Capacity Assessment of Water Supply System Managed by NWSC, WSMB and KUKL

(Improvement Plan)

December 2016

Sector Efficiency Improvement Unit
Ministry of Water Supply and Sanitation
Government of Nepal
Supported by JICA Nepal Office

EXECUTIVE SUMMARY

Improvement plan was made for 23 towns except Banepa, Pokhara and Kathmandu valley where improvement activity has been started through Kavre Valley Integrated Water Supply Project (GON fund), Pokhara Water Supply Improvement Project (JICA grant aid) and Melamchi Water Supply Development Projects (GON and ADB, JICA fund). Improvement plan only includes improvement of existing facilities. Extension work to meet future demand and/or extended area is not included. Improvement work mainly involves pipe replacement because it is either very old, unable to carry required flow or extension within service areas. Washouts with valve box are required in the large networks where people felt turbid or colored water. Most of the WSPs are in need of bulk meter. Some WSPs felt a need of additional wells or sources. Most of the WSPs have some kind of water testing kits and they wanted to establish a regular mini lab. Most of the WSP have some kind of chlorine dosing units but either it is not sufficient or it is not systematic. Therefore, the work to make the units functional is needed.

Total estimated cost for improvement plan of existing facilities is calculated as NRs 4.49 billion, as shown in Chapter 4. Summary of improvement cost. Of the total estimated amount, major cost is for pipe replacement and its total amount is NRs 4.24 billion. Other costs such as washout, bulk meter, additional source, mini lab and chlorination system etc. is NRs 0.25 billion only in total.

ABBREVIATIONS AND ACRONYMS

ADB	-	Asian Development Bank
BLP	-	Bleaching Powder
BM	-	Benchmarking
CR	-	Collection Ratio
CS	-	Consumer Survey
DDC	-	District Development Committee
DUDBC	-	Department of Urban Development and Building Construction
DWSS	-	Department of Water Supply and Sewerage
ENPHO	-	Environment & Public Health Organization
FRC	-	Free Residual Chlorine
FY	-	Fiscal Year
GIS	-	Geographic Information System
GON	-	Government of Nepal
HR	-	Human Resources
HQ	-	Headquarters
JICA	-	Japan International Cooperation Agency
KTM	-	Kathmandu
KUKL	-	Kathmandu Upatyaka Khanepani Limited
KVWSMB	-	Kathmandu Valley Waters Supply Management Board
LPCD	-	Litter Per Capita Per Day
LPS	-	Litter Per Second
MIS	-	Management of Information System
MLD	-	Million Litter Per Day
MWSDB	-	Melamchi Water Supply Development Board
MWSS	-	Ministry of Water Supply and Sanitation
NRs	-	Nepali Rupee
NRW	-	Non Revenue Water
NDWQS	-	Nepal Drinking Water Quality Standard
NWSC	-	Nepal Water Supply Corporation
NWSSTC	-	National Water Supply and Sanitation Training Centre
OHT	-	Overhead Tank
O&M	-	Operation and Maintenance
OR	-	Operating Ratio
PID	-	Project Implementation Directorate
PIs	-	Performance Indicators
RSF	-	Rapid Sand Filter
RT	-	Reservoir Tank
SEIU	-	Sector Efficiency Improvement Unit

SH	-	Service Hours
SOP	-	Standard Operation Procedure
ST	-	Sedimentation Tank
VDC	-	Village Development Committee
WQ	-	Water Quality
WS	-	Water Supply
WSMB	-	Water Supply Management Board
WSTFC	-	Water Supply Tariff Fixation Commission
WSP	-	Water Supply Provider
WSSDO	-	Water Supply and Sewerage District Office
WTP	-	Water Treatment Plant
WUSC	-	Water Users and Sanitation Committee

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CHAPTER 1 BACKGROUND

As a part of capacity assessment, discussion meeting was held with team of service providers and necessary improvement works were identified. Improvement works mainly involves pipe replacement because it is either very old, unable to carry required flow or extension within service areas. Washouts with valve box are required in the large networks where people felt turbid or coloured water. Most of the WSP in need of bulk meter but only some realized. Some WSP felt a need of additional wells or sources. Most of the WSP have some kind of water testing kits and they wanted to establish a regular mini lab. Most of the WSP have some kind of chlorine dosing units but either it is not sufficient or it is not systematic.

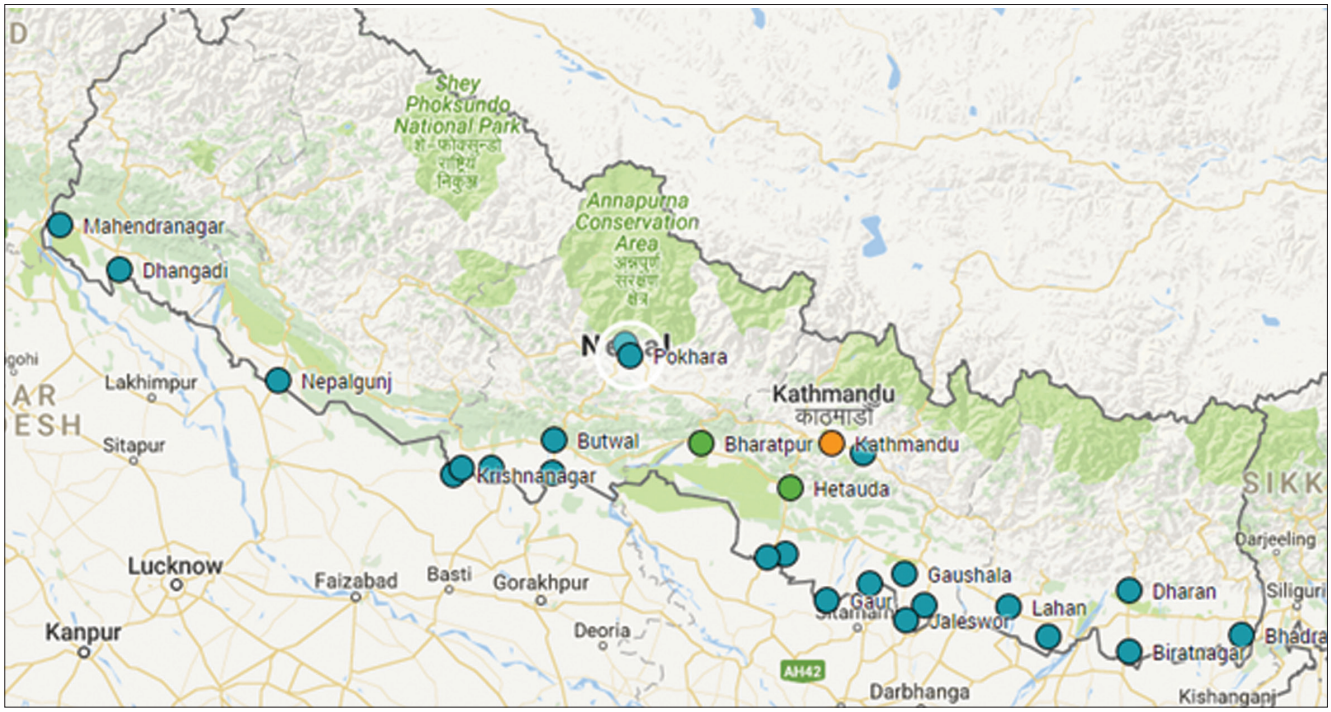
Extension works are mainly to meet future demand of existing area or to provide water supply to the extended area of municipalities or the city centre.

This augmentation program will enhance production capacity and meet the growing water demand. WSP will have more coverage area for service and that will ultimately increase the capacity for the necessary private tap as required by the consumers. With the supply of improved system and required quality water NWSC will be in a position to increase the tariff and recover the losses of expenditures from the revenue generation.

Improvement plan also includes improvement of water treatment system supported by JICA Nepal in six towns: Bhadrapur, Rajbiraj, Lahan, Gaushala, Bharatpur and Mahendranagar.

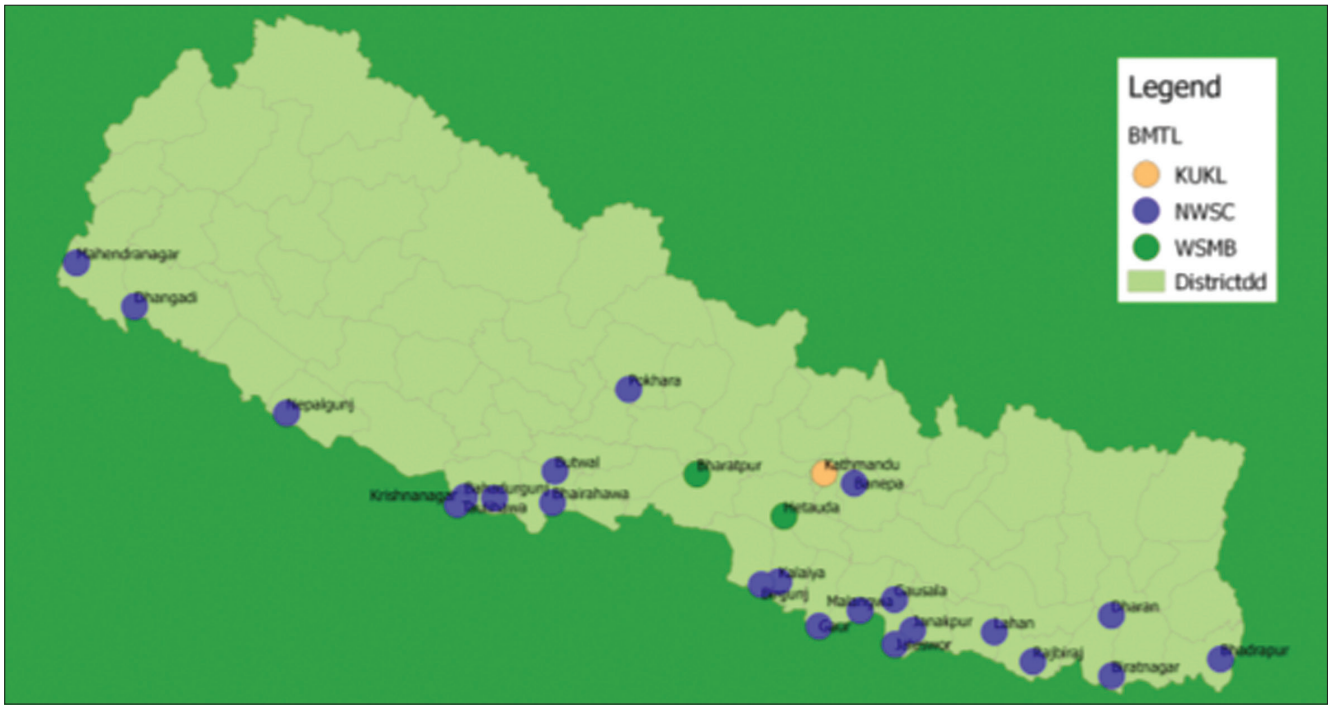
Unit rate used for the improvement plan is based on average of unit rate used by the small town projects of DWSS which are under implementation now.

CHAPTER 2 LOCATION MAP



Location of Participating WSPs (Office) in Google Map

From East: Bhadrapur, Biratnagar, Dharan, Rajbiraj, Lahan, Janakpur, Jaleswor, Gaushala, Malangwa, Gaur, Kalaiya, Birgunj, Hetauda, Bharatpur, Pokhara, Hemja, Bhairahawa, Butwal, Taulaiwa, Bahadurgunj, Krishnanagar, Nepalgunj, Dhangadi, Mahendranagar. Kathmandu, Banepa.



Location of WSP (Office) with BM data in QGIS map

CHAPTER 3 LIST OF WSP COVERED IN THIS ASSESSMENT

List of management organization and GPS location

S.N	Town	District	Category	Latitude	Longitude
1	Bhadrapur	Jhapa	NWSC	26.560093	88.033181
2	Biratnagar	Morang	NWSC	26.457230	87.286396
3	Dharan	Sunsari	NWSC	26.82781	87.284863
4	Rajbiraj	Saptari	NWSC	26.544805	86.745733
5	Lahan	Siraha	NWSC	26.726613	86.480287
6	Janakpur	Dhanusha	NWSC	26.737171	85.920171
7	Jaleshwor	Mahottari	NWSC	26.651101	85.799123
8	Gausala	Mahottari	NWSC	26.924792	85.795218
9	Malangwa	Sarlahi	NWSC	26.859332	85.55957
10	Gaur	Rautahat	NWSC	26.76285	85.27788
11	Kalaiya	Bara	NWSC	27.0348	85.00211
12	Birgunj	Parsa	NWSC	27.017307	84.882853
13	Hetauda	Makawanpur	WSMB	27.434834	85.037602
14	Bharatpur	Chitwan	WSMB	27.690074	84.439631
15	Pokhara	Kaski	NWSC	27.205377	83.970975
16	Hemja	Kaski	NWSC	27.278624	83.93245
17	Butwal	Rupandehi	NWSC	27.709196	83.46504
18	Bhairahawa	Rupandehi	NWSC	27.518080	83.448188
19	Taulihawa	Kapilbastu	NWSC	27.544781	83.049947
20	Bahadurgunj	Kapilbastu	NWSC	27.551937	82.844387
21	Krishnanagar	Kapilbastu	NWSC	27.507056	82.794506
22	Nepalgunj	Banke	NWSC	28.061113	81.623131
23	Dhangadhi	Kailali	NWSC	28.706305	80.578755
24	Mahendranagar	Kanchanpur	NWSC	28.967939	80.180359
25	Banepa	Kavre	NWSC	27.63527	85.51996
26	Kathmandu	Kathmandu	KUKL	27.69625	85.31368

List of WSP with sources, coverage and connections

S.N	Town	Sources			Total Population	Population Served	No. of taps
		Surface	Ground	Tested			
1	Bhadrapur		4	4	22000	12062	1822
2	Biratnagar		10	10	250000	62018	11156
3	Dharan	3	5	8	125000	123013	16601
4	Rajbiraj		3	3	37000	17000	2296
5	Lahan		5	5	40000	16583	2478
6	Janakpur		3	3	155000	21408	3253
7	Jaleshwor		2	2	31827	6312	789
8	Gausala		1	1	3200	3003	546
9	Malangwa		2	2	30000	7122	1079
10	Gaur		3	3	34937	8735	1108
11	Kalaiya		2	2	42000	11165	1447
12	Birgunj		6	6	204000	52395	7242
13	Hetauda	4	13	17	82000	78337	11184
14	Bharatpur		24	24	239292	96360	17493
15	Pokhara	6	5	11	300000	208026	35260
16	Hemja	2		2	21600	21000	202
17	Bhairahawa		6	6	68473	30056	3626
18	Butwal	2	13	15	138742	86213	14464
19	Taulihawa		2	2	15000	5712	820
20	Bahadurgunj		1	1	10700	3848	433
21	Krishnanagar		2	2	30000	6060	990
22	Nepalgunj		3	3	75000	24234	4054
23	Dhangadhi		7	7	36000	26220	4469
24	Mahendranagar		4	4	48936	11298	2002
25	Banepa	5		5	71099	23397	3309
	Sub Total	**22**	**126**	**148**	**2111806**	**961576**	**148123**
26	Kathmandu	35	59	21	2560000	2059940	199416

List of system information

S.N	Town	Pipes(Km)	Taps/Km	Age of oldest pipe (as of 2072 (2015)	Water Treatment Plant
1	Bhadrapur	48.7	37	46	ST/RSF(partial)
2	Biratnagar	210.25	53	35	PF(partial)
3	Dharan	202	82	35	FL/ST(partial)
4	Rajbiraj	34.6	66	46	RSF
5	Lahan	46.1	54	34	ST
6	Janakpur	30.7	106	26	None
7	Jaleshwor	21.82	36	34	None
8	Gausala	15.2	36	29	None
9	Malangwa	11.7	92	32	None
10	Gaur	24.05	46	38	None
11	Kalaiya	31.2	46	37	None
12	Birgunj	139.125	52	50	None
13	Hetauda	210	53	42	PF(Partial)
14	Bharatpur	445.3	39	39	None
15	Pokhara	243	145	40	None
16	Hemja	171	1	32	None
17	Butwal	112	129	40	FL/ST/RSF(Partial)
18	Bhairahawa	69.98	52	48	PF(Partial)
19	Taulihawa	17	48	39	None
20	Bahadurgunj	20.3	21	37	None
21	Krishnanagar	25.1	39	39	None
22	Nepalgunj	105	39	41	None
23	Dhangadhi	50	89	40	None
24	Mahendranagar	30.957	65	40	RSF(Partial)
25	Banepa	61.62	54	26	RF/ST(Partial)
26	Kathmandu	1629	122	116	Various(Partial)

Note: *FL=Flocculation, ST= Sedimentation, RSF= Rapid Sand Filter, PF= Pressure Filter, RF=Roughing Filter, Partial= Part of the production treated.*

CHAPTER 4 SUMMARY OF IMPROVEMENT COST

Estimated cost for improvement activity is summarised in the following list.

S.N	Name of Town	Pipe Replacement (Million NRs.)	Other improvement cost** (Million NRs.)	Total cost (Million NRs.)
1	Bhadrapur	60.0	1.8	61.8
2	Biratnagar	210.0	22.3	232.3
3	Dharan	180.0	20.8	200.8
4	Rajbiraj	13.0	2.1	15.1
5	Lahan	14.0	0.7	14.7
6	Janakpur	10.0	2.4	12.4
7	Jaleshwor	5.0	1.8	6.8
8	Gausala	7.5	1.4	8.9
9	Malangwa	12.0	1.9	13.9
10	Gaur	13.5	2.9	16.4
11	Kalaiya	90.0	3.2	93.2
12	Birgunj	600.0	8.0	60.8.0
13	Hetauda	240.0	97.9	337.9
14	Bharatpur	1,000.0	4.1	1,004.1
15	Hemja	960.0	3.2	963.2
16	Butwal	294.0	21.4	315.4
17	Bhairahawa	42.0	6.4	48.4
18	Taulihawa	30.0	6.3	36.3
19	Bahadurgunj	24.0	4.3	28.3
20	Krishnanagar	24.0	1.1	25.1
21	Nepalgunj	150.0	3.5	153.5
22	Dhangadhi	240.0	25.4	265.4
23	Mahendranagar	18.0	6.0	24.0
	Total	**4,237.0**	**248.7**	**4,485.7**

** Other improvement cost includes washout with valve box, meter replacement, Laboratory equipment, chlorine dosing system, bulk meter, pressure gauge, booster pump, well installation etc.

CHAPTER 5 TOWN WISE IMPROVEMENT PLAN

5.1 Improvement plan: NWSC Bhadrapur

Introduction:

Bhadrapur water supply system was operated and maintained by Department of Water Supply and Sewerage since 2026. JICA has improved system in 2046 adding one water treatment unit and two new wells in the system. This treatment plant includes sedimentation and rapid sand filtration unit along with a ground clear water tank. In 2056 it was formally handover to the NWSC for operation. Bhadrapur municipality is small and one of the old municipalities of the country. It is located close to Indian boarder and not so populated which is spread over an area of 4.6 square kilometres. The system is running well in terms of quantity of water, supply hours and quantity of water to the consumers. Out of 10 wards 2 wards (1 & 3) are not covered yet with this system. Recently Chadragadhi the district head quarter of Jhapa has been merged in it where a separate water supply system is there and managed by water user's committee.

The old pipes have become a cause of contamination in some locations of its service area. Single pipe line system along the road side of the town seems to be another problem to the consumer for interruption of supply and getting contaminated because of pot holes on the road surfaces and reoccurring damages of roads.

Improvement works:

There is need for improving existing system and reduce leakage, contamination and better serviceability. This requires replacing 10 Km pipes (3"-6"), 10 Km new pipe laying for double line, add meter in public taps, and 20 washouts.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (3"-10")	m	10,000	6,000	60,000,000
2	Washouts with valve box	No	20	50,000	1,000,000
3	Meter replacement	No	47	6,000	282,000
4	Lab equipment	LS	1	200,000	200,000
5	Chlorine dosing	No	1	150,000	150,000
6	Bulk meter, pressure gauge, etc	Set	1	200,000	200,000
	Total				**61,832,000**

Extension works:

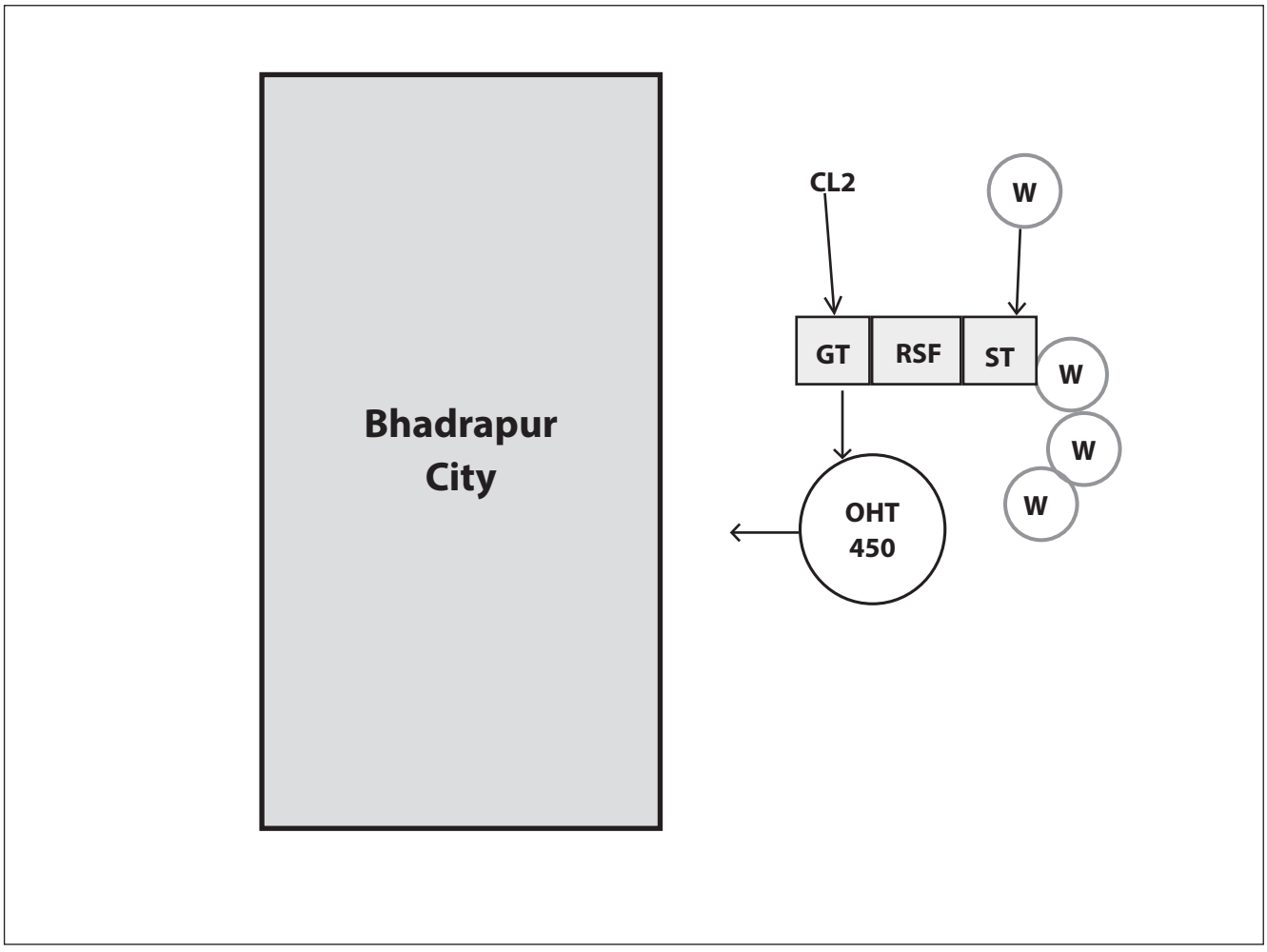
There is need for increasing production and extending networks for the unreached area of ward no 1 and 2. This requires construction of one well and one OHT (250m^3) and pipelines (2"-3") for 5km. This area is likely to contained with Iron hence pressure filter is required.

