RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

FIRE STUDY
AND
FIRE WATER MAIN NETWORK HYDRAULIC CALCULATION - MAASVLAKTE NEW AREA

REV.	DATE	STATUS
	2-9-2021	issued for local authorities
C	08/07/2021	ISSUED FOR FEED
B	02/02/2021	ISSUED FOR BASIC DESIGN
A	18/11/2020	ISSUED FOR REVIEW

DC

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INDEX

1.	GENERAL	4
1.1.	Introduction	4
1.2.	Scope of present document	5
1.3.	References	6
1.4.	Acronyms and Abbreviations	7
2.	FIRE WATER SYSTEM DESCRIPTION	8
3.	FIRE WATER DEMAND CRITERIA	9
4.	BASIS FOR FIRE WATER NETWORK VERIFICATION	10
4.1.	Basis	10
4.2.	Assumptions	10
4.3.	Tool	11
5.	FIRE SCENARIOS	12
5.1.	Fire Water demand in the NExBTL area (Unit 21)	12
5.1.1.	Fire Water Demand in Fire Scenario Area 1 (Unit 21)	14
5.1.2.	Fire Water Demand in Fire Scenario Area 2	20
5.1.3.	Fire Water Demand in Fire Scenario Area 3	26
5.1.4.	Fire Water Demand in Fire Scenario Area 4	30
5.1.5.	Fire Water Demand in Bio-propane Fire Scenario Area	35
5.1.6.	Fire Water demand in the ammonia loading area	39
5.2.	Fire Water demand in the storm water pond area (Unit 62)	41
5.3.	Fire Water demand in the flare area (Unit 67)	43
5.4.	Fire Water demand in the hot oil and HTU area (Unit 57/11)	46
5.4.1.	Fire Water Demand in Hot Oil Fire Scenario Area (Unit 57/11)	47
5.4.2.	Fire Water Demand in Hot Oil Storage Tank Fire Scenario Area (Unit 57/11)	51
5.4.3.	Fire Water Demand in HTU Fire Scenario Area 1 (Unit 57/11)	54
5.4.4.	Fire Water demand in HTU Fire Scenario Area 2 (Unit 57/11)	58
5.4.5.	Fire Water demand in the rerun bullet Fire Scenario Area (Unit 57/11)	62
5.5.	Fire Water demand in the intermediate storage area (Unit 42)	66
5.6.	Fire Water demand in the PTU area (Unit 12)	67
5.7.	Fire Water demand in the pre-treatment section Area (Unit 62)	69
5.8.	Fire Water demand in the pig launcher / receiver area (Unit 81)	70
5.9.	Fire Water demand in the utilities Area (Unit 53)	71
5.10.	Fire Water demand inside FW pumps building (Unit 86)	72
6.	NETWORK CONFIGURATION	74
7.	RESULTS	75
7.1.	Fire Water Demand	75
7.2.	Fire Water Network	75
7.3.	Fire Water Storage	81

8. ATTACHMENTS 82

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1. GENERAL

1.1. Introduction

Neste has a target to increase its renewable diesel production capacity in Rotterdam with a new NEXBTL2 Unit; in particular the units in RDCG scope of work are:

- Units in MNA Area:
  - Process Units:
    - Heat Treatment Unit (HTU) Unit 11;
    - Pre-Treatment Unit (PTU) Unit 12;
    - NExBTL 2 Unit 21;
    - Hot oil Unit Unit 57;
  - Auxiliary Units, Utilities and Offsites:
    - MNA Tank Farm Unit 42;
    - MNA Utilities Unit 53;
    - Waste Water Handling (MNA) Unit 62;
    - Flare System Unit 67;
    - Fire Water Unit 86;
  - Other Units:
    - Technical Buildings (MNA) Unit 76;
    - MNA Interconnecting Unit 81;
    - Corridor Interconnecting Unit 82,
- Units in Existing Refinery:
  - Auxiliary Units, Utilities and Offsites:
    - Refinery Tank Farm (existing) Unit 40;
    - Refinery Tank Farm (new) Unit 41;
    - Jetty Loading Expansion Unit 45/46;
    - Refinery Utilities Unit 52;
    - Refinery Waste Water Treatment Unit 60;
      (note: only new lifting station)
  - Other Units:
    - Civil/Industrial Buildings Unit 70;
    - Technical Buildings Unit 75;
    - Refinery Interconnecting Unit 80.

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1.2. Scope of present document

Scope of present document is to establish the fire water demand deriving from new fire scenarios and to verify the hydraulic performance of the Fire Water Network related to "MNA Area" as part of Project.

Hydraulic calculation report related to "Refinery New Area" is included in a separated report (doc. N° 082755C-000-CN-1901-0001).

The fire water demand is based on the expected consumption of fire water used:

- as cooling medium,
- as fire suppression medium,
- as gas dispersion and/or abetment medium,
- as carrier for foaming solution for foam generation.

In order to achieve the scope of assessing the fire water demand and to verify the adequacy of the system the following steps are needed:

a) establish system configuration,
b) assess target for evaluation,
c) perform assumption when data are not available,
d) select tool for calculation,
e) identify each separate fire scenario,
f) assess fire water demand for each scenario,
g) check adequacy of systems.

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1.3. References

Ref	Title	Doc. Number	Rev
Ref. [1]	Active Fire Protection Philosophy	082755C-000-JSD-1900-0001	D
Ref. [2]	Deleted		
Ref. [3]	General Plot Plan MNA Area RDCG Project	082755C-000-DW-0051-0005	E
	012 (PTU) - Unit Plot Plan	082755C-012-DW-0051-0001-01	C
	021 (NEXBTL) - Unit Plot Plan	082755C-021-DW-0051-0001-01	C
	042 (Tank Farm MNA) - Unit Plot Plan	082755C-042-DW-0051-0001-01	C
	053 (Utilities MNA) - Unit Plot Plan	082755C-053-DW-0051-0001-01	C
	057 (Hot Oil) / 011 (HTU) Unit Plot Plan	082755C-057-DW-0051-0001-01	C
	062 (WWT Handling MNA) Unit Plot	082755C-062-DW-0051-0001-01	C
	062 (WWT Handling MNA) - Unit Plot Plan Pre-Treatment Section	082755C-062-DW-0051-0001-02	A
	067 (Flare System) Unit Plot Plan	082755C-067-DW-0051-0001-01	C
	Unit 081 (Interconnecting Mna) Unit Plot Plan	082755C-081-DW-0051-0001-01	C
	086 (Firewater) - Unit Plot Plan	082755C-086-DW-0051-0001-01	C
Ref. [4]	Fire Water Pump 86GA-01 A/B/C	082755C-086-SP-0910-0001	A
Ref. [5]	Deleted		
Ref. [6]	Deleted		
Ref. [7]	Centrifugal Pump Process Data Sheet	2305-G85-SP-0910-01	1
Ref. [8]	Process Description MNA Fire Water Unit 86	082755C-086-CN-0009-0001	C
Ref. [9]	Major Underground And Piping Layout MNA Area - Part 1	082755C-000-DW-1442-0001-02	D
	Major Underground And Piping Layout MNA Area - Part 2	082755C-000-DW-1442-0001-03	D
	Major Underground And Foundation Layout Unit 057/011 Hot Oil And Htu	082755C-057-DW-1442-0001-01	A

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1.4. Acronyms and Abbreviations

