

2. Pilot Activities in Borella

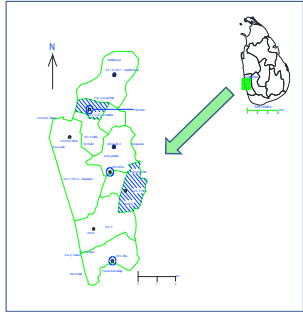
THE CAPACITY DEVELOPMENT PROJECT FOR NRW REDUCTION IN COLOMBO CITY

Borella Area

Presented by
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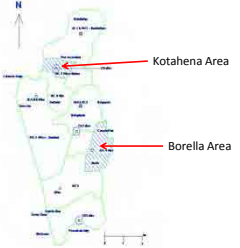
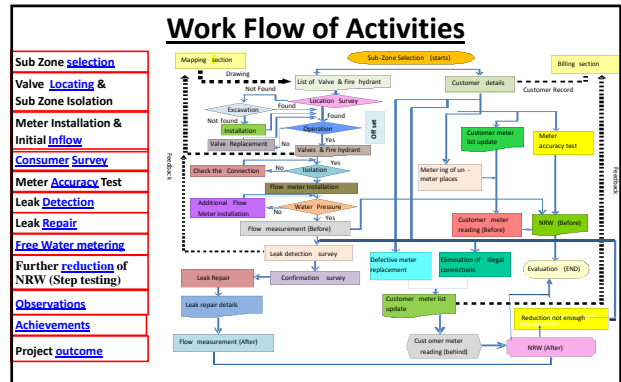
Present Situation of the Colombo City

- Area 37.4 Sqkm
- No of Connections as at 2011 128,000
- Administrative by Two Manager office , 4 AEE & 8 OICC with 24 Zone Officers
- NRW Percentage 49%

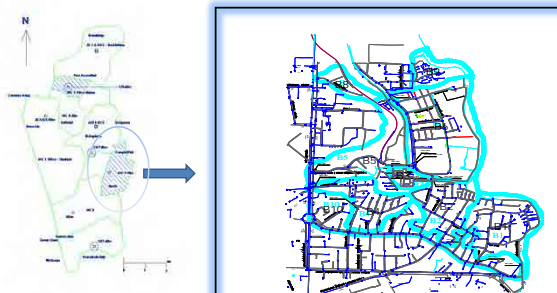


Purpose of the Project & Project Area

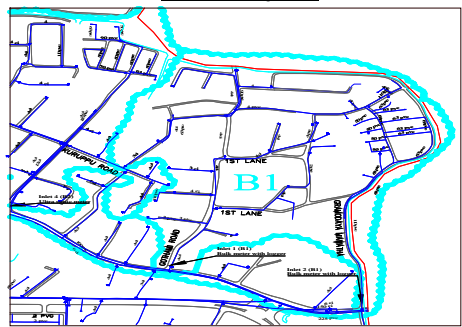
- NWSDB Capacity to implement NRW reduction activity in Colombo City is Strengthened
- Borella Pilot Zone
 - Area nearly 4 Sqkm
 - Total Connections 5000
 - Length of Pipe network - 32 km
 - Community consists of Domestic, Commercial & Tenement Gardens

Selected Pilot Zones In Colombo City Area



Zone Map-B1



2. Pilot Activities in Borella

Key Details of Covered Area

Zone Name	No of connections covered
Zone – B1	584
Zone – B2	624
Zone – B3	360
Zone – B4	453
Zone – B5	814
Zone – B6	1109
Zone – B7	307
Zone – B8	186
Zone – B9	623
Zone – B10	191
Total	5251



Valve installation & placing

- Condition of boundary valves which are needed for the Isolation of the sub zone were checked.
- If they cannot completely close, they were replaced.
- Installed additional valves when required.
- Data sheet shall be filled.
- Valves detected by using valve locator, Metal pipes by using Pipe locator & PVC pipes by using leak detection instrument or Dalsin equipment.

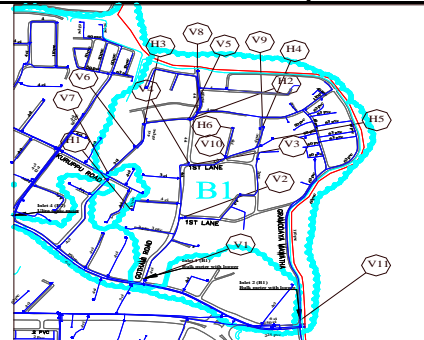
Detecting buried lines & valves by using metal locator and pipe locator



valve locating by using Valve locator

Line locating by Using line stressor

Identification of Valves – (Borella-1)



Valve Installation & Zone Isolation



Installation of valve V4 of B1

Installation of valve V11 of B1

Valve condition survey

Valve condition checking list Name of Pilot area:
Name of Sub-zone:

Item	No.	Size(mm)	Pipe material	Location			Condition			Remarks
				(Existence, Buried)	Valve cover (OK, Not)	Direction (Clockwise, Anticlockwise)	Operable (C, NC)	Number of rotation to be closed	Need for a replacement	
Valve	V1									
	V2									
	V3									
	V4									
	V5									
	V6									
	V7									
	V8									
	V9									
	V10									
Fire Hydrant	H1									
	H2									
	H3									
	H4									
	H5									
	H6									
Water post	W1									
	W2									
Stand post	SP1									
	SP2									
	SP3									

All valves, fire hydrant,



2. Pilot Activities in Borella

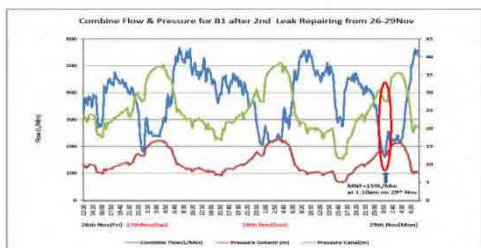
Isolation & Metering

- Some selected valves will be closed (without interrupting water to zone) to minimize the feeding points.
- All feeding points are metered or converted into accessible positions (Installation of meter chamber) to fixed mobile meters (Ultrasonic meters) when it is required.

Initial Inflow & Pressure



Obtain logger measurements



Preparation of customer list

- Prepare the customer list of sub zone including the customer name, customer-ID, address and meter-conditions.
- Customer meter condition were checked one by one house based on the customer list.

Customer list

Customer meter check list				Name of Flat area						
House				Flat No						
No	Customer name	Customer ID	Road name / House No	Phone no (if any)	Meter condition (OP, IS, I, NAK, O)	Family's Number	Number of no.	Flat Condition (Demand, Y, N)	Meter condition (OP, N, I, I, NAK, O)	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

Customer list should be prepared and all meter condition should be checked.

Customer List and Meter Condition Survey

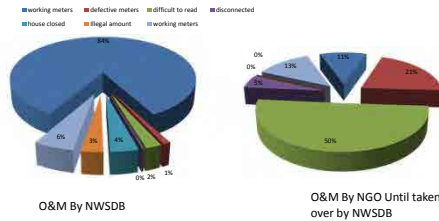


2. Pilot Activities in Borella

Summery of the Survey

zone name	B1	B2	B3	B4	B5	B6	B7	B8	B10	Total	%	B9
No. of consumers	584	624	360	453	814	1109	307	186	191	4628	100	623
Commen taps	2	6	0	27	11	7	1	2	0	56		2
No. of working meters	543	596	289	435	762	891	287	160	164	4127	89.17459	77
No. of unmeter detected	12	3	1	17	6	9	0	1	3	52	1.123596	148
No. of defective detected	15	2	13	15	28	25	5	4	3	110	2.376837	360
No. of difficult to read	0	0	2	0	4	5	0	2	0	13	0.280899	38
No. of disconnected premises	0	0	3	0	12	155	3	12	9	194	4.191876	0
No. of houses closed	7	23	47	12	8	24	12	7	12	152	3.284356	0
No. of illegal rectified	8	15	25	13	14	190	1	9	4	279	6.028522	90

Graphical representation of Survey data



Meter testing

- Out of total, at least 10% of water meters were tested randomly at site with the help of calibrated(50l) bucket (Ex. 60 meters for zone B1)
- Additionally, another few meters (mostly doubted once) were checked through meter testing unit

Meter Accuracy test



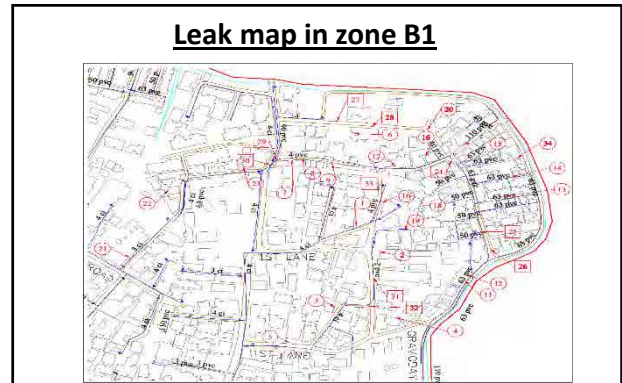
Key items of leak detection

- The portion between ferrule to house meter point will be checked by using **Eco-stick**.
- All other areas will be checked by using **Leak Detection Instrument** some times by correlator.
- Pin-point or confirmation survey can be introduces if required.

