Well)	:	7.039	M
	Say	:	7.039	M
	IPS 3 Finished Ground Level	:	50.000	M

4.0 RAW SEWAGE SUMP (WET WELL)

	Coarse Screen Channel Invert Level	:	42.048	M
	Free Fall, Fine Screen Channel IL - Raw Sewage Sump TWL	:	0.300	M
	Raw Sewage Sump Top Water Level	:	**41.748**	M
	Raw Sewage Sump Side Water Depth	:	**2.000**	M
	Raw Sewage Sump Invert Level	:	**39.748**	M
	Finished Ground Level	:	50.000	M
	Dry Well Plinth Level	:	50.300	M
	Height, Dry Well Plinth Level (Above Ground)	:	0.850	M
	Raw Water Sump Top of Structure Level	:	50.300	M
	Raw Water Sump Free Board	:	8.552	M

(Refer Process & Instrumentation Diagram Drawing No. TT/BEI/HJ/1051/IPS3/A07).

GENERAL DESCRIPTION

Each Electrical Drive of the Intermediate Pumping Station can be controlled as follows:

1.0 Through Local Push Button START/ STOP Station installed locally near the drive when in LOCAL Mode.
2.0 Through the Motor Control Center (MCC).
3.0 Through PLC/ SCADA installed in the Control Room when MCC is in REMOTE Mode. In REMOTE MANUAL Mode the Electrical Drive can be operated manually through Soft Keys on the SCADA Screen. In REMOTE AUTO Mode the Electrical Drive will START/ STOP automatically through software already installed in the PLC.

Details of Plant Automation pertaining to specific units are as follows:

MECHANICAL SCREEN CHANNEL

1.0 Inlet Gate will be manually operated.
2.0 Mechanical Coarse Screen/ Conveyor Belt will be Timer Operated. Timer setting will be 0 – 30 minutes for Cycle time 30 minutes. Conveyor Belt will automatically stop after a Lag Period of 60 seconds following Mechanical Screen Stop.

RAW SEWAGE SUMP WET WELL

1.0 Raw Sewage Transfer Pumps will be operated through PLC SCADA linked to Ultrasonic Level Sensor. During rising Sump Level 1 No. Raw Sewage Transfer Pump will come in to operation at Low Level 1 of the Sump Wet Well. A second Pump will come in to operation at Low Level 2. A third Pump will come in to operation at High Level 1. A fourth Pump will come in to operation at High Level 2. The operating sequence of the Raw Sewage Transfer Pumps will be rotated weekly through PLC SCADA. During decreasing Sump Level the operating sequence will be reversed.
2.0 Individual Pump Delivery Electrically Actuated Butterfly Valves will automatically OPEN at PUMP START and automatically CLOSE at PUMP STOP.

3.0 Pump(s) in operation will be tripped automatically through Level Switch Hard Wire Interlock at Low Low Level in the Sump Wet Well.
4.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Ultrasonic Level Sensor.
5.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Level Switch.

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Pumping Head Calculations for Raw Sewage Transfer Pumps IPS-3**
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A05 REV. 03 DT. 12.03.2014**

S.NO.	PARAMETER		VALUE	UNIT
1.0	Individual Pump Flow Rate, Q	:	365.000	M^3/Hr
		:	0.101	M^3/s
	Total Nos. Pumps	:	5.000	
	Nos. Pumps Working	:	4.000	
	Nos. Pumps Stand-By	:	1.000	
	Combined Pump Flow Rate	:	1460.000	M^3/Hr
		:	0.406	M^3/s
2.0	**STATIC HEAD CALCULATION**			
	Raw Sewage Sump IL	:	39.748	M
	Receiving Manhole N-41 Ground Level	:	50.000	M
	Static Head	:	**10.252**	M
3.0	**PIPE FRICTION LOSS - 300 NB DI K7 INDIVIDUAL DELIVERY**			
	Pump Flow Rate, Q	:	0.101	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.300	M
	Pump Delivery Pipeline Length (Max), L	:	10.000	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.434	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.075	M
	Friction Slope, S (by Calculation)	:	0.01072	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.107**	M
4.0	**PIPE FRICTION LOSS - 700 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.406	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.700	M

S.NO.	PARAMETER		VALUE	UNIT
	Pump Delivery Pipeline Length (Max), L	:	**750.000**	M
	Pipe Velocity, V = Q/ (∏*D*D/4) Hazen William Equation, V = 0.849 * C * $R^{0.63}$ * $S^{0.54}$	:	1.054	M/s
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.175	M
	Friction Slope, S (by Calculation)	:	0.00121	M/M
	Pipe Friction Loss, H_F = S * L	:	**0.907**	M

