Appendix A

Table A1 Preliminary Capital and Recurring Cost for Alternative 1 to 3

Capacity Component

	Alternative 1	Alternative 2	Alternative 3
Dinapur STP (mld), (AS)	100.0	90.0	80.0
Incremental Capacity	20.0	10.0	0.0
Divert to Relief Sewer (mld)			
year 2030	0.0	3.7	13.7
Sathwa STP (mld), (UASB++)			
year 2030	205.0	215.0	225.0

Land Cost (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Dinapur STP	0.0	0.0	0.0
Konia MPS	0.0	0.0	0.0
Sathwa STP	287.0	301.0	315.0
Chaughat MPS	4.0	4.0	4.0
Sub-Total	291.0	305.0	319.0

Capital Cost (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Dinapur STP	54.0	27.0	0.0
Konia MPS	31.7	0.0	0.0
Sathwa STP	615.0	645.0	675.0
Chaughat MPS	99.1	100.6	104.8
Sub-Total	799.8	772.6	779.8

Annual O/M Cost (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Dinapur STP	36.0	32.4	28.8
Konia MPS	14.5	11.3	9.3
Sathwa STP	26.7	28.0	29.3
Chaughat MPS	16.0	16.3	17.4
Sub-Total	93.2	88.0	84.8

Present Value (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Dinapur STP	654.3	568.3	482.3
Konia MPS	272.8	188.5	157.7
Sathwa STP	1,354.2	1,420.2	1,486.2
Chaughat MPS	363.8	370.7	392.6
Sub-Total	2,645.1	2,547.7	2,518.8

Table A1.1 Konia MPS: Preliminary Capatal and Recurring Cost

Capacity Component

	Alternative 1	Alternative 2	Alternative 3
Capacity (mld)	100.0	90.0	80.0
Stage 1 - Screw Pump			
1,158 lps x 215HP	4	3	3
Stage 2 - Centrifugal Pump			
420 lps x 150HP	4	3	3
Stage 2 - Centrifugal Pump			
740 lps x 250HP	4	3	3

Capital Cost Component (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Stage 1	21.0	0.0	0.0
Stage 2	10.7	0.0	0.0
Sub-Total	31.7	0.0	0.0

Recurring Cost Component (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Stage 1 - energy cost	3.4	3.1	2.7
Stage 2 - energy cost	7.3	5.3	3.7
Annual O&M Cost	3.8	2.9	2.9
Sub-Total	14.5	11.3	9.3

Replace M&E Equipment Every 15 year (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Replace M&E equipment every 15 year	43.0	32.2	32.2

Total Present Value (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Total Present Value	272.8	188.5	157.7

Interest	5%
Project Life	30 year

Table A1.2 Dinapur STP: Preliminary Capital and Recurring Costs

Capacity Component

	Alternative 1	Alternative 2	Alternative 3
Rated Capacity (mld)	100.0	90.0	80.0
Incremental Capacity	20.0	10.0	0.0

Unit Rate (Activated SludgeProcess)

		Alternative 1	Alternative 2	Alternative 3
Land area	(ha/mld)	0.2	0.2	0.2
Capital Cost	(Million Rs./mld)	2.7	2.7	2.7
Capital Cost for expansion	(% new)	100.0	100.0	100.0
M&E Cost	(% of total)	40.0	40.0	40.0
Annual O&M Cost	(Million Rs./mld)	0.36	0.36	0.36

Capital Cost Components (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Cost of land	0.0	0.0	0.0
Cost of augument capacity	54.0	27.0	0.0

Recurring Cost Component (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Annual O&M Cost	36.0	32.4	28.8
Replace M&E equipment every 15 year	108.0	97.2	86.4

Total Present Value (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Total Present Value	654.3	568.3	482.3

Table A1.3 Sathwa STP: Comparison of Cost for Various Treatment Methods

Capacity	225 mld
Land cost	4 Million Rs.
Interest	5 %
Project life	30 years

Unit Rate

		WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area	(ha/mld)	1.25	0.35	0.75	0.20	0.60	0.06	0.35
Capital Cost	(Million Rs./mld)	1.6	2.5	3.2	2.7	3.4	4.6	3.0
M&E Cost	(% of total)	2%	20%	20%	40%	40%	60%	30%
Annual O&M Cost	(Million Rs./mld)	0.06	0.30	0.32	0.36	0.38	0.59	0.13

Capital Cost Component (Million Rs.)

		WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area for treatment process	(ha)	281	79	169	45	135	14	79
Land cost		1,125	315	675	180	540	54	315
Capital cost		360	563	720	608	765	1,035	675
Sub-Total		1,485	878	1,395	788	1,305	1,089	990

Recurring Cost Compoment (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Replace M&E equipment every 15 year	7	113	144	243	306	621	203
Annual O&M Cost	14	68	72	81	86	133	29

Total Present Value (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Total Present Value	1,633	1,933	2,501	2,106	2,705	3,366	1,481

WSP: Wastewater Stabilization Ponds
AL1: Aerated Lagoon + Chlorination
AL2: Aerated Lagoon + Maturation Ponds
AS1: Activated Sludge Process + Chlorination
AS2: Activated Sludge Process + Maturation Ponds
FAB: Fluidized Aerobic Bed+Chlorination
UASB++: Upflow Anaerobic Sludge Blanket + Aerated Lagoon + Chlorination

Table A1.4 Sathwa STP: Preliminary Capital and Recurring Costs

UASB + Aetared Lagoon + Chlorination

Land cost	4 Million Rs.
Interest	5 %
Project life	30 years

Capacity Component

	Alternative 1	Alternative 2	Alternative 3
Rated Capacity (mld)	205.0	215.0	225.0

Unit Rate (UASB++)

		Alternative 1	Alternative 2	Alternative 3
Land area	(ha/mld)	0.35	0.35	0.35
Capital Cost	(Million Rs./mld)	3.0	3.0	3.0
Capital Cost for expansion	(% new)	100.0	100.0	100.0
M&E Cost	(% of total)	30.0	30.0	30.0
Annual O&M Cost	(Million Rs./mld)	0.13	0.13	0.13

Capital Cost Components (Million Rs.)

		Alternative 1	Alternative 2	Alternative 3
Land Area	(ha)	71.8	75.3	78.8
Cost of land		287.2	301.2	315.2
Cost of construction		615.0	645.0	675.0

Recurring Cost Component (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Annual O&M Cost	26.7	28.0	29.3
Replace M&E equipment every 15 year	184.5	193.5	202.5

Total Present Value (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Total Present Value	1,354.2	1,420.2	1,486.2

Table A1.5 Chauka ghat MPS: Preliminary Capatal and Recurring Cost

Land cost	4 Million Rs.
Interest	5 %
Project life	30 years

Capacity Component

	Alternative 1	Alternative 2	Alternative 3
Rated Capacity (mld)	156.4	160.1	170.1

Capital Cost Components (Centrifugal pump) (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Land Area (ha)	1.0	1.0	1.0
Cost of land	4.0	4.0	4.0
M&E cost	43.5	44.4	46.9
Civil works	55.6	56.2	57.9
Total Capital Cost	99.1	100.6	104.8

Recurring Cost Component (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Energy Cost	13.9	14.2	15.1
Annual O&M cost for M&E (1)	1.3	1.3	1.4
Annual O&M cost for civil works (2)	0.8	0.8	0.9
Sub-Total of annual O&M cost	16.0	16.3	17.4
Replace M&E equipment every 15 year	43.5	44.4	46.9

Total Present Value (Million Rs.)

	Alternative 1	Alternative 2	Alternative 3
Total Present Value	363.8	370.7	392.6

(1) Annual O&M costs for M&E = 3% of total cost of M&E

(2) Annual O&M costs for civil works = 1.5% of total cost of civil works

Table A2 Preliminary Capital and Recurring Cost for Alternative 4 to 6

Capacity Component

		Alternative 4	Alternative 5	Alternative 6
Bhagwanpur STP (mld), (AS)		15.0	8.0	0.0
	Incremental Capacity	7.0	0.0	0.0
Flow to Nagwa MPS (mld)				
	year 2015	32.7	39.7	47.7
	year 2030	30.1	37.1	45.1
Flow to Ramna STP (mld)				
	year 2015	32.7	39.7	47.7
	year 2030	58.4	65.4	73.4

Land Cost (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Bhagwanpur STP	0.0	0.0	0.0
Nagwa MPS	2.0	2.0	2.0
Ramna STP	292.0	327.0	367.0
Sub-Total	294.0	329.0	369.0

Capital Cost (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Bhagwanpur STP	18.9	0.0	140.6
Nagwa MPS	23.6	31.0	38.2
Ramna STP	93.4	104.6	117.4
Sub-Total	135.9	135.6	296.2

Annual O/M Cost (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Bhagwanpur STP	5.4	2.9	0.0
Nagwa MPS	3.9	4.8	5.8
Ramna STP	3.5	3.9	4.4
Sub-Total	12.8	11.6	10.2

Present Value (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Bhagwanpur STP	108.4	48.2	133.9
Nagwa MPS	89.3	111.0	134.4
Ramna STP	421.8	472.4	530.1
Sub-Total	619.5	631.6	798.5

Table A2.1 Ramna STP: Comparison of Cost for Various Treatment Methods

Capacity	75 mld
Land cost	4 Million Rs.
Interest	5 %
Project life	30 years

Unit Rate

		WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area	(ha/mld)	1.25	0.35	0.75	0.20	0.60	0.06	0.35
Capital Cost	(Million Rs./mld)	1.6	2.5	3.2	2.7	3.4	4.6	3.0
M&E Cost	(% of total)	2%	20%	20%	40%	40%	60%	30%
Annual O&M Cost	(Million Rs./mld)	0.06	0.30	0.32	0.36	0.38	0.59	0.13

Capital Cost Component (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area for treatment process (ha)	94	26	56	15	45	5	26
Land cost	375	105	225	60	180	18	105
Capital cost	120	188	240	203	255	345	225
Sub-Total	495	293	465	263	435	363	330

Recurring Cost Compoment (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Replace M&E equipment every 15 year	2	38	48	81	102	207	68
Annual O&M Cost	5	23	24	27	29	44	10

Total Present Value (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Total Present Value	549	649	834	702	907	1,117	499

WSP: Wastewater Stabilization Ponds
AL1: Aerated Lagoon + Chlorination
AL2: Aerated Lagoon + Maturation Ponds
AS1: Activated Sludge Process + Chlorination
AS2: Activated Sludge Process + Maturation Ponds
FAB: Fluidized Aerobic Bed+Chlorination

Table A2.2 Ramna STP: Preliminary Capital and Recurring Costs

Capacity Component (mld)

	Alternative 4	Alternative 5	Alternative 6
Capacity in 2030	58.4	65.4	73.4

Capital Cost Components (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Land area (ha)	73.0	81.8	91.8
Cost of land	292.0	327.0	367.0
Cost of construction	93.4	104.6	117.4

Recurring Cost Component (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Annual O&M Cost	3.5	3.9	4.4
Replace M&E equipment every 15 year	1.9	2.1	2.3

Total Present Value (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Total Present Value	421.8	472.4	530.1

Unit Rate (WSP)

Land area	1.25	ha/mld
Construction cost	1.6	Million Rs./mld
M&E cost	2	% of total capital cost
Annual O&M cost	0.06	Million Rs./mld
Land cost	4	million Rs./ha

Interest	5%	
Project life	30	years

Table A2.3 Bhagwanpur STP: Preliminary Capital and Recurring Costs

Capacity Component (mld)

	Alternative 4	Alternative 5	Alternative 6
Capacity in 2030	15.0	8.0	0.0
Incremental capacity	7.0	0.0	0.0

Capital Cost Components (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Land area (ha)	0.0	0.0	0.0
Cost of land	0.0	0.0	0.0
Cost of construction (STP)	18.9	0.0	0.0
Cost of construction (Outfall sewer)	0.0	0.0	140.6

Recurring Cost Component (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Annual O&M Cost	5.4	2.9	0.0
Replace M&E equipment every 15 year	16.2	8.6	0.0

Total Present Value (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Total Present Value	108.4	48.2	133.9

Unit Rate (ASP)

Land area	0.2	ha/mld
Construction cost	2.7	Million Rs./mld
M&E cost	40	% of total capital cost
Annual O&M cost	0.36	Million Rs./mld
Land cost	4	million Rs./ha

Interest	5%
Project life	30 years

Table A2.4 Nagwa MPS: Preliminary Capatal and Recurring Cost

Capacity Component

	Alternative 4	Alternative 5	Alternative 6
Capacity in 2030 (mld)	30.1	37.1	45.1

Capital Cost Component (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Land area (ha)	0.5	0.5	0.5
Cost of land	2.0	2.0	2.0
M&E cost	12.4	14.1	16.1
Civil work cost	11.2	16.8	22.1

Recurring Cost Component (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Energy cost	3.3	4.1	5.0
Annual O&M cost for M&E	0.4	0.4	0.5
Annual O&M Cost for civil works	0.2	0.3	0.3
Sub-Total	3.9	4.8	5.8

Replace M&E Equipment Every 15 year (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Replace M&E equipment every 15 year	12.4	14.1	16.1

Total Present Value (Million Rs.)

	Alternative 4	Alternative 5	Alternative 6
Total Present Value	89.3	111.0	134.4

Unit Cost

Land area	0.5	ha
Annual energy cost	0.11	Million Rs./mld
Land cost	4	Million Rs./ha

Interest	5%
Project Life	30 year

Table A3.1 Lotha STP: Comparison of Cost for Various Treatment Methods

Capacity	50 mld
Land cost	4 Million Rs.
Interest	5 %
Project life	30 years

Unit Rate

		WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area	(ha/mld)	1.25	0.35	0.75	0.20	0.60	0.06	0.35
Capital Cost	(Million Rs./mld)	1.6	2.5	3.2	2.7	3.4	4.6	3.0
M&E Cost	(% of total)	2%	20%	20%	40%	40%	60%	30%
Annual O&M Cost	(Million Rs./mld)	0.06	0.30	0.32	0.36	0.38	0.59	0.13

Capital Cost Component (Million Rs.)

		WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Land area for treatment process	(ha)	63	18	38	10	30	3	18
Land cost		250	70	150	40	120	12	70
Capital cost		80	125	160	135	170	230	150
Sub-Total		330	195	310	175	290	242	220

Recurring Cost Compoment (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Replace M&E equipment every 15 year	2	25	32	54	68	138	45
Annual O&M Cost	3	15	16	18	19	30	7

Total Present Value (Million Rs.)

	WSP	AL1	AL2	AS1	AS2	FAB	UASB++
Total Present Value	361	428	556	468	599	755	338

WSP: Wastewater Stabilization Ponds
AL1: Aerated Lagoon + Chlorination
AL2: Aerated Lagoon + Maturation Ponds
AS1: Activated Sludge Process + Chlorination
AS2: Activated Sludge Process + Maturation Ponds
FAB: Fluidized Aerobic Bed+Chlorination
UASB++: Upflow Anaerobic Sludge Blanket + Aerated Lagoon + Chlorination

Appendix B

Appendix B-1

1. A Brief History of Public Interest Litigation (PIL) of Ganga Action Plan Phase-II at Varanasi

April-1993 The Ganga Action Plan Phase-II was launched by the GOI.

Oct.-1993 The UPJN, through GoUP prepared and submitted the GAP-II project for Varanasi amounting to Rs. 53.50 crore.

Dec.-1993 A local NGO, the Sankat Mochan Foundation (SMF) floated a separate proposal for Varanasi GAP-II.

Aug.-1994 SMF made a presentation of their proposal before technical experts of NRCD.

July-1995 CCEA approval accorded for Rs. 47.52 crore (which was revised to Rs. 45.06 crore in 1997 according to revised funding pattern).

Aug.-1995 SMF submitted a PFR for Varanasi GAP-II.

May-1997 SMF resubmitted their PFR which was subsequently revised in September-1997, then again in November-1997, then again in December-1997.

July-1997 Rakesh Jaiswal, a resident of Kanpur filed a Public Interest Litigation (PIL) before the Allahabad High Court about pollution of river Ganga.

Mar.-1998 The High Court directed to make fool proof arrangements for abatement of pollution of the river.

July-1998 General body of VNN accepted the SMF proposal by a resolution (However, the GoUP rejected this resolution in public interest on 03.09.1998).

July-1998 Two corporators of VNN, Sri Narayan Mishra and Sri Devdutt Tiwari impleaded themselves in the writ petition filed by Rakesh Jaiswal. They prayed before the High Court for a direction for implementation of SMF project through VNN.

Sept.-1998 The Allahabad High Court vide order dated 17.09.1998 gave a direction that the projects relating to GAP-II be scrutinised and approved by a committee of experts.

Oct-1998 NRCD preferred special leave petition before the Supreme Court of India against the order dated 17.09.98 of the High Court.

Oct.-1998 The Supreme Court vide order dated 29.10.1998 stayed the operation of the order of the High Court.

Mar.-1999 UPJN submitted revised PFR amounting to Rs. 236.28 crore.

Dec.-1999 VNN requested Prof. G.D. Agrawal, a retired Professor of IIT, Varanasi for the evaluation of the two PFRs. Prof. Agrawal, in his opinion submitted to VNN in March, 2000, recommended for implementation of the SMF Project.

Jan.-2000 NRCD appointed a committee under Prof. K.J. Nath of All India Institute of Hygiene and Public Health, Kolkata University for comparative evaluation of two projects. This committee recommended for the UPJN project in its report submitted on 01.03.2000 with some suggested improvements.

