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STRENGTHEN THE WATER UTILITIES CAPACITIES TO MANAGE/REDUCE NRW AND DETECT LEAKAGE

Water Supply System (WSS) GIS Database Design Report

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v.2	*WES N-W-EG1 WSS GIS DB*	*Paolo RUFINI*	*Suzan TAHA*

WATER AND ENVIRONMENT SUPPORT IN THE ENI SOUTHERN NEIGHBOURHOOD REGION

The "Water and Environment Support (WES) in the ENI Neighbourhood South Region" project is a regional technical support project funded by the European Neighbourhood Instrument (ENI South). WES aims to protect the natural resources in the Mediterranean context and to improve the management of scarce water resources in the region. WES mainly aims to solve the problems linked to the pollution prevention and the rational use of water.

WES builds on previous similar regional projects funded by the European Union (Horizon 2020 CB/MEP, SWIM SM, SWIM-H2020 SM) and strives to create a supportive environment and increase capacity all stakeholders in the partner countries (PCs).

The WES Project Countries are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Libya, Palestine, Syria and Tunisia. However, in order to ensure the coherence and effectiveness of EU funding or to promote regional cooperation, the eligibility of specific actions can be extended to neighbouring countries in the Southern Neighbourhood region.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AOD	Above Ordnance Datum, used to specify heights above mean sea level
AOI	Area of Interest
AWWC	Asyut Water and Wastewater Company
CARL	Current Annual Real Losses
DB	Database
DMA	District Metering Area
DMZ	District Metering Zone
DN	Diamètre Nominal (Nominal Diameter)
EPSG	European Petroleum Survey Group. It is a public registry of geodetic datum, spatial reference systems, Earth ellipsoids, coordinate transformations and related units of measurements.
ESRI	Environmental Systems Research Institute
GIS	Geographic Information System
HCWW	Holding Company for Water and Wastewater
HP	Horsepower
ILI	Infrastructure Leakage Index
IWA	International Water Association
kVA	kilovolt-Ampere
Kw	Kilowatt
lps	litre per second
m	metre
m^3/day	cubic metre per day
m^3/hour	cubic metre per hour
m^3/year	cubic metre per year
MLD	Million Litres per day
mm	millimetre
NOS	Normal Operating Status
NRW	Non-revenue Water
POI	Point of Interest
PRV	Pressure Reducing Valve
PS	Pump Station
SMS	Short Message Service
TP	Treatment Plant

UARL	Unavoidable Annual Real Losses
WDS	Water Distribution System
WGS	World Geodetic System
WKID	Well-Known ID
WSS	Water Supply System
WTP	Water Treatment Plant
WTS	Water Transmission System

1 EXECUTIVE SUMMARY

This report comprises the second deliverable within the framework of the second task of WES activity in Egypt (WES-N-W-EG-1) titled "Strengthen the water utilities capacities to manage/reduce NRW and detect leakage". **Task 2 Verification of GIS Maps and Customers database** of the said activity involves: (1) checking of: existing background maps (aerial photography, vector cartography, etc.), existing network maps (primary, distribution, service connections) and infrastructures (water intakes, water treatment plants, tanks/reservoirs, pumping stations, etc.) information and (2) verification of customers' database; in addition to the abovementioned activities, the task has also the objectives to prepare the GIS DB Conceptual and Logical Data Model and to perform quality control of the Customers' DB and Network data after completion of their upload by AWWC staff into the new GIS DB.

Therefore, the task aims at:

- performing a diagnosis of existing network and infrastructures data ab customers DB
- prepare a GIS DB Conceptual and Logical data model
- implement the structure of the developed GIS database water supply network and facilities
- validate the data once they have been uploaded in the GIS DB.

In order to achieve the objective of this task, a mission was undertaken by the local GIS expert during the period of 3-7 January 2021. It aimed at checking the existing background maps, the network maps and infrastructures information and verification of customers' database. An output of this mission was:

1. The verification of the full availability of a workspace for the WES team equipped with what is necessary to carry out the activities
2. WSS maps (both digital and paper) and DB and Customer DB were verified by the WES GIS expert who also collected the tables representing the existing GIS database in use at AWWC.

AWWC already uses GIS and Hydraulic modelling tools. At the moment, the GIS staff (4 persons; two field workers for assets' documentation and two digitising the network) has one license of ArcGIS 9.3.

The AWWC Reduction of Water Losses and Hydraulic Analysis department uses WaterCAD as hydraulic modelling tool. AWWC has already developed a schematic of the overall network, importing data from the GIS.

The "Maps Verification" task ends with the preparation of the GIS Database Design and Customers' DB Report. The WSS GIS DB Design Report includes the proposed Conceptual data model and the Logical data model, and it aims at being a supporting tool in the integration of the AWWC existing GIS DB structure with the improvements necessary to make the GIS DB an effective tool in the NRW reduction activity; it also includes the definition of the set of attributes of each GIS database entity that have been proposed with the Conceptual data model and the Logical data model and approved by AWWC in the earlier stage of this activity. The WSS GIS DB Design Report also aims to integrate the existing set of GIS database attributes, already in use at AWWC - with the set of attributes proposed by the WES team - thus combining - in a single list - the definition and description of the entities that form the GIS DB and their attributes.

2 PREAMBLE

AWWC uses a GIS database provided by HCWW and shared with other water utilities in the holding company. Therefore, HCWW decided not to replace the database in use by AWWC with the one proposed by WES but to run the WES database in parallel with the HCWW's database. Once the WES DB is fed with information of the Asyut's water supply system HCWW will be able to evaluate both the alternatives and make the necessary decisions.

As a consequence of this decision, the design of the GIS database will include, besides the traditional steps, also the comparative analysis of the structure of the two databases - HWCC and WES - in order to find both the entities in common between the two databases and those present in one database but not in the other; in addition, it will also be indicated how to keep the tables of the two databases linked.

In the end, this report will provide:

1) an alternative option to organize the Water Supply System database to keep into consideration the needs of hydraulic analysis, NRW reduction activities and O&M requirements
2) an indication of how to keep the tables of the two databases connected.

It is the responsibility of the WES team to provide a prioritised list of attributes that must be uploaded first so as not to halt the project progress.

It is the responsibility of the AWWC GIS staff to both implement the WES database structure and upload the necessary information to start the operation of the WES GIS DB.

It is the responsibility of the WES team to provide support, quality check and supervision to the upload activities carried out by the AWWC GIS staff.

3 INTRODUCTION

GIS database design consists of the following steps:

- Analysis of the sources of information from which to take the data to upload the GIS database.
- Preparation of the Conceptual Data Model of the water supply system: this stage involves the identification of the crucial high-level key business and system entities and their relationships that define the scope of the problem to be addressed by the system.
- Preparation of the Logical Data Model of the water supply system: that is the preparation of a data model of the Water System expressed in terms of data structures such as relational tables and columns and object-oriented classes.
- Definition of the set of attributes of each GIS database entity.

In addition to these activities, in this specific case, the activity of comparative analysis of the HCWW database with the WES database was added.

This report is organized in the following chapters:

1. Analysis of the HCWW databases
2. Conceptual Data Model
3. Logical data Model
4. HCWW / WES databases Comparative Analysis
5. Definition of the set of attributes of each entity in the WES GIS database

4 HCWW DATABASES ANALYSIS

AWWC provided information on the organization of the GIS in use in the company; in particular on:

- Adopted list of entities of the WSS GIS
- Adopted list of entities not belonging to the WSS GIS

  Both types of entities have been grouped in three different classes, as usually done in this case:

  - Point
  - Line
  - Polygon
- List of attributes of the existing Customer DB
- Adopted cartographic projection

The list of entities already present in the existing DB is – of course – the core of the WSS GIS DB structure to be presented. For this reason, a comparison table between existing and proposed entitles is presented.

4.1 HCWW WSS GIS DB

The water supply network of Asyut, including infrastructures such as Water Treatment Plants, water intakes, pumps and tanks, has already been uploaded into a GIS by the AWWC staff, the next **FIGURE *1*** shows the overall WSS network of Asyut city.

FIGURE 1: AWWC WATER SUPPLY SYSTEM MAP

The entities of the existing database are the core of the new database to be proposed and will be included together with their attributes in the database to be adopted. An integration of the existing attributes and revision of the existing entities has been proposed to make possible the analysis of NRW characters using GIS tools.

The tables of attributes of all objects – both WSS DB and Non-WSS DB – of the HCWW DB are presented in Annex 1.

4.1.1 ENTITY TYPE: POINT

1. Compact_TP
2. Desalination_TP
3. Pump Station
4. Well_station
5. WTP
6. Wells
7. Filter
8. Clarifier
9. Intake
10. Pump
11. Tank
12. Meter
13. Fitting[1]
14. Hydrant
15. Valve_Chamber
16. W_Valve
17. C_hydrant
18. C_Meter

The entity W_valve represents the following WSS objects:

TABLE 1: WSS OBJECTS REPRESENTED BY THE ENTITY W_VALVE

No.	Code	Description
1	AIR	Air Valve
2	GT	Gate Valve
3	DR	Drain Valve
4	BF	Butterfly Valve
5	NRV	Non-Return Valve
6	HYD	Hydrant Valve
7	PRV	Pressure Reducing Valve
8	PB	Pressure Breaker Valve
9	FCV	Flow Control Valve

10	PL	Plug Valve
11	AHC	Auto Close Hydraulic Valve

4.1.2 ENTITY TYPE: LINE

1. Pipe
2. C_Pipe (Customer Line)

4.1.3 ENTITY TYPE: POLYGON

1. Station_Component

4.2 HCWW CUSTOMER DATABASE

Next table shows the **structure of the HCWW Customer database** presently in use in Asyut. This is the table that should be linked to the WES WSS GIS DB.

TABLE 2: HCWW CUSTOMER DATABASE TABLE

Description	AutoNumber	Width
Number of units	Number	Integer
Flat	Number	Integer
Meter diameter	Number	Double
Meter Status	Text	50
Current Reading	Number	Double
Usage	Text	50
Type of payment	Text	50
Connection Status	Text	50
Unit activity	Text	100
Activity description	Text	255

4.3 HCWW NON-WSS GIS DB

The next chapters show the list of non-WSS entities. They do not normally affect the structure of the WSS database and therefore they do not form part of the present analysis unless, for some reason, it is important that they get included because they are in some way related to some of the WSS entities (i.e.: administration organization of the territory or warehouse to which the network components may refer).

4.3.1 POINT

Bridge (point)[1]
Spot Elevation (point)[2]
POI (point)[2]

4.3.2 LINE

Drain (line)[2]
Canal (line)[2]
Railway (line)[2]
Street (line)[2]

4.3.3 POLYGON

Building (polygon)[2]
Company Site (polygon)[2]
District (polygon)[2]
Fence (polygon)[2]
Governorate (polygon)[2]
Green Area (polygon)[2]
Land Use (polygon)[2]
Landmark (polygon)[2]
Maintenance Branch (polygon)[2]
Section (polygon)[2]
Urban Area (polygon)[2]
Water Body (polygon)[2]
Local Administration (polygon)[2]

[1] to be clarified whether a relation with any WSS entity exists

4.4 MAP PROJECTION OF THE GIS DB ENTITIES

TABLE 3: HCWW MAP PROJECTION DATA

Projected Coordinate System	WGS_1984_UTM_Zone_36N
WKID:	EPSG: 32636
Projection:	Transverse Mercator
False_Easting:	500000.0
False_Northing:	0.0
Central_Meridian:	33.0
Scale_Factor:	0.9996
Latitude_Of_Origin:	0.0
Linear Unit	Meter (1.0)

5 THE CONCEPTUAL DATA MODEL

The primary objective of the Conceptual data modelling is to identify the data content and describe data in an abstract, or conceptual, level.

Typical characteristics of a conceptual data model are:

- It covers enterprise-wide concepts.
- It contains relationships between entities.
- All the entities have definitions.
- It is designed and developed to be independent of DBMS, data storage locations or technologies. In fact, it would address digital and non-digital concepts. This means it would model paper records and artefacts as well as database artefacts.

In this view, the Water Utility water network system will be conceptualised, i.e.: water network entities, domains, relationships and attributes will be identified, then a Geodatabase structure will be developed.

To design the conceptual model and the related database the following rules/criteria have been used:

- The Water Utility AWWC is the only water provider of the water system both for water production, water transportation and water distribution. It is also a member of HCWW along with other companies that are not part of the analysis at this time.
- Water sources are surface water (river) and groundwater (tube wells) exclusively.
- The water supply networks are deemed divided in Water Transmission System (WTS) and Water Distribution System (WDS) that, in turn, includes District Metering Zones (DMZ).
- A water transmission system always starts with a water intake – or, alternatively, with a WTP - and ends with an end cap.
- The transmission pipeline is always connected - at the ends - to one of the following entities: water intake, tube-well, water treatment plant, pump station, service reservoir, node, flowmeter, wash-out, air valve.
- Any water system will be modelled by means of lines, nodes, elements and containers.

The GIS software must have the following characteristics:

1. Capacity to link the tables of the entities in the WES DB with the tables of the corresponding entities in the HCWW DB
2. Capacity to import existing background maps
3. Capacity to import existing current information on water supply systems stored in different formats (i.e.: AutoCAD and ESRI files, or other GIS formats)
4. Capacity to locate the assets according to a geographic coordinate system (georeferencing)
5. Capacity to edit spatial data in vector and raster formats

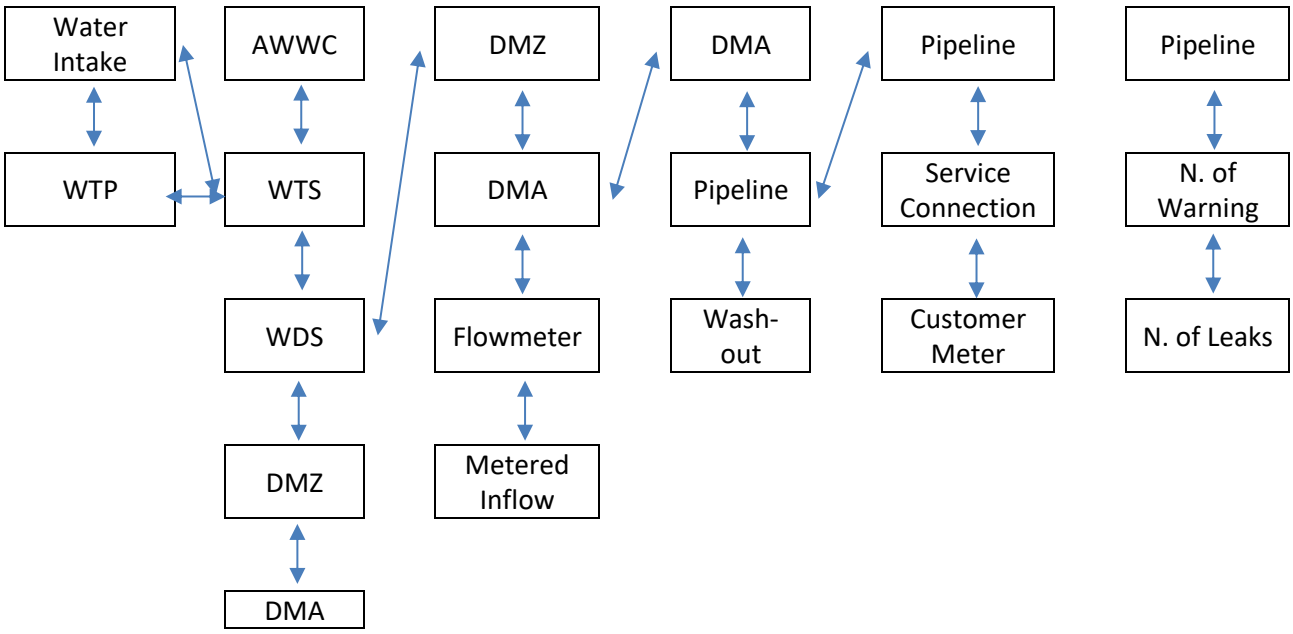
6. Capacity to handle attribute data of water assets
7. Capacity to include **data necessary for the application of Water Audit Methods following the IWA standards and procedures**.
8. Capacity to provide data for the **preparation of Water Balance** for selected controlled areas of the water system, following IWA standards and procedures.
9. Capacity to **provide data and necessary information to proceed with the calculation of NRW Performance Indicators, as per IWA standards and procedures**.
10. Capacity to **support the NRW analysis**; in this regard, the following functions should be considered in the GIS:
    a. It should be possible the import/export hydraulic of modelling results from WATERCAD
    b. It should be possible to add interventions to the network (in particular, sites connected to locations where leakages or any kind of work have been identified)
    c. It should be possible to add Water Balance tables (as per IWA standard) to the controlled areas to help prioritizing interventions
    d. It should be possible to use information stored in the GIS DB to calculate the IWA performance indicators
    e. It should be possible to link any object of the WSS to the Control Areas.

The following categories should be included in the database keeping into consideration the above-mentioned characteristics:

- Control Areas
- Water infrastructures
- IWA Water Balance (Water audits)
- IWA Performance Indicators

On top of that, once the database is implemented, well defined profiles of queries must be defined. Next **Error! Reference source not found.**table shows an example of possible profiles of queries.

FIGURE 2: EXAMPLES OF QUERY PROFILES



Each relationship is bidirectional, i.e.: selecting a customer identifies the service connection, the pipe, the DMA and the DMZ (bottom-up query); at the same time, selecting a DMZ identifies all DMAs, all pipes, all service connections and all connected customers (top-down query).

5.1 THE CONTROL AREA

The components of a Water Supply System can normally be grouped at different level, which we call “control areas". From a hydraulic point of view, it is important to stress that any portion of the WSS - even if we call it a “control area” –always refers to branches of the water supply system, not to parts of the territory (administrative regions, urban areas etc.).