Data Profile:

Water Utility	WSP	NWSC - Bhadrapur (Jhapa)		
	Telephone	023-520983	Email: nwscbhadrapur1@gmail.com	
	Head	Abadh Narayan Shah		
	Service Area (Wards)	Bhadrapur-2, 4-10		
	No of staff	22	Staff per (1000) Taps	12
	Population Covered	12062	WS Coverage (%)	55
Mission Statement				
Service Connection	Total Taps	1822	Private Taps	1723
	Public Taps	47	Metered Taps	1775
	New Connections in FY	140	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	1.3	Users satisfied (%)	100
	No of break/Km/Yr	49	Supply hours	9
Water Production	Production (m^3/day)	1382	NRW (%)	24
	Consumption (LPCD)	87	Production (LPCD)	115
Revenue and Expenses	Annual O&M Cost (NRs)	10614692	Annual billing (NRs)	7199759
	Collection Ratio	1.0	Operating Ratio	1.5
	Cost/m^3 of water used	28	Average billing (NRs/M)	338
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	19	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			240(100)
	No of sample tested for biological parameters (% passed)			240(100)
	No of sample tested for FRC (% passed)			240(100)

Water Qualities at taps:

Bhadrapur Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**148**	**149**	**150**	**151**	**152**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	**<0.5**
2	Turbidity	NTU	5 (10)	1	<1.0	<1.0	<1.0	<2.0
3	pH	-	6.5 - 8.5*	6.9	7	7	7	**7**
4	Temperature	^{0}C	-	24.5	24.6	24.5	24.4	24.5
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.02	0.02	0.02	0.1	0.09
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	0.03	<0.02
8	Nitrite	mg/l as NO_3	50	0.6	0.53	0.56	0.36	0.53
9	Iron	mg/l	0.3 (3)	0.03	0.04	0.05	0.03	0.26
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.6	0.58	0.86	0.82	0.18
12	E. Coli	CFU/100ml	Nil	**100**	**30**	**13**	**8**	**65**



ST: Sedimentation Tank, RSF: Rapid Sand Filter, GT: Ground Tank, OHT: Over Head Tank,
Cl2= Chlorination Unit, W= Tubewell

5.2 Improvement plan: NWSC Biratnagar

Introduction:

Biratnagar Water Supply Project was initially constructed by Department of Water Supply and Sewerage in 2037. An elevated tank of 450m^3 capacity was constructed in Tinpaini and started it's service to the people of Biratnagar. This system was maintaining the supply of water for a long time. With the growth of the population of this sub metropolitan city, two new elevated tanks were constructed of 500 m3 at Devkota Chowk and at Rani. A further three new wells were added to meet the demand of growing populations of the city. These wells are also maintaining the online supply in the system. The present supply of water is also not sufficient when it comes to compare with the demand of current population and its coverage of the supply. A new elevated tank is under construction of 450m^3 at Munal Path. Hence, Biratnagar has a combination of old as well as new systems along with 210 km of distribution networks in the city. Rani production unit has pressure filter plant and remaining systems have no any other treatment facilities. Biratnagar sub metropolitan municipality is since two years back upgrading its services like sewer construction works and at the same time the department of roads also constructing six lane road in Biratnagar. These ongoing work currently obstructing the supply and get interrupted in many locations. Replacement of pipes and extension works are carried out without any design and drawings in most of the branches for existing systems.

Improvement works:

System is in need of replacing bout 100km old pipes (6"-12") of which 65 km will be replaced by UEIP project as a part of road improvement. About 400 valve chamber is needed for zoning and washouts. All seven stations need systematic chlorine dosing. Three stations Pichara, Munal and BFM needs pressure filters.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (4"-6")	m	35,000	6,000	210,000,000
2	Washouts with valve box	No	400	50,000	20,000,000
3	Lab equipment and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	7	100,000	700,000
5	Bulk meter, pressure gauge, etc	Set	7	200,000	1,400,000
	Total				**232,300,000**

Extension works:

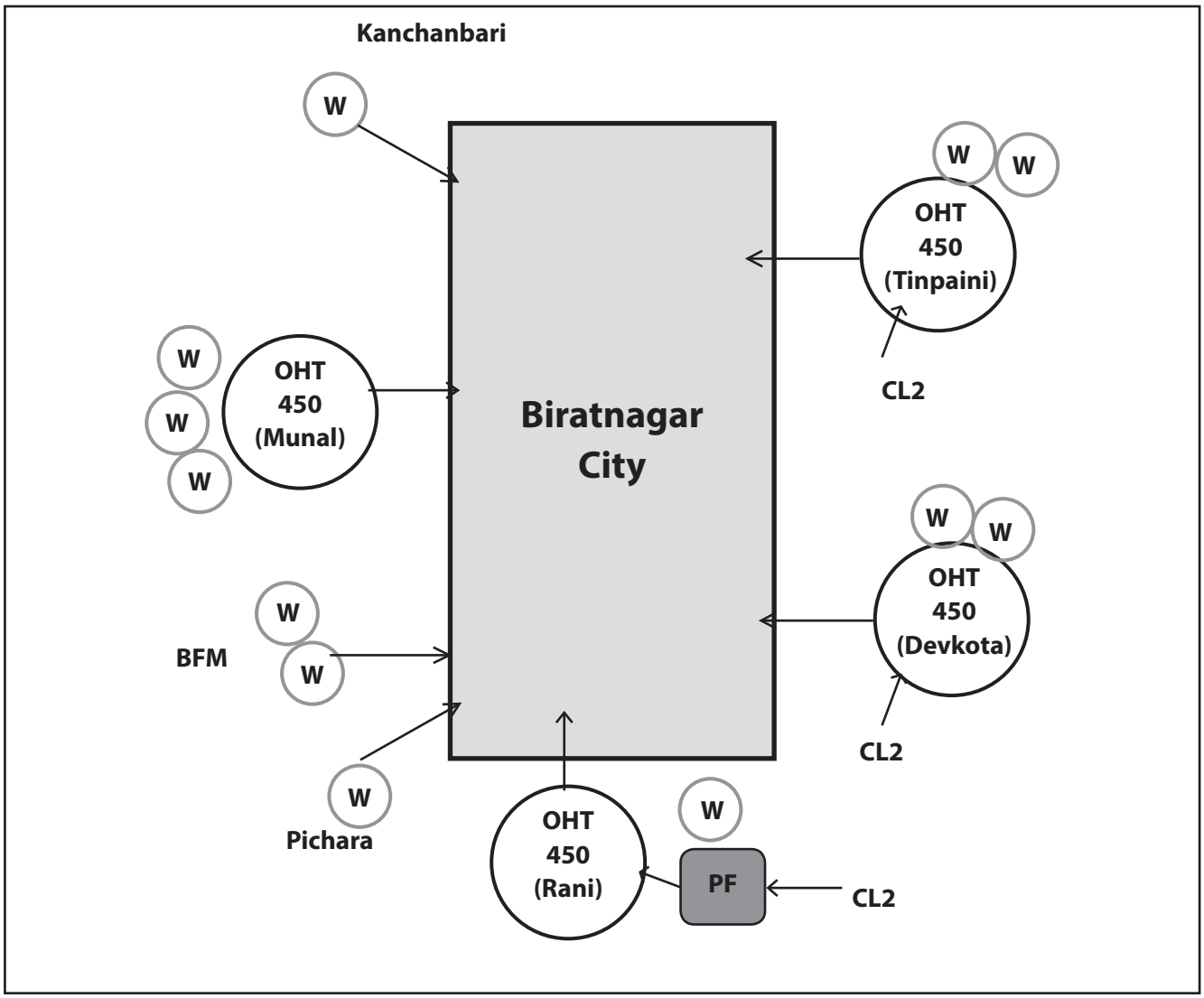
System is in need to extending services in new area: wards1, 5, 6, 7, 11, 13, 15, 16, 17, 18, 22. Six wells and 30 km pipe line and 60 valve chambers are required. This will add about 3000 new taps.

Data Profile:

Water Utility	WSP	NWSC - Biratnagar (Morang)		
	Telephone	021-523329	Email: srauni@gmail.com	
	Head	Santosh Rauniyar		
	Service Area (Wards)	Wards: 1-11		
	No of staff	44	Staff per (1000) Taps	4
	Population Covered	62018	WS Coverage (%)	25
Mission Statement				
Service Connection	Total Taps	11156	Private Taps	10975
	Public Taps	24	Metered Taps	11132
	New Connections in FY	245	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	3.7	Users satisfied (%)	70
	No of break/Km/Yr	210	Supply hours	11
Water Production	Production (m^3/day)	10860	NRW (%)	42
	Consumption (LPCD)	102	Production (LPCD)	175
Revenue and Expenses	Annual O&M Cost (NRs)	26994118	Annual billing (NRs)	38165450
	Collection Ratio	0.9	Operating Ratio	0.7
	Cost/m3 of water used	12	Average billing (NRs/M)	286
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	16	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			108(100)
	No of sample tested for biological parameters (% passed)			108(56)
	No of sample tested for FRC (% passed)			108(67)

Water Qualities at taps:

Biratnagar Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**127**	**128**	**129**	**130**	**131**
1	Color	Hazen	5 (15)	<5.0	5	<5.0	<5.0	5
2	Turbidity	NTU	5 (10)	<1.0	**6**	2.0	1.0	3
3	pH	-	6.5 - 8.5*	7	6.9	7.3	7	7.3
4	Temperature	^{0}C	-	24.1	24.1	24.1	24	24.1
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	0.2
6	Ammonia	mg/l	1.5	0.12	0.26	0.23	0.1	0.25
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.19	<0.02v	0.09	0.07	0.15
9	Iron	mg/l	0.3 (3)	0.01	**0.48**	0.16	0.15	0.17
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.47	<0.02	0.79	0.6	0.52
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	Nil	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.3 Improvement plan: NWSC Dharan

Introduction:

The piped water supply system in Dharan had been operated by Municipality since 2037. Later on in 2046 this system was hand over to NWSC. This water supply system has been upgraded by different donors during this period also. At present the water supply is not sufficient to meet the demand of growing population and other development of the municipality. Combination of Streams and ground water sources has been maintaining the supply of water to the consumers. The dry period production rate drops significantly creating a scarce situation in the distribution systems. Because of low flow rate from the stream sources in this period NWSC cuts the supply during dry period and maintain the supply in alternate day only which is creating severe situation for uniform distribution. The terrain of Dharan also affects the distribution systems in terms of supply and consequently most of the clusters have different flow rate and pressure. Apart from this there are losses because of old pipe networks. The current production rate in wet season is found to be 25 MLD where as in dry period it falls down up to 11 MLD. All most all potential sources have been taped so far and consumers do not have any other alternate source to use. In this situation the improvement of existing system with replacement of new pipes for old networks will reduce the losses and increase the supply to some extent to the consumers. Additional source is urgent to be explored to meet the growing demand of the municipality.

Improvement works:

System is in need of replacing bout 30km old pipes (4"-10"), adding chlorine dosing units and adding 100 numbers of washout valves with chamber. This will add about 4000 new taps.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (4"-10")	m	30,000	6,000	180,000,000
2	Washouts with valve box	No	100	200,000	20,000,000
3	Lab equipment and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	1	50,000	50,000
5	Bulk meter, pressure gauge, etc	Set	1	500,000	500,000
	Total				**200,750,000**

Extension works:

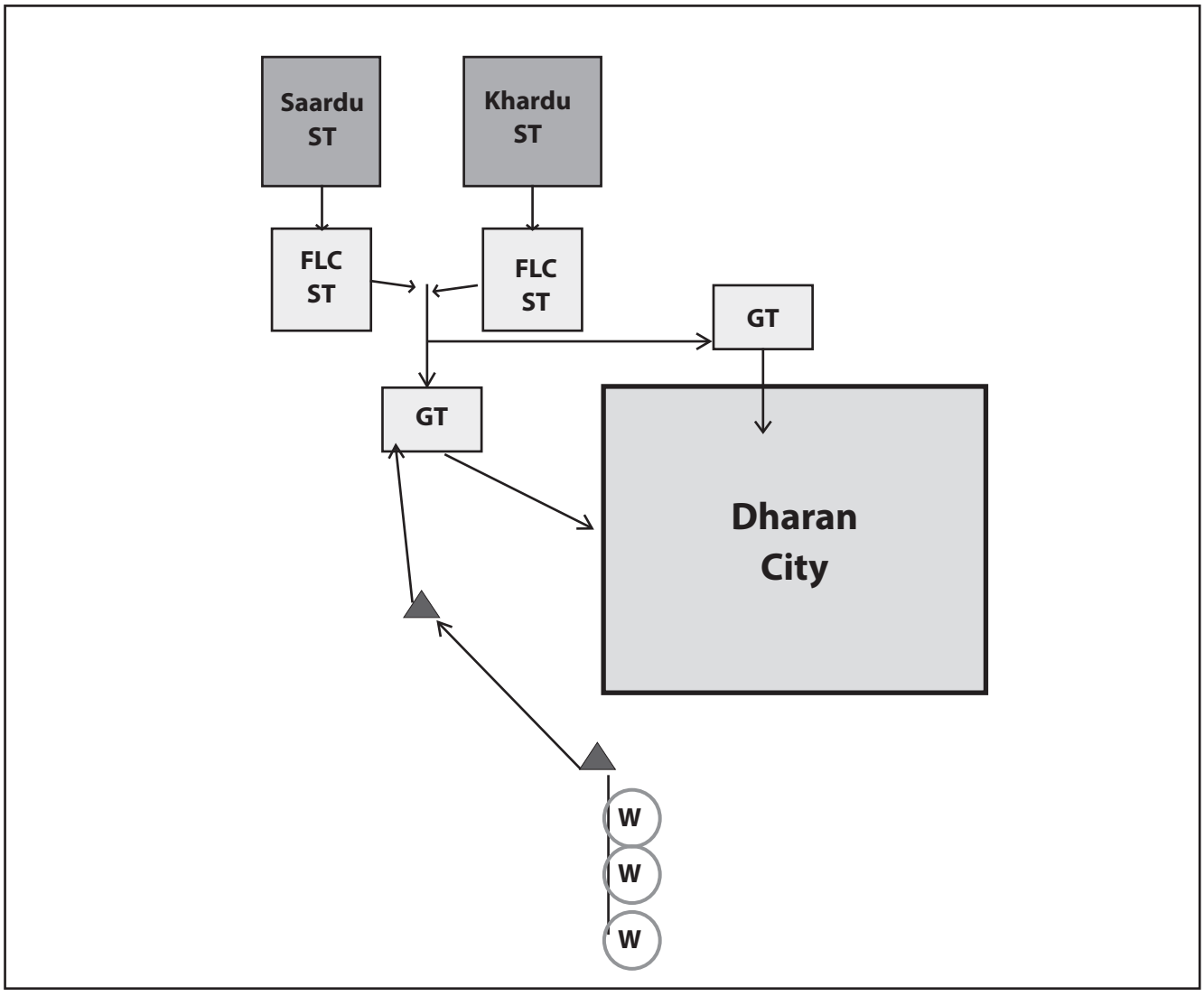
Similarly, there is need for adding new sources for meeting demand in the wet season and extension of services in the new area of the municipality. One possibility is from the Chatara (Koshi) which involves 15km transmission line through three stages pumping for lifting 300m. This also requires pipe line extension of 150km (4-10") and about 6000 m^3 tanks divided in to three locations. For climate resilient catchment area of Sardu source spread into 6km^2 area needs conservation which has already been evacuated.

Data Profile:

Water Utility	WSP	NWSC - Dharan (Sunsari)		
	Telephone	025-520400	Email: ersksshah@yahoo.com	
	Head	Sailendra Sah		
	Service Area (Wards)	Wards: 1-19		
	No of staff	60	Staff per (1000) Taps	4
	Population Covered	123013	WS Coverage (%)	98
Mission Statement				
Service Connection	Total Taps	16601	Private Taps	16286
	Public Taps	304	Metered Taps	16293
	New Connections in FY	784	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	1.8	Users satisfied (%)	60
	No of break/Km/Yr	202	Supply hours	5
Water Production	Production (m^3/day)	15000	NRW (%)	42
	Consumption (LPCD)	71	Production (LPCD)	122
Revenue and Expenses	Annual O&M Cost (NRs)	52511000	Annual billing (NRs)	71364147
	Collection Ratio	1.0	Operating Ratio	0.7
	Cost/m^3 of water used	17	Average billing (NRs/M)	365
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	22	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Dharan Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**108**	**109**	**110**	**111**	**112**
1	Color	Hazen	5 (15)	<5.0	5	<5.0	5	<5.0
2	Turbidity	NTU	5 (10)	**7.0**	**18.0**	2.0	**9.0**	<1.0
3	pH	-	6.5 - 8.5*	7	7	6.8	7	6.8
4	Temperature	^{0}C	-	24.3	24.4	24.5	24.5	24.3
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.06	0.06	<0.02	0.05	<0.02
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	1.8	2	4.6	2.1	4.7
9	Iron	mg/l	0.3 (3)	0.11	**0.46**	0.05	0.15	<0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.19	0.11	<0.02	0.15	0.06
12	E. Coli	CFU/100ml	Nil	**115**	**22**	**5**	**59**	**56**



OHT: Over Head Tank, GT= Ground Tank, FLC= Flocculation Chamber, ST= Sedimentation Tank, Cl2= Chlorination Unit, W= Tubewell

5.4 Improvement Plan: NWSC Rajbiraj

Introduction:

Rajbiraj Water Supply Project was initially constructed by the Indian Government to fulfil the demand of pipes water system in the town in 2026 It was further operated by Department of Water Supply and Sewerage. In 2056 this system was handover to NWSC for the operation. This town is one of the oldest municipalities of the country that lies on the south of east west highway. Coverage of this system has been found to be spread over areas of 5.5 km^2. Out of ten wards, eight wards have been covered by this system. As per the present coverage of data of NWSC only 41 percent population of this municipality has piped water supply and the demand is in increasing trend. Supply hours are one time in the morning and one time in the evening. Total supplied water is for 3.5 hours only. Ground water has been used for this system which is heavily containing iron. This system was designed to treat the iron problem also and a treatment plant has been constructed with series of unit operation of aeration, sedimentation and rapid sand filter. This plant could not function properly as it was envisaged in the designed and problem of iron had become a challenging problem for long time. JICA supported this system for the improvement and treatment facilities in 2046. At present NWSC is operating the plant and maintaining the water supply to the consumer. Although the system has been maintained by the NWSC since 2056 but still it is not well managed in term of quality, service deliver and coverage.

Improvement works:

System is in need of replacing about 13km old pipes (2" HDPE), changing two booster pumps, adding chlorine dosing units and 15 numbers of washout valves with chamber. This will add about 500 new taps.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	13,000	1,000	13,000,000
2	Washouts with valve box	No	15	50,000	750,000
3	Chlorine dosing	No	1	50,000	50,000
4	Lab equipment	Set	1	200,000	200,000
5	Bulk meter, pressure gauge, etc	Set	1	100,000	100,000
6	Booster pump	No	2	500,000	1,000,000
	Total				**15,100,000**

Extension works:

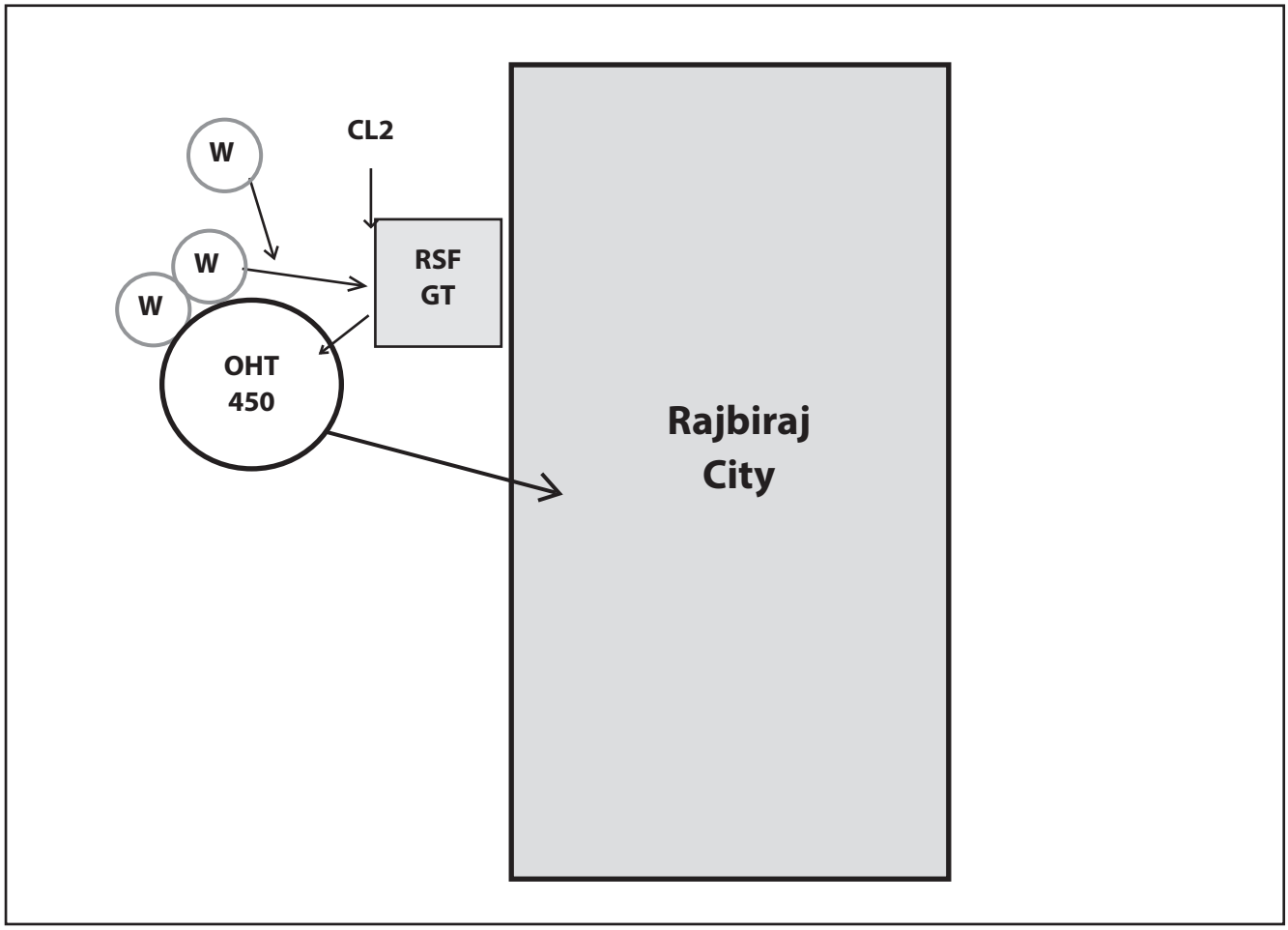
There is need for extension of services in the Ward 2, 10, 5 and 8. One OHT (450 m^3) and additional wells has been planned in ward 2. About 10 km pipes for ward 10.2km for ward 5 and 1.5 km for ward 8 is needed ranging from 3"-4". This augmentation works will enable to NWSC Rajbiraj to increase around 1200 new tap connection in the system and the revenues.

