

# This presentation premiered at WaterSmart Innovations

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# **Case Study – Modernization of Nagpur City Drinking Water Supply Scheme**

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# ORANGE CITY NAGPUR

- Nagpur is Second Capital of Maharashtra State, next to Mumbai.
- One of historic City located almost at center of in India.
- Present population of the City is 27,20,000
- Called Orange City as it produces maximum Oranges in the country.

# Orange City Nagpur...

- Water supply to Nagpur City was drawn from three surface sources Gorewada Tank (1911), Kanhan river, and Pench canal.
- Pench-I ,II & III Schemes were commissioned in 1982, 1984, & 2003 respectively.
- There are 43 Service reservoirs with 150.79 ML Storage (32% of total supply per day)

# **WATER... Transformation**

**Water for Drinking**

**to**

**Drinking Water**

# Impact on Water Supply ...

## Population & Industrial growth

- Insufficient, irregular water supply
- Uneven distribution of water
- Drastic increase in UFW
- Water Quality was degraded.
- Stress on the Managers responsible for water supply
- New resources to cater future demands

# Population & Water Supply

ZONE	POPULATION	AREA	QTY. SUPPLIED
	2004	Ha.	IN MLD
I DHARAMPETH	261666	4084.63	78.55
II LAXMI NAGAR	257960	3516.31	54.05
III HANUMAN NAGAR	165717	2181.52	27.91
IV DHANTOLI	236701	815.37	36.16
V NEHARU NAGAR	198411	1423.69	27.22
VI SOKTA BHAWAN	290076	556.07	61.03
VII SATRANJIPURA	336267	744.48	91.98
VIII LAKHADGANJ	176716	2406.16	16.04
IX ASHI NAGAR	225881	3225.02	23.14
X MANGALWARI	204606	2109.06	44.26
PUMPING/FEEDER MAIN			29.65
<b>Total</b>	<b>2354001</b>	<b>21062</b>	<b>490.00</b>

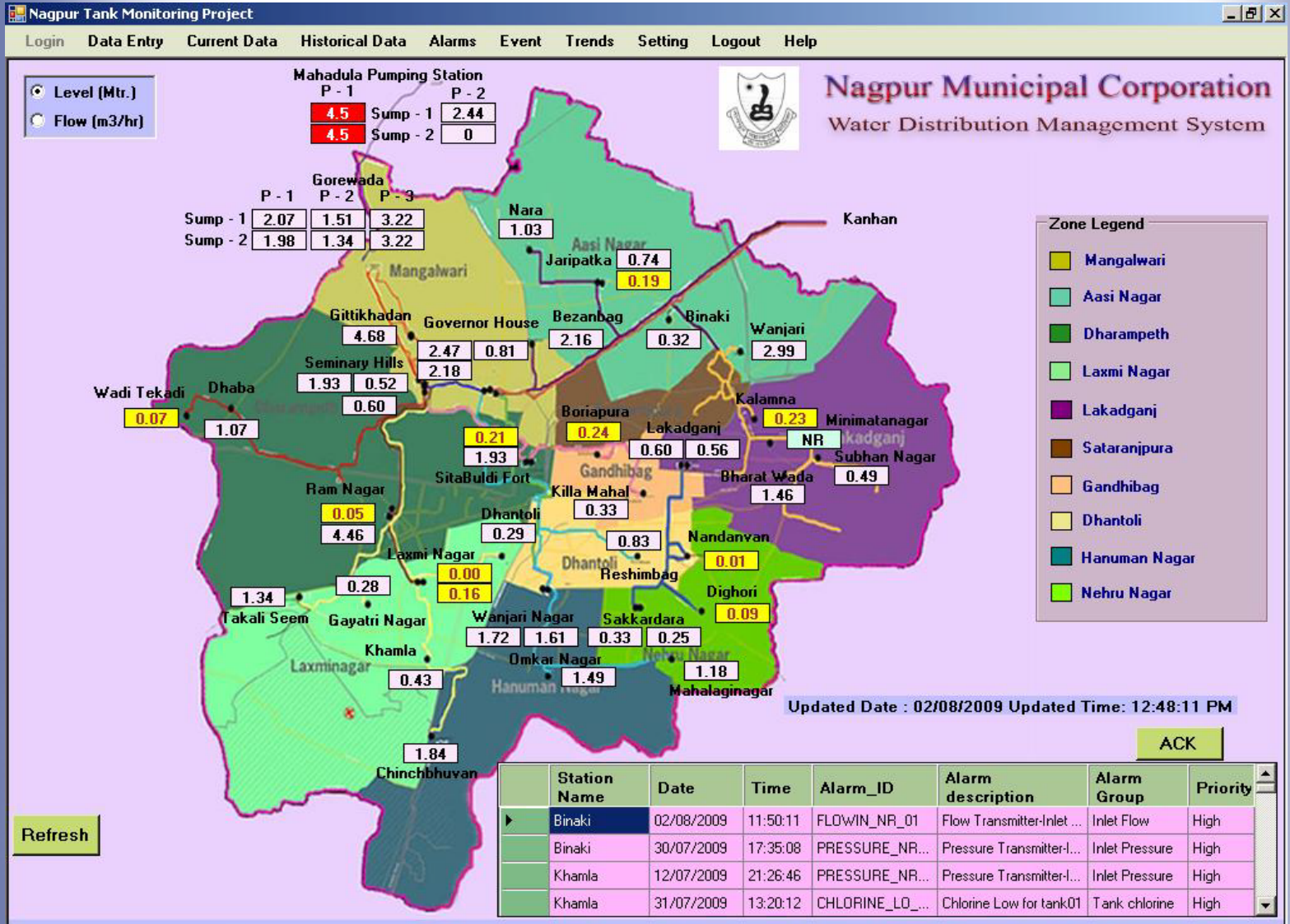
Slum population with house connections : 4,94,340souls  
 Slum population on stand post/Tanker supply : 3,29,560 souls  
 Total Slum Population : 8,23,900souls

# Jawaharlal Nehru National Urban Renewal Mission (JnNURM)

- To create infrastructural sustainability for Civil Amenities in urban areas, Government of India, Ministry for Urban development has provided funds and guidelines.
  - Prime areas of concern were-
    - Drinking water treatment, storage & distribution,
    - Water Audit & Energy Efficiency management,
    - Public Transport
    - Sewage water & storm water drainage & Treatment
    - Slum area development
    - E- Governance in public services