FW: Fire Water

MNA: Maasvlakte New Area

NFPA: National Fire Protection Association

PGS: Publicatiereeks Gevaarlijke Stoffen

PTU: Pre Treatment Unit

RJF: Renewable Jet Fuel

RDCG: Rotterdam Capacility Growth

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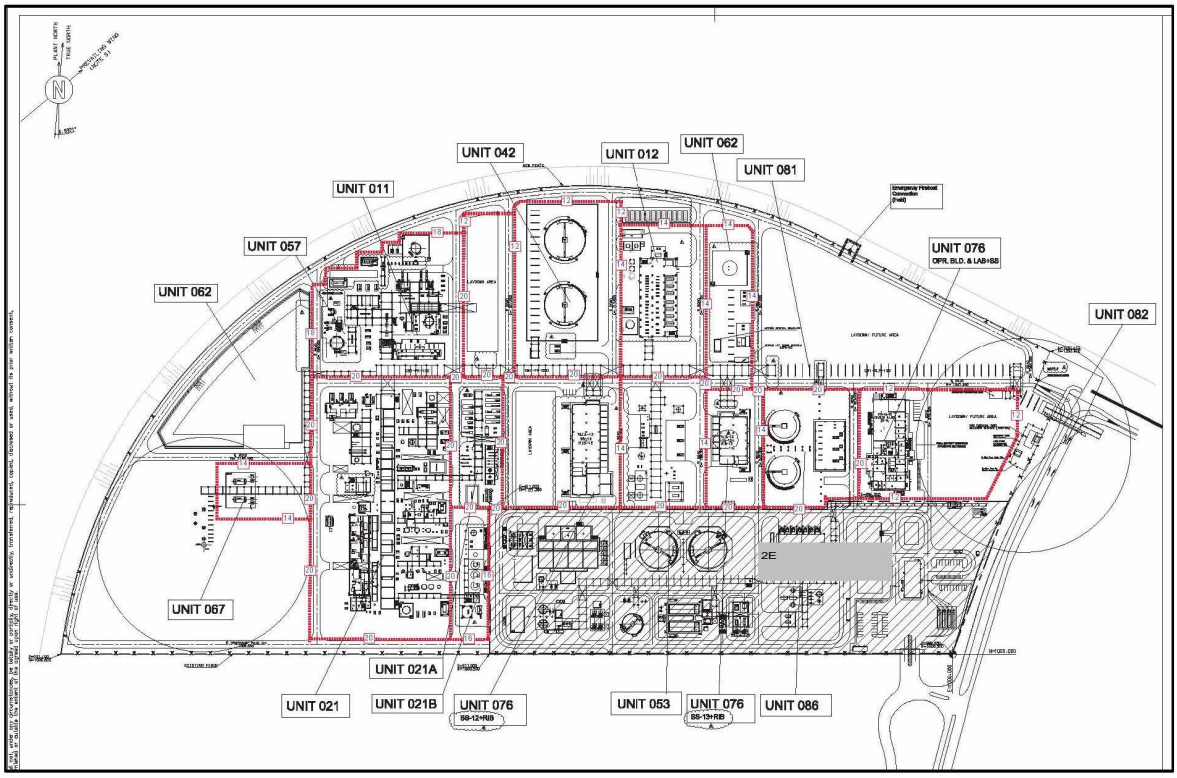
2. FIRE WATER SYSTEM DESCRIPTION

The new facilities located at MNA will be served by new dedicated fire water system with associated storage and pumping facilities.

As part of current project, the fire water network will be placed as depicted in the following picture 2.a.

Picture 2.a: schematic representation of FW network required for the RDCG Project – MNA Area



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3. FIRE WATER DEMAND CRITERIA

The fire water system shall be verified to guarantee the continuous supply at the required capacity and pressure for the required period.

The fire water storage capacity is calculated on the basis of the supply period for which the uninterrupted water supply is required: which is, for each fire scenario, the sum of the following:

- FW required for extinguishing primary source as per the scenario duration (especially for foam systems because the foam supply is limited);
- plus 4 hours for cooling;
- plus 4 hours for fire brigade at 600 m3/h.

The fire water demand for each fire scenario is based on requirements listed into Ref. [1].

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4. BASIS FOR FIRE WATER NETWORK VERIFICATION

4.1. Basis

According to Ref. [1] the following points shall be considered:

The main ring shall be verified by hydraulic calculation considering “C” factor for relating pipe material in the Hazen-William’s formula.

The network shall be verified to supply fire water at following conditions:

- Case A:
  1. Flowrate: equal to the Water Demand figure at the reference area;
  2. Pressure: the minimum operating pressure shall not be lower than 9.0 barg at network take-off point to the reference area users.
  3. Configuration: the network grid shall be considered in operation with one the fire water main supply route (one branch comprised between post indicator isolation valves) is out of operation.

- Case B:
  1. Flowrate: 120% of the Water Demand figure at the reference area;
  2. Pressure: the minimum operating pressure shall not be lower than 7.0 barg at network take-off point to the reference area users.
  3. Configuration: the network grid shall be considered in operation with all branches in service.

Pipe sizing shall be performed ensuring 3.5 m/s maximum water velocity (on entire network) for both cases A and B above.

4.2. Assumptions

Reinforced Fiber Glass is to be considered as a materials for new underground main network pipes; hence:

- C-factor has been assumed 150;
- Schedule of Reinforced Fiber Glass material has been considered for calculations (nominal diameter is the same of internal diameter).

Number of curves and tees connection of underground network pipes are estimated on the basis of proposed routing as shown on picture 2.a in chapter 2 above adding a presence of expected elbows/tees.

For the underground main network pipes, the equivalent pipe lengths have been evaluated as (refer to report in Attachments 1.B, 2.D, 3.D, 4D…..):

- 120% of the geometrical pipe length to account of presence of valves for branches which are linear in the picture 2.a;

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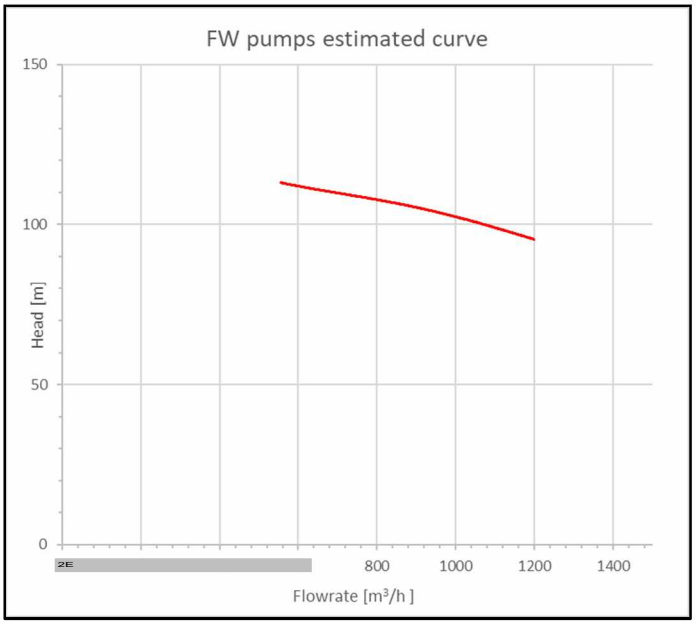
- 150% of the geometrical pipe length to account of presence of valves and curves not shown in picture 2.a for branches which are curvilinear.

Since the FW pumps vendor data are not yet available at this stage of the Project, the following assumptions have been made to estimate the FW pumps curve in order to get the data of discharge pressures for each fire scenario:

1. The FW pumps curve shows the same trend as existing pumps located in refinery area (Ref. [7]);
2. The discharge pressure at 100% flowrate (1000 m^3/h) is 10.0 barg (Ref. [4]);
3. The estimated discharge pressures related to MNA FW pumps are calculated assuming a linear increase compared to the real values of the existing pumps located in the refinery area (refer to picture 4.1);
4. When the flowrate is lower or equal to 1000 m^3/h only one FW pump is activated;
5. When the flowrate is higher than 1000 m^3/h, two FW pumps are activated dividing the required flowrate equally for each pump activated (for 1200 m^3/h two pumps are activated, for 2400 m^3/h two pumps are activated etc)
6. The discharge pressure given by fire water pumps has been estimated for each fire scenario according to the required flowrate from the estimated FW pumps curve shown on picture 4.1.

Picture 4.1: estimated fire water pump curve



4.3. Tool

The hydraulic calculation is using “PIPENET Vision 1.9.0” software developed by SUNRISE.

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5. FIRE SCENARIOS

5.1. Fire Water demand in the NExBTL area (Unit 21)

For Unit 21, including Unit 21A and 21B, six different Fire Scenario Areas have been identified (Picture 5.1) as these zones are delimited by curbed area and dividing area which is 10 cm higher than the "normal level" of the plant (the dividing areas have been considered in the Fire Scenario Area towards which they are sloped).

For each Fire Scenario Area, a Fire Area has been defined assuming to be the surface corresponding to the sum of the areas drained into maximum 4 adjacent catch basins, depending on the leakage location.