In terms of water network, these groups are considered:

AWWC network: it is the overall AWWC water system, from the water intakes to the final customer meters; it is made of several Water Transmission System.

Water Transmission System (WTS): is a water system starting from a water intake or any water delivery point and ending at the initial point of a water distribution system. A WTS is made of intakes, WTP, Pumping Stations, tanks, pipes and standard components of the water network (e.g.: valves, wash-out, etc.).

Water Distribution System (WDS): is the water network supplying the final customers; it normally begins with a header tank and ends with a customer meter, a hydrant or an end cap.

DMZ, District Metering Zone: is a controlled portion of the Water Distribution System. It always starts with a flowmeter and ends with closed valves or end caps.

DMA, District Metering Area: is a controlled portion of a DMZ. it always starts with a flowmeter and ends with closed valves or end caps.

Therefore, the organizational hierarchy of the water networks is:

1. all Water Transmission Systems (WTS) belong to AWWC
2. One WTS consists of many Water Distribution Systems (WDS)
3. One WDS consists of many DMZs
4. One DMZ consists of many DMAs.

5.2 THE WATER INFRASTRUCTURES

The water supply system is considered as a single entity; the standard classification is adopted:

- Water Transmission System (made of facilities, pipelines and nodes)
- Water Distribution System (made of facilities, pipelines, nodes, service connections and other components)

Facilities of the water transmission system are:

- water source (river water intake, well-field, water treatment plant)
- tank
- pump station
- chamber.

The pipelines of the system can be:

- raw water transmission pipeline (from any water intake to the WTP)
- treated water transmission pipeline (from the WTP to the header tank of a WDS)
- treated water distribution pipeline

Nodes of the system are:

- Junction (it represents a: cross, a T, a coupling, an endcap)
- Valve (it represents any type of valve i.e.: a gate valve, a PRV etc.)
- Pump
- Air valve
- Wash-out
- Flowmeter
- Monitoring point (a pressure monitoring point, a water quality monitoring point, etc.)

In addition to the previous facilities the following components of the water network are considered:

- Service connection
- Hydrant: always connected to a service connection
- Fire-hydrant: always connected to a service connection
- Customer Meter: always connected to a service connection.

Together with pipes, facilities and components the following entities have been also included in the analysis:

- Warning
- Intervention.

5.2.1 THE WATER TRANSMISSION SYSTEM

The following table shows the entities of the Water Transmission System that have a geographic representation.

TABLE 4: WATER TRANSMISSION GEOGRAPHIC ENTITIES

Name	Description
Water Intake	initial node of a Water System from where water is transferred from a natural recipient (water body) to a Water Treatment Plant and then – by means of a WTS - to the distribution network; the natural recipient is a surface water body (river).
Well-field / well	initial node of a Water System from where water is transferred from a natural recipient to a Water Treatment Plant and then – by means of a WTS - to the distribution network; the natural recipient is an aquifer.
Water Treatment Plant	Water Treatment point of a water system
Pump Station / Pump	facility providing energy to transfer water
Tank	Storage facility of a water system
Chamber, Surface box	Access point to the network for various purposes: inspection, valve operation etc.
Pipeline	linear element joining two entities of a Water System
Endcap	Endpoint of the network: normally flanged or welded depending on the pipe material
Valve	Water network component aimed to regulate the flow, reduce pressure, and prevent backflow.
Flowmeter	Flowmeters allow monitoring of the volume of water distributed in the various control areas for analysis of consumption and cross checks of potential discrepancies (e.g. leakages, illegal spillages, NRW).
Junction	Water network component that connects two or more pipes.
Washout	Water network component aimed to blow off or drain water from parts of the system.
Air valve	Water network component aimed to provide air and vacuum relief.

Name	Description
Surge Control Device	Surge control equipment in a hydraulic system whose scope is preventing any excessive gain in pressure (also known as a pressure surge) that would cause the hydraulic pressure to exceed the maximum working pressure of the mechanical equipment used in the system.
Monitoring Point	Accessible point of the network where data samples of physical/chemical parameters are collected

5.2.2 THE WATER DISTRIBUTION SYSTEM

The water distribution network is the system in charge to supply water to the final customer. It usually begins with a header tank and ends with the customer meter or an end cap.

The following table shows the elements making up the WDS that should have a cartographic representation.

TABLE 5: WATER DISTRIBUTION GEOGRAPHIC ENTITIES

Name	Description
Water intake (well-field only)	As for the Water Transmission System components
Tank	
Chamber	
Pump Station / Pump	
Distribution Pipeline	
Junction	
Endcap	
Valve	
Flowmeter	
Washout	
Air valve	
Surge Control Device	
Monitoring Point	
Service Connection	Service connections are used to connect individual buildings or other plumbing systems to the distribution system mains
Customer meter	the Water meter is an instrument intended to measure continuously, memorise and display the volume of water used by the customer
Hydrant	A hydrant is a connection point by which drawing water from a main or a service pipe

Name	Description
Fire Hydrant	A fire-hydrant is a connection point by which fire-fighters can tap into a water supply

5.2.3 OTHER WATER SUPPLY SYSTEM ENTITIES

Next **TABLE *6*** shows geographical entities connected to the WSS (therefore having a geographical representation) but not part of the WSS.

TABLE 6: GEOGRAPHIC ENTITIES NOT PART OF THE WSS

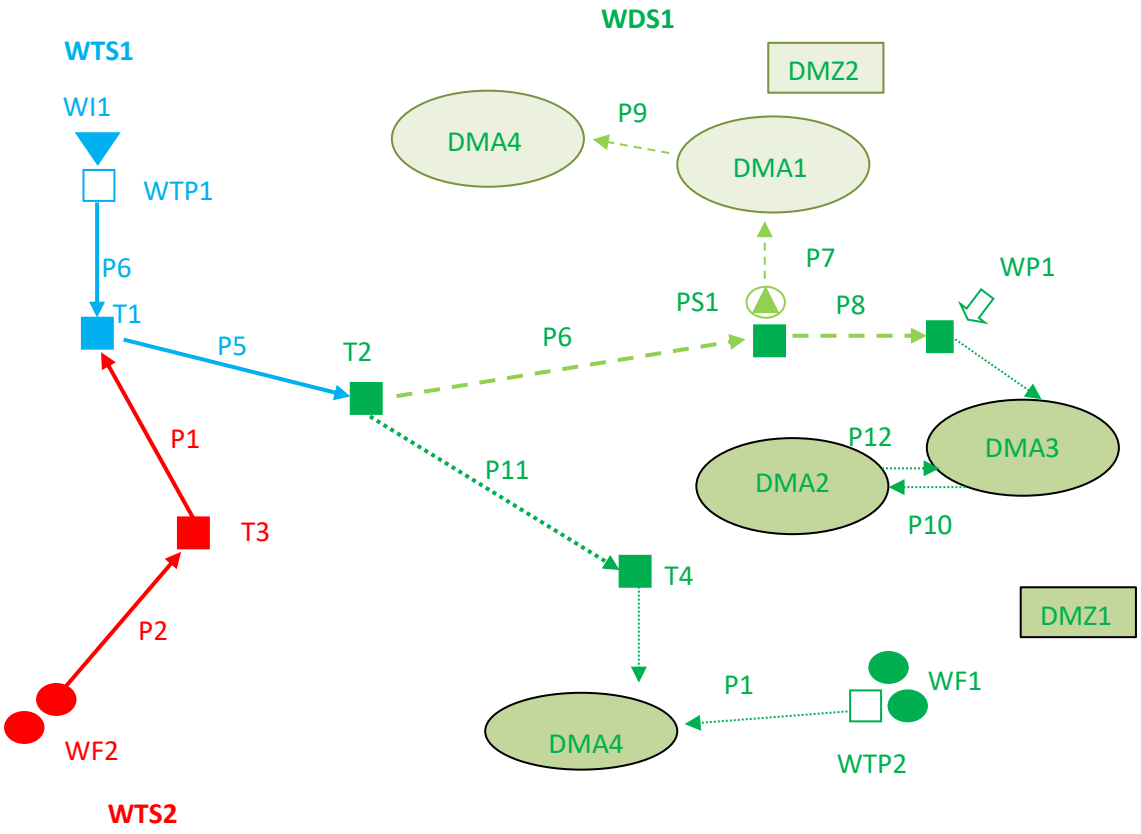
Name	Description
Warning	it represents any signalling of malfunction of the network reported to the Water utility
Intervention	it represents the type of intervention followed to the Warning

Not all the entities considered in the analysis have a cartographic representation. The following list reports those that have not a symbolic representation.

- The Customer database: the Water Utility Customer database
- The Water Balance: it is the IWA based Water Balance of a portion of the network. The portion of the network could be a: WTS, WDS, DMZ, DMA
- The Network Warning Log: it is the list of warnings for selected areas
- The Network Intervention Log: it is the list of interventions for a selected area
- The Monitoring Point Readings: it is the set of readings for a selected monitoring point

FIGURE *3* provides an example of a WSS schematization; two WTSs (red and blue) supply one WDS (WDS1, in green, whose pipe are dotted), which in turn is sectored into two DMZs (DMZ2, light green dashed pipes and DMZ1, dark green dotted pipes). WDS1 is also directly supplied by a water point (WP1) and by a wellfield (WF2). Each entity, together with its own ID also inherits the ID of the group to which it belongs, for example: WTS1_P6 is a transmission pipe belonging to WTS1. WDS1_DMZ1_DMA3_P12 is a pipe (P12) belonging to DMA3, which in turn belongs to DMZ1 that is a section of the Water Distribution System WDS1. In this way - with this way of coding entities - the database is able to answer a large number of questions.

FIGURE 3: WSS SCHEMATIC REPRESENTATION



5.3 IWA WATER BALANCE

An audit has been defined as an examination of records or financial accounts to check their accuracy. The water audit typically traces the flow of water from the site of water withdrawal or treatment, through the water distribution system, and into customer properties. The water audit usually exists in the form of a worksheet or spreadsheet that details the variety of consumption and losses that are in a community water system.

The water balance summarizes the components and provides accountability, as all of the water placed into a distribution system should – in theory – equal all of the water taken out of the distribution system.

TABLE 7: WATER BALANCE

<table>
<tr><td rowspan="8">System Input Volume (corrected for known errors)</td><td rowspan="3">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="7">Non-Revenue Water (NRW)</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to the point of Customer metering</td></tr>
</table>

TABLE 8: WATER BALANCE - COMPONENTS AND DEFINITIONS

Water Balance Component	Definition
System Input Volume	The annual volume input to the water supply system
Authorized Consumption	The annual volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are authorized to do so
Water Losses	The difference between System Input Volume and Authorized Consumption, consisting of Apparent Losses plus Real Losses
Apparent Losses	Unauthorized Consumption, all types of metering inaccuracies and systematic data handling errors

Water Balance Component	Definition
Real Losses	The annual volumes lost through all types of leaks, breaks and overflows on mains, service reservoirs and service connections, up to the point of customer metering.
Revenue Water	Those components of System Input Volume which are billed and produce revenue
Non-Revenue Water (NRW)	The difference between System Input Volume and Billed Authorized Consumption

5.4 IWA PERFORMANCE INDICATORS

The performance indicators, shown in the next Table, allow water utilities to make a meaningful assessment of their water loss standing, benchmark themselves with other water utilities and set performance targets. The water audit tells us how much of each type of loss occurs and how much it costs the water utility. The key concept around this method is that all water is quantified – via measurement or estimate – as either a form of beneficial consumption or as wasteful loss. A cost is placed on each volume component to assess its financial impact to the water utility.

TABLE 9: PERFORMANCE INDICATORS FOR NON-REVENUE WATER AND WATER LOSSES

Performance Indicator	Function	Comments
Volume of Non-revenue water as a percentage of system input volume	Financial - Non-Revenue water by volume	Can be calculated from a simple water balance; good only as a general financial indicator
Cost of Non-revenue water as a percentage of the annual cost of running the water system	Financial - Non-revenue water by cost	Allows different unit costs for Non-revenue water components
Volume of Apparent Losses per service connection per day	Operational - Apparent Losses	Basic but meaningful indicator once the volume of apparent losses has been calculated or estimated
Volume of Real Losses as a percentage of system input	Inefficiency of use of water resources	Unsuitable for assessing efficiency of management of distribution systems
Normalized Real Losses (litres/service connection/day) when the system is pressurized	Operational - Real Losses	Good operational performance indicator for target-setting for real loss reduction
Current Annual Real Losses (CARL)	Operational – Real Losses	

Performance Indicator	Function	Comments
Unavoidable Annual Real Losses (UARL)	UARL (litres/day) = $(5.41L_m + 0.15N_c + 7.5L_p) \times P$ Where: L_m = length of water mains (km) N_c = number of service connections L_p = total length of private pipe, (km) L_{Nd} = N_c × average distance from curb-stop to customer meter P = average pressure in the system (psi)	A theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. A key variable in the calculation of the Infrastructure Leakage Index (ILI) It is not necessary that systems set this level as a target unless water is unusually expensive, scarce or both
Infrastructure Leakage Index (ILI)	ILI = Operational Losses - Real Losses	Ratio of Current Annual Real Losses (CARL) to Unavoidable Annual Real Losses (UARL); good for operational benchmarking for real loss control.

6 THE LOGICAL DATA MODEL

A *logical data model* is the translation of the conceptual database design into the data model of a software system; it is a fully attributed data model that is independent of DBMS, software technology, data storage or organizational constraints. Very commonly, data modelling techniques use a relational model notation.

Common characteristics of a logical data model are:

- Typically describes data requirements for a single system or major subject area.
- May be integrated with other logical data models via a repository of shared entities
- Contains relationships between entities that address cardinality and nullability (optionality) of the relationships.
- It is designed and developed to be independent of DBMS, data storage locations or technologies. In fact, it may address digital and non-digital concepts.
- Data attributes will typically have datatypes with precisions and lengths assigned.
- Data attributes will have nullability (optionality) assigned.
- Entities and attributes will have definitions.

A logical data model will normally be derived from and or linked back to objects in a conceptual data model.

The entities of the system are organised depending either on the hydraulic or on the topological characteristics:

Line:	it is a linear object represented by a continuous line, with variable length, included between two nodes N_1 and N_n. The intermediate nodes N_2 ... N_{n-1} are vertexes that don't interrupt the line. The connectivity rules between nodes and lines are defined in the following chapters.
Node:	it is a punctual object spatially put in one of the two last nodes of the line. Putting a node, it means breaking the line.
Element	it is an object spatially put in any intermediate point of the line. Putting an element doesn't break the line.
Container	it is an object that can be located in any place, it is a polygon representing an infrastructure of the water network system (i.e.: water intake, pump station, water treatment plant, valve chamber, etc.)

To make possible both a simplified representation of the water network schematic and a detailed representation, the concept of "*Container*" can be introduced.

A container is an object representing an area occupied by an infrastructure of the water system - like a water intake, a water treatment plant, a tank, a pumping station, a valve chamber – that contains pipelines and other objects of the water network.

Therefore, a valve chamber can be represented with a polygon that has the real size of the chamber to which attributes can be assigned. All the entities within the chamber (valves, fittings and pipelines) will have an ID linking them to the chamber.

The entities representing a water system are listed in the following table.

Entities of the system may have a cartographic representation or not. The following list reports those entities that have a symbolic representation.

TABLE 10: GIS GEOGRAPHIC ENTITIES

Name	Topology	Geometry	Code
Water Intake	Node	Point	WI
Well-field / well	Node	Point	WF
Water Treatment Plant	Node	Point	WTP
Pump Station / Pump	Node	Point	PS
Tank (storage reservoir)	Node	Point	T
Chamber / Surface box	Container	Polygon	C
Junction	Node	Point	J
Flowmeter	Node	Point	FM
Valve	Node	Point	V
Washout	Node	Point	WO
Air valve	Node	Point	AV
Surge Control Device	Element	Point	SD
Service Connection	Element	Polyline	SC
Monitoring Point	Node	Point	PM
Water Connection Point (Hydrant, Fire Hydrant)	Element	Point	WCP
Customer Meter	Element	Point	WCM
Warning	Element	Point	WRN
Intervention	Element	Point	INT
Pipeline	Line	Polyline	P

The characteristics of each entity in the database shall be expressed using:

1. Name
2. Description
3. ID prefix
4. Type
5. Symbology
6. Descriptive Tables.

Annex 2 reports the proposed WSS GIS DB Entity-Relationship Diagram of the entities used to model the WSS.

7 HCWW / WES DB COMPARATIVE ANALYSIS

TABLE *11* compares the entities of the two databases (the HCWW and the WES), in order to check what entities are in both structures and what are not. Of course, the final structure of the database must include what is deemed necessary by the AWWC staff and what the WES team considers indispensable to carry out a performing NRW analysis by using a GIS.