Leak Detection



2. Pilot Activities in Borella



Leak Survey Details

Summary of the Detected Leaks Deuring the survey

Zone Name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	Total	
Type of the leak	Service	35	29	16	26	24	18	8	9	65	3	233
	Main	12	2	2	8	12	13	1	3	0	1	54
Total	47	31	18	34	36	31	9	12	65	4	307	



Leak Recording System after repairing

Leakage Record Sheet

Ref. No. 27


Date of survey: 27/10/2010		Street No.:	
Account No.:	House No.:		Point of Fix:
Pipe/Type:	GP, CP, Other:	Location:	Pipe, Connection, Valve, Other:
Diameter:	mm	Condition:	Pipe, Crack, Straddle, Friction, Loose, Other:
House Connection:	PVC, GP, Other:	Cause:	Corrosion, Water pressure, Damaged, Hand, Straddle, Other:
Diameter:	19 mm	Location:	Pipe, Connection, Valve, Other:
Depth:	cm	Condition:	Pipe, Crack, Straddle, Loose Connection, Friction, Unknown, Other:
Leakage Size:	Slope (Medium)	Cause:	Corrosion, Water pressure, Leak Adhesive, Deterioration, Wrong Construction, Traffic load, Unknown, Friction, Other:
Leakage Date:		Depth:	Asphalt, Concrete, Gravel, Glass, Soil, Other:
Leakage Quantity (Measured):		Point of Leakage:	
Date of Repair: . . . 2010 Time/ . . . (H)		Material:	
Other Remarks:		Other Remarks:	



2. Pilot Activities in Borella

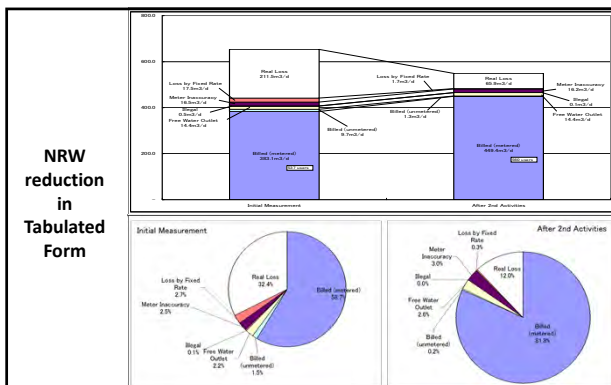
Further Reduction of Leakages

- Step Testing
- Results
 - Minimum Night Flow(MNF)
 - Zone 01 –56 l/Min
 - Zone 02 –24 l/Min
 - Zone 03 –108 l/Min
 - Zone 04 –100 l/Min
- Observations
 - No. of leaks-06(within zone-03 & 04)



Details of NRW reduction in B1 (According to IWA water balanced sheet)

B1 Initial Measurement				B1 After 2nd Activities			
System Input Volume	407.1 m ³	42.7%	800.0%	465.1 m ³	44.7%	800.0%	800.0%
Billed Authorized Consumption	392.7 m ³	96.5%		450.1 m ³	96.8%		
Unbilled Authorized Consumption	14.4 m ³	3.5%		14.4 m ³	3.1%		
Unauthorized Consumption	0.0 m ³	0.0%		0.1 m ³	0.0%		
Water Losses	34.5 m ³	8.5%		18.0 m ³	4.3%		
Apparent Losses	16.5 m ³	4.0%		16.2 m ³	3.5%		
Mater Inaccuracy	16.5 m ³	4.0%		16.2 m ³	3.5%		
Loss by Fixed Gate	0.0 m ³	0.0%		0.0 m ³	0.0%		
Non-Revenue Water	26.0 m ³	6.5%		17.9 m ³	4.2%		
Real Losses	211.5 m ³	51.9%		65.9 m ³	14.2%		

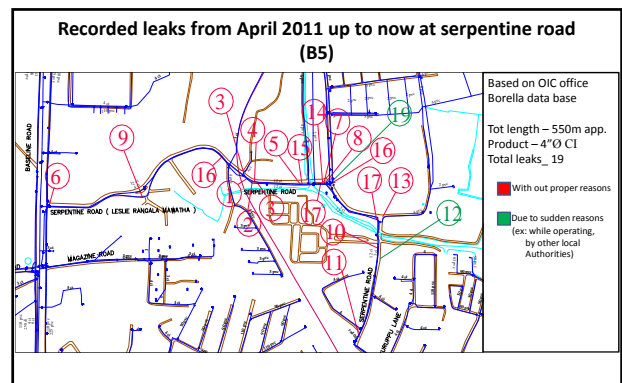


Detail of NRW reduction in Borella

Zone	Initial Amount in %	Final Amount in %
B1	39.9	17.9
B2	61.7	
B3	84.1	28.6
B4	60.74	60.1
		61.6
B5	62.3	
B6	49.5	28.5
B7	30	
B8	28	
B9	62	37
B10	75.6	9.7

Evaluation of Achieved Results

- Difficult to reduced NRW in CI distribution areas Due to
 - ❖ Edging / Bad construction (Less cover)/ Frequent leak condition
 - ❖ Construction of building over the lines
 - ❖ Detection difficulties (difficult reach up to leak position/water logged condition) 😊
- Difficult to reduced NRW in Tenement gardens Due to
 - ❖ Bundle pipe condition
 - ❖ Illegal activities 😊



2. Pilot Activities in Borella



Physical progress continued.....												
zone name		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	Total
No. of sluse-valves & wash-out(FH) trace & surfaced	12"φ		2			1						3
	6"φ									1		1
	4"φ	8	3	2	4	7	9	1	1	1	1	37
	2"φ	1										1
No. of new sluse-valves & wash-out(FH) installed	6"φ						5					5
	4"φ	6	5		6	4	4	1			1	27
	2"φ	2					3					5
Length of newly layed commen mains (m)	3"φ		90				200					290
	2"φ	60					450					510
Meter Chambers installed	2"φ	2	4	1	2	2	2	1			1	15
No. of connections transferred		3	21				125					149
Replaced length of bundle pipes(m)		15	840				4800					5655

Summery of Out Come							
	B1	B3	B4	B6	B9	B10	Total
Amount of water saving (m ³ /day)	104.1	901.0	252.0	277.0	101.0	0.3	1,635.4

- ### Problems Encountered
- Inaccuracy of the current drawings
 - Lack of valve location details
 - Burried and non function condition of the existing valves
 - Difficulty of gaining approval from local authorities (Presently RDA not giving approval to excavate some of their roads)
 - Consumer relation problems
 - Old & complicated service Distribution & High Leak System
 - Scaling of old Distribution network
 - Work with restriction due to Motor Traffic and City Congestion

- ### How to Overcome
- Use of modern equipment (used to find burried valves and leaks)
 - Regular meeting helps to share the experience, gain new knowledge and change bad attitudes
 - Consumer related problems minimized by acknowledging the community about NRW activities
 - Initiation of a leak detection and repairs
 - Programme for routine night survey
 - Implementation of meter sealing process (to minimized illegal activities)

- ### Obtain benefits
- Methodical approach to identify the way of reduction of NRW.
 - Use of modern equipment for asset management.
 - Pressure improvements(in B1, some area's pressure increase from 2m to 6m)
 - Significant reduction of NRW
 - Capacity development of engaged personnel.
 - Encourage an improved service level to consumer.
 - Able to include new consumers in to the billing system (By eliminating common taps and giving new connections to surround people as well as elimination of illegal connections).
 - Improvement of consumer satisfaction as well as their relationship.
 - Control of illegal connections, vandalism and misuse of supply.

- ### Future Expectations
- Regular night survey for identification of visibal leaks 
 - Implementation of same procedure for other areas which are not covered through this project.
 - Implementation of regular monitoring activities for minimized estimated bills.
 - Introduction of valve operating routine system, specially for  washouts.
 - Implementation of Meter sealing work for other areas which are still not covered.
 - Regular monitoring system of NRW variation in completed sub-zones.

2. Pilot Activities in Borella

Schedule of FH/WO flushing

Zone	Wash out no.	Year							
		Month 1				Month 2			
		Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
B11	F141	✓							
	F142	✓							
	F143	✓							
	F144	✓							
	F145	✓							
B12	F146	✓							
	F147	✓							
	F148	✓							
	F149	✓							
	F150	✓							
B13	W151	✓							
	F152	✓							
	F153	✓							
	F154	✓							
	F155	✓							
B14	F156							✓	
	F157							✓	
	F158							✓	
	F159							✓	
	F160							✓	
B15	F161							✓	
	F162							✓	
	F163							✓	
	F164							✓	
	F165							✓	
B16	F166							✓	
	F167							✓	
	F168							✓	
	F169							✓	
	F170							✓	
B17									
B18									
B19									
B20	F171							✓	

Scheduled Night Leak Survey

Night leak Survey	Year											
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3	Week 3
B1	✓											
B2		✓										
B3				✓								
B4					✓							
B5						✓						
B6							✓					
B7								✓				
B8									✓			
B9										✓		
B10											✓	
Remaining area												✓
Remaining area												

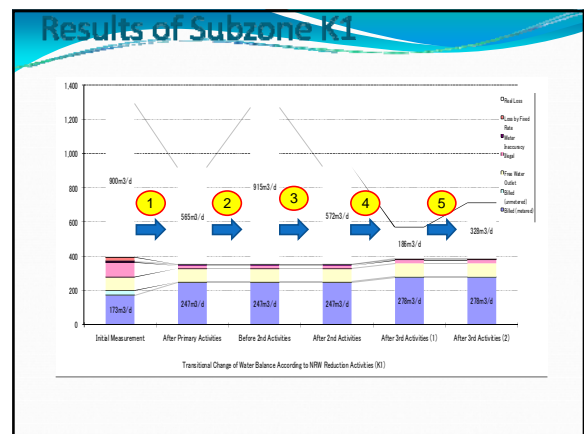
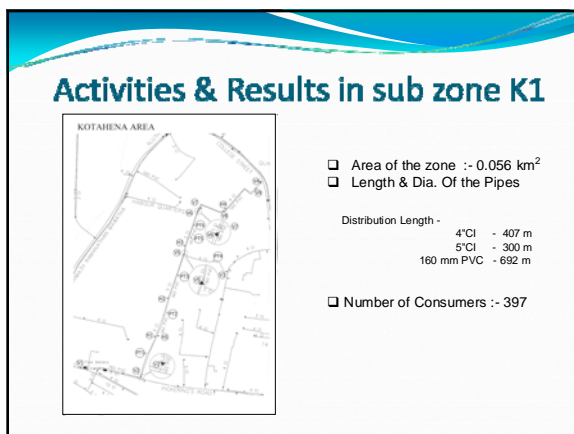
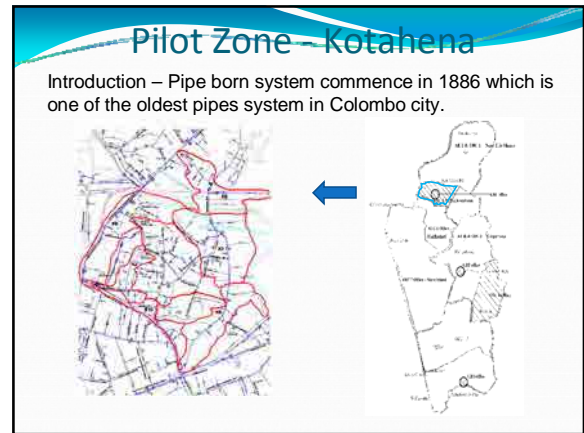
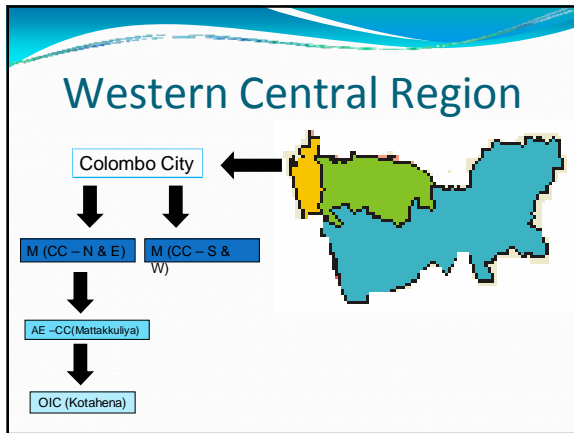
Lesson Learn

