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Water Leak Detection

**Riyadh
Saudi Arabia**



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IAC Projects

Part One: Potable Water Distribution Networks

- During the last (5) years (IAC) has successfully executed “Water Leak Detection & Repair” of :-
 - More than **12** thousands kilometers of pipelines of various diameters.
 - More than **half million** house service connections (HSCs).
- These projects have covered various major cities in KSA for example Riyadh- Madinah- Tabuk- Dammam- Alkhobar- Jubail- Qatif- Ras Tanura- Ahsa- Abaqiq... and more).

Part Two: Wastewater Networks (Domestic, Storm, Combined & Industrial Sewers)

- (IAC) has successfully executed more than (**150**) projects in the field of inspection, condition assessment & Trenchless Rehabilitation of sewage networks in KSA.



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Importance of Water Leak Detection:

- To detect and repair of visible and invisible water leaks in the water supply network and house service connections.
- To bring the leakage percentage to the allowable leakage percentage requested.
- Performing Leakage Studies to determine the quantity of water lost due to leaks.
- Performing Flow Measurement Analysis including pressures and flow rates.
- Testing the components of the water supply network (valves, water meters, fire hydrants, main pipelines, house service connections...etc) .
- To improve the efficiency of the water supply system.
- To achieve water quality improvement as a result of leak detection and subsequently, the repairs which will be carried out for leakage points.



Types of Leaks

Visible Leaks

This type of Leaks appears on the surface due to the following:-

- ☐ Road failure beside the leakage location.
- ☐ Water filtration in the floor of some houses.
- ☐ Appearance of plants and grass in places which are allocated for agriculture.
- ☐ Accumulation of water on the ground surface.



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Invisible Leaks

- This type of leakage is aroused due to the presence of fracture or certain defect in the water network without any signs above the ground which indicates its presence, this called “**Real Losses**” and it causes serious damages to the public & private properties.
- Real losses are known as “**Unaccounted for Water**” (UFW) which reduce the operation efficiency and affect the economic operation of the network .





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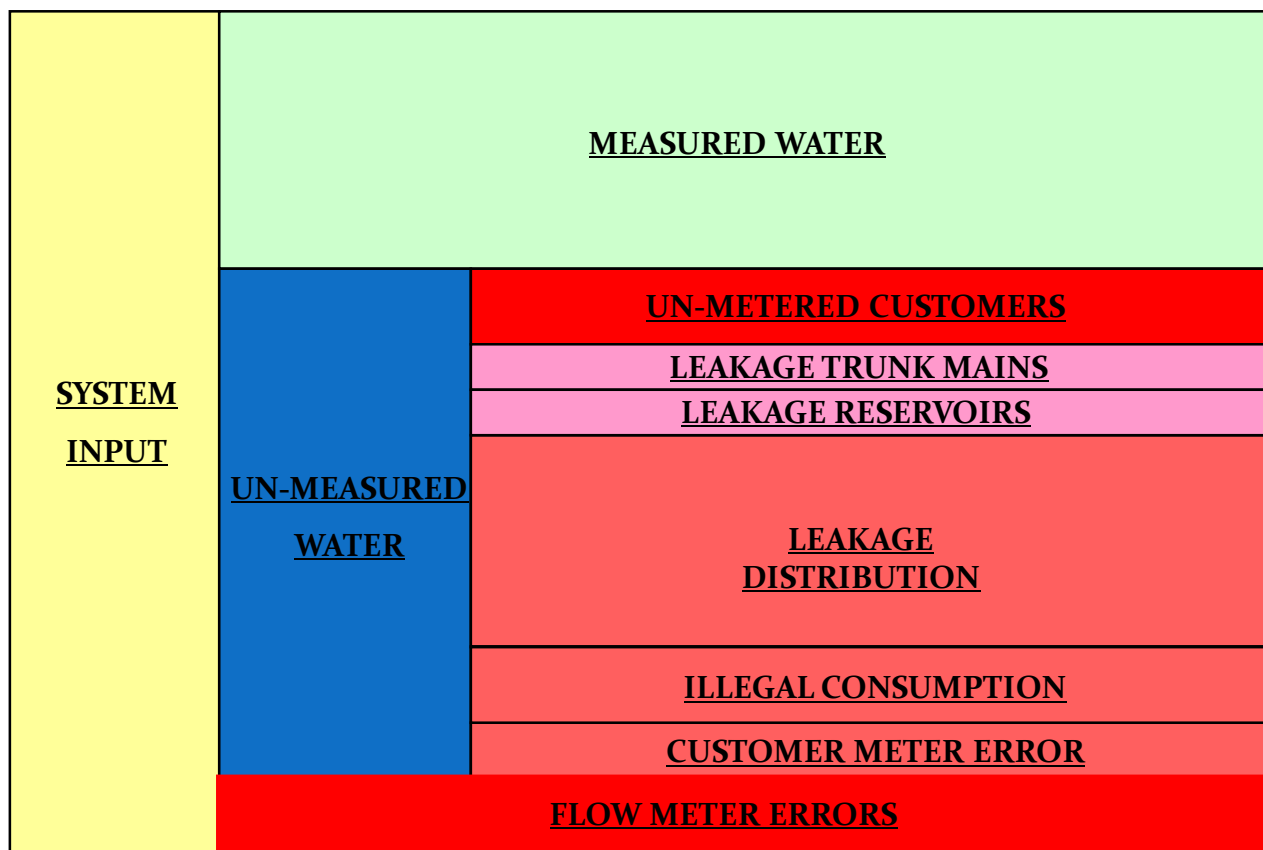
IWA Standard Water Balance

System Input Volume (corrected for known errors)	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
		Unbilled Authorized Consumption	Billed Unmetered Consumption	
	Water Losses	Apparent (<i>commercial</i>) Losses	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
		Real (<i>physical</i>) Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies and Data Handling Errors	
			Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

IWA: International Water Association



(Water Balance)





Methodology of Work

Data Collection from the Client including:-

- As-built drawings of the water distribution network and its components.
- GIS data base (if any).
- GPS reference points.

Field Survey of the Water Network Components as follows:

- ☐ **Valves:** Location, type, exist or missing, valve condition...etc.
- ☐ **Fire Hydrants:** location ,condition (e.g. normal, damaged, broken...etc).
- ☐ **House Service Connections “HSCs”:**
 - Street number, House number, no. of floors, building type, post code- GPS coordinates location and existence on map and on site.
 - “HSC” length and diameter, main pipeline diameter connected to “HSC”.
 - Material type of the HSC (e.g. PVC, PE,...etc.).



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Checking Gate Valve



Locating Missing Valve



Replacement of Defected Valve





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Construction of Valve Chamber & Installation of a New Valve





Cont./ Methodology of Work

- ❑ **Service Water Meters inspection** :Types, brand, position (ground, wall horizontal, wall vertical), distance from the main line street number, building number, house meter status and house meter valve status...etc.
- ❑ **Tracing Pipelines alignments:**
 - a. **Metallic pipelines locators** which can identify the alignment of the pipeline by sending and receiving electromagnetic waves.
 - b. **Non-metallic pipelines locators** are applied which create sonic waves in the pipeline body and receive these sonic waves to identify the pipeline alignment below the ground surface.
- ❑ **Locating lost valves and Valve chambers covers.**



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Inspection of Water Meters and Replacement of the Defected Meters





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Pipelines Locators

Metallic Pipes locating



Non Metallic pipes locating



**Valves & Metallic
Covers Locating**





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Cont./ Methodology of Work

❑ GPS Survey

To get the accurate X, Y and Z coordinates of the water network components which includes lines, valves, fire hydrants and angle of specific buildings to define road route.

❑ Total Station Survey

It is applied in locations where satellite signals are not available due to the presence of high trees & tall buildings....etc.



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GPS Survey





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Cont./ Methodology of Work

GIS maps & As built drawings updating

Updating the coordinates of the water network components in the GIS maps and update the As-built drawings according to the findings of the Field Survey.