# Water Distribution network



# System- Implemented

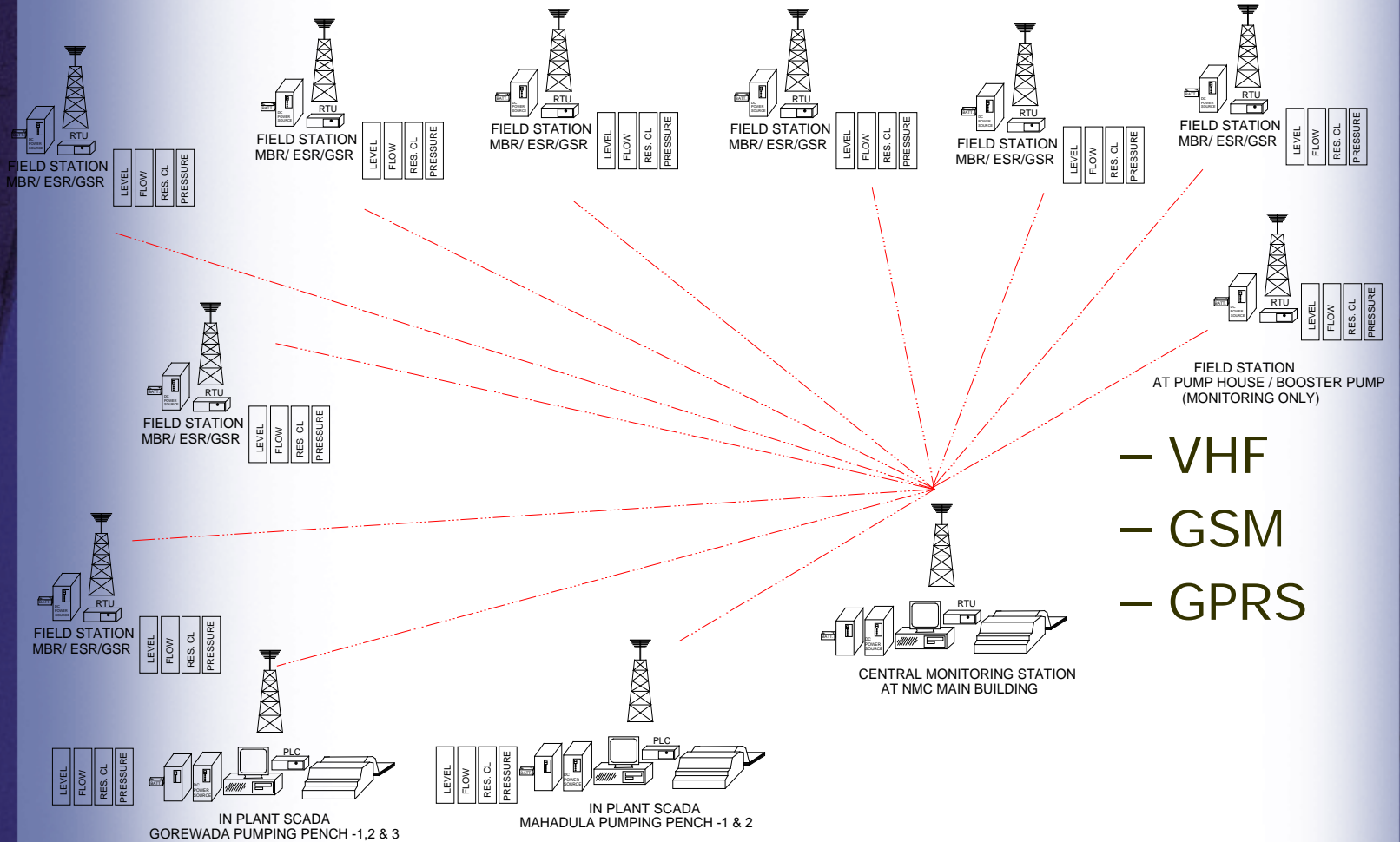
## Monitoring of

- Pumping and Treatment stations at –
  - Pumping stations at Mahadula, Pench-I & II
  - Gorewada WTP & Pumping Station – Pench – I, II, III & Old Gorewada
  - Kanhan WTP & Pumping Station– DW1, DW2, NEW and Proposed
  - City Pumping Stations (Sump Booster ) at Dhaba, Boriyapoorra, Reshimbagh, Jaitala, Chinchbuban, Tekdi wadi and Seminary Hills
  
- 43 Nos. ESRs, GSRs & MBRs at, 32 different locations.

# System - Implemented

- Real Time Monitoring of
  - Flow,
  - Level,
  - Pressure,
  - Water quality
    - Chlorine
    - Turbidity
    - pH
    - Conductivity
  - Pump Parameters
    - Electrical – voltage, current, energy, frequency, power factor
    - RPM, Vibration, Temperature

# Data Communication network



# Reservoir Monitoring Station

- Real-time automatic monitoring of-
  - Tank levels & Contents
  - Free Chlorine level
  - Inlet Flow
  - Pressure
- Real-time data communication to central control station under command.
- Battery backed power source for monitoring equipment

# Reservoir Monitoring Station- Graphical - Single Tank

**Nagpur Tank Monitoring Project**

Login Data Entry Historical Data Current Data Alarms Event Trends Setting Logout Help

नागपूर महानगरपालिका जलप्रदाय विभाग  
Nagpur Municipal Corporation Water Works Department

**Gittikhadan (GSR) गितीखदान** 01

Contents(ML) 5.078

Tank Level (mtr) 5.13

Chlorine(ppm) 0.44

86%

Pressure(kg/cm2) NR

Gittikhadan GSR 1816.00

O & M Manual

Last Updated Date And Time : 07/11/2009 04:25:50 PM

Station Name	Date	Time	Alarm_ID	Alarm description	Alarm Group	Priority
Gittikhadan	17/09/2009	14:50:01	PRESSURE_NR...	Pressure Transmi...	Inlet Pressure	High