It is found that the major reason for the NRW is due to the leaks of the existing pipe network

- Systematic night leak survey is very important
- Rapid engagement to leak repair works is a must
- Replacing of old CI lines as well as selected PVC line will be very important

Thank You

3. Pilot Activities in Kotahena



Step 1 (Primary Activities)

Component	Initial		After Primary		
	m ³ /day	(%)	m ³ /day	(%)	
NRW	Billed Consumption	173.0	13.4%	246.7	26.9%
	Unauthorized Consumption	27.3	2.1%	2.3	0.2%
	Free Water Outlet	78.8	6.1%	78.8	8.6%
NRW	Unauthorized Consumption	85.7	6.6%	17.1	1.9%
	Meter Loss by Fixed Rate	7.2	0.6%	6.8	0.7%
	Metering Inaccuracy	23.0	1.8%	1.3	0.1%
	Real Losses	309.3	29.2%	568.8	61.5%
Total System Input		1290	100.0%	918.0	100.0%
MNF (liters)		600		330	
MNF (converted to m ³ /day)		998		475	
Pressure at MNF (m)		18.5		18.5	
Measured on:		19-20 May, 2010		11-23 Nov, 2010	

- 41 meters were installed for Un-metered locations
- 18 meters were replaced for defective
- 49 connections were Legalized
- 56 leaks were repaired (Main :- 03 , Service :- 53)
- Ball valves were installed for two storage tanks

Step 2 (Before 2nd Activities)

After six month without any NRW reduction activities

Component	After Primary		Before 2nd Activities		
	m ³ /day	(%)	m ³ /day	(%)	
NRW	Billed Consumption	246.7	26.9%	246.7	19.5%
	Unauthorized Consumption	2.3	0.3%	2.3	0.2%
	Free Water Outlet	78.8	8.6%	78.8	6.2%
NRW	Unauthorized Consumption	17.1	1.9%	17.1	1.4%
	Meter Loss by Fixed Rate	6.8	0.7%	6.8	0.5%
	Metering Inaccuracy	1.3	0.1%	1.3	0.1%
	Real Losses	568.8	61.5%	918.0	72.2%
Total System Input		918.0	100.0%	1,268.0	100.0%
MNF (liters)		330		600	
MNF (converted to m ³ /day)		475		864	
Pressure at MNF (m)		18.5		18.2	
Measured on:		11-22 Nov, 2010		5 - 9 May, 2011	

- Value of the real loss was increasing (More leaks)

3. Pilot Activities in Kotahena

Step 3 (After Second Activities)

Components	Before 2nd		After 2nd		
	m3/day	(%)	m3/day	(%)	
Billed Consumption	2467	19.5%	2467	26.7%	
Unauthorized Consumption	2.1	0.2%	2.1	0.2%	
Unauthorized Consumption	788	6.2%	788	8.5%	
Unauthorized Consumption	17.1	1.4%	17.1	1.9%	
Apparent Losses	6.8	0.5%	6.8	0.7%	
Metering Inaccuracy	1.3	0.1%	1.3	0.1%	
Real Losses	914.0	72.2%	574.0	61.8%	
Total System Input		1,264	100.0%	925.0	100.0%
MNF (g/min)		600		330	
MNF (converted to m3/day)		868		475	
Pressure at MNF (m)		18.2		18.3	
Measured on:		5 - 9 May, 2011		24-26 Jun, 2011	

590 metres CI Pipe lines were abandoned
 782 metres Common pipes were installed & meters were connected to common pipe (Normal action for bundle pipe replacement)

Step 4 (After 3rd Activities(1))

Components	After 2nd		After 3rd		
	m3/day	(%)	m3/day	(%)	
Billed Consumption	2467	26.7%	278.3	48.7%	
Unauthorized Consumption	2.1	0.2%	2.3	0.4%	
Unauthorized Consumption	788	8.5%	78.8	13.8%	
Unauthorized Consumption	17.1	1.9%	17.1	3.0%	
Apparent Losses	6.8	0.7%	6.8	1.2%	
Metering Inaccuracy	1.3	0.1%	1.3	0.2%	
Real Losses	573.0	61.8%	186.3	32.6%	
Total System Input		925.0	100.0%	571.0	100.0%
MNF (l/min)		330		170	
MNF (converted to m3/day)		475		173	
Pressure at MNF (m)		18.3		17.1	
Measured on:		24-26 Jun, 2011		26-27 Oct, 2011	

Disconnection of bundle pipes at ferrule or nearest point
 Step testing and leak repairing

Method of Abandonment of the CI pipe line

Activities
 1. Site Survey for identifying house connections from CI
 2. Transfer identified connections to existing PVC
 3. Disconnection of CI line at identified locations.

Laying of common Pipes lines & Replacement of Bundle Pipe

Preparation of Manual for bundle pipe replacement

- Preparation stage
 - * Preparation of drawings & BOQ
- Construction Stage
 - * Installation of branch and Valve
 - * Recording of valve & pipe positions
 - * Laying of house connection pipes and take records
 - * Disconnection of existing connection at ferrule or nearest point
 - * Leak test
- After Construction Stage
 - * Preparation of as - built drawings

Preparation of Drawings & BOQ

No.	Item	Spec.	Qty	Remarks
1	Branch valve	1/2" BSP	1	
2	Branch	1/2" BSP	1	
3	Branch	1/2" BSP	1	
4	Common pipe	1/2" BSP	10	
5	Common pipe	1/2" BSP	10	
6	Common pipe	1/2" BSP	10	
7	Common pipe	1/2" BSP	10	
8	Common pipe	1/2" BSP	10	
9	Common pipe	1/2" BSP	10	
10	Common pipe	1/2" BSP	10	
11	Common pipe	1/2" BSP	10	
12	Common pipe	1/2" BSP	10	
13	Common pipe	1/2" BSP	10	
14	Common pipe	1/2" BSP	10	
15	Common pipe	1/2" BSP	10	
16	Common pipe	1/2" BSP	10	
17	Common pipe	1/2" BSP	10	
18	Common pipe	1/2" BSP	10	
19	Common pipe	1/2" BSP	10	
20	Common pipe	1/2" BSP	10	
21	Common pipe	1/2" BSP	10	
22	Common pipe	1/2" BSP	10	
23	Common pipe	1/2" BSP	10	
24	Common pipe	1/2" BSP	10	
25	Common pipe	1/2" BSP	10	

Installation & Recordings

Details sketch of branch valve installation
 Details sketch of branch valve replacement
 Details sketch of house connection pipe
 Details sketch of house connection pipe

3. Pilot Activities in Kotahena

Disconnection of Existing Connections

Method for making a long distance connection at intervals or segment points

Preparation (check list of cut pipes cut, water stop and gas, lower connection)

Account No.	Existing Inside pipe size	Construction of water stop	Construction from low connection pipe	Remarks
1-1-1	100mm	Completed	Completed	
1-1-2	100mm	Completed	Completed	
1-1-3	100mm	Completed	Completed	
1-1-4	100mm	Completed	Completed	
1-1-5	100mm	Completed	Completed	
1-1-6	100mm	Completed	Completed	
1-1-7	100mm	Completed	Completed	
1-1-8	100mm	Completed	Completed	
1-1-9	100mm	Completed	Completed	
1-1-10	100mm	Completed	Completed	
1-1-11	100mm	Completed	Completed	
1-1-12	100mm	Completed	Completed	
1-1-13	100mm	Completed	Completed	
1-1-14	100mm	Completed	Completed	
1-1-15	100mm	Completed	Completed	
1-1-16	100mm	Completed	Completed	
1-1-17	100mm	Completed	Completed	
1-1-18	100mm	Completed	Completed	
1-1-19	100mm	Completed	Completed	
1-1-20	100mm	Completed	Completed	

Step 5(After 3rd Activities(2))

Components	After 3rd activity (1)		After 3rd activity (2)		
	Authorized (m ³ /day)	Billed (m ³ /day) (%)	Authorized (m ³ /day)	Billed (m ³ /day) (%)	
RW	Billed Consumption	278.3	48.7%	278.3	59.0%
	Authorized Consumption	2.3	0.4%	2.3	0.3%
NRW	Unauthorised Consumption	78.8	13.8%	78.8	11.1%
	Free Water Outlet	17.1	3.0%	17.1	2.4%
	Illegal Meter	6.8	1.2%	6.8	1.0%
	Loss by Metering Inaccuracy	1.3	0.2%	1.3	0.2%
	Real Losses	186.3	32.6%	186.3	46.1%
Total System Input		571.0	100.0%	713.0	100.0%
MNF (liters)		120		200	
MNF (converted to m ³ /day)		173		288	
Pressure at MNF (m)		17.1		22.9	
Measured on:		26-27 Oct, 2011		10-12 May, 2012	

The flow measurement was conducted after Six month

Parallel Execution

- Works in other sub zones up to K10 were completed
- Due to difficulty of isolation, the sample zone was selected for some zones by considering easy isolation