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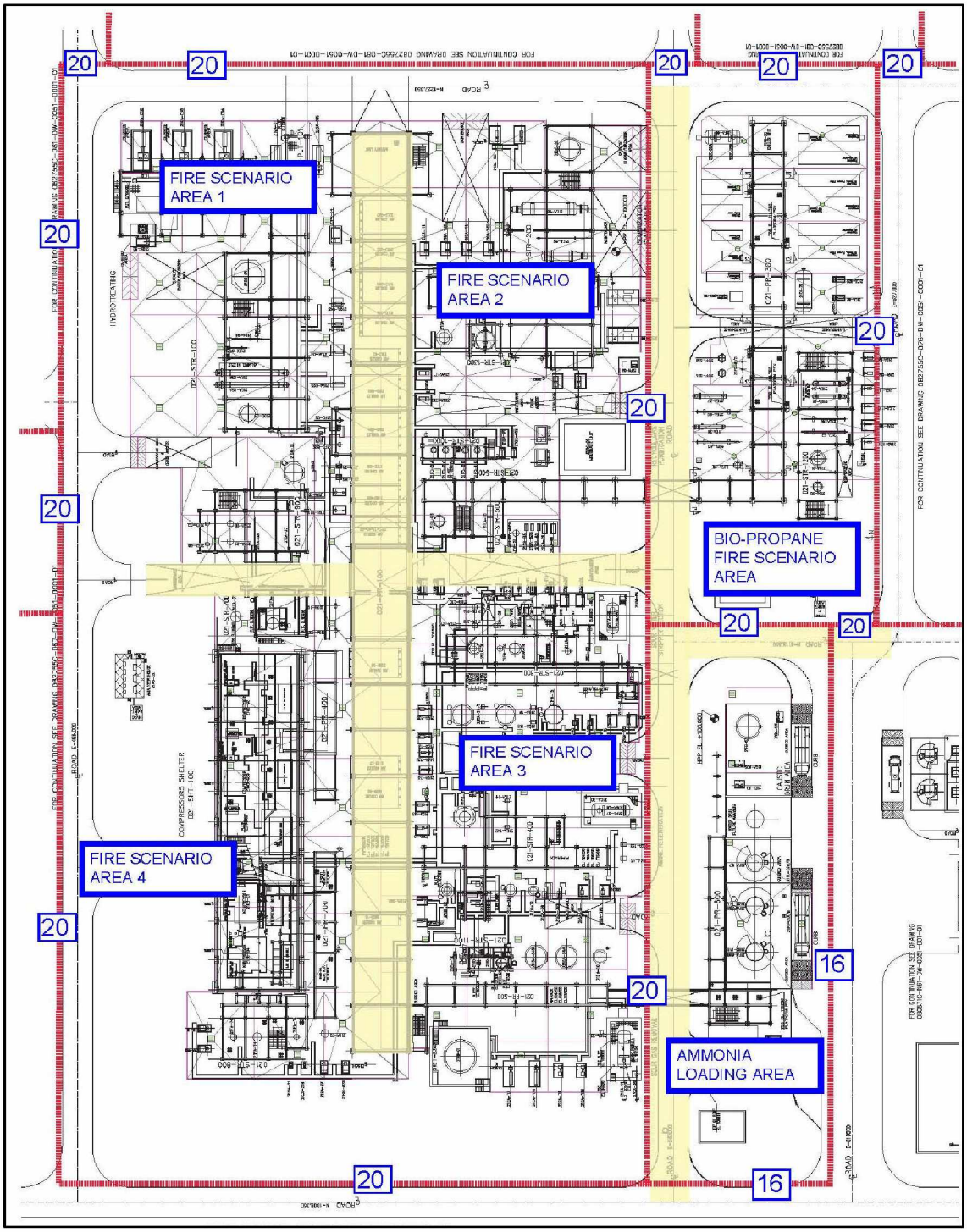
Picture 5.1.a



Calculations of fire water demand for each Fire Scenario Area are presented in paragraphs below.

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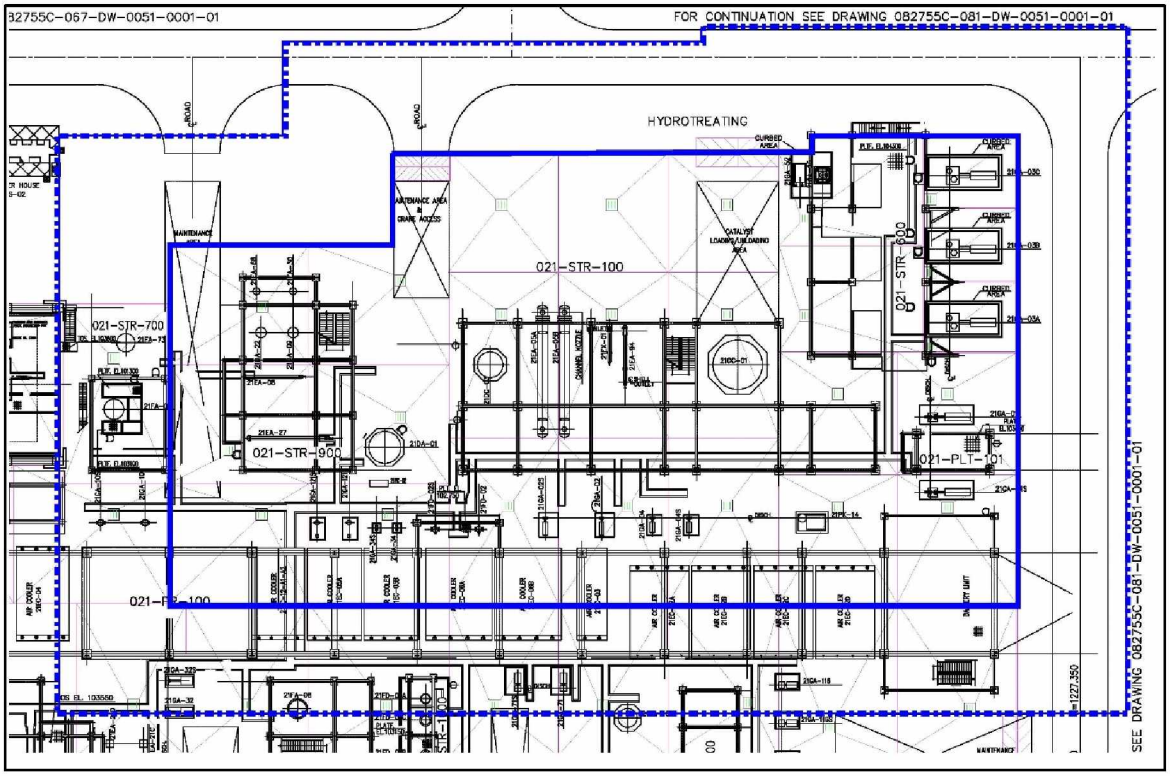
5.1.1. Fire Water Demand in Fire Scenario Area 1 (Unit 21)

Fire Scenario Area 1 is shown in Picture 5.1.1.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 21DC-01;
- Jet fire due to release from 21DC-01 high pressure reactor flanges.

Picture 5.1.1.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.1.1.a and table 5.1.1.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21DC-01	118	12,2	86	Protection up to 12 m
21GA-03A/B/C	76	20,4	93	
21FA-02	191	10,2	117	
21GA-02/S	10	20,4	13	
21GA-121/S	9	20,4	11	New item added in FEED documentation
21FA-18	21	10,2	13	
21GA-34/S		20,4	12	It has been considered minimum installation of two spray nozzles for each pump (each spray nozzle is about 3 m3/h flowrate)
21GA-71/S	12	20,4	14	
TOTAL FIXED SPRAY SYSTEM			**359**	

Note: 21GA-86/S, indicated as protected by deluge on Detailed Firefighting Layout (082755C-021-DW-1933-0001_A) has been deleted in FEED documentation, therefore it is not considered in the sum of water required by fixed spray system.

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Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21GA-25	11	20,4	13	
21GA-52	3	20,4	4	
21EA-01	27	10,2	17	
21DC-03	68	10,2	41	Protection up to 20 m
21EA-111A/B	51	10,2	31	
21EA-28	30	10,2	18	
21EA-110	12	10,2	7	
21EA-02A/B	54	10,2	33	
21EA-92	7	10,2	5	
21EC-02				Not applicable: no water consumption has been associated
21EA-03	27	10,2	17	
21EA-95	19	10,2	11	
21EA-93	37	10,2	23	
21EX-01	7	10,2	4	
21DA-01	42	10,2	25	Protection up to 12 m
21EA-32A/B	24	10,2	59	
21EC-03				Not applicable: no water consumption has been associated
21EC-06				Not applicable: no water consumption has been associated
21EC-12				Not applicable: no water consumption has been associated
21EC-05				Not applicable: no water consumption has been associated
21DA-09	24	10,2	15	Protection up to 12 m
21EA-33	12	10,2	7	
21EA-27	12	10,2	7	
21EA-08	6	10,2	4	
21EC-04				Not applicable: no water consumption has been associated

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Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21FA-08	21	10,2	13	
21DA-22	18	10,2	11	Protection up to 12 m
21EA-68	2	10,2	1	
21EA-67	8	10,2	5	
21EA-69	6	10,2	4	
21EA-70	37	10,2	22	
21EA-71	12	10,2	7	
21FA-09	29	10,2	18	
21FA-73	28	10,2	17	
21EA-30	4	10,2	2	
21EA-67	11	10,2	7	
21FA-69	46	10,2	28	
	TOTAL MONITOR		**476**	

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Table 5.1.1.a

Pool Fire scenario inside FIRE SCENARIO AREA 1		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed / foam spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	359
Total flow required for fire monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =476 m3/h Flowrate with additional margin =476*1,3= 619 m3/h.	619
	Monitor** required for local foam application. Fire area = 217 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =217*6,5= 1411 l/min. Flowrate with additional margin =1411*1,3= 1834 l/min= 110 m3/h.	110
Additional flow required for fire brigade	10000 l/min	600
Sub total		1688
Ageing safety margin (10%)		169
TOTAL FIRE WATER DEMAND		1857

*: Monitor type and number will be defined according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Monitor type and number will be defined according to outcomes of FHA – part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering one catch basin in fire of 217 m2, which is the surface of the catchment area below the 21DC-01, considered as the worst pool fire scenario in the Fire Scenario Area examined.

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The required minimum foam concentrate is 1100 l (1834 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.1.1.b

Jet Fire scenario inside FIRE SCENARIO AREA 1		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the jet fire impact area. Assumed conservatively the equipment with fixed spray system 21FA-02 that requires largest amount of firewater, being characteristics of jet fire coming from 21DC-01 (assumed only one equipment impinged by jet fire).	117
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 6000 l/min (360 m3/h).	360
Additional flow required for fire brigade	10000 l/min	600
Sub total		1077
Ageing safety margin (10%)		108
TOTAL FIRE WATER DEMAND		1185

*: Monitor type and number will be defined according to outcomes of FHA – part 2.