TABLE 11: HCWW / WES WSS GIS DB ENTITIES

	HCWW GIS WSS DB Entities				WES WSS GIS DB Entities			
	Entity Name	**Topology**	**Geometry**	**Entity ID**	**Entity Name**	**Topology**	**Geometry**	**Entity ID**
5	Compact_TP		Point		Water Treatment Plant	Node	Point	WTP
5	Desalination_TP		Point		Water Treatment Plant	Node	Point	WTP
3	Filter		Point					
3	Clarifier		Point					
2	Fitting		Point		Junction	Node	Point	J
2	Hydrant		Point		Water Connection Point	Element	Point	WP
1	Intake		Point		Water Intake	Node	Point	WI
1	Meter		Point		Flowmeter	Node	Point	FM
1	Pipe		Line		Pipeline	Line	Polyline	P
1	Pump		Point		Pump Station / Pump	Node	Point	PS
1	Pump_Station		Point		Pump Station / Pump	Node	Point	PS
3	Station_Component		Polygon					
1	Tank		Point		Tank	Node	Point	T
1	Valve_chamber		Point		Chamber	Container	Polygon	C
1	W_valve		Point		Valve	Node	Point	V
1	Well_station		Point		Wellfield / Well	Node	Point	WF
1	Well		Point		Wellfield / Well	Node	Point	WE
5	WTP		Point		Water Treatment Plant	Node	Point	WTP
1	C_Meter		Point		Customer Meter	Element	Point	CM
2	C_Hydrant		Point		Water Connection Point [?]	Element	Point	CM
1	C_Pipe		Line		Service Connection	Line	Polyline	SC
2	W_valve		Point		Washout	Node	Point	WO
2	W_valve		Point		Air Valve	Node	Point	AV
4					Surge Control Device	Element	Point	SD
4					Monitoring Point	Node	Point	MP
4					Warning	Element	Point	WRN
4					Intervention	Element	Point	INT

About the entities used to describe the WSS in the two databases, five classes were found:

1) Entities present in both databases
2) Entities present in both databases the need a clarification from AWWC GIS staff on their characteristics
3) Entities present in the HCWW DB but not present in the WES DB
4) Entities present in the WES DB but not present in the HCWW DB
5) Entities treated differently by the structures of the two databases

7.1 ENTITIES PRESENT IN BOTH DATABASES

For these entities there is no doubt that they represent the same object of the WSS. The only issues to tackle are:

- the creation of the link between the tables of the two databases
- the definition of a list of attributes that must be uploaded first.

A special consideration can be made for the objects: Wellfield / well and Pump Station /Pump. In fact, the HCWW database treats them as separated object while the WES DB uses a single entity for both.

In addition, in some cases a different terminology has been used to define the same WSS object.

7.2 ENTITIES PRESENT IN BOTH DATABASES THE NEED A CLARIFICATION

Several sub-cases must be considered within the main category:

Clarifying whether the object “Fitting” of the HCWW DB corresponds to the object “Junction” of the WES DB. If the answer is “yes” this case falls in the type 1 class. If the answer is “no” it falls in the type 3 class.

Clarifying whether the “hydrant” and the “C_hydrant” of the HCWW DB corresponds to the type “hydrant” of the object “Water Connection Point” of the WES DB. If yes, it is only a matter of terminology.

The object “W_Valve” of the HCWW DB has – among others – the type “Air valve” that corresponds to the entity “air valve” of the WES DB. Therefore, it is a matter of terminology only

The object “W_Valve” of the HCWW DB has – among others – the type “drain valve” that should correspond to the object Washout” of the WES DB. This should be confirmed making this case a matter of mere different terminology.

7.3 ENTITIES PRESENT IN THE HCWW DB BUT NOT PRESENT IN THE WES DB

They are:

1. Filter
2. Clarifier
3. Station_Component

In this case, it is necessary to clarify in deep details what these objects are and how to treat them in the WES DB.

7.4 ENTITIES PRESENT IN THE WES DB BUT NOT PRESENT IN THE HCWW DB

They are:

1. Surge Control Device
2. Monitoring Point
3. Warning
4. Intervention

The WES team recommends the use of those objects, particularly from no. 2 to no. 4 and suggest that they should be added to the HCWW DB.

7.5 ENTITIES TREATED DIFFERENTLY BY THE STRUCTURES OF THE TWO DATABASES

They are:

1. Compact_TP
2. Desalination_TP
3. WTP

The three entities refer to the same object class, that is: water treatment plant. The WES DB considers one object only and differentiate the type by using one attribute. The HCWW uses three different objects, most probably because they defined different attributes for the three types of plants. The use of the DB in the pilot area will clarify which of the two approaches is preferable.

8 WES GIS DATABASE STRUCTURE

Annex 3 and Annex 4 show respectively the Entity Domains and the Common Domains of the WES GIS DB entities, e.g.: the column “Allowed Value” - if not reporting “Free Text” or the two alternatives in case of LOGIC field format - indicates the domain name to which the attribute refers. If the domain name has the “ID prefix “then it is an Entity Domain. If there is no “ID prefix”, then it is a common domain to many entities.

8.1 WSS ENTITIES

6.1.1 JUNCTION

NAME: JUNCTION

DESCRIPTION: a junction is a point object of the network connecting two or more pipelines.

A Junction can be a cross piece (double T), a tee piece, a reducer, a coupling (connection point between two pipes), or an endcap. This object always has the condition: OPEN; when it is an endcap – i.e., an end node of the pipeline - the object always has the condition: CLOSED.

ID prefix: J

Geometry Type: Node (Point)

Symbology:

1. Junction:
2. Capped/Dead End:

Note: it must spatially co-exist with an end of a line.

The WES team assumes that the HWWC DB entity “Fitting” corresponds to the WES DB entity “Junction”. This assumption must be confirmed by AWWC GIS expert. In. addition, the AWWC GIS expert should provide the list of values of the HWWC table attribute “TYPE” to make a comparison with the WES table attribute with the same name (“Type”) possible.

Attributes of the HCWW DB entity (Fitting).

Fitting (Point)

OBJECTID	Description	AutoNumber	Width
TYPE	Type of disconnection	Number	Integer
Notes	Notes	Text	255
In_Svc_Year	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
Rotation_Angle	Rotation_Angle	Number	Double
RuleID	RuleID	Number	Long Integer
created_user	created_user	Text	255

OBJECTID	Description	AutoNumber	Width
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Pipe_ID (NULL)	Pipe_ID	Number	Long Integer
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Attributes of the WES DB entity.

JUNCTION General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	J_ID	VARCHAR 12	Jxxx
HCWW ID	J_HCWW	VARCHAR 12	HCWW
WTS ID	J_WTS	VARCHAR 4	WTS
WDS ID	J_WDS	VARCHAR 4	WDS
DMZ ID	J_DMZ	VARCHAR 4	DMZ
DMA ID	J_DMA	VARCHAR 4	DMA
Container ID	J_CNT	VARCHAR 4	CNT

JUNCTION Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Elevation	J_ELEV	NUMBER 12,3	Free text
Type	J_TYPE	VARCHAR 20	J_TYPE
Junction NOS[2]	J_OC	LOGIC	O/C
Nominal Pressure	J_PN	NUMBER 4	PN
DN	J_DN	NUMBER 4	DN
Material	J_MAT	VARCHAR 20	MAT
Note	J_NOTE	VARCHAR 200	Free Text

[2] NOS = Normal Operating Status

6.1.2 FLOWMETER

NAME: FLOWMETER

DESCRIPTION: Flowmeters are used at the water sources, wells, or throughout the water system to determine the water flow in a particular portion of the system.

A Flowmeter is a point object representing tools for metering flow. This object can be either CLOSED or OPEN. A Flowmeter can also be a boundary point of one controlled area in between two of the following: WTS, WDS, DMZ, DMA; for that reason, it is important to record the IDs of the boundary systems.

ID prefix: FM

Type: Node

Symbology: 

Note: it must spatially co-exist with an end of a line.

The WES team assumes that the HCWW DB entity “Meter” corresponds to the WES DB entity “FLOWMETER”. This assumption must be confirmed by AWWC GIS expert.

The AWWC GIS staff should decide whether the name of the entity is “Meter” or “Flowmeter”.

Attributes of the HCWW DB entity (Meter).

Meter (Point)

OBJECTID	Description	AutoNumber	Width
Location		Text	100
Meter_Num		Number	Long Integer
Meter_Dia		Number	Integer
TYPE		Text	50
MES_TYPE		Text	50
Manufacturer		Text	50
Status		Text	255
Notes		Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
Enabled		Number	Integer
created_user		Text	255
created_date		Date/Time	
last_edited_user		Text	255
last_edited_date		Date/Time	
Station_Code		Text	50
Street_Name		Text	50

OBJECTID	Description	AutoNumber	Width
Section_Code	Village or city code	Text	255
District_		Text	100
Sections_		Text	100

Attributes of the WES DB entity.

FLOW-METER General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	FM_ID	VARCHAR 12	FMxxx
HCWW_1 ID	FM_HCWW_1	VARCHAR 12	HCWW
WTS_1 ID	FM_WTS_1	VARCHAR 4	WTS
WDS_1 ID	FM_WDS_1	VARCHAR 4	WDS
DMZ_1 ID	FM_DMZ_1	VARCHAR 4	DMZ
DMA_1 ID	FM_DMA_1	VARCHAR 4	DMA
HCWW_2 ID	FM_HCWW_2	VARCHAR 12	HCWW
WTS_2 ID	FM_WTS_2	VARCHAR 4	WTS
WDS_2 ID	FM_WDS_2	VARCHAR 4	WDS
DMZ_2 ID	FM_SEC_2	VARCHAR 4	DMZ
DMA_2 ID	FM_DMA_2	VARCHAR 4	DMA
Container ID	FM_CNT	VARCHAR 4	Free Text

FLOWMETER Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Class	FM_CLASS	VARCHAR 20	FM_CLASS
Serial Number	FM_SN	VARCHAR 20	Free Text
Date of Installation	FM_YEAR	INTEGER 8	Free Text
Elevation	FM_ELEV	NUMBER 12,3	Free Text
Flowmeter NOS	FM_NOS	LOGIC	O/C
Flowmeter Type	FM_MTYPE	VARCHAR 12	FM_MTYPE
Flowmeter Status	FM_STS	LOGIC	Active/Not Active
Flowmeter Reading Type	FM_READT	VARCHAR 12	FM_READT
Manufacturer	FM_MANUF	VARCHAR 20	Free Text
Nominal Diameter	FM_DN	NUMBER 4	DN
Meter Locked	FM_LOCK	LOGIC	Y/N
Notes	FM_NOTE	VARCHAR 200	Free Text

6.1.3 WASHOUT

NAME: Washout

DESCRIPTION: Network device installed to allow evacuation of water from network. Washout are considered OPEN when they are in the middle of the pipe and CLOSED when they are at the end of the pipe.

ID prefix: WO

Type Node

Symbology: 

Note: it must spatially co-exist with an end of a line.

The AWWC GIS expert should confirm whether the entity W_VALVE/DRAIN VALVE of the HWWC DB corresponds to the entity WASHOUT of the WE GIS DB.

Attributes of the HCWW DB entity (W_Valve).

W_VALVE (Point)

OBJECTID	Description	AutoNumber	Width
V_Num	Valve No.	Text	50
Valve_Kind	The main types of valves	Number	Integer
V_TYPE	Valve type	Text	50
V_OPR_CON	Valve operating condition	Text	10
V_VERIFY	Nature check	Text	20
X_DIST (NULL)	X_DIST (NULL)	Number	Double
Y_DIST (NULL)	Y_DIST (NULL)	Number	Double
Valve_Depth	Valve_Depth	Number	Double
Chamber_ID	Chamber_ID	Number	Integer
Status	Status	Text	50
Valve_DIA	Valve Diameter	Number	Integer
PIPE_DIA	Pipe Diameter	Number	Integer
Street_Name	Street_Name	Text	255
DIRECTION	Closing direction	Text	1
NUM_of_TURNS	The number of turns of closing the valve	Number	Integer
Close_Per	Close valve ratio	Number	Integer
In_Svc_Year	Year of entry into service	Number	Integer
ROT_ANGL (NULL)	Symbol Angle	Number	Double
Notes	Notes	Text	255

OBJECTID	Description	AutoNumber	Width
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Attributes of the WES DB entity.

Washout General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WO_ID	VARCHAR 12	WOxxx
HCWW ID	WO_HCWW	VARCHAR 12	HCWW
WTS ID	WO_WTS	VARCHAR 4	WTS
WDS ID	WO_WDS	VARCHAR 4	WDS
DMZ ID	WO_DMZ	VARCHAR 4	DMZ
DMA ID	WO_DMA	VARCHAR 4	DMA
Container ID	WO_CNT	VARCHAR 4	Free Text
Form ID	WO_FRM	VARCHAR 4	Free Text

Washout Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Type	WO_TYPE	VARCHAR 20	WO_TYPE
Elevation	WO_ELEV	NUMBER 12.3	Free Text
Year of Installation	WO_YEAR	INTEGER 4	Free Text
Discharge Control Device	WO_DCD	VARCHAR 20	WO_DCD
Nominal Diameter	WO_DN	NUMBER 4	DN
Nominal Pressure	WO_PN	NUMBER 2	PN
Washout Status	WO_STS	VARCHAR 20	STS
Notes	WO_NOTE	VARCHAR 200	Free Text

6.1.4 AIR VALVE

NAME: Air valve

DESCRIPTION: The scope of this device is to remove air from the pipe system or to make air enter the system when the network is emptying. To give more information to the elevation profile of the pipes it has been decided to consider air valves as a node.

ID prefix: AV

Type: Node

Symbology: 

Note: it must spatially co-exist with an end of a line.

The entity W_VALVE/AIR VALVE of the HWWC DB corresponds to the entity WASHOUT of the WES GIS DB.

Attributes of the HCWW DB entity (W_Valve).

W_VALVE (Point)

OBJECTID	Description	AutoNumber	Width
V_Num	Valve No.	Text	50
Valve_Kind	The main types of valves	Number	Integer
V_TYPE	Valve type	Text	50
V_OPR_CON	Valve operating condition	Text	10
V_VERIFY	Nature check	Text	20
X_DIST (NULL)	X_DIST (NULL)	Number	Double
Y_DIST (NULL)	Y_DIST (NULL)	Number	Double
Valve_Depth	Valve_Depth	Number	Double
Chamber_ID	Chamber_ID	Number	Integer
Status	Status	Text	50
Valve_DIA	Valve Diameter	Number	Integer
PIPE_DIA	Pipe Diameter	Number	Integer
Street_Name	Street_Name	Text	255
DIRECTION	Closing direction	Text	1
NUM_of_TURNS	The number of turns of closing the valve	Number	Integer
Close_Per	Close valve ratio	Number	Integer
In_Svc_Year	Year of entry into service	Number	Integer
ROT_ANGL (NULL)	Symbol Angle	Number	Double
Notes	Notes	Text	255
ENABLED	ENABLED	Number	Integer

OBJECTID	Description	AutoNumber	Width
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Attributes of the WES DB entity.

Air valve General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	AV_ID	VARCHAR 12	AVxxx
HCWW ID	AV_HCWW	VARCHAR 12	HCWW
WTS ID	AV_WTS	VARCHAR 4	WTS
WDS ID	AV_WDS	VARCHAR 4	WDS
DMZ ID	AV_DMZ	VARCHAR 4	DMZ
DMA ID	AV_DMA	VARCHAR 4	DMA
Container ID	AV_CONT	VARCHAR 4	Free Text
Form ID	AV_FRM	VARCHAR 4	Free Text

Air valve Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Type	AV_TYPE	VARCHAR 12	AV_TYPE
Elevation	AV_ELEV	NUMBER 12.3	Free Text
Nominal Diameter	AV_DN	NUMBER 4	DN
Nominal Pressure	AV_PN	NUMBER 2	PN
Air valve Status	AV_STS	VARCHAR 20	STS
Year of installation	AV_YEAR	NUMBER 4	Free Text
Note	AV_NOTE	VARCHAR 200	Free Text

6.1.5 MONITORING POINT

NAME: Monitoring Point (Sampling Station)

DESCRIPTION: Device representing the equipment required to monitor pressure or any other water parameter.

ID: MP

Type: Node

Symbology 

Note: it must spatially co-exist with an end of a line.

Monitoring Point General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	MP_ID	VARCHAR 12	MPxxx
HCWW ID	MP_HCWW	VARCHAR 12	HCWW
WTS ID	MP_WTS	VARCHAR 4	WTS
WDS ID	MP_WDS	VARCHAR 4	WDS
DMZ ID	MP_DMZ	VARCHAR 4	DMZ
DMA ID	MP_DMA	VARCHAR 4	DMA
CONTAINER ID	MP_CNT	VARCHAR 4	CNT

Monitoring Point Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Log Type	MP_LOGTYPE	VARCHAR 12	MP_LOGTYPE
Elevation	MP_ELEV	NUMBER 12.3	Free Text
Year of Installation	MP_YEAR	INTEGER 4	Free Text
Monitoring Point Status	MP_STS	VARCHAR 20	STS
Monitoring Point Type	MP_TYPE	VARCHAR 20	MP_TYPE
Monitoring Point NOS	MP_NOS	LOGIC	O/C
MP Data Register ID	MP_DREG_ID	VARCHAR4	Free Text
Notes	MP_NOTE	VARCHAR 200	Free Text

6.1.6 WATER INTAKE

NAME: Water Intake

DESCRIPTION: Start node of the Water Supply System, it indicates a water intake that might require for treatment or not. This object has always the condition: CLOSED. It is connected either to one or more pipelines. It can have or not a water treatment included in the compound

ID: WI

Type: Node

Symbology:  Water Intake without WTP

 Water Intake with WTP

Note: Initial node of a potable water network. This node must co-exist with an end of a line.

Attributes of the supposed corresponding entities (Intake) in the HCWW GIS DB.

Intake (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	100
E_Name	The name of the station is in English	Text	100
Station_Type	Station type	Text	50
Status	Status	Text	50
Intake_Type	Intake type	Text	50
Design_Capacity	Design capacity	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Raw_Pipe_Num	The number of non-clear water pipes	Number	Integer
G_Elevation	Ground level	Number	Double
Min_Intake_LVE	Lower grip level	Number	Double
Max_Intake_LVE (NULL)	The highest intake level	Number	Double
Water_Source	Water Source	Text	255
MIN_W_S_LVE	The lowest level of the water source	Number	Double
Max_W_S_LVE	The highest level of the water source	Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Memo	
created_user	Created user	Text	255
created_date	Created date	Date/Time	

OBJECTID	Description	AutoNumber	Width
last_edited_user	Last edited user	Text	255
last_edited_date	Last edited date	Date/Time	
Station_Code (NULL)	Station Code (NULL)	Text	50
District_	District_	Text	100
Sections_ (NULL)	Sections_ (NULL)	Text	100
District_en	District_en	Text	50

Attributes of the WES DB entity.