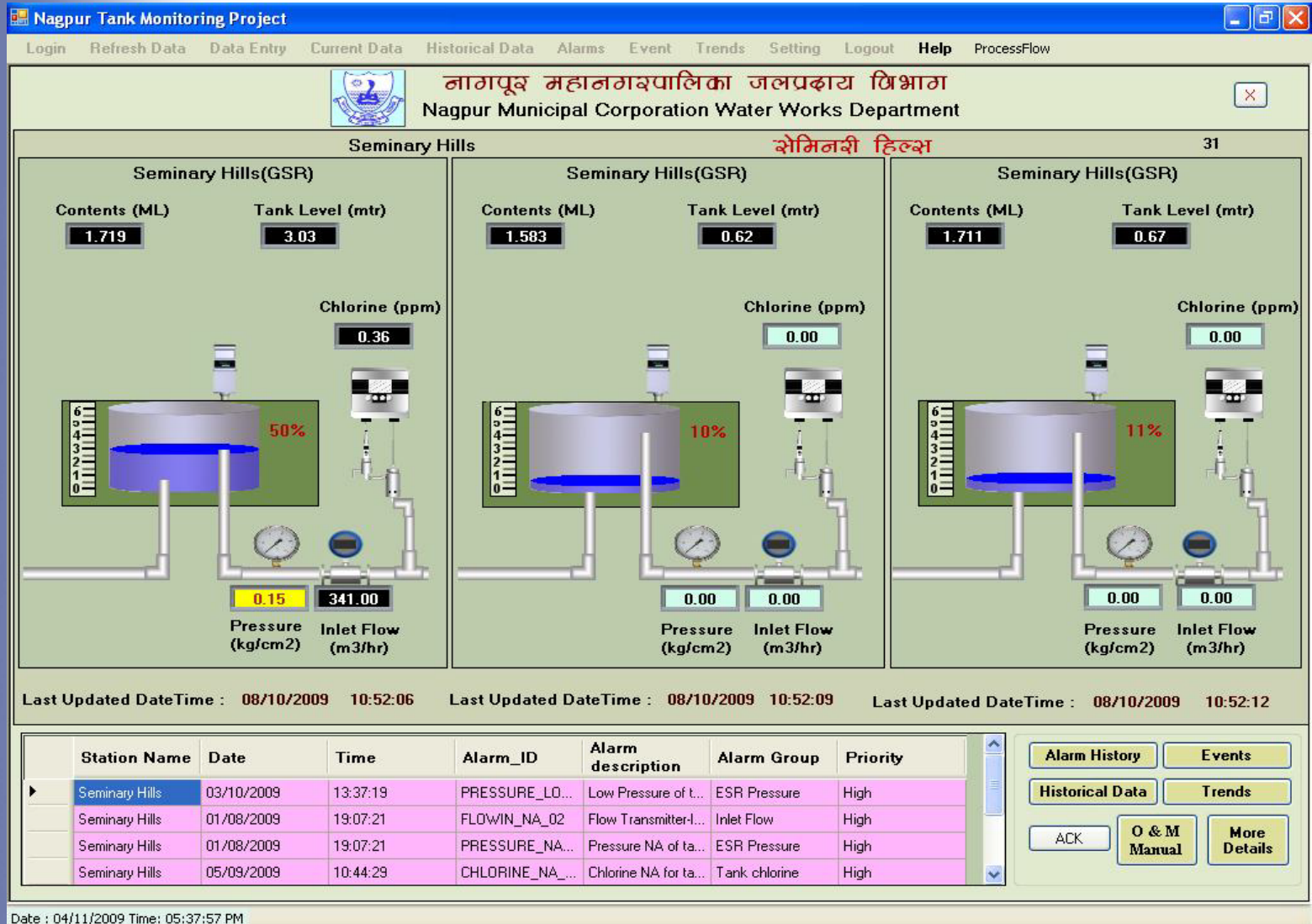
Alarm History Events

Historical Data Trends

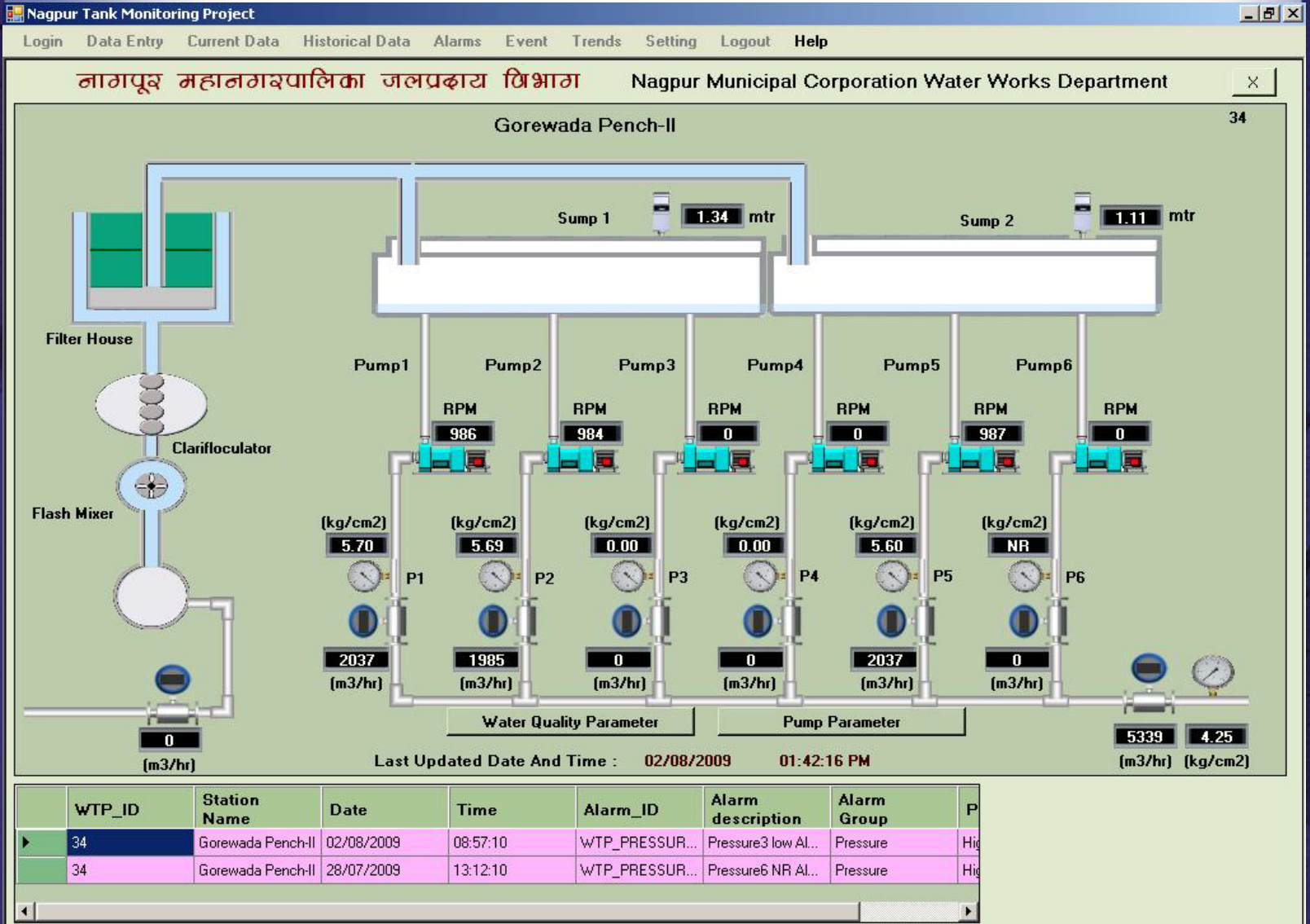
ACK More Details

Date : 12/11/2009 Time: 10:41:44 AM

# Reservoir Monitoring Station- Graphical - Three Tanks

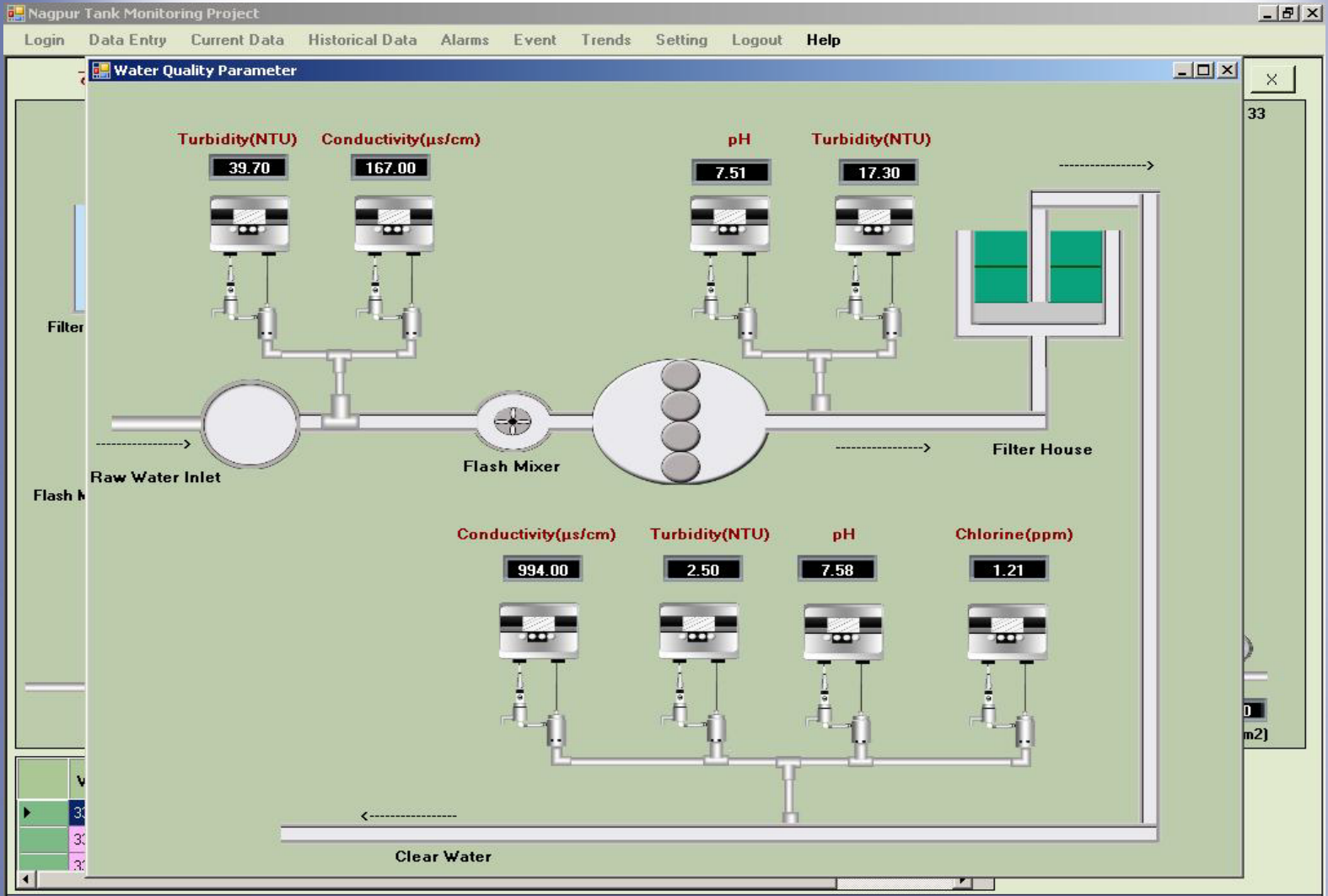