Summaries of the zones

Zone	Area(m ²)	No of consumers	Main Pipe length(m)				No of fire-water outlet	Implemented Activities	Isolation Method
			PVC	CI	GI	Total			
K1	0.056	397	683	707		1390	1st Primary & 2nd Activity	Full Zone	
K2	0.056	426		1468		1468	1st Primary	Full Zone	
K3&4	0.258	1383	173	7525		7703	1st Primary	Full Zone	
K5	0.050	115		867		867	1st Primary	Sample	
K6	0.15	159	338	2307		2645	1st Primary	Full Zone	
K7	0.238	1545	262	4617	304	5383	1st Primary	Sample	
K8	0.138	783	776	1668	239	2713	1st Primary	Sample	
K9	0.158	201	114	3665	89	4074	1st Primary	Sample	
K10	0.18	303	63	2163		2226	1st Primary	Sample	

* Primary Activity - Customer survey, Acoustic Survey, Pig-pipe survey, Confirmation survey, Leak repairing
 2nd Activities: Stop testing, Leak repairing, Pipe replacement, Bundle pipe replacement

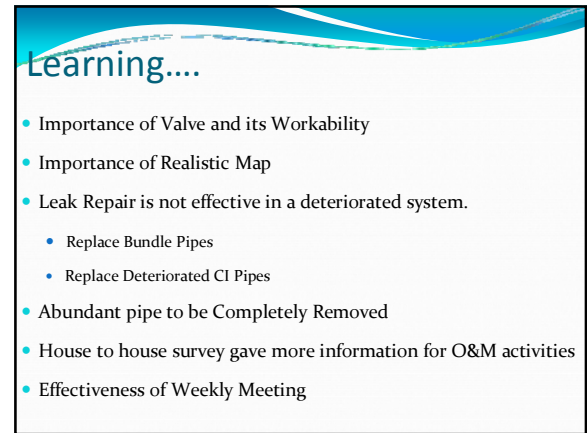
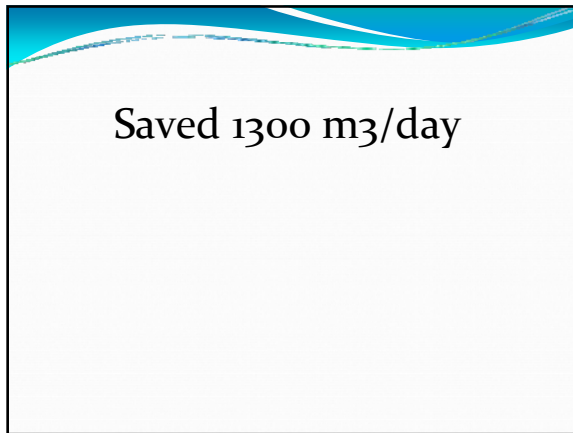
Results of the zones

Zone	Initial Flow (m ³ /Day)	Final Flow (m ³ /Day)	Initial NRW	Final NRW	Saving Amount (m ³ /Day)	Method of Isolation	Activity
K1	1295	571	85%	56%	724	Full	Primary & 2nd Activity
K2	1245	933	78%	72%	312	Full	Primary
K3&4	4240	3989	73%	71%	251	Full	Primary
K5	120	115	59%	55%	5	Sample	Primary
K6	1720		46%			Full	Primary
K7	201	194	65%	64%	7	Sample	Primary
K8	79					Sample	Primary
K9	473					Sample	Primary
K10							Primary

Benefits

- Pressure Improvement in Kotahena Area
- Familiarizing with New Technology
- Methodical approach to address Water Loss Management
- Team Work Effects
- Sharing Knowledge With Japanese Experts
- In depth information about the existing system
- Supplying a good service for consumers

3. Pilot Activities in Kotahena



4. Outline of Execution Plan and Recommendation

Outline of EXECUTION PLAN (Draft) on NRW Reduction in Colombo

October 2012
NRW Reduction Management Team

1

General-1/7

Execution Plan (Draft)

Purpose:

- ◆ To disseminate the NRW reduction activities to entire Colombo City based on the findings obtained through the Project.

Discusses on:

- ◆ Old & deteriorated pipes must be replaced ASAP, but they cannot be replaced at once. It will take years.
- ◆ This plan intends to discuss what we can do to reduce NRW while waiting for pipe replacement.
- ◆ And activities mentioned in this Plan will be also useful for O&M for new system.

2

General-2/7

Prepared by NRW Reduction Management Team (with assistance of JICA Expert Team)

- AGM (NRW) *as the Project Leader*
- AGM (O&M)
- AGM (Development)
- Manger (NRW)
- Manager (O&M)
- Manager (Development)
- Manager (Colombo City – N/E)

3

General-3/7

Contents of Execution Plan

- Part A
 - Outline of the Project
 - Findings of the Project
- Part B
 - Execution Plan

4

General-4/7

PART A: CAPACITY DEVELOPMENT PROJECT

Chapter A1 Outline of the Project
⇒ (explained by AGM-NRW)

Chapter A2 Findings in the Project

Chapter A3 Water Audit
⇒ (explained by OIC Kotahena & Borella)

5

General-5/7

PART B: EXECUTION PLAN

Chapter B1 Policy and Target of NRW Reduction

Chapter B2 Improvement of Measurement System

Chapter B3 Unbilled Authorized Consumption

Chapter B4 Reduction of Apparent Losses

Chapter B5 Reduction of Real Losses *⇒ (will be explained by Manager-NRW in detail)*

Chapter B6 Improvement of GIS *⇒ (will be explained by engineer for GIS in the Project)*

Chapter B7 PR Activities *⇒ (will be explained by PR Officer in detail)*

Chapter B8 Organizational Improvement

Chapter B9 Evaluation and Monitoring of Implementation

Chapter B10 Other Recommendations *⇒ (refer to the Execution Plan)*

6

4. Outline of Execution Plan and Recommendation


General-6/7
<h2>Supporting Report</h2>
<ol style="list-style-type: none"> 1: Results of Pilot Activities 2: Manual for Bundle Pipe Replacement 3: Manual for Operation Methods of Leakage Detection Equipment 4: Leakage Recording System 5: GIS Improvement Methods 6: Cost and Benefit
7

IWA's Terminology for NRW				General-7/7	
System Input Volume M ³ /year	Authorized Consumption M ³ /year	Billed Authorized Consumption M ³ /year	Billed Metered Consumption Billed Non-metered Consumption	Revenue Water M ³ /year	
	Unbilled Authorized Consumption M ³ /year		Unbilled Metered Consumption (water used for fire fighting, etc) Unbilled Un-metered Consumption (free water distributed at standpipes)		
	Water Losses M ³ /year	Apparent Losses M ³ /year	Unauthorized Consumption Metering Inaccuracies		Non-Revenue Water M ³ /year
	Real Losses M ³ /year		Leakage or Transmission and/or Distribution Mains Leakage and Overflows at Utility's Storage Tanks Leakage on Service Connecting up to Customers' Metering		
Note: Source - The categories of the international Water Association (IWA).					
				8	

B1-1/2
<h3>Chapter B1 Policy and Target of NRW Reduction</h3>
<ul style="list-style-type: none"> • Fundamental solution: <ul style="list-style-type: none"> – Pipe Replacement / Rehabilitation is inevitable to reduce NRW • However, other activities are also necessary to bring down NRW to acceptable level such as: <ul style="list-style-type: none"> – Reduction of free water – Reduction of unauthorized consumption – Reduction of administration losses – Active Leakage Control
9

B1-2/2
<p>Execution Plan discuss the activities to be taken:</p> <ul style="list-style-type: none"> • Before completion of pipe replacement / rehabilitation. • In the area where pipe replacement / rehabilitation takes time. • After pipe replacement. • This Execution Plan can be: effective not only to current system, but also to future new system..
10

B2-1/1
<h3>Chapter B2 Improvement of Monitoring/ Measurement System</h3>
<p>Measurement of Inflow to the system is a must to know the NRW.</p> <p>However it is very difficult and requires huge input to isolate the system, according to a finding/experience obtained by the Project. Therefore...</p> <p style="text-align: center;">Wait for Formation of DMA</p> <p>Monitoring of DMA will help selection of the problematic (priority) area and reduction of activities.</p>
11

B3-1/1
<h3>Chapter B3 Unbilled Authorized Consumption</h3>
<ul style="list-style-type: none"> • Findings in Pilot Areas: The more total NRW reduced, the more contribution of free water increase. <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> <p><u>It is important to encourage continuation / improvement of Current Program of Randiya Project and community formation.</u></p> </div>  </div>
12

B4-1/6

Chapter B4 Reduction of Apparent Losses

1. Unauthorized consumption

- Illegal connection

2. Metering Error

- Inaccuracy of Meters
- Reading errors by meter readers
- Fixed rate

13

B4-2/6

1. Reduction of Unauthorized Consumption

NWSDDB is undertaking inspection of illegal connection **at random base**.

Need for Improvement of Methods :

□ **Alternative 1 (Highly recommended option):**

- Meter readers to collect customer information
- OIC office to analyze the data to find suspected houses.
- To inspect at suspected houses.

14

1. Reduction of Unauthorized Consumption (continued) B4-3/6

□ **Alternative 2**

- If “Alternative 1” is difficult, suspicious users may be narrowed down with reference to existing data
 - Extremely low consumption user (by billing record),
 - Previous record of illegal case
 - Disconnected place
 - Area that free water outlet has been removed
- For the narrowing down suspicious users, above information can be overlaid on base map by using **GIS** database

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1. Reduction of Unauthorized Consumption (continued) B4-4/6

□ **Other effective methods to reduce unauthorized connection**

- **PEP is recommended for Service Connection** to prevent unauthorized connection. It will become difficult for customer to tamper PEP connection. (PEP will also contribute to reduction of leakage to a large extent.)
- **Meter sealing** will be efficient to prevent tampering of meters.
- **Education and PR activities;** Customers shall know that it is illegal to touch / repair service connections before customer meters.