WATER INTAKE General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WI_ID	VARCHAR 12	WIxxx
HCWW ID	WI_HCWW	VARCHAR 12	HCWW
WTS ID	WI_WTS	VARCHAR 4	WTS
WDS ID	WI_WDS	VARCHAR 4	WTS
DMZ ID	WI_DMZ	VARCHAR 4	DMZ
DMA ID	WI_DMA	VARCHAR 4	DMA
Container ID	WI_CNT	VARCHAR 4	CNT
Form[3] ID	WI_FRM	VARCHAR 4	Free Text

WATER INTAKE Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Name	WI_NAME	VARCHAR 50	Free Text
WTP FLAG	WI_WTP	LOGIC	Y/N
WTP ID	WI_WTPID	VARCHAR 12	WTP
Type	WI_TYPE	VARCHAR 30	WI_TYPE
Source Name (Intake name)	WI_SRC	VARCHAR 50	Free Text
Elevation	WI_ELEV	NUMBER 12,3	Free Text
Construction Year	WI_CYEAR	NUMBER 4	Free Text
Rehabilitation Year	WI_RYEAR	NUMBER 4	Free Text
Discharge (lps)	WI_MQ	NUMBER 12.3	Free Text
Water Quality	WI_WQ	VARCHAR 10	WI_QUAL
Notes	WI_WTP_NOTE	VARCHAR 200	Free Text

WATER INTAKE – SPRING Attributes

[3] The ID of a Form that reports information on the facility (normally a scanned copy of a paper form)

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Intake Diameter (mm)	WI_S_DIA	NUMBER 12.3	Free Text
Notes	WI_S_NOTE	VARCHAR 200	Free Text

WATER INTAKE – DAM Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Intake Diameter (mm)	WI_D_DIA	NUMBER 12.3	Free Text
Max Water level	WI_D_MAXL	NUMBER 12.3	Free Text
Min Water Level	WI_D_MINL	NUMBER 12.3	Free Text
Notes	WI_D_NOTE	VARCHAR 200	Free Text

WATER INTAKE – RIVER / IRRIGATION CANAL / CANAL Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Intake Diameter (mm)	WI_R_DIA	NUMBER 12.3	Free Text
Screening	WI_R_SCR	LOGIC	Y/N
Notes	WI_R_NOTE	VARCHAR 200	Free Text

6.1.7 WELLFIELD / WELL

NAME: Wellfield /well

DESCRIPTION: Start node of the water system, it indicates either a well-field or a well. If it is a well-field, it may require for treatment or not. This object has always the condition: CLOSED. It is connected either to one or more pipelines. It may or may not have a water treatment included in the facility.

ID: WF / WE

Type: Node

Symbology:


Wellfield with WTP


Wellfield without WTP


Well

Note: it must spatially co-exist with an end of a line.

Attributes of the supposed corresponding entities (Well Station and Well) in the HCWW GIS DB structure.

Well_station (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	100

OBJECTID	Description	AutoNumber	Width
Well_Num	Number of wells	Number	Integer
Design_Capacity	Design Capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Status	Status	Text	200
Output_Pipe_Num	Number of output pipes	Number	Integer
Ground_Elevation (NULL)	Ground elevation	Number	Double
Tank_Volume		Number	Long Integer
IN_SVC_YR	Year of entry into service	Number	Integer
NOTES	Tank volume m3	Text	50
created_user (NULL)	created_user (NULL)	Text	255
created_date (NULL)	created_date (NULL)	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Station_Code (NULL)	Station code (NULL)	Text	50
District_	District	Text	100
Sections_	Sections	Text	100
x	x	Number	Double
y	y	Number	Double

WELL (Point)

OBJECTID	Description	AutoNumber	Width
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Well_Num	Well number	Number	Integer
Well_Depth	Well depth	Number	Double
Well_Pipe_Diam	Well pipe diameter	Number	Integer
CASE_	Well condition	Text	100
NOTES	Notes	Text	100
IN_SVC_YR	Year of entry into service	Number	Integer
Enabled	Enabled	Number	Integer
created_user	created_user	Text	255

OBJECTID	Description	AutoNumber	Width
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Station_Code	Station_Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100

Attributes of the WES DB to be added to the entity.

Well-Field General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Identification Code	WF_ID	VARCHAR 12	WFxxx
HCWW ID	WF_HCWW	VARCHAR 12	HCWW
WTS ID	WF_WTS	VARCHAR 4	WTS
WDS ID	WF_WDS	VARCHAR 4	WDS
DMZ ID	WF_DMZ	VARCHAR 4	DMZ
DMA ID	WF_DMA	VARCHAR 4	DMA
Container ID	WF_CNT	VARCHAR 4	CNT
Form ID	WF_FORM	VARCHAR 4	Free Text

WELLFIELD Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Name	WF_NAME	VARCHAR 50	Free Text
Location	WF_LOC	VARCHAR 50	Free Text
Wellfield type	WF_TYPE	VARCHAR 20	WF_TYPE
WTP Flag	WF_FLG	LOGIC	Y/N
WTP ID	WF_WTPID	VARCHAR 12	WTP
Present Condition	WF_PCOND	VARCHAR 50	Free Text
Note	WF_NOTE	VARCHAR 200	Free Text

WELL Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Well ID	WE_ID	VARCHAR 12	Free Text
Wellfield ID	WE_WF_ID	VARCHAR 12	Free Text
Well Name	WE_NAME	VARCHAR 20	Free Text

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Depth (m)	WE_DEP	NUMBER 12.3	Free Text
Casing Material	WE_CAS	VARCHAR 20	Free Text
Well Diameter	WE_DN	INTEGER 4	Free Text
Filter (Screen location)	WE_FILT	VARCHAR 20	Free Text
Yield WET (MLD)	WE_YWET	NUMBER 12.3	Free Text
Yield DRY (MLD)	WE_YDRY	NUMBER 12.3	Free Text
Water Quality	WE_WQ	VARCHAR 20	Free Text
Well Efficiency	WE_EFF	NUMBER 12.3	Free Text
Static Level	WE_SLEV	NUMBER 12.3	Free Text
Dynamic Level	WE_DLEV	NUMBER 12.3	Free Text
Drilled date	WE_DRDATE	DATE	Free Text
Operation date	WE_OPDATE	DATE	Free Text
Well Room	WE_ROOM	LOGIC	Y/N
Well Chamber	WE_CHB	LOGIC	Y/N
Well Head (m)	WE_WHD	NUMBER 12.3	Free Text
Well Elevation (AOD)	WE_EL	NUMBER 10.3	Free Text
Well Operating	WE_OP	LOGIC	Y/N
Well Status	WE_STS	VARCHAR 20	STS
Present Condition	WE_PCOND	VARCHAR 50	Free Text
Construction Year	WE_YEAR	VARCHAR 4	Free Text
Length Riser Pipe (m)	WE_PLEN	NUMBER 12.3	Free Text
DN Riser Pipe (mm)	WE_PDN	NUMBER 4	Free Text
Depth of Submersible Pump (m)	WE_SUBPS	NUMBER 12.3	Free Text
Pump power (HP/Kw)	WE_PS_HP	NUMBER 12.3	Free Text
Pump Head (m)	WE_PS_H	NUMBER 12.3	Free Text
Transformer capacity. (kVA)	WE_PS_KVA	NUMBER 12.3	Free Text
Note	WE_NOTE	VARCHAR 200	Free Text

6.1.8 WATER TREATMENT PLANT

NAME: Water Treatment Plant

DESCRIPTION: A Water Treatment Plant is a facility where is performed any process that improves the quality of water to make it more acceptable for a drinkable end-use. It is connected either to one or more pipelines.

The status of this entity, when it is a starting point of the WSS, is always CLOSED; when it is preceded by a either a water intake or a wellfield its status is always: OPEN.

ID: WTP

Type: Node

Symbology 

Note: it must spatially co-exist with an end of a line.

Attributes of the supposed corresponding entities (WTP, Compact_TP, Desalination_TP) in the HCWW GIS DB structure.

WTP (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	100
E_Name	The name of the station is in English	Text	100
Status	Status	Text	50
Design_Capacity	Design capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Out_Raw_Rate_Cap	The amount of turbid water leaving the station, m3 / day	Number	Long Integer
EntryRaw_Pipe_Num	Number of turbidity lines entering the station	Number	Integer
Output_Pipe_Num	Number of filtered package lines	Number	Integer
Output_Raw_Pipe_Num	Number of turbidity lines emerging from the station	Number	Integer
Clarifiers_Num	Number of clarifiers	Number	Integer
Filters_Num	Number of filters	Number	Integer
Ground_Tank_Num	The number of ground tanks	Number	Integer
Ground_Tank_Volume	The capacity of the ground tank is m3	Number	Long Integer
Curd_Removal	The place of disposal of the grub	Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
Ground_Elevation	Ground elevation	Number	Double
Intake_Type	Intake type	Text	50
Notes	Notes	Memo	
created_user (NULL)	Created user	Text	255
created_date (NULL)	Created date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255

OBJECTID	Description	AutoNumber	Width
Station_Code (NULL)	Station Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100
x	x	Number	Double
y	y	Number	Double

Compact_TP (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	255
Status	Status	Text	255
Intake_Type	Intake type	Text	255
Design_Capacity	Design capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Output_Pipe_Num	Number of output pipe	Number	Integer
Filter_Num	Number of filters	Number	Integer
Tank_Volume	Tank_Volume	Number	Long Integer
Ground_Elevation (NULL)	Ground elevation	Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Station_Code (NULL)	Station code	Text	50
District_	District	Text	100
Sections_	Sections	Text	100
x	x	Number	Double

OBJECTID	Description	AutoNumber	Width
y	y	Number	Double

Desalination_TP (Point) Empty

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	255
Status	Status	Text	255
Intake_Type	Intake Type	Text	255
Design_Capacity	Design Capacity	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Ent_Raw_Rate_Cap	The amount of turbid water entering the station, m3/day	Number	Long Integer
Out_Raw_Rate_Cap	The amount of turbid water leaving the station, m3/day	Number	Long Integer
Ent_Raw_Pipe_Num	The number of turbidity lines entering the station	Number	Integer
Output_Pipe_Num	Number of filtered package lines	Number	Integer
Treat_RPH	The average pressure of pumps	Number	Double
Filter_Num	Number of filters	Number	Integer
Tank_Volume	Tank Volume	Number	Long Integer
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Text	255
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Station_Code	Station Code	Text	50
Output_Raw_Pipe_Num	The number of turbidity lines emerging from the station	Text	50
Ground_Elevation	Ground level	Number	Double
District_	District	Text	100

OBJECTID	Description	AutoNumber	Width
Sections_	Sections	Text	100

Attributes of the WES DB to be added to the entity.

WATER TREATMENT PLANT General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WTP_ID	VARCHAR 12	WTPxxx
HCWW ID	WTP_HCWW	VARCHAR 12	HCWW
WTS ID	WTP_WTS	VARCHAR 4	WTS
WDS ID	WTP_WDS	VARCHAR 4	WDS
DMZ ID	WTP_DMZ	VARCHAR 4	DMZ
DMA ID	WTP_DMA	VARCHAR 4	DMA
CONTAINER ID	WTP_CNT	VARCHAR 4	CNT
Form ID	WTP_FRM	VARCHAR 4	Free Text

WATER TREATMENT PLANT Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Name	WTP_DEN	VARCHAR 30	Free Text
Location	WTP_LOC	VARCHAR 30	Free Text
Source	WTP_SRC	VARCHAR 30	Free Text
Inlet Elevation	WTP_INEL	NUMBER12,3	Free Text
Outlet Elevation	WTP_EL	NUMBER12,3	Free Text
Treatment Type	WTP_TRTYPE	VARCHAR 20	WTP_TRTYPE
Effluent Quality	WTP_OUTQ	NUMBER 12.3	Free Text
Treatment Rate	WTP_TRRATE	NUMBER 12.3	Free Text
Construction Year	WTP_YEAR	NUMBER 4	Free Text
Capacity (MLD)	WTP_CAP	NUMBER 12.3	Free Text
Notes	WTP_NOTE	VARCHAR 200	Free Text

6.1.9 TANK

NAME: Tank (Storage Reservoir)

DESCRIPTION: A Storage Reservoir is a storage facility of a Water Supply System. It is connected to more than one pipeline. Normally its status is: OPEN.

ID: T

Type: Node

Symbology 

Note: it must spatially co-exist with an end of a line.

Attributes of the supposed corresponding entity (Tank) in the HCWW GIS DB structure.

Tank (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the reservoir is in Arabic	Memo	
E_Name	The name of the reservoir is in English	Text	255
VOLUME	The tank capacity is m3	Number	Double
Radius	The radius of the tank, m	Number	Double
Length	Length	Number	Double
Width	Width	Number	Double
Height	Height	Number	Double
FLOW	The flow rate is m3 / hour	Number	Double
Status	Status	Text	255
Ground_Elevation (NULL)	Ground elevation	Number	Double
TOP_Level	Tank surface level	Number	Double
Bottom_Level	Tank bottom level	Number	Double
Spillway_Level	Overflow pipe level	Number	Double
Inner_T_Depth	The depth of the inner tank	Number	Double
MIN_Level	The lowest water level inside the tank	Number	Double
MIN_Volume	The minimum tank storage capacity m3	Number	Double
IN_SVC_YR	Year of entry into service	Number	Long Integer
Feeder_DIA	Tank inlet pipe diameter	Number	Integer
Output_DIA	The diameter of the tank exit pipe	Number	Integer
Tank_Code NULL)	Tank Code	Text	50
Notes	Notes	Text	255
Section_Code (NULL)	Village or city code	Text	255
Enabled	Enabled	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Type	Type	Number	Integer
District_	District_	Text	100

OBJECTID	Description	AutoNumber	Width
Sections_	Sections_	Text	100
x	x	Number	Double
y	y	Number	Double

Attributes of the WES DB to be added to the entity.

Service Reservoir General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	T_ID	VARCHAR 12	Txxx
HCWW ID	T_HCWW	VARCHAR 12	HCWW
WTS ID	T_WTS	VARCHAR 4	WTS
WDS ID	T_WDS	VARCHAR 4	WDS
DMZ ID	T_DMZ	VARCHAR 4	DMZ
DMA ID	T_DMA	VARCHAR 4	DMA
Container ID	T_CNT	VARCHAR 4	CNT
Form ID	T_FORM	VARCHAR 4	T_FORM

Service Reservoir Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Name	T_NAME	VARCHAR 30	Free Text
Type	T_TYPE	VARCHAR 30	T_TYPE
Location	T_LOC	VARCHAR 30	Free Text
Total capacity (m3)	T_V	NUMBER 12,3	Free Text
Top Water Level	T_TWL	NUMBER 12,3	Free Text
Bottom Water level	T_BWL	NUMBER 12,3	Free Text
Construction type	T_CTYPE	VARCHAR 20	T_CTYPE
Ground elevation	T_GREL	NUMBER 12,3	Free Text
Construction Year	T_CYEAR	NUMBER 4	Free Text
Tank Status	T_STS	VARCHAR 20	STS
Wash-out	T_WO	LOGIC	Y/N
Over-Flow	T_OF	LOGIC	Y/N
Note	T_NOTE	VARCHAR 200	Free Text

6.1.10 PUMP STATION / PUMP

NAME: Pump Station

DESCRIPTION: This is a point object connecting two or more lines of a water supply system. It represents either a pump station or a pump. This object can be either CLOSED or OPEN.

ID prefix: PS

Type: Node

Symbology:  Pump Station

 Pump

Note: it must spatially co-exist with an end of a line.

Attributes of the supposed corresponding entities (Pump_Station and Pump) in the HCWW GIS DB structure.

Pump_Station

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the lift station in Arab	Text	50
E_Name	The name of the lift station in English	Text	50
Treat_RPH1	Average pressure of pumps 1	Number	Long Integer
Treat_RPH2 (NULL)	Average pressure of pumps 2	Number	Long Integer
Status	Status	Text	255
Notes	Notes	Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
PS_Code (NULL)	Lift station code	Text	50
Output_Pipe_Num	The number of pipes outside the station	Number	Integer
Entry_Pipe_Num	The number of pipes entering the station	Number	Integer
Pump_type	Pump type	Text	50
District_	District	Text	100
Sections_	Sections	Text	100

PUMP (Point)

OBJECTID	Description	AutoNumber	Width
TYPE	Pump type	Text	50
Feeder_DIA	Feed pipe diameter	Number	Integer
Output_DIA	Diameter of the discharge pipe	Number	Integer

OBJECTID	Description	AutoNumber	Width
Horse_Power	The power of the pump is the horse	Number	Double
HEAD	Pump capacity m	Number	Double
FLOW	Discharge rate m3 / hr	Number	Double
OPER_MODE	How to operate the pump	Text	50
Efficiency	Pump efficiency%	Number	Double
Status	Status	Text	255
Notes	Notes	Text	255
Manufacture	Country of Manufacture	Text	50
IN_SVC_YR	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Station_Code	Station_Code	Text	255
Pump_Code	Pump_Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100

Attributes of the WES DB to be added to the entity.