Aug.-2000 National Seminar on "Rejuvenation of Culturally Significant Cities with special Reference to Varanasi" was organized at Varanasi on 11th & 12th August-2000 in

	which eminent politicians, academicians and citizens participated. It was declared in the seminar that SMF proposal was not feasible for implementation.
Sept.-2000	UPJN submitted DPRs of priority works within the approved CCEA cost.
Sept.-2000	VNN vide resolution no. 550 dated 28.09.2000 forwarded both the UPJN & SMF proposal to GoUP/GOI for accepting the technically most sound proposal on the plea that VNN did not have technical competence to evaluate the same.
Mar.-2001	SMF approached the Prime Minister's Office. The PMO asked the Planning Commission to look into the controversy.
April-2001	UPJN and SMF made presentations of their proposals before the Deputy Chairman, Planning Commission and other experts at New Delhi on 19.04.2001.
May-2001	Secretary, MoEF, GOI alongwith experts of the Ministry visited Varanasi on 19 & 20 May, 2001 to have first hand assessment.
July-2001	Both proposals were again discussed in high level meeting of experts chaired by the Secretary, MoEF, GOI on 13.07.2001. It was concluded that UPJN proposal was more practical and feasible option.
Aug.-2001	The NRCD conveyed the acceptance of the UPJN proposal and approved for implementation 4 DPRs of priority works, amounting to Rs. 39.00 crore.
Aug.-2001	Sri Narayan Mishra and Sri Dev Dutt Tiwari took the matter before Supreme Court and sought for stay on the implementation of GAP-II works.
Sept.-2001	The Supreme Court directed that the UPJN shall not implement GAP-II without leave of the Supreme Court vide order dated 07.09.2001.
Nov.-2001	NRCD and GoUP filed applications before the Supreme Court for vacating the stay order.
April-2002	The Supreme Court vide order dated 22.04.2002 permitted GoUP and NRCD to go ahead with the implementation of GAP-II according to the proposal which was duly approved by competent experts.
May-2002	Sri Narayan Mishra moved another application before the Supreme Court seeking clarification of the order dated 22.04.2002.
July-2002	56 corporators of VNN filed applications before the Supreme Court for impleadment and direction in favour of SMF proposal.
Sept.-2002	On the application of Sri Narayan Mishra, the Supreme Court vide order dated 23.09.2002 injuncted UPJN from going ahead with its plan for GAP-II.
April-2003	The Supreme Court finally disposed off the SLP of NRCD on 10.04.2003 by setting aside the order of Allahabad High Court dated 17.09.1998 but also remanded the matter to High Court for decision on specific issues and all the interim orders and stay orders were vacated by the Supreme Court.
May-2003	Sri Narayan Mishra moved application before Allahabad High Court on 25.05.2003 seeking stay order on GAP-II works.
July-2003	The High Court Allahabad took up the matter on 25.07.2003 but did not pass any stay order.

Aug.-2003 The matter came up for hearing again on 22.08.2003, but no stay order was passed (Now the counter affidavits have been filed by NRCD and GoUP before the Allahabad High Court. The matter is pending before the High Court for further hearing).

Nov.-2003 Five corporators of VNN filed another writ petition before the Allahabad High Court seeking stay on the implementation of UPJN project. The case was listed on 11.11.2003 but the High Court did not grant any stay order. The matter is pending before the High Court for further hearing.

The case was since listed on a few more dates but no orders were passed by the High Court. Now this petition, as well as the earlier petition, have both been tied together for hearing.

Oct.-2004 One advocated of Varanasi, Mr. N. Ravindran, filed a PIL in the High Court wherein he questioned the activities of JICA regarding the Project at Varanasi on Water Quality Management Plan for Ganga River and has sought directions to restrain JICA to operate in River Ganga at Varanasi and not to operate modernization of Pilot Project at Manikarnika Ghat.

The matter is pending before the High Court for hearing and so far, no orders have been passed by the High Court.

2. A Narrative History PIL of Ganga Action Plan Phase-II at Varanasi

1. A Public Interest Litigation (PIL), Writ Petition No. 21552/1997 was started in Allahabad High Court during July 1997 on the basis of a letter from Shri Rakesh Jaiswal of Eco Friends (a local NGO of Kanpur) regarding disposal of human dead bodies and animal carcasses in Ganga at Kanpur, subsequently the scope of PIL was extended to entire GAP in U.P.

   In reference to the above PIL, Sri Narayan Mishra & Sri Devdutt Tiwari (Senior Corporators of VNN) preferred an impleadment application before High Court in September 1998. The details are as follow:-

Plaint:

- GAP-I has failed because of faulty design, implementation and O&M.
- Pumping Stations being dependent on electricity, become non-operative when electricity is not available.
- Dinapur STP does not have adequate capacity as well as is incapable of addressing to coliform removal.
- ASP Technology is not suitable to control feacal coliform, treat chemicals or to sustain to shock loads.
- The NRCD & UPJN are trying to repeat the same practices of GAP-I in GAP-II also without formal acceptance of VNN or any discussions with NGOs or people of Varanasi and without any technical scrutiny.
- GAP-II proposal of UPJN does not take into account the failures of GAP-I.
- VNN has submitted the SMF proposal for GAP-II which has been accepted by VNN through resolutions of the house but NRCD & GoUP are not considering this PFR which is voilative of the 74th Amendment & Indian Constitution because VNN is the only authority to approve such projects according to the above amendment.
- The SMF proposal was prepared with the help of qualified technical experts.

Prayer:

- Direct the NRCD to authorize VNN to undertake the implementation of GAP-II through any public/private agency of its choice, and VNN be given liberty to choose cost effective and viable technologies after proper scrutiny.
- Appoint a High Powered Committee/Authority of Scientists/Experts, NGOs and eminent citizens to scrutinize the projects of GAP-II.

2. The High Court passed the following order on the above application which was delivered on 16/17 September, 1998

- Place the application along-with annexure before the Chief Secretary, U.P. for careful perusal by the committee.
- Constitute Technical Committee to be set up by the MOEF which will be comprising of Dr. P. Khanna of NEERI as Chairman, Dr. S.C. Moudgil of MOEF, Mr. S.K. Chawla, retired Chief Engineer, CPWD, Dr. G.D. Agrawal, former Member Secretary, CPCB, Dr. B.D. Tripathi of BHU, Varanasi and Sri M.C. Mehta, Advocate, New Delhi and such other NGOs whome the committee may like to co-opt.
- Meanwhile the GAP-II shall not be cleared till the same has been discussed and approved by the above committee.

3. The above order of the High Court was challenged by the NRCD before the Supreme Court of India in SLP No. 16935/98, NRCD v/s State of U.P. & others.

Initially, the Supreme Court, vide order dated 29.10.1998, stayed the operation of the order of High Court. Meanwhile, the VNN on 29.09.2000, resolved that both the projects of SMF and UPJN would be sent to the GoUP and GOI for technical evaluation and decision would be taken by the Govt. Accordingly, the NRCD consulted several experts and after a series of presentations by SMF as well as UPJN, finally, the UPJN Project was approved by NRCD in August-2001.

Sri Narayan Mishra and Sri Devdutt Tiwari, who were respondents in the above SLP, filed an application before the Supreme Court that SMF Project should be approved. The Supreme Court, on 07.09.2001, directed that UPJN will not carry out any of its plans without leave of the court.

On an application filed by the NRCD for modification of the above order, on 22.04.2002, the Supreme Court permitted the NRCD and GoUP to go ahead with the project which has been approved by a competent expert body.

An application was again filed by Sri Narayan Mishra and Sri Devdutt Tiwari on which the Supreme Court, vide order dated 22.04.2002 again injuncted the UPJN from going ahead with GAP-II.

The main pleadings taken by the NRCD and Sri Narayan Mishra & Sri Dvdutt Tiwari were as below:

<u>Pleading NRCD before Supreme Court</u>

- GAP-II has been formulated in consultation with experts and scientists well versed in pollution abatement and management of rivers.
- The plan has been discussed on more than one occasion in the Parliament.
- The High Court aught not to have passed the direction for suspending the clearance and implementation of GAP-II till the plan was cleared by a committee appointed by High Court.
- Stay Order of the Supreme Court has created an impasse.
- The respondents (Sri Narayan Mishra & Sri Devdutt Tiwari) had no right to question the competence of the GOI to take decision on the project, particularly in view of the resolution dated 23.09.2000 of the VNN.
- UPJN project was passed upon notice to and after consulting VNN.
- The application of the respondents (Sri Narayan Mishra & Sri Devdutt Tiwari) for the acceptance of SMF Project is misconceived.
- The court cannot use the power of judicial review to evaluate the technical aspects relating to different projects.

<u>Pleading of Sri Narayan Mishra & Sri Devdutt Tiwari before Supreme Court</u>

- The resolution dated 23.09.2000 of VNN did not authorize the NRCD or Jal Nigam to approve or implement any project in respect of sewerage or water supply in Varanasi.
- Power to take any action in this regard was squarely with VNN. GoUP or UPJN were not competent to exercise this power, particularly by virtue of 74th Constitution Amendment.

- Art. 243W and 243F of Constitution, read with item 6 of the 12th schedule, clearly show the VNN alone could work to implement GAP-II and that GAP-II could be implemented only in consultation with VNN.
- GAP-I has been a total failure
- UPJN is incompetent to implement any project relating to GAP-II.

4. The Supreme Court finally disposed of the matter on 10.04.2003, the list of the Supreme Court's final order is as below:

- None of the issues have been raised or dealt with by the High Court.
- Several other events have taken place subsequent to the order of the High Court.
- The High court did not address itself as to the propriety of issuing such an order under Article 226.
- High Court has not dealt with the issues which have been raised before the Supreme Court.
- Accordingly leave is granted, the order of the High Court is set-aside, all interim orders are vacated.
- The High Court will dispose of the matter after hearing all the parties, considering the material on record and after arriving at a finding on each of the issues raised.

5. The matter has thus been remanded to the High Court at Allahabad for disposal. Since there is no stay order now, the UPJN is going ahead with the implementation of the sanctioned priority project of GAP-II.

6. To raise the issues before the High Court, Sri Narayan Mishra and Sri Devdutt Tiwari have put-up an application before the High Court in the PIL No. 21552/97 Rakesh Jaiswal v/s State of U.P. & others in the month of May-2003.

The pleadings taken in this application are as below:

<u>Pleading of Sri Narayan Mishra and Sri Devdutt Tiwari before the High Court</u>

- GAP-I was unable to stop sewage/industrial pollution flowing into Ganga.
- UPJN failed in conceptualization and implementation of GAP-I.
- GAP-I has been a failure.
- SMF has a very good record and reputation and has got the GAP-II PFR framed with the help of top experts from India, US and Australia.
- VNN has passed the PFR of SMF through its resolution and has sent the same to GoUP & NRCD.
- GoUP & NRCD are not acting on the resolution of VNN and are favoring the PFR of UPJN.
- High Court has not approved the PFR of UPJN.
- Decision of NRCD to approve UPJN PFR is violative of constitution and the Municipal Law.
- PFR of UPJN is grossly unsuitable to achieve the objective of GAP-II, while SMF PFR is able to achieve the same.
- Hence, the implementation of the UPJN PFR should be stayed till further order of the court.

7. The GoUP and NRCD have filed their counter affidavits refuting all the pleadings of the

applicants, Sri Narayan Mishra & Sri Devdutt Tiwari. The list of pleadings of GoUP/NRCD is as below:

- Both the SMF & UPJN PFRs have been subjected to thorough examination by several experts.
- GAP-I has been meeting the parameters as per the design.
- It is necessary to implement GAP-II without any further delay as 8-10 years have already been lost in unnecessary controversy.
- SMF proposal has various infirmities and not a feasible solution.
- VNN was fully involved in the process of decision making and has resolved that both the PFR's be sent to GoUP/GOI who will decide the most appropriate project.
- Selecting the proposal of UPJN is not in violition of 74th constitution Amendment.

8. The High Court took up the matter on 25.07.2003 but did not pass any stay order. The matter came up for hearing again on 22.08.2003 but no stay order was passed. The matter is pending before the High Court for further hearing.

9. Five corporators of VNN have filed another writ petition before Allahabad High Court, the WP No. 50 336/2003, Mithilesh Kumar Rai & others V/s State of UP & others in November-2003. the pleadings in this writ petition are similar to those taken earlier by Sri Narayan Mishra and Sri Devdutt Tiwari before Supreme Court and High Court. They have sought stay on the implementation of UPJN PFR and have prayed for constition of a High Power Committee to examine functioning of GAP-I and the two PFRs of GAP-II.

10. The case was listed on 11.11.2003 but the High Court did not grant any stay order. The matter is pending before the High Court for further hearing. The NRCD/GoUP/UPJN are yet to file their counter affidavits, which they will be filing after orders to that effect by the High Court.

    The case was since listed on a few more dates but no orders were passed by the High Court. Now this petition, as well as the earlier petition, have both been tied together for hearing.

11. One advocate of Varanasi, Mr. N. Ravindran has filed a PIL in the Allahabad High Court where in he has questioned the activities of JICA regarding the Project at Varanasi on Water Quality Management Plan for Ganga River and has sought directions to restrain JICA to operate in the river Ganga at Varanasi and not to operate modernization Pilot Project at Manikarnika Ghat. The main pleadings taken in the PIL are summarized as below:-

    - The JICA Project aims to make River Ganga as 'B' class river, and not 'A' class.
    - The JICA Project is nothing but UPJN's proposal for GAP-II which was earlier objected by VNN.
    - JICA will need hundreds of acres of land at a place which was earlier objected by VNN and the Block Panchayat.
    - JICA is commercially motivated for earning profit, even though GAP is a 100% grant scheme.
    - JICA has proposed to collect tax from public.
    - JICA has no experience in removing pollution because there are no big rivers in Japan and they have adopted UPJN Plan by giving it the name of their own plan.
    - JICA has violated both constitutional and Technical norms to deprive VNN of their powers who can work independently with direct funds from the center.

- The Corporators of VNN have given press statements against JICA Project and sent memorandum to Japanese Ambassador and JICA Chief. MP from Varanasi has written to Prime Minister of India against JICA Project. Neither the Mayor of VNN nor the Deputy Mayor nor the Deputy Chairman of the Executive Committee of VNN nor invited Corporators of VNN nor the MP participated in the workshop held on 14 September-2004.
- JICA has spent not more than Rs. 50 thousand on Manikarnika Ghat Pilot Project but according to them, they have completed the first phase at a cost of Rs. few lakhs. JICA is going to realize this money form people of Varanasi by collecting taxes.

The matter is pending before the High Court for hearing and so far, no orders have been passed by the High Court.

Appendix B-2

EXPERT COMMITTEE REPORT FOR IMPLEMENTATION OF GANGA ACTION PLAN PHASE-II IN VARANASI

1ST MARCH, 2000

MINISTRY OF ENVIRONMENT & FORESTS
GOVERNMENT OF INDIA
NEW DELHI

1. Introduction

The Ganga, the standard bearer of Indian culture, has been the beacon light of inspiration and nationalistic sentiments for several generations. Among the towns located on the banks of the Ganga, Varanasi stands out as the crowning jewel. Beliefs about towns like Varanasi have been built over centuries and reinforced by generations. The veneration of the Ganga at Varanasi is an integral part of Indian culture. Since the value of Varanasi as a heritage site is immeasurable, it was in the fitness of things that the Ganga Action Plan was launched in Varanasi.

2. The Background

The Ganga Action Plan phase I in Varanasi which included 13 schemes implemented by the UP Jal Nigam was completed in 1993. Thereafter the PFR for pollution abatement of the river Ganga at Varanasi under phase II was prepared by the UP Jal Nigam for a cost of Rs.53.60 crores. After examination by the NRCD, approval was accorded in 1995 by the CCEA for a sum of Rs.47.52 crores for Varanasi for the implementation of phase II of the Ganga Action Plan.

Subsequently, detailed project reports for project implementation were prepared by the UP Jal Nigam. While these were being examined for approval, proposals for implementation were also received from the Sankat Mochan Foundation based in Varanasi. The Varanasi Nagar Nigam in April 1997 passed a resolution (Annexure I) supporting the preparation of detailed project proposals by experts of Sankat Mochan Foundation and certain American experts assisted by officials of US AID. These proposals after finalisation were to be placed again before the Varnasi Nagar Nigam for necessary action for implementation.

Preparation of proposals afresh or revision of cost estimates and content of proposals has been done by the UP Jal Nigam and the Sankat Mochan Foundation after the resolution of the Varanasi Nagar Nigam in April 1997. The two proposals that are available from the UP Jal Nigam and the Sankat Mochan Foundation are different. Efforts were made in the last two years to reconcile the two approaches to one common mode of implementation. Since this was consuming a lot of time the National River Conservation Directorate ordered the constitution of an independent expert committee for evaluating on the reports submitted by the UP Jal Nigam and the Sankat Mochan Foundaiton and submitting recommendations so that an early technical solution could be found to facilitate the implementation of GAP II works in Varanasi.

The Committee consists of the following members:

1) Prof. K.J. Nath,
Head of Environment Engg. Department,
All India Institute of Public Health and Hygiene,
Calcutta — Chairman

2) Prof. R.P. Mathur,
Prof. Emeriitus, Roorkee University,
Roorkee.
Member

3) Dr. S.R. Shukla,
Adviser
Ministry of Urban Development.
New Delhi.
Member

4) Prof. A.K. Gosain,
Professor,
Civil Engineering Department,
IIT, Delhi.
Member

5) Shri R. Rajagopal, I.A.S.
Director,
Ministry of Environment & Forests
New Delhi.
Member Secretary

The Committee had its first meeting in Delhi on 3.1.2000. During the meeting, the committee members familiarised themselves with the reports submitted by UP Jal Nigam and Sankat Mochan Foundation. It was then decided that they will be requested to make presentations before the committee which will be then followed by field visits before the finalisation of the report.

The UP Jal Nigam and the Sankat Mochan Foundation were then requested to make their presentations before the committee on 13.1.2000. The Sankat Mochan Foundation requested for another date to be fixed for its presentation since its Chief Executive was away on tour. UP Jal Nigam made its presentation before the Committee on 13.1.2000.

3. Proposal of UP Jal Nigam

1) The proposal aims to tackle the untapped quantities of sewage under Ganga Action Plan phase-I and the additional quantity of sewage generated in the town, after the completion of Ganga Action Plan phase-I.

2) The weeping points which are not taken care of by the Ghat Sewage Pumping Stations and sump wells, at present, are also proposed to be tapped and diverted. Since there exists no interception scheme to check the pollution of the river Varuna at present, this is also proposed to be taken up by laying interceptor sewers along the right and left banks of the Varuna and conveying the sewage for treatment. Besides this, augmentation of the capacities of existing sewage treatment plants and the creation of new sewage treatment plants to handle the present and future loads is also being proposed.

Criteria

The following criteria have been adopted for the different calculations in the preparation of the PFR.

(i) Population growth	2% per annum
(ii) Waste water flow	Measured flow enhanced @ 2%
(iii) Peak factor	As per actual measured value
(iv) Minimum flow	Actual measured value
(v) Manning's 'n' for concrete pipes	= 0.011
(vi) Manning's 'n' for brick sewer in rough condition	= 0.018
(vii) Maximum velocity in rising main	= 1.8 m/sec.
(viii)Maximum velocity in sewers	= 1.0 m/sec.
(ix) Minimum velocity in sewers	= 0.60 m/sec. For present peak = 0.80 m/sec. For ultimate peak
(x) Minimum size of sewers	= 150 mm
(xi) Existing slope of old trunk sewer at 2400 mm dia section	= 1 in 2200
(xii) Base Year	1998
(xiii)Design period	
(a) For sewers	2028 (30 years)
(b) Rising Main	2013 & 2028 (15 years & 30 year as the case may be for particular situation)
(c) Sewage pumping station	2028 (30 years)
(d) Machinery	2013 (15 years)
(e) STP	2008 (5 year) with provisions of add on modules.

Base year in this PFR is 1998.