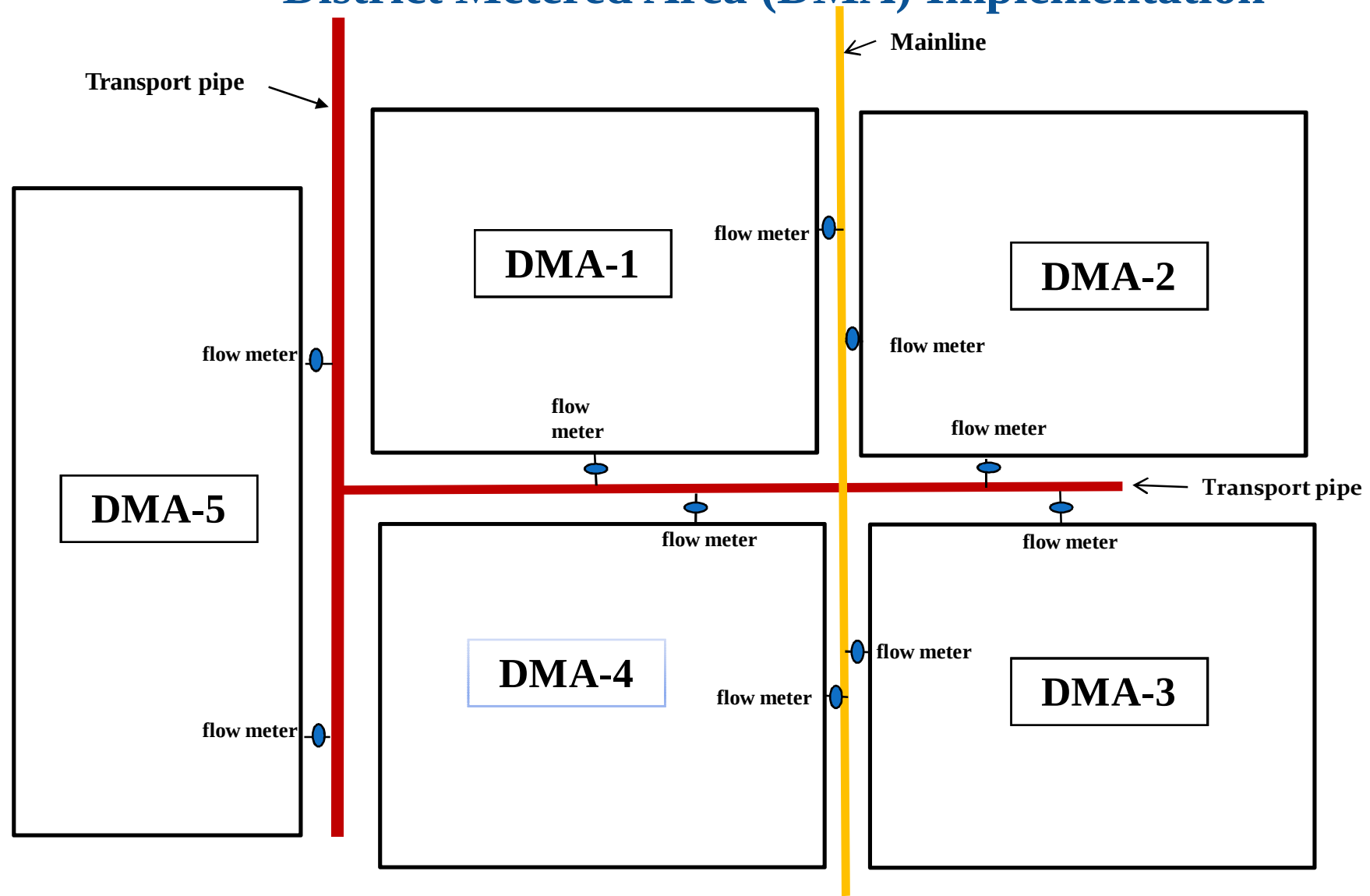
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District Metering Area (DMAs) Implementation

- The Water distribution network is divided into several DMAs in order to control the water supply for each DMA.
- All defected or damaged components of the water network (valves, water meters , fire hydrants ...etc) should be maintained or replaced before starting leakage studies in the DMAs to ensure accurate results for these studies.
- Control Test on the DMAs to ensure full control on the water supply for each DMA.



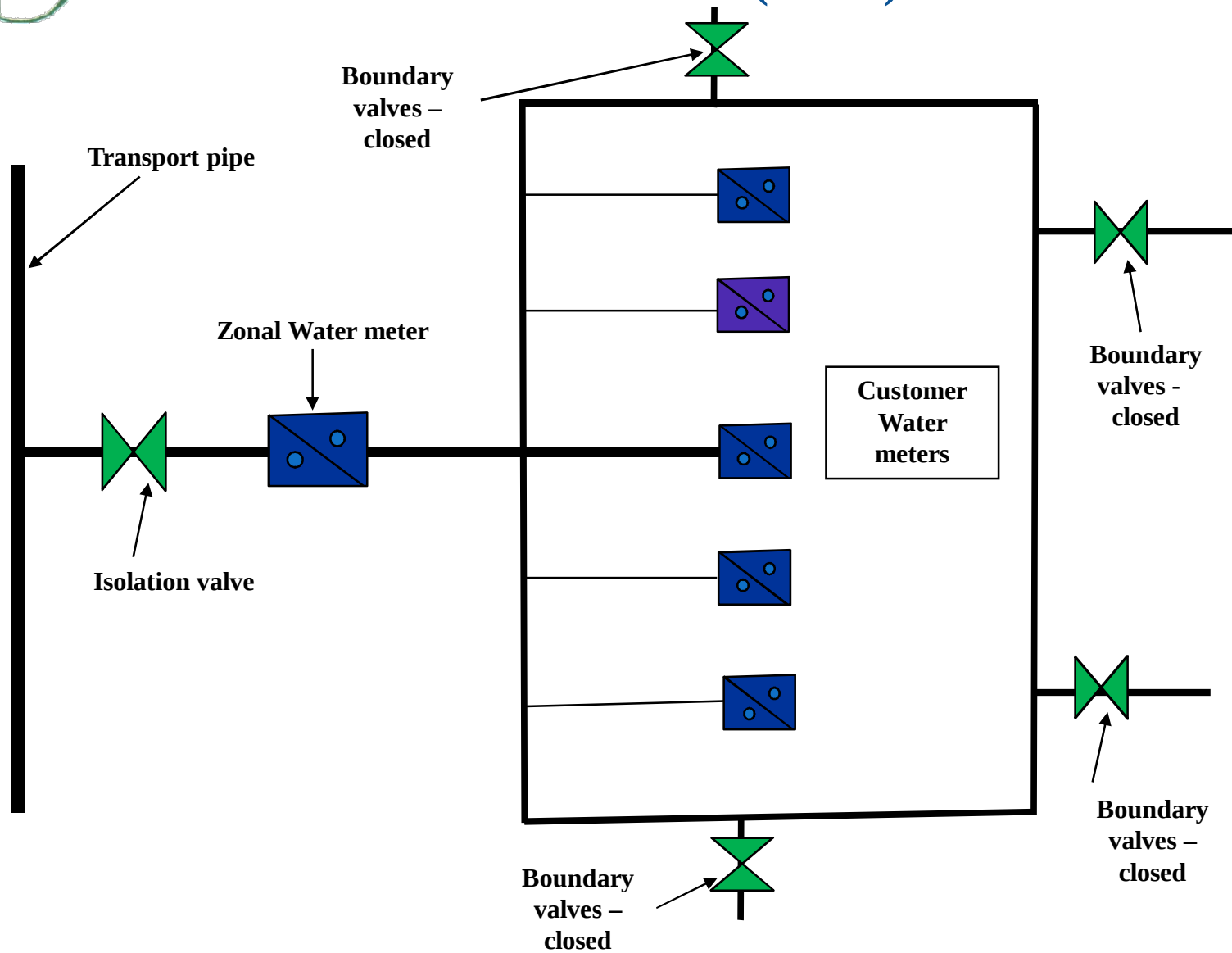
District Metered Area (DMA) Implementation





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District Metered Area (DMA)