PUMP STATION General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Identification Code	PS_ID	VARCHAR 12	PSxxx
HCWW ID	PS_HCWW	VARCHAR 12	HCWW
WTS ID	PS_WTS	VARCHAR 4	WTS
WDS ID	PS_WDS	VARCHAR 4	WDS
DMZ ID	PS_DMZ	VARCHAR 4	DMZ
DMA ID	PS_DMA	VARCHAR 4	DMA
Container ID	PS_CNT	VARCHAR 4	CNT
Form ID	PS_FORM	VARCHAR 4	Free Text

PUMP STATION Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Name	PS_NAME	VARCHAR 30	Free Text

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Location	PS_LOC	VARCHAR 30	Free Text
PS Elevation	PS_ELEV	NUMBER 12,3	Free Text
Construction Year	PS_YEAR	NUMBER 4	Free Text
Max Liftable Flow (m3/h)	PS_MAXQ	NUMBER 12,3	Free Text
Average Pump Head (m)	PS_HEAD	NUMBER 12.3	Free Text
Power (kW)	PS_KW	NUMBER 12.3	Free Text
Average Operating time (hours)	PS_HOUR	NUMBER 12.3	Free Text
Average supplied volume (m3/year)	PS_AVGV	NUMBER 12,3	Free Text
Chlorination	PS_CL	LOGIC	Y/N
Crane	PS_CRANE	LOGIC	Y/N
Pump Station Status	PS_STS	VARCHAR 30	STS
Pump Station NOS	PS_NOS	LOGIC	O/C
No. of pumps	PS_NP	INTEGER 3	Free Text
Pumps Connectivity	PS_PC	VARCHAR 4	PS_PCONN
No. of pane boards	PS_NPB	INTEGER 3	Free Text
No. of transformers	PS_NT	INTEGER 3	Free Text
No. of generators	PS_NG	INTEGER 3	Free Text
No. of flowmeters	PS_NFM	INTEGER 3	Free Text
Notes	PS_NOTE	VARCHAR 200	Free Text

PUMP Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Identification Code	P_ID	VARCHAR 12	Pxxx
Pump Station ID	P_PSID	VARCHAR 12	PSxxx
Pump Type	P_TYPE	VARCHAR 30	PS_PTYPE
Pump Model	P_MODEL	VARCHAR 30	Free Text
Pump Installation Year	P_YEAR	INTEGER 4	Free Text
Pump Elevation	P_ELEV	NUMBER 12,3	Free Text
Pump Manufacturer	P_MANUF	VARCHAR 30	Free Text
Pump Elect. Panel	P_PANEL	LOGIC	Y/N
Pump Power (HP)	P_HP	NUMBER 12,3	Free Text
Pump Surge Control Device	P_SCD	LOGIC	Y/N
Pump Energy Consumption (KW)	P_ENERGY	NUMBER 12,3	Free Text
Pump Head (m)	P_H	NUMBER 12,3	Free Text
Pump Flow (lps)	P_Q	NUMBER 12,3	Free Text

6.1.11 VALVE

NAME: Valve

DESCRIPTION: This is a point object connecting two lines of a water system. It represents a device, either manually or automatically operated, whose role is to regulate either the water flow or the water pressure of a pipeline. This object can be either CLOSED or OPEN. A Valve may also be a network boundary points between two of the following entities: WTS, WDS, DMZ, DMA.

ID prefix: V

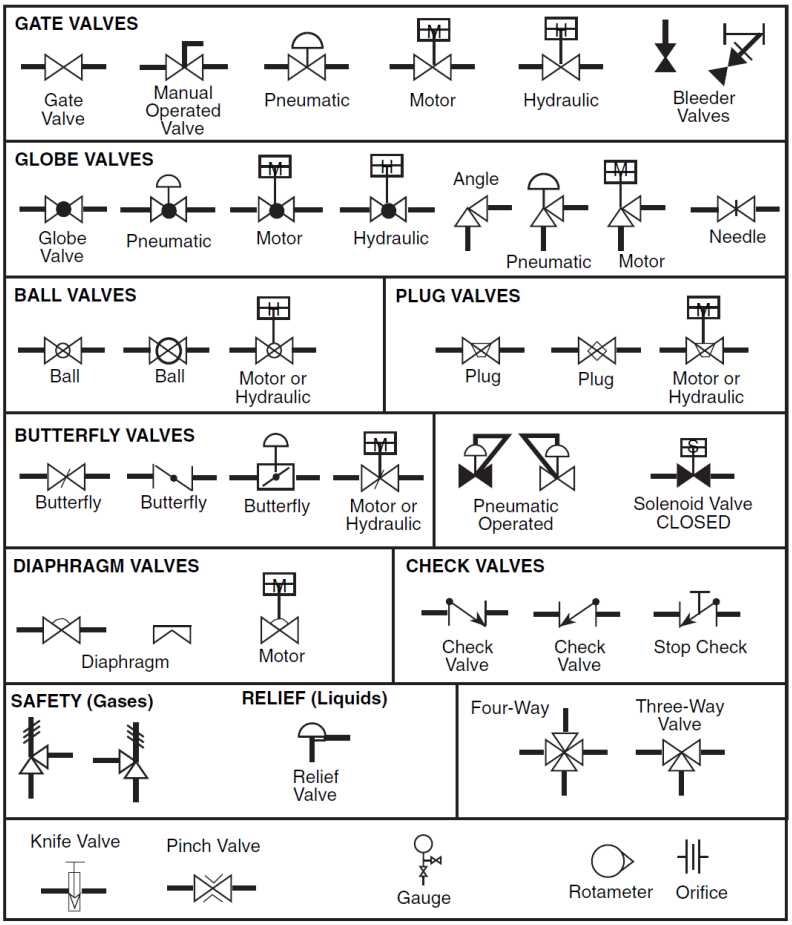
Type: node

Symbology: Status of the valve: OPEN

Status of the valve: CLOSED

Status of the valve: PARTIALIZED

More symbols can be chosen for different type of valves, the following Figure gives an example of possible symbols.



Note: it must spatially co-exist with an end of a line.

Attributes of the supposed corresponding entity (W_Valve) in the HCWW GIS DB structure.

W_VALVE (Point)

OBJECTID	Description	AutoNumber	Width
V_Num	Valve No.	Text	50
Valve_Kind	The main types of valves	Number	Integer
V_TYPE	Valve type	Text	50
V_OPR_CON	Valve operating condition	Text	10
V_VERIFY	Nature check	Text	20
X_DIST (NULL)	X_DIST (NULL)	Number	Double
Y_DIST (NULL)	Y_DIST (NULL)	Number	Double
Valve_Depth	Valve_Depth	Number	Double
Chamber_ID	Chamber_ID	Number	Integer
Status	Status	Text	50
Valve_DIA	Valve Diameter	Number	Integer
PIPE_DIA	Pipe Diameter	Number	Integer
Street_Name	Street_Name	Text	255
DIRECTION	Closing direction	Text	1
NUM_of_TURNS	The number of turns of closing the valve	Number	Integer
Close_Per	Close valve ratio	Number	Integer
In_Svc_Year	Year of entry into service	Number	Integer
ROT_ANGL (NULL)	Symbol Angle	Number	Double
Notes	Notes	Text	255
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Values for the fields TYPE: V_TYPE

COD_TYPE	DESCRIPTION
AIR	AIR VALVE
BLV	BALL VALVE
BFV	BUTTERFLY VALVE
DRV	DRAIN VALVE
FCV	FLOW CONTROL VALVE
GT	GATE VALVE (SLUICE VALVE)
NRV	NON-RETURN VALVE (REFLUX VALVE/CHECK VALVE)
HYD	HYDRANT VALVE
PRV	PRESSURE REDUCING VALVE
PBV	PRESSURE BREAKER VALVE
PLV	PLUG VALVE
AHC	AUTO-CLOSE HYDRAULIC VALVE
PSV	PRESSURE SUSTAINING VALVE
Unknown	UNKNOWN

Attributes of the WES DB to be added to the entity.

VALVE General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	V_ID	VARCHAR 4	Vxxx
HCWW_1 ID	V_HCWW_1	VARCHAR 12	HCWW
WTS_1 ID	V_WTS_1	VARCHAR 4	WTS
WDS_1 ID	V_WDS_1	VARCHAR 4	WDS
DMZ_1 ID	V_DMZ_1	VARCHAR 4	DMZ
DMA_1	V_DMA_1	VARCHAR 4	DMA
HCWW_2 ID	V_HCWW_2	VARCHAR 12	HCWW
WTS_2 ID	V_WTS_2	VARCHAR 4	WTS
WDS_2 ID	V_WDS_2	VARCHAR 4	WDS
DMZ_2 ID	V_DMZ_2	VARCHAR 4	DMZ
DMA_2	V_DMA_2	VARCHAR 4	DMA
Container ID	V_CNT	VARCHAR 4	CNT
Form ID	V_FORM	VARCHAR 4	Free Text

VALVE Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Valve Type	V_TYPE	VARCHAR 40	V_TYPE
Elevation	V_ELEV	NUMBER12,3	Free Text
Nominal Diameter	V_DN	NUMBER 4	DN

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Nominal Pressure	V_PN	NUMBER 2	PN
Normal Operating Status	V_NOS	LOGIC	O/C
Motorised	V_MOTOR	LOGIC	Y/N
Power Driven Actuator	V_ACT	LOGIC	Y/N
Material	V_MAT	NUMBER 2	MAT
Year of Installation	V_YEAR	NUMBER 4	Free Text
Valve Status	V_STS	VARCHAR 20	STS
Note	V_NOTE	VARCHAR 200	Free Text

6.1.12 PIPELINE

NAME: Pipeline

DESCRIPTION: linear object connecting nodes of a water system. It may be a transmission pipeline, a distribution pipeline.

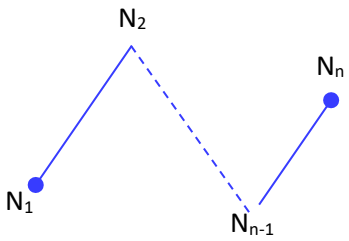
A transmission pipeline is a linear object connecting nodes of a transmission system, nodes of a distribution system, WTP, Intakes, Wellfield (and wells) and Tanks.

A distribution pipeline is a linear object connecting nodes of a distribution system, nodes of a transmission system and Tanks.

ID: P

Type: Linear

Symbology



Note: Nodes N_1 e N_n are last nodes of the line and they have to co-exist with two objects type “node”.

Attributes of the supposed corresponding entity (PIPE) in the existing GIS DB structure.

Pipe (Line)

OBJECTID	Description	AutoNumber	Width
NOM_DIA	Pipe diameter	Number	Integer
PIPE_MATL		Text	255
AS_BUILT		Text	20
water_Type		Text	50
Pipe_Type		Number	Integer
Status		Text	50

OBJECTID	Description	AutoNumber	Width
PIPE_Depth		Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Dist_Pavement		Number	Double
Notes		Text	255
ENABLED		Number	Integer
created_user		Text	255
created_date		Date/Time	
last_edited_user		Text	255
last_edited_date		Date/Time	
Station_Code		Text	50
Street_Name		Text	50
Section_Code	Village or city code	Text	255
District_		Text	100
Sections_		Text	100
HA_Label		Text	50
project		Text	150
District_en		Text	150

Attributes of the WES DB to be added to the entity.

PIPE General Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Identification Code	P_ID	VARCHAR 12	Pxxx
HCWW ID	P_HCWW	VARCHAR 12	HCWW
WTS ID	P_WTS	VARCHAR 4	WTS
WDS ID	P_WDS	VARCHAR 4	WDS
DMZ ID	P_DMZ	VARCHAR 4	DMZ
DMA ID	P_DMA	VARCHAR 4	DMA
Container ID	P_CNT	VARCHAR 4	CNT
Form ID	P_FORM	VARCHAR 20	Free Text

PIPE Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Flag	P_FLAG	VARCHAR 20	P_FLG

DESCRIPTION	FIELD_NAME	FIELD FORMAT	VALUE
Type	P_TYPE	VARCHAR 20	P_TYPE
Length	P_LEN	NUMBER 9,2	Calculated
Material	P_MAT	NUMBER 2	MAT
Nominal Diameter	P_DN	NUMBER 4	P_DN_XX[4]
Internal Diameter	P_ID	NUMBER 4	P_ID[5]
Outer Diameter	P_OD	NUMBER 4	P_OD[3]
Nominal Pressure	P_PN	NUMBER 2	PN
Sleeve (YES/NO)	P_SLV	LOGIC	Free Text
Road Name	P_ROAD	VARCHAR 50	Free Text
Year of installation	P_YEAR	NUMBER 4	Free Text
Manufacturer	P_MAN	VARCHAR 50	Free Text
Construction Company	P_CONS	VARCHAR 50	Free Text
Laying Depth	P_DEPT	NUMBER 5,2	Free Text
Coating Type	P_COAT	VARCHAR 12	COAT
Pipe Condition	P_COND	VARCHAR 20	P_COND
Pipe Status	P_STS	VARCHAR 20	STS
Note	P_NOTE	VARCHAR 200	Free Text

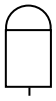
6.1.13 SURGE CONTROL DEVICE

NAME: Surge Control Device (SD)

DESCRIPTION: Surge Control Device is needed to anticipate and dissipate surges from sudden velocity changes after power outages. Surge Control Device will also provide protection against malfunctioning valves, improper filling, or other system problems.

ID prefix: SD

Type: Punctual Element

Symbology: 

Note: may be connected to pipe end, vertex, junction. Shall be connected to a container such as pump station

Surge Control Device Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	SD_ID	VARCHAR 12	SDxxxx

[4] The Nominal Diameter depends on the pipe material, then each material has its own P_DN table.
[5] To be added in accordance with the Manufacturer's table

PS ID	SD_PS	VARCHAR 5	Pxxxxx
Type	SD_TYPE	VARCHAR 20	SD_TYPE
Year of installation	SD_YEAR	NUMBER 4	Free Text
Surge Relief Equip. Status	SD_STS	VARCHAR 20	STS
Note	SD_NOTE	VARCHAR 200	Free Text

6.1.14 WATER CONNECTION POINT

NAME: WATER CONNECTION POINT (WCP)

DESCRIPTION: End point of the system either metered or unmetered connection that provides access to a water supply. It is an end point of a service connection element or can be placed on a pipe.

ID: WP

Type: Punctual Element

Symbology:

Water Connection Point Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
ID	WP_ID	VARCHAR 12	WPxxx
SC [6]ID	WP_SCID	VARCHAR 12	SC[7]
PIPE ID	WP_PID	VARCHAR 12	PIPE[8]
Nominal Diameter	WP_DN	INTEGER 4	Free Text
Type	WP_TYPE	VARCHAR 12	WCP_TYPE
Installation Year	WP_YEAR	INTEGER 4	Free Text
Metered	WP_FM	LOGIC	Y/N
User Purpose	WP_PURP	VARCHAR 20	WCP_PRP
METER_ID	WP_MID	VARCHAR 12	Free Text
Elevation	WP_ELEV	NUMBERE 12.3	Free Text
Location Description	WP_LOC	VARCHAR 30	Free Text
No. of Users (Public Tap only)	WP_USR	INTEGER 4	Free Text
Status	WP_STS	VARCHAR 30	STS
Note	WP_NOTE	VARCHAR 200	Free Text

6.1.15 CUSTOMER METER

NAME: Customer Meter (CM)

DESCRIPTION: It is a metered end point of the system where a customer is connected. It is the end point of a service connection element. For this reason, is status is always CLOSED.

ID: CM

Type: Punctual Element

Symbology: TBD

[6] Service Connection ID. See section 3.1.18

[7] It refers to the list of the Service connections uploaded in the GIS DB

[8] It refers to the list of the Pipes uploaded in the GIS DB

Attributes of the supposed corresponding entity (Customer Meter) in the HC WW DB structure.

Customer Meter

OBJECTID	Description	AutoNumber	Width
ACCT_Num (NULL)		Number	Long Integer
Bronze_Num (NULL)	Bronze number	Number	Long Integer
CUST_Name	Subscriber's name	Text	50
Bld_Num (NULL)	building number	Text	255
Floor_num (NULL)	Floor number	Number	Integer
Flat_num (NULL)	Flat number	Number	Integer
Street_Name	Street_Name	Text	50
Meter_Diameter	Meter_Diameter	Number	Integer
Zone_ID (NULL)	Zone_ID (NULL)	Number	Integer
Cust_Category (NULL)	Customer classification	Text	50
Conn_Type (NULL)	Connection type	Text	255
Status	Meter status	Text	255
Contract_Date (NULL)	Contract date	Date/Time	
Stop_S_Date (NULL)	Date of discontinuation of service	Date/Time	
REASON (NULL)	Reason	Text	100
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
District_	District Sections	Text	100
Sections_ (NULL)		Text	100

Attributes of the WES DB to be added to the entity.

Customer Meter Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
ID	CM_ID	VARCHAR 12	CMxxx

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
SC ID	CM_SCN	VARCHAR 12	SC
Type	CM_TYPE	VARCHAR 12	CM_TYPE
Manufacturer	CM_MAN	VARCHAR 20	Free Text
Nominal Diameter	CM_DN	INTEGER 4	Free Text
Installation Date	CM_DATE	INTEGER 8	Free Text
Meter ID (S/N)	CM_MID	VARCHAR 12	Free Text
Elevation	CM_ELEV	NUMBERE 12.3	Free Text
Location Description	CM_LOC	VARCHAR 30	Free Text
Meter Status	CM_STS	VARCHAR 30	STS
Meter Locked	CM_LOCK	LOGIC	Y/N
Note	CM_NOTE	VARCHAR 200	Free Text

6.1.16 WARNING

NAME: Warning (WRN)

DESCRIPTION: this element represents a report on any malfunctioning of the water network signalled to the Maintenance and Operations Department.

ID: WRN

Type: Punctual Element

Symbology: [W]

Note: it is an intermediate element of a pipeline.

Warning Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WRN_ID	VARCHAR 12	WRNxxx
Typology	WRN_TYPE	VARCHAR 12	WARNING_TYPE
PIPE ID	WRN_P	VARCHAR 4	PIPE
Notice Date/hour	WRN_NDATE	DATE	Free Text
Response Date/hour	WRN_RDATE	DATE	Free Text
Notes	WRN_NOTE	VARCHAR 200	Free Text

6.1.17 INTERVENTION

NAME: Intervention (INT)

DESCRIPTION: this element represents the report prepared after any intervention operated by the Maintenance and Operations Department teams.

ID: INT

Type: Element

Symbology: [I]

Note: this object must spatially co-exist with a vertex of the pipeline or with a point object of the network.