16

2. Metering Inaccuracy B4-5/6

□ **Recommendation to improve metering:**

- **Periodical replacement** of customer meters
- Periodical check of meter accuracy
- Preventative maintenance of bulk meters
- Improvement of **accessibility** to meters by relocating to outside the houses
- Enhancement the roles of **Meter Readers/ Education**
- **Rotation** system of meter readers
- Application of **special (high) rates to continuous estimated (fixed) rates customers**

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2. Metering Inaccuracy (continued) B4-6/6

□ **Proposed Revised (new) Tasks of Meter Readers**

- Customer relation – Appeal “Call 1939”
- Read master meter and child meter
- Read public standpost reading
- Find and Inform visible leakage to OIC
- Customer survey: Requirement for the improvement
- Education / Training
- Uniform
- Rewarding (Giving recommendation)

18

B5-1/7

Chapter B5 Reduction of Real Losses

- Real loss ⇒
Most important factor to be tackled
Details will be presented by Manager (NRW)
- In this presentation, cost vs. benefit by reduction of real loss is presented.

19

B5-2/7

Cost vs. Benefit by Reduction of Real Loss

1. Estimate required cost for reduction of real loss
2. Estimate volume of water saving by NRW Reduction Activities
3. Compare required cost vs. benefit brought by NRW reduction activities

20

B5-4/7

1. Required Cost for Reduction of Real Loss (1/2)

- List up necessary works:
 - Sub-zone selection
 - Isolation & installation of chambers
 - Initial flow measurement
 - Establish initial NRW
 - Leak survey, repair work & recording into database
 - Flow measurement after repair
 - Establish NRW after repair
 - Further leak detection, repair & recording into database
 - Flow measurement after further repair
 - Establish NRW after further repair

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B5-3/7

1. Required Cost for Reduction of Real Loss (2/2)

- Unit cost setting
 - NWSDB Rate Book (2011)
 - Interview with NWSDB
- Estimation of necessary quantities of works
 - Estimation of average number of leakages, based on the findings thru Pilot Activities
 - Estimated for two cases:
 - Borella-similar area (relatively better condition)
 - Kotahena-similar area (relatively poor condition)
- Then calculate total required cost.

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B5-5/7

2. Water Saving by NRW Reduction Activities (1/2)

- Estimation of average water saving (m³/month)
 - Based on the findings thru Pilot Activities
 - Categorized in two cases:
 - Borella-similar area (relatively better condition)
 - Kotahena-similar area (relatively poor condition)

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B5-6/7

2. Water Saving by NRW Reduction Activities (2/2)

- Estimation of average water saving (m³/year)
 - Considers rebounding of real loss after repair, with reference to the result of Pilot Activities
 - Borella-similar area: 10% assumed to go back to original status in 11 months after repair
 - Kotahena-similar area: 20% assumed to go back to original status in 6 months after repair

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3. Cost vs. Benefit of Leak Detection/ Repair (1/1) B5-7/7

	Required Cost per 5,000 Connections ^{*)} _{*)}	Benefit per 5,000 Connections			
		Saved Real Loss per 5,000 Connections		Unit Rate for Water (LKR/m ³) ^{*)}	
		Cost (LKR/y)	(m ³ /d) ^{*)}		(m ³ /y, compensated) ^{*)}
Borella-similar Area	3,856,252	1,886.0	311,191.2	24	7,468,589
Kotahena-similar Area	5,030,480	1,855.4	166,988.4	24	4,007,721

*5): Unit amount (LKR) per water loss (m³) specified by NWSDB for cost vs. benefit calculation.

- Saving volume at initial stage => no big difference b/w B-similar & K-similar
- Rebound rate in K-similar is higher than in B-similar
- If proper bundle pipe works can be done together with leak repair, rebounding rate may be moderated. => benefit in K-similar can be increased

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B6-1/1

Chapter B6 Improvement of GIS

[Details will be presented by person in charge of GIS.](#)

Chapter B7 PR Activities

[Details will be presented by PR Officer.](#)

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B8-1/1

Chapter B8 Organizational Improvement

To do activities mentioned in the Execution Plan practically, following additional input may be required:

- One GIS operator for GIS update + one Engineer to supervise
- Leak Detection Team**
(6 month / team – one Zone officer area of 5,000 connections)
1 team for 1 OIC - **8 Teams**
- A staff** for Leak Repair Record Keeping **at OIC office** (and customer data)
- Team for Customer Survey, if meter readers do not execute

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B9-1/1

Chapter B9 Evaluation and Monitoring of Implementation

- Evaluation and monitoring committee to monitor the activities and evaluate the performance.
- Periodical water audit will be useful.

28

B10-1/1

Chapter B10 Other Recommendations

- ◆ For O&M improvement
- ◆ For system improvement
- ◆ For improvement of Water Act

Refer to the Execution Plan for further detail..

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THANK YOU VERY MUCH

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**Capacity Development Project
For Non Revenue Water (NRW) Reduction
In Colombo City.**

**PROPOSED GIS ACTIVITIES
IN COLOMBO CITY**

D.T.S.U. Dissanayake
Engineer O&M (C-S)

Presentation content

- **GIS Background and Resources in NWSDB**
- **About Pilot project**
- **Activities to be implemented on Colombo city**
- **Benefits associated with GIS (According to Pilot project)**

Presentation content

- **GIS Background and Resources in NWSDB**
- About Pilot project
- Activities to be implemented on Colombo city
- Benefits associated with GIS (According to Pilot project)

Currently Available data at NWS&DB for Greater Colombo

- Base map
Developed under Norad Project using Year 2000 areal Photograph.
- Water utility network
Developed under Norad Project using Norplan maps, As built data and field information. (2000 – 2006)

Base Map need to be updated due to rapid changes



Water utility network includes pipelines, Valves, Fire Hydrants, Standposts, Storages etc

There are several new objects and Information, which are not included in the GIS database and The database shall be updated.

At the moment the GIS database is not using in O&M

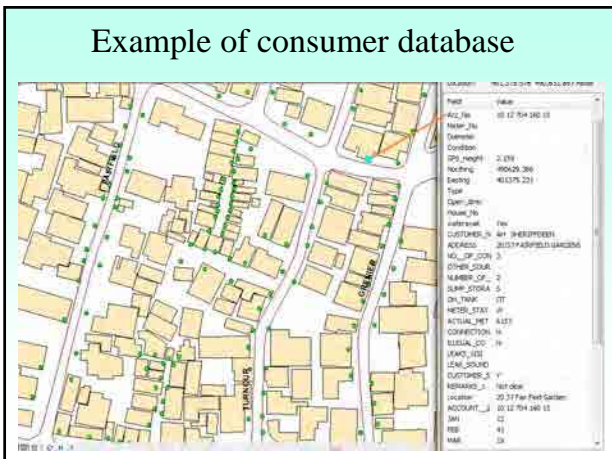
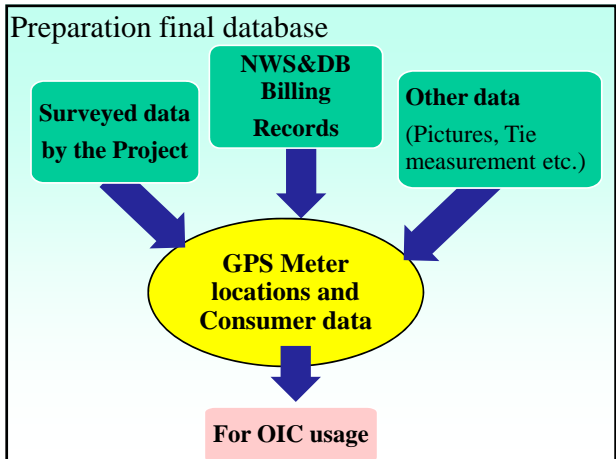
NWSDB is going to use GIS database in O&M work

Presentation content

- GIS Background and Resources in NWSDB
- **About Pilot project**
- Activities to be implemented on Colombo city
- Benefits associated with GIS (According to Pilot project)

About Pilot project

- **Area** :- Borella and Kotahena
- **Base map** :- Digitized infrastructures using high resolution satellite images.
- **Consumer locations** :- Field data collection using high accuracy GPS.
- **Other important locations** :- Field data collection using high accuracy GPS.
- **Data Entering** :- Using Arc GIS platform.
- **Product** :- Consumer database with survey and Billing data.



GIS usage under pilot project

Each OIC has a computer and GIS software

O&M Staff already started bringing maps to the site

Findings at the field are inform to Maligakanda office for update of the database

Presentation content

- GIS Background and Resources in NWSDB
- About Pilot project
- **Activities to be implemented on Colombo city**
- Benefits associated with GIS (According to Pilot project)

Proposed execution plan for Colombo city

- Update existing Base map using satellite images
- Collecting consumer information by field visit
- Locate consumers on the base map
- Preparation of Consumer database
- Carrying GPS field survey to locate valves, bulk meters, Free water outlets etc.
- Update water network database with collected data

Major finding in pilot project

Locating consumers using GPS is a time consuming task

Modified and the simple alternative method Will be introduced

Details included in the execution plan Supporting report 5
“GIS improvement for O&M”

Presentation content

- GIS Background and Resources in NWSDB
- About Pilot project
- Activities to be implemented on Colombo city
- **Benefits associated with GIS (According to Pilot project)**

What we can do with GIS database (According to Pilot project)


- As an updated Base map
- Overlay operation
- Exploring pipe information, Valves, Standpost, ect
- Selecting of High priority illegal connections
- Asset management and Condition assessment

What we can do with GIS database (According to Pilot project)


- Response to customer complain
- Maintain Repair records
- Frequent leakages
- Selection of routes and cost estimation for new connections