Assumptions

Proposals in the revised PFR have been made on the following assumptions:

i) Base year in this revised PFR has been taken as 1998 with the assumption that these works shall be started immediately. Delay in execution may cause an increase in the cost of these proposals.

ii) Anticipated sewage flow in future has been derived considering 2% per annum population growth in the Varanasi city area. The Varanasi development Authority is to ensure that future planning of the city shall be done on the same growth pattern and independent drainage, sewerage and sewage treatment facilities shall be provided in new townships proposed by VDA in the outskirts of the city.

iii) During execution period, required funds shall be made available regularly.

iv) While execution of these works are taken, condition of large drains shall also be investigated and necessary action to repair them will be ensured by the Varanasi Nagar Nigam (VNN), particularly where many branch sewers have connections only to these drains and considerable quantity of the sewage and sullage flows through these drains which ultimately finds its way to the ghat pumping stations from where it is pumped to the city main trunk sewer to prevent pollution of the river.

v) Regular and up-to the mark cleaning of the sewerage system shall be ensured by Varanasi Nagar Nigam.

vi) Illegal and irregular sewer connections shall be checked and eliminated by the Varanasi Nagar Nigam (VNN).

vii) No industrial effluent shall be allowed into the sewerage network. The Varanasi Nagar Nigam shall ensure it.

viii) Required land for the proposed works shall be made available by the VNN / VDA within the stipulated time frame.

ix) Storm water drains shall not be connected to the sewerage network of the city and this will be ensured by the Varanasi Nagar Nigam.

Proposals in Detail

For providing complete interception, diversion and treatment of the sewage produced in all four zones of the city, the following proposals have been made.

a) Laying of Second Trunk Sewer

Second trunk sewer in the city is considered necessary for the Sub-Central City and some part of Central City Zone. It is proposed to lay RCC interceptor sewer from Durgakund to the Bhelupur water works compound through Gurudham colony near Vijaya Cinema. An intermediate sewage pumping station is proposed in the Water Works compound for pumping the sewage which will be diverted through this sewer pumping station will be pumped into the second part of this proposed Second Trunk Sewer which passes through Rathyatra, Sigra, Shastrinagar, Maldahiya crossing, Lahurabir and finally terminates at a special manhole on the city side of Chaukaghat.

Carrying capacity of this trunk sewer at its tail end will be 200 mld (peak flow) and it will be able to carry an average flow of 100 mld.

b) Construction of Sewage Treatment Plant for Bhu zone

(i) *Augmentation of the capacity of the existing STP at Bhagwanpur:*

It is proposed to enhance the capacity of the existing STP at Bhagwanpur from 9.8 mld to 15.0 mld by modifying piping arrangement to take care of the additional 5.2 mld flow. Since effluent of this STP will be discharged into the river in upper stream of the city, roughening filters with sand filtration are being proposed in the existing STP premises, for the removal of the bacteriological contamination of the effluent.

(ii) *Interception & Diversion of Nagwa Drain:*

It is proposed to intercept Nagwa drain at its tail end near Ambedkar Park by constructing a sewage pumping station.

Sewage intercepted through this pumping station will be pumped to the site of proposed STP at Ramana Village through proposed 800 mm dia RCC pipe nearly 7000 m long. In addition to this a ghat sewer of 500 mm dia RCC pipe in 2000 m length is also proposed to intercept the flow of Garhwa nala (G-15), Samne Ghat drain and effluent of nearby colonies.

(iii) *STP at Ramna village:*

Waste stabilization ponds have been proposed at Ramna village for sewage treatment of 30 mld. This capacity will cope with the requirement of 2003. Also provision is being made to add 4.0 mld STP module for the year 2008 and 2013. Maturation ponds in series have also been provided for removal of bacteriological contamination up to the bathing standards. These maturation ponds shall be used for fish culture.

c) Augmentation of the capacity of KONIA MPS & Pretreatment works and Dinapur STP

It is estimated that quantity of sewage generated in the Central City Zone in the year 2003 will be 130 mld, of which nearly 40.00 mld will be diverted to the IInd trunk sewer and only 90.00 mld will be received at the Konia MPS through the city existing trunk sewer. Since existing trunk sewer is nearly 81 years old, it is assumed that sewage flow in this trunk sewer will not increase in future and any further increase will be diverted to the IInd trunk sewer by diverting branch sewers. Presently nearly 130 mld sewage is intercepted at the Konia MPS through the existing trunk sewer and it has been estimated that after completion of IInd trunk sewer, flow in this existing trunk sewer will be reduced to nearly 90 mld.

Installed capacity of the existing STP at Dinapur is 80 mld. To cope with the additional flow of 10 mld from the Central City Zone and 6 mld from the Trans-Varna Zone, augmentation of the capacity of STP Dinapur by 16 mld has been proposed. Apart from that, certain modification for improvement of the existing STP have also been proposed.

d) Prevention of pollution to the river Ganga from additional point sources of pollution along ghats:

For prevention of pollution of river Ganga at bathing ghats in Varanasi city the following proposals have been made.

i) Interception of Railway nala and Bhainsasur nala has been proposed through gravity sewer leading to the Trilochan ghat sewage pumping station. For this replacement of existing ghat sewer of 150 mm dia CI pipe with 300 mm dia CI pipe at 1:180 gradient has been proposed between Bhainsasur ghat and Rani ghat.

ii) Considering inadequate capacity of existing 200 mm dia CI ghat sewer between Teli nala and Trilochan ghat SPS, an additional ghat sewer of 300 mm dia at a gradient of 1:180 and parallel to the existing one has been proposed.

iii) For interception of Sankatha drain and Bramhaghat drain an additional ghat sewer of 300 mm dia CI pipe from Sankatha ghat to Trilochan ghat SPS has been proposed.

iv) Interception of excess flow of Shivala drain has been proposed. It will be done by laying an additional sewer of 450 mm dia from diversion manhole of this drain to Harishchandra ghat SPS.

v) For interception of weeping points it is proposed to connect them to the ghat sewers.

vi) To ensure 100% diversion of sewage thus intercepted through ghat sewers, augmentation of capacity of Trilochan ghat SPS, Jalasen ghat SPS, Dr. R.P. ghat SPS and Harichandra ghat SPS has been proposed. Provision for duplication of existing rising mains of this pumping station has also been made.

vii) To avoid the surcharging of existing old trunk sewer during peak hours, extension of existing rising main of Dr. R.P. ghat sewage pumping station from Church crossing (Godolia) to Benia Park has been proposed. Present estimated carrying capacity of trunk sewer beyond Benia Park is 108 mld which is more than its capacity 82 mld at Church crossing. This arrangement is expected to solve the problem of recirculation of sewage at Dr. R.P. ghat SPS due to the surcharging of trunk sewer at Church crossing.

viii) For continuous operation of ghat sewage pumping stations, even during rainy seasons, provision of watertight manhole covers for low-lying manholes of ghat sewers has been made. These manhole covers will prevent the entry of river water into the ghat sewer during monsoon period when water level of the river rises.

ix) To ensure effective and quick operation of diversion gates and by-pass gates at ghat sewage pumping stations, provision for electrically operated gates has been made in this PFR.

x) To ensure continuous pumping even during power supply failure in power grid, provision of diesel driven generators of required capacity at each ghat SPS has been made.

e) Rehabilitation of Existing Trunk Sewer

For rehabilitation of city main trunk sewer, condition assessment by CCTV survey and relining of old trunk sewer where needed has been proposed. After rehabilitation, this trunk sewer will be sufficient for disposal of sewage generated in central city zone of the city till the year 2013. After the year 2013, sewage generated in central city zone will be more than the carrying capacity of this trunk sewer and part flow of this zone will be diverted to IInd trunk sewer either by connecting Dr. R.P. Ghat SPS with IInd trunk sewer or by diverting some branch sewers from old trunk sewer to IInd trunk sewer.

f) Prevention of Pollution to the River Ganga from the Trans-Varuna and Sub-Central Zones

For interception, diversion and treatment of waste water generated in the Trans-Varuna and Sub-Central city zone following works have been proposed:

(i) Interception Sewer along the Right Bank of the River Varuna

(ii) Interceptor Sewer along the left bank of the rive rVaruna

(iii) Trunk Sewer Across the Varuna River

It is proposed to lay 2000 mm dia RCC pipe just one meter below the bed of Varuna river along the Chaukaghat Bridge.

(iv) Main Sewage Pumping Station

For pumping and diverting the sewage collected through above mentioned interceptor sewers, an MPS near Chaukaghat bridge at the left bank of the river Yamuna has been proposed.

(v) Rising-Main

A Rising Main of 1800 mm dia PSC pipe of 7500 metre length from the Sewage Pumping Station to the Sewage Treatment Plant at the village Sathwa has been proposed.

(vi) Sewage Treatment Plant

Considersing the requirement of the year 2003. 90 mld Waste-Stabilization Pond has been proposed near Sathawa village just 500 metre before the Canal (Babatpur Rajbaha). The second module and similarly another 16 mld STP provided in the third module by the year 2013. Maturation ponds will be used for fish culture.

(vii) Effluent Disposal Pipe

A provision has been made for laying a pipe line of 2200 mm dia RCC pipe of 500metre length from the STP up to the Irrigation Canal with necessary protection work and arrangement to avoid the back-flow of the canal water into the proposed pond.

g) Estimated Cost of all These Five Schemes Prepared by U.P. Jal Nigam for Interception and Diversion and Treatment of Waste-water is Given Below:

(i)	Laying of the second trunk sewer in sub-central city zone.	3751.74 lakhs
(ii)	Interception, Diversion & treatment of the BHU Sewerage Zone.	3834.92 lakhs
(iii)	Augmentation of the capacity of Konia MPS and pre-treatment works and STP, Deenapur.	1300.17 lakhs
(iv)	Prevention of Pollution to the River Ganga from additional point sources of pollution including augmentation of the capacity of the Ghat Sewage Pumping Station and rehabilitation of the main trunk sewer.	2099.25 lakhs

(v)	Prevention of Pollution to the River Ganga from the sub-central city and trans Varuna zone.	11625.14 lakhs
	Total	Rs.22611.22 lakhs

h) Priorities

The following order of preference has been suggested:

(i) Laying of the second trunk sewer in sub-central city zone.
(ii) Interception, Diversion and treatment of the BHU Zone Sewage.
(iii) Augmentation of the capacity of Konia MPS and pre-treatment works and STP, Deenapur.
(iv) Prevention of pollution to the river Ganga from the sub-central city and trans Varuna zone.
(v) Prevention of pollution to the river Ganga from additional point sources of pollution including augmentation of the capacity of the Ghat Sewage Pumping Station and rehabilitation of the existing trunk sewer.

4. Proposal of Sanket Mochan Foundation

The Sanket Mochan Foundation made its presentation before the committee on 4/2/2000. The proposal of the Sanket Mochan Foundation was prepared based on its assessment of GAP Phase – I implementation which were considered to be having the following shortcomings:

1. Interception and diversion of sewage flow to Ganga is faulty and incomplete and that of Varuna totally absent.

2. The SPS to Konia adversely affects the interception and diversion and causes surcharge in trunk sewer and back flow of sewage through outlets along the bathing ghats. Large quantities of sewerage are regularly bypassed in Varuna and eventually into Ganga.

3. Excessive dependence on electricity and high operational and maintenance cost.

4. The treatment plant at Dinapur (ASP) is of inadequate capacity, low BOD removal efficiency, with poor resource recovery capacity.

The proposal of the Sanket Mochan Foundation has been prepared with the following objectives:

1. Total interception of sewage flowing into the religious bathing areas of Ganga and Varuna.
2. Relieving the city (cis Varuna) trunk sewer of its surcharge load by collecting all sewage outflows to the ghat sewage pumps in to a gravity flow interceptor sewer laid along the ghats of Ganga.
3. Intercepting and collecting all present and future sewage flows in to Varuna from both of its banks by two parallel interceptor sewers laid along two banks.
4. Conveyance of the sewage flows collected by the three interceptor sewers, one along Ganga and two along the river Varuna, by gravity, to a terminal pumping station.
5. An attempt to reduce dependence on electricity and operation and maintenance costs.
6. Removal of fecal coliform, thus rendering the effluent fit for agricultural use as well as discharge into receiving water bodies.
7. Resource generation through pisiculture and cattle fodder production.

The Proposal

The proposal gives special emphasis to items 1 and 6 of the objectives and to the concept of retrofitting of the existing facilities in Varanasi. The salient components of the recast proposal are:

1. Constructing an interceptor sewer along the ghats of Ganga between the last line of buildings and the river. This will collect the sewage from all ghat front waste-water outflows and convey the same by gravity to a terminal pumping station outlined in item (v) below.

2. The Ganga interceptor sewer will accept the Assi nala and Nagwa drain discharges at its Assi Ghat end.

3. Constructing two interceptor sewers along the two banks of river Varuna and conveying the collected sewage to the treatment plant outlined in item (iv) below.

4. Constructing an Advanced Integrated Wastewater Oxidation Pond System (AIWPS^{TM} developed at the University of California, Berkeley, California, USA) of 300 mld capacity at the sandbar, known as Sota, about 8 km downstream of Malvia Bridge north of the city.

5. All the three interceptor sewer, one along Ganga and two along the banks of Varuna will terminate around downstream of the Ganga-Varuna confluence where the SPS is to be located. Beyond this point the sewage will be

transported through two rising mains (of 1.5 m dia) each conveying at the rate of 200 mld at peak flows (future/ultimate).

6. The Ganga interceptor as well as the right bank Varuna interceptor will go below the Varuna river-bed in entering the pump sump slightly below the 57.50 sump water-level. The Varuna left bank interceptor sewer need not cross the Varuna and hence will enter the pump sump at any desired level.

7. The effluent channel from Dinapur STP will be tapped at a point sufficiently high, near Sehbar, to lead the effluent by gravity to separate high rate and maturation ponds at Sota for treatment to remove fecal coliform. The distance is about 3-3.5 km.

Salient Features of the Proposal:

a) The Interceptor Sewer

An interceptor sewer is proposed with a diameter going up to 2 m for the major part of its length beneath the Panchkroshi Marg between the ghats and river front buildings and the Ganga. Such a sewer it is proposed will ensure the interception of all the sewage falling into the river Ganga in the religious bathing area and will act as relieving sewer to the city main trunk sewer. It is meant to be an in-situ water tight RCC sewer with the parameters being as follows for the various stretches.

Ganga Interceptor Sewer

Reach	Length m	Dia m	Flow mld		Uniform flow vel.	
			Present peak	Future peak	Present peak	Future peak
APS-ASI	850	1.2	34	52	0.90	1.00
ASI-HCH	875	1.5	34	52	0.90	1.01
HCH-MNS	550	2.0	38.5	59.2	0.90	1.02
MNA-RPD	770	2.0	44.5	68.8	0.90	1.02
RPD-JLN	380	2.0	66.5	104.0	0.90	1.02
JLN-TLN	1600	2.0	76.2	119.2	0.90	1.015
TLS-SPS	2450	2.0	81.2	127.5	0.90	1.015

In addition interceptor sewers are proposed along the left bank and the right bank of the river Varuna for Rs.23.64 crores and Rs.6 crores respectively.

b) Flow from Assi SPS to the Ganga Interceptor Sewer

It has been estimated that at present 21 mld of avg. flow is required to be treated at BHU STP. Assuming the BHU's contribution in this is about 4 mld, about 17 mld of average flow has been calculated to be reaching Assi SPS at

present. It is further estimated that in future this is likely to grow about 26 mld of average flow. The corresponding peak rates would then be about 34 mld for the present and 52 mld for the future flows.

A conduit of 1.2m dia has been proposed for carrying by gravity the flow from the SPS at Assi nala to the beginning of the Ganga interceptor at Assi Ghat. The treatment of the effluent from the BHU STP to remove fecal coliform's proposed to be done locally instead of carrying the effluent all the way to Sota.

At present the Assi SPS receives sewage flow through Assi nala acting as an open drain. It is proposed that a closed conduit running at a suitable grade along Assi river collect the sewage from all the sewer outlets as also the sewage presently handled by Assi SPS and transport the same to theGanga interceptor sewer through the pipe line proposed in the preceding paragraph. The storm water going through Assi nala will thus be seperated from sewage and flow into the Ganga directly.

c) Treatment of Dinapur Effluent to Remove Fecal Coliform

The tertiary treatment of the effluent from the Dinapur STP is provided for, at Sota in separate high rate and maturation ponds. For this purpose, the effluent channel from the Dinapur STP is proposed to be tapped at a point near the village Sehbar and taken by gravity flow to Sota, a distance of about 3.5 km. The tapping is to be done at a high point of the effluent channel so that adequate head for ensuring gravity flow is available.

d) Interception of Outfall Drains

The major drain outfalls have already been intercepted and brought into the sump wells of the following five ghat sewage pumping stations.

- Harishchandra ghat SPS
- Mansarovar ghat SPS
- Rajendra Prasad ghat SPS
- Jalesan ghat SPS
- Trilochan ghat SPS

Each of these sump wells is provided with a bypass opening to the Ganga. It is proposed to tap these sump wells for receiving the wastewater inflows into the interceptor sewer. The interceptor will be accessed also from these sump wells. The access shaft either horizontal or inclined depending on the relative elevations of the sump and interceptor inverts shall be rectangular in shape with 2 m invert with suitable height and width and not less than 2 m to enable material to be transported into or out of the interceptor sewer. The access shaft and the conduit outlet (from the sump to the interceptor) may be one and the same or they may be separate about which a choice will be made when specific detailed proposals for these connections are given.

It is also proposed to divert and lead the flows from the i) Telia Nala ii) Rajghat nala iii) Khirka nala bypass iv) drain from Kashi railway station and colony and v) Sanketa drain by tapping then at their upper level manholes and combining them suitably, to connect them upto the interceptor sewer. Standard manholes are proposed at junction points with water shed covers and vend pipes. Flows from weeping points are also proposed to be tapped combined and then conveyed to the interceptor sewer, there being standard manholes with water tight covers.

e) Storm Water Bypassing

No flow estimates of the storm water discharges through the drain outfalls are said to be available. Hence, a satisfactory solution to the problem of bypassing storm water runoffs coming through the various objects is considered difficult. Keeping the ghat sewage pumps inoperative during the high storm water flow periods and bypassing them all into the river indiscriminately is objected to by the SMF. In their May 1997 report, SMF has implied acceptance of storm water in the inteceptor sewer and their subsequent discharge into Ganga either at the bypass arrangement provided at the upstream chamber of syphon (at the mouth of Varuna) or at the SPS at Sota or at both the places. With the syphon having been eliminated subsequently and the SPS being shifted to a location 6.5 km upstream, quicker disposal of the entering storm water will take place. With all the pumps (8 nost of 50 kl.min rating) working sufficient velocity will be maintained in the interceptor to avoid deposition even if flowing full. The evacuation rate can be increased, if desired by augmenting the pump capacity in the SPS. A reliable estimate of the quantum of augmentation required can be arrived at after monitoring the system operation for a few years. The sewage inlets into the sumps at the ghat SPS's will be closed for brief periods when the rate of storm water inflow into the interceptor sewer exceeds its evacuation rate. For this purpose, the inlet (into sump well/interceptor sewer) device is proposed to be designed as one of the several types of throttle valves or "discharge limiters" which allow unhindered waste water entry into the sump well upto a predetermined limiting value.