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Water Balance of DMA

Water Balance of DMA is done through five steps as follows:-

- **Step 1 – Determining system input volume.**
- **Step 2 – Determining authorized consumption**
- **Step 3 – Estimating apparent losses**
- **Step 4 – Calculating real losses**
- **Step 5 – Quantifying real loss components**



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Flow Measurement & Analysis

**Electromagnetic
Flow meter**



**Data loggers in special
concrete chambers**



DMA Flow Meter Installation



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Onsite Installation of Electromagnetic Flow Meter





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Pressure Management



**Pressure measuring &
recording devices for
continuous monitoring of the
network pressure**

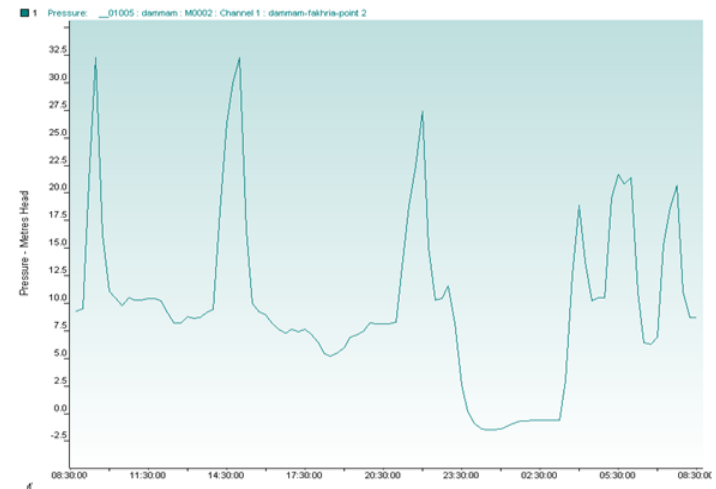


**Installation of Pressure Relief
Valves to control the pressure
values to comply with standards
& safe operation of the network**



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Installation of Pressure Measurement Devices





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Leakage Control

Leak Detection Programs:

- A. Primary Leakage Detection.
- B. Leak detection using acoustic devices (Correlators & Ground Microphones)
- C. Leak localizing through (Noise Loggers).
- D. Leak detection using Helium Gas Method.

Leaks Repair.

Data Analysis & Reporting.

Network monitoring with the support of Software programs.



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IAC Leak Detection Crew





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Leakage Control

Leak Detection Programs:

(A) Primary Leak Detection

- ☐ Depend on the visible leaks above the ground surface.
- ☐ Notifications from the Citizens or the network Observers.

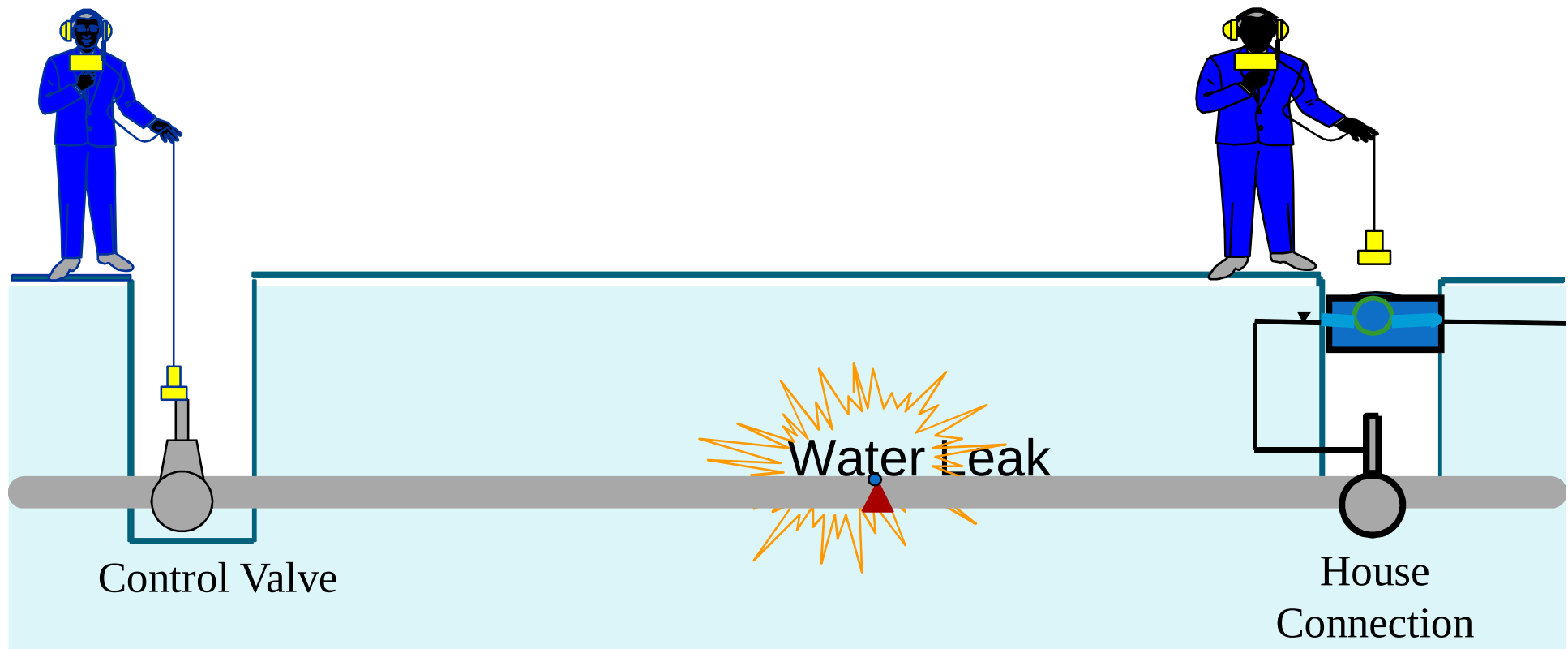




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Leakage Control

(B) Leak detection using acoustic devices (Correlators & Ground Microphones)





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Leakage Control

Leaks Inspection in Water meters



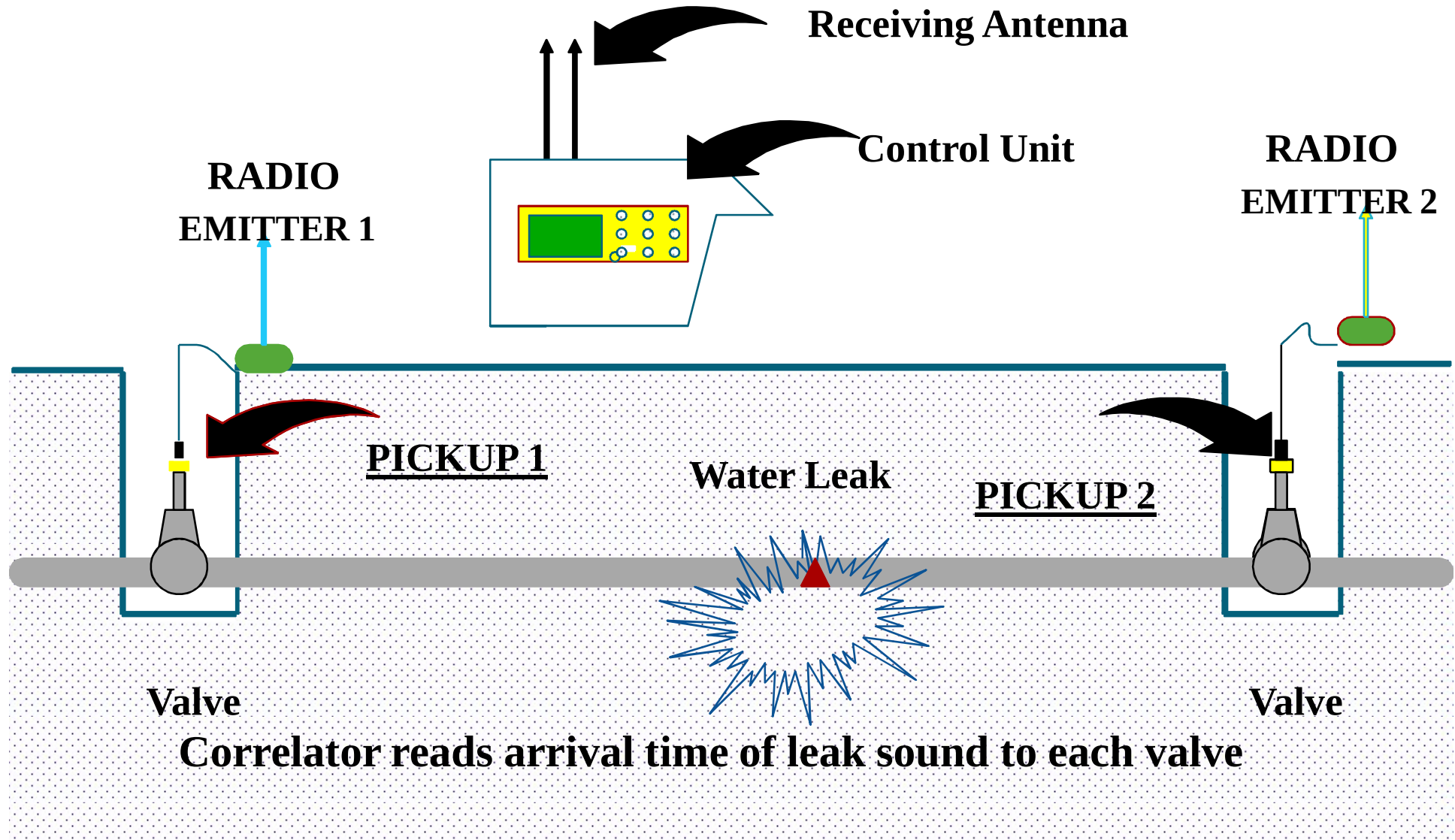
Listening above ground, using Acoustic Devices