# Pumping station – Graphical





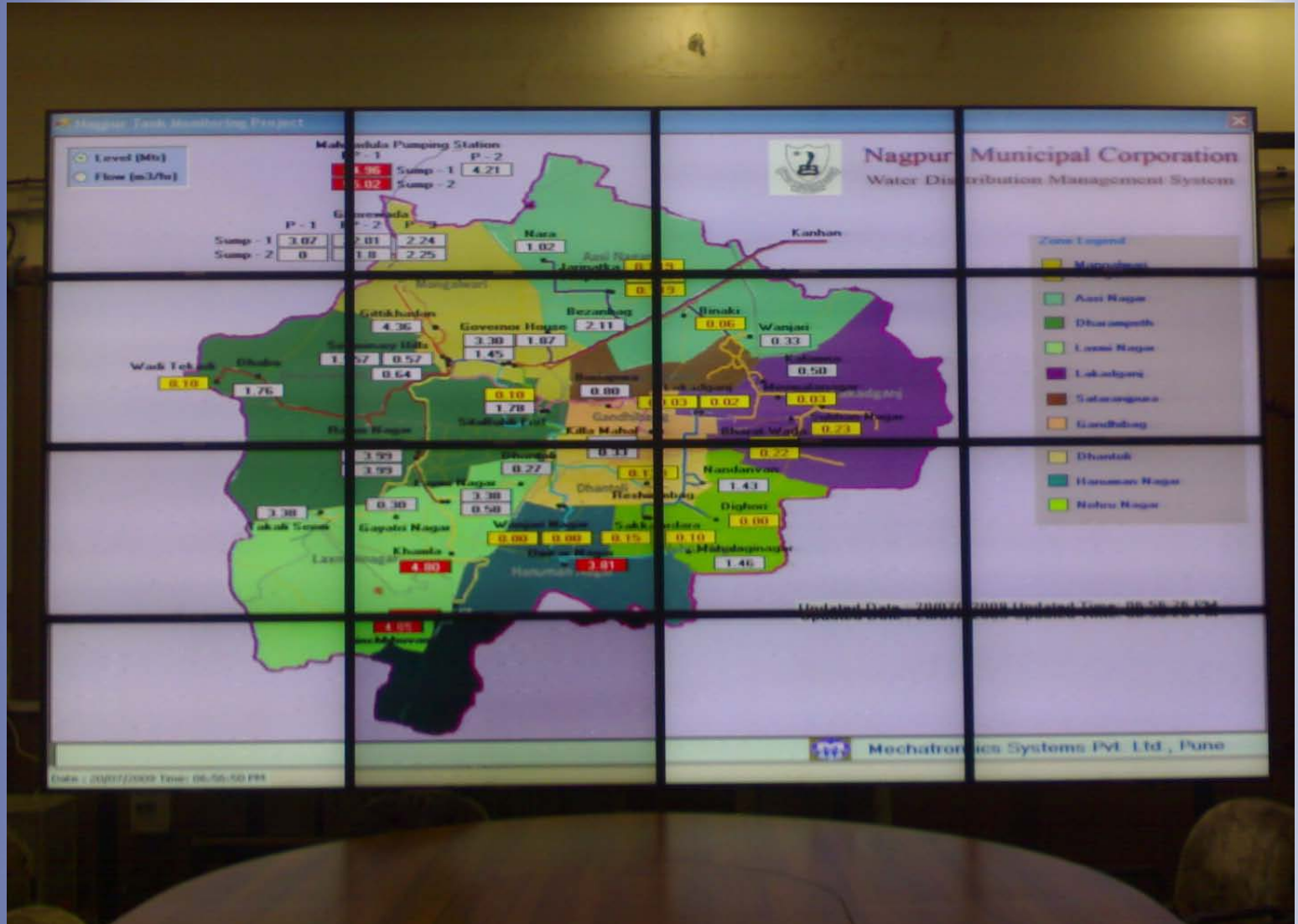
# Water Quality Parameters – Graphical



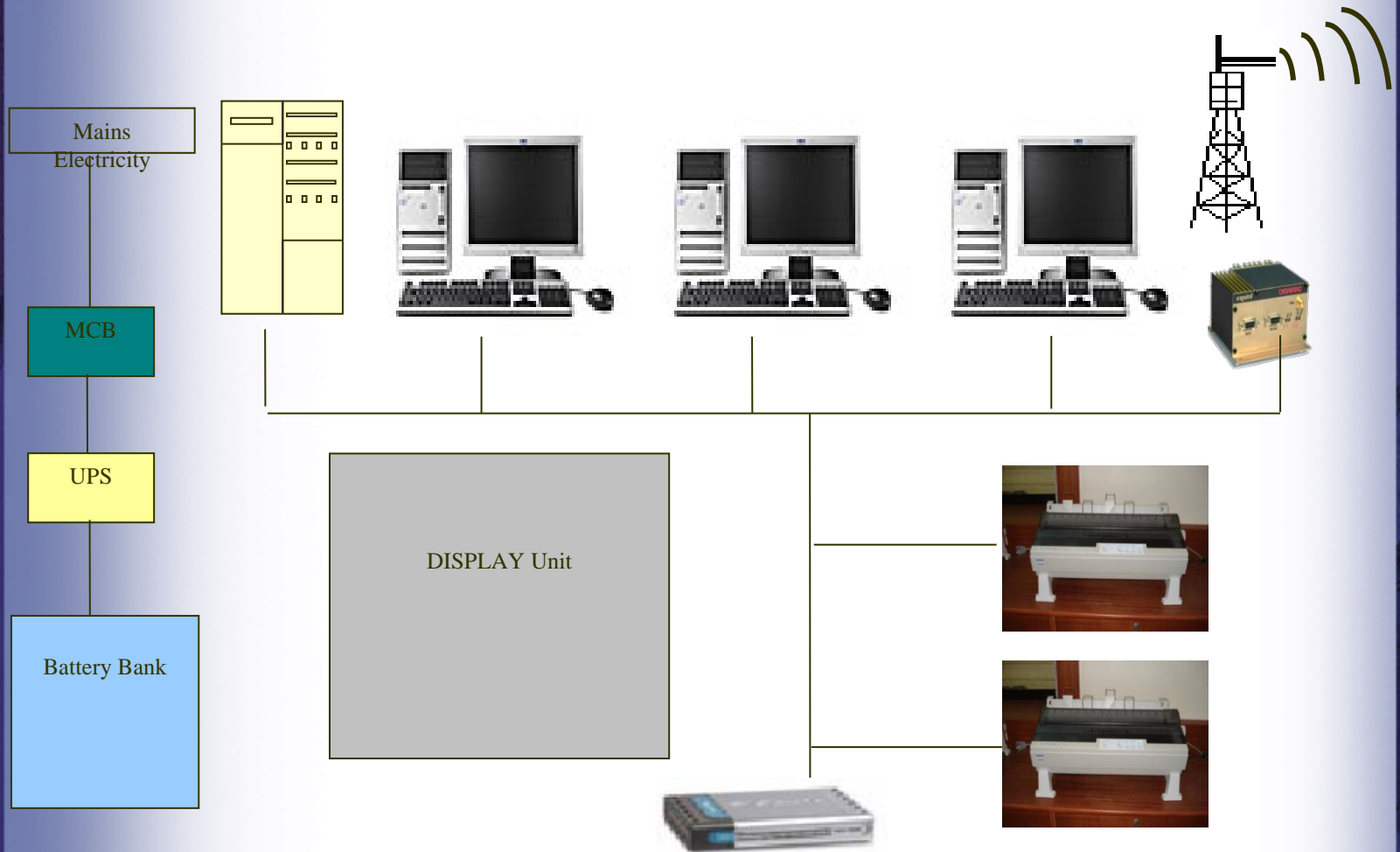
# Central Monitoring Station

- Real-time Data Acquisition
  - 12.0 feet x 7.0 feet wall mount LCD display
  - Status, Warnings & Alarms on GSM
  - Pumping station Efficiency Calculations
  - Water Accounting
  - Alarms, Events, Trends
  - Historical Data Storage & Analysis
  - Even logging on line Printer.