Intervention Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification ID	INT_ID	VARCHAR 12	INTxxx
Type	INT_TYPE	VARCHAR 12	INT_TYPE
Status	INT_STS	VARCHAR 12	INT_STS
WRN ID	INT_WRN	VARCHAR 4	WRN[9]
Intervention Start Date	INT_STDATE	DATE	Free Text
Intervention End Date	INT_ENDDATE	DATE	Free Text
Notes	INT_NOTE	VARCHAR 200	Free Text

6.1.18 SERVICE CONNECTION

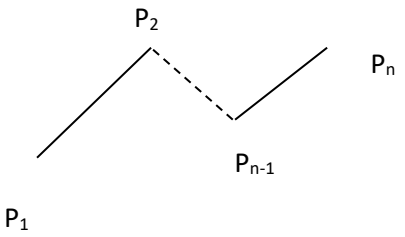
NAME: Service Connection (SC)

DESCRIPTION: linear elements connecting any distribution network pipe to any supply point, i.e.: one water point or one customer meter.

ID: SC

Type Linear Element

Symbology:



[9] It refers to the warning uploaded in the GIS DB.

P_1 is the starting point of the element and it has to co-exist with an intermediate point of the pipe. P_2, ..., P_{n-1} are intermediate points of the polyline. P_n is the last point of the linear element.

Attributes of the supposed corresponding HCWW entity (C_pipe).

C_Pipe

OBJECTID	Description	AutoNumber	Width
ACCT_NO (NULL)	Account number	Number	Long Integer
DIAMETER	DIAMETER	Number	Double
MATERIAL	MATERIAL	Text	50
AS_BUILT (NULL)	File number	Text	10
Status	Status	Text	50
IN_SVC_YR	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Street_Name (NULL)	Street name	Text	50
Notes (NULL)	Notes	Text	50
District_	District	Text	100
Section_	Section	Text	100

Attributes of the WES DB to be added to the entity.

Service connection Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	SC_ID	VARCHAR 12	SCxxx
PIPE ID	SC_PID	VARCHAR 4	PIPE
Material	SC_MAT	NUMBER 2	SC_MAT
Nominal Diameter	SC_DN	NUMBER 4	SC_DN[10]
Nominal Pressure	SC_PN	NUMBER 2	PN
Coating Type	SC_COAT	VARCHAR 12	COAT
Construction Year	SC_YEAR	NUMBER 4	Free Text

[10] The Nominal Diameter of the Service Connection depends on the Service Connection material, for that a DN table for each material needs to be prepared.

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Laying down Depth	SC_DEPT	NUMBER 5,2	Free Text
Meter ID	SC_MTRID	VARCHAR 12	Free Text
SC Status	SC_STS	VARCHAR 20	STS
Note	SC_NOTE	VARCHAR 200	Free Text

6.1.19 CONTAINER

NAME: Container (CNT)

DESCRIPTION: **Container**: object representing the area occupied by a complex infrastructure like WTS, WDS, DMZ, DMA or water network infrastructure such as water intake, water treatment plant, pumping station, reservoir, chamber or a surface box.

There are two types of container:

- Type 1: it is a container that can only contain objects of the network (nodes, element, pipes).
- Type 2: it is a container that can contain either objects of the network or type 1 containers.

Each linear element crossing the border of the container is broken by a simulated junction object.

ID: CNT

Type: Polygon

Symbology: 

Container Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Container ID	CNT_ID	VARCHAR 12	CNTxxx
HCWW ID	CNT_HCWW	VARCHAR 12	HCWW
WTS ID	CNT_WTS	VARCHAR 4	WTS
WDS ID	CNT_WDS	VARCHAR 4	WDS
DMZ ID	CNT_DMZ	VARCHAR 4	DMZ
DMA ID	CNT_DMA	VARCHAR 4	DMA
Container type	CNT_TYPE	VARCHAR 30	“Type1”/”Type2”
Container Infrastructure	CNT_TYPE	VARCHAR 30	CNT_INFR
Form ID	CNT_FORM	VARCHAR 4	Free Text
Name	CNT_NAME	VARCHAR 30	Free Text
Area	CNT_AREA	NUMBER 12.3	Free Text
Perimeter	CNT_PERIM	NUMBER 12.3	Free Text
Note	CNT_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Water Intake”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WI_ID	VARCHAR 12	CNTXXX
Name	WI_DEN	VARCHAR 30	Free Text
Location	WI_LOC	VARCHAR 30	Free Text
Type	WI_TYP	VARCHAR 30	Free Text
Capacity (MLD)	WI_CAP	NUMBER 12.3	Free Text
AVG Supplied Volume (MLD)	WI_AGV	NUMBER 12.3	Free Text
Water Intake Status	WI_STS	VARCHAR 20	STS
Construction Year	WI_YEAR	NUMBER 4	Free Text
Notes	WI_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Water Treatment Plant”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WTP_ID	VARCHAR 12	CNTXXX
Name	WTP_DEN	VARCHAR 30	Free Text
Location	WTP_LOC	VARCHAR 30	Free Text
Type	WTP_TYP	VARCHAR 30	Free Text
Capacity (MLD)	WTP_CAP	NUMBER 12.3	Free Text
AVG Supplied Volume (MLD)	WTP_AGV	NUMBER 12.3	Free Text
WTP Status	WTP_STS	VARCHAR 20	STS
Construction Year	WTP_YEAR	NUMBER 4	Free Text
Notes	WTP_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Wellfield”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	WF_ID	VARCHAR 12	CNTXXX
Name	WF_DEN	VARCHAR 30	Free Text
Location	WF_LOC	VARCHAR 30	Free Text
Type	WF_TYP	VARCHAR 30	Free Text
Capacity (MLD)	WF_CAP	NUMBER 12.3	Free Text
AVG Supplied Volume (MLD)	WF_AGV	NUMBER 12.3	Free Text
Well-field Status	WF_STS	VARCHAR 20	STS
Construction Year	WF_YEAR	NUMBER 4	Free Text
Notes	WF_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Tank”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
ID	TNK_ID	VARCHAR 12	CNTxxx
Type	TNK_TYPE	VARCHAR 30	T_TYPE
Name	TNK_NAME	VARCHAR 30	Free Text
Construction Year	TNK_YEAR	NUMBER 4	Free Text
Number of basins	TNK_NTNKS	NUMBER 4	Free Text
Total capacity (m3)	TNK_CPT	NUMBER 12,3	Free Text
Annual overflow volume (m3/year)	TNK_VOLOVF	NUMBER 12,3	Free Text
Average supplied volume (m3/year)	TNK_VOLAVG	NUMBER 12,3	Free Text
Tank Status	TNK_STS	VARCHAR 20	STS
Note	TNK_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Pump Station”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
ID	PS_ID	VARCHAR 12	CNTXXX
Type	PS_TYPE	VARCHAR 30	PS_TYPE
Name	PS_NAME	VARCHAR 30	Free Text
Construction Year	PS_YEAR	NUMBER 4	Free Text
Note	PS_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Chamber”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	CH_ID	VARCHAR 12	CNTXXX
Type of chamber	CH_TYPE	VARCHAR 12	CNT_CH_TYPE
Chamber material	CH_MAT	VARCHAR 12	CNT_CH_MAT
Chamber size (H×L×W)	CH_SIZE	VARCHAR30	Free Text
Ground Elevation	CH_GEL	NUMBER 8,2	Free Text
Chamber Status	CH_STS	VARCHAR 20	STS
Note	CH_NOTE	VARCHAR 200	Free Text

Attributes for Container Infrastructure = “Surface Box”

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Identification Code	SB_ID	VARCHAR 12	CNTXXX
Spindle	SB_SP	LOGIC	Y/N
Ground Elevation	SB_GEL	NUMBER 8,2	Free Text
Surface Box Status	SB_STS	VARCHAR 20	STS
Note	SB_NOTE	VARCHAR 200	Free Text

8.2 NON-WSS ENTITIES

8.2.1 CUSTOMER

NAME: Customer (C)

DESCRIPTION: The purpose of this table is to store costumer details, information of water meter, meter billing record and the information of water access connection details. This table will be replaced by the corresponding PARTNER costumer database table.

ID: C

Type: Database Table

Attributes of the HCWW DB entity (Customer).

C_Meter

Description	AutoNumber	Width
Number of units	Number	Integer
Flat	Number	Integer
Meter diameter	Number	Double
Meter Status	Text	50
Current Reading	Number	Double
Usage	Text	50
Type of payment	Text	50
Connection Status	Text	50
Unit activity	Text	100
Activity description	Text	255

Attributes of the WES DB entity.

Customer Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Customer ID	C_ID	VARCHAR 12	Cxxxx
Customer Meter ID	C_USR	VARCHAR 12	CM
Customer Type	C_TYPE	VARCHAR 12	C_TYPE
Meter Number	C_METER_NO	VARCHAR 12	Free Text
Name	C_NAME	VARCHAR 30	Free Text
Address	C_ADDRESS	VARCHAR 30	Free Text
Current Meter Reading	C_MREAD	NUMBER 8	Free Text
Meter Reading Date	C_MDATE	DATE	Free Text
Meter Billing Record	C_MBILL	NUMBER 8	Free Text
Note	C_NOTE	VARCHAR 200	Free Text

8.2.2 WATER BALANCE

NAME: Water Balance (WBL)

DESCRIPTION: The purpose of this water balance table is to store NRW volume and evaluate the water balance in a selected area of interested (AOI) in the water network, the AOI could be a WTS, a WDS, a DMZ or a DMA area or any network selected area in which service connections will be selected and the input flow meters will be installed on the source pipelines on that area.

Non-revenue water (NRW) is water that has been produced and not paid by the customer. Such losses may be caused through leaking and burst pipes, illegal connections and metering inaccuracies.

ID: WBL

Type: Database Table

Attributes

DESCRIPTION	FIELD_NAME	FIELD FORMAT	ALLOWED VALUE
Water Balance Event ID	WBL_ID	VARCHAR 12	WBLXXXX
WTS_ID	WBL _WTS	VARCHAR 12	WTS
WDS_ID	WBL _WDS	VARCHAR 12	WDS
DMZ_ID	WBL _SEC	VARCHAR 12	DMZ
DMA_ID	WBL _DMA	VARCHAR 12	DMA
INITIAL DATE	WBL_IDATE	DATE	Free Text
FINAL DATE	WBL_FDATE	DATE	Free Text
System Input Water Volume (in m3)	WBL _INPUT	NUMBER 12,2	Free Text
Authorized billed Metered Consumption (in m3)	WBL _AB_M	NUMBER 12,2	Free Text
Authorized billed unmetered Consumption (in m3)	WBL _AB_UM	NUMBER 12,2	Free Text
Authorized unbilled metered Consumption (in m3)	WBL _AUB_M	NUMBER 12,2	Free Text
Authorized unbilled Unmetered Consumption (in m3)	WBL_AUB_UM	NUMBER 12,2	Free Text
Apparent Loss: Unauthorized Consumption (in m3)	WBL_CMLOSS1	NUMBER 12,2	Free Text
Apparent Loss: Customer Meter inaccuracies & Data handling errors (in m3)	WBL_CMLOSS2	NUMBER 12,2	Free Text
Physical Loss1[11]	WBL_LEAK1	NUMBER 12,2	Free Text
Physical Loss2[12]	WBL_LEAK2	NUMBER 12,2	Free Text
Physical Loss3[13]	WBL_LEAK3	NUMBER 12,2	Free Text
Water Losses[14]:	WBL_WLOSS	NUMBER 12,2	Free Text
Non-Revenue Water NRW (in m3)	WBL_NRW	NUMBER 12,2	Free Text
NRW in Percentage	WBL_%NRW	NUMBER 12,2	Free Text

[11] Leakage on Transmission and Distribution Mains (in m3)
[12] Leakage and overflows from the storage tanks (in m3)
[13] Leakage on service connections up to the customer meter (in M3)
[14] The difference between System input volume and Authorised consumption (in M3)

System input volume: Water volume input to that part of the water supply system to which the water balance calculation relates.

Authorised consumption: Water volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorised to do so for residential, commercial and industrial purposes. It includes water exported. If there are a significant number of customers that are not billed by volume, then Billed unmetered consumption should be estimated by sample metering a selection of customers, chosen to be statistically representative of the population. Note that this component may also include firefighting, flushing, street cleaning, public fountains, building water, etc. or some of these may be unbilled and/or metered, depending on the water utility's policies.

Water losses: The difference between System input volume and Authorised consumption. Water losses can be considered as total volume for the whole system or for partial systems such as raw water mains, transmission and distribution. Water losses consist of apparent losses and real losses

Apparent losses: accounts for theft or illegal use and all types of inaccuracies associated with production metering and customer metering (the combined effect of any under- and over-registration) and systematic data handling errors.

Real losses: physical water losses from the pressurised system, up to the point of customer metering. Physical losses after the point of customer metering are excluded from this definition of Commercial losses, but these can be significant and may be worthy of separate analysis. The annual volume of all types of leaks, bursts and overflows depends on frequencies, flow rates and average duration of individual leaks.

Non-revenue water: the difference between System input volume and Billed authorised consumption. Non-revenue water includes real losses, apparent losses and Unbilled authorised consumption.

8.2.3 MONITORING DATA REGISTER

NAME:	Flow Meter readings (FMR)
DESCRIPTION:	The purpose of this table is to receive, store and maintain flow-meter readings.
ID:	FMR
Type:	Database Table

NAME:	Monitoring Point readings (MPR) (Table)
DESCRIPTION:	The purpose of this table is to receive, store and maintain monitor point readings.
ID:	MPR
Type:	Database Table

NAME:	Customer readings (CMR) (Table)
DESCRIPTION:	The purpose of this table is to receive, store and maintain customer meter readings.
ID:	CMR
Type:	Database Table

ANNEXES

ANNEX 1: HCWW DB TABLES

HCWW GIS DB TABLES

Compact_TP (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	255
Status	Status	Text	255
Intake_Type	Intake type	Text	255
Design_Capacity	Design capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Output_Pipe_Num	Number of output pipe	Number	Integer
Filter_Num	Number of filters	Number	Integer
Tank_Volume	Tank_Volume	Number	Long Integer
Ground_Elevation (NULL)	Ground elevation	Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Station_Code (NULL)	Station code	Text	50
District_	District	Text	100
Sections_	Sections	Text	100
x	x	Number	Double
y	y	Number	Double

Desalination_TP (Point) Empty

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	255
Status	Status	Text	255
Intake_Type	Intake Type	Text	255
Design_Capacity	Design Capacity	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Ent_Raw_Rate_Cap	The amount of turbid water entering the station, m3 / day	Number	Long Integer
Out_Raw_Rate_Cap	The amount of turbid water leaving the station, m3 / day	Number	Long Integer
Ent_Raw_Pipe_Num	The number of turbidity lines entering the station	Number	Integer
Output_Pipe_Num	Number of filtered package lines	Number	Integer
Treat_RPH	The average pressure of pumps	Number	Double
Filter_Num	Number of filters	Number	Integer
Tank_Volume	Tank Volume	Number	Long Integer
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Text	255
created_user	created_user	Text	255

OBJECTID	Description	AutoNumber	Width
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Station_Code	Station Code	Text	50
Output_Raw_Pipe_Num	The number of turbidity lines emerging from the station	Text	50
Ground_Elevation	Ground level	Number	Double
District_	District	Text	100
Sections_	Sections	Text	100

Filter (Point) Empty

OBJECTID	Description	AutoNumber	Width
Filter_num	Filter number	Number	Integer
TYPE	Filter type	Text	50
Lenght	Filter length	Number	Double
Width	Filter width	Number	Double
Filter_Depth	Filter Depth	Number	Double
Filter_Capacity	Filter Capacity	Number	Long Integer
Status	Status	Text	255
In_Svc_Year	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Station_Code	Station_Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100

Fitting (Point)

OBJECTID	Description	AutoNumber	Width
TYPE	Type of disconnection	Number	Integer
Notes	Notes	Text	255
In_Svc_Year	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
Rotation_Angle	Rotation_Angle	Number	Double
RuleID	RuleID	Number	Long Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Pipe_ID (NULL)	Pipe_ID	Number	Long Integer
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Hydrant (Point)

OBJECTID	Description	AutoNumber	Width
NOM_DIA	Pipe diameter	Number	Integer
H_Position (NULL)	Fire valve location	Text	50
Status	Status	Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Text	255
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Pipe_ID (NULL)	Pipe_ID	Number	Long Integer
District_	District	Text	100
Sections_ (NULL)	Sections	Text	100
District_en	District_en	Text	50

Intake (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	100
E_Name	The name of the station is in English	Text	100
Station_Type	Station type	Text	50
Status	Status	Text	50
Intake_Type	Intake type	Text	50
Design_Capacity	Design capacity	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Raw_Pipe_Num	The number of non-clear water pipes	Number	Integer
G_Elevation	Ground level	Number	Double
MIn_Intake_LVE	Lower grip level	Number	Double
Max_Intake_LVE (NULL)	The highest intake level	Number	Double
Water_Source	Water Source	Text	255
MIN_W_S_LVE	The lowest level of the water source	Number	Double
Max_W_S_LVE	The highest level of the water source	Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Notes	Notes	Memo	
created_user	Created user	Text	255
created_date	Created date	Date/Time	
last_edited_user	Last edited user	Text	255
last_edited_date	Last edited date	Date/Time	
Station_Code (NULL)	Station Code (NULL)	Text	50
District_	District_	Text	100
Sections_ (NULL)	Sections_ (NULL)	Text	100
District_en	District_en	Text	50

Meter (Point) Empty

OBJECTID	Description	AutoNumber	Width
Location		Text	100
Meter_Num		Number	Long Integer
Meter_Dia		Number	Integer
TYPE		Text	50
MES_TYPE		Text	50
Manfacture		Text	50
Status		Text	255
Notes		Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
Enabled		Number	Integer
created_user		Text	255
created_date		Date/Time	
last_edited_user		Text	255
last_edited_date		Date/Time	
Station_Code		Text	50
Street_Name		Text	50
Section_Code	Village or city code	Text	255
District_		Text	100
Sections_		Text	100