5. Improvement of GIS for O&M in entire CMC


Overlay operation



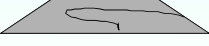
Buildings




Utility cables or pipes



Water bodies



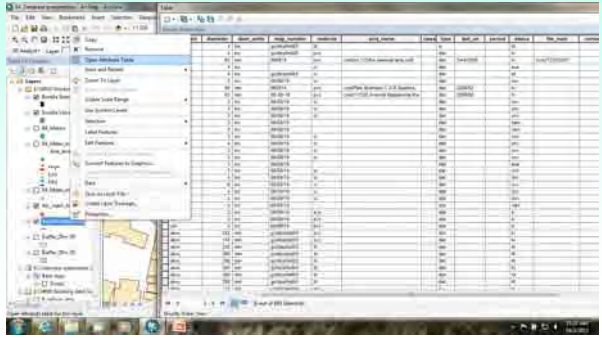
Administrative data



Customer locations

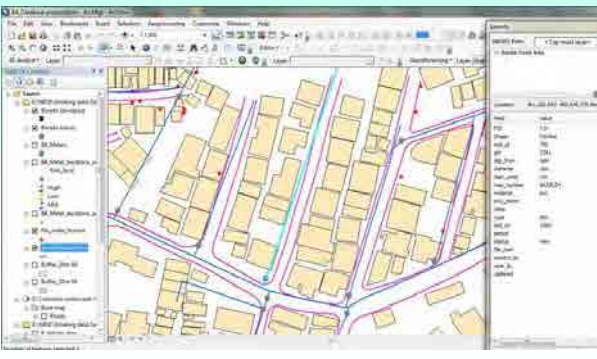
Exploring pipe information

By attribute Table



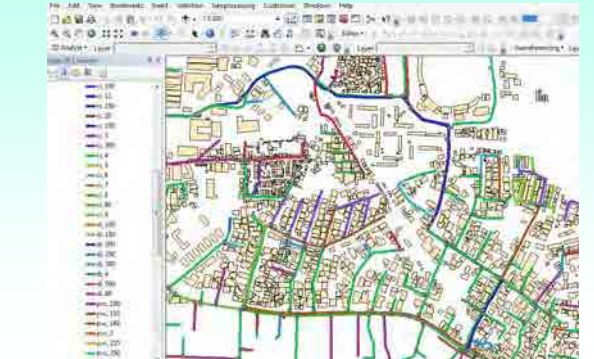
Exploring pipe information

Selecting an object



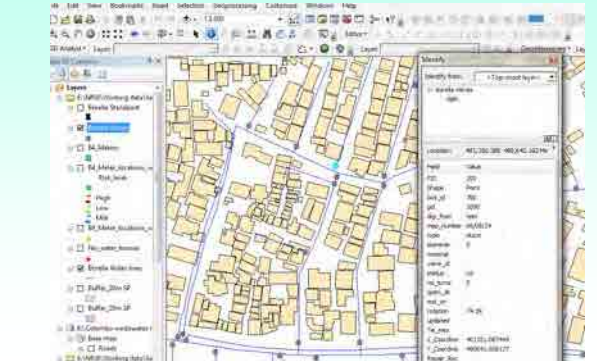
Exploring pipe information

Querying Objects



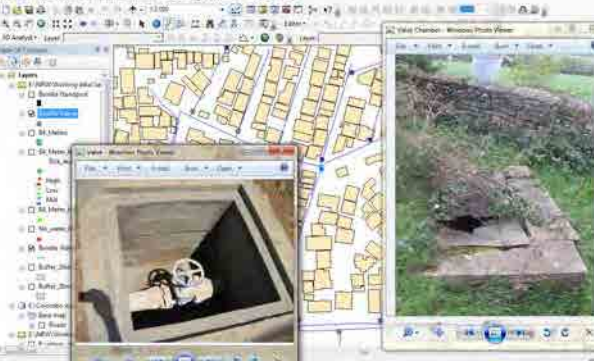
Exploring Valve information

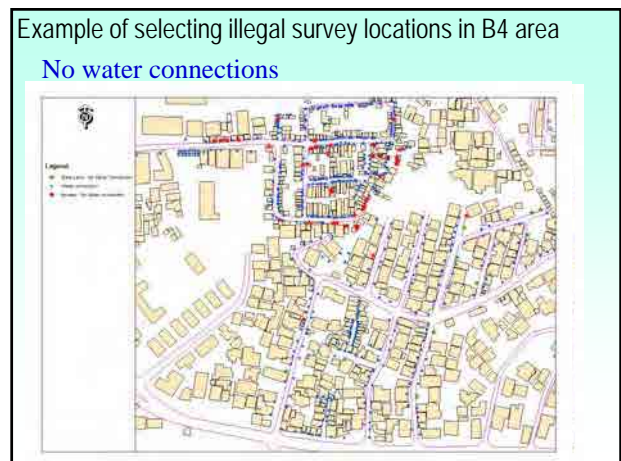
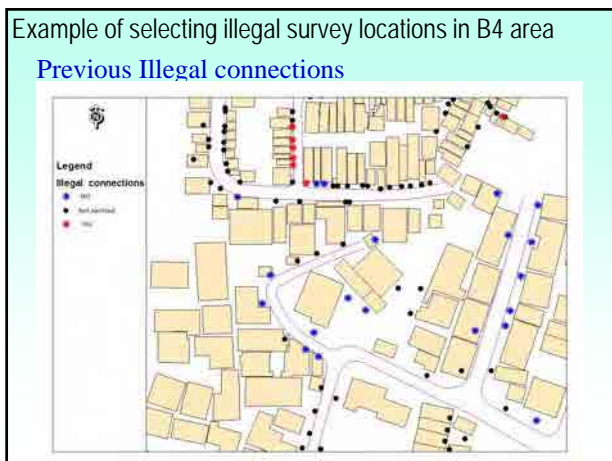
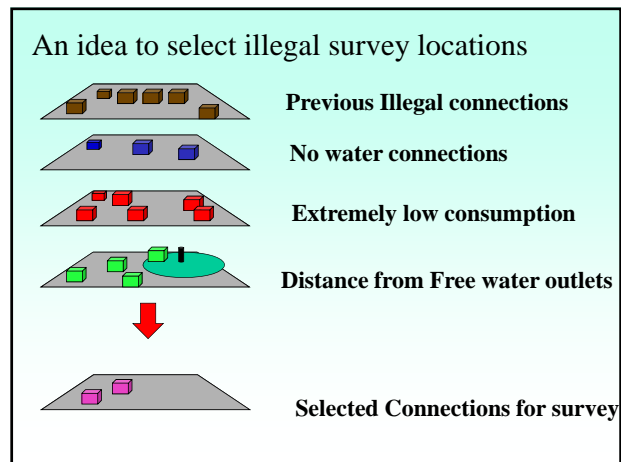
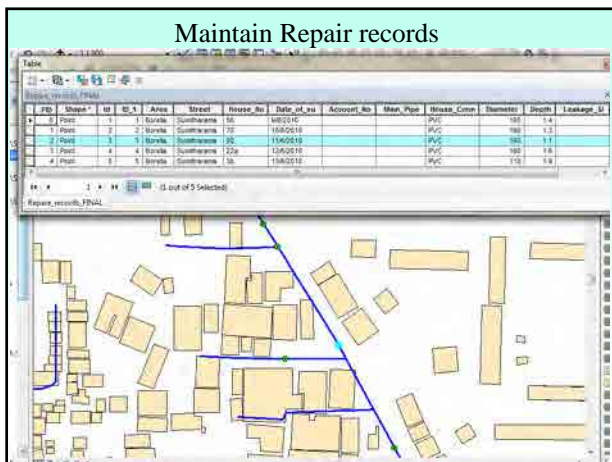
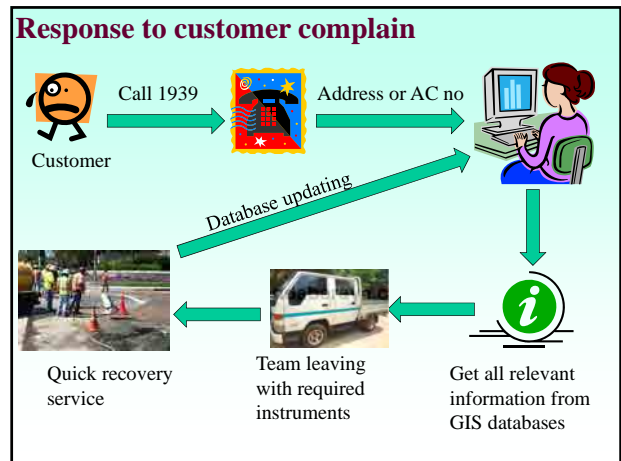
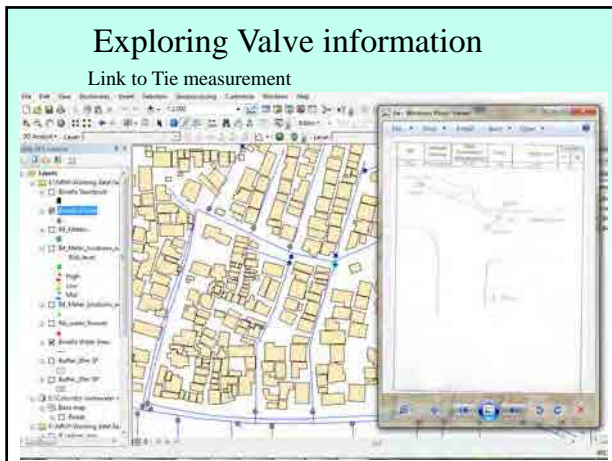
Same thing can be done as pipelines