5.0 FITTINGS LOSSES - PUMP SUCTION

Pump Flow Rate, Q	:	0.101	M^3/s
Pump Suction Diameter, D	:	0.300	M
Suction Velocity V = Q/(∏/4*D*D)	:	1.434	M/s
Velocity Head = $V^2/2g$	:	0.105	M
Entrance Loss Co-Efficient, K	:	0.500	
Pump Suction Fittings Losses = K * $V^2/2g$	:	**0.052**	M

6.0 FITTINGS LOSSES - 300 NB DI K7 INDIVIDUAL PUMP DELIVERY

Pump Flow Rate, Q	:	0.101	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.300	M
Delivery Velocity V = Q/(∏/4*D*D)	:	1.434	M/s
Velocity Head = $V^2/2g$	:	0.105	M
Loss Co-Efficient, Reducer 200 NB - 150 NB, K_1	:	1.000	
Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
Nos. 90^0 Bends, N	:	2.000	
Loss Co-Efficient Non Return Valve, K_4	:	2.500	
Loss Co-Efficient Butterfly Valve, K_5	:	1.000	
Total Loss Co-Efficient K = (K_1 + N*K_2 + K4 + K5)	:	6.500	
Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.681**	M

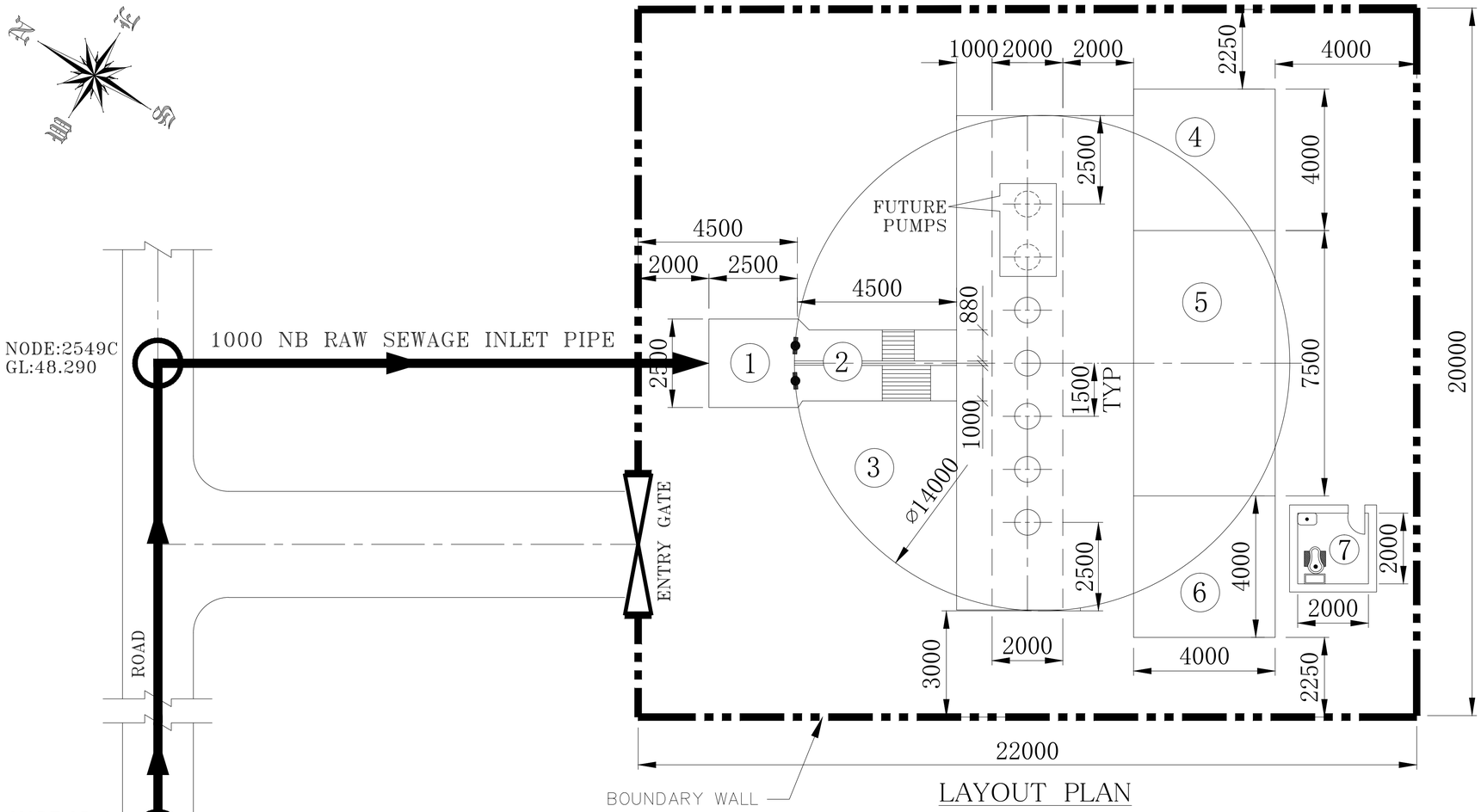
7.0 FITTINGS LOSSES - 700 NB DI K7 COMMON DELIVERY HEADER