No. of storm events occurring in Varanasi and causing inundation and surcharge of sewers during monsoons is roughly estimated to be 6 to 7 times. According the SMF the present experience is that during heavy downpours, peak strom runoffs do not enter the sewers once they get surcharged and flows off as surface runoff through the various roads and streets towards Ganga. Varanasi has three natural drainage systems in Ganga, Varuna and Assi. Surface drainage was good has been badly affected because of urban growth. Improving this surface drainage, providing water tight manholes and mandatory provisions of disconnecting roof top drainage from entering the sewerage system would decrease the storm water entry into the sewerage system.

The energy requirement for the evacuation of storm water has not been estimated in the absence of (storm water) flow duration and joint frequency distribution (of storm water runoff and river state) data. It is however, expected by the SMF that this may not be too high.

f) Terminal Sewage Pumping Station

This is located at a point closed to the Ganga Varuna confluence and about 6.5 km from the Sota. The sumpwell would be about 50m in diameter with normal water level maintained at about RL 57.50. The waste-water inflows, from the three interceptor sewers (Interceptor sewer along the river Ganga dnd the left bank and right bank interceptor sewers during the river Varuna) would be passing through a trash rack and a grit chamber before entering the sumpwell. It is proposed to install 8 nos of grinder pumps each of about 50 kl/min. The delivery pipe of each pump is to have a bypass outlet discharging into a bypass channel/conduit placed suitably in the river. Two rising mains each of 1.5m dia and carrying the discharge from four of the eight pumps would deliver the waste water to the AIWPS facility at Sota.

g) AIWPS Sewage Treatment Plat at Sota

For the treatment of the sewage collected by the interceptor sewer and transported to Sota, construction of an Advanced Integrated Watewater Oxidation Pond System of 300 MLD capacity is proposed. Preliminary design of this facility has been provided by Oswald Green, LLC. of Concord, California through the sponsorship of RHUDO, USAID – New Delhi. The design is based on principles and processes developed by Prof. W. Oswald at the University of California, Berkeley, USA. The design facility provides for a series of four types of ponds, namely,

1.	Advanced Facultative Ponds (AFP)	4 Nos
2.	High Rate Ponds (HRP)	8 Nos
3.	Algae Setting Ponds (ASP)	16 Nos
4.	Maturation Ponds (MP)	3 Nos

The treated effluent would be free from suspended solids and fecal coliform. The BOD removal efficiency is high and any heavy metal that may be present in the incoming waste is mostly removed. Dried algal sludge is rich in nitrogen, phophorus and potash and hence is an excellent fertilizer. The total area required is proposed to be obtained by reclaiming a part of Sota sand bar by constructing dykes and low embankments.

h) Estimate of the cost of the recast retrofitted proposals are given below:

Sl. No	Item	Cost Lakh Rs.
1 (a)	Provision of interceptor sewer for the ghats along Ganga less cost of Siphon as per May 1997 report	2280
(b)	Cost of additional support for the interceptor sewer	1000
2.	Provision of two interceptor sewers along Varuna	2964
	a) Left bank interceptor Rs. 2364 lakhs b) Right bank interceptor Rs. 600 lakhs	
3.	Terminal sewage pumping station	1205
	a) Pumping plant and electrical Installations Rs. 840 lakhs b) Pump house (5% increase due to Lower levels) Rs. 140 lakhs c) 400 kva diesel generator set 4 nos and 1 no 50 kva gen set Rs. 225 lakhs	
	AIWPS Treatment Plant (300 mld capacity)	5920
	Provision of additional facilities (item 5 - - p.p. 2)	354
	Centage (Incidental etc) @ 20%	1370
	Grand Total	15093

(i) Operation and Maintenance Cost of Proposed Interceptor and AIWPS at Varanasi

S.No.	Particulars	Quantity	Rate	Amount (lakh)
1.	Energy Cost of pumping 200 mld per one year			210.00
2.	Manpower (Skilled & Semi-skilled) i) Interceptor pumphouse (30 men) ii) AIWPS (30 men)			
3.	Interceptor (20 men)	80 men	4000/- (per month)	38.40
4.	Operation & Maintenance Supervisors/year	L.S.		25.00
5.	Consumables/Spares/ Supplies/lab. etc.	4.5		77.00
	Total			350.40

SMF/Oswald Green LLC

5. Observations and Recommendations of the Committee

The expert committee met in Varanasi on 4/2/2000 after the presentation by the Sankat Mochan Foundation. It was decided to undertake field visits on 5/2/2000. Accordingly an inspection (by boat) along the Ganga, close to the ghats was organised as also field visits to location in and around the town. The Committee met the Divisional Commissioner Varanasi as also the Mayor and Municipal Councilors of Varanasi Nagar Nigam.

The Committee decided to meet in Delhi on 6/2 to give shape to the ideas presented before it, in the form of a report. Detailed observations from the various members were exchanged. Since Shri R.P. Mathur could not attend this meeting it was decided to have the next meeting in Delhi on the 18th of February after giving sufficient time for all the members to summarize their view points in writing, so as to help in the early finalisation of the report. During the meeting on 18th February the various issues were taken up one by one for discussion and a final consensus arrived at. The observations of the Committee are as follows:

a. General

The Committee analysed in detail the reasons for the pollution problem facing the town and ghats along the river on account of the inadequate sewage systems. The need for an integrated scheme for the town was emphasized by all the members. Some localities within the town have no sewage system, resulting in unauthorised domestic connection from houses into surface drains. This pollutes the surface drains resulting in obnoxious living conditions particularly during times of heavy rain. Further, many of the surface drains have their eventual outlet into the trunk sewer resulting in the trunk sewer getting unnecessarily overloaded. A clear case in point is the absence of sewage system in areas such as Muhmoor ganj, Tulsipur, Shivpurna, Shil Nagar etc. Because of this, it is likely that sever connections from houses will be made to the newly built storm water drain laid from Muhmoor ganj to the DLW Petrol pump. Since this drain will eventually drain into the Assi Nala through the 1200 mm concrete pipe of DLW high pollution loads can be anticipated in the river upstream of and close to the important ghats of Varanasi.

The Committee is firmly of the view that unless a comprehensive proposal providing for adequate sewage systems and clear separation of sewage and storm water is implemented, any measures to merely attend to augmentation of trunk sewer capacities and diversion and treatment of sewage will not meet the requirements of protecting the ghats of Varanasi from pollution in a fool proof manner.

The proposals of UP Jal Nigam and Sankat Mocha Foundation are inadequate to this extent. The Committee recommends that assistance from the NRCD be supplemented with assistance from financial institutions such as HUDCO and the pollution problem of Varanasi addressed in an integrated manner. In this context the Committee requests the NRCD to take early steps for the launching of the Ganga Trust Fund, as was directed by the Allahabad High Court, since lakhs of Indians will be willing to contribute to an effort that will ensure the prevention of pollution of the river Ganga. This fund if created will help to supplement the institutional sources of financial assistance for the proper upkeep of heritage sites such as Varanasi.

b) Interceptor Sewer

It is clear that the existing trunk sewer which is about 81 years old needs to be properly cleaned, maintained and rehabilitated. The capacity for sewage conveyance has been definitely threatened owing to the age of this sewer and its limited capacity. The U.P. Jal Sansthan and the Varanasi Nagar Nigam and other appropriate agencies should immediately take efforts for restoring and rehabilitating this trunk sewer to its optimal capacity for sewage conveyance. The flow of sewage is also inhibited owing to the incompatibility between this sewer and the Konia Pumping Station. This, it is learnt has caused problems of heavy back-flows in the trunk and lateral sewers resulting in emergency measures having to be taken to by pass the sewage flow into the river. It is necessary to examine immediately and in depth the causes for this incompatibility so that this trunk sewer and the pumping station established at great cost in GAP Phase-I are put to proper use.

The Committee members are firmly of the view that an interceptor sewer along the ghats and underneath the Panchkroshi Marg is not desirable for the following reasons:

1) The Panchkroshi Marg is a sacred route for perambulating the temples in Varanasi and hence, laying a sewage line underneath the Marg will amount to pilgrims walking on pathways acting as seals for a sewage line. This will hurt the sentiments of vast sections of pilgrims and is hence avoidable.

2) The difficulties of laying a sewer line underneath the Panchkroshi Marg cannot be brushed aside lightly. During the process of construction which may last a few years, the ghats and the river front will present an unpresentable sight besides putting to extreme discomfort pilgrims who throng to Varanasi driven by their religious beliefs.

3) It is very essential that self cleaning velocity in this interceptor sewer line is ensured. While a definite improvement in the gradient of the sewer line and thereby flow velocities has been done by the SMF compared to its earlier

proposal to carry the sewage by gravity up to the SOTA (which called for flatter slopes), it is noticed that there could be a problem of self-cleansing velocity in certain critical sections.

4) Moreover possibility of leaks or sabotage in this sewer cannot be ruled out. This can result in throwing out of gear the entire sewerage network of the city besides disrupting the smooth flow of pilgrims to the ghats with the pathways being tainted with noxious and foul smelling sewage. It is not possible for this committee or for that matter, any independent and impartial observer to close its eyes to the consequential difficulties that will follow in case the sewer line springs a leak, big or small.

5) The Sankat Mochan Foundation proposes a huge pumping station of very large capacity and head for carrying water from the confluence of the Varuna and the Ganga to the Sota, location of the treatment plant. In case of stoppage of pumping under any unavoidable circumstances, the consequence upstream along the ghats could be extremely serious.

6) During the presentation, it was clarified to the committee that the interceptor sewer line along the ghats will be suitably enchored to withstand the hydraulic pressures on account of submergence of the sewer line for at least four to five months of the year. The committee appreciates that though difficult, it is feasible to lay an interceptor sewer line along the ghats as has been done in certain countries of the world. But it would not like to draw a parallel here since the ghat stretches in Varanasi are intensively used and are sentimentally very close to millions of Indians around the world.

7) Flow by gravity is to be encouraged compared to power dependent conveyance of sewage. In this respect, both the proposals are found to be dependent on power for the purpose of conveying the sewage to the sewage treatment plant. In such a situation, it is definitely preferable to lay the relieving sewer to the west and in the town close to the existing trunk sewer. The relieving sewer is functionally very important, and hence, the alignment of the sewer line should be so designed that the laying of the sewer line is quick and can be completed with the least discomfort to the local residents and so as to cause least interference to the existing underground water supply lines or telecommunication cables. In this case, it may, therefore, be possible to consider a modification to the alignment proposed by the UP Jal Nigam. The Committee recommends that an in depth study be made immediately to finalise the alignment of the relieving sewer.

c) Treatment Plant (Technology and Location)

The treatment plants proposed are based on the Waste Stabilisation Pond technology or Advanced Integrated Wastewater Pond System technology. The Waste Stabilisation Pond relies on the sequence of anaerobic ponds, facultative

ponds and maturation ponds for sewage treatment. The NRCD and the State Governments are already familiar and experienced with this technology.

The AIWPS (Advanced Integrated Water Pond System) technology has not been so far implemented anywhere in India. The Committee had a presentation on this by Prof. Bailey Green on 4.2.2000. According to Prof. Bailey Green, the design facility provides for a series of four type of ponds, namely

i) Advanced facultative ponds,
ii) High rate ponds,
iii) Algae settling ponds,
iv) Maturation ponds.

The processes in the above mentioned four types of ponds are as follows:

(1) Advanced Facultative Ponds

Sedimentation and anaerobic digestion of primary sewage solids, occurs in specially designed primary ponds known as Advanced Facultative Ponds (AFPs) which contain one or more internal Fermentation Pits (FPs). In large AIWPS Facilities such as the one proposed for Varanasi, there will be multiple FPs in each AFP. Large FPs are rectangular trenches for ease and economy of construction and flow distribution.

Following the collection and pre-treatment of wastewater (e.g. screening, grit removal and grinding), the entire flow of sewage is conveyed by gravity and distributed near the bottom of each FCs. In order to prevent internal circulation and to maintain the stability of the sludge blanket, individual FCs are not to exceed 1000 m^2 in surface area.

The single most important design criterion for FPs is the hydraulic loading rate or the upflow velocity because of the importance of sedimentation. To ensure a high sedimentation efficiency and a high degree of parasite disinfection, a hydraulic loading rate or upflow velocity of 2 meters per day is used in the FPs.

Because any amount of dissolved oxygen, even 0.1 ppm, is lethal to methanogenic bacteria, a 2 meter high vertical baffle wall is proposed around the 2.0 meter deep excavated FPs in order to protect the anaerobic consortium from the intrusion of cold dissolved oxygen bearing water that without such baffles may be introduced into the bottom of the AFP by wind induced vertical mixing.

65% of the organic load is expected to be removed in the FPs. So, the organic load entering AFPs will be 35 % of the influent.

Half of the residual BOD will be removed in the overlying AFP and half in the subsequent, secondary pond which is called an algal High Rate Pond (HRP).

(2) High Rate Ponds

Because 65% of the influent BOD entering the AIWPS Facility is removed in the FPs and half of the residual BOD is removed in AFPs, the BOD load entering the HRPs is considerably reduced.

In the High Rate Ponds, oxygen released by algae growth help in the decomposition of organic matter. Re-circulation of effluent from the High Rate Pond to the AFPs helps in the quicker and more efficient removal of BOD. Algae Settling Ponds are proposed in the sequence after High Rate Ponds.

(3) Algae Settling Ponds

The primary function of the Algae Settling Ponds (ASPs) is to remove a majority of the algal suspended solids grown in the HRPs. Two ASPs are proposed per HRP. Approximately twice a year, the supernatant in each ASPs will be decanted by pump down to the top of the settled algae layer. This water containing approximately 50 mg/l of algal suspended solids will then be discharged into the re-circulation line and conveyed back to the surface of the AFPs. The settled algal slurry will then be pumped to sand beds for drying and subsequent use as either an animal feed supplement, aqua-culture feed or fertiliser. This algal biomass is odorless and contains approximately 50 per cent crude protein of which approximately 75 per cent is digestible protein for ruminants such as cows and water buffalo. The algal biomass is also an excellent fish feed and fertilizer containing approximately 8 per cent nitrogen and approximately 1 per cent phosphorus.

(4) Maturation Ponds follow the algal settling ponds

The primary function of the Maturation Ponds (MPs) is to store the reclaimed effluent and to improve further its quality by the continued die-off of bacterial pathogens by time and exposure to UV light. Fish culture can be practised in the maturation ponds.

The Committee had detailed discussions on the working of the AIWPS facility. It took into account the invitation offered by US AID to have a look at the AIWPS plants which are operating on the commercial scale in the U.S.A. The committee is firmly of the view that only a sewage treatment technology already tried and tested in India for effectiveness can be adopted in Varanasi. AIWPS technology shows a lot of promise. The proposal of treating waste water by AIWS to bring down MPN of faecal coliform count to 50 after maturation ponds is attractive, but is far stricter then the present effluent standards of NRCD (faecal

coliform 10^4). NRCD may like to review and decide whether this sophisticated treatment of waste water at much higher costs compared with WSP technology is required at this stage. Efficiency in algal settling will also have to be correctly determined and only then, the disposal of treated effluent into water bodies can be considered. For use for irrigation, it is noticed that in Varanasi dependence on power will be there for discharging the treated effluent to the fields. Therefore, the technology can be experimented with, on a pilot basis, in any one or two stations in India. After the results are effectively proved, action may be taken to adopt this technology for implementation under the National River Conservation Plan. If deemed fit, action could be taken in the NRCD to become familiar with this innovative method of sewage treatment.

Choice of technology is dependent on the availability of land. If sufficient land can be provided, then the committee recommends that Waste Stabilisation Pond technology be made use of for sewage treatment in Varanasi. Minimum upgradation of the Dinapur plant to the extent of 16 mld can be considered only after power availability can be ensured and arrangements also made to subject the waste water to tertiary treatment to meet NRCD's standards. Capacities of sewage treatment plants need to be planned consistent with the possibilities of quick acquisition of land, proper estimation of sewage flows and the economics of conveying the sewage to the STPs. The prescribed standards of NRCD for sewage treatment are

"For application on land - BOD N.E.100 mg/l and TSS N.E. 200 mg/l

For discharge into water bodies - BOD N.E. 30 mg/l and TSS N.E. 50 mg/l

Irrespective of the final mode of disposal, i.e., discharge into a water body or for agriculture, acquaculture, forestry, etc. fecal coliform in treated sewage should not exceed 10000 MPN/100 ml. This should be reviewed periodically at close intervals, with an effort to move closer to the desirable level of 1000 MPN/100 ml." No dilution of standards for sewage treatment should be permitted and all STPs must necessarily conform to the above prescriptions as is being followed by the NRCD now.

Location of the Sewage Treatment Plant

There has already been a lot of debate about the location of the sewage treatment plant at Sota. The Committee had the occasion to peruse the reports of the University of California, the Central Water Commission and Inland Water Transport Authority of India. The Committee recommends that physical modelling exercises for determining the suitability of the Sota for establishing the sewage treatment be initiated immediately. The Ganga is known to change its course and any decision to interfere with the course of this mighty river will have to be taken cautiously and after careful detailed examination. A reference to the report of James W. Kirchner, Department of Geology and Geo-physics University of California also justifies this. He says, "It is critically important to recognise that

the banks of the Ganga are naturally mobile and that significant bank erosion whether or not the Sota is closed." The Committee is, therefore, of the view that possibility of using the Sota land may be considered after physical modelling is completed. Meanwhile, the Government of U.P. may also be requested to provide the land necessary for the STPs. The Committee members after examining the long delays that have taken place under the Ganga Action Plan phase-I and the Yamuna Action Plan wish to add that special steps need to be taken by the Government of U.P. to obtain the land for the project in the near future, if the plan to protect the Ganga in Varanasi from pollution loads is to be realised.

d) Estimation of Sewage Flows

The estimation of sewage flows is important for the design of the conveyance systems and the sewage treatment plants. Both the proposals are not based on any independent measurement of sewage flows in the drains lying untapped and, therefore, joining the river. The measurements of the UP Jal Nigam indicate a figure of 205 mld of sewage in the year 1996. It is revealing to note that at the time of obtaining the approval of the CCEA the flow expected to be tackled was only 160 mld. This flow seems to have registered a sudden rise of 45 mld in just one year. The committee recommends that measurement of sewage flow be taken once again through an independent institution or the CPCB within the space of the next one month so that suitable alterations to the design of the conveyance system and the extent of land required and the design for sewage treatment be properly made so as to eliminate large gaps or excesses in detailed project design.

e) Implementation Strategy

The meetings with the Mayor and Councillors of Varanasi Nagar Nigam were revealing to the Committee. When the Committee was given a presentation of the SMF proposal on 4.2.2000, the Mayor and a few Councillors were present. The Councillors stated that they had no opportunity to see the UP Jal Nigam proposal and desired that the UP Jal Nigam make a presentation before them. It was felt that a presentation of both the proposals should be made before the Mayor and all the Councillors for which the Municipal Commissioner should make the arrangements early. Since the Councillors present on 4.2.2000 insisted that the UP Jal Nigam make a presentation before them immediately, it was explained to them by the Municipal Commissioner that arrangements will be made for this presentation the next day after informing all the Councillors.