Data Profile:

Water Utility	WSP	NWSC - Rajbiraj (Saptari)		
	Telephone	031-521254	Email: bariyaitajay@gmail.com	
	Head	Narendra Kumar Lal Karna		
	Service Area (Wards)	Wards: 1,3-10		
	No of staff	18	Staff per (1000) Taps	8
	Population Covered	17000	WS Coverage (%)	46
Mission Statement				
Service Connection	Total Taps	2296	Private Taps	2135
	Public Taps	79	Metered Taps	2076
	New Connections in FY	66	Disconnectons in FY	19
Customer Service	Complains/100 Taps/Yr	6.2	Users satisfied (%)	90
	No of break/Km/Yr	35	Supply hours	3.5
Water Production	Production (m^3/day)	1944	NRW (%)	36
	Consumption (LPCD)	73	Production (LPCD)	114
Revenue and Expenses	Annual O&M Cost (NRs)	11044636	Annual billing (NRs)	5288845
	Collection Ratio	1.0	Operating Ratio	2.1
	Cost/m^3 of water used	25	Average billing (NRs/M)	199
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	12	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			24 (100)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			24 (75)

Water Qualities at taps:

Rajbiraj Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**61**	**62**	**63**	**64**	**65**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	5.0	1.0	1.0	1.0	1.0
3	pH	-	6.5 - 8.5*	7.1	6.9	6.9	7	6.9
4	Temperature	^{0}C	-	25	25.1	25.1	25.2	25.2
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.13	0.06	<0.02	<0.02	0.02
7	Nitrite	mg/l as NO_2	3	0.02	0.04	0.02	0.05	<0.02
8	Nitrite	mg/l as NO_3	50	1.2	0.77	0.7	0.81	0.81
9	Iron	mg/l	0.3 (3)	0.18	0.03	0.05	0.02	0.02
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.5	0.54	0.53	0.63	0.62
12	E. Coli	CFU/100ml	Nil	**7**	**5**	**1**	**5**	**>300**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.5 Improvement Plan: NWSC Lahan

Introduction:

Lahan Water Supply Project was completed in 2038 by Department of Water Supply and Sewerage. Further the system was upgraded by JICA with water treatment facilities and two new wells. This system was operated by the DWSS up to the fiscal year 2055 and handed over to the NWSC in 2056 for further operation. At present the Lahan Municipality has altogether 22 wards and out of 22 only 10 wards have access of piped water supply. Core populated areas are expanded along the east west highway. Old Lahan Bazar is on the northern side of the highway where NWSC office is located. Although the newly added wards are scattered but this existing system covers the area of 6.6 Km^2 only. As per the population coverage only 41 percent of the demand has been met so far. NWSC Lahan is planning for future extension of its service area to increase the consumer and sales. This system has altogether five wells and all of them are in use. Some of these wells have sediment problems that chock the pipe networks during low pressure flow and consumers are using turbid water some times. Some of the service areas are facing problems with contaminated water because of drainage suction during non-supply hours. Based on the service provided by the NWSC Lahan and the quality of the water available at the tap, service provider has to improve its quality of service in terms of quality of water and increase its production to cope up the demand minimizing the leakages for pollution control and the losses.

Improvement works:

There is in need of replacing 20 km (2"-4"), installing about 15 number of wash out valves for equitable water distribution purpose. There is bulk meter in two new wells and same is needed for the four wells used in the office production units. This improvement of existing system will enable the NWSC to increase its capacity for the connections of 2000 more taps in the system.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	20,000	700	14,000,000
2	Washouts with valve box	No	15	25,000	375,000
3	Lab equipment and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	1	50,000	50,000
5	Bulk meter, pressure gauge, etc.	Set	1	100,000	100,000
	Total				**14,725,000**

Extension works:

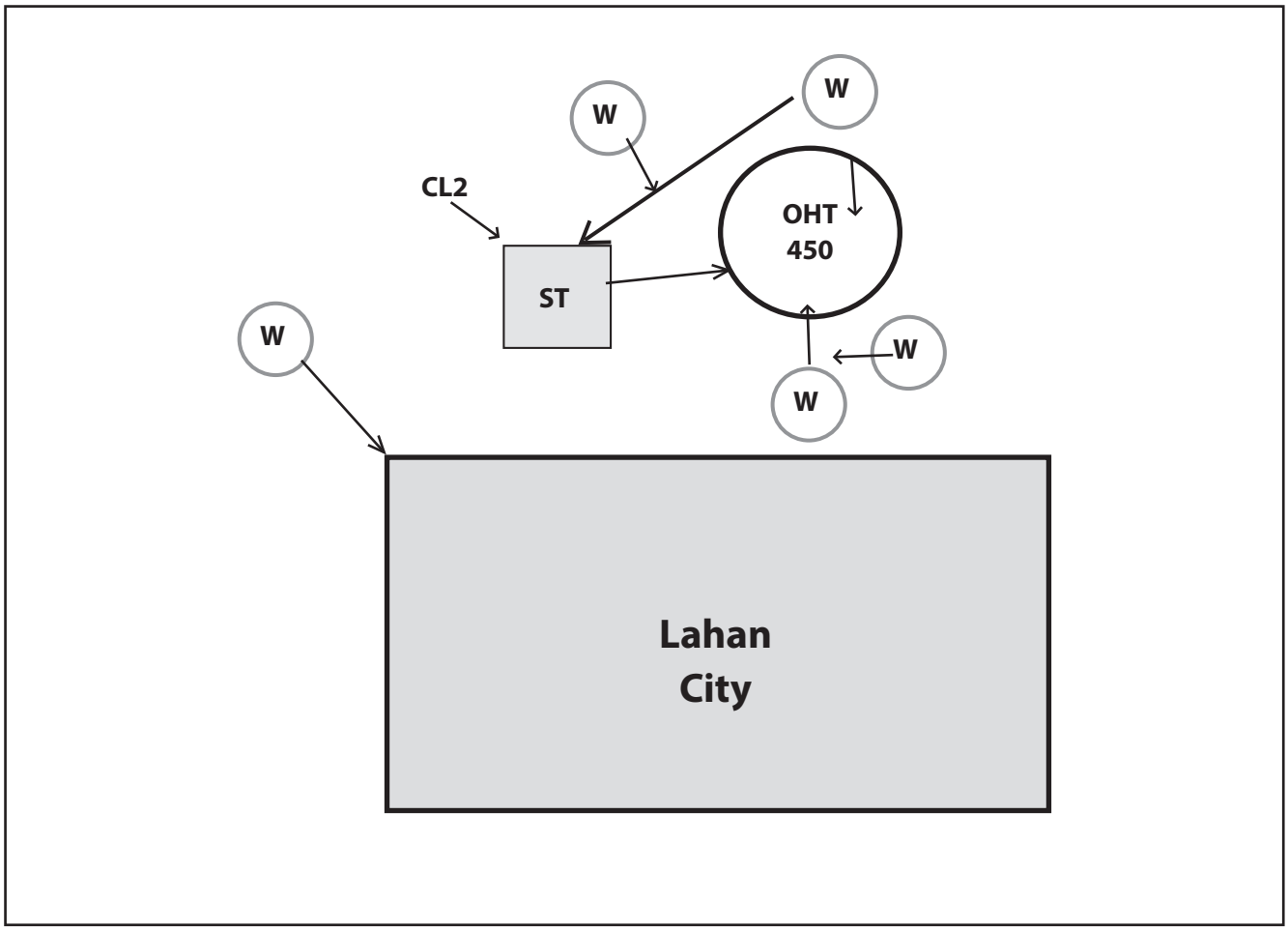
Similarly, there is need of 450 m^3 tank and 5km trunk line and 217 km distribution lines for extending services to all in the existing service area of ward 1-10. This will add about 4000 taps.

Data Profile:

Water Utility	WSP	NWSC - Lahan (Siraha)		
	Telephone	033-560931	Email: binodmishra33382@gmail.com	
	Head	Binod Kumar Mishra		
	Service Area (Wards)	Lahan 1-10 out 22		
	No of staff	19	Staff per (1000) Taps	8
	Population Covered	16583	WS Coverage (%)	41
Mission Statement				
Service Connection	Total Taps	2478	Private Taps	2390
	Public Taps	56	Metered Taps	2382
	New Connections in FY	426	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	2.6	Users satisfied (%)	47.2
	No of break/Km/Yr	46	Supply hours	5
Water Production	Production (m^3/day)	2090	NRW (%)	45
	Consumption (LPCD)	69	Production (LPCD)	126
Revenue and Expenses	Annual O&M Cost (NRs)	8075000	Annual billing (NRs)	7069650
	Collection Ratio	0.9	Operating Ratio	1.1
	Cost/m^3 of water used	19	Average billing (NRs/M)	243
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	15	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Lahan Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**21**	**22**	**23**	**24**	**25A**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	5.0
2	Turbidity	NTU	5 (10)	1	1	**13.0**	3.0	**50.0**
3	pH	-	6.5 - 8.5*	7	7.1	7.1	7.1	6.7
4	Temperature	^{0}C	-	24.7	24.9	24.8	24.7	25.1
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	0.2	**Nil**
6	Ammonia	mg/l	1.5	0.06	0.04	0.12	0.09	0.64
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	0.02	<0.02	0.03
8	Nitrite	mg/l as NO_3	50	1.3	1.3	1.1	1.3	0.26
9	Iron	mg/l	0.3 (3)	0.18	0.18	**0.63**	0.16	**2.2**
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.1	0.17	0.16	<0.02	0.54
12	E. Coli	CFU/100ml	Nil	**5**	**1**	**3**	Nil	**20**



OHT: Over ST= Sedimentation Tank, Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.6 Improvement Plan: NWSC Janakpur

Introduction:

Janakpur water supply project was constructed in 2027 and taken over by NWSC in 2056 and has increased capacity by constructing a new overhead tank having capacity of 450m^3. Although Janakpur water supply system has two elevated tanks of 450m3 capacity and 30 km of distribution networks, it is not in position to meet the growing demand of people of Janakpur.

NWSC Janakpur is now facing problems of water quality due to contamination of cross drainage waste water. Quality of water supplied from the sources has been found to be contaminated during the conveyance of water to the consumers. Hence, to meet the water demand of present population and existing situation of the system it is urgent to plan for further improvement.

Improvement works:

System is in need of replacing about 10 km pipelines for leakage control, pressure balance and controlling contamination. There is need of about 20 washout valves, mini labs, chlorine dosing. This will add 200 taps / year.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (4"-5")	m	10,000	1,000	10,000,000
2	Washouts with valve box	No	20	50,000	1,000,000
3	Well development	No	2	500,000	1,000,000
4	Lab equipment and chemicals	LS	1	200,000	200,000
5	Chlorine dosing	No	1	150,000	150,000
	Total				**12,350,000**

Extension works:

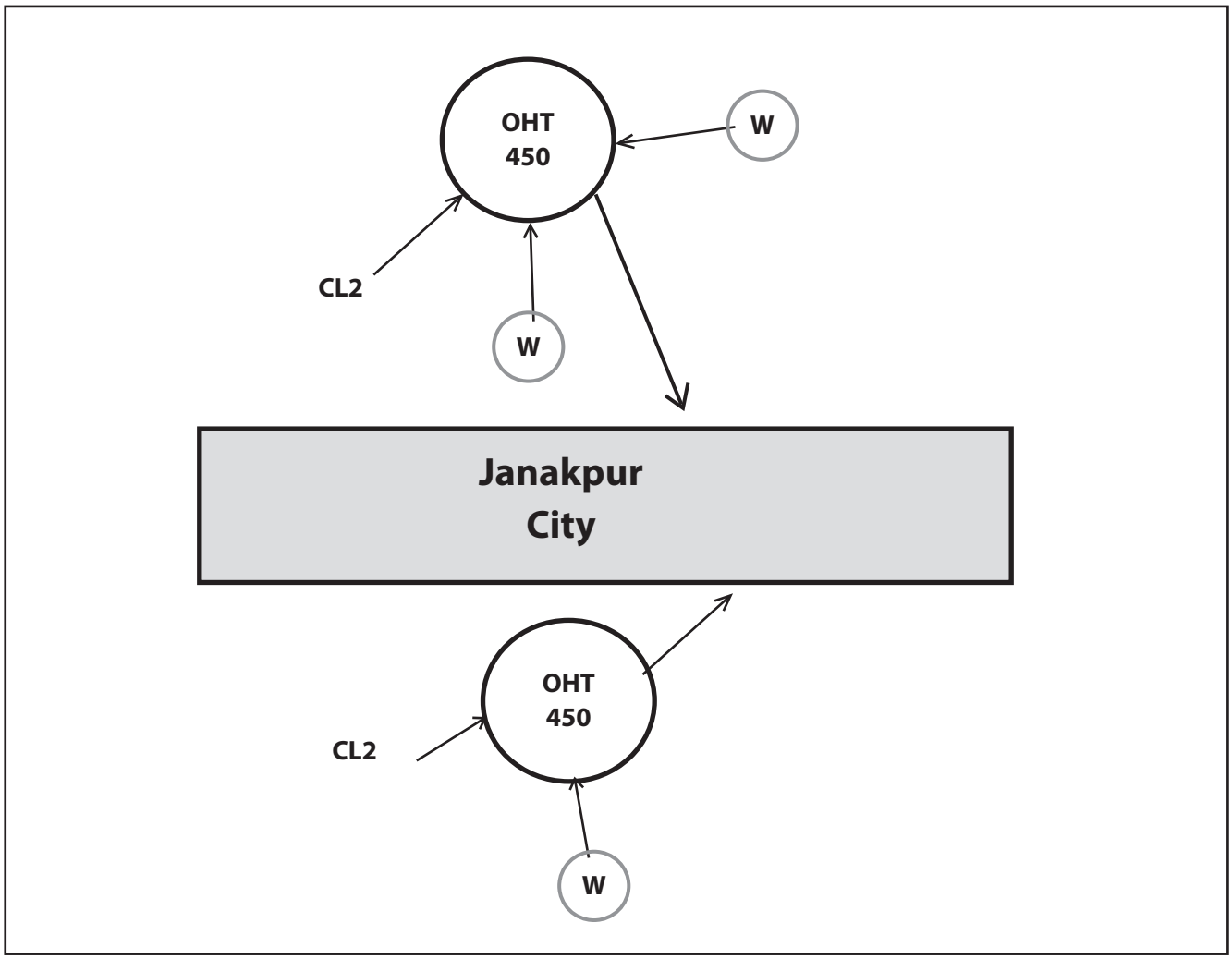
System is in need of operation of existing new well. Rehabilitation of existing old network with replacement or parallel laying. Main pipe line of 7 km along high way and 15Km distribution line are required for the extension works in new area. Extra Tanks are also needed in two locations with other facilities. Development and installation of 3 new tube wells are also necessary for extended areas. Generators should be installed in all three new wells for standby operations of the wells. It is estimated that this improvement will definitely increase around 6000 more taps connections.

Data Profile:

Water Utility	WSP	NWSC - Janakpur (Dhanusha)		
	Telephone	041-520158	Email: smahto45@yahoo.com	
	Head	Suresh Kumar Mahato		
	Service Area (Wards)	Janakpur 1-12, 14 out 16wards		
	No of staff	26	Staff per (1000) Taps	8
	Population Covered	21408	WS Coverage (%)	14
Mission Statement				
Service Connection	Total Taps	3253	Private Taps	3148
	Public Taps	42	Metered Taps	3198
	New Connections in FY	122	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	2.0	Users satisfied (%)	57
	No of break/Km/Yr	31	Supply hours	2.5
Water Production	Production (m^3/day)	1800	NRW (%)	12
	Consumption (LPCD)	74	Production (LPCD)	84
Revenue and Expenses	Annual O&M Cost (NRs)	14823914	Annual billing (NRs)	7941147
	Collection Ratio	0.7	Operating Ratio	1.9
	Cost/m^3 of water used	26	Average billing (NRs/M)	206
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	9	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Janakpur Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**3096**	**3097**	**3098**	**3099 B**	**3101**
1	Color	Hazen	5 (15)	<5.0	<5.0	**10**	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1	**18**	**35**	2	5
3	pH	-	6.5 - 8.5*	6.6	6.6	6.9	7	7.2
4	Temperature	^{0}C	-	26.3	26.5	26	25.8	26.4
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	0.2	**Nil**
6	Ammonia	mg/l	1.5	<0.02	**3.5**	**8.1**	<0.02	0.14
7	Nitrite	mg/l as NO2	3	<0.02	0.22	**5.02**	<0.02	0.02
8	Nitrite	mg/l as NO3	50	0.45	0.03	8.7	0.12	<0.02
9	Iron	mg/l	0.3 (3)	0.06	0.18	**1.39**	0.12	**0.32**
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.22	0.26	0.41	0.24	0.24
12	E. Coli	CFU/100ml	Nil	Nil	**>300**	**>300**	Nil	**55**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.7 Improvement plan: NWSC Jaleshwar

Introduction:

Jaleswar Water Supply Project was initially constructed by Department of Water Supply and Sewerage in 2037 and was handover to the NWSC in 2046. Since then this system is being managed and operated by NWSC Jaleswar. Out of 3 tube wells of Jaleswar water supply system two tube wells are in operation along with one overhead tank having capacity of 450m^3 inside the office compound. Total service area of 15.5 km^2 of Jaleswar Municipality has been connected with 22 km of distribution networks. A total of 748 nos. of private taps have been found to be connected so far that generates the revenue for the operation of the system. Although the present capacity of the NWSC Jaleswar is not sufficient to meet the demand of more than 300 taps where as the potential areas of Jaleswar Municipality is still remaining to be covered with this system. Sediments load have been found one of the problem during initial supply hours and this water as being turbid consumers are complaining in this regard time to time. Based on the information and the existing situation of the system a treatment unit should be introduced in the system and extension of the service area is required in terms of reliability and serviceability for the improvement of the system.

Improvement works:

System is in need of replacing about 13 km pipes and adds about 20 washout valves. Systematic chlorination unit is need and test kits should be updated.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (4"-5")	m	5,000	10000	500,000
2	Washouts with valve box	No	20	50,000	1,000,000
3	Lab equipments and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	1	150,000	150,000
5	Pressure filter	Set	1	400,000	400,000
	Total				**6,750,000**

Extension works:

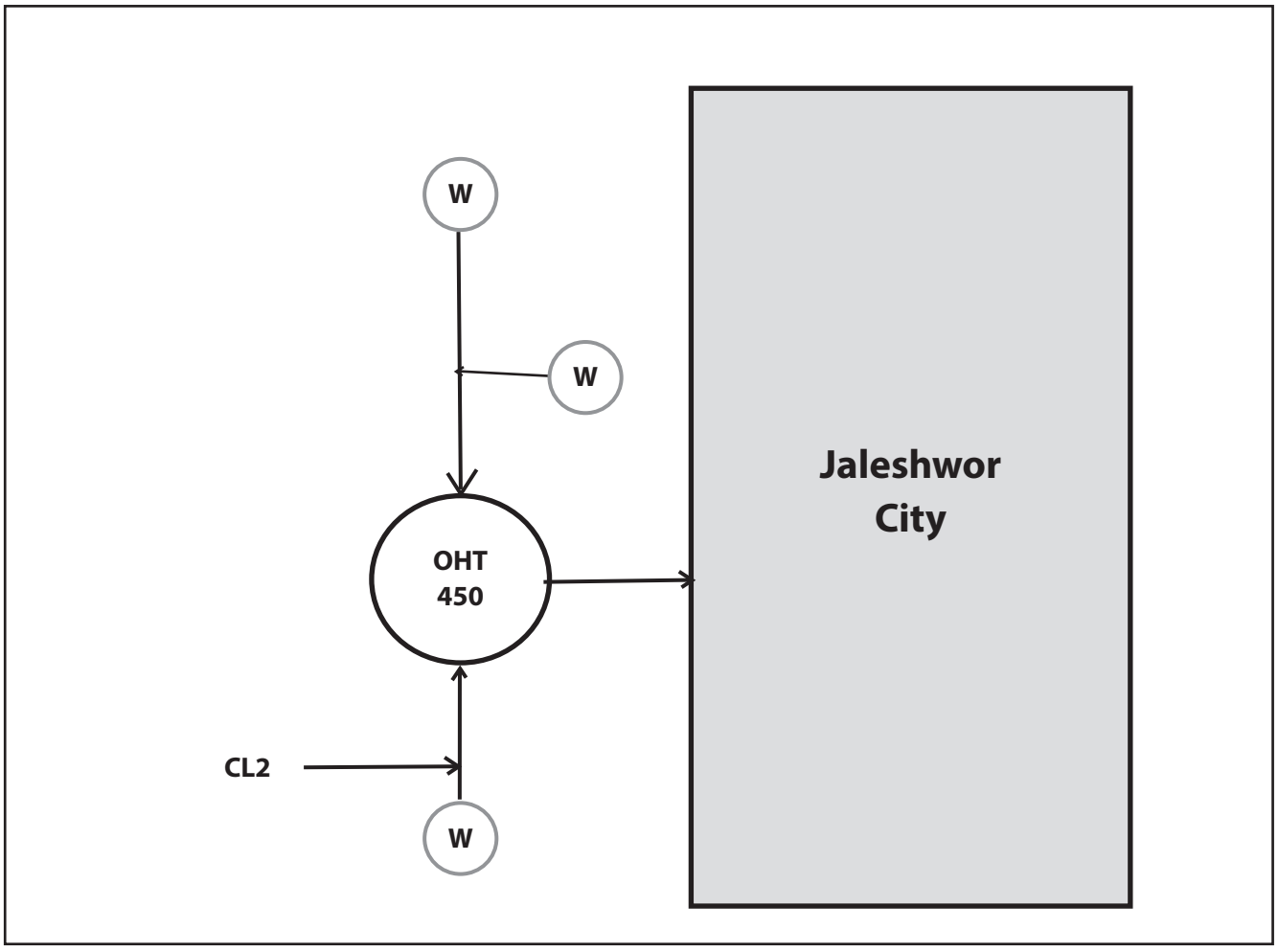
There is need for extending services by installing one OHT (450 m^3) with well and 13 km pipe lines. This will add about 1400 taps. Pipe line extension works for Suga VDC (5km trunk, 5 km distribution). This will add 300 taps. Tube well Boring plus 5 Km pipe line and one tank 450 m^3 is needed for ward 12, 13 will add 400 taps. To cover Bela the ward no. 14 is also needed tube wells and tank (450 m^3), this will add 1000 taps. Parkauli and Ramauli are other wards to be covered with this system adding tube wells and pipe networks. This augmentation will increase around 1400 new metered tap connections and minimise the gap between revenue and expenditures.

Data Profile:

Water Utility	WSP	NWSC - Jaleswor (Mahottari)		
	Telephone	044-520089	Email: sunilsingh22766@yahoo.com	
	Head	Sunil Kumar Singh		
	Service Area (Wards)	Jaleswor 1-7,10 out 17 wards		
	No of staff	10	Staff per (1000) Taps	13
	Population Covered	6312	WS Coverage (%)	20
Mission Statement	Adequate of protble water for all in a efficient and effectiv manner			
Service Connection	Total Taps	789	Private Taps	711
	Public Taps	41	Metered Taps	748
	New Connections in FY	211	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	2.7	Users satisfied (%)	57
	No of break/Km/Yr	22	Supply hours	6.5
Water Production	Production (m^3/day)	900	NRW (%)	52
	Consumption (LPCD)	69	Production (LPCD)	143
Revenue and Expenses	Annual O&M Cost (NRs)	5216124	Annual billing (NRs)	1850135
	Collection Ratio	0.9	Operating Ratio	2.8
	Cost/m^3 of water used	33	Average billing (NRs/M)	206
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	11	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Jaleshwor Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**3104**	**3105**	**3106**	**3107**	**3108**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	<1.0	1	5	2	1.9
3	pH	-	6.5 - 8.5*	7.2	7.4	7.2	7.4	8.1
4	Temperature	^{0}C	-	27.2	27.1	27.3	27.4	30.7
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Trace**	**Trace**	**Trace**
6	Ammonia	mg/l	1.5	<0.02	0.02	0.1	0.08	0.06
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.33	0.12	0.03	0.07	0.08
9	Iron	mg/l	0.3 (3)	0.24	0.2	0.05	0.2	0.18
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.38	0.24	0.58	0.42	0.44
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	Nil	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.8 Improvement plan: NWSC Gaushala

Introduction:

Gaushala water supply project was constructed by Japan government under grant aid program of JICA in 2044. It was further handover to the water user committee for operation. It was initially operated with steel overhead tank on top of the steel column PVC tank was installed. There is a ground sedimentation tank having capacity of 250m^3 with chlorination unit attached. Two tube wells are functioning but the tank and sedimentation basin are not in operation. It is possible to operate both of them. The Department of Water Supply and Sewerage in 2068 has constructed a new RCC tank having capacity of 450m^3. The government of Nepal decided to hand over this system to the NWSC in 2073 and now it is being managed by NWSC. Although the user's committee has extended the pipe network but they are not in proper manner. At present consumer has problem with adequate water and required pressure due to fragmented clusters and geography. Leakage problem with contaminants prevails. Expenditures are made based on the revenue generation along with minor maintenance works.