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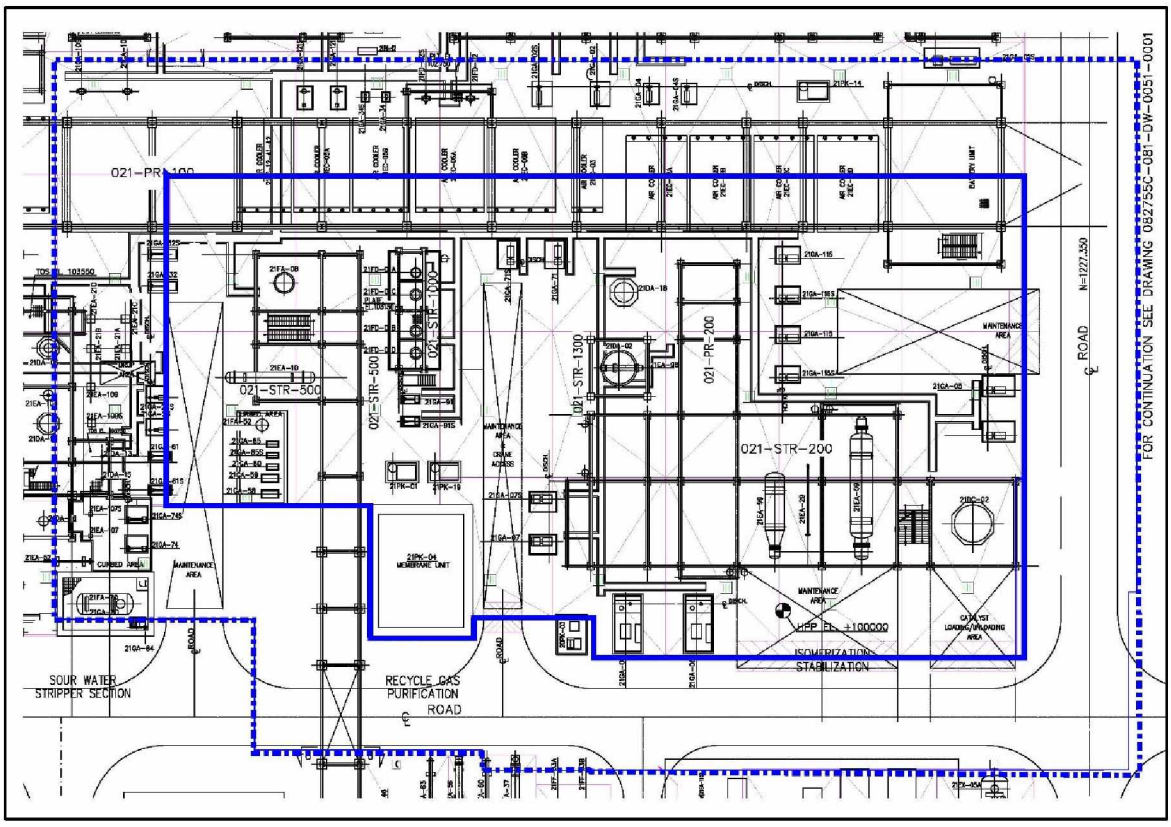
5.1.2. Fire Water Demand in Fire Scenario Area 2

Fire Scenario Area 2 is shown in Picture 5.1.2.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 21DC-02;
- Jet fire due to failure of 21GA-05/S pump seal.

Picture 5.1.2.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.1.2.a and table 5.1.2.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21DC-02	59	12,2	43	Protection up to 12 m
21GA-05/S	15	20,4	18	
21GA-71/S	12	20,4	14	
21GA-06/S	40	20,4	49	
21GA-07/S	15	20,4	18	
21GA-02/S	10	20,4	13	
21GA-121/S	9	20,4	11	New item added in FEED documentation
21GA-34/S		20,4	12	It has been considered minimum installation of two spray nozzles for each pump (each spray nozzle is about 3 m3/h flowrate)
	TOTAL FIXED SPRAY SYSTEM		**178**	

Note: 21GA-86/S, indicated as protected by deluge on Detailed Firefighting Layout (082755C-021-DW-1933-0001_A) has been deleted in FEED documentation, therefore it is not considered in the sum of water required by fixed spray system.

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Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21EC-02				Not applicable: no water consumption has been associated
21EA-06A/B/C/D	46	10,2	28	
21EC-03				Not applicable: no water consumption has been associated
21FA-03	59	10,2	36	
21DA-02				Tangent line from SGEXP more than 20 m, therefore no water consumption has been associated
21EA-97	35	10,2	22	
21EC-06				Not applicable: no water consumption has been associated
21EA-07	16	10,2	10	
21FA-05	61	10,2	37	
21DA-18	17	10,2	10	Protection up to 12 m
21EA-98	5	10,2	3	
21EA-99	32	10,2	20	
21EA-100A/B	8	10,2	5	
21EC-12				Not applicable: no water consumption has been associated
21EA-101A/B	18	10,2	11	
21EA-09	87	10,2	53	
21EA-25	10	10,2	6	
21EC-05				Not applicable: no water consumption has been associated
21EA-10	16	10,2	10	
21GA-91/S	2	20,4	3	
21FA-08	21	10,2	13	
21EA-12	6	10,2	4	
21EA-37	2	10,2	1	

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Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21EA-60	16	10,2	10	
21EA-04A/B	39	10,2	24	
21EA-29	4	10,2	3	
21DA-14	53	10,2	32	Protection up to 12 m
	TOTAL MONITOR		**341**	

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Table 5.1.2.a

Pool Fire scenario inside FIRE SCENARIO AREA 2		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed / foam spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	178
Total flow required for fire monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =341 m3/h Flowrate with additional margin =341*1,3= 443 m3/h.	443
	Monitor** required for local foam application. Fire area = 227 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =227*6,5= 1476 l/min. Flowrate with additional margin =1476*1,3= 1918 l/min= 115 m3/h.	115
Additional flow required for fire brigade	10000 l/min	600
Sub total		1336
Ageing safety margin (10%)		134
TOTAL FIRE WATER DEMAND		1470

*: Monitor type and number will be defined according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Monitor type and number will be defined according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering one catch basin in fire of 227 m2 which is the surface of the catchment area below the 21DC-02, considered as the worst pool fire scenario in the Fire Scenario Area examined.

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The required minimum foam concentrate is 1151 l (1918 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.1.2.b

Jet Fire scenario inside FIRE SCENARIO AREA 2		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the jet fire impact area. Assumed conservatively the equipment with fixed spray system 21DC-02 that requires largest amount of firewater, being characteristics of jet fire coming from 21GA-05/S (assumed only one equipment impinged by jet fire).	43
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 6000 l/min (360 m3/h).	360
Additional flow required for fire brigade	10000 l/min	600
Sub total		1003
Ageing safety margin (10%)		100
TOTAL FIRE WATER DEMAND		1103

*: Monitor type and number will be defined according to outcomes of FHA - part 2.

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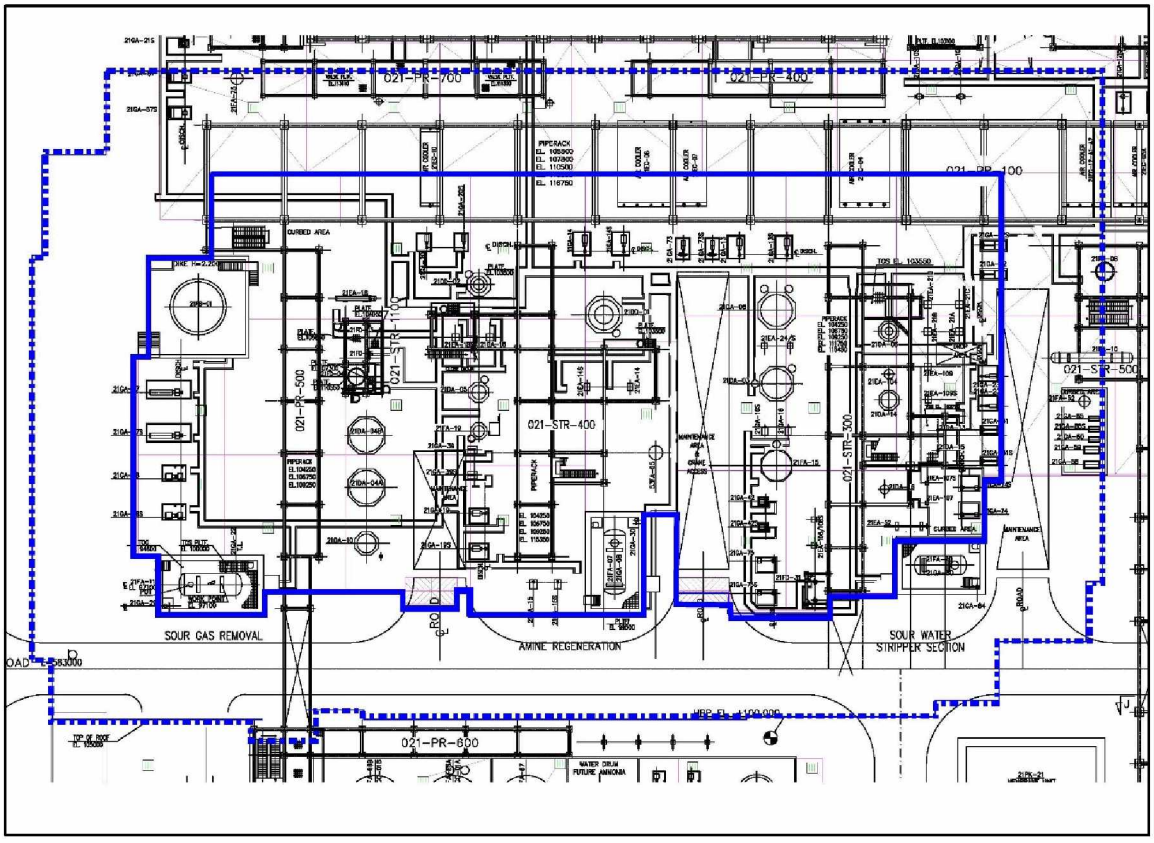
5.1.3. Fire Water Demand in Fire Scenario Area 3