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Leakage Control Acoustic Correlation





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Leakage Control

Leak Detection using Acoustic Correlators





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Leakage Control

Leak Detection using Ground Microphones



Pinpointing Leak Location





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Leakage Control **Leak Detection Devices Compilation**





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Leakage Control

Leaks Repair





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Leakage Control



House Service Connections (HSCs) Leakages



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Leakage Control



Leaks Repair



Data Analysis & Reporting

- Analysis of flow characteristics data of the network (Pressure, Flow rate....etc).
- Analysis of water supply and consumption data.
- Leakage studies for each DMA.
- Reporting (leaks detection , leaks repair, water loss studies, flow characteristics of the network , water supply in the network....etc).
- Reports on the progress of water leak detection & repair activities are submitted periodically (usually monthly reports) to the Client.



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Network Monitoring using “WATCH LEAK” Water Management System

- ☐ Applying long term monitoring programs of the network to control leaks.
- ☐ Periodical inspection & condition assessment for the networks components.
- ☐ Replacement of damaged components of the network (valves, fire hydrants, water meters, pipes...etc).



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Importance of Zonal (DMZ or DMA) Monitoring

- ☐ **Determination of the supplied and the consumed water volume.**
- ☐ **Cost estimation of the lost water.**
- ☐ **Prioritizing system. (i.e. monitoring system gives priorities for the locations which urgently need leak detection & repair activities).**
- ☐ **Allows the operator to focus leak detection effort to give most benefit.**



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Network Monitoring **Watch Leak Performance**

Network Map

Delivers advanced functionality for GIS

Remote Reading Status

Send reports for any defect (Data Logger)

Flow & Pressure

Continuous Monitoring for
water distribution systems
(Data & Graph)

Water Supply

DMZ & DMA (Data & Graph)

Alarm

Warnings issued by the meter



Leak Test

Actual Leak Test for DMA
including Step Test

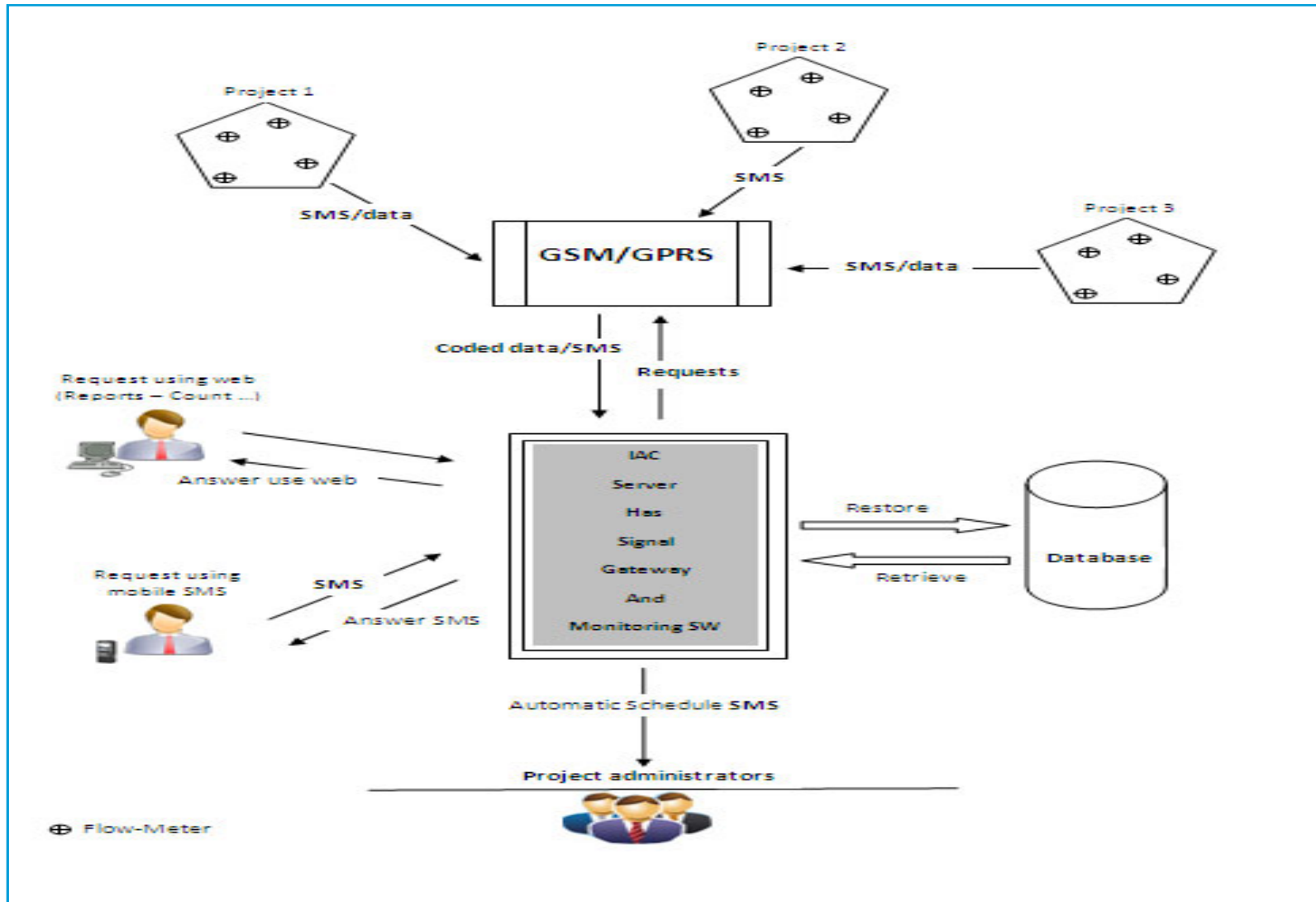
Losses Calculation

Automatically for the DMA
stored in the system



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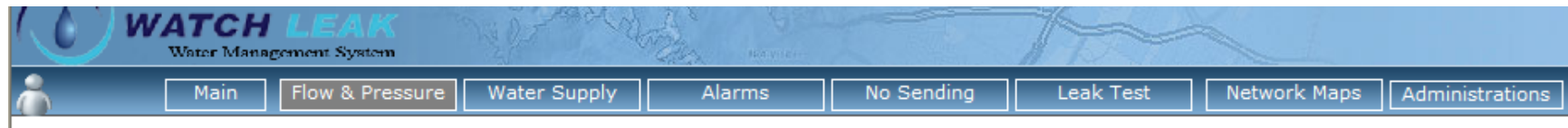
Network Monitoring