Pump Flow Rate, Q	:	0.406	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.700	M
Delivery Velocity V = Q/(∏/4*D*D)	:	1.054	M/s
Velocity Head = $V^2/2g$	:	0.057	M

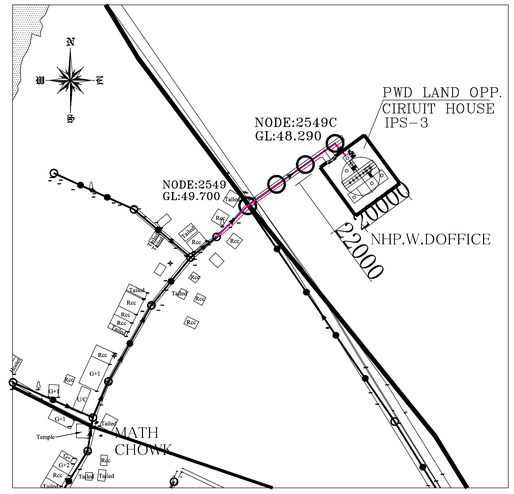
S.NO.	PARAMETER		VALUE	UNIT
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N (Max)	:	8.000	
	Exit Loss Co-Efficient, K_6	:	1.000	
	K6)	:	9.000	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.509**	M

7.0 TOTAL HEAD LOSS CALCULATION

Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	12.509	M
Pump Delivery Head with considering 10% margin	:	13.760	M
Pump Delivery Head (Provided)	:	**14.000**	M



LAYOUT PLAN



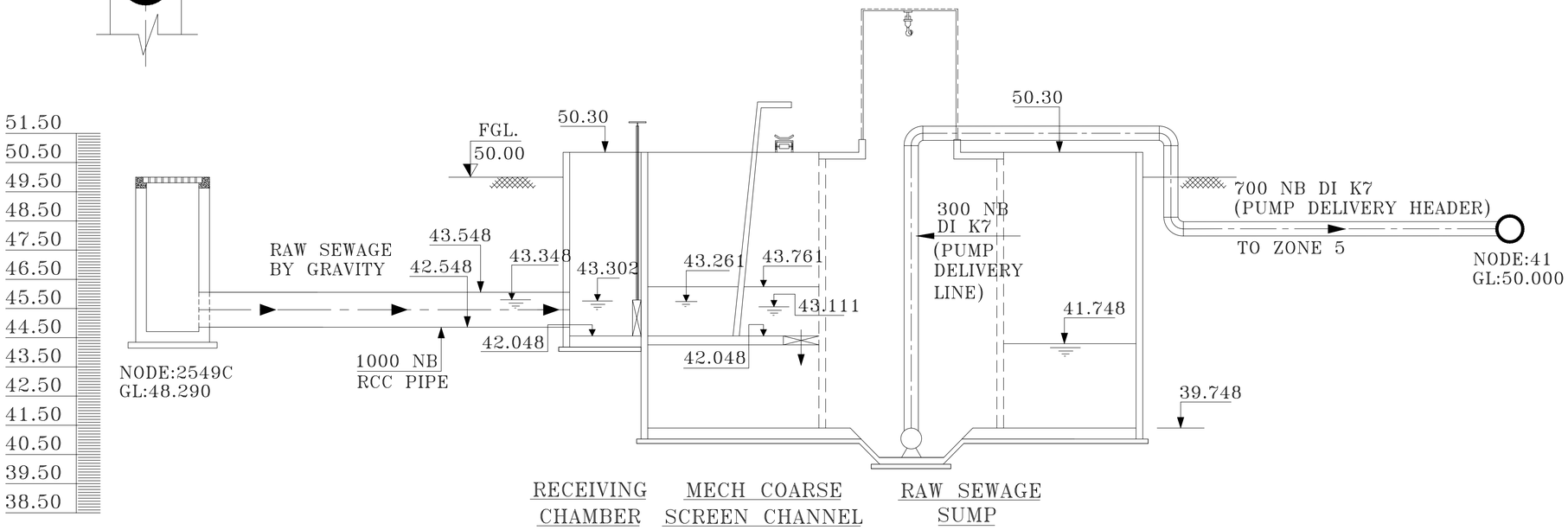
KEY PLAN

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	14.0 ⌀ x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTES:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.