Fire Scenario Area 3 is shown in Picture 5.1.3.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, only jet fire scenario is considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Jet fire due to release from 21DA-14 column flanges.

Pool fire scenario is not considered in the Fire Scenario Area 3 since the only item classified as having pool fire scenario is 21FA-07 HC Closed Drainage Collection Drum, containing slope oil and water, and located inside pit. Therefore the scenario is assumed not credible due to the content of the drum and location.

Picture 5.1.3.a



Calculation of fire water demand for the above fire scenario has been performed as shown on table 5.1.3.a, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21GA-87/S	8	20,4	10	
21FA-75	19	10,2	12	
	TOTAL FIXED SPRAY SYSTEM		**22**	

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Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21FA-07	59	10,2	36	
21GA-08	7	20,4	8	
21EC-12				Not applicable: no water consumption has been associated
21EA-101A/B	18	10,2	11	
21EA-10	16	10,2	10	
21PK-01				Not applicable: no water consumption has been associated
21DA-03	91	10,2	56	Protection up to 12 m
21FA-08	43	10,2	26	
21EA-12				Located more than 12 m from ground level and in the radius of 12 m from fire scenario border, therefore no water consumption has been associated
21EC-04				Not applicable: no water consumption has been associated
21DA-08	67	10,2	41	Protection up to 12 m
21DD-02	36	10,2	22	Protection up to 12 m
21EC-10				Not applicable: no water consumption has been associated
21FA-15	42	10,2	26	
21DA-14	53	10,2	32	Protection up to 12 m
21EA-105	21	10,2	13	
21DA-07				Tangent line from SGEXP more than 12 m, therefore no water consumption has been associated
	TOTAL MONITOR		**281**	

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Table 5.1.3.a

Jet Fire scenario inside FIRE SCENARIO AREA 3		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor protection (fixed spray systems are not foreseen for items in the jet Fire impact Area 3)	Monitor required inside the jet fire impact area. Assumed conservatively the equipment with monitor protection 21DA-03 that requires largest amount of firewater, being characteristics of jet fire coming from 21DA-14 (assumed only one equipment impinged by jet fire).	56
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 4000 l/min (360 m3/h).	240
Additional flow required for fire brigade	10000 l/min	600
Sub total		896
Ageing safety margin (10%)		90
TOTAL FIRE WATER DEMAND		986

*: Currently Detailed Firefighting Layout (082755C-021.DW-1931-0001) foresees a monitor with capacity 240 m3/h. Monitor type and number will be defined according to outcomes of FHA - part 2

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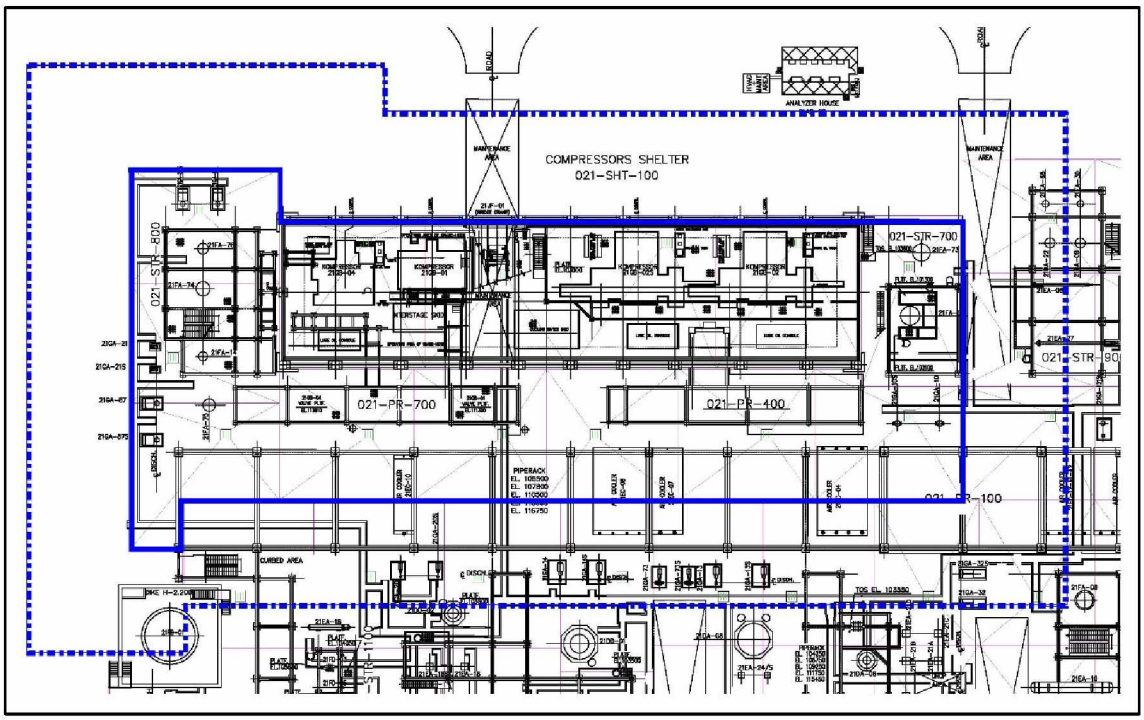
5.1.4. Fire Water Demand in Fire Scenario Area 4

Fire Scenario Area 4 is shown in Picture 5.1.4.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 21FA-75 and 21GA-87/S;
- Jet fire due to leakage from 21GB-02/S flanges/seals.

Picture 5.1.4.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.1.4a and table 5.1.4b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21GA-89/S	8	20,4	10	
21GA-87/S	8	20,4	10	
21FA-75	19	10,2	12	
21GB-04	52	20,4	63	
Lube oil system of 21G-04	12	20,4	14	
21GB-01 and lube oil system	55	20,4	68	
21GB-02/S	315	20,4	386	
Lube oil systems of 21GB-02/S	31	20,4	38	

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Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21EA-32A/B				Located more than 12 m from ground level in the radius of 12 m from Fire Scenario Area border, therefore no water consumption has been associated
21EA-33				Located more than 12 m from ground level and in the radius of 12 m from Fire Scenario Area border, therefore no water consumption has been associated
21EA-27	12	10,2	7	
21EA-08	6	10,2	4	
21EA-121	16	10,2	10	
21FA-74	18	10,2	11	
21EA-125	5	10,2	3	
21FA-76	12	10,2	8	
21EA-122	5	10,2	3	
21EA-115A/B	20	10,2	12	
21EA-114	7	10,2	4	
21EC-04				Not applicable: no water consumption has been associated
21EA-13	17	10,2	10	
21FA-69	46	10,2	28	
21FA-09	29	10,2	18	
21FA-73	28	10,2	17	
21DD-02	36	10,2	22	Protection up to 12 m
21EA-34	3		2	Not applicable: no water consumption has been associated
21FA-14	11	10,2	7	
21EA-67	11	10,2	7	
21EA-123	2	20,4	1	
		TOTAL MONITOR	**174**	

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Table 5.1.4.a

Pool Fire scenario inside FIRE SCENARIO AREA 4		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed / foam spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	32
Total flow required for fire monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =174 m3/h Flowrate with additional margin =174*1,3= 217 m3/h.	227
	Monitor** required for local foam application. Fire area = 455 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =455*6,5= 2958 l/min. Flowrate with additional margin =2958*1,3= 3845 l/min= 231 m3/h.	231
Additional flow required for fire brigade	10000 l/min	600
Sub total		1090
Ageing safety margin (10%)		109
TOTAL FIRE WATER DEMAND		1199

*: Monitor type and number will be defined according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Monitor type and number will be defined according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area. It is to be noted that only contributes of items located outside compressor shelter 021-SHT-100 have been included in the sum, as the pool fire scenario is considered outside the compressor shelter.