Pipe (Line)

OBJECTID	Description	AutoNumber	Width
NOM_DIA	Pipe diameter	Number	Integer
PIPE_MATL		Text	255
AS_BUILT		Text	20
water_Type		Text	50
Pipe_Type		Number	Integer
Status		Text	50
PIPE_Depth		Number	Double
IN_SVC_YR	Year of entry into service	Number	Integer
Dist_Pavement		Number	Double
Notes		Text	255
ENABLED		Number	Integer
created_user		Text	255
created_date		Date/Time	
last_edited_user		Text	255
last_edited_date		Date/Time	
Station_Code		Text	50
Street_Name		Text	50
Section_Code	Village or city code	Text	255
District_		Text	100
Sections_		Text	100
HA_Label		Text	50
project		Text	150
District_en		Text	150

PUMP (Point) Empty

OBJECTID	Description	AutoNumber	Width
TYPE	Pump type	Text	50
Feeder_DIA	Feed pipe diameter	Number	Integer

OBJECTID	Description	AutoNumber	Width
Output_DIA	Diameter of the discharge pipe	Number	Integer
Horse_Power	The power of the pump is the horse	Number	Double
HEAD	Pump capacity m	Number	Double
FLOW	Discharge rate m3 / hr	Number	Double
OPER_MODE	How to operate the pump	Text	50
Efficiency	Pump efficiency%	Number	Double
Status	Status	Text	255
Notes	Notes	Text	255
Manufacture	Country of Manufacture	Text	50
IN_SVC_YR	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Station_Code	Station_Code	Text	255
Pump_Code	Pump_Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100

Pump_Station (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the lift station in Arab	Text	50
E_Name	The name of the lift station in English	Text	50
Treat_RPH1	Average pressure of pumps 1	Number	Long Integer
Treat_RPH2 (NULL)	Average pressure of pumps 2	Number	Long Integer
Status	Status	Text	255
Notes	Notes	Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
PS_Code (NULL)	Lift station code	Text	50
Output_Pipe_Num	The number of pipes outside the station	Number	Integer
Entry_Pipe_Num	The number of pipes entering the station	Number	Integer
Pump_type	Pump type	Text	50
District_	District	Text	100
Sections_	Sections	Text	100

Station_Component (Polygon)

OBJECTID	Description	AutoNumber	Width
Station_Code (NULL)	Station Code	Text	50
Station_Name	Station Name	Text	50
Building_Name	Building Name	Text	50
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	

OBJECTID	Description	AutoNumber	Width
Notes	Notes	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100
Type (NULL)	Type	Text	50
Station_type	Station_type	Text	50
District_en	District_en	Text	50

Tank (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the reservoir is in Arabic	Memo	
E_Name	The name of the reservoir is in English	Text	255
VOLUME	The tank capacity is m3	Number	Double
Radius	The radius of the tank, m	Number	Double
Length	Length	Number	Double
Width	Width	Number	Double
Height	Height	Number	Double
FLOW	The flow rate is m3 / hour	Number	Double
Status	Status	Text	255
Ground_Elevation (NULL)	Ground elevation	Number	Double
TOP_Level	Tank surface level	Number	Double
Bottom_Level	Tank bottom level	Number	Double
Spillway_Level	Overflow pipe level	Number	Double
Inner_T_Depth	The depth of the inner tank	Number	Double
MIN_Level	The lowest water level inside the tank	Number	Double
MIN_Volume	The minimum tank storage capacity m3	Number	Double
IN_SVC_YR	Year of entry into service	Number	Long Integer
Feeder_DIA	Tank inlet pipe diameter	Number	Integer
Output_DIA	The diameter of the tank exit pipe	Number	Integer
Tank_Code (NULL)	Tank Code	Text	50
Notes	Notes	Text	255
Section_Code (NULL)	Village or city code	Text	255
Enabled	Enabled	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Type	Type	Number	Integer
District_	District_	Text	100
Sections_	Sections_	Text	100
x	x	Number	Double
y	y	Number	Double

Valve_Chamber (Point)

OBJECTID	Description	AutoNumber	Width
Chamber_ID	Chamber number	Number	Long Integer
TYPE	TYPE	Text	255

OBJECTID	Description	AutoNumber	Width
Length	Length	Number	Double
Width	Width	Number	Double
Chamber_Depth	Chamber depth	Number	Double
Num_valve	The number of valves inside the room	Number	Integer
Notes	Notes	Text	255
Enabled	Enabled	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Street_Name	Street_Name	Text	50
District_	District_	Text	100
Sections_ (NULL)	Sections_ (NULL)	Text	100
District_en	District_en	Text	50

W_VALVE (Point)

OBJECTID	Description	AutoNumber	Width
V_Num	Valve No.	Text	50
Valve_Kind	The main types of valves	Number	Integer
V_TYPE	Valve type	Text	50
V_OPR_CON	Valve operating condition	Text	10
V_VERIFY	Nature check	Text	20
X_DIST (NULL)	X_DIST (NULL)	Number	Double
Y_DIST (NULL)	Y_DIST (NULL)	Number	Double
Valve_Depth	Valve_Depth	Number	Double
Chamber_ID	Chamber_ID	Number	Integer
Status	Status	Text	50
Valve_DIA	Valve Diameter	Number	Integer
PIPE_DIA	Pipe Diameter	Number	Integer
Street_Name	Street_Name	Text	255
DIRECTION	Closing direction	Text	1
NUM_of_TURNS	The number of turns of closing the valve	Number	Integer
Close_Per	Close valve ratio	Number	Integer
In_Svc_Year	Year of entry into service	Number	Integer
ROT_ANGL (NULL)	Symbol Angle	Number	Double
Notes	Notes	Text	255
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
District_	District_	Text	100
Sections_	Sections_	Text	100
District_en	District_en	Text	50

Well_station (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	255
E_Name	The name of the station is in English	Text	100
Well_Num	Number of wells	Number	Integer
Design_Capacity	Design Capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Status	Status	Text	200
Output_Pipe_Num	Number of output pipes	Number	Integer
Ground_Elevation (NULL)	Ground elevation	Number	Double
Tank_Volume		Number	Long Integer
IN_SVC_YR	Year of entry into service	Number	Integer
NOTES	Tank volume m3	Text	50
created_user (NULL)	created_user (NULL)	Text	255
created_date (NULL)	created_date (NULL)	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Station_Code (NULL)	Station code (NULL)	Text	50
District_	District	Text	100
Sections_	Sections	Text	100
x	x	Number	Double
y	y	Number	Double

WELLS (Point) Empty

OBJECTID	Description	AutoNumber	Width
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Well_Num	Well number	Number	Integer
Well_Depth	Well depth	Number	Double
Well_Pipe_Diam	Well pipe diameter	Number	Integer
CASE_	Well condition	Text	100
NOTES	Notes	Text	100
IN_SVC_YR	Year of entry into service	Number	Integer
Enabled	Enabled	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Station_Code	Station_Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100

WTP (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	The name of the station is in Arabic	Text	100
E_Name	The name of the station is in English	Text	100
Status	Status	Text	50
Design_Capacity	Design capacity m3 / day	Number	Long Integer
Actual_Capacity	Actual energy m3 / day	Number	Long Integer
Out_Raw_Rate_Cap	The amount of turbid water leaving the station, m3 / day	Number	Long Integer

OBJECTID	Description	AutoNumber	Width
EntryRaw_Pipe_Num	The number of turbidity lines entering the station	Number	Integer
Output_Pipe_Num	Number of filtered package lines	Number	Integer
Output_Raw_Pipe_Num	The number of turbidity lines emerging from the station	Number	Integer
Clarifiers_Num	Number of clarifiers	Number	Integer
Filters_Num	Number of filters	Number	Integer
Ground_Tank_Num	The number of ground tanks	Number	Integer
Ground_Tank_Volume	The capacity of the ground tank is m3	Number	Long Integer
Curd_Removal	The place of disposal of the grub	Text	255
IN_SVC_YR	Year of entry into service	Number	Integer
Ground_Elevation	Ground elevation	Number	Double
Intake_Type	Intake type	Text	50
Notes	Notes	Memo	
created_user (NULL)	Created user	Text	255
created_date (NULL)	Created date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Station_Code (NULL)	Station Code	Text	50
District_	District_	Text	100
Sections_	Sections_	Text	100
x	x	Number	Double
y	y	Number	Double

Customer Meter (Point)

OBJECTID	Description	AutoNumber	Width
ACCT_Num (NULL)		Number	Long Integer
Bronze_Num (NULL)	Bronze number	Number	Long Integer
CUST_Name	Subscriber's name	Text	50
Bld_Num (NULL)	building number	Text	255
Floor_num (NULL)	Floor number	Number	Integer
Flat_num (NULL)	Flat number	Number	Integer
Street_Name	Street_Name	Text	50
Meter_Diameter	Meter_Diameter	Number	Integer
Zone_ID (NULL)	Zone_ID (NULL)	Number	Integer
Cust_Category (NULL)	Customer classification	Text	50
Conn_Type (NULL)	Connection type	Text	255
Status	Meter status	Text	255
Contract_Date (NULL)	Contract date	Date/Time	
Stop_S_Date (NULL)	Date of discontinuation of service	Date/Time	
REASON (NULL)	Reason	Text	100
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
District_	District	Text	100

OBJECTID	Description	AutoNumber	Width
	Sections		
Sections_ (NULL)		Text	100

C_Pipe (Line) Customer Line

OBJECTID	Description	AutoNumber	Width
ACCT_NO (NULL)	Account number	Number	Long Integer
DIAMETER	DIAMETER	Number	Double
MATERIAL	MATERIAL	Text	50
AS_BUILT (NULL)	File number	Text	10
Status	Status	Text	50
IN_SVC_YR	Year of entry into service	Number	Integer
ENABLED	ENABLED	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Street_Name (NULL)	Street name	Text	50
Notes (NULL)	Notes	Text	50
District_	District	Text	100
Section_	Section	Text	100

HCWW NON-WSS GIS DB TABLES

Bridges (Point)

OBJECTID	Description	AutoNumber	Width
A_Name	Bridge name in Arabic	Text	100
E_Name (NULL)	Bridge name in English	Text	255
type (NULL)	type	Text	50
Notes (NULL)	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
District_	District_	Text	100
Section_	Section_	Text	100

Building (Polygon)

OBJECTID	Description	AutoNumber	Width
A_Name	Building name in Arabic	Text	50
E_Name (NULL)	Building name in English	Text	50
A_Street (NULL)	Street name in Arabic	Text	50
E_Street	Street name in English	Text	50
Block_num (NULL)	Block number	Number	Long Integer
Building_num (NULL)	Building number	Number	Long Integer
Building_code (NULL)	Building code	Text	
Floors_num	Floors number	Number	Integer
Flats_num (NULL)	Flats number	Number	Integer

OBJECTID	Description	AutoNumber	Width
Population_num (NULL)	Population number	Number	Integer
Case (NULL)	Case	Text	50
Notes	Notes	Memo	
Mogawra	Neighbour	Text	50
Region	Region	Text	50
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Section Code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate	Governorate	Text	50

Spot_Elevation (Point)

OBJECTID	Description	AutoNumber	Width
Elevation	Elevation	Number	Double
POINT_X	POINT_X	Number	Double
POINT_Y	POINT_Y	Number	Double
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255

Drains (Line)

OBJECTID	Description	AutoNumber	Width
Drainge_Code (NULL)	Drainage code	Text	50
A_NAME	Name in Arabic	Text	50
E_NAME	Name in English	Text	50
Drainge_Type (NULL)	Drainage type	Text	50
RANK	RANK	Number	Integer
Width	Width	Text	50
Removal_Point (NULL)	Removal point	Text	50
Master_Drainge (NULL)	Master drainage	Text	50
Village_num (NULL)	Village number	Number	Integer
Total_Population (NULL)	Total Population	Number	Long Integer
Total_Population_Discharge (NULL)	Total discharge	Number	Double
Irrigation_Discharge (NULL)	Irrigation discharge	Number	Double
Criticl_Level (NULL)	Critical level	Number	Double
ACTUAL_LEVEL (NULL)	ACTUAL_LEVEL	Number	Double
POLLUTION_DEGREE (NULL)	POLLUTION_DEGREE	Number	Double
REGION	REGION	Text	80
Handsat	Engineering Management	Text	80
Notes (NULL)	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	**Date/Time**	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	**Date/Time**	
District_	District_	Text	100

OBJECTID	Description	AutoNumber	Width
Governorate	Governorate	Text	50

Canals (Line)

OBJECTID	Description	AutoNumber	Width
A_NAME	Canal name in Arabic	Text	50
E_NAME	Canal name in English	Text (NULL)	50
Canal_Code	Canal code	Text (NULL)	50
TYPE	TYPE	Text(NULL)	50
RANK	RANK	Number (NULL)	Integer
Width	Width	Text	50
Master_Canal	Master Canal	Text (NULL)	50
Criticl_Level	Critical Level	Number (NULL)	Double
ACTUAL_LEVEL	ACTUAL_LEVEL	Number (NULL)	Double
POLLUTION_DEGREE	POLLUTION_DEGREE	Number (NULL)	Double
REGION	REGION	Text (NULL)	80
Handsat	Engineering Management	Text (NULL)	80
Notes	Notes	Memo (NULL)	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
District_	District_	Text	100
Governorate	Governorate	Text	50

Company_Sites (Polygon)

OBJECTID	Description	AutoNumber	Width
A_name	Company site name in Arabic	Text	50
E_name (NULL)	Company site name in English	Text	50
Type	Type	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Section_ (NULL)	Section	Text	100
District_ (NULL)	District	Text	100
Governorate	Governorate	Text	50

Districts (Polygon)

OBJECTID	Description	AutoNumber	Width
A_Name	District name in Arabic	Text	50
E_Name (NULL)	District name in English	Text	255
District_Code (NULL)	District code	Text	20
Type	Type	Text	255
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Governorate	Governorate	Text	50

Fence (Polygon)

OBJECTID	Description	AutoNumber	Width
A_Name	Fence name	Text	100
Notes	Notes	Text	200
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate	Governorate	Text	50

Governorate (Polygon)

OBJECTID	Description	AutoNumber	Width
Gov_A_Name	Governorate name in Arabic	Text	50
Gov_E_name	Governorate name in English	Text	50
Governorate_Code	Governorate Code	Text	2
Districts_Num	Districts Number	Number	Integer
Local_admin_Num	Local_admin_Num	Number	Long Integer
Sections_Num	The number of the mother villages	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	

Green_Area (Polygon)

OBJECTID	Description	AutoNumber	Width
A_name (NULL)	Green area name in Arabic	Text	50
E_Name (NULL)	Green area name in English	Text	50
Type (NULL)	Type	Text	50
Notes (NULL)	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Section_ (NULL)	Section	Text	100
District_	District	Text	100
Governorate (NULL)	Governorate	Text	50

Land_Use (Polygon) Empty

OBJECTID	Description	AutoNumber	Width
A_name	Land use name in Arabic	Text	75
E_Name	Land use name in English	Text	75
Type	Type	Text	100
Notes	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255

OBJECTID	Description	AutoNumber	Width
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate	Governorate	Text	50

LandMark (Polygon)

OBJECTID	Description	AutoNumber	Width
A_NAME	Landmark name in Arabic	Text	100
E_Name	Landmark name in English	Text	100
A_Street	Street name in Arabic	Text	50
E_Street	Street name in English	Text	50
Landmark_Num	Landmark number	Text	50
Main_Type	Main Type	Number	Integer
Sub_Type	Sub Type	Text	50
Notes	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Section_Code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate	Governorate	Text	50

Maintenance_Branch (Polygon)

OBJECTID	Description	AutoNumber	Width
A_name	Maintenance Branch name in Arabic	Text	50
E_Name (NULL)	Maintenance Branch name in English	Text	50
Type	Type	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Section_ (NULL)	Section	Text	100
District_	District	Text	100
Governorate	Governorate	Text	50

POIs (Point) (Landmark internal building)

OBJECTID	Description	AutoNumber	Width
A_NAME	Name in Arabic	Text	100
E_Name	Name in English	Text	100
A_Street (NULL)	Street name in Arabic	Text	100
E_Street (NULL)	Street name in English	Text	100
Building_Num (NULL)	Building_Num	Number	Integer
Building_Code (NULL)	Building_Code	Text	50
Notes	Notes	Memo	
Region (NULL)	Region	Text	50
created_user	created_user	Text	255

OBJECTID	Description	AutoNumber	Width
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Section_ (NULL)	Section	Text	100
District_	District	Text	100
Governorate (NULL)	Governorate	Text	50

Railway (Line)

OBJECTID	Description	AutoNumber	Width
A_name	Railway name in Arabic	Text	50
E_Name	Railway name in English	Text	50
Type	Railway type	Text	50
Status	Status	Text	50
Direction	Direction	Text	50
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_ (NULL)	Section	Text	100
District_ (NULL)	District	Text	100
Governorate	Governorate	Text	255

Section (Polygon)

OBJECTID	Description	AutoNumber	Width
A_name	Section name in Arabic	Text	100
E_Name (NULL)	Section name in English	Text	100
Section_Code	Section code	Text	255
Local_Admin_Name (NULL)	Local admin name	Text	100
District_	District	Text	100
created_user	Created user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Governorate (NULL)	Governorate	Text	50

Street (Line)