# Wall Mount Display



# Central Control Station



# Web Portal...

- Real-time data on website
- Historical reports in .pdf format
- Password protection for secured data
- Access from any part of the world
- Dynamic data pages,
- Automatic uploading to web server
- <http://www.nagpurwater.com>

Connect

# Working of the system...

- Field data from all ESRs, GSRs MBRs Treatment Plants & Pumping Stations is collected by RTUs and is transmitted to the central control station using wireless data communication network, on command.
- Monitoring software at CCS validates, displays and store received data.
- Perform automatic analysis of data, generates alarms, event logs & trends.
- Calculates pumping station efficiency and per ML energy consumption.
- Fires messages automatically on GSM network to respective authorities on hierarchal basis.
- Automatic uploading of the data to the web server

# Remote Monitoring software

- Real-time data acquisition
- Data analysis & calculations
- Multi level 'Password Protection' for secured data accesses
- Alarms, event-logs, trends (real time and historical)
- Interface with wall mount 12' x 7' LCD display.
- Automatic data uploading to web server
- Automatic mobile message delivery of selected data to concern authorities for timely action.

# Water Distribution System- Post Commissioning

- Even and timely water distribution
- Improved water quality with close loop monitoring within the distribution network
- Reduction in losses – immediate information to water supply network managers for excess leakage, unauthorized water withdrawals
- Improved efficiency of pumping machinery by timely maintenance
- Real-time Water Audit
- Water Accounting – overall and zone-wise linked to revenue / water billing system.



# Reports ...



महाराष्ट्र महानगरपालिका

उत्पन्न विभाग

Total Bulk Audit Details of Date 25/08/2010

1 Laxmi Nagar		
Type	Location Name	Flow (MLD)
F	Laxminagar-I (Old) ESR	14.000
F	Laxminagar-II (New) ESR	5.200
F	Pandey Layout ESR	12.400
F	Adhyapak T-Point ESR	3.400
F	Gayatri Nagar ESR	5.000
T	Consumer Forensic Lab	0.003
T	Pande Layout ESR To Narendra Nagar	-5.000
T	Rahate Colony To Dhantoli	-0.340
T	Kachipura Sq. To Ramdaspath	-0.220
T	VNIT Gate To Corporation Colony	-0.310
T	Consumer MSEDCL Congress Nagar	0.003
T	Consumer Ramkrishna Math	0.003
T	Consumer Home guard	0.780
T	Consumer New English High School	0.003
T	Consumer Dhanvate College	0.003
T	Consumer Doctors Colony	0.003
T	Consumer Doctors Colony	0.080
T	Consumer Vainganga Colony	0.130
Zone Total :		35.138

**Energy Audit**  
**Pump Efficiency Test Sheet**

Location		Gorewada Pench-I													Date		01/08/2009										
Pump in Operation		Pump No.		1																							
Pump Details				Duty Parameters						Motor Details						Instruments											
Pump Model		18UPH3		Flow lps /m3/Hr. / MLD			694.5			2498.4			0			Make		Alstom		Frame		CC400U800		Flow Meter		Ultraflux	
Pump Sr. No.		1704407001		Head ( m )			53			Rating ( kW )		500		Rated RPM [c]		988		Energy Meter		Conserve							
Pump Make		KBL		Pump Input ( kW )			392			Voltage ( V )		3300		Frequency		49.9		RPM Meter		Jayshree							
Deliv/Suc. Dia (mm)		400		Speed ( rpm )			988			Current ( A )		106.5		M. /C. No.		k23		Pressure		E&H							
Pipe int. Dia (mm)		825		Pump Effi. ( % )			92			Motor Effi. ( % )		96		Temp. Meter		Digital											
Pump Suction Level (m)		[a]	302.012		LSL (m)		[b]	301.16		CT Ratio 150/5		200/5															
OBSERVATIONS AT THE TIME OF TESTING															CONVERSION AT RATED SPEED												
Pump Details									Motor Details																		
Sr. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14=8/12	Actual Observed		17	18	19	20	21						
							=2+3+5+8					=9*11	=8/9*100				[(c/16)*1]	[(c/16)*2]*7	=(c/16)*3)*12	=(c/16)*3)*8	(20/19)*100						
Time	Flow	Discharge Pr.	Ht. of Pr. Gauge	Sump Level	Head Below	Velocity Head	Total Head	Pump Output	Power Consumed	Kwh Redgs.	Rated Motor Eff.	Motor Output (Pump Input)	Combine Efficiency (Pump +Motor)	Pump Efficiency	15 Freq	16 Speed	Discharge at Rated Speed	Head at Rated Speed	Pump Input at Rated Speed	Pump output at Rated Speed	Eff.						
HH:mm	LPS	mcw	mcw	mcw	mcw	mcw	mcw	kW	kW	kWh	%	kW	%	%	Hz	Rpm	LPS	M	kW	kW	%						
09:00	803.84	48.10	0.17	2.83	-1.98	0.13	44.43	350.02	486.20	3019948.0000	98.00	486.75	71.99	74.99	49.37	981.00	809.37	45.06	476.82	357.57	74.99						
10:00	793.84	48.50	0.17	2.86	-2.01	0.13	44.79	348.82	491.58	3020560.0000	98.00	471.90	70.92	73.88	49.44	984.00	797.07	45.16	477.88	352.89	73.88						
11:00	803.84	48.30	0.17	3.20	-2.35	0.13	44.26	348.68	482.62	3020916.0000	98.00	483.32	72.25	75.26	49.29	977.00	812.69	45.26	479.14	360.59	75.26						
12:00	725.24	50.00	0.17	2.38	-1.53	0.12	48.76	346.71	431.03	3021484.0000	98.00	413.79	80.44	83.79	49.02	980.00	731.18	49.56	424.00	355.27	83.79						
13:00	725.24	49.80	0.17	2.01	-1.16	0.12	48.73	346.50	429.90	3021698.0000	98.00	412.70	80.80	83.96	49.29	976.00	734.18	49.94	428.11	359.44	83.96						
15:00	793.84	45.50	0.17	1.31	-0.46	0.13	45.34	352.90	472.68	3022940.0000	98.00	453.77	74.86	77.77	49.16	973.00	808.08	46.75	476.09	366.47	77.77						
16:00	793.84	45.80	0.17	1.53	-0.66	0.13	45.42	353.52	485.84	3023192.0000	98.00	486.40	72.77	76.80	49.53	981.00	799.50	46.07	476.46	361.14	75.80						
18:00	725.24	49.80	0.17	1.73	-0.86	0.12	49.21	349.91	432.67	3024619.0000	98.00	415.37	80.87	84.24	49.38	979.00	731.91	50.12	428.93	359.65	84.24						
20:00	793.84	45.80	0.17	1.28	-0.41	0.13	45.49	354.07	465.04	3024619.0000	98.00	446.44	76.14	79.31	49.03	977.00	802.78	46.52	481.89	366.16	79.31						
21:00	793.84	45.80	0.17	1.48	-0.63	0.13	45.27	352.35	485.65	3025099.0000	98.00	486.22	72.55	75.58	49.42	973.00	808.08	46.68	488.12	368.90	75.58						
22:00	793.84	45.80	0.17	1.69	-0.84	0.13	45.26	352.28	475.41	3025574.0000	98.00	456.39	74.10	77.19	49.24	977.00	802.78	46.29	471.98	364.31	77.19						
23:00	793.84	48.10	0.17	2.24	-1.39	0.13	45.01	350.33	482.64	3026054.0000	98.00	483.33	72.59	75.81	49.40	978.00	801.98	45.94	477.69	361.19	75.81						
00:00	793.84	48.10	0.17	2.28	-1.41	0.13	44.99	350.18	482.52	3026537.0000	98.00	483.22	72.57	75.80	49.29	979.00	801.14	45.82	476.11	359.92	75.80						