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Pool fire area has been calculated considering two catch basins in fire of 455 m2 which is the surface of the two catchment areas below the 21FA-75 and 21GA-87/S considered as the worst pool fire scenario in the Fire Scenario Area examined.
The required minimum foam concentrate is 2307 l (3845 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.1.4.a

Jet Fire scenario inside FIRE SCENARIO 4		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems inside the jet fire impact area	Fixed spray system inside the jet fire impact area. Assumed conservatively the equipment with fixed spray system 21GB-02 that requires largest amount of firewater, being characteristics of jet fire coming from 21GB-02S (assumed only one equipment impinged by jet fire).	193
Total flow required for monitor application (with 30% additional margin)	Monitor required for jet fire application. Not applicable since item source of jet fire is located inside the compressor shelter	0
Additional flow required for fire brigade	10000 l/min	600
Sub total		793
Ageing safety margin (10%)		79
TOTAL FIRE WATER DEMAND		872

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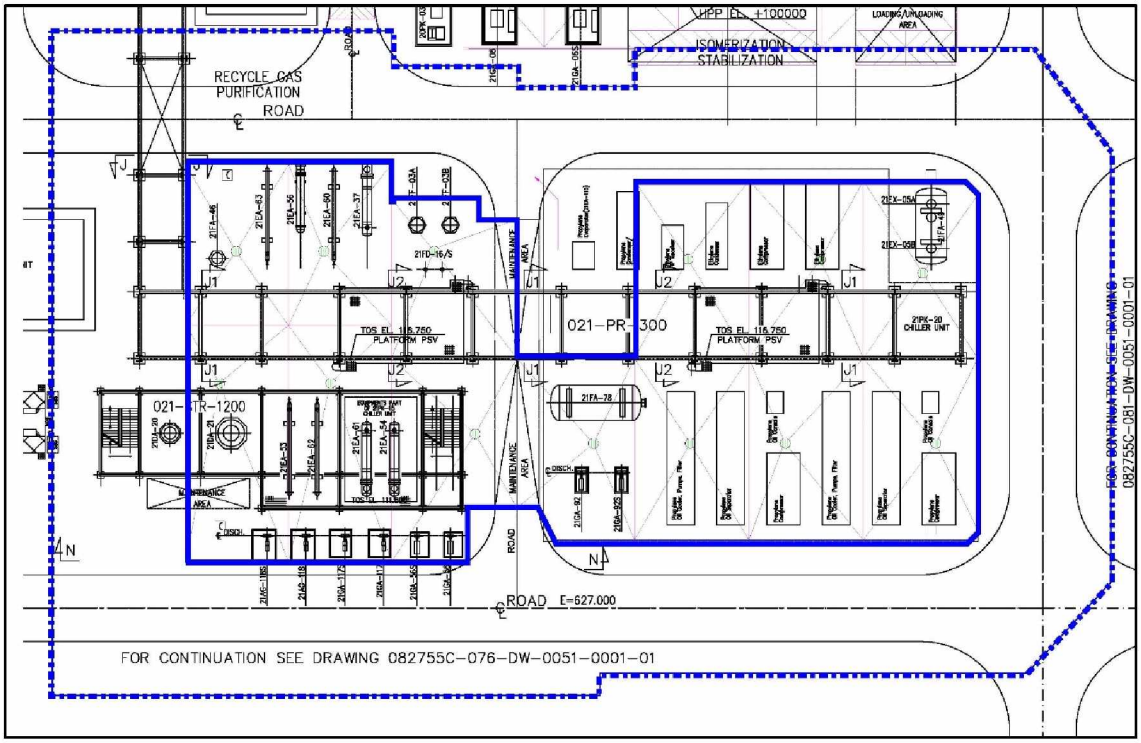
5.1.5. Fire Water Demand in Bio-propane Fire Scenario Area

Bio-Propane Fire Scenario Area is shown in Picture 5.1.5.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 21DA-21;
- Jet fire due to leakage from 21DA-20 flanges.

Picture 5.1.5.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.1.5.a and table 5.1.5.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21GA-117/S	7	20,4	9	
21GA-118/S	7	20,4	9	
21GA-56/S	7	20,4	9	
21DA-21	38	12,2	28	Protection up to 12 m
21DA-20	22	12,2	16	Protection up to 12 m
21FA-48	19	10,2	11	
21PK-20				HOLD New tag is 21PK-15, items inside 21PK-20 are now included inside 21PK-15
21EA-55	12	10,2	8	
21FA-46	14	10,2	9	
	TOTAL FIXED SPRAY SYSTEM		**99**	

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21EA-37	2	10,2	1	
21FF-03A/B				HOLD: Dimensions not available
21EA-62	8	10,2	5	
21EA-53A/B	16	10,2	10	
21EA-60	16	10,2	10	
21EA-56	6	10,2	4	
21EA-63	8	10,2	5	
21FA-49	62	10,2	38	
21EA-54	14	10,2	9	Item part of 21PK-15
21EA-61	12	10,2	9	Item part of 21PK-15
21EA-64				HOLD: Dimensions not available
		TOTAL MONITOR	**91**	

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Table 5.1.5.a

Pool Fire scenario inside BIO-PROPANE Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed / foam spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	99
Total flow required for fire monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =91 m3/h Flowrate with additional margin =91*1,3= 118 m3/h.	118
	Monitor** required for local foam application. Fire area = 197 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =197*6,5= 1281 l/min. Flowrate with additional margin =1281*1,3= 1665 l/min= 100 m3/h. .	100
Additional flow required for fire brigade	10000 l/min	600
Sub total		917
Ageing safety margin (10%)		91
TOTAL FIRE WATER DEMAND		1008

*: Monitor type and number will be defined according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Monitor type and number will be defined according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

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Pool fire area has been calculated considering one catch basin in fire of 197 m2 which is the surface of the catchment area below the 21DA-21 considered as the worst pool fire scenario in the Fire Scenario Area examined.
The required minimum foam concentrate is 999 l (1665 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.1.5.b

Jet Fire scenario inside BIO-PROPANE Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the jet fire impact area. Assumed conservatively the equipment with fixed spray system 21DA-21 that requires largest amount of firewater, being characteristics of jet fire coming from 21DA-20 (assumed only one equipment impinged by jet fire).	28
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 4000 l/min (240 m3/h).	240
Additional flow required for fire brigade	10000 l/min	600
Sub total		868
Ageing safety margin (10%)		87
TOTAL FIRE WATER DEMAND		955

*: Currently Detailed Firefighting Layout (082755C-021.DW-1931-0001) foresees a monitor with capacity 240 m3/h. Monitor type and number will be defined according to outcomes of FHA - part 2.

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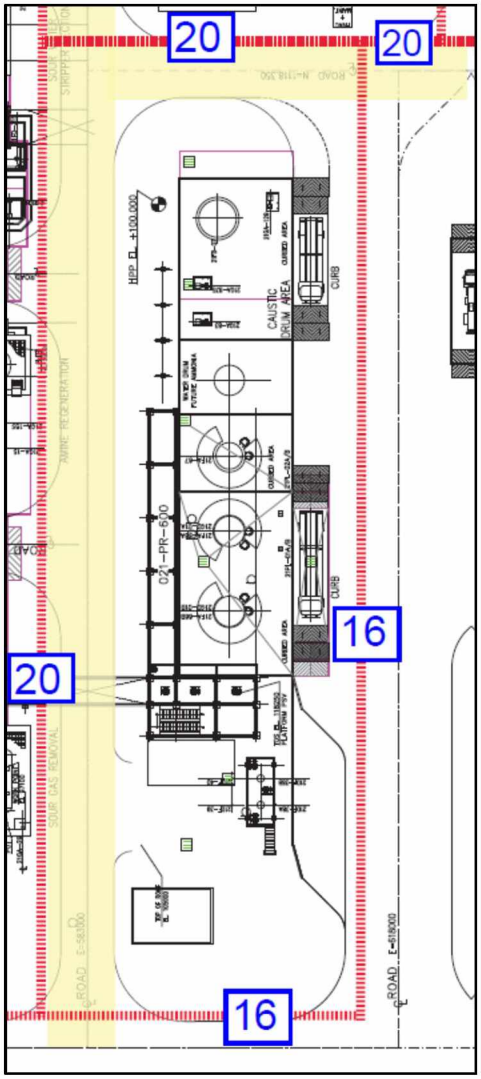
5.1.6. Fire Water demand in the ammonia loading area

Ammonia Loading Area is shown in Picture 5.1.6.a.

In this area, toxic release scenario is considered credible due to possible ammonia release.

Picture 5.1.6.a



Calculation of fire water demand for the above scenario has been performed as shown on table 5.1.6.a, based on the fire protection layouts developed..