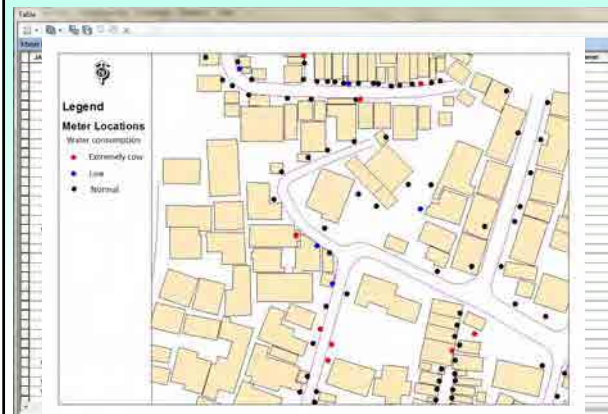
Exploring Valve information

Link to Documents & Pictures



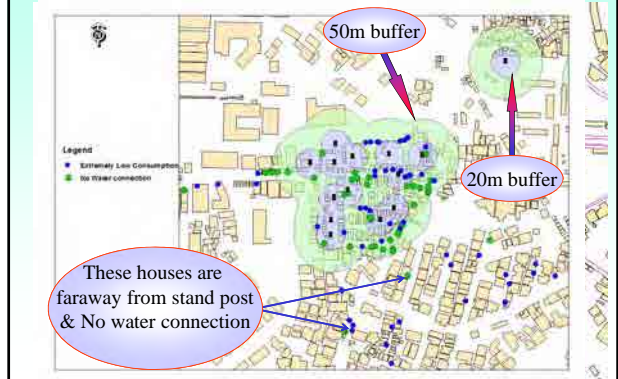


Example of selecting illegal survey locations in B4 area

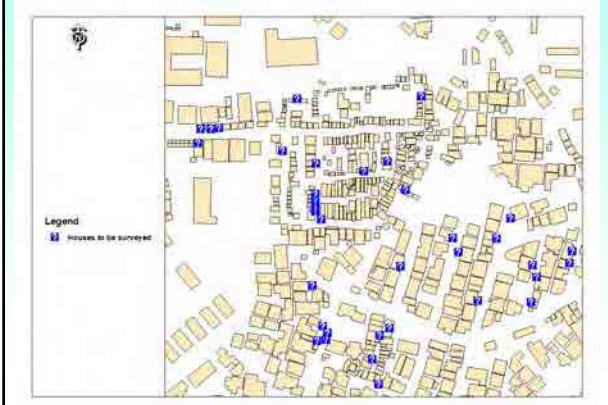


Example of selecting illegal survey locations in B4 area

Far from Public stand post



High priority location for illegal survey



Leak locations - Kotahena



Leak locations - Borella



Benefits associated with GIS

- Improved quality of service to the consumer
- Improved field activities
- Reduced operating costs
- Security of data
- Map updating
- Production of hardcopy
- Avoided duplication / consistency of information

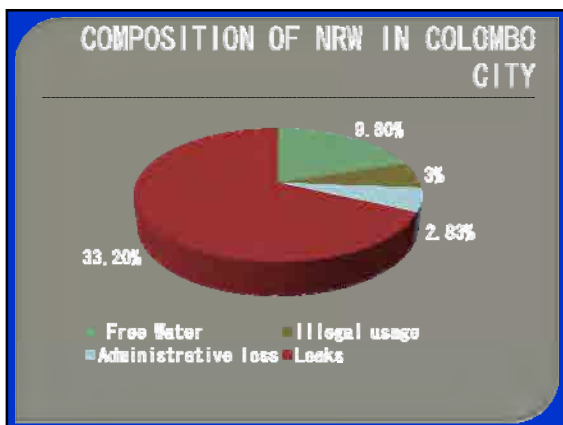
6. Reduction of Real Losses (Leakage)

Reduction Of Real losses (leakage)

T.B.Heenkenda
B.Sc.(Engg) C.E., M.B.E.S.U.(P.O. Dip.Ed)
Manager(WLM)

Why should leakage be Reduced ?

- To meet increasing water demand in the country
- To avoid requirement of new water sources
- To avoid unnecessary production at plants
- To defer high capital cost for new water treatment plants
- To avoid tariff increase



Real Losses

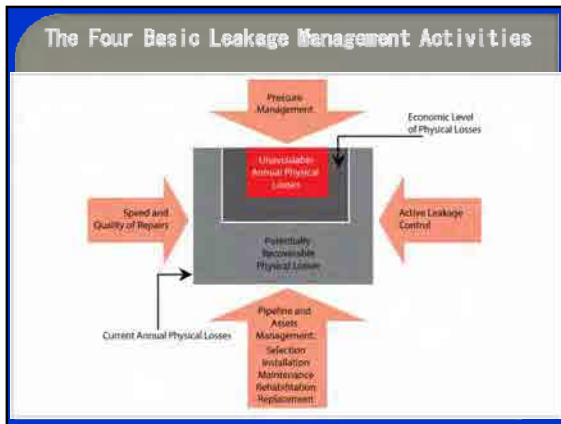
- Main Break or Pipe fracture
- Crack
- Pinhole
- Leakage on Packing Glands of pumps or valves
- Pipe joint leaks
- Leaking service connection pipe

- Reservoirs, sumps, overhead tank leaks and overflow
- Flushing hydrant
- Flushing main line
- Tank backwash

Reasons for leakages

- Network deterioration
- Poor installation
- Inadequate cover
- Bundle pipe
- Incorrect material

6. Reduction of Real Losses (Leakage)



Leakage Control Options

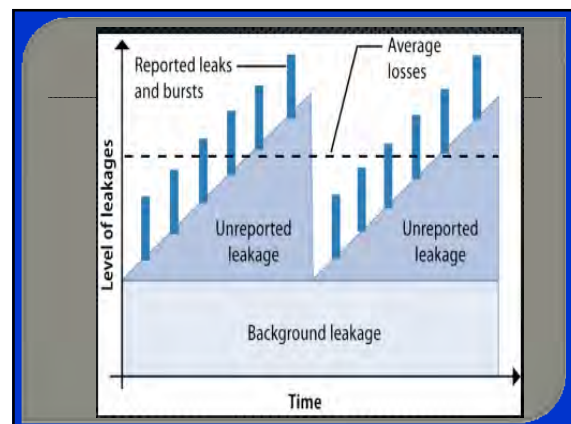
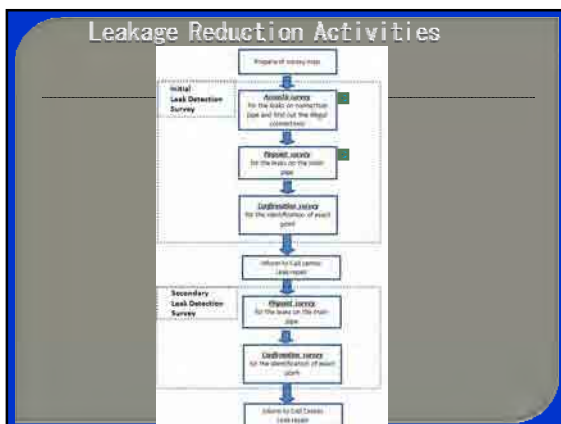
- > **Passive control**
 - Respond only to reported faults (present policy)
 - Requires least effort but results in highest leakage levels
 - Normally only cost-effective where water is very cheap (little pumping and treatment)
- > **Active control options**
 - Regular sounding
 - Zonal metering
 - Pressure control

Active Policy Options

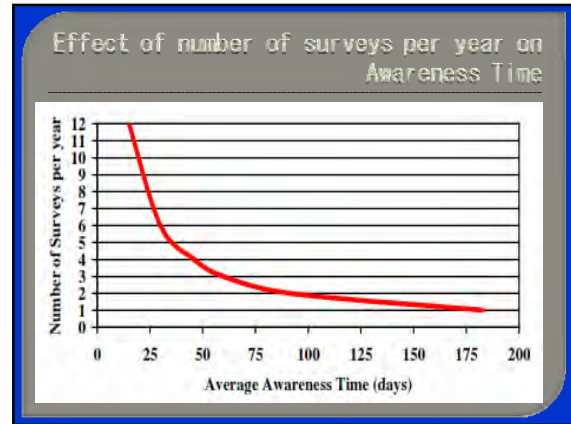
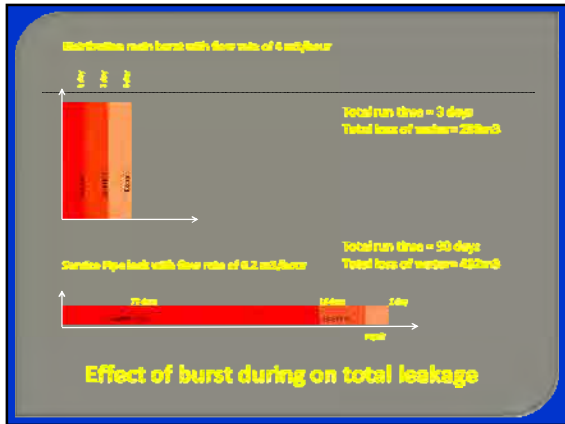
- > **Pressure control**
 - Reduce pressure and leakage without affecting the supply to consumers
 - Location of leaks not required
- > **Regular sounding**
 - Systematically sound pipes to locate leaks
 - Need many trained inspectors
 - Only cost-effective where the value of water is high
- > **Zonal metering (District Metering Areas - DMA's)**
 - Regularly (weekly/monthly) monitor net zone inflow to determine flow characteristics and leakage level, identify the worst affected areas and undertake leakage detection surveys
 - cost-effective where the value of water is high

Components of Real Losses or Leakage

- ▣ **Reported leaks and breaks**
Typically high flow rates, short run-time notified to the water utility customers etc
- ▣ **Unreported leaks and breaks**
Typically moderate flow rates, long run-time located by active leak control
- Background leakage**
(mostly at joints and fittings)
flow rates too small to be detected if hidden generally



6. Reduction of Real Losses (Leakage)



Kotahena Pilot Zone

Sub Zone	K1	K2	K3 & K4	K5	K7	K8	K9	K10	Total	
No of Connections	397	476	1383	115	1545	269	201	301	4136	
Area (Km²)	0.056	0.066	0.256	0.091	0.258	0.138	0.196	0.08	1.122	
Length of pipe line (m)	CI	707	1,168	7,160	867	1,617	1,668	3,669	21,165	
	DI					504	299	587	1,460	
	PVC	602		173		262	778	114	53	
Total length (m)	Acoustic		52	36	17	8	9	58	10	8
	Pinpoint		33	37	8	1	13	6	0	2
	Visual		23	20	4	4	4	0	0	1
	Pinpoint		4	0	7	1	3	2	0	19
Total No of Service leak per 100 connection									6.40%	
No of service leak detected from acoustic method									3.40%	