Improvement works:

System is in need of maintenance of generator, operation of sedimentation tank with chlorination unit, operation of Sedimentation tank with chlorination unit and Repair and maintenance of pipe line.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (4"-8")	m	5,000	1,500	7,500,000
2	Washouts with valve box	No	20	50,000	1,000,000
3	Generators repair	No	1	30,000	30,000
4	Chlorine dosing	No	1	150,000	150,000
5	Bulk meter, pressure gauge, etc	Set	1	200,000	200,000
	Total				**8,880,000**

Extension works:

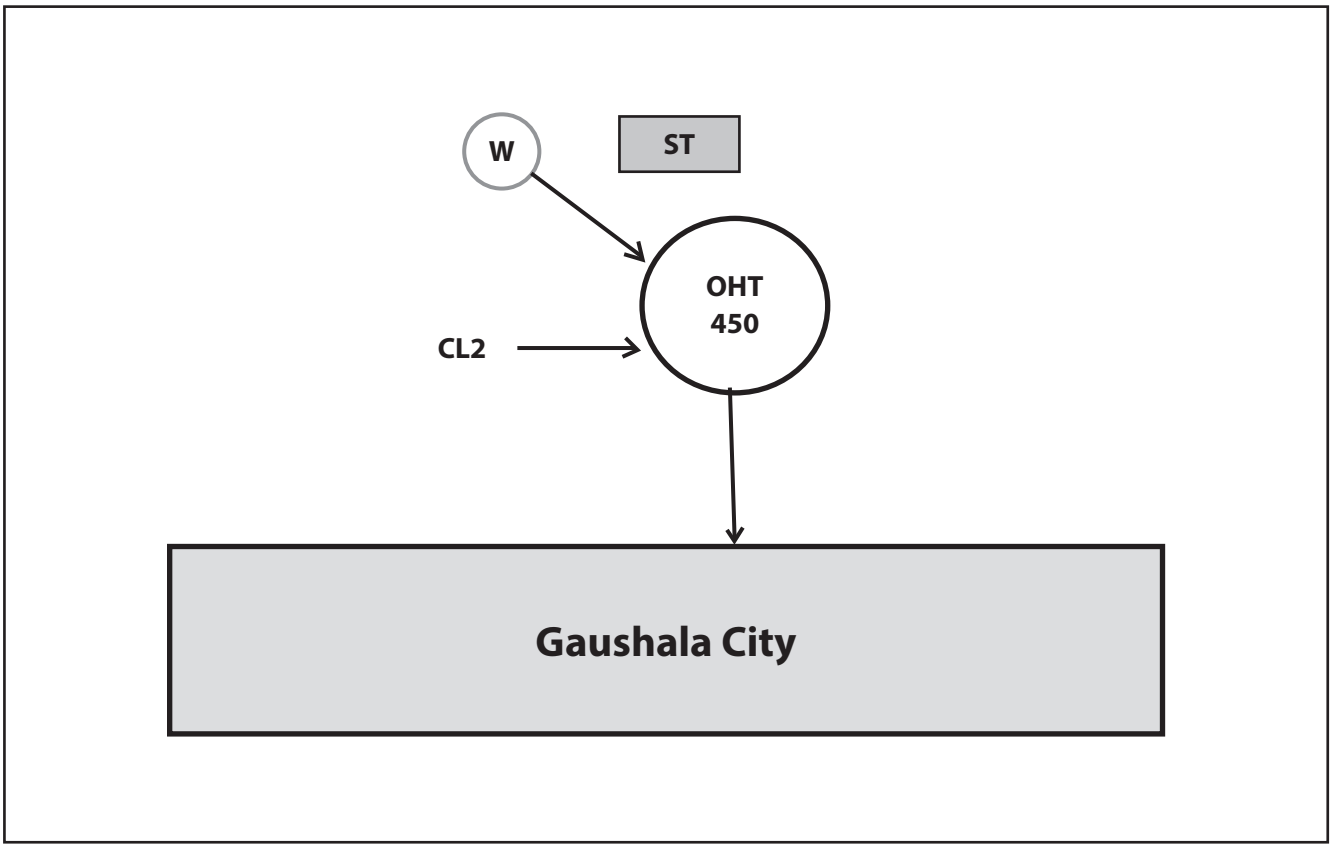
Pipeline extension works in ward 8 for 150 taps, Pipe line extension in ward 8 for 200 taps. Pipe extension in ward 6 for 35 taps, Pipe extension in ward 5 for tap 25 taps. This works will increase the revenue generation at the same time the adequate supply of water along with required pressure at tap.

Data Profile:

Water Utility	WSP	NWSC - Gaushala (Mahottari)		
	Telephone	046-520450	Email: sunilsingh22766@yahoo.com	
	Head	Sunil Kumar Singh		
	Service Area (Wards)	Gaushala 5-8 out of 11 wards		
	No of staff	8	Staff per (1000) Taps	15
	Population Covered	3003	WS Coverage (%)	94
Mission Statement				
Service Connection	Total Taps	546	Private Taps	546
	Public Taps	0	Metered Taps	546
	New Connections in FY	80	Disconnectons in FY	20
Customer Service	Complains/100 Taps/Yr	5.5	Users satisfied (%)	57
	No of break/Km/Yr	15	Supply hours	5
Water Production	Production (m^3/day)	600	NRW (%)	65
	Consumption (LPCD)	70	Production (LPCD)	200
Revenue and Expenses	Annual O&M Cost (NRs)	940691	Annual billing (NRs)	982800
	Collection Ratio	0.8	Operating Ratio	1.0
	Cost/m^3 of water used	12	Average billing (NRs/M)	150
Water Tariff	Metered Taps	125	Un-metered Taps	500
	Increment (NRs/unit)	15	Community	1600
	Average Tariff (NRs/M\m^3)	10	Connections charge	2500
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Gaushala Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**3111**	**3112**	**3113**	**3114**	**3115**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	2	2	1.8	1.9	2
3	pH	-	6.5 - 8.5*	7.02	7.6	7.4	7.24	7.4
4	Temperature	^{0}C	-	31.6	31	31.6	28.9	26.3
5	Residual Total Chlorine	mg/l	0.1-0.2	**Trace**	0.1	0.1	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	<0.02	<0.02	<0.02	0.92
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	2.22	2.17	2.02	2.14	1.5
9	Iron	mg/l	0.3 (3)	0.09	0.07	0.07	0.1	<0.02
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.12	0.13	0.11	0.11	0.29
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	Nil	Nil



OHT: Over Head Tank, ST= Sedimentation Tank, Cl2= Chlorination Unit, W= Tubewell

5.9 Improvement plan: NWSC Malangwa

Introduction:

Malangawa water supply system was completed in 2039 by the Department of Water Supply and Sewerage. NWSC Malangawa has taken responsibility for the management of the system in 2046. This system has one overhead tank of capacity 450m^3 that serves the water demand of 13 wards of this municipality. A total of 11.5 km of pipe networks is not sufficient to cover the service area. This municipality seems to be a big densely populated cluster spread over an area of 3Km^2. Pipes in some locations are chocked as being old pipes and gets contaminated during non-supply hours of the system. The present capacity and distribution networks are not sufficient to cover the demand of the people. Consumers want the reliability on supply hours and extend the supply hours also.

Based on the information and field visit and the existing system as being old the pipe networks of some location should be replaced with new pipes to ensure the quality of water supply. Coverage of water supply should be extended up to the new settlement area of the municipality and increase the revenue as well. Installation of a new chemical dosing system is also necessary to ensure the free residual chlorine at taps.

Improvement works:

System is in need of replacing about 8km old pipes (2"-8"), 30 washouts, one flow meter and chlorine dosing units.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (2"-8")	m	8,000	1,500	12,000,000
2	Washouts with valve box	No	30	50,000	1,500,000
3	Chlorine dosing	No	1	150,000	150,000
4	Bulk meter, pressure gauge, etc	Set	1	200,000	200,000
	Total				**13,850,000**

Extension works:

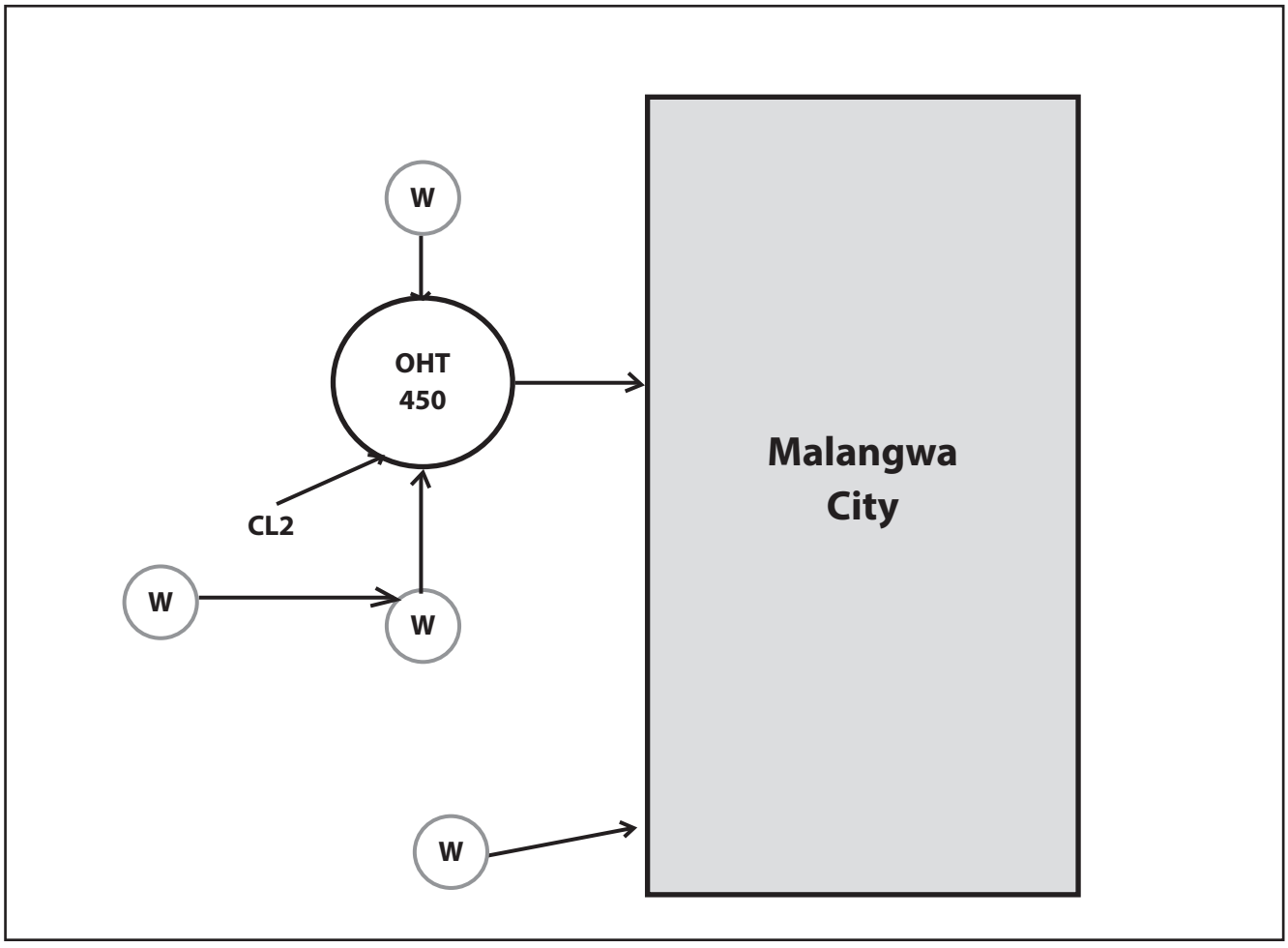
There is need extending pipes to Palsi ward 4 with one well and 8 km distribution pipes. One system is required for ward 1, 2, 11, 12, 13 with OHT (450 m^3), 8 km pipes. Extension will add about 1800 taps.

Data Profile:

Water Utility	WSP	NWSC - Malangwa (Sarlahi)		
	Telephone	046-520450	Email: None	
	Head	Buddha Ram Pal		
	Service Area (Wards)	Malangwa 2-10 out of 13 wards		
	No of staff	14	Staff per (1000) Taps	13
	Population Covered	7122	WS Coverage (%)	24
Mission Statement				
Service Connection	Total Taps	1079	Private Taps	1020
	Public Taps	12	Metered Taps	906
	New Connections in FY	60	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	8.2	Users satisfied (%)	57
	No of break/Km/Yr	12	Supply hours	7
Water Production	Production (m^3/day)	900	NRW (%)	25
	Consumption (LPCD)	95	Production (LPCD)	126
Revenue and Expenses	Annual O&M Cost (NRs)	7241334	Annual billing (NRs)	2831351
	Collection Ratio	0.7	Operating Ratio	2.6
	Cost/m^3 of water used	29	Average billing (NRs/M)	221
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	8	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Malangwa Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**3119**	**3120**	**3121**	**3122**	**3123**
1	Color	Hazen	5 (15)	<5.0	5	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	**12**	5	5	1	**8**
3	pH	-	6.5 - 8.5*	7.3	7.1	7	7.7	7.5
4	Temperature	^{0}C	-	26.8	26.6	26.7	26.8	26.7
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.34	0.35	0.36	0.04	0.05
7	Nitrite	mg/l as NO2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO3	50	0.09	0.09	0.12	0.42	0.14
9	Iron	mg/l	0.3 (3)	**0.52**	0.18	0.28	0.11	0.2
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.25	0.43	0.32	0.39	0.17
12	E. Coli	CFU/100ml	Nil	**30**	**20**	**22**	**10**	**28**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.10 Improvement plan: NWSC Gaur

Introduction:

Gaur water supply system was constructed in 2034 by the Department of Water Supply and Sewerage. It was operated and maintained by the department up to the fiscal year 2046 and in the same year the system was handover to the NWSC. This system has one overhead tank having capacity of 225 m^3 and 24 km of pipe networks. Some of the clusters of the system is scattered and have problem with regular supply in all location and pressure deficiencies in the system due to elevation differences. To maintain the supply hours in all coverage has been found to be difficult because of pipes looped each other and at the same time without zoning seems to be difficult to control the system and flushing the chocked old pipes also. Out of 13 wards remaining 4 wards are yet to be covered with this system. People are using hand pumps as an alternate source because of lack of tap connections. There are some old pipes and are damaged and these pipes are vulnerable to drainage suction during non-supply hours.

For the improvement of the system leakage from the old pipe should be controlled and service area should be extended to cover the new area of Gaur Municipality.

Improvement works:

There is a plan for extension in ward 13, further extension in ward 10 and 11 wells to be constructed by NWSC and tank by division of DWSS. There is well and primary distribution in ward 13 and need to extend distribution. With this the NWSC Gaur will be able to add 3000 more taps to the consumer.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	9,000	1,500	13,500,000
2	Washouts with valve box	No	50	50,000	2,500,000
3	Chlorine dosing	No	1	150,000	150,000
4	Bulk meter, pressure gauge, etc	Set	1	200,000	200,000
	Total				**16,350,000**

Extension works:

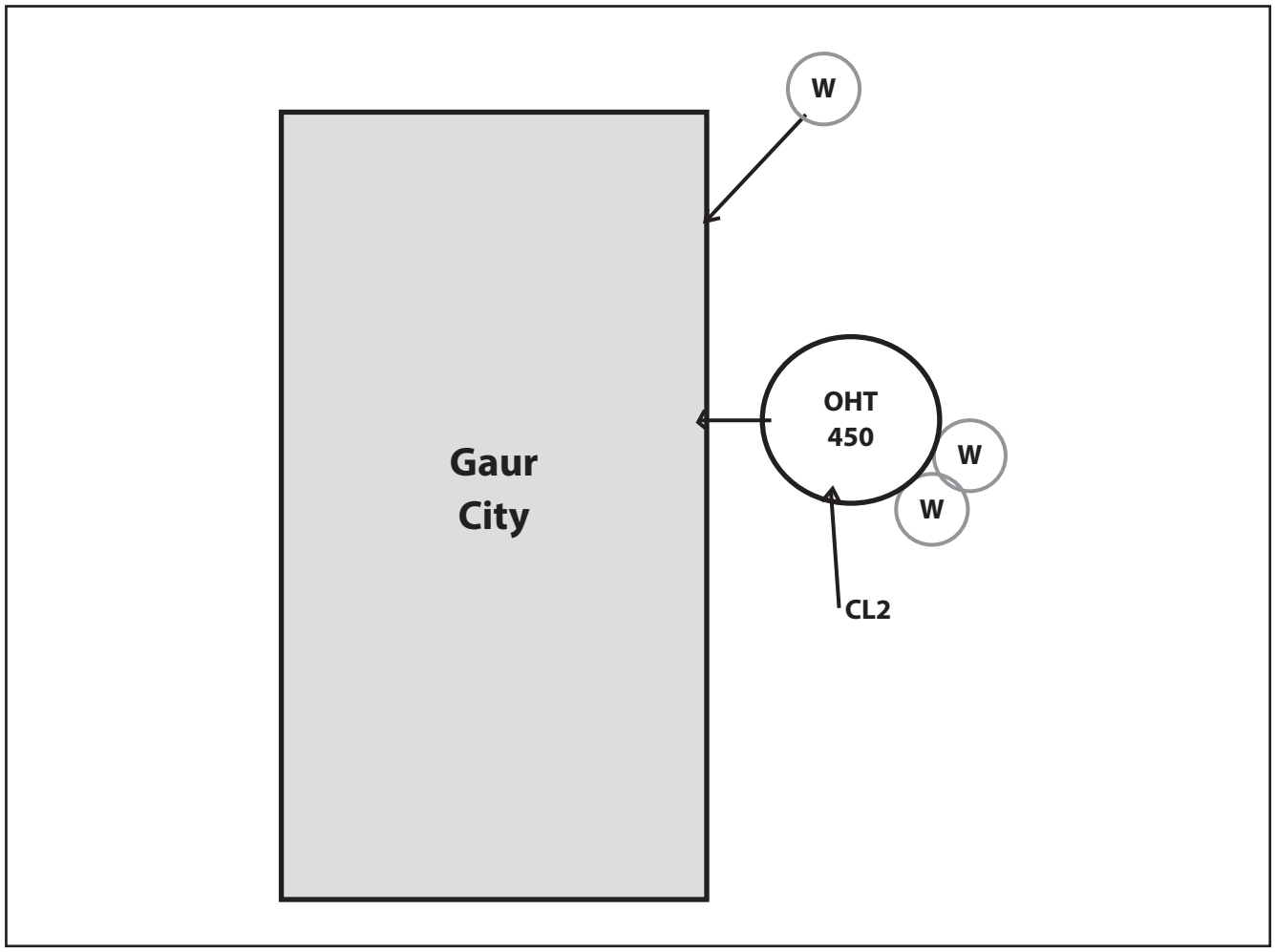
There is need of OHT of 450 m3 and one well at ward no 7 to supply water to ward no. 6, 7, 10 and11 for 3000 taps. Pipe line for above system of sizes 1.5-4" is also required. OHT 450 m^3 for w 12, 13, along with pipe extension works of 12km for 2000 tap connection. With this new construction works the remaining wards will be covered. These activities will enhance the capacity of the system along with increment in revenue generations.

Data Profile:

Water Utility	WSP	NWSC - Gaur (Rautahat)		
	Telephone	065-520611	Email: None	
	Head	Krit Bhushan Lal		
	Service Area (Wards)	Gaur 1-9 out of 13 wards		
	No of staff	17	Staff per (1000) Taps	15
	Population Covered	8735	WS Coverage (%)	25
Mission Statement				
Service Connection	Total Taps	1108	Private Taps	1064
	Public Taps	10	Metered Taps	1076
	New Connections in FY	28	Disconnectons in FY	10
Customer Service	Complains/100 Taps/Yr	4.2	Users satisfied (%)	64
	No of break/Km/Yr	24	Supply hours	7
Water Production	Production (m^3/day)	750	NRW (%)	27
	Consumption (LPCD)	63	Production (LPCD)	86
Revenue and Expenses	Annual O&M Cost (NRs)	6453909	Annual billing (NRs)	3003921
	Collection Ratio	0.7	Operating Ratio	2.1
	Cost/m^3 of water used	32	Average billing (NRs/M)	228
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	10	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Gaur Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**3136**	**3137**	**3138**	**3139**	**3140**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	2	2	<1.0	1	3
3	pH	-	6.5 - 8.5*	7.2	7.4	7.5	7.6	7.4
4	Temperature	^{0}C	-	26.1	26.2	26	26	25.8
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.18	0.35	0.08	0.19	0.09
7	Nitrite	mg/l as NO_2	3	0.04	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	3.3	1	0.23	0.09	0.05
9	Iron	mg/l	0.3 (3)	0.18	0.18	0.05	0.18	0.16
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.2	0.36	0.31	0.39	0.19
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	Nil	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.11 Improvement plan: NWSC Kalaiya

Introduction:

Kalaiya water Supply Project was constructed by the Department of Water Supply and Sewerage in 2035 and hand over to NWSC in 2056 for the operation and maintenance of the system. This system has been operated with an elevated tank of 450m^3 capacity and two tube wells as a source of supply. Kalaiya is a district headquarters of Bara district. This municipality has altogether 25 wards out which 12 wards have been covered by this system. This water supply system covers about 60 % of total population. Some of the area of Kalaiya bazaar has been expanded along Barewa, Padam Road and Bhawani pur. After the inclusion of some of the VDC of the surroundings in this municipality the population as well as coverage area has been increased significantly. These wards are developed radial from the centre (Bharat Chok). Recently included wards are extended up to 5 km from the centre of the town.