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Table 5.1.6.a

Toxic release scenario inside AMMONIA LOADING area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor application (with 30% additional margin)	Assumed two monitors* required for toxic vapor cloud dispersion abatement: One monitor capacity is 4000 l/min (240 m3/h)	480
Additional flow required for fire brigade	10000 l/min	600
Sub total		1080
Ageing safety margin (10%)		108
TOTAL WATER DEMAND		1188

*: Monitor type and number will be defined during next phase of the Project according to outcomes of FHA - part 2

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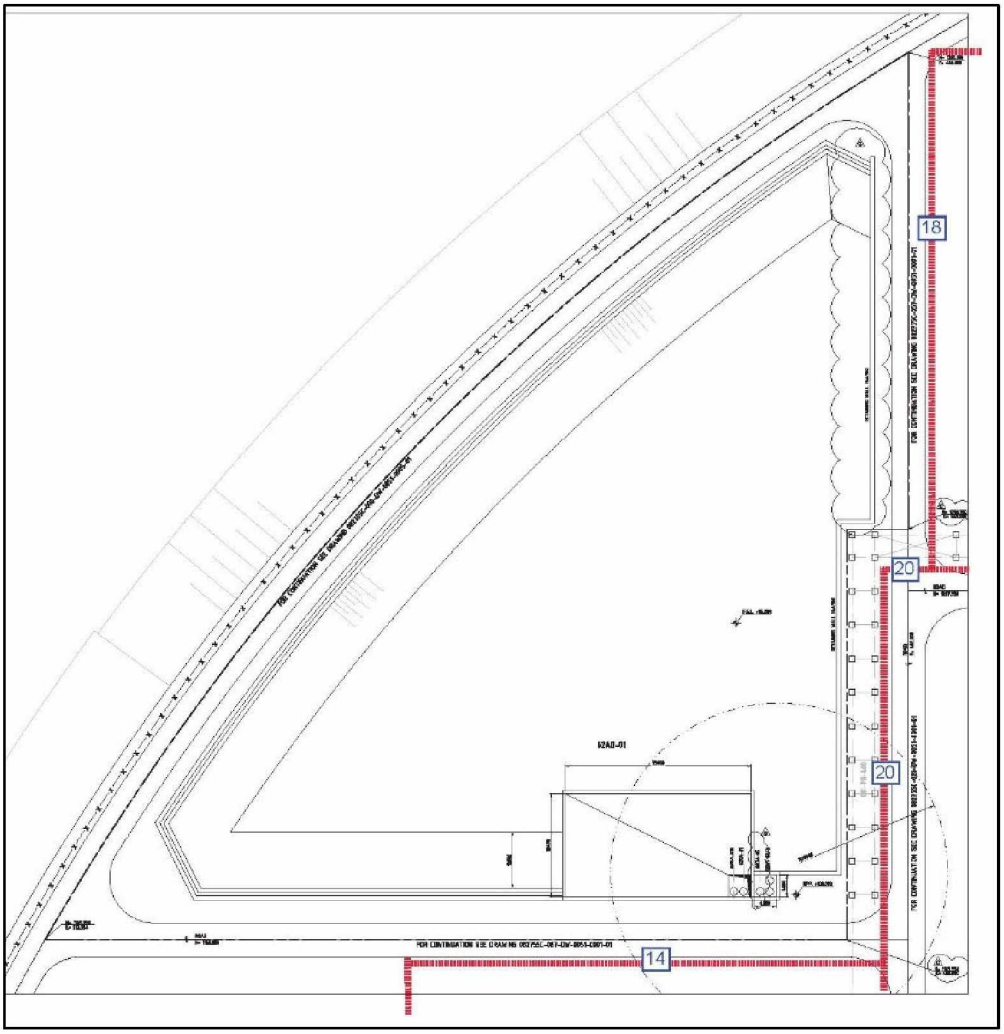
5.2. Fire Water demand in the storm water pond area (Unit 62)

Storm water pond area is shown in Picture 5.2.a.
In this area, the only scenario considered credible is the pit pool fire, while the pool fire involving the whole storm water pond is considered not credible.

Picture 5.2.a



Calculation of fire water demand for the area has been performed as shown on table 5.2.a, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Table 5.2.a

Pool Fire scenario inside STORM WATER POND area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor application (with 30% additional margin)	No monitor for cooling purpose is present in the area	0
	No foam monitor is required	0
Additional flow required for fire brigade	10000 l/min	600
Sub total		600
Ageing safety margin (10%)		60
TOTAL FIRE WATER DEMAND		660

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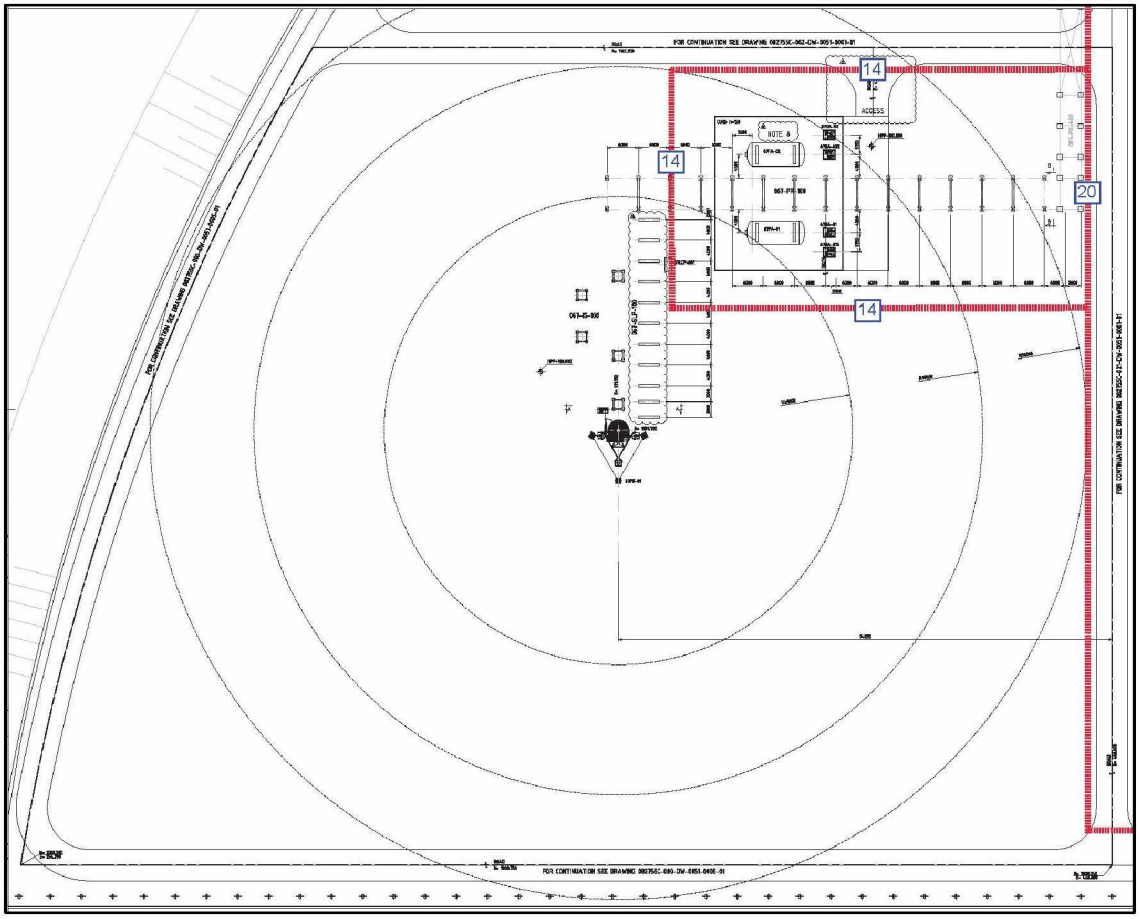
5.3. Fire Water demand in the flare area (Unit 67)

Flare area is shown in Picture 5.3.a.
In this area, pool fire scenario is considered credible due to possible leakage from KO drums 67FA-01 and 67FA-02 and relevant pumps.

Picture 5.3.a



Calculation of fire water demand for the area has been performed as shown on table 5.3.a, based on the fire protection layout developed.

Additional updating is required during Execution stage of Project also to check any possible change in layout or equipment dimension.

Equipment requiring application of water through monitors for cooling inside the Flare area:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
67FA-01	159	10,2	97	
67FA-02	159	10,2	97	
67GA-01/S	10	20,4	12	
67GA-02/S	10	20,4	12	
		TOTAL MONITOR	**218**	

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Table 5.3.a

Pool Fire scenario inside FLARE area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor application (with 30% additional margin)	Monitor* required for cooling purpose inside the area. Theoretical flowrate =218 m3/h Flowrate with additional margin =218*1,3= 283 m3/h.	283
	Monitor** required for control of burning liquid pool. Fire scenario area assumed = 360 m2. Application rate = 12,2 l/min m2. Theoretical flowrate =360*12,2= 4392 l/min. Flowrate with additional margin =4392*1,3= 5710 l/min = 343 m3/h.	343
Additional flow required for fire brigade	10000 l/min	600
Sub total		1226
Ageing safety margin (10%)		123
TOTAL FIRE WATER DEMAND		1349

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

**: It is to be noticed that minimum application rate of 12,2 l/min/m2 for control of burning liquid pool taken from para 9 of Ref. [1] has been used instead of 6,5 l/min/m2 application rate on the fuel surface taken from para 16.5 of Ref. [1] since no foam is provided in the area. Monitor type and number will be defined according to outcomes of FHA - part 2.