When the Councillors assembled on 5.2.2000 for the presentation (the Divisional Commissioner, Varanasi was present), they complained that they had not had the opportunity to see the SMF proposal. It is clear that if a presentation of the proposals as proposed to the Committee is made early before the Municipal Council, it may be easier to obtain the cooperation of the Councillors completely. It is to be added here that the Varanasi Nagar Nigam should be made fully aware of

the PFRs of both the proposals along with their cost estimates and the costs of operation and maintenance for the Councillors to come to a reasonable conclusion. The importance that Varanasi enjoys as a heritage site in India is immeasurable. Hence, it is all the more the reason that the stretch of the river along the ghats in Varanasi is not considered to be the field of design and project execution by any one agency. The best design and the best of project execution should be ensured. This recommendation is based on an understanding of the experiences of the past, when enormous delay has taken place in the process of execution. The UP Jal Nigam during its presentation has indicated that the project may require at least seven to eight years for completion. It is distressing to imagine the situation that will prevail in Varanasi and along the ghats if such project implementation periods are going to be permitted.

In this age of advancing technology, any technical proposal has relevance only if the project is implemented within a period of three to four years. It is, therefore, strongly recommended that a 'Mission Mode' be adopted for project execution in Varanasi.

Since an integrated approach has been suggested for Varanasi, a coordination committee covering the Ministries of Environment & Forests and Urban Development may be set up along with suitable representation from the Government of U.P. The NRCD may take the help of leading consulting engineering firms/institutions for the quick completion of in depth studies on critical issues such as

(i) estimation of sewage flows,
(ii) the alignment of the relieving sewer,
(iii) physical modelling for the Sota, and
(iv) establishing compatibility between the Konia Pumping Station and the existing trunk sewer.

Thereafter, detailed project reports should be prepared. Detailed project report should be prepared keeping the U.P. State Government and the Varanasi Nagar Nigam in the picture and in a manner so that constitutional provisions and the policies followed by the NRCD are respected. The DPRs should be so prepared as to enable the entrustment of project execution on a turnkey basis with BOT conditions. The turnkey contract should cover the costs of maintenance for at least three years after project completion. It is recommended that considering the complexity of the situation in Varanasi, the services of the firm/institution initially engaged by the NRCD for detailed report finalisation be continued to be utilized whenever technical problems crop up during the course of project execution. This will ensure continuity and stability in technical consultation and advice. An officer in the NRCD may be specifically nominated to carry through the project up to and into the stages of execution and early completion. The NRCD in consultation with the UP State Government and the Varanasi Nagar Nigam may finalise suitable supervisory arrangements during the process of project execution and maintenance for the first three years after completion of creation of assets.

Thanks Giving

The Committee records its sincere appreciation for the keen efforts made by the Sankat Mochan Foundation, the Varanasi Nagar Nagar and the UP Jal Nigam towards eliminating the pollution loads in the Ganga in Varanasi. The spirit of goodwill displayed by the participants in the presentations made before the Committee was exemplary. The Committee is thankful to all the agencies and the Government of Uttar Pradesh for having assisted in the early finalisation of the report and to the NRCD for the faith and confidence reposed in the members of the Committee.

29.2.2000
(Prof. K.J. Nath)
Chairman

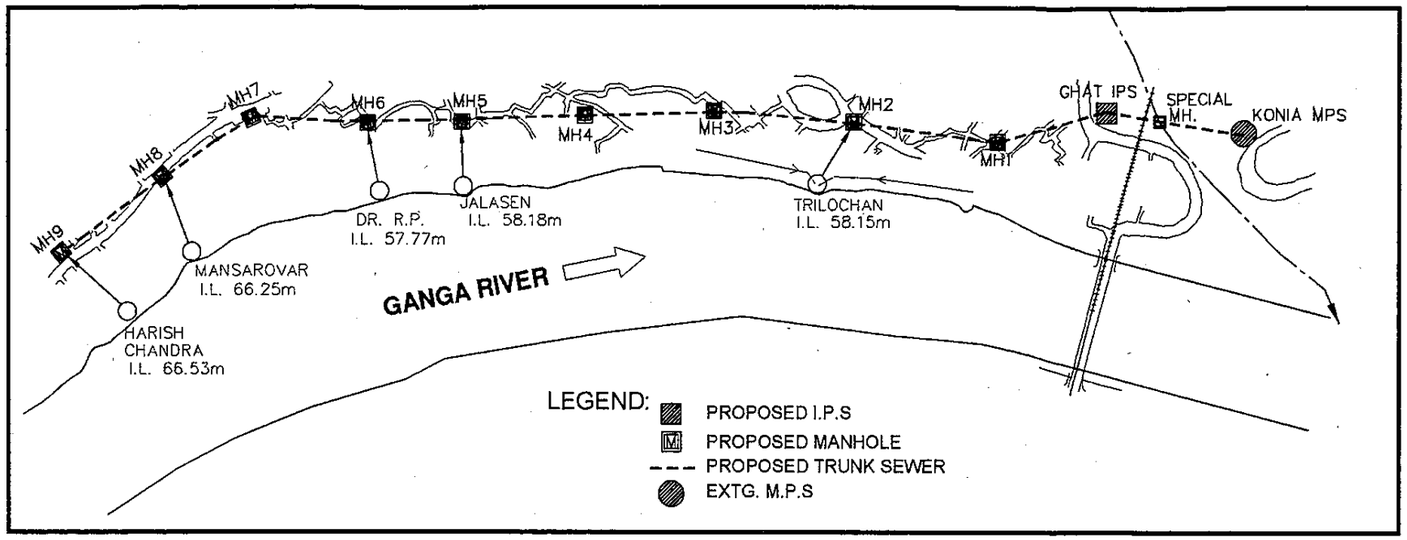
(Prof. R.P. Mathur) 29/2/2000

(R. Rajagopal)

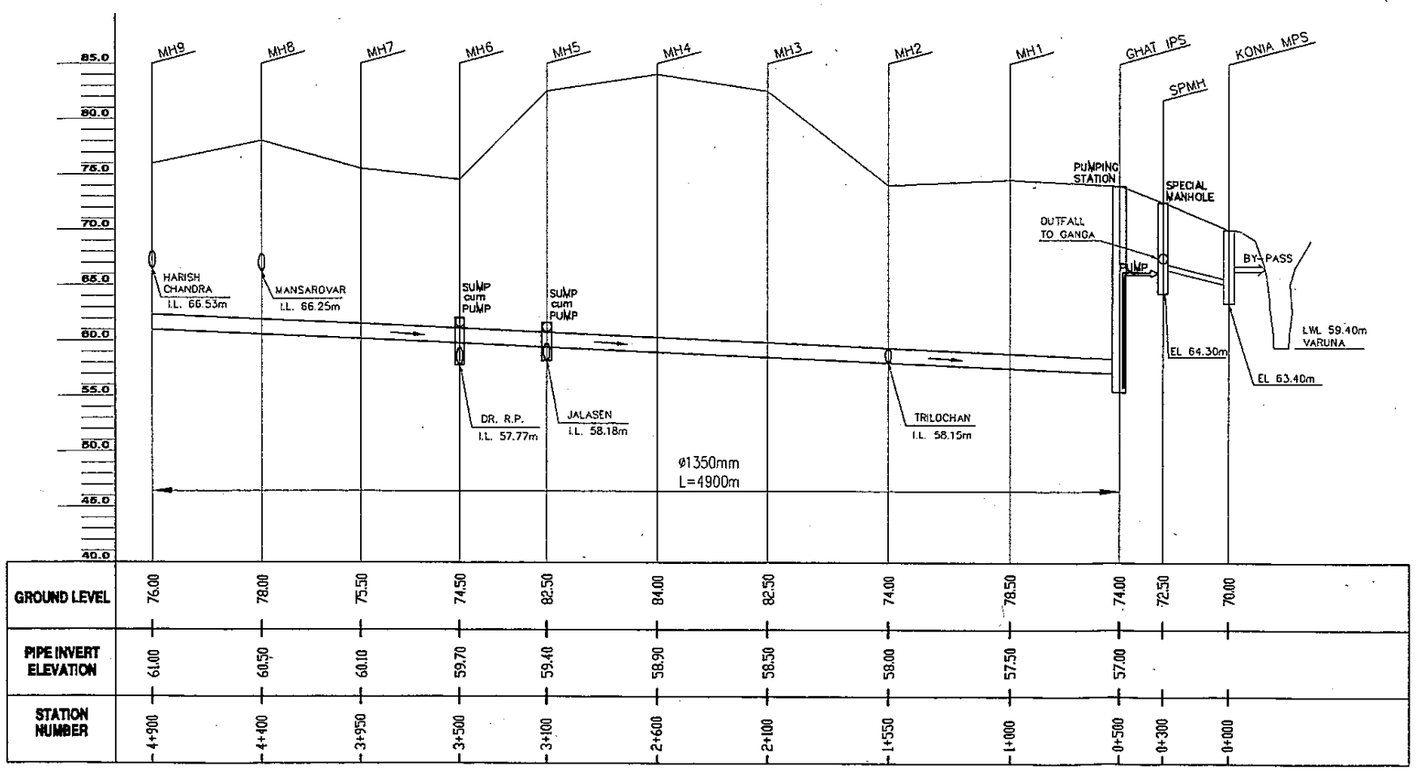
(Dr. S.R. Shukla) 29/2/2000

(Prof. A.K. Gosain) 29/2/2000

Appendix C



1 PLAN



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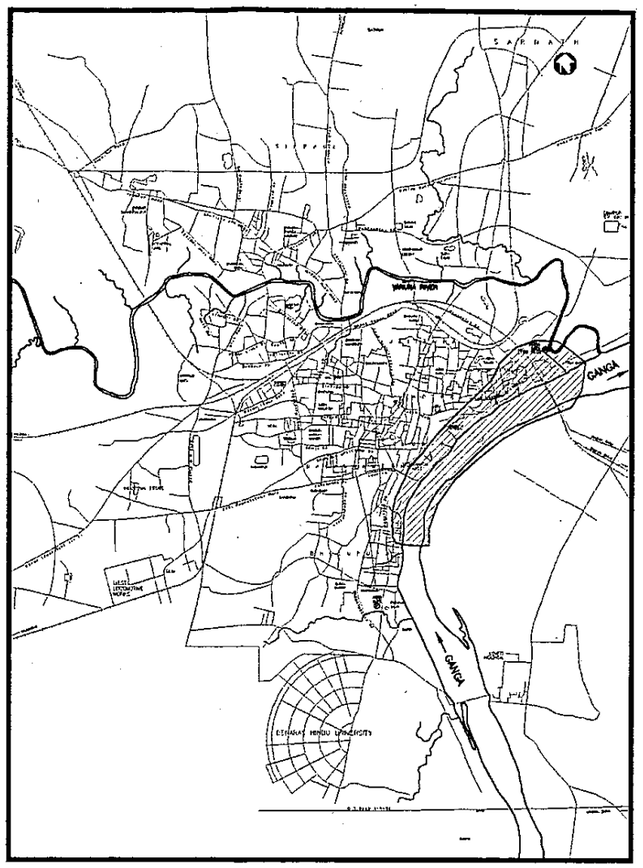
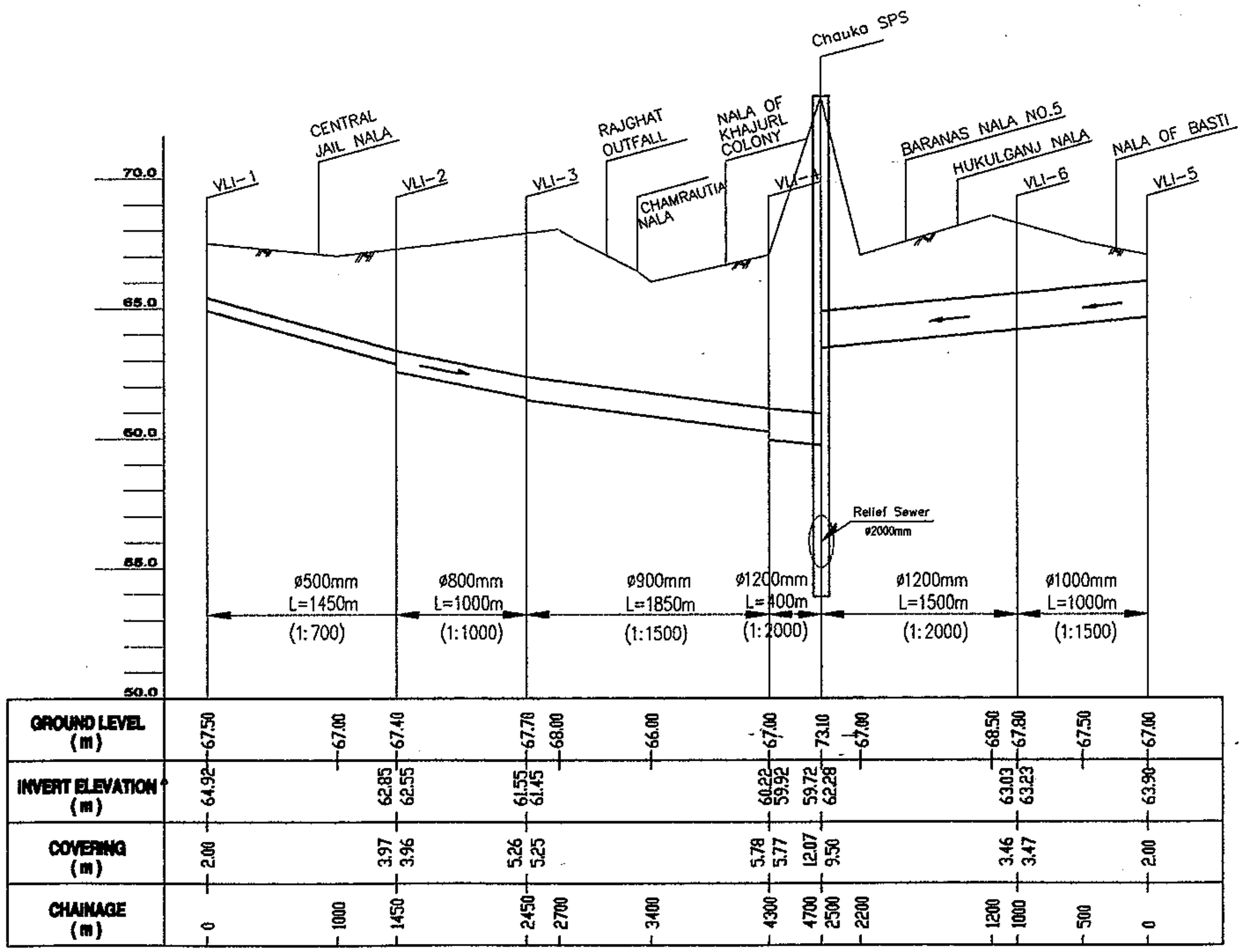
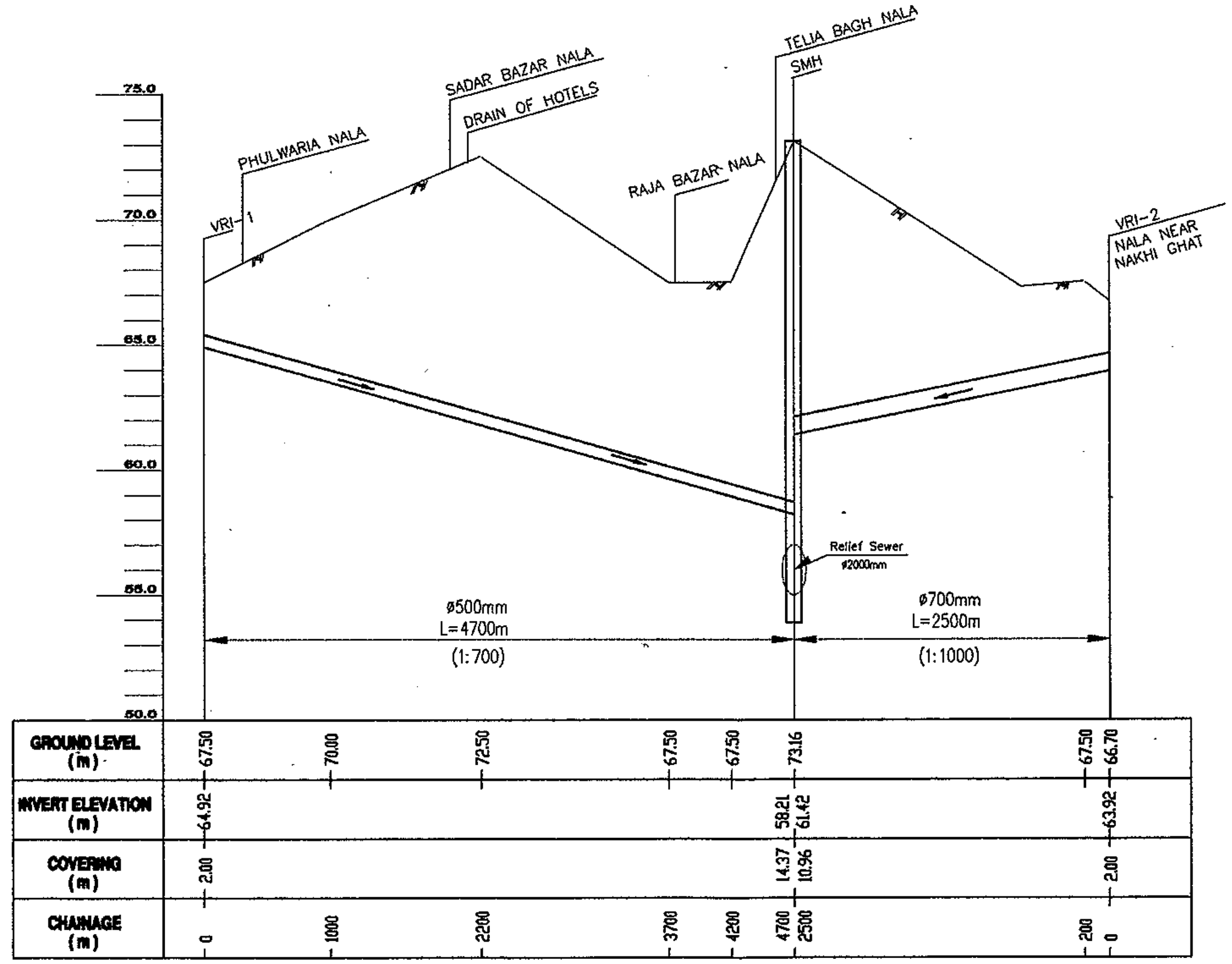