Improvement works:

System is facing problem of leakages due to old pipes. It is in need of replacing about 15 km pipes in Devkota chowk, Birjung road, Barai road, cinema road with pipes ranging from 4- 6". There is need of about 20 valve chambers, chlorine dosing units, flow meter, mini lab. This will increase around 200 taps.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	15,000	6,000	90,000,000
2	Washouts with valve box	No	20	100,000	200,0000
3	Meter replacement	No	20	6,000	120,000
4	Lab equipments and chemicals	LS	1	500,000	500,000
5	Chlorine dosing	No	1	150,000	150,000
6	Bulk meter, pressure gauge, etc.	Set	2	200,000	400,000
	Total				**93,170,000**

Extension works:

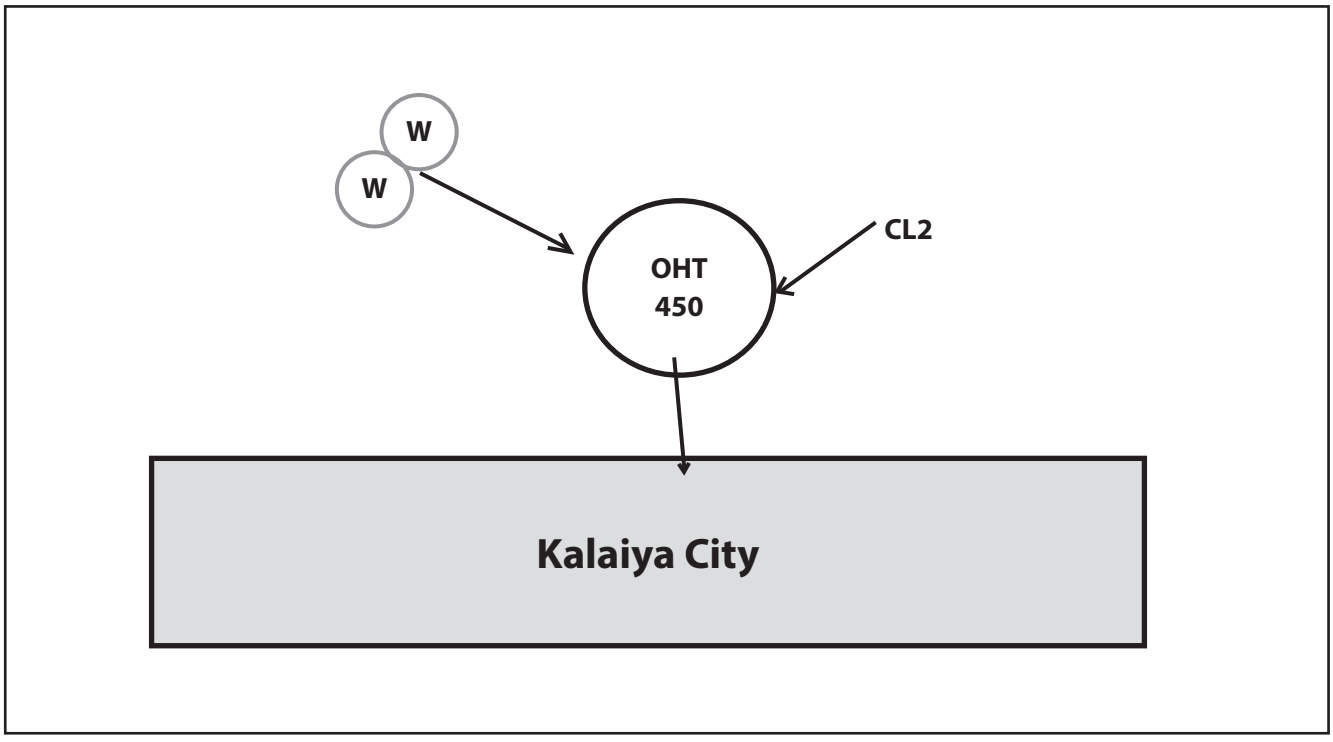
There is need of extending system in wards 2, 5, 8, 11, 19, 25. About 22 km pipes and three wells are needed. This will add about 2500 new connections.

Data Profile:

Water Utility	WSP	NWSC - Kalaiya (Bara)		
	Telephone	053-550428	Email: None	
	Head	Chandeswar Sah/Ram Chandra Sahani		
	Service Area (Wards)	Kalaiya 1-9,11 Total 25		
	No of staff	14	Staff per (1000) Taps	10
	Population Covered	11165	WS Coverage (%)	27
Mission Statement				
Service Connection	Total Taps	1447	Private Taps	1395
	Public Taps	20	Metered Taps	1403
	New Connections in FY	34	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	8.0	Users satisfied (%)	90
	No of break/Km/Yr	11	Supply hours	8
Water Production	Production (m^3/day)	1440	NRW (%)	39
	Consumption (LPCD)	78	Production (LPCD)	129
Revenue and Expenses	Annual O&M Cost (NRs)	7477506	Annual billing (NRs)	4462586
	Collection Ratio	0.8	Operating Ratio	1.7
	Cost/m^3 of water used	795937	Average billing (NRs/M)	3461468
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	1	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			90 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Kalaiya Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**986**	**987**	**988**	**989**	**990**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1.0	2.0	2.0	2.0	1.0
3	pH	-	6.5 - 8.5*	6.8	7.4	7.4	7.2	7.3
4	Temperature	^{0}C	-	25.1	24.9	25.2	25.2	25.5
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	<0.02	0.04	<0.02	<0.02
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.04	0.09	<0.02	0.16	0.25
9	Iron	mg/l	0.3 (3)	0.01	0.11	0.12	0.03	0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	<0.02	0.1	0.2	<0.02	<0.02
12	E. Coli	CFU/100ml	Nil	Nil	**35**	**>300**	Nil	**7**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.12 Improvement Plan: NWSC Birgunj

Introduction:

Birganj is one of the historical places of Nepal and have been developed since Rana Regieme as an entry point for Nepal. This is most used transit point for trade and commerce and ranked as no.1 in terms of revenue generation. Birgunj is sub metropolitan city of Nepal, recently some of the Village Development Committee have been included in this city and population increased up to 153,000 (2011 census).

Water supply system for Birgunj was initially constructed by Indian commission mission in 2022 under cooperation program. It was operated by the Department of Water Supply and Sewerage for long time and added one another system in Aadarshanagar with one overhead tank having capacity of 450m^3 along with 2 new wells. Further it was handover to NWSC in 2046. At present 7 wells are running to maintain the water supply system in Birgunj city. In other hand the leakages is also one of the challenging job for this branch. Branch office is willing to update the system with computerized billing along with on spot billing system and develop household networking in GPS mappings to control the metering system. Revenue collections for the old taps is being difficult since owners are not identified since long back as per rule of NWSC it is difficult to disconnect the tap in case of unidentified owners. Chlorine dose has been applied well but testing of water at consumer's tap has not been continued.

Improvement works:

System is in need of replacing of 100 km pipes, adding 20 washouts, three flow meters for supply and eight for wells, chlorine dosing equipment for four station and four points in networks and updating minilab.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	100,000	6,000	600,000,000
2	Washouts with valve box	No	40	100,000	4,000,000
3	Meter replacement	No	20	6,000	120,000
4	Lab equipments and chemicals	LS	1	500,000	500,000
5	Chlorine dosing	No	8	150,000	1,200,000
6	Bulk meter, pressure gauge, etc.	Set	11	200,000	2,200,000
	Total				**608,020,000**

Extension works:

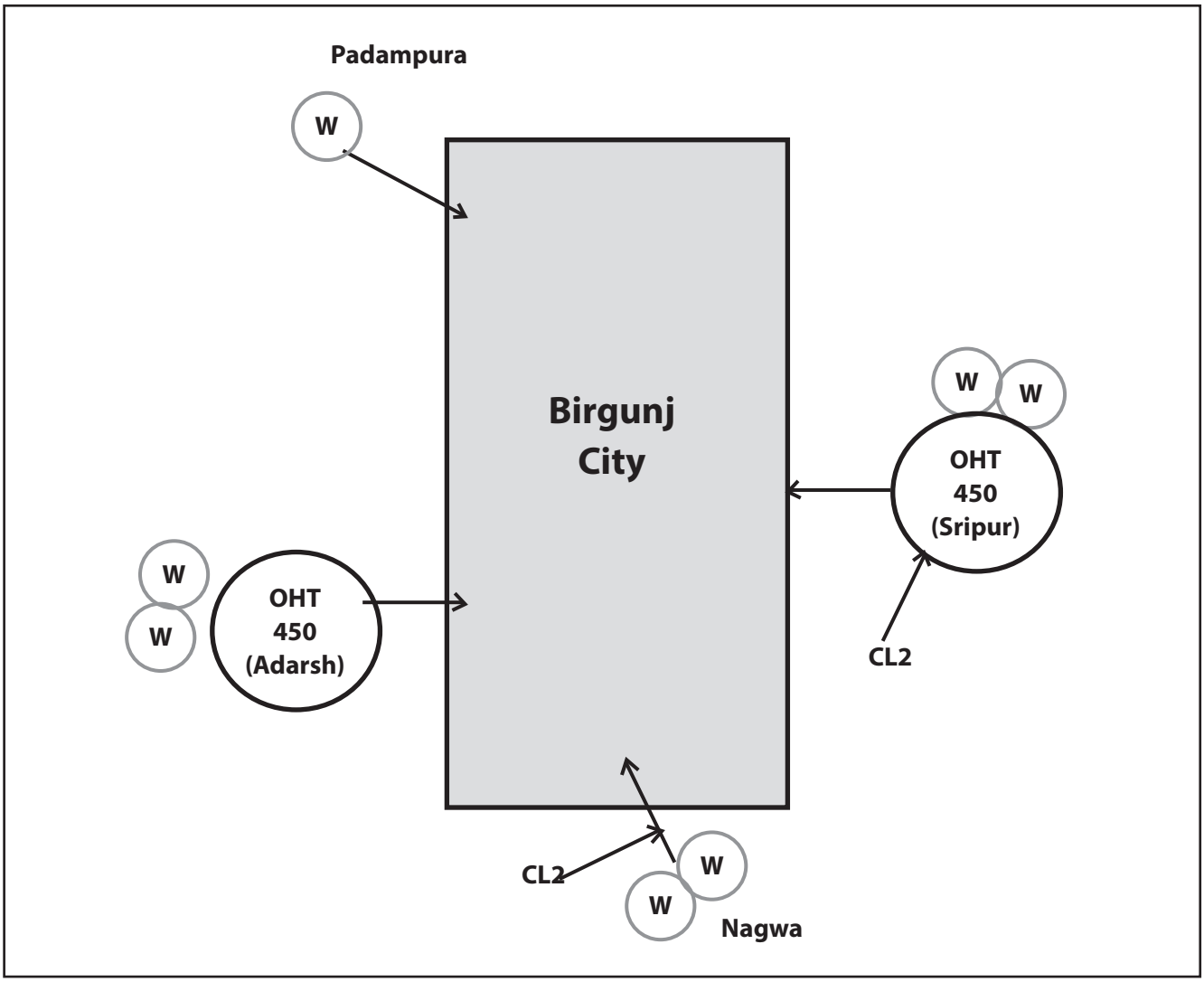
There is need for extending system for power house, Gandak and Pragati nagar: pipes 20 km. 4 Wells, OHT at Pratima. This can be also extended up to Bindabasani: This will add 1000 taps. Similarly existing system operated by users committee at Pokharia and Simara can be taken over and improved.

Data Profile:

Water Utility	WSP	NWSC - Birgunj (Parsa)		
	Telephone	051-522874	Email: kun_dahal@yahoo.com	
	Head	Chandeswar Sah		
	Service Area (Wards)	Birgunj 1-9 out of 30		
	No of staff	31	Staff per (1000) Taps	4
	Population Covered	52395	WS Coverage (%)	26
Mission Statement				
Service Connection	Total Taps	7242	Private Taps	7035
	Public Taps	45	Metered Taps	6931
	New Connections in FY	57	Disconnectons in FY	41
Customer Service	Complains/100 Taps/Yr	2.6	Users satisfied (%)	80
	No of break/Km/Yr	139	Supply hours	11
Water Production	Production (m^3/day)	5546	NRW (%)	23
	Consumption (LPCD)	82	Production (LPCD)	106
Revenue and Expenses	Annual O&M Cost (NRs)	20681820	Annual billing (NRs)	22210572
	Collection Ratio	0.7	Operating Ratio	0.9
	Cost/m3 of water used	13	Average billing (NRs/M)	257
Water Tariff	Metered Taps	10	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m3)	10	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			24(100)
	No of sample tested for biological parameters (% passed)			12 (100)
	No of sample tested for FRC (% passed)			10 (100)

Water Qualities at taps:

Birgunj Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**992**	**993**	**994**	**995**	**996**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	5.0
2	Turbidity	NTU	5 (10)	3.0	1.0	4.0	1.0	1.0
3	pH	-	6.5 - 8.5*	7.5	7.6	7.6	7.5	7.6
4	Temperature	^{0}C	-	25.4	25.4	25.5	25.3	25.3
5	Residual Total Chlorine	mg/l	0.1-0.2	**1**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.04	<0.02	<0.02	0.03	0.14
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.07	<0.02	0.1	<0.02	0.14
9	Iron	mg/l	0.3 (3)	**0.88**	0.09	**0.44**	0.1	<0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.17	0.03	0.06	0.06	1.0
12	E. Coli	CFU/100ml	Nil	Nil	**20**	**24**	Nil	**150**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.13 Improvement plan: WSMB Hetauda

Introduction:

Hetauda Water Supply Project was constructed in 2026 by the Department of Water Supply and Sewerage. It was operated and maintained by the Department of Water Supply and Sewerage up to 2046 and handover to NWSC for further operation. With the improvement of the system supported by municipality/EUIP in 2070 it was handover to the Hetauda Water Supply Management Board. Hetauda City has 29 wards and are scattered from its core market area. Most of these wards have covered with separate systems. Altogether 5 systems maintain the water supply in different locations based on the available sources and geography of the service area.

Supply systems are intermittent and geography of the municipality does not allow covering all the area with one system. The distribution systems of core bazaar area are old and under size. During non-supply hours these pipes get contaminated with waste water and other foreign elements. At present 65 percent populations have been covered and remaining 35 percent is still remaining to be covered. Production is insufficient for supplying with all existing sources. The trend of tap connections is increasing every year.

Improvement works:

System is in need of replacing 15 km pipes, adding 20 km pipes for double line layout where the roads are extending and 5 km for fetching additional water of 30 lps from Bundol source. There is need for establishing minilab, 20 washouts, 2250 m^3 of additional tanks. Similarly there is need for extending system in wards 19, 20, 21, 22 with 40km pipes, 600 m^3 GT for adding 2500 taps.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	40,000	6,000	240,000,000
2	Washouts with valve box	No	20	100,000	2,000,000
3	Meter replacement	No	20	2,000	40,000
4	Well development	No	2	5,000,000	10,000,000
5	Generators	No	5	3,000,000	15,000,000
6	Lab equipment and chemicals	LS	1	500,000	500,000
7	Chlorine dosing	No	18	50,000	900,000
8	Bulk meter, pressure gauge, etc.	Set	10	200,000	2,000,000
9	Reservoir	m3	2,250	30,000	67,500,000
	Total				**337,940,000**

Extension works:

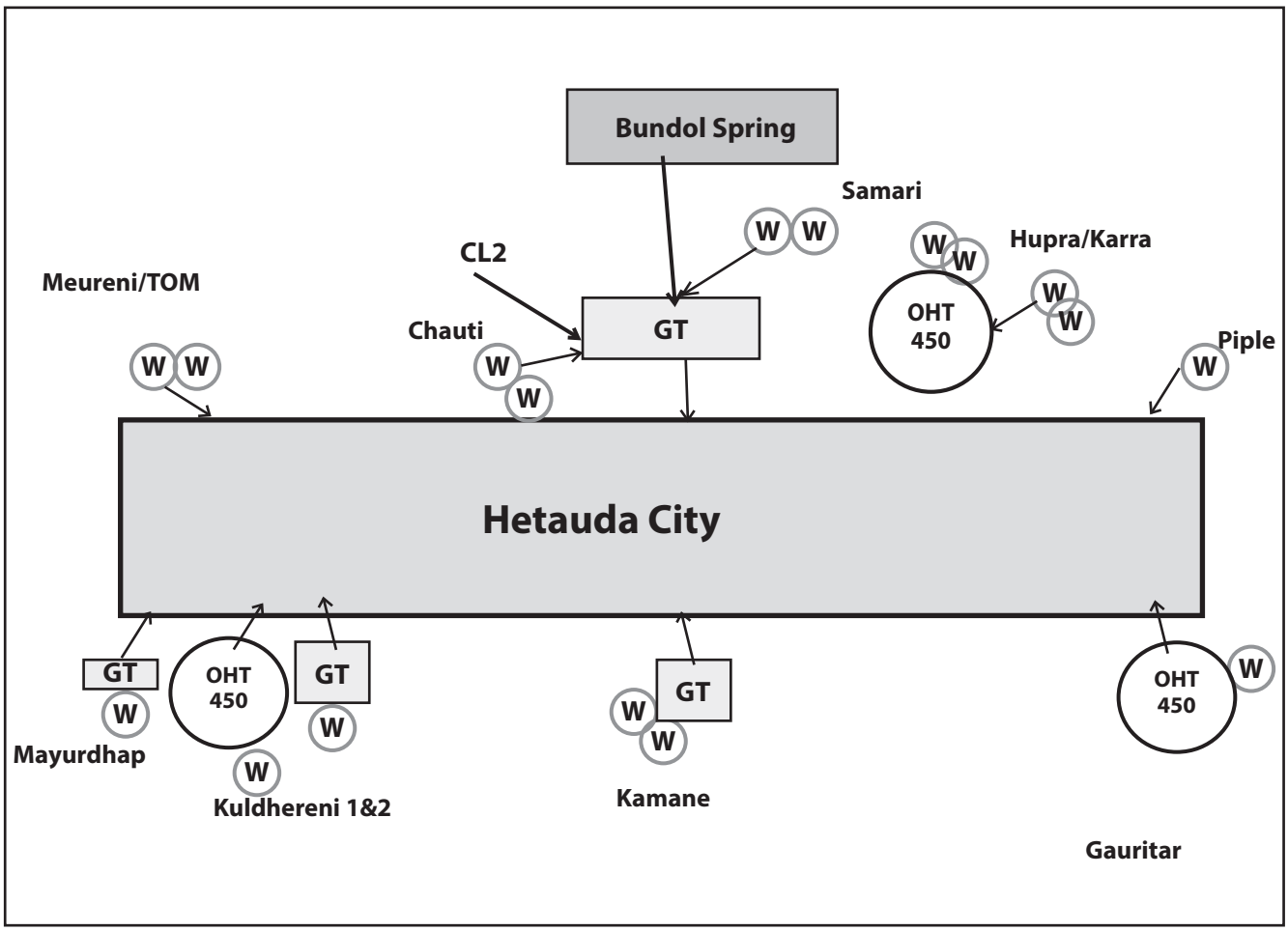
Similarly, there is need for adding new system in wards 16, 17, 18, 19 with 70km pipes, 3 wells, 4*300m^3 tanks with lifting 3 stage. This will add 2500 and 2000 taps.

Data Profile:

Water Utility	WSP	WSMB - Hetauda (Makawanpur)		
	Telephone	057-523708	Email: hwsmboard@gmail.com	
	Head	Sudarshan Dhakal/ Chair: Pratap Bist		
	Service Area (Wards)	Hetauda 1-10, 16,17,18,19, 20 (Total 29)		
	No of staff	45	Staff per (1000) Taps	4
	Population Covered	78337	WS Coverage (%)	96
Mission Statement				
Service Connection	Total Taps	11184	Private Taps	11015
	Public Taps	22	Metered Taps	10975
	New Connections in FY	533	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	4.9	Users satisfied (%)	60
	No of break/Km/Yr	210	Supply hours	6
Water Production	Production (m^3/day)	9214	NRW (%)	28
	Consumption (LPCD)	85	Production (LPCD)	118
Revenue and Expenses	Annual O&M Cost (NRs)	24378680	Annual billing (NRs)	27813973
	Collection Ratio	1.0	Operating Ratio	0.9
	Cost/m^3 of water used	10	Average billing (NRs/M)	208
Water Tariff	Metered Taps	50	Un-metered Taps	360
	Increment (NRs/unit)	15	Community	0
	Average Tariff (NRs/M\m^3)	11	Connections charge	15000
Water Quality	No of sample tested for physicochemical parameters (% passed)			1 (100)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			231 (100)

Water Qualities at taps:

Hetauda Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**966**	**967**	**968**	**969**	**970**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1.0	1.0	1.0	1.0	1.0
3	pH	-	6.5 - 8.5*	**5.6**	6.9	7.1	**6.2**	6.8
4	Temperature	^{0}C	-	24.2	24.2	24.3	24.4	24.5
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	<0.02	<0.02	<0.02	<0.02
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	15.2	28.1	13.8	3.4	**63.4**
9	Iron	mg/l	0.3 (3)	<0.01	<0.01	<0.01	<0.01	0.03
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	<0.02	<0.02	<0.02	<0.02	<0.02
12	E. Coli	CFU/100ml	Nil	**1**	Nil	**15**	**4**	**12**



OHT: Over Head Tank, GT= Ground Tank, ST= Sedimentation Tank, Cl2= Chlorination Unit, W= Tubewell

5.14 Improvement plan: WSMB Bharatpur

Introduction:

Bharatpur water supply system was constructed in 2033 conveying water from Jugedi khola. This system was constructed by the Department of Water Supply and Sewerage to meet the water demand of Bharatpur which is not in operation because of damages caused by floods and seems to be unsafe for conveyance of water regularly. Bharatpur is located in the bank of Narayani River and its geology found to be potential ground water source. In 2050 a project was constructed by the Technical and financial support of JICA using ground water. Along with existing system this newly constructed ground water system started supplying water with an elevated tank having capacity of 400 m^3 and 1200m^3 ground tanks as a balancing reservoir. Initially it was having 4 tube wells and operated by the Department of Water Supply and Sewerage. Further in 2056 this system was hand over to NWSC for operation. This system was handover to the Water Supply Management Board formally in 2064 and started operation in 2069 improving the system in terms of production, quality of water and services to the consumer.

Now Bharatpur has become sub metropolitan city and water demand has increased significantly and numbers of wells reached up to 24 and water has been supplying with 3 elevated tanks and 500 kilometres of distribution main in which urban environmental improvement project has carried out major works by constructed the reservoirs and elevated tank also. Department of Water Supply and Sewerage is another partner to provide the necessary support as per the requirement of the board. Recently an elevated tank has been constructed by the Division office in Aanandpur. Private sector like CokaCola has also made an agreement to support for laying of pipes for the people of this industrial area.

Improvement works:

System is in need of replacing about 100 km old pipes (3"-8") for controlling leakage and flow. About 20 valve chambers are needed for zoning and washouts. There is need for system for chlorination and upgrading minilabs.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (3"-8")	m	100,000	10,000	1,000,000,000
2	Washouts with valve box	No	20	100,000	2,000,000
3	Lab equipment and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	5	150,000	750,000
5	Bulk meter, pressure gauge, etc.	Set	23	50,000	1,150,000
	Total				**1,004,100,000**

Extension works:

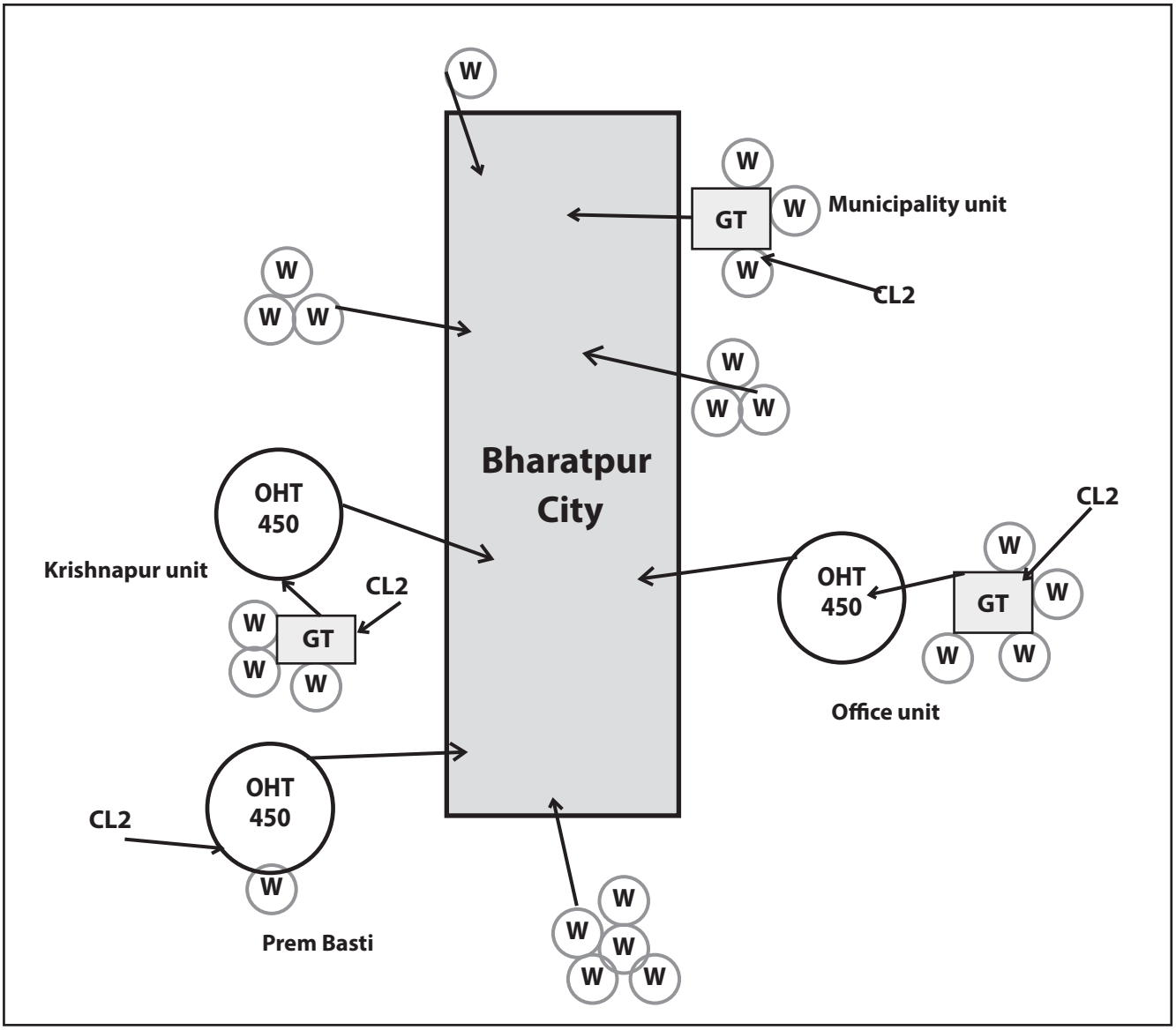
Similarly, system is in need to extending services in new area of municipality mainly in the Jhakhadimai area, Mangalpur, Fulbari, Patihani, Gitaqanagar and Shivanagar. Projects has been initiated byWSSDO. This will add about 30,000 taps.