HYDRAULIC FLOW DIAGRAM

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	12.03.14	REVISED AS PER REVISED SIZING CALCULATION	M.S.	MB	AKS
2	19.09.13	REVISED AS PER REVISED SIZING CALCULATION	M.S.	SHIV	RKS
1	26.03.13	REVISED AS PER REVISED SIZING CALCULATION	M.S.	SHIV	RKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI–TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 27.11.12

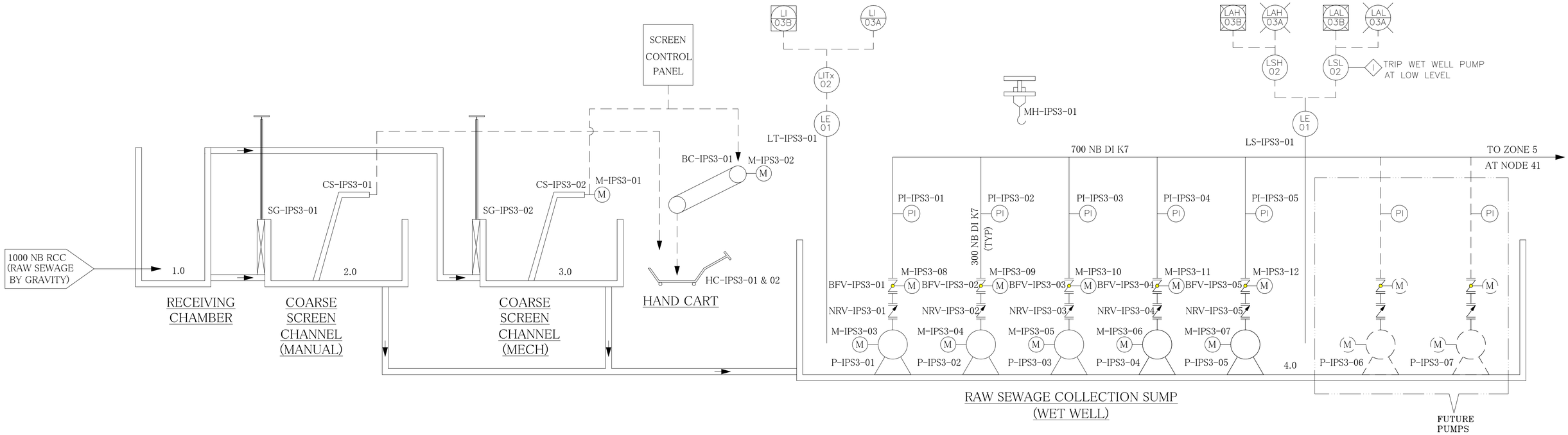
DRAWN.: – M.S.

CHKD.: – DR. A.DUTT

APPD.: – DR. A.DUTT

TITLE: – IPS 3 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS3/A06	3



UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.5 x 2.5 x 1.254 SWD + 6.998FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.88 x 1.213 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 1.00 x 1.213 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	14.0ø x 2.0 SWD + 8.552 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS3-01	MANUAL COARSE BAR SCREEN	0.675 W x 1.7 HT	1	SS 304
CS-IPS3-02	MECH COARSE BAR SCREEN	0.710 W x 9.65 HT	1	SS 304
BC-IPS3-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS3--01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS3-01/02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	365.0 M3/HR x 14.0 MWC	5	AS PER NIT
M-IPS3-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS3--01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	800 x 800	2	CI (AS PER NIT)
NRV-IPS3-01/02/03/04/05	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	300 NB	5	CI (AS PER NIT)
BFV-IPS3-01/02/03/04/05	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	300 NB	5	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS3-01/02/03/04/05	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	5	MFG STD
LS-IPS3-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS3-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

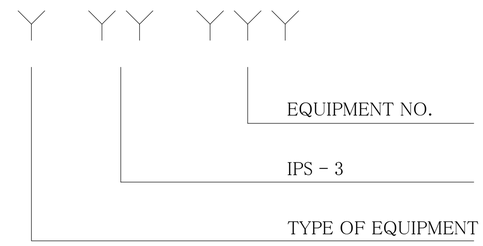
LEGENDS:-

	NON RETURN VALVE
M	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
I	HARD WIRE INTERLOCK
———	SEWAGE/WATER LINE
— — —	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-



REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	12.03.14	REVISED AS PER REVISED SIZING CALCULATION	MS	MB	AKS
2	19.09.13	REVISED AS PER REVISED SIZING CALCULATION	MS	SHIV	RKS
1	26.03.13	REVISED AS PER REVISED SIZING CALCULATION	MS	SHIV	RKS
0	30.11.12	SUBMISSION FOR APPROVAL	P.B.	SHIV	A.DUTT

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- PROCESS & INSTRUMENTATION DIAGRAM OF IPS-3

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS3/A07	3

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Pumping Head Calculations for Raw Sewage Transfer Pumps IPS-4**
Doc. No.	**: TT/BEI/HJ/1051/IPS4/A05 REV. 03 DT. 09.07.2013**

S.NO.	PARAMETER		VALUE	UNIT
1.0	Individual Pump Flow Rate, Q	:	142.000	M^3/Hr
		:	0.039	M^3/s
	Total Nos. Pumps	:	5.000	nos.
	Nos. Pumps Working	:	4.000	nos.
	Nos. Pumps Stand-By	:	1.000	nos.
	Combined Pump Flow Rate (for year 2026)	:	568.000	M^3/Hr
		:	**0.158**	**M^3/s**
2.0	**STATIC HEAD CALCULATION**			
	Raw Sewage Sump IL	:	40.313	M
	Receiving Manhole N-2322B Ground Level	:	47.984	M
	Static Head	:	**7.671**	M
3.0	**PIPE FRICTION LOSS - 200 NB DI K7 INDIVIDUAL DELIVERY**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.200	M
	Pump Delivery Pipeline Length (Max), L	:	10.000	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.255	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.050	M
	Friction Slope, S (by Calculation)	:	0.00721	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.072**	M
4.0	**PIPE FRICTION LOSS - 400 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.158	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.400	M
	Pump Delivery Pipeline Length (Max), L	:	**1600.000**	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.255	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.100	M
	Friction Slope, S (by Calculation)	:	0.00321	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**5.141**	M

S.NO.	PARAMETER		VALUE	UNIT
5.0	**FITTINGS LOSSES - PUMP SUCTION**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Suction Diameter, D	:	0.200	M
	Suction Velocity V = Q/(∏/4*D*D)	:	1.255	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Entrance Loss Co-Efficient, K	:	0.500	
	Pump Suction Fittings Losses = K * $V^2/2g$	:	**0.040**	M
6.0	**FITTINGS LOSSES - 200 NB DI K7 INDIVIDUAL PUMP DELIVERY**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.200	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.255	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Loss Co-Efficient, Reducer 200 NB - 150 NB, K_1	:	1.000	
	Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N	:	2.000	
	Loss Co-Efficient Non Return Valve, K_4	:	2.500	
	Loss Co-Efficient Butterfly Valve, K_5	:	1.000	
	Total Loss Co-Efficient K = (K_1 + N*K_2 + K4 + K5)	:	6.500	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.522**	M
7.0	**FITTINGS LOSSES - 400 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.158	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.400	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.26	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N (Max)	:	30.000	
	Exit Loss Co-Efficient, K_6	:	1.000	
	K5 + K6)	:	31.000	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**2.490**	M
7.0	**TOTAL HEAD LOSS CALCULATION**			
	Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	15.937	M
	Pump Delivery Head with 10% margin	:	17.530	M
	Pump Delivery Head (Provided)	:	**18.000**	M
	Pumping KW rating		10.709	

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**		
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**		
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**		
Doc. Name	**: Hydraulic Design Calculation for IPS-4**		
Doc. No.	**: TT/BEI/HJ/1051/IPS4/A02**	**REV. 03**	**DT. 02.07.2013**

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Peak Flow Rate, Q_P	:	16.848	MLD
		:	702.000	M^3/Hr
		:	0.195	M^3/s
2.0	**RECEIVING CHAMBER**			
	Outfall Sewer to Receiving Chamber Invert Level	:	**42.913**	M
	Say	:	42.913	M
	Outfall Sewer Diameter	:	0.700	M
	Outfall Sewer Soffit Level	:	43.613	M
	IPS 4 Finished Ground Level (Considered)	:	50.000	M
	Height, Top of Receiving Chamber (Above Ground)	:	1.000	M
	Receiving Chamber Top of Structure Level	:	51.000	M
	Outfall Sewer Capacity, Q_P	:	702.000	M^3/Hr
		:	0.195	M^3/s
	Sewage Level in Outfall Sewer (Considered)	:	80.000	%
		:	0.560	M
	Outfall Sewer Top Water Level	:	**43.473**	M
	Outfall Sewer Wetted Cross Section Area, A			
	Triangle Portion			
	Triangle Height, H	:	0.210	M
	Subtended Angle, $\theta = \cos^{-1}(H/(D/2))$	:	53.130	^{0}