Borella Pilot Zone

Sub Zone	B1	B2	B3	B4	B5	B6	B7	B9	B10	Total
No of Connections	526	634	360	453	840	1119	1300	594	101	6967
Area (Km²)	0.177	0.143	0.076	0.111	0.196	0.133	0.199	0.093	0.182	1.41
Length of pipe line (m)	CI	1,380	2,768	1,368	1,179	1,572	2,100	1,187		501
	DI							1,163		1,461
	PVC	873	1,940	1,058	1,775	400	1,289	1,526	1,310	723
Total length (m)	Acoustic		33	24	16	21	14	14	7	1
	Pinpoint		0	2	2	12	7	8	0	0
	Visual		0	2	0	0	0	1	1	0
	Pinpoint		0	0	3	0	21	0	1	0
Total No of Service leak per 100 connection										4.75%
No of service leak detected from acoustic method										3.64%
No of service leak detected from Pin point method										1.10%

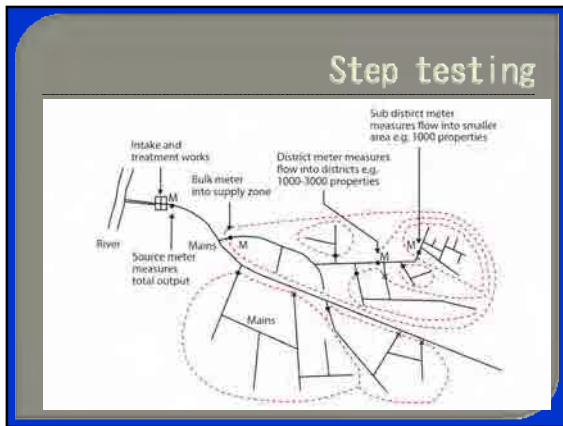
- Leak repair record**
- Report all the leak to relevant OIC through Call centre
 - Prepare Repair order sheet and give to Zone officer
 - Repair leakage quickly and fill Repair order sheet
 - Record information to data base and locate at GIS

Leak Recording System

Leakage Record Sheet

Date of leak	07.05.12	Time	11:00 AM
Location	Sub-zone	Area	
Leak type	Service	Leakage	Acoustic
Leak description	Leak detected by acoustic method		
Leak location	Sub-zone: K1, Area: K1, Meter: K1		
Leak status	Open	Leakage	Acoustic
Leak type	Service	Leakage	Acoustic
Leak location	Sub-zone: K1, Area: K1, Meter: K1		
Leak status	Open	Leakage	Acoustic
Leak type	Service	Leakage	Acoustic
Leak location	Sub-zone: K1, Area: K1, Meter: K1		
Leak status	Open	Leakage	Acoustic
Leak type	Service	Leakage	Acoustic
Leak location	Sub-zone: K1, Area: K1, Meter: K1		
Leak status	Open	Leakage	Acoustic

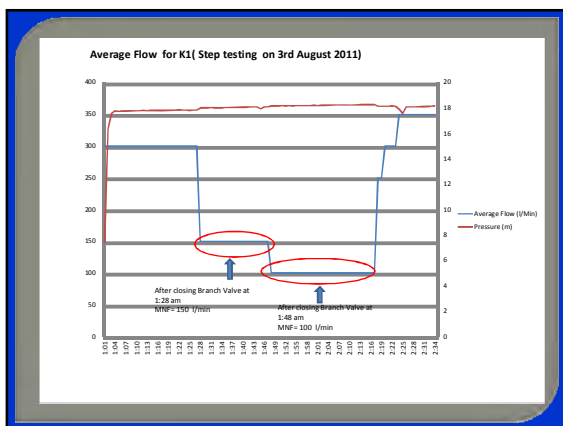
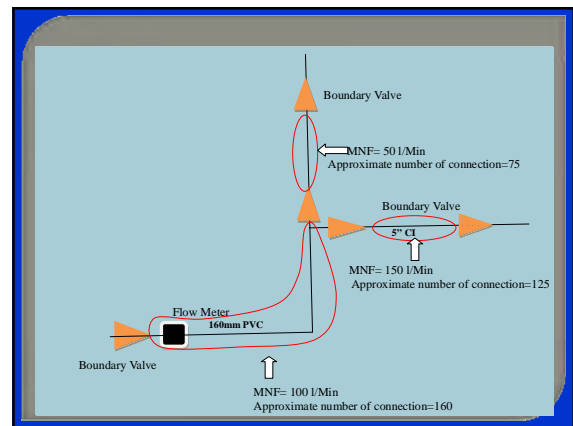
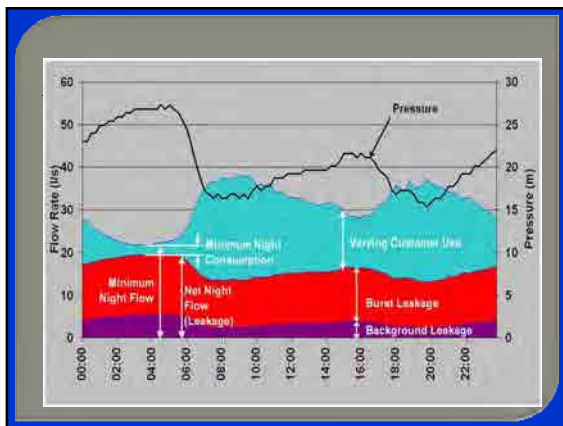
6. Reduction of Real Losses (Leakage)



Implementing Leakage Control in District Meter Areas

Step Testing

- Step testing is a technique used to locate the areas of greatest leakage within a zoned distribution system.
- The test is undertaken at night during the period of minimum demand when leakage rates are highest.
- The areas identified with high leakage levels can then be given priority attention for leakage surveys.




THANK YOU !

6. Reduction of Real Losses (Leakage)



Capacity Development Project for
Non Revenue Water Reduction in
Colombo City Area

Public Relations Activities in
Selected Schools



National Water Supply & Drainage Board
Regional Support Centre (Western – Central)

Why Public Relations Activities in Schools?

- To educate the future generation
- To make them a part of this project
- To send the message to their homes

Activity 01



Poster Competition

How we selected the schools ?

- 5 schools - within the pilot area.
- 5 schools - outside the pilot area



5 schools from the pilot area.

01. C. W. W. Kannagara Maha Vidyalaya	- Borella	
02. Ratnaweli Balika Vidyalaya	- Borella	
03. Carey College	- Borella	
04. Yashodhara Balika Vidyalaya	- Borella	
05. Wesley College	- Kotahena	


5 schools from outside the pilot area.

01. Rajasinghe Maha Vidyalaya	- Dematagoda	
02. St. Antonies Balika Vidyalaya	- Dematagoda	
03. St Mathews Vidyalaya	- Dematagoda	
04. Gothami Balika Maha Vidyalaya	- Maradana	
05. Anurudda Balika Vidyalaya	- Dematagoda	



How we made them to draw POSTERS?

*We made aware the school children on Non Revenue Water reduction
with the support of Principals & Art Teachers of the respective schools*



7. PR Activities

JICA provided valuable drawing-kits for all students participated



What they Created?



What children gained?


- Awareness on water conservation
- Knowledge on Reduction of Non Revenue Water

How we appritiated them ?

- Participatory Certificates & Drawing -kits.
- Special Certificates & gifts for winners.

Selecting winners

Judges from the University of Kelaniya selected the winners.



3rd Place




Chansu Vimukthi of Carey College

2nd Place



Anupa Gunawardena of WesleyCollege

1st Place



S. K. Sadini Mekela of Ratnawali Balika Maha Vidyalaya

7. PR Activities

Activity 02

Special School Activity

We selected five schools in Colombo.

- S. W. R. D. Bandaranayaka Vidyalaya - Borella
- St. Benadict's College - Kotahena



Ratnawali Balika Vidyalaya - Borella



St. Mathew's College - Dematagoda



St. Anthony's Balika Vidyalaya - Dematagoda



Awareness Programs conducted in Relation to;

- Water Purification / Cost of water/ Water conservation for the future and Non Revenue Water issues.



7. PR Activities

➤ *All the participants were given the opportunity to create drawings on given themes.*

➤ *Drawing materials were provided by JICA*

We allowed the children to come out with their own ideas.



Water Board & JICA

Achivements

- *Knowledge given to children.*
- *We got the opportunity to send the good message to their homes & schoolmates.*
- *Opportunity to display the winning posters in public places & schools with a message from the Water Board & JICA.*

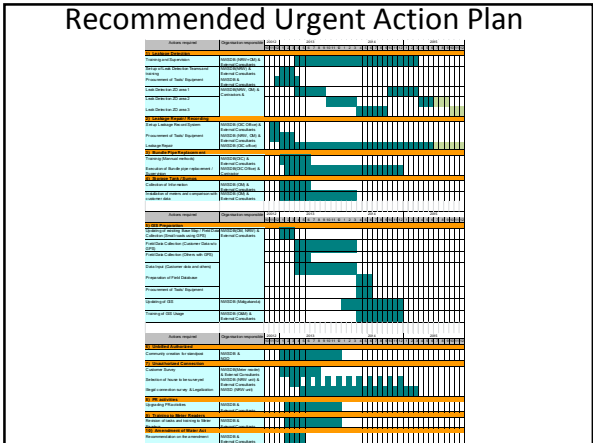
Thank you.

Presented by:
Shiromi Karunaratne
Senior Corporate Communication Officer
Regional Support Center (Western - Central)

8. Recommended Action Plan

Recommended Action Plan

Summary of Activities to be executed			
Item	Contents		Description
1. Unbilled Authorized Consumption (Free Water Outlets)	Community formation		Enhance the current activities
2. Unauthorized Consumption	Investigation		Improve random base checking by using customer data
3. Metering Error	Education to Meter readers		Revision of the tasks and training
4. Real Losses	Leakage Detection		Continuation of the pilot activities with some modification
	Leakage Repair / Recording		Continuation of the pilot activities with some modification
	Bundle pipe replacement		Replacement of bundle pipe by using / following the manual.
	Storage tanks/ sumps		List up and measure water loss volume to make clear the seriousness of the problem.
5. GIS for O&M	Preparation		Continuation of the pilot activities with some modification
	Usage		Usage of GIS especially by O&M field staff
6. PR activities	Improvement of current activities		Introduction of new idea such as school curriculum and manual for notification of water suspension.
7. Water Act	Study Amendment	required	Recommendation on amendment such as improvement of illegal connections



If NWSDb propose assistance for the execution of the Action Plan,