Data Profile:

Water Utility	WSP	WSMB - Bharatpur (Chitwan)		
	Telephone	056-524916	Email: bharatpurwatersupplymb@gmail.com	
	Head	Salik Ram Paudel		
	Service Area (Wards)	Bharatpur 1-19		
	No of staff	49	Staff per (1000) Taps	3
	Population Covered	96360	WS Coverage (%)	40
Mission Statement				
Service Connection	Total Taps	17493	Private Taps	16990
	Public Taps	3	Metered Taps	17490
	New Connections in FY	1550	Disconnectons in FY	18
Customer Service	Complains/100 Taps/Yr	1.7	Users satisfied (%)	95
	No of break/Km/Yr	445	Supply hours	12
Water Production	Production (m^3/day)	15548	NRW (%)	33
	Consumption (LPCD)	108	Production (LPCD)	161
Revenue and Expenses	Annual O&M Cost (NRs)	38900000	Annual billing (NRs)	56376000
	Collection Ratio	0.9	Operating Ratio	0.7
	Cost/m^3 of water used	10	Average billing (NRs/M)	269
Water Tariff	Metered Taps	100 (135)*	Un-metered Taps	810
	Increment (NRs/unit)	18 (20)*	Community	1080
	Average Tariff (NRs/M\m^3)	14	Connections charge	4000
Water Quality	No of sample tested for physicochemical parameters (% passed)			360 (100)
	No of sample tested for biological parameters (% passed)			360 (100)
	No of sample tested for FRC (% passed)			360 (100)

Water Qualities at taps:

Bharatpur Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**535**	**536**	**537**	**538**	**539**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	<1.0	<1.0	<1.0	<1.0	<1.0
3	pH	-	6.5 - 8.5*	6.6	7.4	7.4	8.3	7.7
4	Temperature	^{0}C	-	26.8	26.7	26.7	26.7	26.7
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.05	0.05	<0.02	0.04	0.04
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	8.4	**58.2**	15.1	10.5	14.4
9	Iron	mg/l	0.3 (3)	<0.01	<0.01	<0.01	<0.01	<0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	<0.02	0.04	<0.02	0.06	<0.02
12	E. Coli	CFU/100ml	Nil	**1**	Nil	**3**	**15**	**3**



OHT: Over Head Tank, GT= Ground Tank, Cl2= Chlorination Unit, W= Tubewell

5.15 Improvement plan: NWSC Hemja

Introduction:

Hemja water supply project was completed in 2040 by the Department of Water Supply and Sewerage. After completion of the project Department of Water Supply and Sewerage continued to operate for long time and further it was handover to the water users committee. This VDC now has been added to the Pokhara sub metropolitan city and it is a part of Pokhara sub metropolitan city. It has been turned into ward no. 27 and 29 of Pokhara sub metropolitan city. Hemja is a small town along the Pokhara- Baglung highway which is close to Pokhara city. Hemja is spread over an area of 1.5 km^2 mainly along the highway. This system has been handover to the NWSC recently and is in developmental phase of NWSC. Hence, it is not in full operation in terms of revenue collections and its complete establishment. Initially this system is having altogether 103 taps and all they are community taps. These taps are managed by the community and distributed to the nearby houses. These taps covers nearly 15 houses and supply has been maintained for 24 hours. After handover of the system NWSC is improving the system with replacement of old pipes and extending its distribution networks for the connections of private taps. At present NWSC – Hemja has distributed 99 nos. of private taps and it is continuing every day. Hemja town is at developing stage and service level of water supply system requires improvement in terms of coverage and quality of water to be supplied to the consumers.

Improvement works:

System is in need of adding intake filter at Ghattekhola and Ramalung stream, spring protection in existing three springs, adding ground tank of 500m^3 capacity at Surka. There is need of reconstruction of 160 km pipes to over whole Hemja to switch from public to private taps. Chlorine dosing unit and mini lab are needed for WQ monitoring.

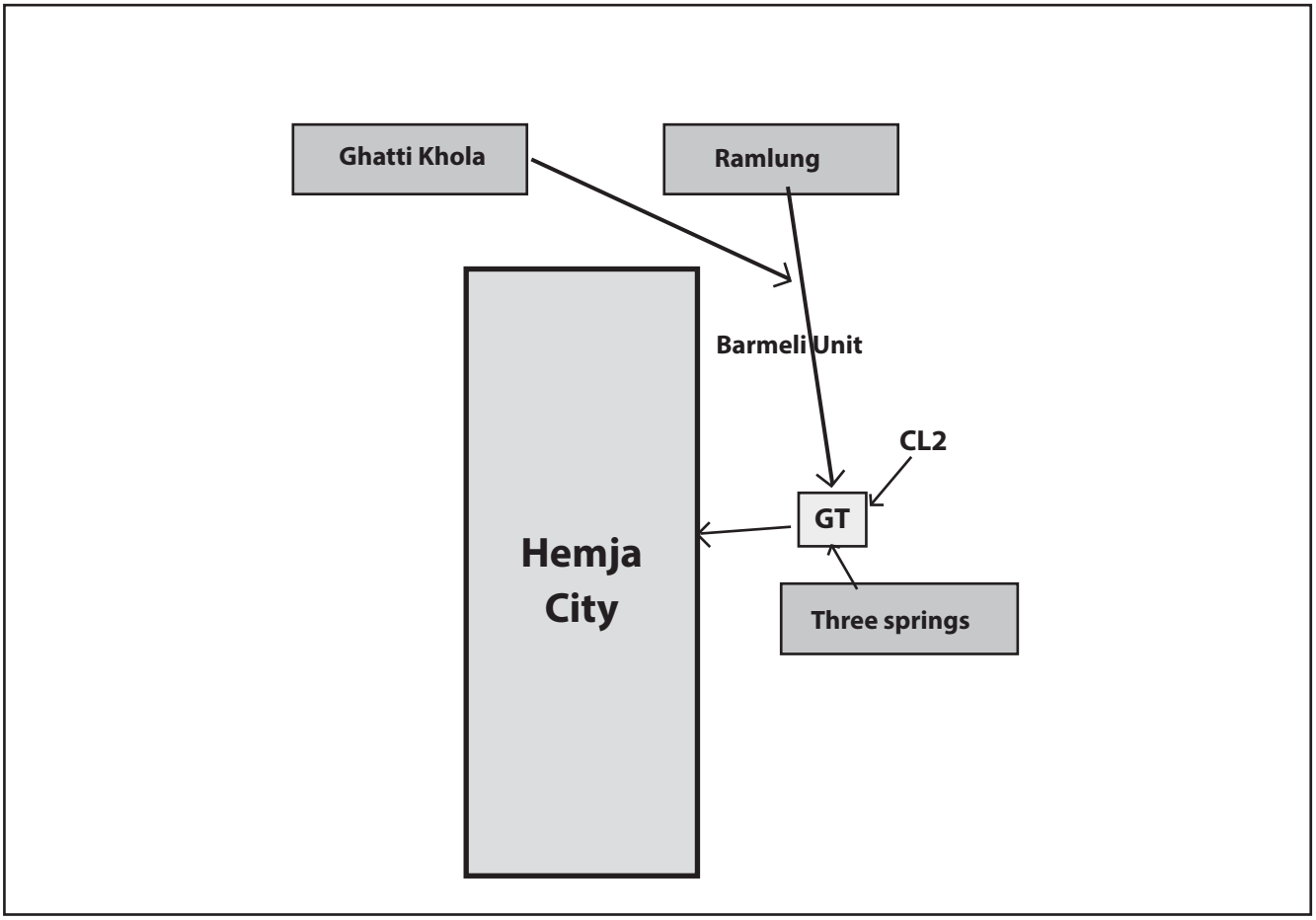
SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	160,000	6,000	960,000,000
2	Washouts with valve box	No	20	100,000	2,000,000
3	Lab equipment and chemicals	LS	1	500,000	500,000
4	Chlorine dosing	No	1	500,000	500,000
5	Bulk meter, pressure gauge, etc.	Set	1	200,000	200,000
	Total				**963,200,000**

Extension works:

Replacement of existing old pipes of 100 km in distribution networks. Construction of branch line of distribution networks for maintaining the uniform flow in the pipe networks. Construction of Valve chambers for branch line control. These Augmentation activities will increase nearly 3,500 private taps.

Water Qualities at taps:

Hemja Taps				Observed Value in Test Samples			
SN	**Parameters**	**Units**	**NDWQS**	**1133**	**1211**	**1212**	**1213**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	5.0	1.0	1.0	1.0
3	pH	-	6.5 - 8.5*	**6.3**	7.2	6.6	**6.0**
4	Temperature	^{0}C	-	25.4	23.7	23.6	23.6
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	<0.02	<0.02	<0.02
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.1	<0.02	<0.02	<0.02
9	Iron	mg/l	0.3 (3)	0.13	0.03	0.07	0.02
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	<0.02	<0.02	<0.02	<0.02
12	E. Coli	CFU/100ml	Nil	**70**	**20**	**24**	Nil



OHT: Over Head Tank, GT= Ground Tank, Cl2= Chlorination Unit, W= Tubewell

5.16 Improvement plan: NWSC Butwal

Introduction:

Butwal water supply system was initially constructed by the Department of Water Supply and Sewerage in 2033. It was constructed and managed by the DWSSC as a project for short period and further Butwal municipality has taken this responsibility to maintain the water supply in its service area and extended the system with some new wells. In 2038 this system was hand over to the NWSC for better operation and maintenance of the system. The growing trend of population in this city expanded its service area about 10 km^2 around Butwal. Now Butwal sub-metropolitan city has become one of the densely populated and industrial and educational centres of the Rupendehi District.

Bulk of surface water are collected for the supply and treated in the treatment plant located in Ramphedi. This plant has flocculation, plain sedimentation and rapid sand filter unit operation and Bleaching powder has been used as chlorinating the raw water. There are 14 tube wells in the town. Supply system has been divided into two parts with reference to main highway and supply has been maintained accordingly from the production units. The water treatment plant is not functioning well because of heavy sediment loads during rainy season. Rapid sand filter unit is chocked with and not operated since long back. People prefer drinking the tube water well compare to the stream water during rainy season. There is certain area where supply is not in pressure and gets water in small quantity. There are some small system also managed by the community within its coverage area.

Improvement works:

System is in need of replacing about 49 km old pipes (2"-10") laid in both side of the main roads for controlling leakage and flow. About 50 valve chamber is needed for zoning and washouts. There is need for system for chlorination and test kits for water quality testing mainly bacteriological

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	49,000	6,000	294,000,000
2	Washouts with valve box	No	50	100,000	5,000,000
3	Meter replacement	No	103	6,000	618,000
4	Well development	No	3	2,000,000	6,000,000
5	Generators	No	3	2,000,000	6,000,000
6	Lab equipment	LS	2	500,000	1,000,000
7	Chlorine dosing	No	5	150,000	750,000
8	Bulk meter, pressure gauge, etc.	Set	10	200,000	2,000,000
	Total				**315,368,000**

Extension works:

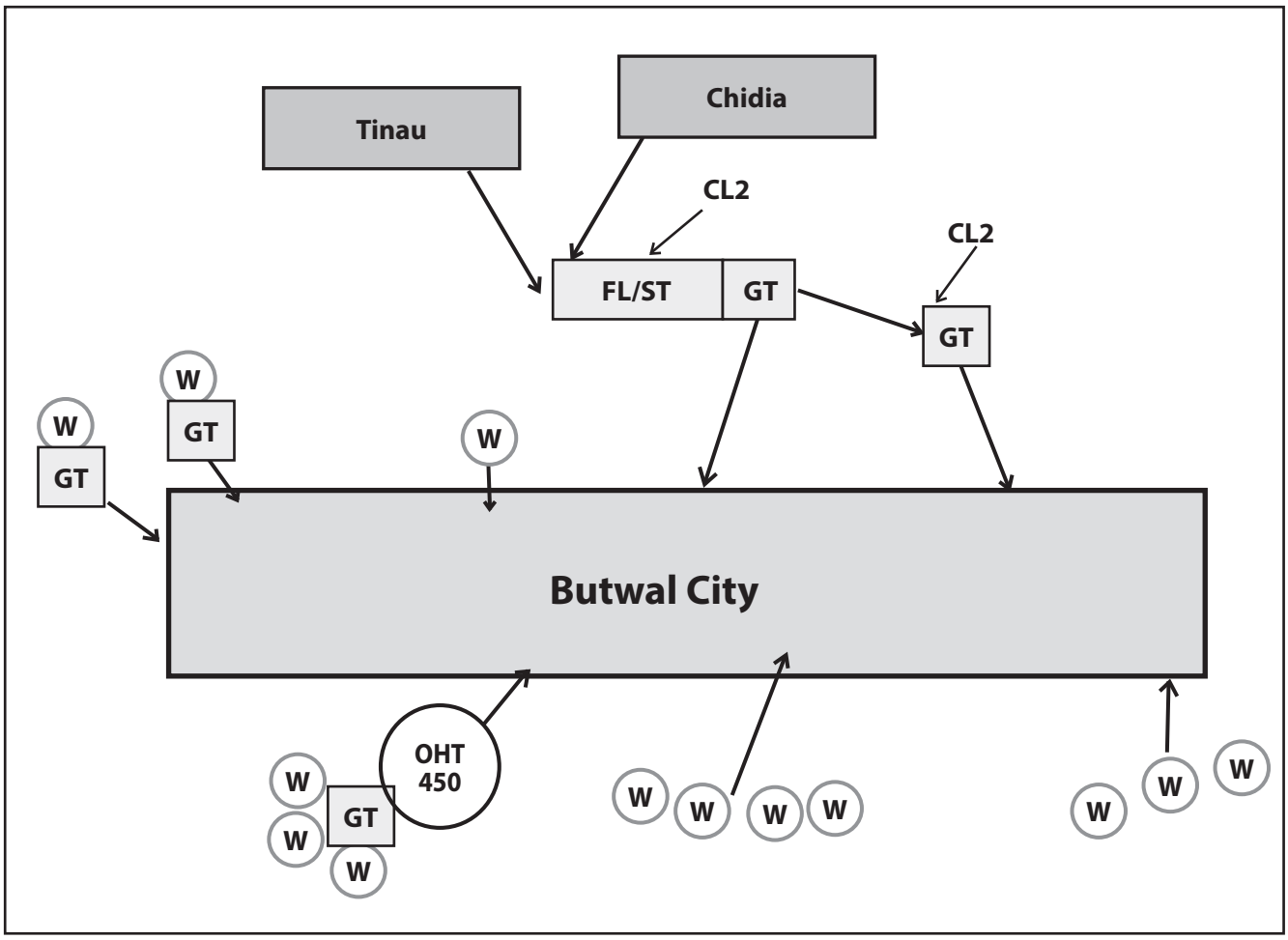
System is in need to extending services in Pipeline for the newly extended area of the municipalities and merging all system managed by the users committees. This will add about 10,000 new taps.

Data Profile:

Water Utility	WSP	NWSC - Butwal (Rupandehi)		
	Telephone	071-540781	Email: nwscbutwal@gmail.com	
	Head	Mohan Dutta Bhatta		
	Service Area (Wards)	Butwal (1-3,15) Total 22		
	No of staff	65	Staff per (1000) Taps	4
	Population Covered	86213	WS Coverage (%)	62
Mission Statement				
Service Connection	Total Taps	14464	Private Taps	14130
	Public Taps	103	Metered Taps	14319
	New Connections in FY	326	Disconnectons in FY	7
Customer Service	Complains/100 Taps/Yr	2.1	Users satisfied (%)	75
	No of break/Km/Yr	112	Supply hours	6
Water Production	Production (m^3/day)	21960	NRW (%)	57
	Consumption (LPCD)	109	Production (LPCD)	255
Revenue and Expenses	Annual O&M Cost (NRs)	36661047	Annual billing (NRs)	28732002
	Collection Ratio	0.9	Operating Ratio	0.6
	Cost/m^3 of water used	11	Average billing (NRs/M)	341
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	16	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			720 (100)
	No of sample tested for biological parameters (% passed)			360 (100)
	No of sample tested for FRC (% passed)			720 (100)

Water Qualities at taps:

Butwal Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**476**	**477**	**478**	**479**	**480**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	<1.0	**17.0**	<1.0	<1.0	<1.0
3	pH	-	6.5 - 8.5*	7	7.5	7.1	7.3	7.3
4	Temperature	^{0}C	-	26.3	26.6	26.5	26.5	26.5
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	0.2	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	<0.08	0.02	0.04	0.51
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	32.2	4.5	44.2	35.3	28.5
9	Iron	mg/l	0.3 (3)	0.03	0.02	0.05	0.05	0.23
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	>0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.44	0.36	0.22	0.7	0.44
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	**4**	Nil



OHT: Over Head Tank, GT= Ground Tank, FL= Flocculation Tank, ST= Sedimentation Tank,
Cl2= Chlorination Unit, W= Tubewell

5.17 Improvement plan: NWSC Bhairahwa

Introduction:

Bhairahwa Water Supply Project was constructed under the cooperation of government of India in 2023. It was designed to supply water 15 gallons per capita per day with a 225 m^3 overhead tank and a ground tank for emergency storage of 100m^3. In 2046 this system was handover to the NWSC for operation. NWSC started the service constructed another overhead tank of 450m^3 capacity to fulfil the demand of growing population of Sidharthnagar municipality. Now this system is having 6 wells in different locations and they are connected to the main line of the system. These wells supply the water directly to distribution systems to maintain the pressures in the networks.

Sidharthanagar Municipality is having altogether 13 wards and some of the wards are scattered from the main core bazaar area. At present the system is not covering the whole municipality and some of the wards have been partially covered with this system. One of the well of the system is artesian well that maintains the supply in the system 24 hours directly in Paklihawa area. Sidharthanagar Municipapity is one of the famous for pilgrim destination of Buddhism because of Lumbini is the birth place of Lord Buddha is located 15 km from Bhairahwa. Second International Airport of the country is under construction and town is expanding towards north and west side of the municipality.

Population coverage with this system seems to be not so high in terms of private tap connections because of use of alternate source. Senior chemist is monitoring the quality of water at production site and at the house hold level also.

Improvement works:

There is need of replacing old pipes and upgrade size in about 7 km in ward 6, 7 and 9. About 20 number of valve chamber is needed to be able to control the flow. One generator is needed to be able to continue supply during load shading of electricity.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (2"-3")	m	7,000	6,000	42,000,000
2	Washouts with valve box	No	20	100,000	2,000,000
3	Meter replacement	No	23	6,000	138,000
4	Generators	No	1	3,000,000	3,000,000
5	Lab equipment and chemicals	LS	1	200,000	200,000
6	Chlorine dosing	No	3	150,000	450,000
7	Bulk meter, pressure gauge, etc.	Set	6	100,000	600,000
	Total				**48,388,000**

Extension works:

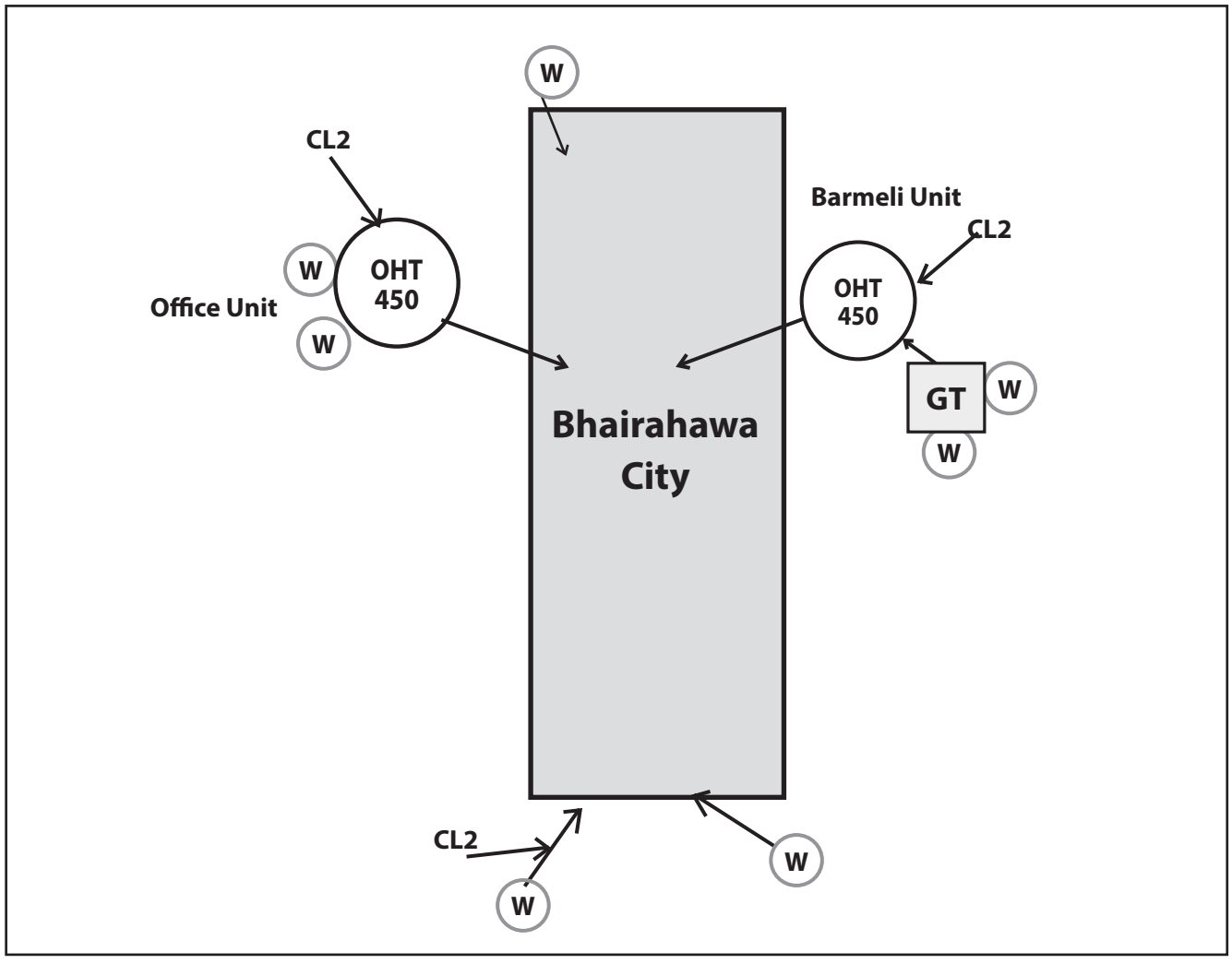
Similarly, There is need of pipe extension in the ward 8 (bank area), Ward 9 (Goligard), ward 7 (Janapath). About 24 km pipeline is required with pipe size ranging from 2-6". One well is required for the ward 9 for direct pumping. This will add about 2,500 new connections.