LOCATION MAP

JAPAN INTERNATIONAL COOPERATION AGENCY	CONSULTANTS	PROJECT	LOCATION	APPENDIX C1
	TOKYO ENGINEERING CONSULTANTS CO., LTD. CTI ENGINEERING INTERNATIONAL CO., LTD.	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	GHAT-DEEP INTERCEPTOR PLAN AND PROFILE

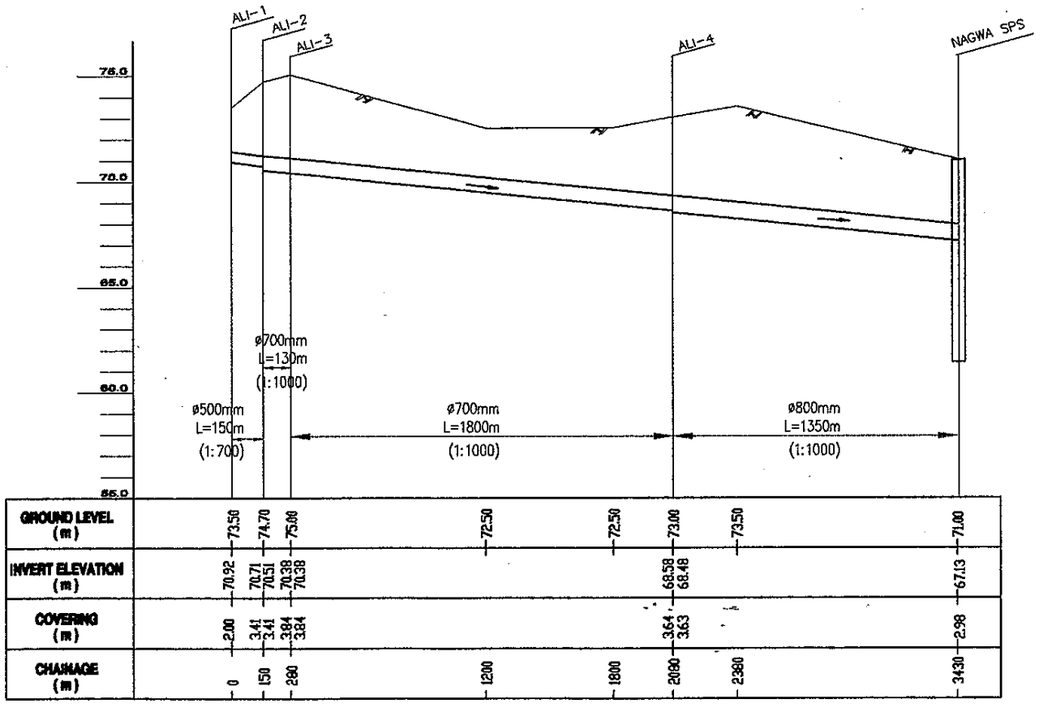


1 PROFILE
VARUNA LEFT BANK INTERCEPTOR

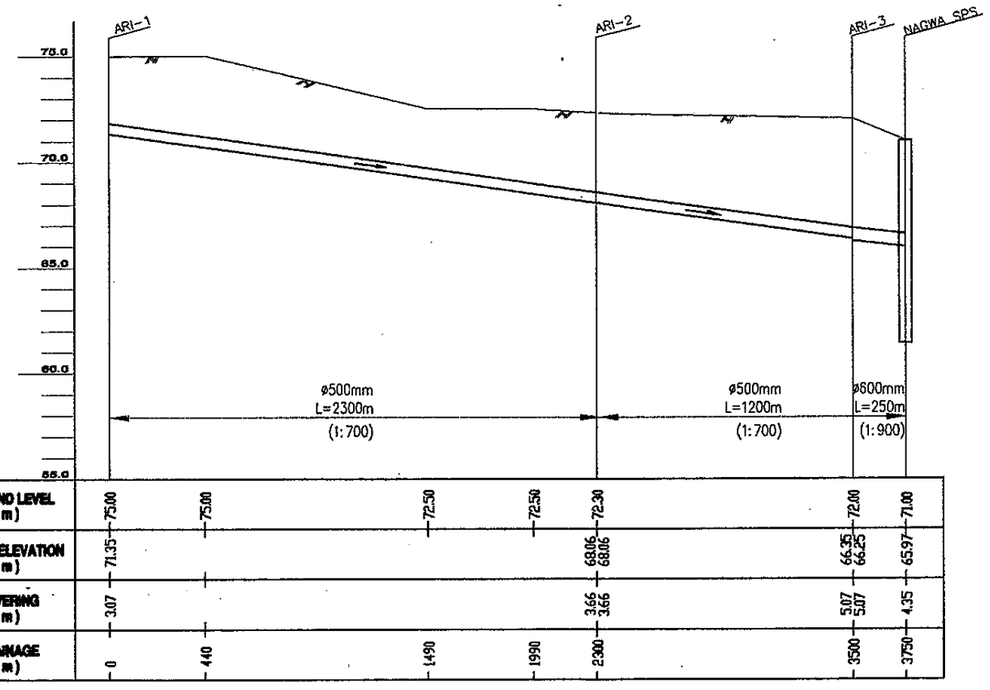


2 PROFILE
VARUNA RIGHT BANK INTERCEPTOR

JICA JAPAN INTERNATIONAL COOPERATION AGENCY TEC TOKYO ENGINEERING CONSULTANTS CO., LTD. CTI CTI ENGINEERING INTERNATIONAL CO., LTD.	PROJECT THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	LOCATION VARANASI CITY	APPENDIX C2 VARUNA INTERCEPTOR

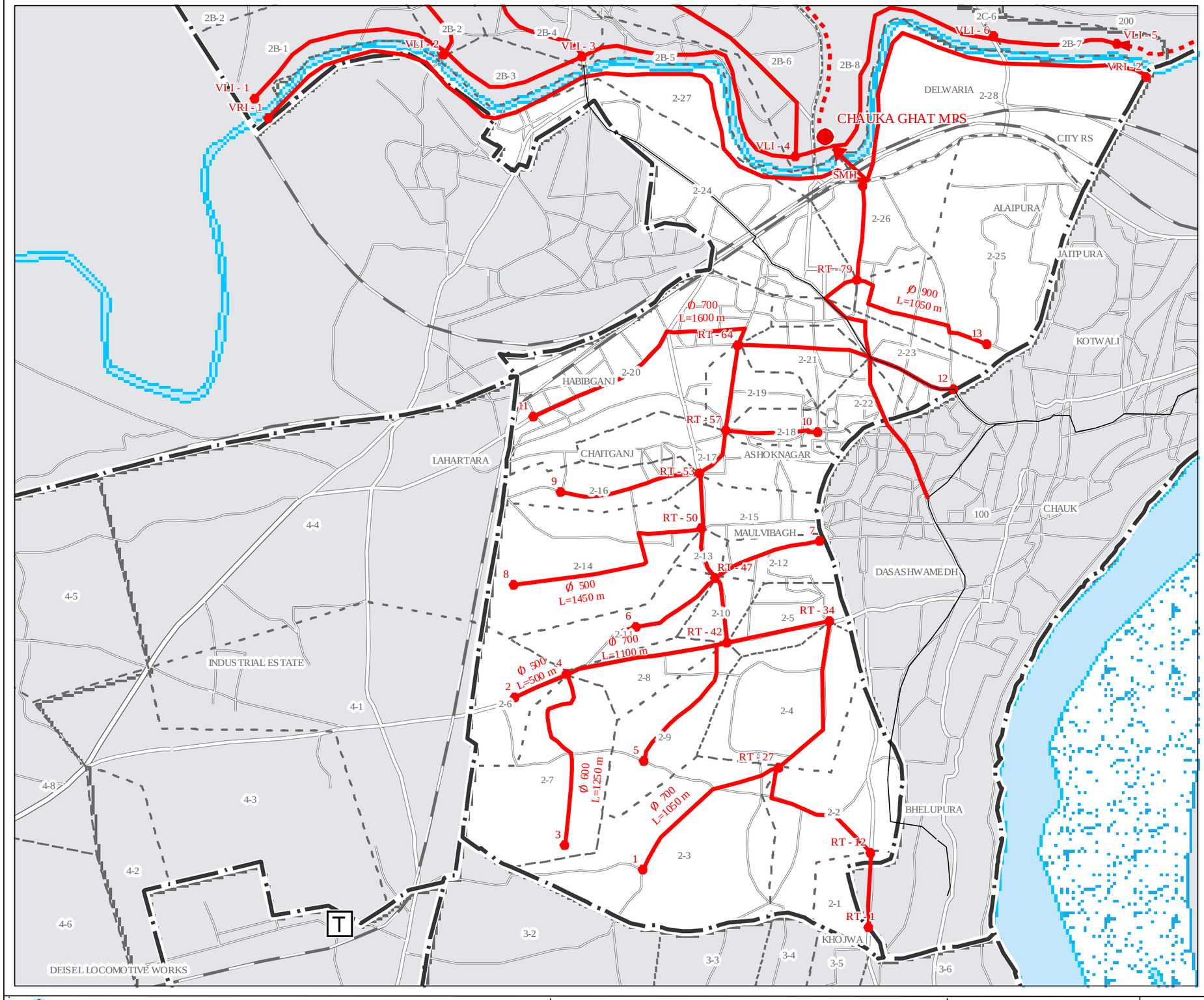


1 PROFILE
ASSI LEFT BANK INTERCEPTOR

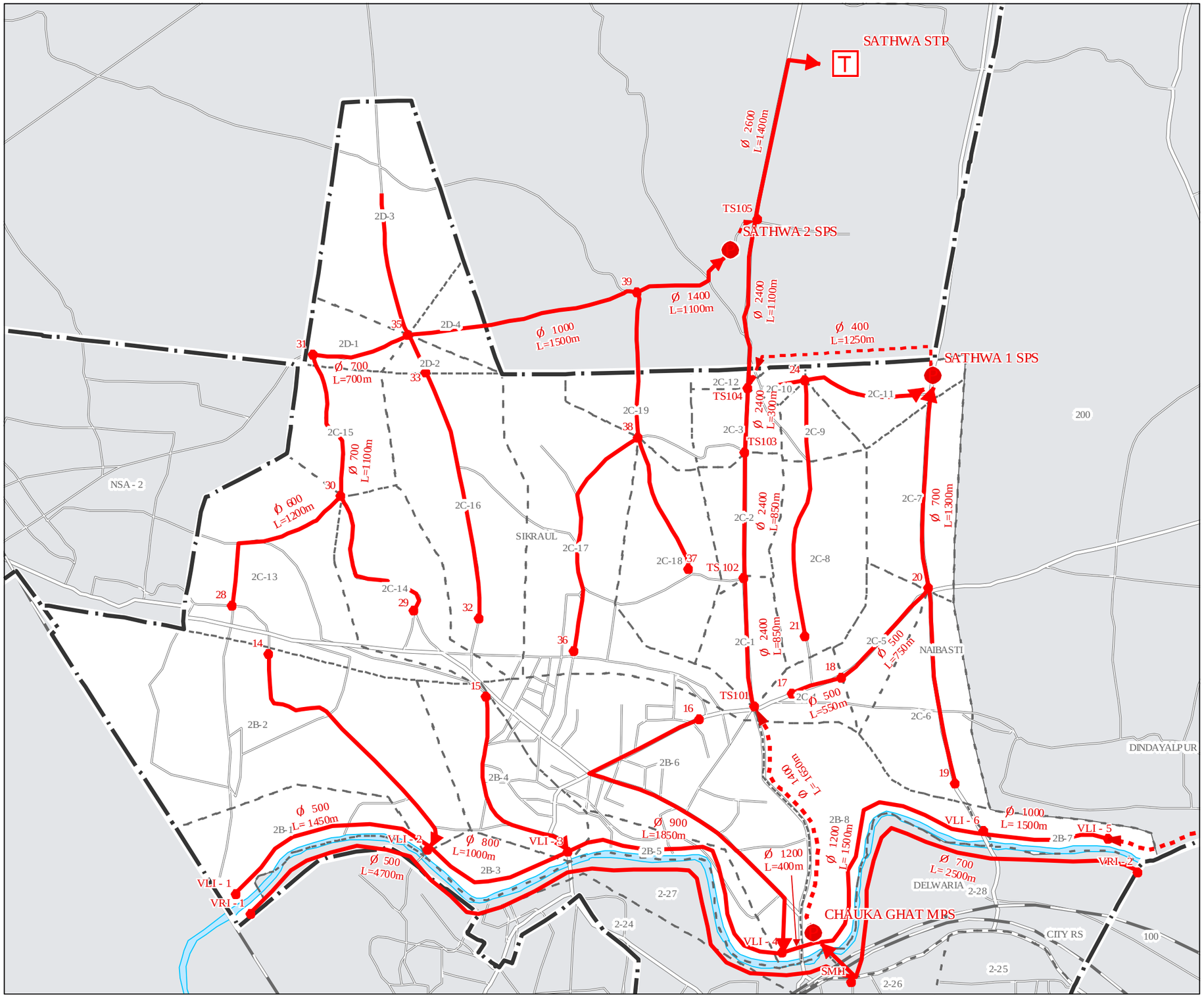


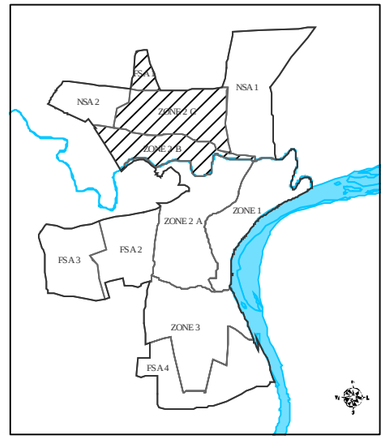
2 PROFILE
ASSI RIGHT BANK INTERCEPTOR

JICA JAPAN INTERNATIONAL COOPERATION AGENCY TEC TOKYO ENGINEERING CONSULTANTS CO., LTD. CTI CTI ENGINEERING INTERNATIONAL CO., LTD.	PROJECT THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	LOCATION VARANASI CITY	APPENDIX C3 ASSI NALA INTERCEPTOR



JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO ENGINEERING CONSULTANTS CO. LIMITED CTI ENGINEERING INTERNATIONAL CO. LIMITED	PROJECT	LOCATION	**APPENDIX C4**
	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	TRUNK SEWERS AND LATERALS DISTRICT 2 ZONE 2A





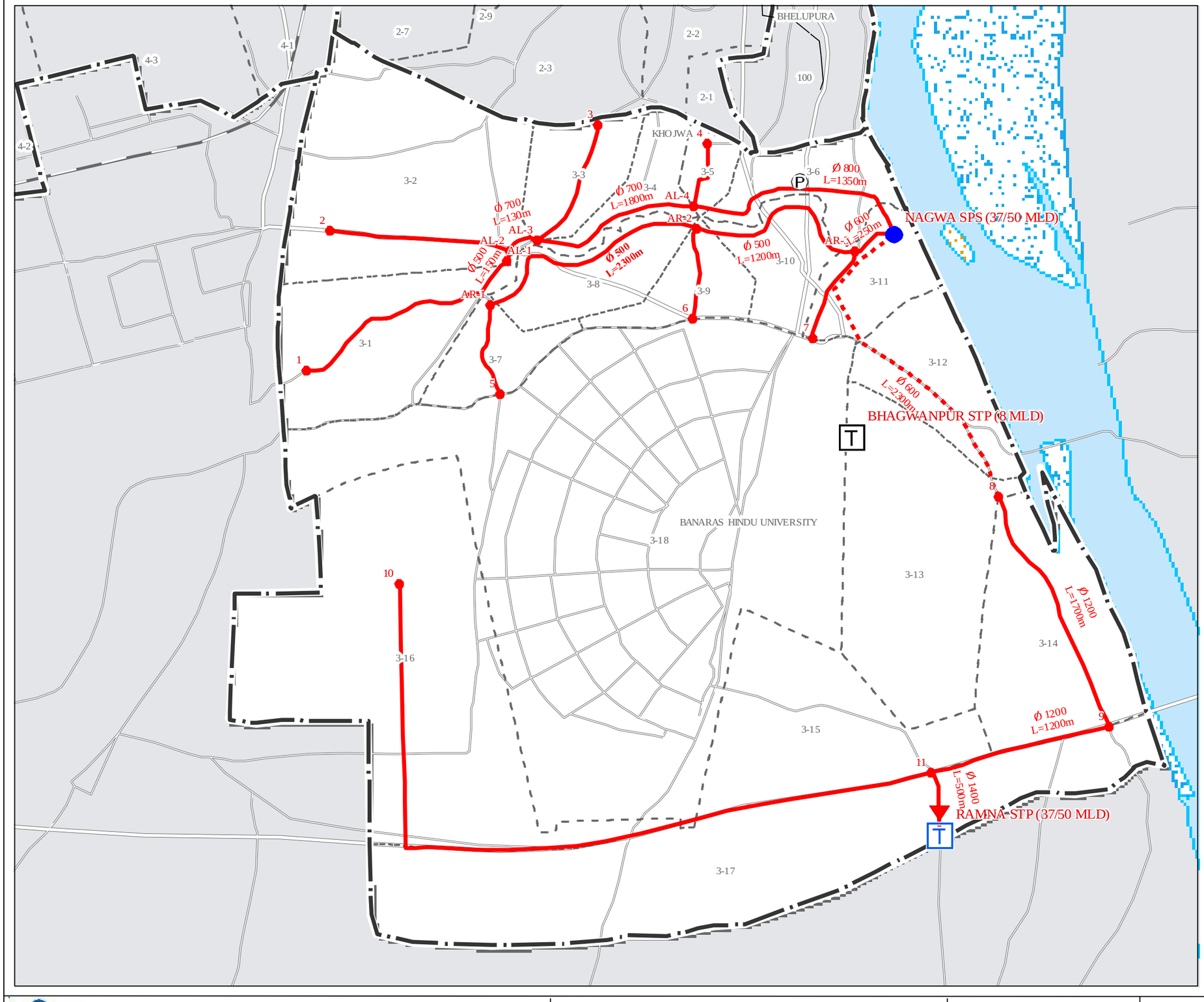
INDEX MAP

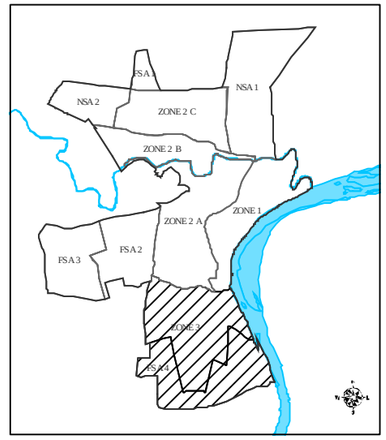
Legend

- SPS Proposed
- STP Proposed
- Gravity Sewer Proposed
- Rising Main Proposed
- Sewerage Sub District Boundary
- Sewerage District Boundary
- 2C - 1 Sewerage Sub District
- 17 , TS 104 Node Number