नामपूर महानगरपालिका  
जलप्रकार विभाग

ESR Residual Chlorine Report for Date 25/08/2010

Print Date: 26/08/2010

Location Name	Tank No	Time	Chlorine (ppm)
Gittikhadan(Ramdeobaba)	1	18:00	0.21
Minimatanagar	1	23:00	0.06
Binaki (Mahendra Nagar)	1	10:15	0.43
Khamla	1	12:30	0.42
Omkarnagar	1	00:15	0.10
Nandanvan	1	17:15	0.27
Shubhan Nagar	1	00:00	0.00
Takali Seem(Adhyapak Layout)	1	00:00	0.00
Nara	1	02:00	0.11
Mahalgi Nagar	1	15:30	0.33
Wanjari	1	00:00	0.00
Dabha	1	08:15	0.49
Dhantoli	1	17:15	1.77
Reshimbag	1	14:15	0.09
Boriapura(Khadan)	1	00:00	0.00
Gayatri Nagar	1	02:00	0.13
Chinchbhuvan	1	17:30	0.15
Killamahal	1	12:15	0.03
Bezanbag	1	00:00	0.89
Kalamna	1	22:15	0.98
Bharatwada(Deshpande Layou	1	15:45	0.27
Dighori(Taj Bagh)	1	08:15	0.01
Wadi Tekdi	1	00:00	0.00
Ram Nagar	1	16:30	1.52
Ram Nagar	2	12:30	0.18
Wanjari nagar	1	07:30	0.10
Wanjari nagar	2	17:45	1.35
Laxminagar	1	16:30	1.30
Laxminagar	2	12:15	0.51
Sakkardara	1	15:45	1.76
Sakkardara	2	07:00	0.34
Lakadganj	1	14:45	0.04
Lakadganj	2	00:00	0.00
Jariptka	1	08:15	0.35
Jariptka	2	15:00	0.03
Sitabuldi fort	1	10:15	0.08
Sitabuldi fort	2	00:00	0.00
Seminary Hills	1	19:30	0.43
Seminary Hills	2	00:00	0.00
Seminary Hills	3	00:00	0.00
Governor House	1	00:00	0.00
Governor House	2	01:30	0.11
Governor House	3	00:00	0.00



नागपूर महानगरपालिका  
जलप्रकल्प विभाग  
Flowmeter Detail Daily Report

Date: 25-08-2010

Print Date: 26/08/2010

Zone No	Zone Name	Flowmeter Name	Daily Flow(MLD)
1	Laxmi Nagar		
		Adhyapak T-Point ESR	3.40
		Gayatri Nagar ESR	5.00
		Laxminagar-I (Old) ESR	14.00
		Laxminagar-II (New) ESR	5.20
		Pandey Layout ESR	12.40
2	Dharampeth		
		Buldi Line AT GH	36.60
		Dhantoli ESR	3.00
		Ramnagar-I (GSR)	10.00
		Ramnagar-II (ESR)	24.90
		Rifle Line	13.40
		Seminary Hill-Futala Line	4.60
3	Hanuman Nagar		
		Kannamwar Nagar ESR	3.90
		Omkar Nagar ESR	7.70
		Wanjarinagar-01 (Old) ESR	4.00
4	Dhantoli		
		Reshimbagh ESR	7.90
		Wanjarinagar at GH	54.70
		Wanjarinagar-01 (Old) ESR	4.00
5	Nehru Nagar		
		Mahalgi Nagar ESR	8.50
		Nandanvan New ESR	0.00
		Nandanvan Old ESR	14.50
		Sakkardara I & II ESR	7.30
		Tajbagh ESR	4.40
6	Gandhibagh		
		Buldi Fort-I GSR	11.30
		Buldi Fort-II GSR	40.00
		Khadan ESR	1.70
		Killa Mahal ESR	4.50
7	Satranjipura		
		Boriyapura AT GH	70.00
		Kalamna ESR	2.90
		Vinoba Bhawe Nagar ESR	0.60
8	Lakkadganj		
		Deshpande Layout ESR	4.00
		Lakkadganj ESR	14.00
		Minimata Nagar ESR	2.90
		Subhan Nagar ESR	0.40
9	Ashi Nagar		
		Bezanbagh ESR	4.00
		Mahendra Nagar ESR	12.80
		Nara ESR	1.30
		Nari Jaripatka New ESR	10.30
10	Mangalwari		
		Chaoni	10.90
		Ramdeobaba	16.90
12	Others		
		Kanhan 900 at GH	25.80
		Laxminagar Link (By Pass)	7.30
		Seminary Hill To Laxminagar	36.20
		Seminary Hill To Pandey Layout	70.50
		University Sump	2.40
		Wanjarinagar-II (New) ESR	11.80