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Network Monitoring



1. The program works as web technology, whether internal network or through the internet at the same time.
2. Details of the work of great powers to the users .
3. Data to accommodate an infinite number of years and readings stored and retrieved at any time
4. Export all reports directed by the program to the office programs like Word, Excel and thus can make adjustments before printing



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Network Monitoring

Watch Leak Operations

1 Network Map

Delivers advanced functionality for GIS

8 Remote Reading Status

Send reports for any defect (Data Logger)

2 Flow & Pressure

Continuous Monitoring for
water distribution systems
(Data & Graph)

3 Water Supply

DMZ & DMA (Data & Graph)

4 Losses Calculation

Automatically for the DMA
stored in the system

5 Leak Test

Actual Leak Test for DMA
including Step Test

7 Alarm

Warnings issued by the meter

6 Continuous Losses Monitoring

Automatically for the DMA daily,
Monthly, yearly





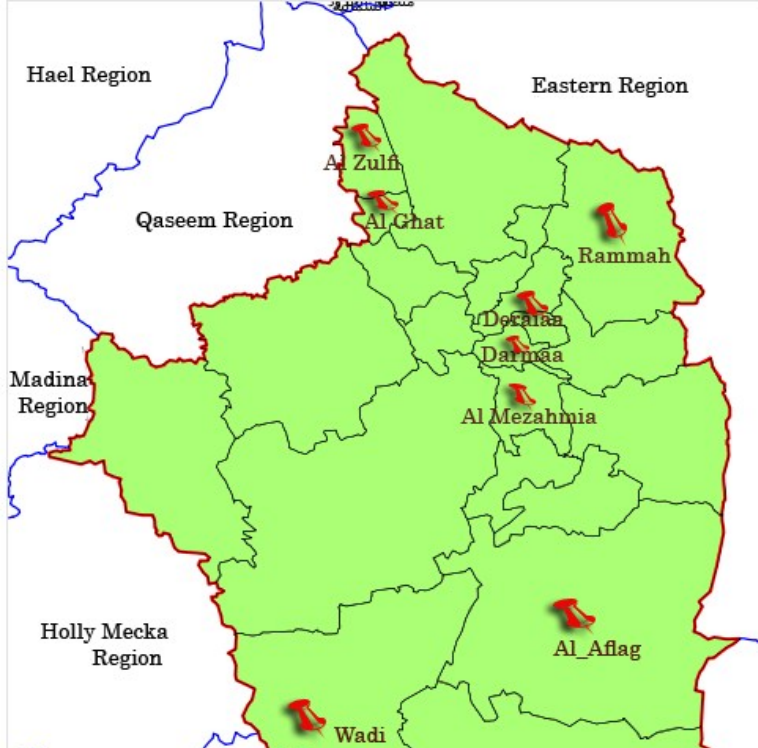
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Network Monitoring

Easy Access

DMZ & DMA Logging





AI MEZAHMIA

Select the desired :

Network Point

Network Zone

☒ DMZ ☐ DMA

DMA Zone: DMA1

Flow-Meter: MZAHMIA ANDALOS SH FM1

Submit >>

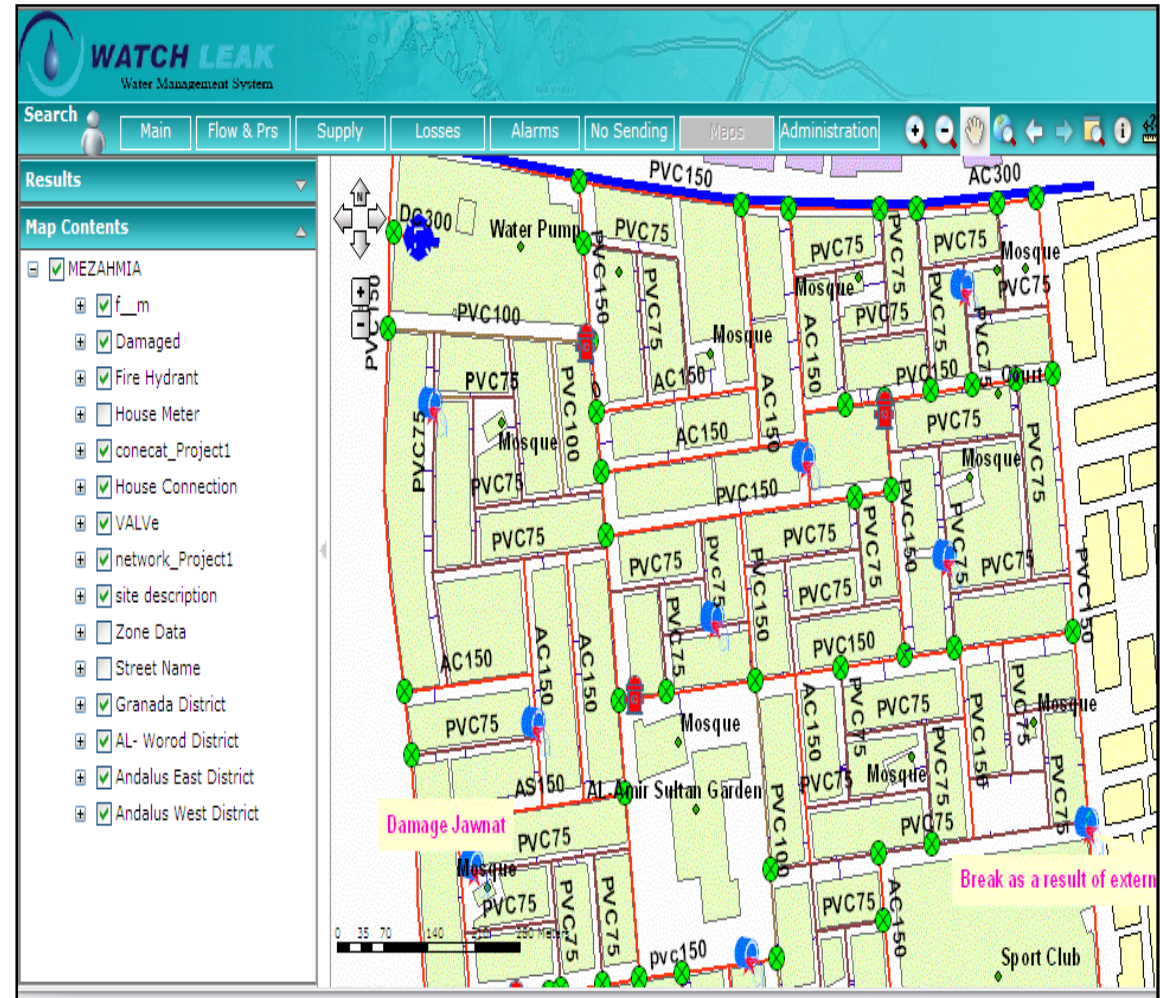


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Network Monitoring

Network Map

- ❑ Geographic information System (GIS) on the points and lengths of pipes and their actual locations and all components of the network up to date.
- ❑ Compatible with (ARC GIS) and provided the full control of all the information about the network in the form of maps up to date.
- ❑ Adding of variables on the grid in the area map designated as an example of knowledge of breaks and the dates of repair & reform of existing company, etc. through a constantly updated map of the area.
- ❑ Networks Maintenance Schedule