OBJECTID	Description	AutoNumber	Width
A_NAME	Street name in Arabic	Text	100
A_NAME2	Street name in Arabic2	Text	100
E_Name	Street name in English	Text	100
Street_Code (NULL)	Street Code	Text	50
Street_Width	Street width	Number	Double
Street_Flow (NULL)	Street flow	Text	255
Street_Class	Street class	Text	100
Street_Struc (NULL)	Street type	Text	100
Street_Priv (NULL)	Street Privilege	Text	100
Speed	Speed	Number	Integer
Notes	Notes	Text	250
created_user	created_user	Text	255

OBJECTID	Description	AutoNumber	Width
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code	Village or city code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate (NULL)	Governorate	Text	50

Urban_Area (Polygon)

OBJECTID	Description	AutoNumber	Width
A_NAME	Urban area name in Arabic	Text	100
E_Name (NULL)	Urban area name in English	Text	50
Local_administration_unit (NULL)	Local administration name	Text	100
Notes (NULL)	Notes	Memo	
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
Section_Code (NULL)	Village or city code	Text	255
Section_	Section	Text	100
District_	District	Text	100
Governorate (NULL)	Governorate	Text	50

Water_bodies (Polygon)

OBJECTID	Description	AutoNumber	Width
A_NAME	Water body name in Arabic	Text	100
E_Name (NULL)	Water body name in English	Text	100
Type (NULL)	Type	Text	50
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
District_	District	Text	100
Governorate (NULL)	Governorate	Text	50

Local_administration (Polygon)

OBJECTID	Description	AutoNumber	Width
A_NAME	Local administration name in Arabic	Text	100
E_Name (NULL)	Local administration name in English	Text	100
Section_NUM	The number of villages belonging to the Local administration	Number	Integer
created_user	created_user	Text	255
created_date	created_date	Date/Time	
last_edited_user	last_edited_user	Text	255
last_edited_date	last_edited_date	Date/Time	
District_	District_	Text	100
Governorate	Governorate	Text	50

HCWW CUSTOMER DB TABLE

Description	AutoNumber	Width
Number of units	Number	Integer
Flat	Number	Integer
Meter diameter	Number	Double
Meter Status	Text	50
Current Reading	Number	Double
Usage	Text	50
Type of payment	Text	50
Connection Status	Text	50
Unit activity	Text	100
Activity description	Text	255

ANNEX 2: PROPOSED WSS GIS DB ENTITY – RELATIONSHIP DIAGRAM

ANNEX 3 – WES DB ENTITIES DOMAINS

Values for the fields: J_TYPE

TYPE	COD_TYPE
End cap	END CAP
Coupling (change of material)	JUNCTION
Reducer (change of diameter)	REDUCTION
Tee piece	TEE PIECE
Cross piece	CROSS PIECE

Values for the field: FM_CLASS

CLASS	COD_CLASS
Bulk (WTS)	BULK
Master (WDS)	MASTER
DMZ	DMZ
DMA	DMA
Unknown	UNKNOWN

Values for the field TYPE: FM_MTYPE

FM_TYPE	COD_MTYPE
Mechanical	MECHANICAL
Volumetric	VOLUMETRIC
Electro-Magnetic	MAGNETIC
Ultrasonic	ULTRASONIC
Turbine	TURBINE
Venturi	VENTURI
Other	OTHER
Unknown	UNKNOWN

Values for the field TYPE: FM_READT

FM_READT	COD_READT
Dry Dial	DRY DIAL
Wet Dial	WET DIAL
Digital	DIGITAL
Smart	SMART
Mechanic	MECHANIC
Other	OTHER
Unknown	UNKNOWN

Values for the fields TYPE: WO_TYPE

TYPE	VALUE
By gravity	By gravity
Pumped	Pumped
Unknown	Unknown

Values for the fields TYPE: WO_DCD

TYPE	COD_TYPE
Flap	Flap
Valve	Valve
Unknown	Unknown

Values for the field TYPE: AV_TYPE

TYPE	VALUE
Double Orifice	DOUBLE
Single Orifice	SINGLE
Unknown	UNKNOWN

values for the field: MP_LOGTYPE

TYPELOG	COD_TYPELOG
Pressure gauge	Pressure
Quality	Quality
Other	Other

Values for the field: MP_TYPE

TYPE	COD_TYPE
Analog	ANALOG
Digital	DIGITAL
Dry	DRY
Wet	WET
Unknown	UNKNOWN

Values for the field: WI_TYPE

Type	DESCRIPTION
River	Directly from river or natural channel
Irrigation Canal	Irrigation canal, usually concrete lined
Canal	From canal, stream or large ditch
Dam	Directly from a dam
Gravity spring	Spring Capture
Artesian spring	Spring Capture

Values for the field: WI_QUAL

Type	COD_TYPE
Good	GOOD
Poor	POOR

Values for the field: WF_TYPE

TYPE	VALUE
Borewell	BOREWELL
Dug well	DUG WELL
Deep well	DEEP WELL
Shallow well	SHALLOW WELL
Other	OTHER
Unknown	UNKNOWN

Values for the field: WTP_TRTYPE

TYPE	VALUE
PRIMARY	PRIMARY (PHISICAL)
SECONDARY	SECONDARY (BIOLOGOCAL)
TERTIARY	TERTIARY (CHEMICAL)
UNKNOWN	UNKNOWN

Values for the fields TYPE: T_TYPE

TYPE	VALUE
Ground level	GROUND LEVEL STORAGE
Underground	UNDERGROUND STORAGE
Elevated	ELEVATED STORAGE
Water tower	WATER TOWER
Other	OTHER
Unknown	UNKNOWN

This Project is funded by the European Union

Values for the fields TYPE: T_CTYPE

TYPE	VALUE
Stone Masonry	STONE MASONRY
Brick Masonry	BRICK MASONRY
Steel	STEEL
Fiberglass	FIBERGLASS
Reinforced Concrete (RCC)	REINFORCED CONCRETE
Other	OTHER
Unknown	UNKNOWN

Values for the field: PS_PCONN

TYPE	VALUE
Series	SERIES
Parallel	PARALLEL
Other	OTHER
Unknown	UNKNOWN

Values for the field: PS_PTYPE

TYPE	VALUE
Horizontal Centrifugal	HORIZONTAL CENTRIFUGAL
Vertical Spindle Shaft Driven	VERTICAL SPINDLE SHAFT DRIVEN
Submersible	SUBMERSIBLE
Other	OTHER
Unknown	UNKNOWN

Values for the fields TYPE: V_TYPE

TYPE	COD_TYPE
Ball Valve	BALL VALVE
Butterfly Valve	BUTTERFLY VALVE
Flow Control Valve	FLOW CONTROL VALVE
Gate (sluice)	GATE VALVE (SLUICE VALVE)
Non-Return Valve	NON-RETURN VALVE (REFLUX VALVE/CHECK VALVE)
Pressure Reducing Valve	PRESSURE REDUCING VALVE
Pressure Sustaining Valve	PRESSURE SUSTAINING VALVE
Unknown	UNKNOWN

Values for the field: P_FLG

TYPE	VALUE
Raw Water	RAW WATER PIPE
Trunk main (Transmission)	TRUNK
Principal [Primary Distribution (main)]	PRINCIPAL
Local 2 [Secondary Distribution (sub-main)]	LOCAL2
Local 3 [Tertiary Distribution (branch)]	LOCAL3

Values for the fields TYPE: P_TYPE

TYPE	VALUE
Siphon	SIPHON
Pressurised	PRESSURISED
By gravity	BY GRAVITY
Tunnel	TUNNEL
Unknown	UNKNOWN

Values for the P_DN_OTHER

CODE	VALUE
32	32
40	40
50	50
60	60
63	63
65	65
75	75
80	80
90	90
100	100
110	110
125	125
140	140
150	150
160	160
175	175
180	180
200	200
225	225
250	250

CODE	VALUE
275	275
280	280
300	300
315	315
350	350
355	355
400	400
450	450
500	500
550	550
560	560
600	600
630	630
650	650
700	700
710	710
750	750
800	800
850	850
900	900
1000	1000
1050	1050
1100	1100
1200	1200
1400	1400
99	Unknown

Values for the P_DN_AC

CODE	VALUE
50	50
80	80
100	100
125	125
150	150
200	200
250	250
300	300
350	350
400	400
450	450
500	500
600	600
700	700
800	800
99	Unknown

Values for the P_DN_CI

CODE	VALUE
80	80
100	100
150	150
200	200
250	250
300	300
350	350
400	400
450	450
500	500
600	600
750	750
900	900
1050	1050
1200	1200
99	Unknown

Values for the P_DN_DI

CODE	VALUE
80	80
100	100
150	150
200	200
250	250
300	300

CODE	VALUE
350	350
400	400
450	450
500	500
600	600
700	700
750	750
800	800
900	900
1000	1000
1100	1100
1200	1200
1400	1400
99	Unknown

Values for the P_DN_HDPE

CODE	VALUE
20	20
32	32
40	40
50	50
63	63
75	75
90	90
110	110
125	125
140	140
160	160
180	180
200	200
225	225
250	250
280	280
315	315
355	355
400	400
450	450
500	500
560	560
630	630
99	Unknown

Values for the P_DN_MS

CODE	VALUE
300	300

CODE	VALUE
350	350
400	400
450	450
500	500
550	550
600	600
650	650
700	700
750	750
800	800
850	850
900	900
1000	1000
1200	1200
1400	1400
99	Unknown

Values for the P_DN_PVC

CODE	VALUE
32	32
40	40
50	50
63	63
75	75
90	90
110	110
125	125
160	160
180	180
200	200
225	225
250	250
280	280
315	315
355	355
400	400
450	450
500	500
630	630
710	710
800	800
99	Unknown

Values for the P_DN_GI

CODE	VALUE
40	40
50	50
63	63
75	75
90	90
110	110
125	125
160	160
180	180
200	200
99	Unknown

Values for the P_DN_GRP

CODE	VALUE
300	300
99	Unknown

Values for the fields P_COND

STS	COD_STS
Abandoned	ABANDONED
Under Design	UNDER DESIGN
Under Tender	UNDER TENDER
Under Construction	UNDER CONSTRUCTION
Under Testing	UNDER TESTING
Operating	OPERATING
Other	OTHER
Unknown	UNKNOWN

Values for the field TYPE: SD_TYPE

TYPE	COD_TYPE
Vessel	Vessel
Air Vessel	Air Vessel
Slow Closure Valve	Slow Closure Valve
Surge shaft	Surge shaft
Increased Pump Inertia	Increased Pump Inertia
Other	Other
Unknown	Unknown

Values for the field TYPE: WCP_TYPE

TYPE	COD_TYPE
Hydrant	Hydrant
Fire-Hydrant	Fire Hydrant
Public Tap	Public Tap
Other	Other
Unknown	Unknown

Values for the field TYPE: WCP_PRP (for Hydrant only)

TYPE	COD_TYPE
Irrigation	Irrigation
Street-washing	Hydrant
Other	Other
Unknown	Unknown

Value of the field Intervention Type: INT_TYPE

TYPE	CODE_TYPE
Preventive	Preventive
Corrective	Corrective
Reliability Centred	Reliability Centred
Other	Other
Unknown	Unknown

values for the field: INT_STS

TYPE	CODE_TYPE
Activated	Activated
Aborted	Aborted
Stand-by	Stand-by
In Progress	In Progress
Completed	Completed
Other	Other
Unknown	Unknown

Values for the field: SC_MAT

CODE	DESCRIPTION	ALLOWED VALUE
0	Other	OTHER
4	HDPE	HDPE

CODE	DESCRIPTION	ALLOWED VALUE
6	Mild Steel	MS
9	PVC	PVC
10	GI	GI
99	Unknown	UNKNOWN

Values for the field: SC_DN_OTHER

CODE	VALUE
6	6
8	8
10	10
15	15
16	16
20	20
25	25
32	32
40	40
50	50
60	60
63	63
65	65
75	75
80	80
90	90
100	100
110	110
125	125
140	140
150	150
160	160
175	175
180	180
200	200
99	Unknown

Values for the field: SC_DN_HDPE

CODE	VALUE
16	16

CODE	VALUE
20	20
25	25
32	32
40	40
50	50
63	63
75	75
90	90
110	110
125	125
140	140
160	160
180	180
200	200
99	Unknown

Values for the field: SC_DN_MS

CODE	VALUE
10	10
15	15
20	20
25	25
32	32
40	40
50	50
65	65
80	80
90	90
100	100
125	125
150	150
175	175
200	200
99	Unknown

Values for the field: SC_DN_PVC

CODE	VALUE
20	20
25	25
32	32
40	40
50	50
63	63
75	75
90	90
110	110
125	125
140	140
160	160
180	180
200	200
99	Unknown

Values for the field: SC_DN_GI

CODE	VALUE
6	6
8	8
10	10
15	15
20	20
25	25
32	32
40	40
50	50
65	65
80	80
90	90
100	100
125	125
150	150
175	175
200	200
99	Unknown

values for the fields: CNT_INFR

INFRASTRUCURE	COD_INFR
Water Intake	WATER INTAKE
Wellfield	WELLFIELD
Water Treatment Plant	WATER TREATMENT PLANT
Pump Station	PUMP STATION
Tank	TANK
Chamber	CHAMBER
Surface Box	SURFACE BOX

values for the fields: CNT_CH_TYPE

TYPE	COD_TYPE
Meter chamber	METER CHAMBER
Valve chamber	VALVE CHAMBER
Hydrant chamber	HYDRANT CHAMBER
Wash-out chamber	WASH-OUT CHAMBER
Well-head chamber	WELL-HEAD CHAMBER
Air Valve Chamber	AIR VALVE CHAMBER
Surface Box	SURFACE BOX
Other	OTHER

values for the fields: CNT_CH_MAT

CHAMBER MATERIAL	COD_TYPE
Precast	PRECAST
Reinforced Cement Concrete	RCC
Brick Masonry	BRICK MASONRY
Other	OTHER

Value of field Customer Type: C_TYPE

TYPE	CODE_TYPE
Commercial	Commercial
Industrial	Industrial
Domestic	Domestic
Public/Government	Government
Unknown	Unknown

Value of the field Type of Warning Media: WLOG_MTYPE

TYPE	CODE_TYPE
Phone	Phone
SMS	SMS
Email	Email
Official Document	Official Document
Unknown	Unknown

Value of the field Network Feature Type: INT_TYPE

TYPE	CODE_TYPE
Preventive	Preventive
Corrective	Corrective
Reliability Centred	Reliability Centred
Other	Other
Unknown	Unknown

Preventive Intervention: Preventive maintenance is maintenance performed in an attempt to avoid failures, unnecessary production loss and safety violations.

Corrective intervention: Corrective maintenance can be defined as the maintenance required to bring an item has failed or worn out back to working order. Corrective maintenance is carried out on all items where the consequences of failure or wearing out are not significant and the cost of this maintenance is much greater than preventive maintenance.

Reliability Centred Intervention: Reliability centred maintenance is an engineering framework that enables the definition of a complete maintenance regime. It regards maintenance as the mean to maintain the functionality that an user may require of a system in a defined operating context.

Value of the field Network Feature Type: INT_STS

TYPE	CODE_TYPE
Activated	Activated
Aborted	Aborted
Stand-by	Stand-by
In Progress	In Progress
Completed	Completed
Other	Other
Unknown	Unknown

Values for the field TYPE: CM_TYPE

TYPE	CM_TYPE
Dry-Dial Meter	DRY-DIAL
Wet-Dial Meter	WET-DIAL
Other	OTHER
Unknown	UNKNOWN

ANNEX 4 – WES DB COMMON DOMAINS

The following are domains that are common to a number of entities.

Values for the fields PN

TYPE	VALUE
6	6
10	10
12	12
20	20
Unknown	99

Values for the fields DN

TYPE	VALUE
50	50
65	65
80	80
100	100
125	125
150	150
200	200
250	250
300	300
400	400
450	450
500	500
550	550
600	600
700	700
800	800
900	900
1000	1000
1100	1100
1200	1200
99	Unknown

Values for the fields STS

FM_STS	COD_STS
Excellent	EXCELLENT
Good	GOOD
Average	AVERAGE
Poor	POOR
Very Poor	VERY POOR
Operating	OPERATING
Not Operating	NOT OPERATING
Unknown	UNKNOWN

Values for the fields MAT

CODE	Type	DESCRIPTION
0	Other	OTHER
1	AC	AC
2	CI	CAST IRON
3	DI	DUCTILE IRON
4	HDPE	HDPE
5	Lead	LEAD
6	MS	MILD STEEL
7	Steel	STEEL
8	Rubber	RUBBER
9	PVC	POLYVINYLCHLORIDE
10	GI	GALVANISED IRON
11	GRP	GLASSFIBER REINFORCED PLATIC
99	Unknown	UNKNOWN

Values for the fields COAT

PCOAT	COD_PCOAT
Untreated	UNTREATED
Bitumen - coated	BITUMEN - COATED
Epoxy resin	EPOXY RESIN
Extruded Polyethylene	EXTRUDED POLYETHYLENE
Other	OTHER
Unknown	UNKNOWN

values for the fields WARNING_TYPE

TYPE	COD_TYPE
Break	Break

TYPE	COD_TYPE
Leak	Leak
Meter Damaged	Meter Damaged
No water Supply	No water Supply
Water Supply drop down	Water Supply drop down
Poor Water Quality	Poor Water Quality
Pressure Drop	Pressure Drop
New Connection	New Connection
No Meter Reading	No Meter Reading
No Billing	No Billing
Pipe Repair	Repair
Pipe Replace	Replace
Other	Other

Values for the fields TYPE: WTS

CODE	DESCRIPTION
WTS1	WTS1
WTS2	WTS2
WTS3	WTS3
WTS4	WTS4
…	…

Values for the fields TYPE: WDS

CODE	DESCRIPTION
WDS1	WDS1
WDS2	WDS2
WDS3	WDS3
…	…

Values for the fields TYPE: DMZ

CODE	DESCRIPTION
DMZ1	DMZ1
DMZ2	DMZ2
DMZ3	DMZ3
…	…