Data Profile:

Water Utility	WSP	NWSC - Bhairahawa (Rupandehi)		
	Telephone	071-520628	Email: dpk.shakya8@gmail.com	
	Head	Deepak Jyoti Shakya		
	Service Area (Wards)	Shidaarthanagar 1-3, 5-9,12,13		
	No of staff	25	Staff per (1000) Taps	7
	Population Covered	30056	WS Coverage (%)	44
Mission Statement				
Service Connection	Total Taps	3626	Private Taps	3527
	Public Taps	23	Metered Taps	3595
	New Connections in FY	97	Disconnectons in FY	1
Customer Service	Complains/100 Taps/Yr	3.4	Users satisfied (%)	47
	No of break/Km/Yr	70	Supply hours	8
Water Production	Production (m^3/day)	3528	NRW (%)	45
	Consumption (LPCD)	65	Production (LPCD)	117
Revenue and Expenses	Annual O&M Cost (NRs)	12543553	Annual billing (NRs)	10780850
	Collection Ratio	0.9	Operating Ratio	1.2
	Cost/m^3 of water used	18	Average billing (NRs/M)	249
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	13	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			480 (99)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			480 (80)

Water Qualities at taps:

Bhairahawa Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**456**	**457**	**458**	**459**	**460**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1	2.0	3.0	2.0	1.0
3	pH	-	6.5 - 8.5*	7.3	7.3	7.3	7.3	7.4
4	Temperature	^{0}C	-	26.2	26.3	26.1	26.3	26.2
5	Residual Total Chlorine	mg/l	0.1-0.2	0.2	0.1	**0.4**	**Nil**	0.2
6	Ammonia	mg/l	1.5	<0.02	0.08	0.04	0.21	0.12
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	2.8	1.5	3.0	3.1	2.5
9	Iron	mg/l	0.3 (3)	0.03	0.08	0.02	0.19	0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.17	0.32	0.18	0.25	0.16
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	**100**	Nil



OHT: Over Head Tank, GT= Ground Tank, Cl2= Chlorination Unit, W= Tubewell

5.18 Improvement plan: NWSC Taulihawa

Introduction:

Taulihawa water supply system was constructed by the Department of Water Supply and Sewerage in 2034. It was operated and maintained by the Department of Water Supply and Sewerage till 2056 then after it was hand over to NWSC. Taulihawa is named as Kapilbastu municipality which is located 15 km south from the Jeetpur of east west highway. This municipality was having 10 wards initially is now being increased to 17 wards adding neighbour VDC. This system covers 9 words of 10 excluding ward no. 8 of the municipality. Taulihawa as being district head quarter of Kapilvastu district is expanding towards northern part of core bazaar area. These areas are located in elevated side of the municipality where the supply of the system irregular and service level is not meeting the consumer's demand. Pipes are old and clogged get contaminated in some of the areas of this system and turbidity increases sometimes. These pipes are also vulnerable to contamination during non-supply hours. Clusters of this service area scattered far away from the source of supply and because of this reason also it is difficult to maintain uniform pressures in all distribution networks. The northern part of this municipality is developing with population when it comes to compare with the existing core bazaar area and future extension system is necessary for the coverage of such area.

Improvement works:

System is in need of replacing bout 5km old pipes (2"-3"). About 5 valve chamber is needed for zoning and washouts.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	5,000	6,000	30,000,000
2	Washouts with valve box	No	5	50,000	250,000
3	Wel development	No	1	5,000,000	5,000,000
4	Generators	No	1	500,000	500,000
5	Lab equipment and chemicals	LS	1	200,000	200,000
6	Chlorine dosing	No	1	150,000	150,000
7	Bulk meter, pressure gauge, etc.	Set	1	200,000	200,000
	Total				**36,300,000**

Extension works:

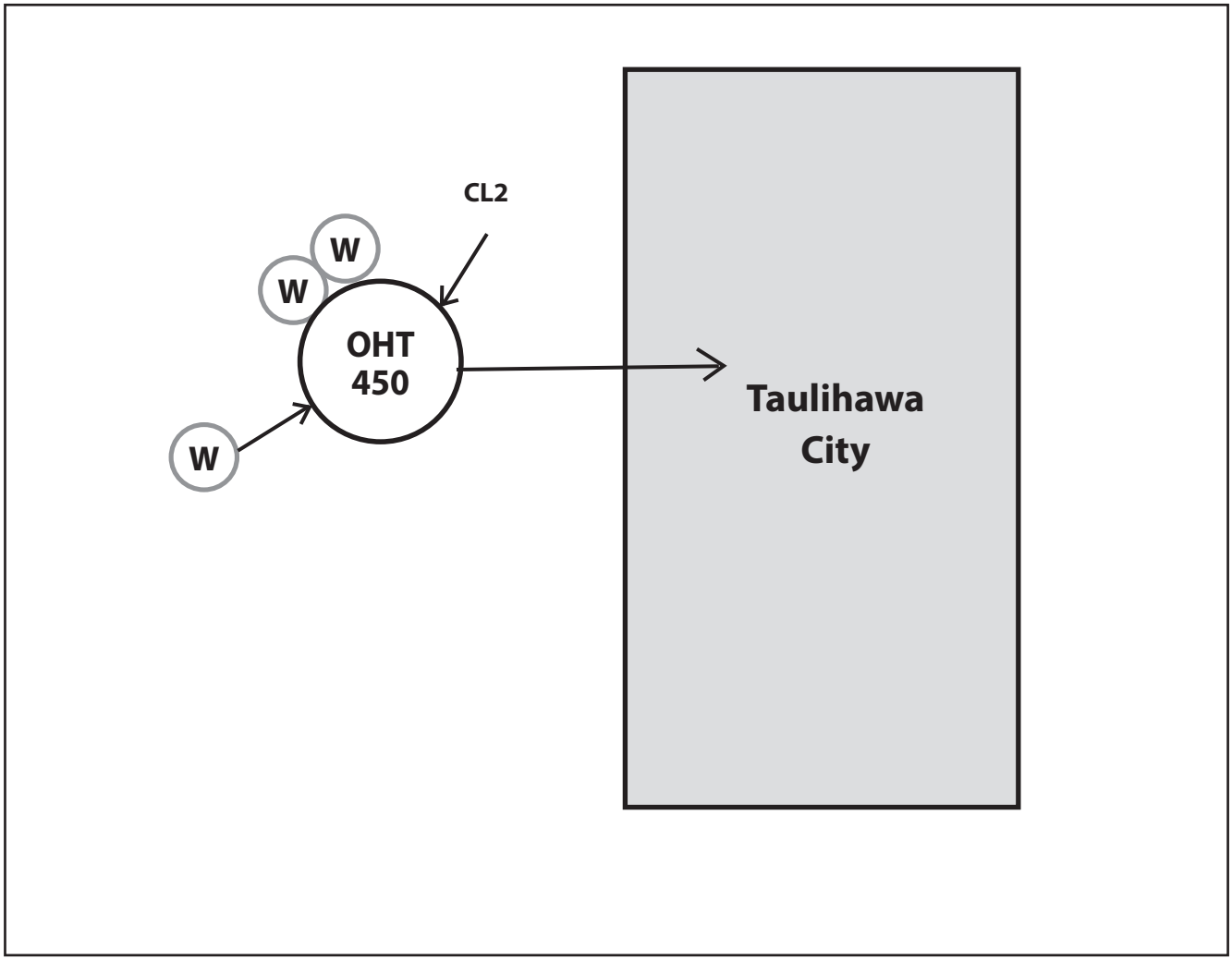
The system is in need to extending services in campus, Tilaurakot, Chotki Taulihawa, and hospital area which requires about 8.5 km pipes (1.5'-3") and one well in campus area for direct pumping. This will add about 200 new taps.

Data Profile:

Water Utility	WSP	NWSC - Taulihawa (Kapilbastu)		
	Telephone	076-560535	Email: skhsantoshdot@gmail.com	
	Head	Santosh Sah		
	Service Area (Wards)	1-7, 8-10 Total wards 223		
	No of staff	11	Staff per (1000) Taps	13
	Population Covered	5712	WS Coverage (%)	38
Mission Statement				
Service Connection	Total Taps	820	Private Taps	786
	Public Taps	2	Metered Taps	818
	New Connections in FY	30	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	2.8	Users satisfied (%)	70
	No of break/Km/Yr	17	Supply hours	6
Water Production	Production (m^3/day)	964	NRW (%)	54
	Consumption (LPCD)	77	Production (LPCD)	169
Revenue and Expenses	Annual O&M Cost (NRs)	5185580	Annual billing (NRs)	2348920
	Collection Ratio	0.9	Operating Ratio	2.2
	Cost/m^3 of water used	32	Average billing (NRs/M)	239
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	13	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			360 (100)
	No of sample tested for biological parameters (% passed)			0
	No of sample tested for FRC (% passed)			360 (93)

Water Qualities at taps:

Taulihawa Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**407**	**408**	**409**	**410**	**411**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	<1.0	<1.0	<1.0	<1.0	<1.0
3	pH	-	6.5 - 8.5*	7.7	7.7	7.8	7.9	7.8
4	Temperature	^{0}C	-	25.9	25.9	25.9	26	26
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	<0.02	0.17	0.04	0.14	0.02
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.36	0.39	0.36	1.3	0.09
9	Iron	mg/l	0.3 (3)	0.13	0.1	0.1	0.06	0.04
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.42	0.53	0.55	0.61	0.5
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	Nil	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.19 Improvement plan: NWSC Bahadurgunj

Introduction:

Bahadurganj water supply project was completed by the Department of Water Supply and Sewerage in 2035 which was further maintained operated by the DWSS with its own. For its sustainability and better operation and maintenance hand was over to the community in 2064. For the first three years water user's committee was supported with some financial grant by the DWSS. Having this support WUSC operating and maintaining this system till date. Now it is in the process of handover to the Nepal Water Supply Corporation which will be further operated and maintained by NWSC Krisnanagar. With limited numbers of staffs the system has been operating so far. Most of the ward of this VDC has been covered by this system and some of the wards of neighbour VDC have also getting service from this system.

Department of Water Supply and Sewerage had hand over this system constructing one new well as a stand by for the operation but it has not been used by the WUSC since its completion time. WUSC could not bring this well in operation because of quality of water, They have complain regarding this tube well that it was not completely developed and turbidity is very high and water is totally yellow colour. Consumers have complains on reliability of supply although WUSC supplies the water for 2 times a day. Service area is so scattered that leakages area not maintained in time.

Improvement works:

System is in need of replacing bout 4km old pipes (2"-5"). About 10 valve chamber is needed for zoning and washouts. There is need for system for chlorination and test kits for water quality testing.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	4,000	6,000	24,000,000
2	Washouts with valve box	No	10	50,000	500,000
3	Meter replacement	No	27	6,000	162,000
4	Well development	No	1	100,000	100,000
5	Generators	No	1	3,000,000	3,000,000
6	Lab equipment and chemicals	LS	1	200,000	200,000
7	Chlorine dosing	No	1	150,000	150,000
8	Bulk meter, pressure gauge, etc.	Set	1	200,000	200,000
	Total				**28,312,000**

Extension works:

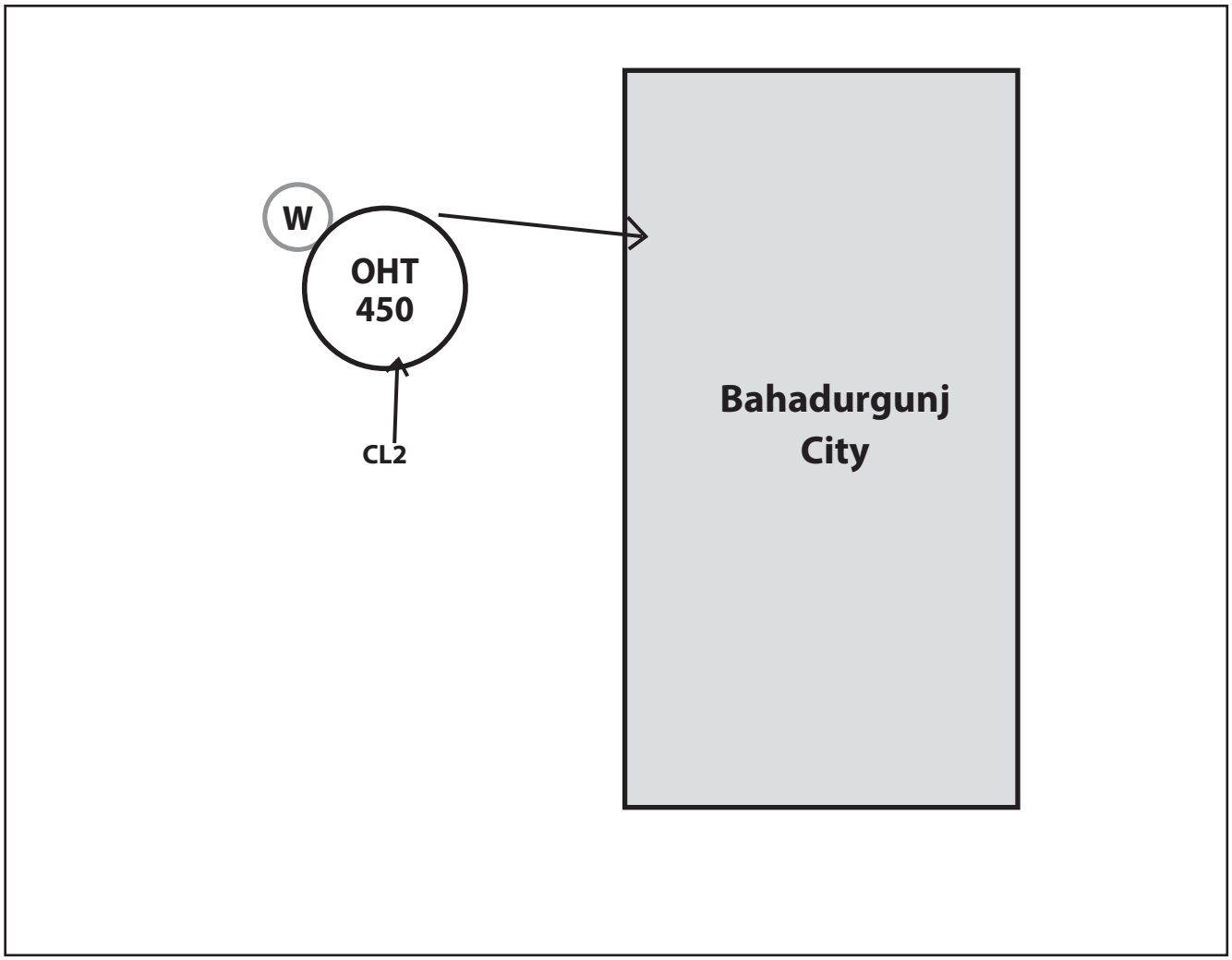
Similarly, system is in need to extending services Pipe line for the Babanpur, Junila, Ganeshpr, Raharaula, Bijayanagar and Dagarmarua. This needs about 15 km pipes. This will add about 200 new taps.

Data Profile:

Water Utility	WSP	NWSC - Bahadurgunj (Kapilbastu)		
	Telephone		Email:	
	Head	Santosh Sah (UC chair Akbal Ahmed Khan)		
	Service Area (Wards)	Bahadurgunj (1,2,5), Purushotampur (3-5), Ajgara (7-9)		
	No of staff	4	Staff per (1000) Taps	9
	Population Covered	3848	WS Coverage (%)	36
Mission Statement				
Service Connection	Total Taps	433	Private Taps	407
	Public Taps	15	Metered Taps	406
	New Connections in FY	3	Disconnectons in FY	35
Customer Service	Complains/100 Taps/Yr	0.6	Users satisfied (%)	0
	No of break/Km/Yr	20	Supply hours	4.5
Water Production	Production (m^3/day)	374	NRW (%)	27
	Consumption (LPCD)	71	Production (LPCD)	97
Revenue and Expenses	Annual O&M Cost (NRs)	587894	Annual billing (NRs)	702420
	Collection Ratio	1.0	Operating Ratio	0.8
	Cost/m^3 of water used	6	Average billing (NRs/M)	140
Water Tariff	Metered Taps	80	Un-metered Taps	500
	Increment (NRs/unit)	15	Community	0
	Average Tariff (NRs/M\m^3)	7	Connections charge	1595
Water Quality	No of sample tested for physicochemical parameters (% passed)			2 (100)
	No of sample tested for biological parameters (% passed)			2 (100)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Bahadurgunj Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**438**	**439**	**440**	**441**	**442**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1	<1.0	2	<1.0	2
3	pH	-	6.5 - 8.5*	7.8	7.9	8	8	8
4	Temperature	^{0}C	-	27	26.7	26.7	27	27
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**NIl**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.11	0.07	0.09	0.1	0.06
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.5	0.41	0.45	0.5	0.53
9	Iron	mg/l	0.3 (3)	0.03	0.01	0.08	0.1	0.09
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.54	0.63	1.28	0.74	1.35
12	E. Coli	CFU/100ml	Nil	**61**	**36**	**10**	**>300**	**2**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.20 Improvement plan: NWSC Krishnanagar

Introduction:

Krishnanagar Water System was constructed by the Department of Water Supply and Sewerage in 2034. This system was operated and maintained by the Department of Water Supply up to the fiscal year 2063 and hand over to the water user's Committee to run the system with grant support for better operation installing one standby tube well inside the compound. Krishna Nagar is one of the old town of Kapilvastu district and located very close to Indian boarder. This town is not so densely populated town and urbanizing trend shows the growth of the population in this town also. This town lies 20 km south of Chandrauta of east west high ways. This is also one of the importing centres of the country and contribute big amount of revenue for national budgetary system.

This system is supplying water to the consumers with one overhead tank having capacity of 450 m^3 and 25 km of distribution main. Extension works have been done to cover the demand of people in some of the location of the town. Now the Municipality has included two of neighbour VDC where service has to be provided. The system has distribution networks of very old pipes and they are difficult for maintenance as the surface level rising up because of filling trend of road level in the town. Some of the locations of the town are not having equal distribution in terms of quantity of water and services provided by this branch.

Improvement works:

System is in need of replacing about 4 km old pipes (2"-3"). About 15 valve chamber is needed for zoning and washouts.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (2"-3")	m	4,000	6,000	24,000,000
2	Washouts with valve box	No	15	50,000	750,000
3	Chlorine dosing	No	1	150,000	150,000
4	Bulk meter, pressure gauge, etc.	Set	1	200,000	200,000
	Total				**25,100,000**

Extension works:

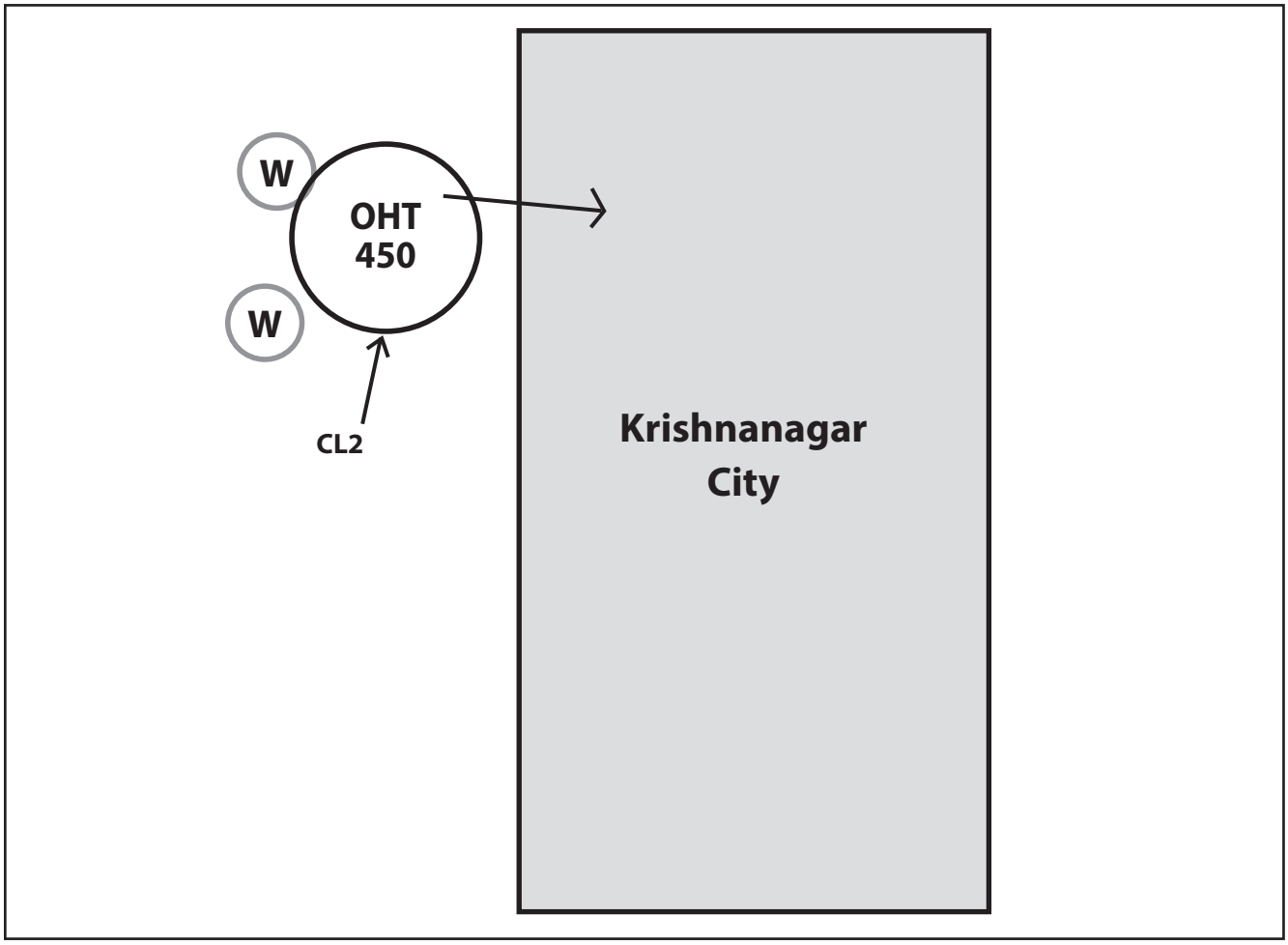
Similarly, system is in need of extending services in Laxminager, Chaipurawa, Semera and Baraham with 6 km pipes (2"-3"), Baraha area with one well and 10 km pipes and one OHT (250 m^3) in Jhandenagar. This will add about 200 new taps.