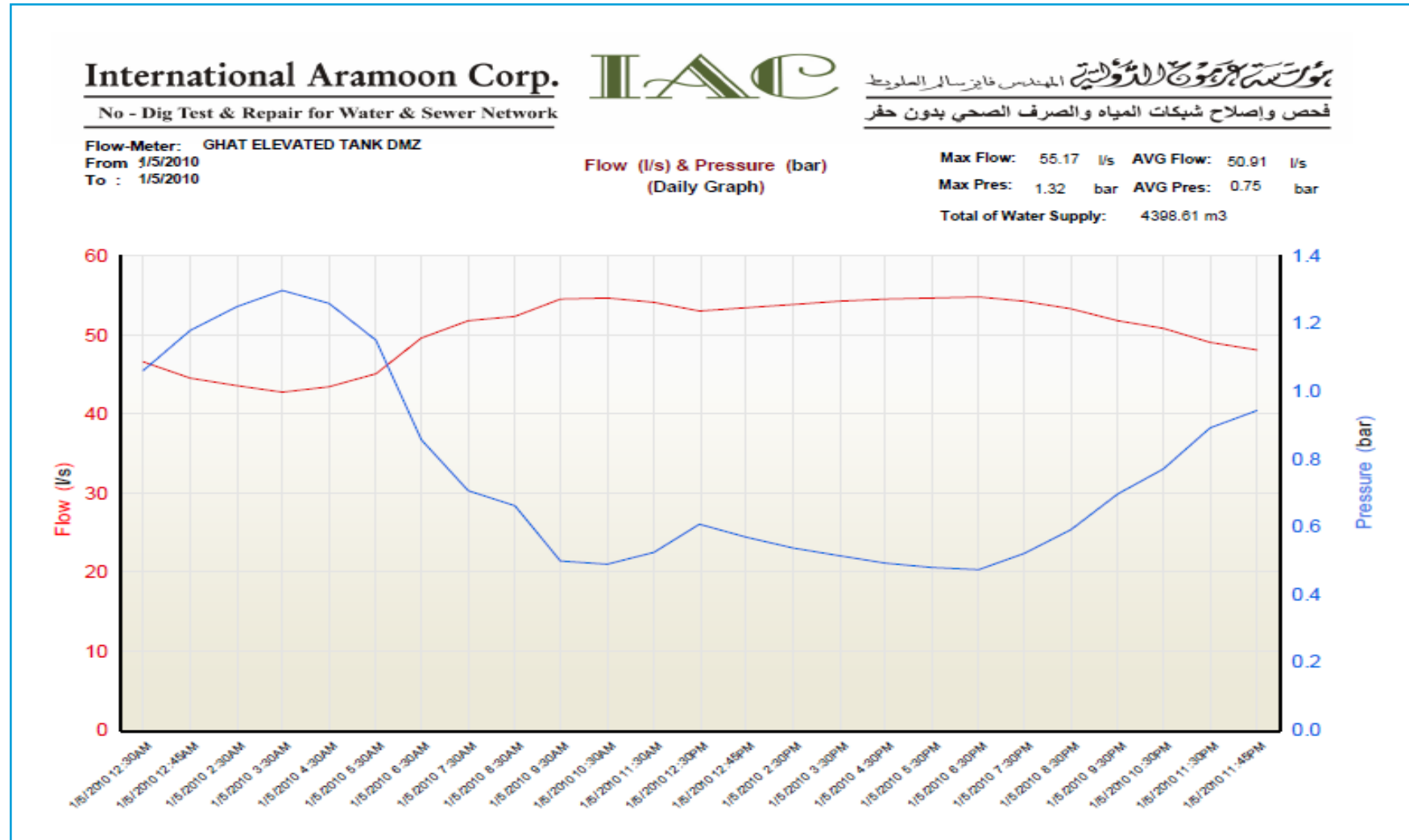


GIS File



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Flow & Pressure

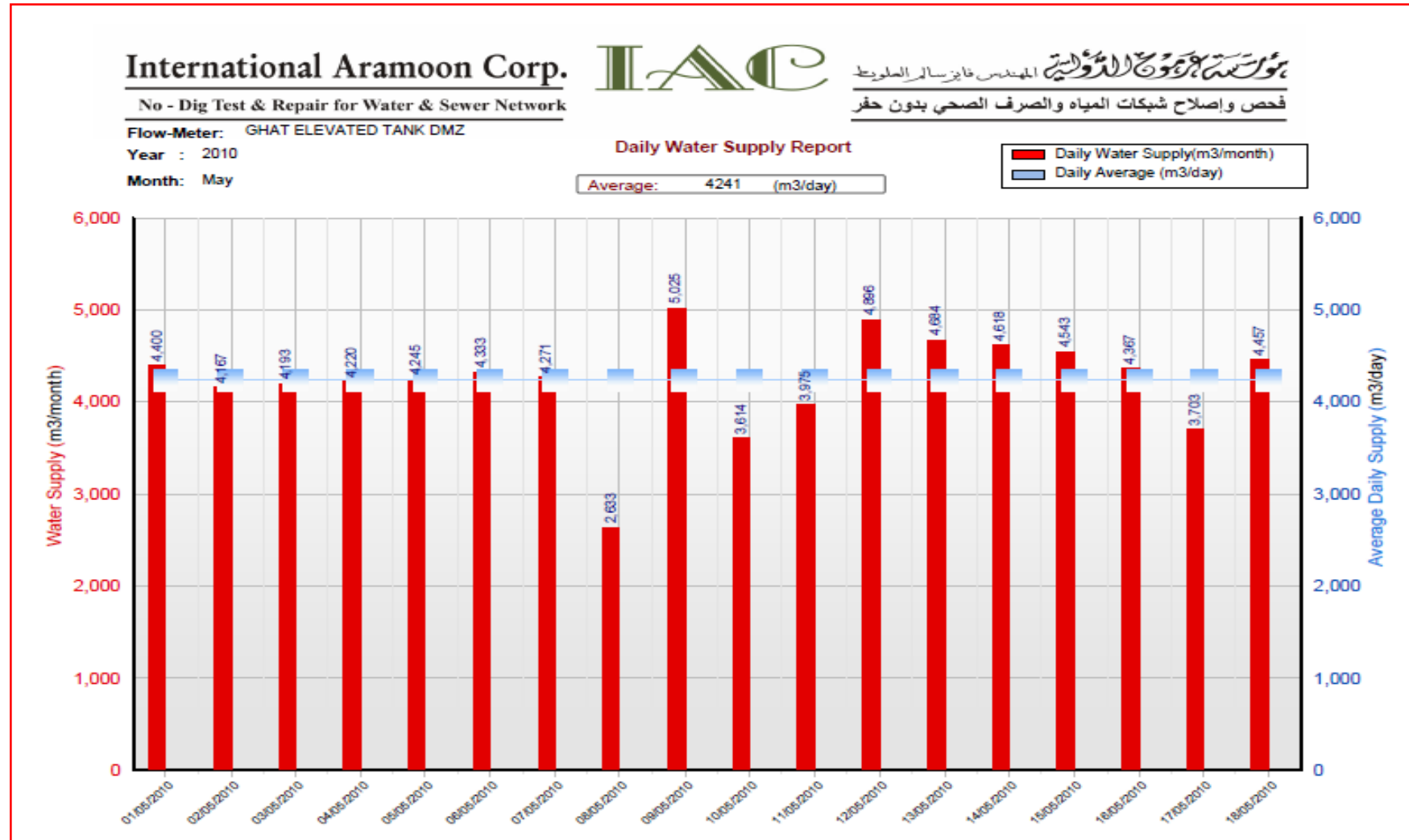


Daily / Monthly / Period



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Water Supply



Daily / Monthly / Average



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Cont/. Water Supply
DMZ & DMA Water Balance

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No - Dig Test & Repair for Water & Sewer Network