# NAGPUR MUNICIPAL CORPORATION

## Water Works Department

ESB/COR Zone Total Bulk Audit (ML) Monthly Details  
for the Month August 2010

Print Date : 26/08/2010 10:07:15

	Local Nagar	Dharam path	Haraman Nagar	Dhantoli	Nehru Nagar	Gandhi Bag	Sataramjipura	Lakodraj	Asal Nagar	Mangalwadi	Total
01/08/2010	42.24	67.10	28.24	48.91	35.25	51.95	12.11	32.28	32.90	168.91	528.55
02/08/2010	52.24	63.80	32.24	48.91	38.45	51.95	10.91	32.94	29.90	167.91	540.55
03/08/2010	51.24	90.90	27.44	48.91	32.95	51.25	10.71	29.94	32.40	164.91	528.55
04/08/2010	37.44	95.90	29.24	48.91	32.25	52.95	11.91	31.74	29.90	163.91	518.55
05/08/2010	48.94	72.90	32.74	2.91	28.25	52.95	9.91	29.94	29.90	175.11	478.25
06/08/2010	48.54	64.20	32.54	(4.99)	29.45	51.25	7.91	29.44	29.90	178.91	481.95
07/08/2010	48.24	67.90	31.24	(5.19)	25.25	51.45	11.91	29.94	29.70	169.91	495.95
08/08/2010	45.94	95.90	32.24	34.21	27.95	51.45	9.41	24.94	25.20	168.41	499.25
09/08/2010	48.24	68.20	29.44	7.91	29.25	52.95	10.21	31.94	29.70	177.11	478.45
10/08/2010	52.24	92.40	32.24	29.21	32.15	52.15	11.91	24.94	29.10	168.91	509.95
11/08/2010	43.54	79.90	32.24	14.21	29.25	48.95	9.91	24.24	27.90	167.91	475.75
12/08/2010	48.44	63.10	32.14	(6.29)	34.25	48.95	10.91	29.44	29.20	171.11	476.95
13/08/2010	48.44	67.20	34.24	37.91	29.95	52.95	9.91	27.14	27.20	163.91	497.95
14/08/2010	48.14	93.90	34.24	47.91	37.25	52.25	9.41	24.14	27.90	169.91	532.95
15/08/2010	39.24	105.90	32.44	48.91	23.95	51.95	9.91	29.94	29.70	163.41	514.75
16/08/2010	48.24	99.90	32.14	43.21	32.75	52.95	7.91	29.94	29.90	168.91	530.95
17/08/2010	52.24	111.90	29.94	53.91	29.15	52.25	7.71	25.94	29.20	145.91	529.55
18/08/2010	43.24	108.90	29.94	52.11	32.25	51.15	9.91	29.94	29.50	148.91	529.25
19/08/2010	51.14	98.90	32.24	41.11	23.75	52.25	9.21	29.24	29.90	161.91	511.15
20/08/2010	41.94	98.20	29.54	44.91	23.25	48.95	7.21	25.24	29.50	141.91	495.95
21/08/2010	45.94	95.90	32.24	52.21	29.95	52.45	29.11	29.14	27.10	24.91	504.25
22/08/2010	52.74	51.90	29.24	53.91	29.45	51.95	77.41	23.24	29.40	23.11	502.95
23/08/2010	48.44	98.90	29.94	52.21	34.25	52.95	77.21	32.24	29.10	69.91	518.95
24/08/2010	51.24	92.20	32.54	51.71	37.95	51.95	77.41	18.74	27.90	69.41	509.95
25/08/2010	35.14	100.10	29.94	53.91	34.75	52.45	29.21	25.44	29.90	64.91	495.45
26/08/2010	(2.18)	17.90	9.54	1.21	3.95	(5.18)	5.11	4.24	9.20	51.91	69.95
Total (ML)	1153.79	2241.15	771.94	892.96	768.40	4289.90	589.50	696.74	706.90	3621.16	12711.29

# Trends

Flow vs time graph for Scada Station

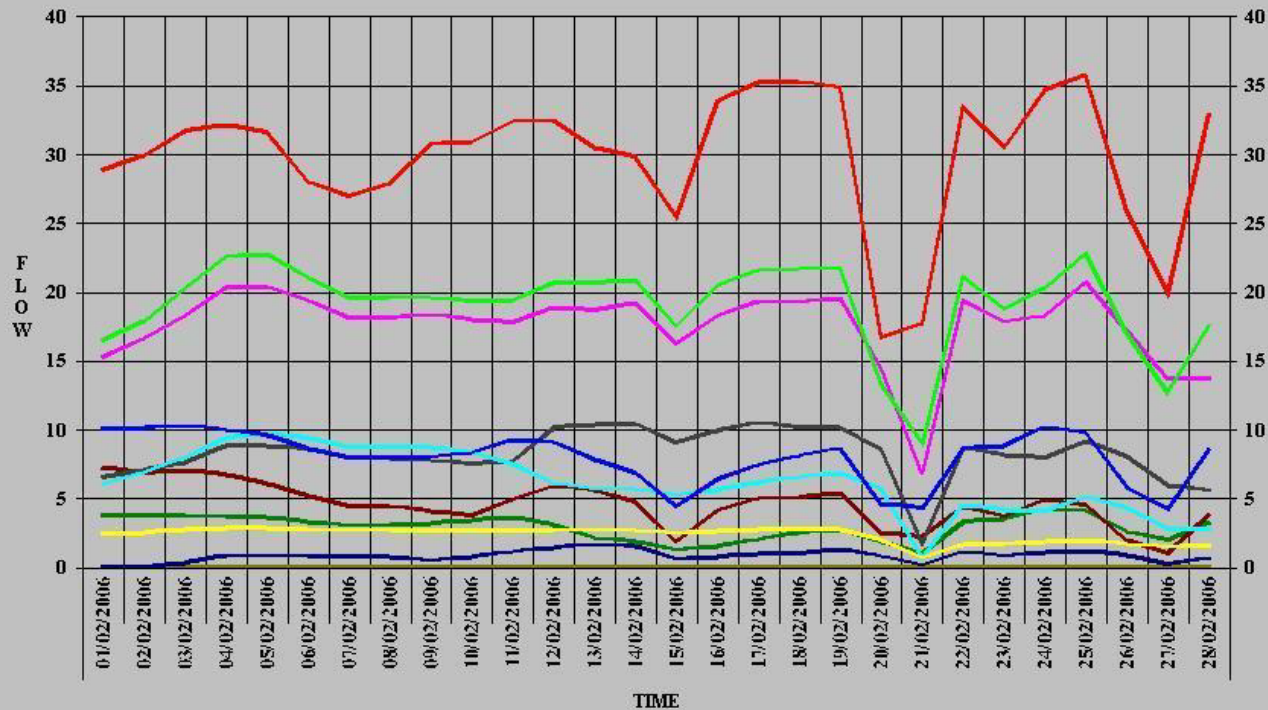
02/2006

Daily

Monthly

Show Graph

Flow vs time of SCADA Station for Month February 2006



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# Future Scope

- Remote operation of Pumping Machinery
- Distribution network & consumer connection monitoring
- Zone wise Water balance / buffer for instantaneous demands
- On-line water accounting and metered water billing
- Improving efficiency of network and reduction in transit losses
- Chlorine measurement at each Outlets
- Identifying new water recourses to mitigate future demands.

Thank you.

**THANK YOU**