Data Profile:

Water Utility	WSP	NWSC - Krishnanagar (Kapilbastu)		
	Telephone	052-514076	Email: skhsantoshdot@gmail.co	
	Head	Santosh Sah/Tikaram Kunwar		
	Service Area (Wards)	Krishnanagar 1-7, 9-14		
	No of staff	15	Staff per (1000) Taps	15
	Population Covered	6060	WS Coverage (%)	20
Mission Statement				
Service Connection	Total Taps	990	Private Taps	955
	Public Taps	11	Metered Taps	936
	New Connections in FY	27	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	2.1	Users satisfied (%)	80
	No of break/Km/Yr	25	Supply hours	5
Water Production	Production (m^3/day)	1026	NRW (%)	37
	Consumption (LPCD)	106	Production (LPCD)	169
Revenue and Expenses	Annual O&M Cost (NRs)	6538727	Annual billing (NRs)	3753235
	Collection Ratio	0.9	Operating Ratio	1.7
	Cost/m^3 of water used	28	Average billing (NRs/M)	319
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	14	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			720 (100)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			720 (100)

Water Qualities at taps:

Krishnanagar Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**431**	**432**	**433**	**434**	**435**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	4	5	**10**	3	**6**
3	pH	-	6.5 - 8.5*	7.7	7.4	7.7	7.8	7.8
4	Temperature	^{0}C	-	26.8	26.9	27	26.9	27
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**0.4**	0.2	0.1	0.2
6	Ammonia	mg/l	1.5	0.22	0.16	0.12	0.17	0.14
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.1	0.09	0.03	0.1	0.05
9	Iron	mg/l	0.3 (3)	0.03	0.01	0.08	0.1	0.09
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.55	1.24	0.75	0.85	1.06
12	E. Coli	CFU/100ml	Nil	**3**	Nil	NIl	Nil	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.21 Improvement plan: NWSC Nepalgunj

Introduction:

Nepalgunj water supply system was constructed by the Indian commission mission in 2031. It was further operated by public works division office of Nepalgunj. Formally it was hand over to NWSC in 2038 for operation. Nepalganj is a border town of mid-western region and has been developed as an industrial district of this region. This is also a transit point of tourists and business centre of this region. Nepalgunj is expanding around old core city area which has been developed with growing population. Recently this town has become a sub metropolitan city.

NWSC Nepalgunj is operating this system to cover the population altogether of 17 wards. Now it has been expanded up to 28 wards including some of the Neighbour VDCs. Population coverage of this city has been estimated to be 20,000 out of total population of 75,000. The pipe networks are very old and urban environmental improvement project of Ministry of Urban Planning has affected its networks in Surkhet road section. Pipe networks very close to storm water drain were constructed by this project. Around 19 % coverage shows a very low rate of household connections of the system. People have choices of alternate sources but lack of consumer's education the connection rate has not been increased. At present 3 wells are in operation which is not sufficient to meet the demand of population. Water quality has not been monitored since two years back. Bleaching powder has been used for chlorinating purpose.

Improvement works:

System is in need of replacing about 25 km old pipes (1.5"-3") and shifting 2000 taps, adding 30 valve chambers for controlling leakage and flow and washouts

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	25,000	6,000	150,000,000
2	Washouts with valve box	No	30	100,000	3,000,000
3	Lab equipment and chemicals	LS	1	200,000	200,000
4	Chlorine dosing	No	2	150,000	300,000
	Total				**153,500,000**

Extension works:

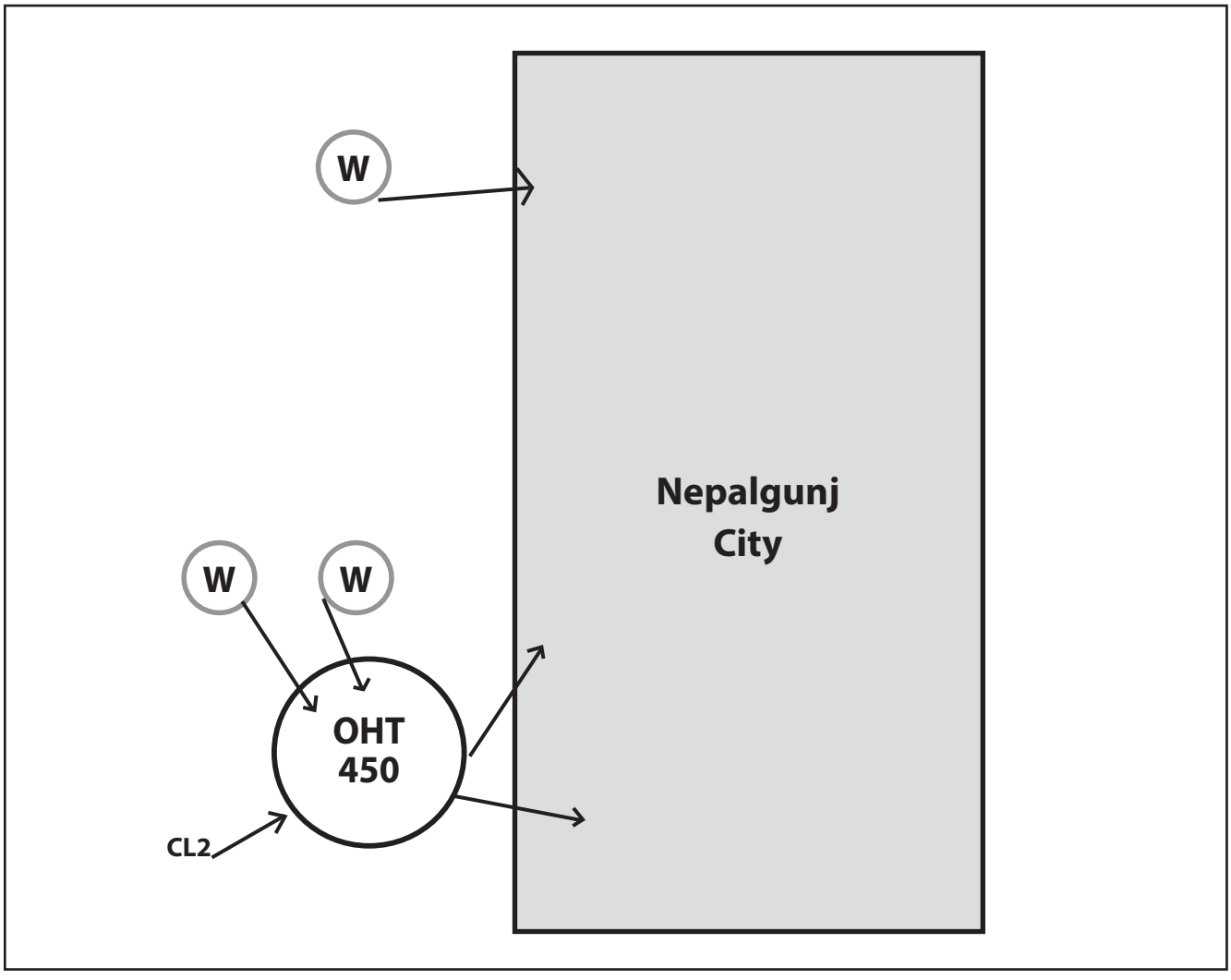
The system is in need to extending pipes about 38 km in Karkando (W-24), Muktipur (W-16), Baspark (W5), Adarsha nagar (W-13), Belashpur (W16), Tejnagar (W-24), Surjegaw (W-25), Ladawa (W2-4). Two wells are needed in Karkando and Campus. One OHT of 400m^3 is under construction in the Karkando. This will add about 2,500 taps.

Data Profile:

Water Utility	WSP	NWSC - Nepalgunj (Banke)		
	Telephone	081-520592	Email: oasis_ses@hotmail.com	
	Head	Asis Karki		
	Service Area (Wards)	Nepalgunj (1-17) of 28		
	No of staff	29	Staff per (1000) Taps	7
	Population Covered	24234	WS Coverage (%)	32
Mission Statement				
Service Connection	Total Taps	4054	Private Taps	3939
	Public Taps	10	Metered Taps	4044
	New Connections in FY	48	Disconnectons in FY	16
Customer Service	Complains/100 Taps/Yr	3.5	Users satisfied (%)	25
	No of break/Km/Yr	105	Supply hours	6
Water Production	Production (m^3/day)	3888	NRW (%)	37
	Consumption (LPCD)	101	Production (LPCD)	160
Revenue and Expenses	Annual O&M Cost (NRs)	12865000	Annual billing (NRs)	11611123
	Collection Ratio	0.9	Operating Ratio	1.1
	Cost/m^3 of water used	14	Average billing (NRs/M)	239
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	12	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Nepalgunj Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**591**	**592**	**593**	**594**	**595**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	2	<1.0	5	1	<1.0
3	pH	-	6.5 - 8.5*	7.4	7.5	7.6	7.5	7.5
4	Temperature	^{0}C	-	26.3	26.2	26.2	26	26.1
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.25	0.25	0.18	0.36	0.25
7	Nitrite	mg/l as NO_2	3	0.02	0.02	0.03	0.04	0.03
8	Nitrite	mg/l as NO_3	50	0.79	0.25	0.18	0.49	0.2
9	Iron	mg/l	0.3 (3)	0.01	<0.01	0.07	<0.01	<0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.85	0.81	0.88	0.83	0.96
12	E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	**3**	**2**



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.22 Improvement Plan: NWSC Dhangadhi

Introduction:

Dhangadhi Water Supply Project was completed in 2030 by Department of Supply and sewerage. It has been operating by NWSC Dhangadi Branch since 2056 after handover from Department of Water Supply Sewerage. Dhangadhi water supply system was further improved with one steel tank having capacity of 200m^3 and two new wells by Japanese cooperation to meet the increasing demand of the town. At present Dhangadhi Water Supply System is having altogether 8 wells and most of them are artesian wells. Out of them 4 wells are in operation and remaining wells have to be developed because of clay and sand accumulation. The elevation difference of some of the location of the town from the source of supply reduces the pressure and consequently consumers do not get the water in their houses. Pipes are being very old and of under size requires proper replacement in the system. Old pipes get chocked with sand deposits and with sewages in some locations because of surface drains during non-supply hours

Improvement works:

System is in need of changing old and small pipes for 10 km main lines and 30 km distribution lines for equal distribution of flow and controlling leakage and contamination. Pressure filters are needed for two units and four wells serving online. Chlorine dosing is needed in six. About 5 number of washout is needed.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	40,000	6,000	240,000,000
2	Washouts with valve box	No	50	100,000	5,000,000
3	Meter replacement	No	13	6,000	78,000
4	Well development	No	2	200,000	400,000
5	Lab equipment and chemicals	LS	1	200,000	200,000
6	Chlorine dosing	No	6	150,000	900,000
7	Bulk meter, pressure gauge, etc.	Set	4	200,000	800,000
8	Pressure filter	No	6	3,000,000	18,000,000
	Total				**265,378,000**

Extension works:

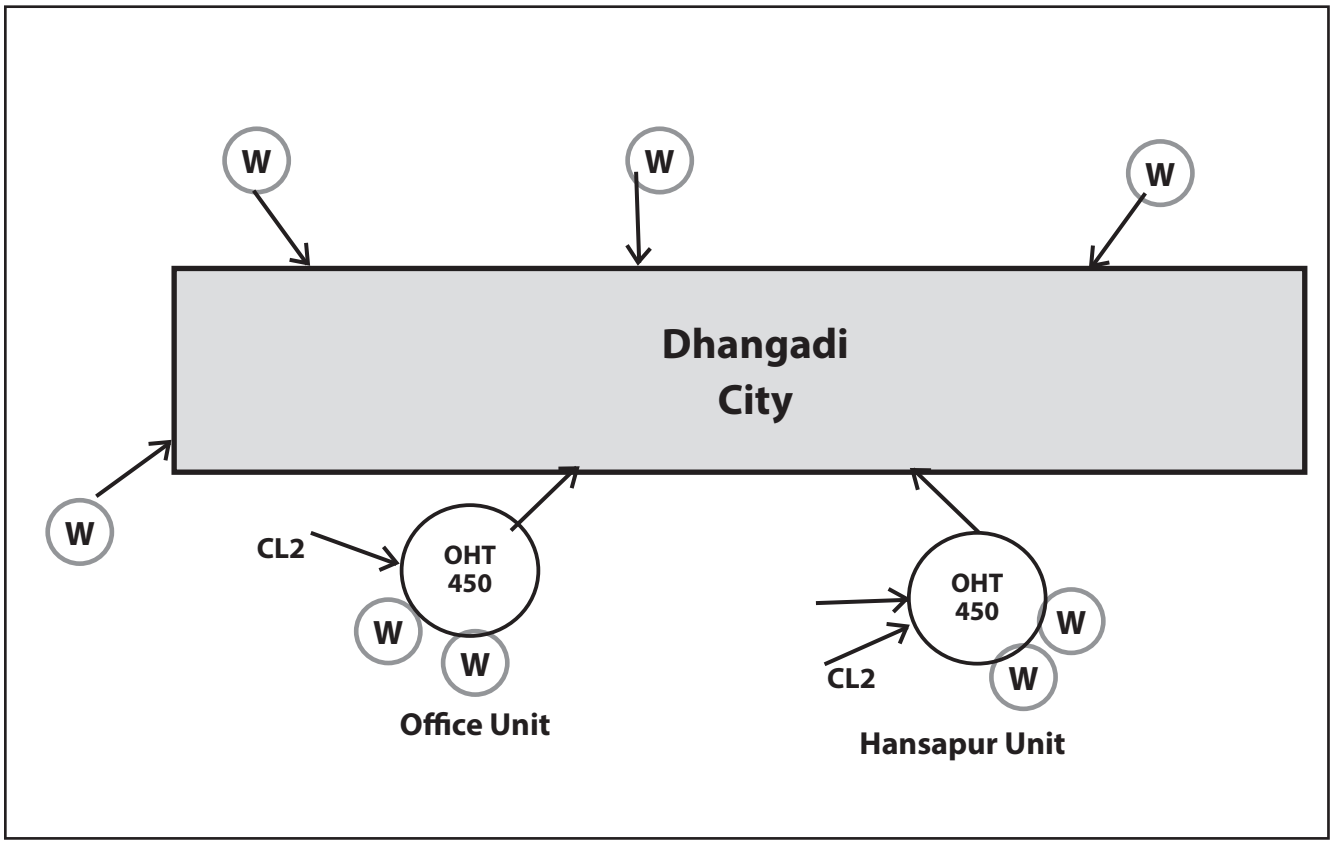
There is need for extending system for Jugeda (W-13): Two wells, one 450m^3 OHT and 10 km pipes and Bishalnagar (W-3): One wells, one 450m^3 OHT and 5 km pipes. Improvement adds 3,000 taps and extension adds 3,000 taps.

Data Profile:

Water Utility	WSP	NWSC - Dhangadi (Kailali)		
	Telephone	091-524471	Email: nwscdh.info@gmail.com	
	Head	Arbinda Kumar Lal Karna		
	Service Area (Wards)	Dhangadi 1-18 out of 14 wards		
	No of staff	26	Staff per (1000) Taps	6
	Population Covered	26220	WS Coverage (%)	73
Mission Statement				
Service Connection	Total Taps	4469	Private Taps	4305
	Public Taps	13	Metered Taps	4456
	New Connections in FY	106	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	6.0	Users satisfied (%)	90
	No of break/Km/Yr	50	Supply hours	12
Water Production	Production (m^3/day)	2800	NRW (%)	18
	Consumption (LPCD)	87	Production (LPCD)	107
Revenue and Expenses	Annual O&M Cost (NRs)	10270189	Annual billing (NRs)	13817518
	Collection Ratio	0.9	Operating Ratio	0.7
	Cost/m^3 of water used	12	Average billing (NRs/M)	258
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	15	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			0 (0)
	No of sample tested for biological parameters (% passed)			0 (0)
	No of sample tested for FRC (% passed)			0 (0)

Water Qualities at taps:

Dhangadi Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**677**	**678**	**679**	**680**	**681**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	1	1	1	1	**1**
3	pH	-	6.5 - 8.5*	7.4	7.3	7.4	7.4	7.4
4	Temperature	^{0}C	-	27.3	27.3	27.2	26.8	26.9
5	Residual Total Chlorine	mg/l	0.1-0.2	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**
6	Ammonia	mg/l	1.5	0.45	0.28	0.39	0.2	0.32
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	0.12	0.05	0.2	0.05	0.22
9	Iron	mg/l	0.3 (3)	<0.01	0.01	0.01	<0.01	0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.86	0.88	1.0	1.0	0.95
12	E. Coli	CFU/100ml	Nil	Nil	**1**	Nil	**11**	Nil



OHT: Over Head Tank, Cl2= Chlorination Unit, W= Tubewell

5.23 Improvement plan: NWSC Mahendranagar

Introduction:

Mahendranagar water Supply project was constructed in 2030 by Department of Water Supply and Sewerage under ministry of water and electricity. Augmentation of the system along with the construction of wells and treatment facilities was done by the government of Japan in 2050. Mahendranagar was initially developed as a planned city for far western region of Nepal which is one of the border towns also. River Mahakali separates the country from India.

Mahendranagar municipality has total 19 wards but these are scattered around the town. All these wards are not covered with this system. At present 3 wards are totally covered by this system. In recent days the connections of the private taps are in increasing trend and production is sufficient to cover more area for tap connections. There are other water supply systems within this municipality. These systems have been completed by the Department of Water Supply and Sewerage to cover the isolated wards of the municipality.

Ground water is the source of supply which has calcium concentration in dissolved state. Japan government has constructed the system to control the concentration of calcium with Rapid sand filter and clear water tank for distribution. Consumers have complained on the calcinations deposit in their utensils.

Improvement works:

System is in need of changing sand media in RSF filter media. Out of three booster pump two pump are not functioning. About 3 km pipes (3-4") need to be replaced in main line and 5 km pipes (6-8") need to be replaced in distribution line. About 5 number of washout is needed. There is calcium deposition in the water vessels at HH which need to be examined.

SN	Works	Units	Quantity	Rate	Cost
1	Pipe replacement (1.5"-4")	m	3,000	6,000	18,000,000
2	Washouts with valve box	No	5	100,000	500,000
3	Generators	No	1	3,000,000	3,000,000
4	Lab equipment and chemicals	LS	1	200,000	200,000
5	Chlorine dosing	No	2	150,000	300,000
6	RSF	No	1	2,000,000	2,000,000
	Total				**24,000,000**

Extension works:

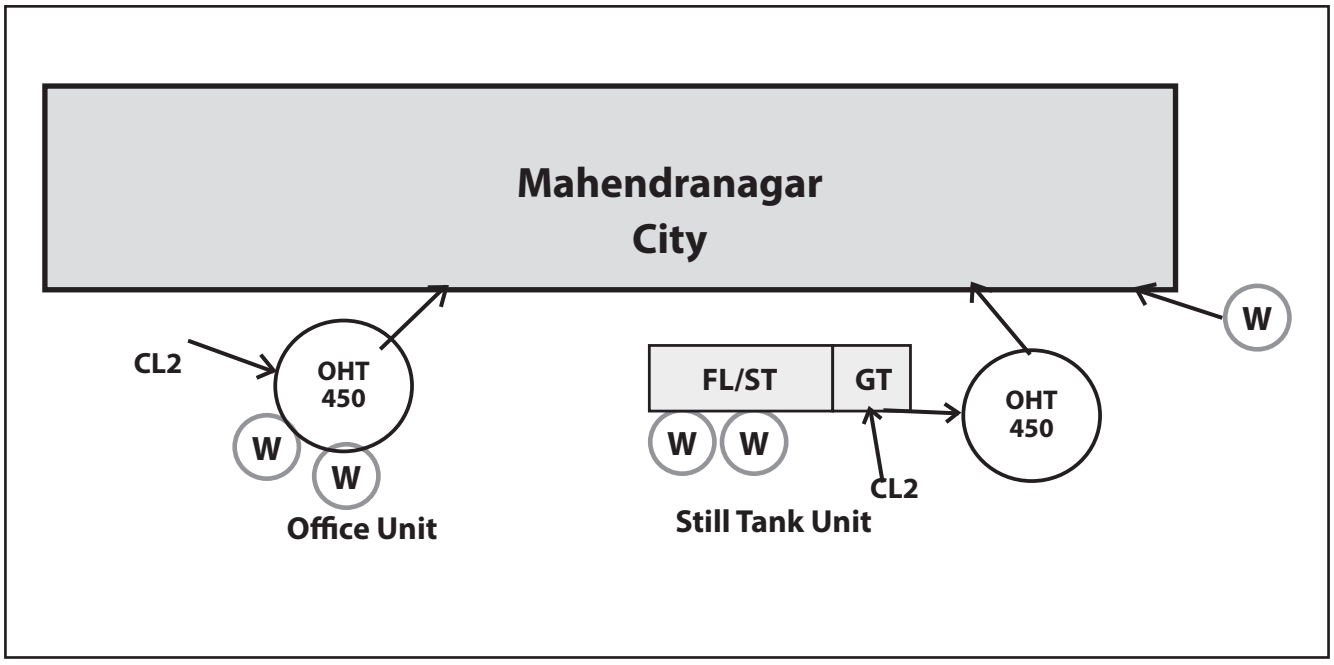
There is need for extending system for Bangau (One well, One OHT and 12 km pipes), Airport (One well, One OHT and 15 km pipes one OHT) and Nayakatan (One OHT and 5 Km pipes).

Data Profile:

Water Utility	WSP	NWSC - Mahendranagar (Kanchanpur)		
	Telephone	099-521133	Email: harishrestha211@gmail.com	
	Head	Hari Kumar Shrestha		
	Service Area (Wards)	Bhimdutta (3,4,6,18) out of 19 wards		
	No of staff	17	Staff per (1000) Taps	8
	Population Covered	11298	WS Coverage (%)	23
Mission Statement				
Service Connection	Total Taps	2002	Private Taps	1883
	Public Taps	6	Metered Taps	1711
	New Connections in FY	156	Disconnectons in FY	0
Customer Service	Complains/100 Taps/Yr	4.3	Users satisfied (%)	90
	No of break/Km/Yr	31	Supply hours	9
Water Production	Production (m^3/day)	1860	NRW (%)	59
	Consumption (LPCD)	68	Production (LPCD)	165
Revenue and Expenses	Annual O&M Cost (NRs)	7520116	Annual billing (NRs)	5728290
	Collection Ratio	0.9	Operating Ratio	1.3
	Cost/m^3 of water used	27	Average billing (NRs/M)	239
Water Tariff	Metered Taps	110	Un-metered Taps	560
	Increment (NRs/unit)	25	Community	1600
	Average Tariff (NRs/M\m^3)	19	Connections charge	1980
Water Quality	No of sample tested for physicochemical parameters (% passed)			72 (100)
	No of sample tested for biological parameters (% passed)			72 (100)
	No of sample tested for FRC (% passed)			72 (50)

Water Qualities at taps:

Mahendranagar Taps				Observed Value in Test Samples				
SN	**Parameters**	**Units**	**NDWQS**	**622**	**623**	**624**	**625**	**626**
1	Color	Hazen	5 (15)	<5.0	<5.0	<5.0	<5.0	<5.0
2	Turbidity	NTU	5 (10)	<1.0	<1.0	<1.0	<1.0	<1.0
3	pH	-	6.5 - 8.5*	7.4	7.3	7.3	7.1	7.3
4	Temperature	^{0}C	-	25.7	25.5	25.5	25.5	25.7
5	Residual Total Chlorine	mg/l	0.1-0.2	0.2	**Trace**	**Nil**	**Nil**	**0.3**
6	Ammonia	mg/l	1.5	0.07	0.08	0.18	0.14	0.24
7	Nitrite	mg/l as NO_2	3	<0.02	<0.02	<0.02	<0.02	<0.02
8	Nitrite	mg/l as NO_3	50	4.94	7.56	10.8	10.64	4.6
9	Iron	mg/l	0.3 (3)	<0.01	0.02	0.02	0.02	<0.01
10	Arsenic	mg/l	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
11	Fluoride	mg/l	0.5 - 1.5*	0.14	0.21	0.15	0.1	0.98
12	E. Coli	CFU/100ml	Nil	Nil	**2**	Nil	**15**	Nil



OHT: Over Head Tank, GT= Ground Tank, FL= Flocculation Tank, ST= Sedimentation Tank,
Cl2= Chlorination Unit, W= Tubewell