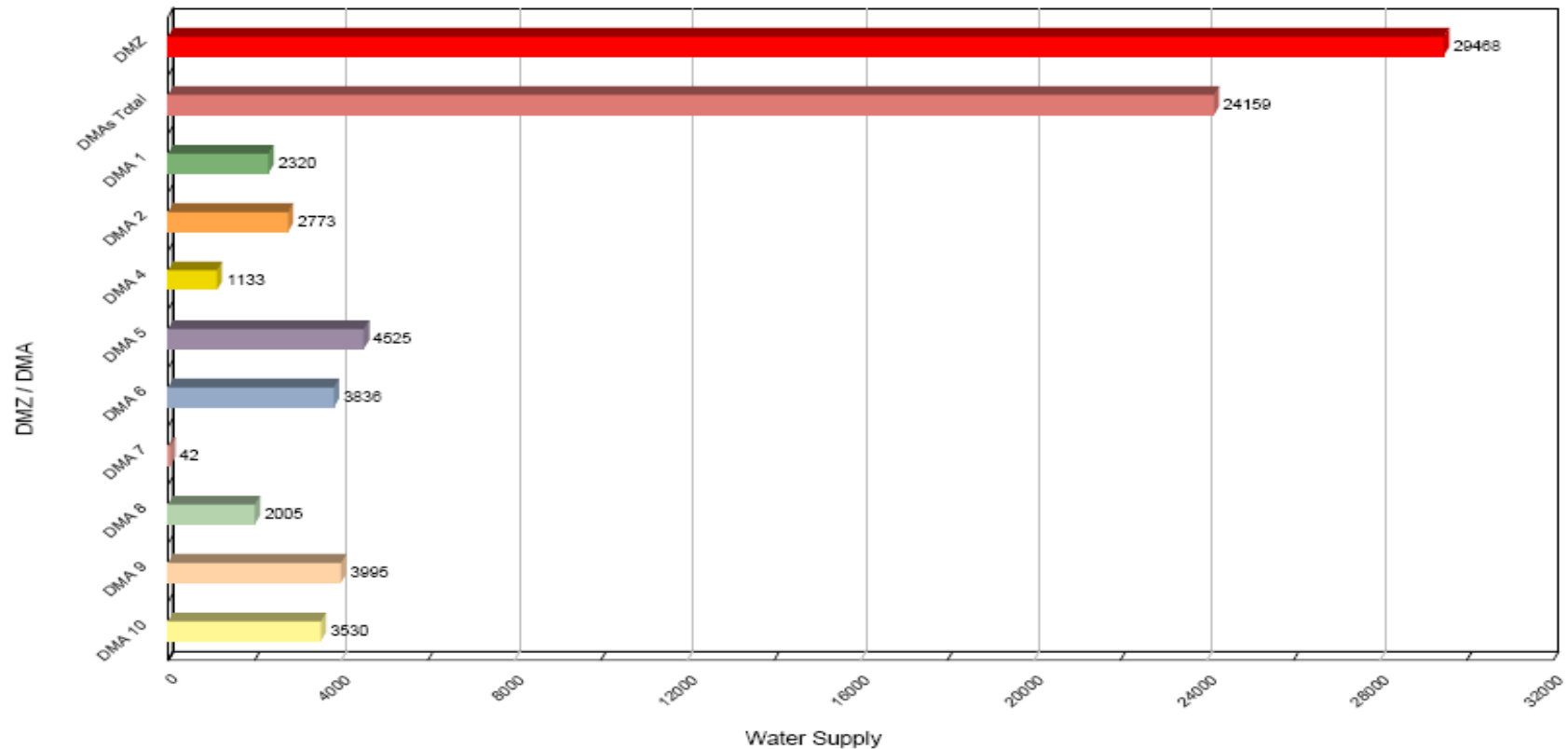
مؤسسة ارامون الدولية
المهندس فايز سالم الملوذ

فحص وإصلاح شبكات المياه والصرف الصحي بدون حفر

Province: ALMZHAMIA

From: 1/11/2010 To : 7/11/2010

DMZ/DMA Water Balance



Print Date: 5/12/2010



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Alarms

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No - Dig Test & Repair for Water & Sewer Network



بوصلة شركة المهندسين مازين سالم الملوحة

فحص وإصلاح شبكات المياه والصرف الصحي بدون حفر

Flow-Meter: MZAHMIA TWEK FMS

From : 1/11/2010

To : 30/11/2010

Flow-Meter Alarms

Time	Alarm Code	Alarm Description
2/11/2010 4:06:05 AM	264598	ALM- Call ABB, ALM- Sensor Bonding, INSTALLATION- Empty Pipe, INSTALLATION- :
2/11/2010 4:06:10 AM	264598	ALM- Call ABB, ALM- Sensor Bonding, INSTALLATION- Empty Pipe, INSTALLATION- :
3/11/2010 4:06:04 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
3/11/2010 4:06:10 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
4/11/2010 4:06:08 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
4/11/2010 4:06:16 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
5/11/2010 4:06:06 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
5/11/2010 4:06:13 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
6/11/2010 4:06:05 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
6/11/2010 4:06:09 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
7/11/2010 4:06:05 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
7/11/2010 4:06:08 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
8/11/2010 4:06:03 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
8/11/2010 4:06:10 AM	33174	ALM- Call ABB, INSTALLATION- Empty Pipe
9/11/2010 4:06:04 AM	264598	ALM- Call ABB, ALM- Sensor Bonding, INSTALLATION- Empty Pipe, INSTALLATION- :
9/11/2010 4:06:12 AM	264598	ALM- Call ABB, ALM- Sensor Bonding, INSTALLATION- Empty Pipe, INSTALLATION- :
11/11/2010 4:06:01 AM	33170	INSTALLATION- Empty Pipe
11/11/2010 4:06:04 AM	33170	INSTALLATION- Empty Pipe



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Flow-Meter Sending Status

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IAC

مؤسسة ارامون الدولية
المهندس فايز سالم الملويت

No - Dig Test & Repair for Water & Sewer Network

فحص واصلاح شبكات المياه والصرف الصحي بدون حفر

Flow-Meter MZAHMIA DMZ

Sim: +966563855803

From: 1/12/2010

To: 31/12/2010

Flow-Meter Sending Status

S	Day	Flow	Pressure	Total
1	01/12/2010	OK	OK	OK
2	02/12/2010	OK	OK	-
3	03/12/2010	OK	OK	OK
4	04/12/2010	OK	OK	OK
5	05/12/2010	OK	OK	OK
6	06/12/2010	OK	OK	OK
7	07/12/2010	OK	OK	OK
8	08/12/2010	OK	OK	OK
9	09/12/2010	OK	OK	OK
10	10/12/2010	OK	OK	OK
11	11/12/2010	OK	OK	OK
12	12/12/2010	OK	OK	OK
13	13/12/2010	OK	OK	OK
14	14/12/2010	-	-	-
15	15/12/2010	-	-	-
16	16/12/2010	-	-	-
17	17/12/2010	-	-	-
18	18/12/2010	-	-	-
19	19/12/2010	-	-	-
20	20/12/2010	-	-	-
21	21/12/2010	-	-	-
22	22/12/2010	-	-	-
23	23/12/2010	-	-	-
24	24/12/2010	-	-	-
25	25/12/2010	-	-	-
26	26/12/2010	-	-	-
27	27/12/2010	-	-	-
28	28/12/2010	-	-	-
29	29/12/2010	-	-	-
30	30/12/2010	-	-	-
31	31/12/2010	-	-	-

Page 1 of 1

Print Date: 13/12/2010



Losses Calculation

New Study

Earlier Studies



Water Loss Report

From

To

November							December 2010							January						
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	29	30	1	2	3	4	28	29	30	1	2	3	4	28	29	30	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11	5	6	7	8	9	10	11
12	13	14	15	16	17	18	12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	31	1	26	27	28	29	30	31	1	26	27	28	29	30	31	1
2	3	4	5	6	7	8	2	3	4	5	6	7	8	2	3	4	5	6	7	8

November							December 2010							January						
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	29	30	1	2	3	4	28	29	30	1	2	3	4	28	29	30	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11	5	6	7	8	9	10	11
12	13	14	15	16	17	18	12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	31	1	26	27	28	29	30	31	1	26	27	28	29	30	31	1
2	3	4	5	6	7	8	2	3	4	5	6	7	8	2	3	4	5	6	7	8