0 0.25 0.5 1 Kilometers

JICA JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO ENGINEERING CONSULTANTS CO. LIMITED CTI ENGINEERING INTERNATIONAL CO. LIMITED	PROJECT	LOCATION	**APPENDIX C5**
	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	TRUNK SEWERS AND LATERALS DISTRICT 2 ZONE 2B , ZONE 2C AND FSA-1





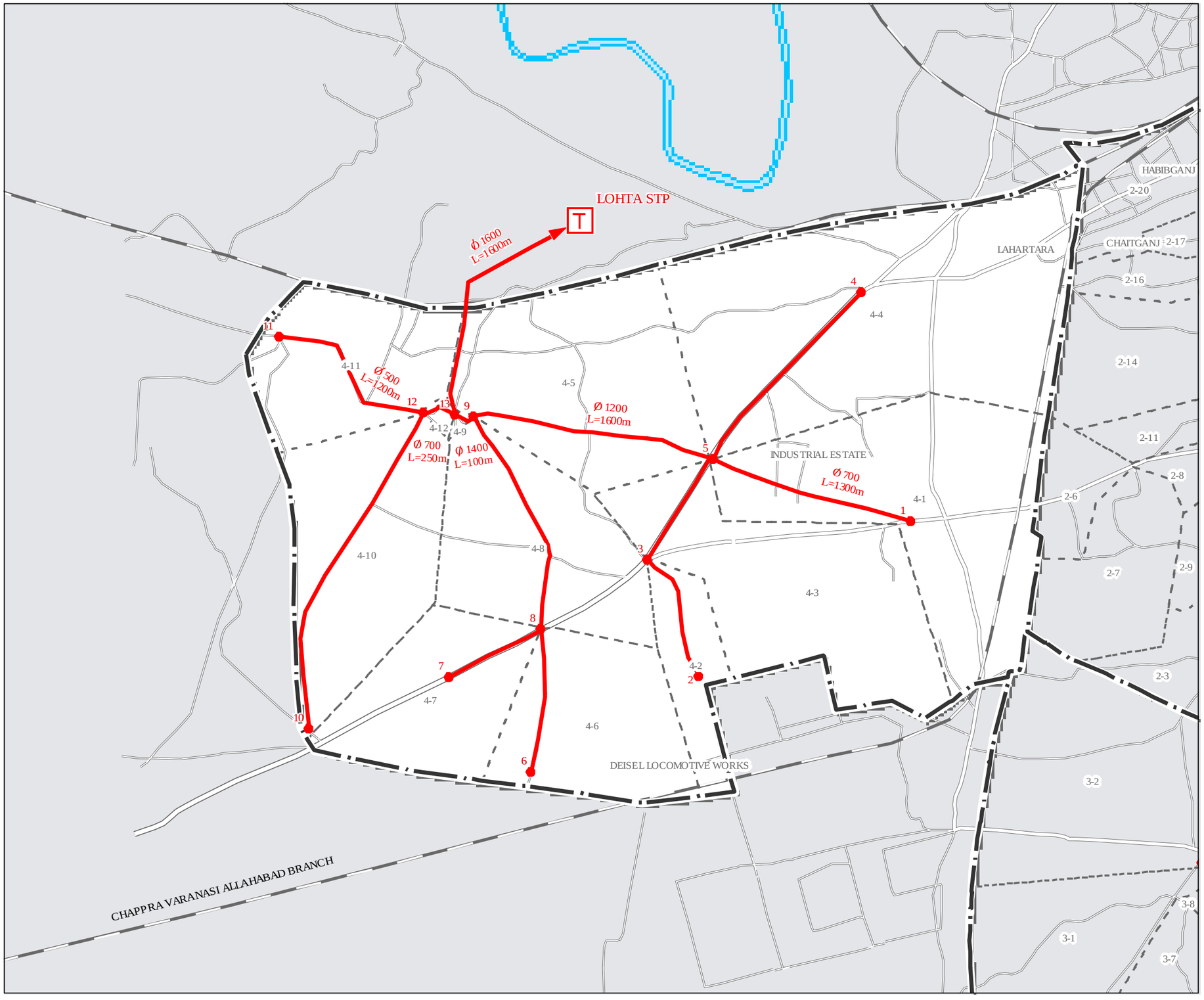
INDEX MAP

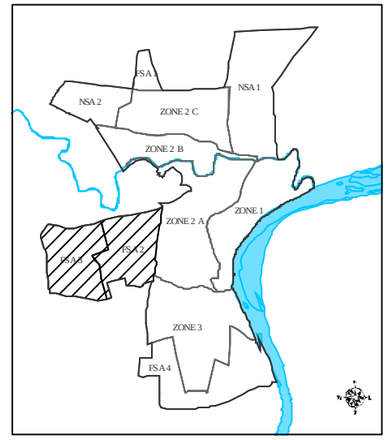
Legend

- Existing SPS
- SPS Santioned By GAP
- SPS Proposed
- STP Proposed
- STP Santioned By GAP
- Existing STP
- Existing Gravity Sewer
- Existing Rising Main
- Gravity Sewer Proposed
- Rising Main Proposed
- Sewerage Sub District Boundary
- Sewerage District Boundary
- 2C - 1 Sewerage Sub District
- 17 , TS 104 Node Number

0 0.25 0.5 1 Kilometers

JICA JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO ENGINEERING CONSULTANTS CO. LIMITED CTI ENGINEERING INTERNATIONAL CO. LIMITED	PROJECT THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	LOCATION VARANASI CITY	**APPENDIX C6** TRUNK SEWERS AND LATERALS DISTRICT 3 ZONE 3 AND FSA 4





INDEX MAP

Legend

- Existing SPS
- SPS Proposed
- STP Proposed
- Existing STP
- Existing Gravity Sewer
- Existing Rising Main
- Gravity Sewer Proposed
- Rising Main Proposed
- Sewerage Sub District Boundary
- Sewerage District Boundary
- 2C - 1 Sewerage Sub District
- 17 , TS 104 Node Number

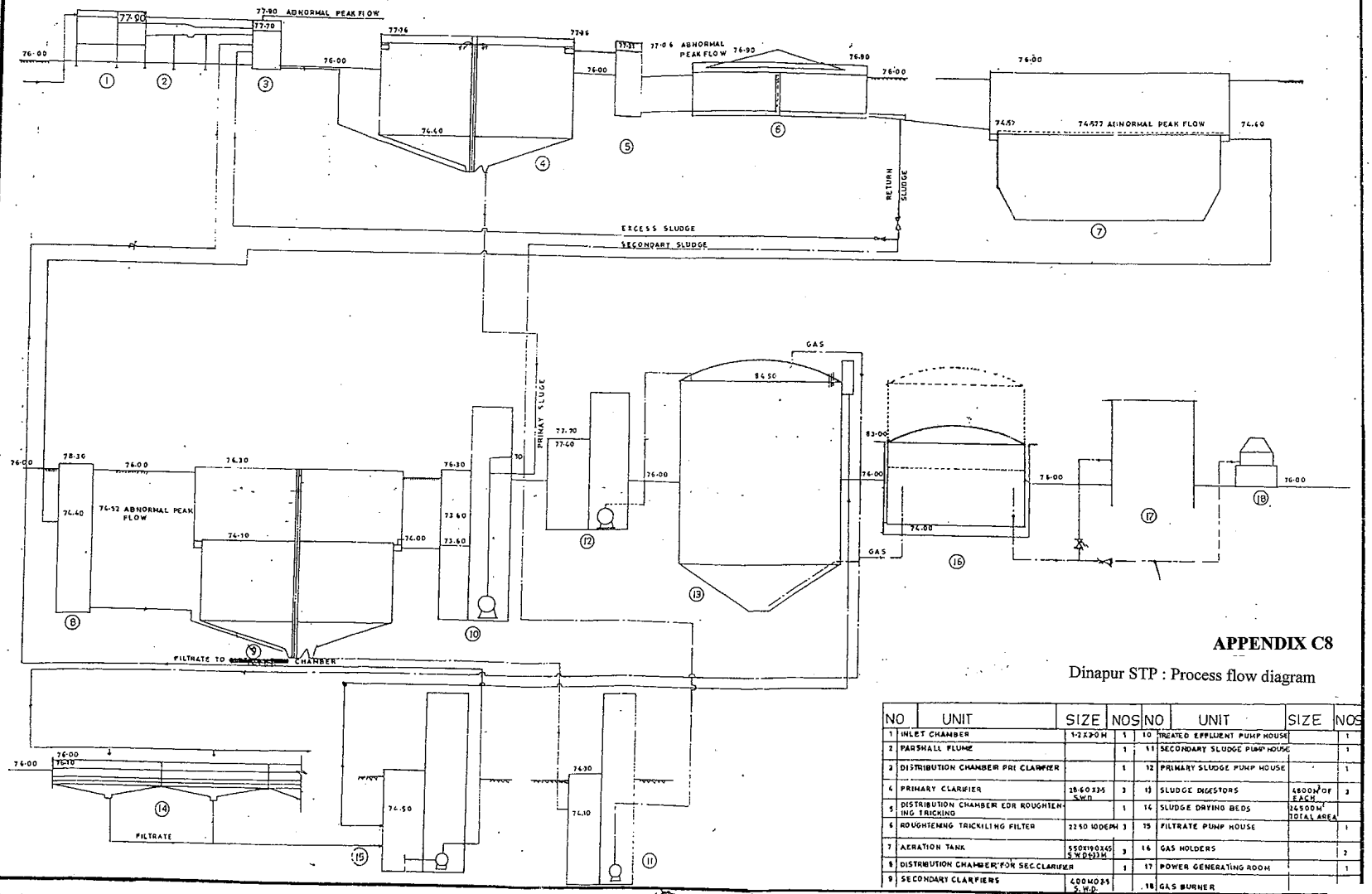
0 0.25 0.5 1 Kilometers

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO ENGINEERING CONSULTANTS CO. LIMITED
CTI ENGINEERING INTERNATIONAL CO. LIMITED

PROJECT	LOCATION	**APPENDIX C7**
THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	TRUNK SEWERS AND LATERALS DISTRICT 4 ZONE FSA 2 AND FSA 3

FLOW DIAGRAM OF 80 MLD SEWAGE TREATMENT PLANT AT DINAPUR VARANASI

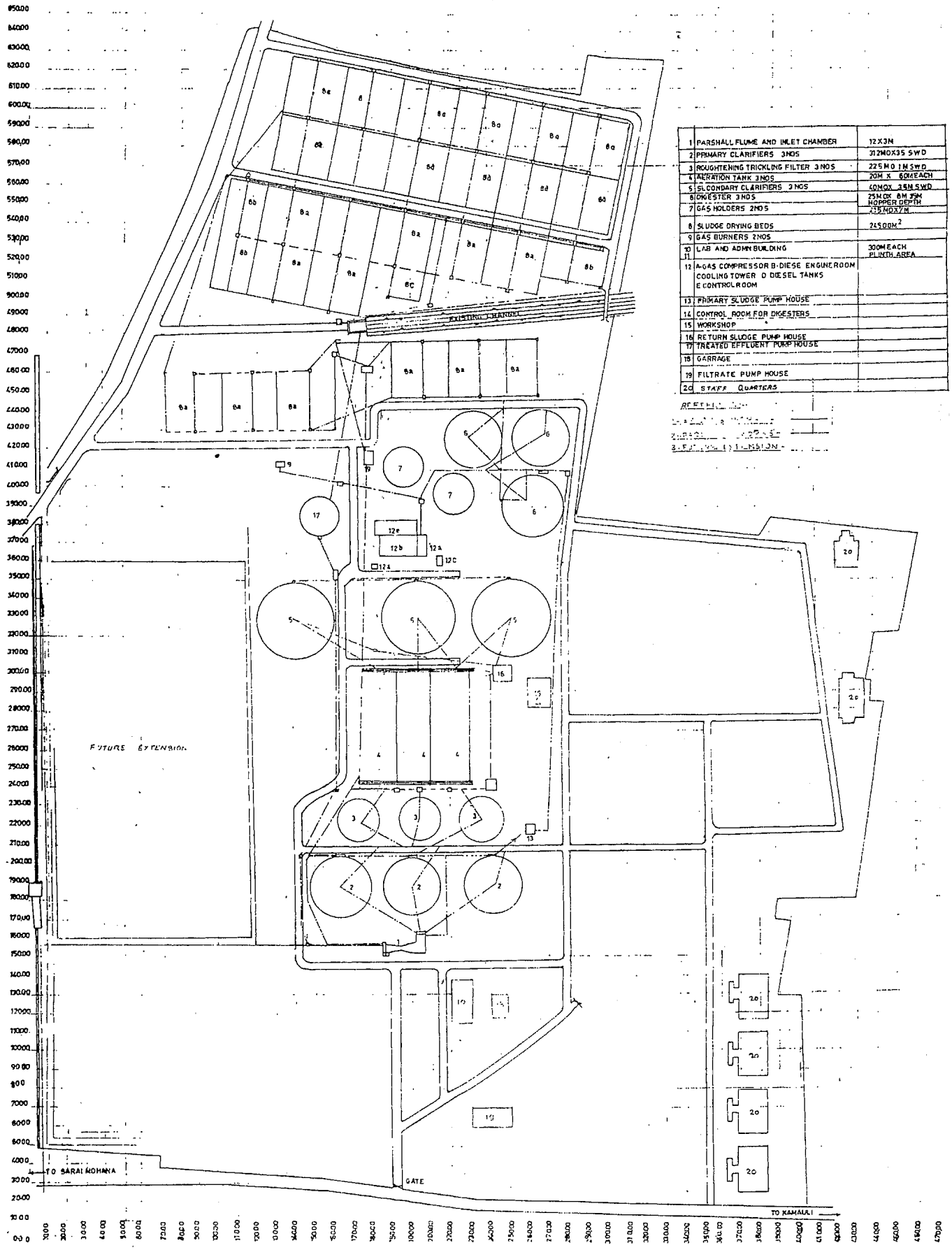


APPENDIX C8

Dinapur STP : Process flow diagram

NO	UNIT	SIZE	NOS	NO	UNIT	SIZE	NOS
1	INLET CHAMBER	1·2 X 2·0 H	1	10	TREATED EFFLUENT PUMP HOUSE		1
2	PARSHALL FLUME		1	11	SECONDARY SLUDGE PUMP HOUSE		1
3	DISTRIBUTION CHAMBER PRI CLARIFIER		1	12	PRIMARY SLUDGE PUMP HOUSE		1
4	PRIMARY CLARIFIER	28·60 X 3·5 S.W.D.	3	13	SLUDGE DIGESTORS	4800 M² OF EACH	3
5	DISTRIBUTION CHAMBER FOR ROUGHTENING TRICKING		1	14	SLUDGE DRYING BEDS	24500 M² TOTAL AREA	
6	ROUGHTENING TRICKILING FILTER	22·50 I.D. DEPTH 3		15	FILTRATE PUMP HOUSE		1
7	AERATION TANK	55.0 X 19.0 X 3.5 S.W.D. 4 3 M	3	16	GAS HOLDERS		2
8	DISTRIBUTION CHAMBER FOR SEC. CLARIFIER		1	17	POWER GENERATING ROOM		1
9	SECONDARY CLARIFIERS	40.0 M DIA S.W.D.		18	GAS BURNER		

SITE PLAN OF SEWAGE TREATMENT PLANT AT DINAPUR VARANASI

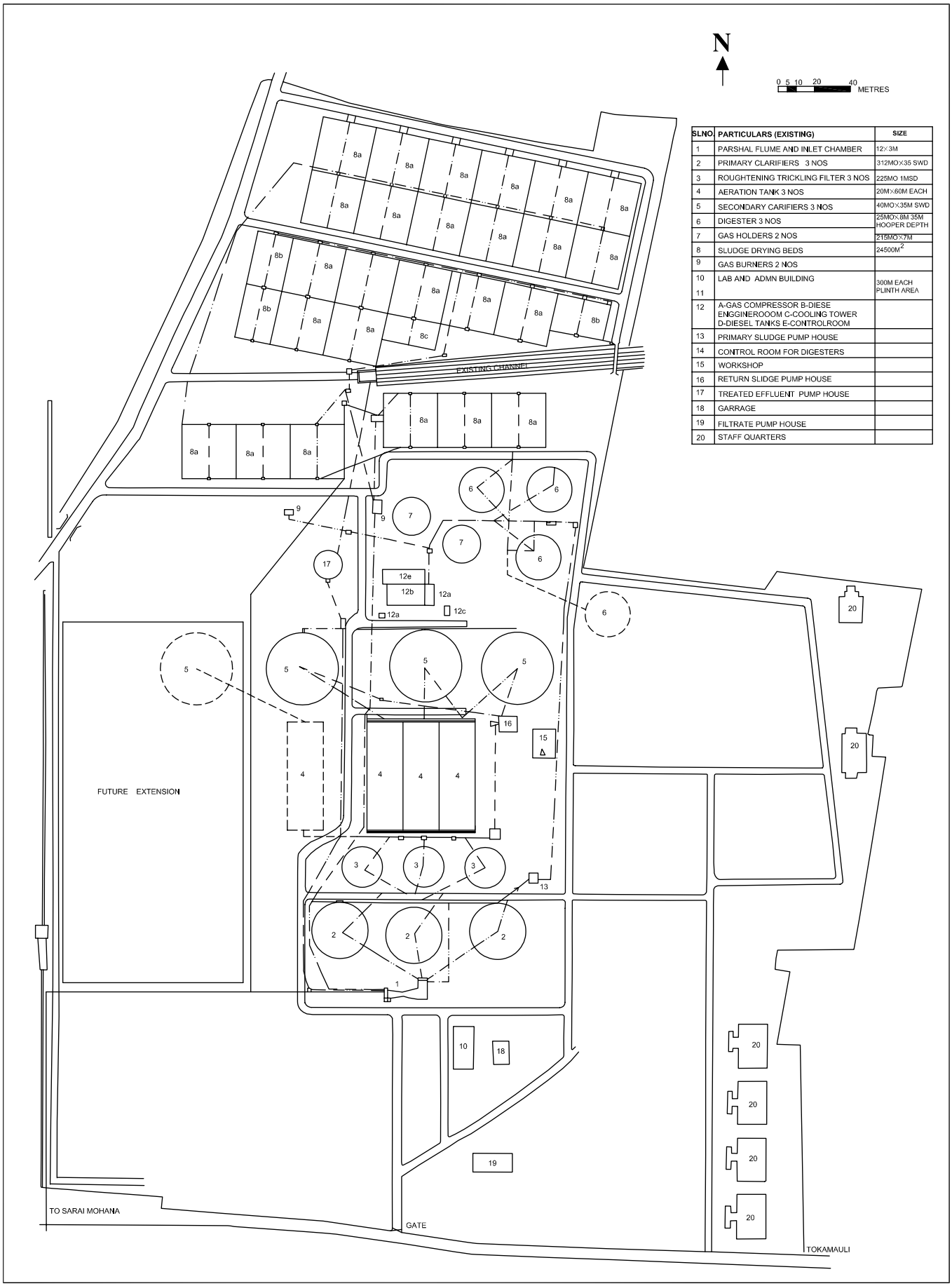


1	PARSHALL FLUME AND INLET CHAMBER	12X3M
2	PRIMARY CLARIFIERS 3NOS	31.2MDX3.5 SWD
3	ROUGHTENING TRICKLING FILTER 3 NOS	22.5M D 1M SWD
4	AERATION TANK 3NOS	20M X 6.0M EACH
5	SLOONDARY CLARIFIERS 3 NOS	40MDX 2.5M SWD
6	DIGESTER 3 NOS	25M DX 6M SW HOPPER DEPTH
7	GAS HOLDERS 2NOS	21.5MDX7M
8	SLUDGE DRYING BEDS	24500M^2
9	GAS BURNERS 2NOS	
10 11	LAB AND ADMN BUILDING	300M EACH PLINTH AREA
12	A-GAS COMPRESSOR B-DIESE ENGINE ROOM COOLING TOWER D DIESEL TANKS E CONTROL ROOM	
13	PRIMARY SLUDGE PUMP HOUSE	
14	CONTROL ROOM FOR DIGESTERS	
15	WORKSHOP	
16	RETURN SLUDGE PUMP HOUSE	
17	TREATED EFFLUENT PUMP HOUSE	
18	GARRAGE	
19	FILTRATE PUMP HOUSE	
20	STAFF QUARTERS	