	Triangle Base, B = ((((D/2)^2) - (H^2))^0.5)*2	:	0.560	M
	Triangle Area, A_1 = 0.5 * H * B	:	0.059	M^2
	Circle Segment Portion			
	Subtended Angle, $\theta_1 = 360^0 - (\theta * 2)$	:	253.740	^{0}
	Outfall Sewer Wetted Circular Cross Section Area, A_2	:	0.271	M^2
	Outfall Sewer Wetted Cross Section Area, $A = A_1+A_2$	:	0.330	M^2
	Outfall Sewer Design Flow Rate, Q_D	:	0.195	M^3/s
	Outfall Sewer Velocity, $V = Q_D / A$	:	0.591	M/s
	Velocity Head, $V^2/2g$	:	0.018	M
	Exit Head Loss Co-Efficient, K	:	1.000	
	Exit Head Loss, $K * V^2/2g$	:	0.018	M
	Receiving Chamber Top Water Level	:	43.455	M
	Say	:	**43.455**	M
	Gap, Sewer Pipeline IL - Receiving Chamber IL	:	0.300	M
	Receiving Chamber Invert Level	:	42.613	M
	Receiving Chamber Side Water Depth	:	**0.842**	M
	Free Board	:	7.545	M
3.0	**MECHANICAL COARSE SCREEN CHANNEL**			
	Inlet Sluice Gate Width, W	:	0.450	M
	Inlet Sluice Gate Side Water Depth, Z	:	0.450	M
	Velocity (across Sluice Gate), $V = Q_P / W*Z$	:	0.963	M/s
	Velocity Head $V^2 / 2g$	:	0.047	M
	Sluice Gate Head Loss Co-Efficient	:	0.800	
	Head Loss across Sluice Gate, $K * V^2 / 2g$	:	0.038	M
	Say	:	0.050	M
	Coarse Screen Channel Top Water Level (U/s)	:	43.405	M
	Say	:	**43.405**	

	Coarse Screen Channel Invert Level	:	42.613	M
	Coarse Screen Channel Side Water Depth (U/s)	:	0.792	M
	Say		**0.792**	
	Head Loss across Coarse Screen (Maxi)	:	0.150	M
	Coarse Screen Channel Top Water Level (D/s)	:	**43.255**	M
	Free Board (To Top of Screen Channel)	:	0.500	M
	Coarse Screen Channel Top of Structure Level	:	43.905	M
	Wet Well Top of Structure Level	:	51.000	M
	Free Board (To Top of Wet Well)	:	**7.595**	M
	IPS 4 Finished Ground Level	:	50.000	M

4.0 RAW SEWAGE SUMP (WET WELL)

	Coarse Screen Channel Invert Level	:	42.613	M
	Free Fall, Fine Screen Channel IL - Raw Sewage Sump TWL	:	0.300	M
	Raw Sewage Sump Top Water Level	:	**42.313**	M
	Raw Sewage Sump Side Water Depth	:	2.000	M
	Raw Sewage Sump Invert Level	:	**40.313**	M
	Finished Ground Level	:	50.000	M
	Height, Dry Well Plinth Level (Above Ground)	:	1.000	M
	Raw Water Sump Top of Structure Level	:	51.000	M
	Raw Water Sump Free Board	:	8.687	M

Project : DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN

Client : Bihar Urban Infrastructure Development Corporation.

Head loss calculation of Mechanical Coarse screen for IPS-4

09.07.2013

Design Avg. flow for year 2041 (Qa)		327.6	m3/hr
		0.091	m3/sec
Design Peak flow for year 2041 (Qp)		702	m3/hr
		0.195	m3/sec
Maximum water depth (Wd)		**0.792**	M
Bar spacing (as per NIT) - Bs		25	mm
Bar size (Width) -Bt		10	mm
Screen inclination - θ		80	Deg
Channel width (provided) as per sizing calculation)Cw)		0.6	m
Screen Width provided (refer Sizing calculation for IPS-4) (Sw)		0.3	m
Clogging factor (Cf)		30%	
Coefficeint of discharge(C)		0.7	
Gravitational acceleration (g)		9.81	
Head loss through the clossed screen desired		150	mm

HYDRAULICS CALCULATION:

Let Velocity through screen		1	m/sec
So clear width required		0.2	m
No. of opening		9.85	nos.
	say	10.00	
No. of Bars		11.00	nos
Inclined Submerged Screen length (Li)		0.804	
Velocity in channel at avg flow (Va)		0.19	
Velocity in channel at Peak flow (Vp)		0.41	
Clear area of screen at No clogging condition (Ac)		0.20	m2
Velocity throught screen at peak flow (Vs1)		0.97	m2/sec
Head loss calculation : by using Bernoulli Equation (Hl1)			
((1/(c*2g))*(Vs12-Vp2)		0.056	m
		56	mm
Velocity through screen at 30% clogged condition (Vs2)		1.39	m/sec
Head loss calculation at 30 % clogged condition			
((1/c*2g*(Vs2^2-Vp^2))		**0.128**	m
		128	mm < 150mm
	Hence OK		

NOTE: Controlling of screen will do throught PLC accordingly so that clogging should not be more than 30%

			IPS - 4					
Head Calculation			**Inter flow**	**Ultimate Flow**	**Inter flow**	**Ultimate Flow**		
Frictional Losses due to fittings (H2) = KV2/2g			for 350		For 400		for 450	
H2 = head loss, m								
K = co-efficient for bends								
K for bends		=	0.32	0.32	0.32	0.32	0.32	0.32
K for valves		=	0.8	0.8	0.8	0.8	0.8	0.8
K for NRV		=	2.5	2.5	2.5	2.5	2.5	2.5
K for Expander		=	0.5	0.5	0.5	0.5	0.5	0.5
g = gravitational force	m/sec2	=	9.8	9.8	9.8	9.8	9.8	9.8
No. of bends		=	6	6	6	6	6	6
No. of valves		=	1	1	1	1	1	1
No. of NRVs		=	1	1	1	1	1	1
No. of Expander		=	1	1	1	1	1	1
V, velocity through pipe	m/sec	=	1.61	2.028	1.23	1.553	0.98	1.227
Total head loss for fittings (H2)	**m**	**=**	**0.758**	**1.200**	**0.444**	**0.703**	**0.277**	**0.439**
Frictional loss in pipe length (H1)		=						
FL = {6.815 x (V/C)$^{1.852}$ x (1/ D)$^{1.167}$} x								
V = Velocity through pipe	m/sec	=	1.61	2.03	1.23	1.55	0.98	1.23
C = Hazen Williams co-efficient		=	140	140	140	140	140	140
D = Dia of Pipe	m	=	0.350	0.350	0.400	0.400	0.450	0.450
Frictional loss in pipe length (H1)	**m**	=	**0.006**	**0.009**	**0.003**	**0.005**	**0.002**	**0.003**

Project : **DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN**

Client : **Bihar Urban Infrastructure Development Corporation.**

09.07.2013

Economic Size of Pumping Main from IPS 4 to Zone 5 Manhole No 2322B

Volume provided IPS -4 (Provided)	=	157.08	m3		
Average Flow in Present Year	=	2.88	m3/min	172.8	m3/hr
Average Flow in Intermediate Year	=	3.96	m3/min	237.6	m3/hr
Average Flow in Ultimate Year	=	5.46	m3/min	327.6	m3/hr
Peak Flow in Present Year	=	6.66	m3/min	399.6	m3/hr
Peak Flow in Intermediate Year	=	9.30	m3/min	558	m3/hr
Peak Flow in Ultimate Year	=	11.70	m3/min	702	m3/hr
Pumping Rate in the Present	=	6.66	m3/min	399.6	m3/hr
Pumping Rate in the Intermediate	=	9.30	m3/min	558	m3/hr
Pumping Rate in the Ultimate	=	11.70	m3/min	702	m3/hr
Pumping Machinery provided 2026 (Intermediate)	=				
Each pump capa.		142	m3/hr		
Totol pumping capacity at avg flow		426	m3/hr	3W +2SB	
		7.1	m3/min.		
Totol pumping capacity at peak flow		568.00	m3/hr	4W +1SB	
		9.5	m3/min.		
Pumping Machinery provided 2041 (ultimate)	=				
Each pump capa.		142	m3/hr		
Totol pumping capacity at avg flow		426	m3/hr	3W +4SB	
		7.1	m3/min.		
Totol pumping capacity at peak flow		710.00	m3/hr	5W +2SB	
		11.8	m3/min.		