< Analysis >

Total Water Supply: 2750 m3

Manual

Customers consumption

2120 m3

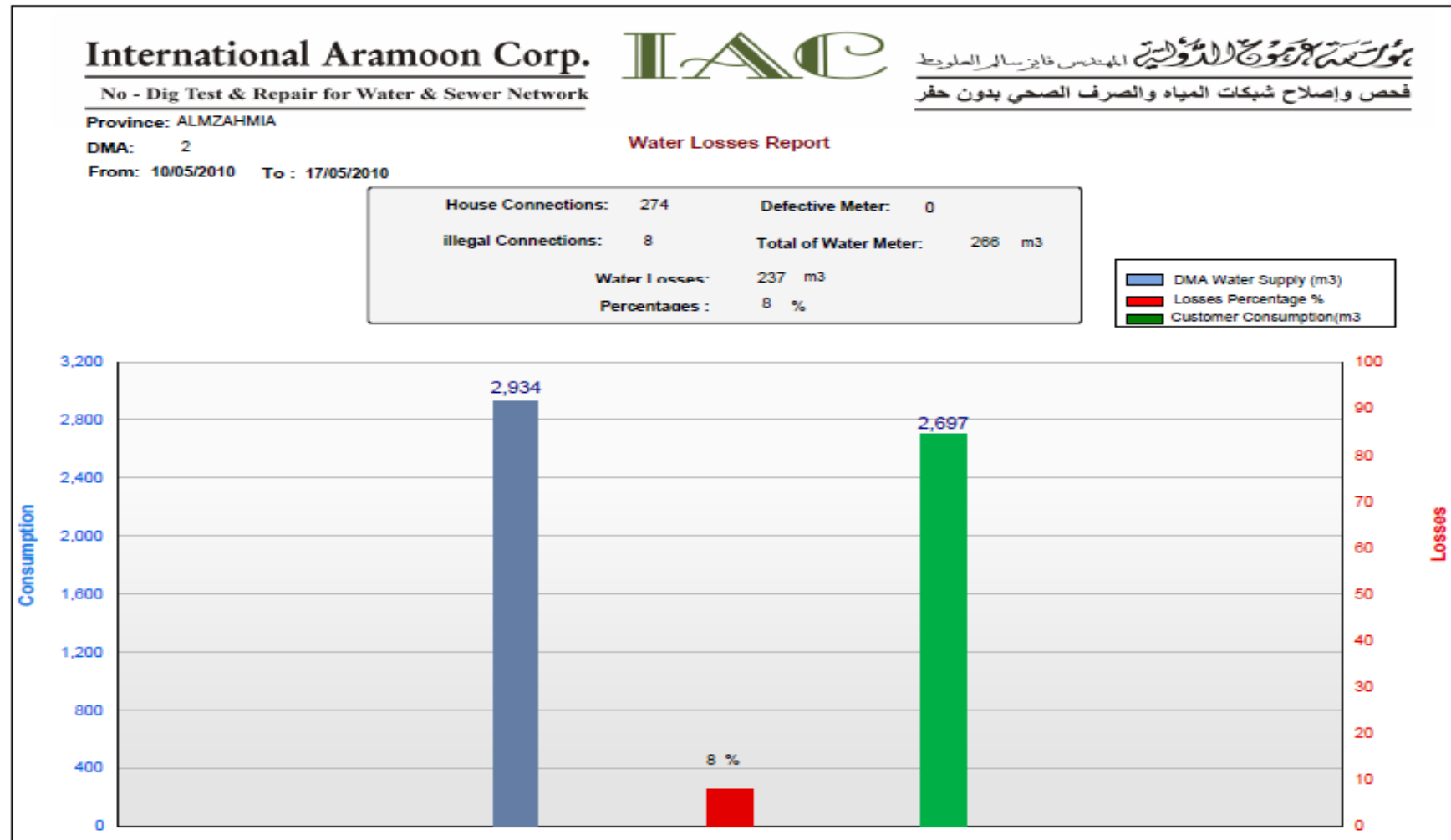
Automatic

Get Report



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Cont/. Losses Calculation



Print Date: 13/11/2010



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Cont/. Losses Calculation



WATCH LEAK
Water Management System

[Main](#) [Zone's Info](#) [Flow & Pressure](#) [Water Supply](#) [Water Balance](#) [Losses Study](#) [Network Maps](#) [Administrations](#)

[New Study](#) [Earlier Studies](#)



WATER LOSS CONTROL

[Earlier Water Losses Studies](#)

Area: Central Region **City:** Riyadh
Province: ALMZAHMIA **DMA:** DMA2

Earlier Periods:

	From	To	Supply (m3)	Consumption (m3)	Loss Value (m3)	Loss (m3/day)	Percentage (%)
>>	26/04/2010	03/05/2010	2722	1674	1048	149.71	39 %
>>	03/05/2010	10/05/2010	2850	2007	843	120.43	30 %
>>	10/05/2010	17/05/2010	2934	2697	237	33.86	8 %
>>	17/05/2010	24/05/2010	2884	2820	64	9.14	2 %

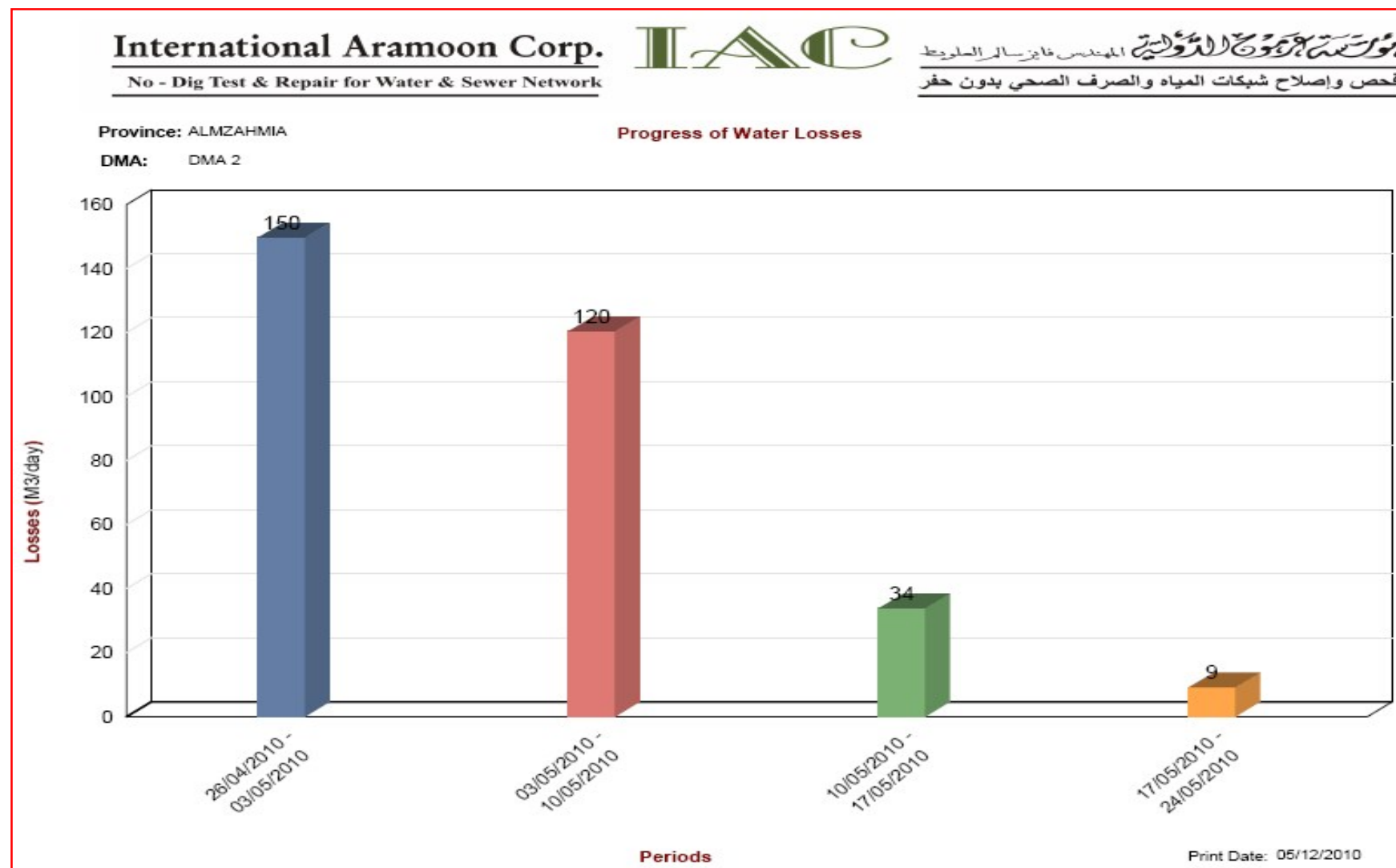
Losses Progress Chart

Losses Progress Values



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Losses Calculation/Cont.





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THANK YOU

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