APPENDIX C9 Dinapur STP : Site plan existing

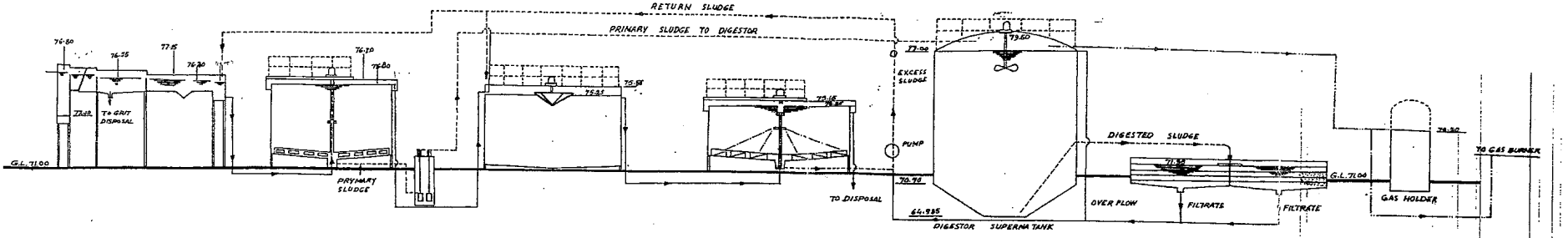
PROJECT ENGINEER PROJECT MANAGER GENERAL MANAGER

GANGA POLLUTION PREVENTION UNIT JAL NIGAM VARANASI

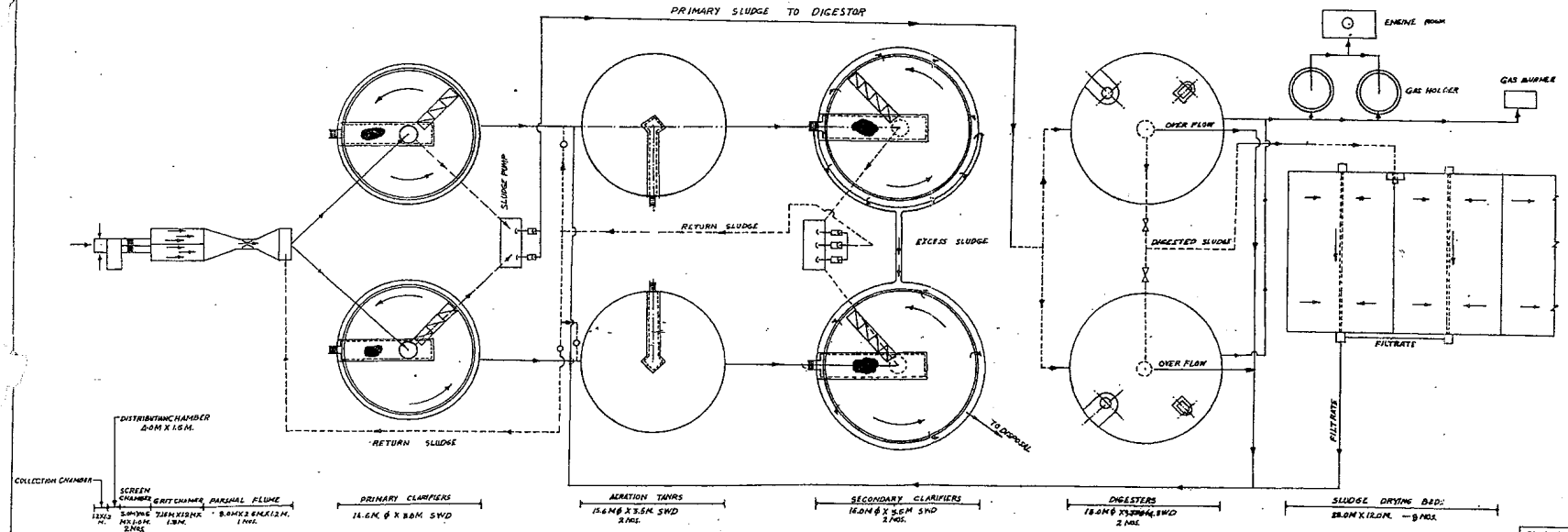


SLNO.	PARTICULARS (EXISTING)	SIZE
1	PARSHAL FLUME AND INLET CHAMBER	12×3M
2	PRIMARY CLARIFIERS 3 NOS	312MO×35 SWD
3	ROUGHTENING TRICKLING FILTER 3 NOS	225MO 1MSD
4	AERATION TANK 3 NOS	20M×60M EACH
5	SECONDARY CARIFIERS 3 NOS	40MO×35M SWD
6	DIGESTER 3 NOS	25MO×8M 35M HOOPER DEPTH
7	GAS HOLDERS 2 NOS	215MO×7M
8	SLUDGE DRYING BEDS	24500M^2
9	GAS BURNERS 2 NOS	
10 11	LAB AND ADMN BUILDING	300M EACH PLINTH AREA
12	A-GAS COMPRESSOR B-DIESE ENGGINEROOOM C-COOLING TOWER D-DIESEL TANKS E-CONTROLROOM	
13	PRIMARY SLUDGE PUMP HOUSE	
14	CONTROL ROOM FOR DIGESTERS	
15	WORKSHOP	
16	RETURN SLIDGE PUMP HOUSE	
17	TREATED EFFLUENT PUMP HOUSE	
18	GARRAGE	
19	FILTRATE PUMP HOUSE	
20	STAFF QUARTERS	

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO ENGINEERING CONSULTANTS CO., LTD. CTI ENGINEERING INTERNATIONAL CO., LTD.	PROJECT THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	LOCATION VARANASI CITY	APPENDIX C 10 DINAPUR STP: SITE PLAN FOR AUGMENTED CAPACITY



HYDRAULIC FLOW DIAGRAM

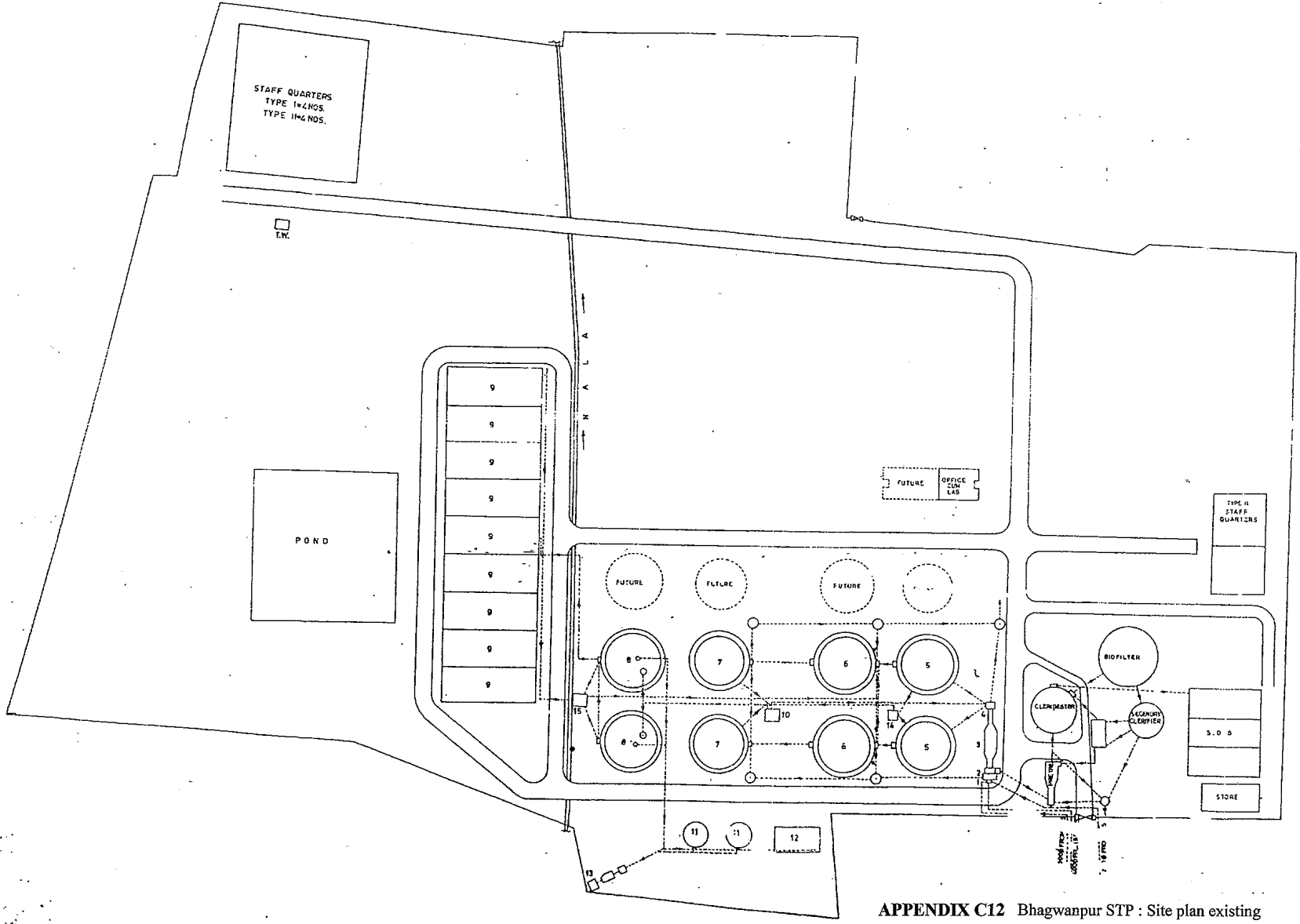


SCHEMATIC FLOW DIAGRAM

NOTE
ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES.

CLIENTS:— GANGA POLLUTION PREVENTON UNIT U.P JAL NIGAM VARANASI.		
PROJECT:— GANGA POLLUTION PREVENTION PROJECT B.H.U. VARANASI		
TITLE:— COMPLETION DRAWING HYDRAULIC AND SCHEMATIC FLOW DIAGRAM 8 MLD S.T.P.		
DRG. NO:— SCALE:— 1:2·5	D/MAN	HEAD D/MAN
ASST. PRO. ENGR.	PRO. ENGR. PRO. MANAGER	G. M.

APPENDIX C11 Bhagwanpur STP : Process flow diagram



SL.NO	PARTICULARS	QTY.	SIZE
1	INLET CHAMBER	1	1.2 X 1.2
2	BAR SCREEN CHANNEL	2	2.5X0.5X1.0
3	GRIT CHAMBER	2	7.15W X 2 X L 30
4	PARSHALL FLUME	1	250MM
5	PRIMARY SETTLING TANK	2	16.66 X 3
6	AERATION TANK	2	15.66 X 3.5
7	SECONDARY SETTLING TANK	2	16.0 DX3.5
8	DIGESTER	2	18.0 X 8.775
9	SLUDGE DRYING BEDS	8	28.0 X 12.0
10	RECIRCULATION PUMP CUM SUMP HOUSE	1	6.0 X 5.0
11	GAS HOLDER	2	7.5 X 14.0
12	ENGINE ROOM	1	15.5 X 8.8
13	GAS BURNER	1	—
14	PRIMERY SLUDGE PUMP CUM SUMP HOUSE	1	3.5X3.5
15	FILTERATE SUMP CUM PUMP HOUSE	1	3.5X3.5

CLIENTS—
GANGA POLLUTION PREVENTION UNIT
U. P. JAL NIGAM VARANASI

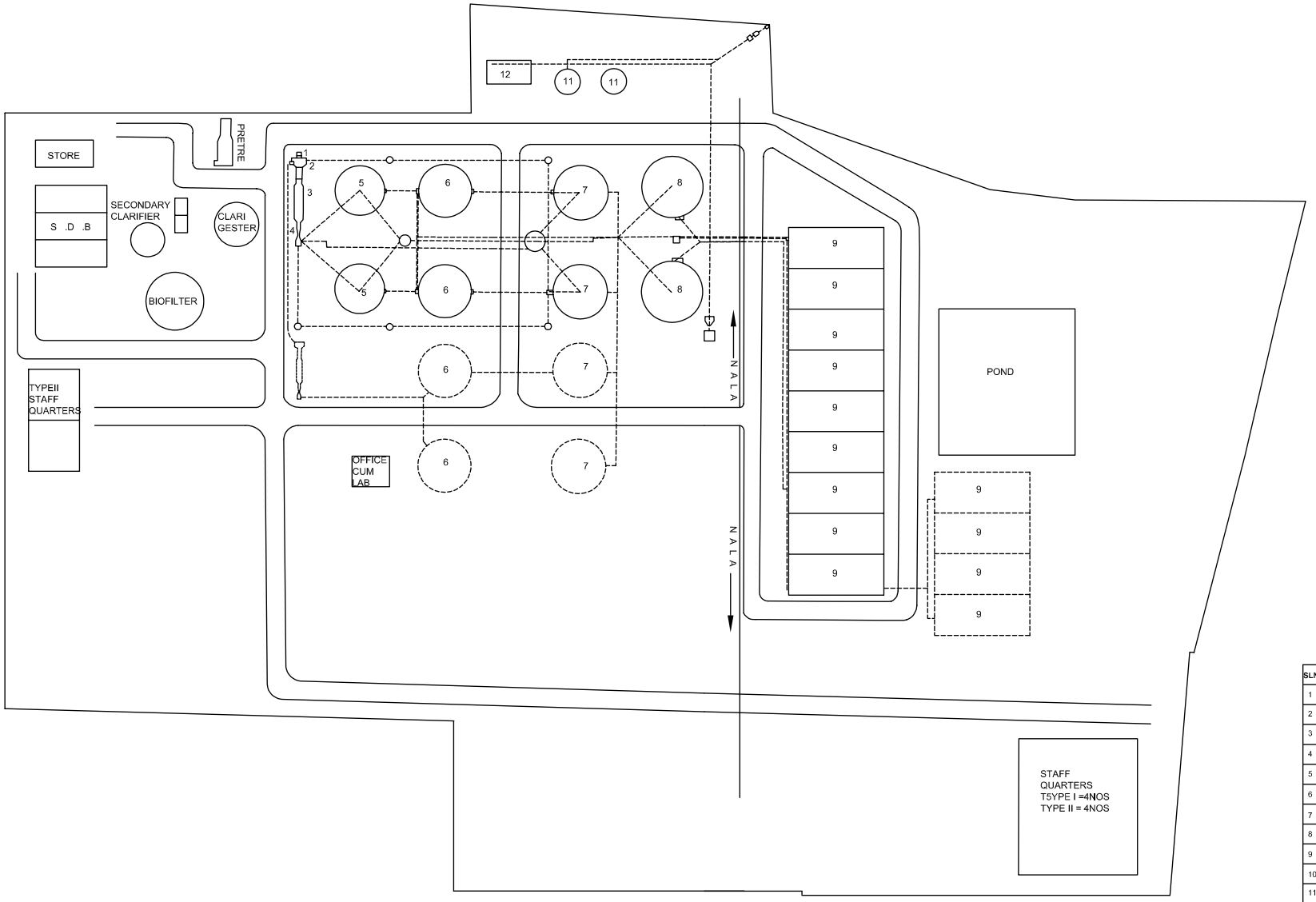
PROJECT—
GANGA POLLUTION PREVENTION PROJECT
B. H. U. VARANASI.

FILE—
LAY OUT PLAN OF B.H.U. S.T.P.

NO. | DATE | HEAD OF MAN

ASST. PROJ. ENGR. | PROJ. ENGR. | PROJ. MANAGER | REGIONAL MANAGER

APPENDIX C12 Bhagwanpur STP : Site plan existing



SL.NO.	PARTICULARS (EXISTING)	Q.T.Y	SIZE
1	INLET CHAMBER	1	1.2x1.2
2	BAR SCREEN CHANNEL	2	2.0 x 0.5 x 1.0
3	GRIT CHAMBER	2	7.15x1.2x1.30
4	PARSHALL FLUME	1	350MM
5	PRIMARY SETTLING TANK	2	14.6Øx3
6	AERATION TANK	2	15.6Øx3.5
7	SECONDARY SETTING TANK	2	16.0Øx3.5
8	DIGESTER	2	18.0Øx9.775
9	SLUDGE DRYING BEDS	9	28.0 X 12.0
10	RECIRCULATION PUMP CUM HOUSE	1	6.0 x 5.0
11	GAS HOLDER	2	7.5Øx4.0
12	ENGINE ROOM	1	15.5x8.5
13	GAS BURNER	1	-
14	PRIMERY SLUDGE PUMP CUM SUMP HOUSE	1	3.5x 3.5
15	FILTERATE SUMP CUM PUMP HOUSE	1	3.5 x 3.5

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO ENGINEERING CONSULTANTS CO., LTD.
CTI ENGINEERING INTERNATIONAL CO., LTD.

PROJECT	LOCATION	APPENDIX C 13
THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	BHAGWANPUR STP : SITE PLAN FOR AUGMENTED CAPACITY