Flows	Time of Fill (min)	Time of Empty (min)	No of Starts/Hr	No. of pumps Working	Running Time (hr)
Average Flow in Present Year	55	24	**1**	1.22	29.21
Average Flow in Intermediate Year	40	8	2	1.67	40.16
Average Flow in Ultimate Year	29	7	2	2.31	55.37
Peak Flow in Present Year	24	12	2	2.81	67.54
Peak Flow in Intermediate Year	17	6	3	3.93	94.31
Peak Flow in Ultimate Year	13	3	5	4.94	118.65

Flows	m3/hr	m3/s	LPS
Average Flow in Present Year	172.80	0.048	48.00
Average Flow in Ultimate Year	327.60	0.091	91.00
Average Flow in Intermediate Year	237.60	0.066	66.00
Peak Flow in present Year	399.60	0.111	111.00
Peak Flow in Intermediate Year	558.00	0.155	155.00
Peak Flow in Ultimate Year	702.00	0.195	195.00

Pipe dia Calculations

	Velocity	Flow	Area	Dia
for present flow	0.8	0.111	0.14	0.420
for Intermediate flow	1.3	0.155	0.12	0.390
for Ultimate flow	2.2	0.195	0.09	0.336

Head Calculation for Raw Sewage pumps

Raw Sewage Sump Invert Level	=	40.313	m
GL at Disposing Point (Zone 5 Manhole No 2322B)	=	47.984	m
Static head (H1)	=	7.67	m

Project : DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN

Dia of Pipe in mm	350		400		450	
Area of the Pipe	0.096		0.126		0.159	
Velocity m/sec for present flow	1.15		0.88		0.698	
Velocity m/sec for int flow	1.61		1.23		0.98	
Velocity m/sec for ultimate flow	2.03		1.55		1.23	
	Int. Period	**Ult. Period**	**Int. Period**	**Ult. Period**	**Int. Period**	**Ult. Period**
Flow rate in lps	155.00	195.00	155.00	195.00	155.00	195.00
Frictional Losses in Pipe per m	0.006	0.009	0.003	0.005	0.002	0.003
Pumping Main Length in m	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00
Total Frictional Loss	9.53	14.58	4.97	7.61	2.80	4.29
Static Head	7.67	7.67	7.67	7.67	7.67	7.67
Head loss due to fitting (Station Losses)	0.758	1.200	0.444	0.703	0.277	0.439
Residual Head in m	2.00	2.00	2.00	2.00	2.00	2.00
Total Head in m	19.96	25.45	**15.09**	**17.98**	**12.75**	**14.40**
Cost of Pipe in Rs.	6847.50	6847.50	7716.25	7716.25	14405.00	14278.75
Total cost of pipe Lakhs	109.56		123.46		230.48	
Kw required	46.66	74.85	35.27	52.88	29.81	42.34
cost of pump set in lakhs	14.00	22.45	10.58	15.87	8.94	12.70
Equivalent cost in 2011	14.00	8.14	10.58	5.75	8.94	4.60
Present value of Total Capitalised Pump set Cost	22.13		16.33		13.54	
Annual Electrical Charges in Lakhs considering Avg Int flow	34.19	54.85	25.85	38.76	21.84	31.03
Energy cost Capitalised in Lakhs	311.51	499.71	235.49	353.08	199.01	282.69
Present value of Total Capitalised Energy Cost	811.21		588.58		481.69	
Total cost in Lakhs	**942.90**		**728.37**		**725.72**	

Economic size of pumping main as per velocity = 400 mm

Determination of Water Hammer Pressure

Ultimate Peak Discharge (Q)	=	0.195 m3/s
Diameter of Pipe (d)	=	400 mm
Thickness of Pipe (t)	=	6.3 mm
Modulus of Elasticity of Pipe Material (E)	=	2.1E+10
Bulk Modulus of Water (k)	=	207000000 kg/m3
Cross - Sectional Area of Pipe Line (a)	=	0.126 m2
Normal Velocity in the pipe Line (Vo)	=	1.551 m/s
Velocity of pressure Wave Travel (C.)	=	$\frac{1425}{1+(kd/Et)}$
Velocity of pressure Wave	=	1418.03 m/s
Maximum Water hammer, Hmax	=	C Vo/g
		224.36 m

Conclusion:

We recommend 400 mm dia K7 Pipesdue to following reasons:

1) Presently we are getting the required minimum velocity which is not possible in 450mm dia.
2) In intermediate stage we are getting the required minimum velocity which is not possible in 450mm dia.
3) Maximum Operating pressure is 1.8 Kg/cm2 in ultimate stage.
4) Class K-7 is capable to withstand the pressure upto 25 kg/cm2
5) Maximum surge coming to the systemis 22.4 kg/cm2 without any surge protection devises.
6) Comparing the maximum surge pressure and design pressure of K-7 its found ok.

7) However we are providing 3 nos of air release valves to minimize the surge pressure that will be the extra safety of the system.

8) Prize of 450 mm dia pipe not available in bid document, how vere for 400 mm dia pipe prize is available in Bid document.

It is very difficult as well as time consuming to take approval of prise for new size of pipe line which is not include in

bid document.

9) In 400 dia pipe we can gate more optimizing velocity , As per general engineering practice velocity in rising main should not be less than 1m/sec.