Pool fire area has been calculated considering one catch basin in fire of 360 m2 which is the surface of the catchment area below the 67FA-01 and relevant pumps considered as the worst pool fire scenario in the area examined.

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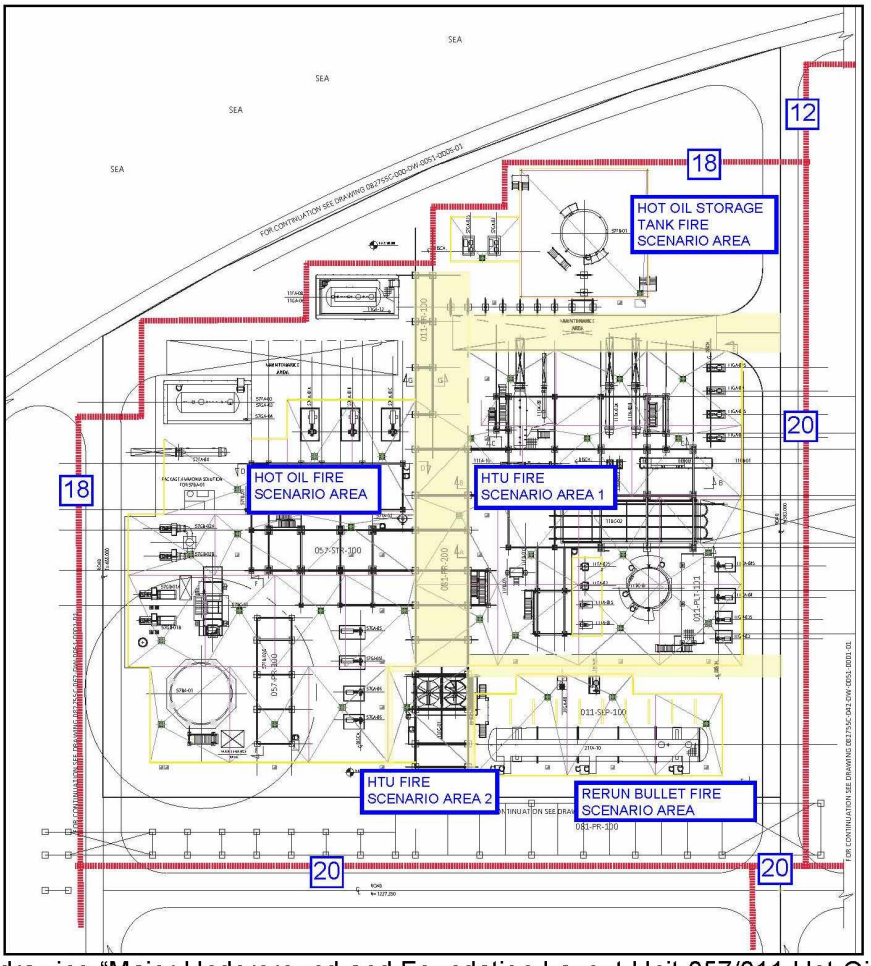
5.4. Fire Water demand in the hot oil and HTU area (Unit 57/11)

For Unit 57/11, five different Fire Scenario Areas have been identified (Picture 5.4.a), as per Neste instructions, as these zones are delimited by curbed area and dividing area which is 10 cm higher than the "normal level" of the plant (the dividing area has been considered in the Fire Scenario Area towards which it is sloped).

For each Fire Scenario Area, a Fire Area has been defined assuming to be the surface corresponding to the sum of the areas drained into maximum 4 adjacent catch basins, depending on the leakage locations.

Picture 5.4.a



Note: Civil drawing "Major Underground and Foundation Layout Unit 057/011 Hot Oil and HTU" (082755C-057-DW-1442-0001-01), used as reference for Picture 5.4.a has to be updated to include modifications to the curbed area of HTU (already considered in above Picture).

Calculations of fire water demand for each Fire Scenario Area are presented in paragraphs below.

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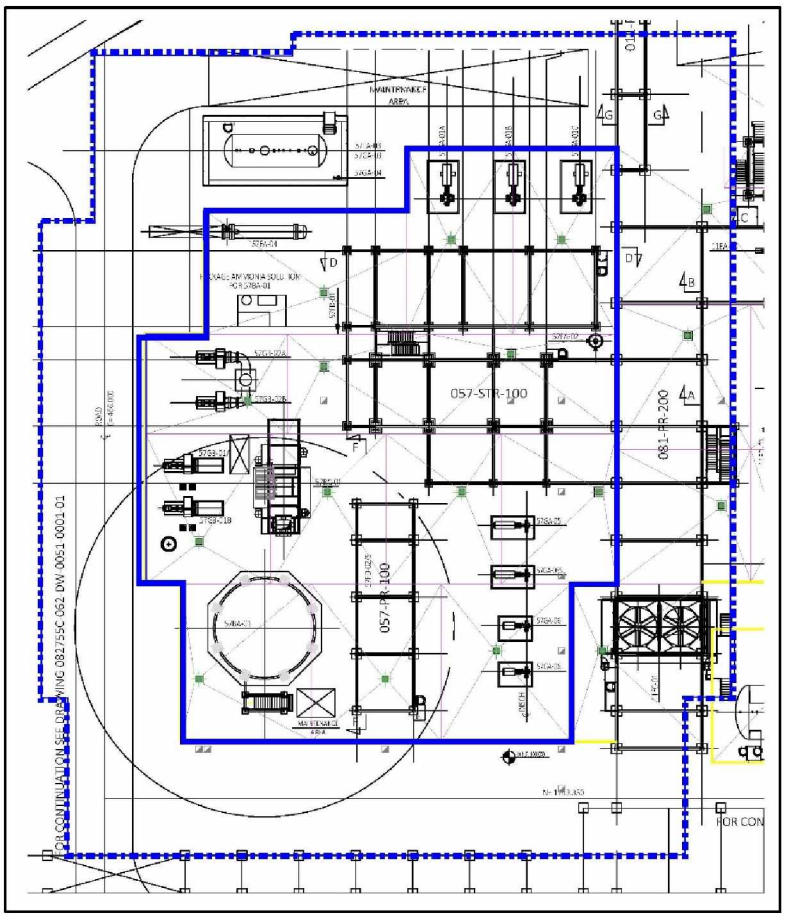
5.4.1. Fire Water Demand in Hot Oil Fire Scenario Area (Unit 57/11)

Hot Oil Fire Scenario Area is shown in Picture 5.4.1.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 57BA-01;
- Jet fire due to leakage from 57FA-04 vessel flanges and associated piping.

Picture 5.4.1.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.4.1.a and table 5.4.1.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
57FA-02	5	10.2	3	
57BA-01				Direct cooling of hot oil heater is not applicable.
57FA-01	262	10,2	161	
57GA-01A/B/C	49	20.4	57	
57FA-03	115	10,2	71	
57GA-03			8	Firewater assumed based on 21GA-08 dimension
57FA-04	64	10,2	39	
57GA-05/S	20	20,4	24	
57EA-02	37		23	Not applicable: no water consumption has been associated
57EA-04	40	10,2	24	
57FA-05	136	10,2	83	
57GA-06/S	16	20,4	20	
		TOTAL MONITOR	**513**	

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Table 5.4.1.a

Pool Fire scenario inside HOT OIL Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	No fixed spray system for cooling purpose is present inside the fire area and outside but in the radius of 12m.	0
Total flow required for monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =513 m3/h Flowrate with additional margin =513*1,3= 667 m3/h.	667
	Monitor** required for local foam application. Fire area = 855 m2. Application rate = 6.5 l/min m2. Theoretical flowrate =855*6.5= 5558 l/min. Flowrate with additional margin =5558*1,3= 7225 l/min= 433 m3/h.	433
Additional flow required for fire brigade	10000 l/min	600
Sub total		1700
Ageing safety margin (10%)		170
TOTAL FIRE WATER DEMAND		1870

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Currently Detailed Firefighting Layout (082755C-057-DW-1931-0001) foresees only a monitor with foam connection of 240 m3/h capacity. Monitor type and number will be defined according to outcomes of FHA - part 2.

The total flow required for cooling by means of monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items

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inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering four catch basins in fire of 855 m2, which is the surface of the catchment areas below the 57BA-01, considered as the worst pool fire scenario in the Fire Scenario Area examined.
The required minimum foam concentrate is 4335 l (7225 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.4.1.b

Jet Fire scenario inside HOT OIL Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor protection (fixed spray systems are not foreseen for items in the jet Fire impact Hot Oil Area)	Monitor required inside the jet fire impact area. Assumed conservatively the equipment with monitor protection 57FA-01 that requires largest amount of firewater, being characteristics of jet fire coming from 57FA-04 (assumed only one equipment impinged by jet fire).	161
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 6000 l/min (360 m3/h)	360
Additional flow required for fire brigade	10000 l/min	600
Sub total		1121
Ageing safety margin (10%)		112
TOTAL FIRE WATER DEMAND		1233

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2

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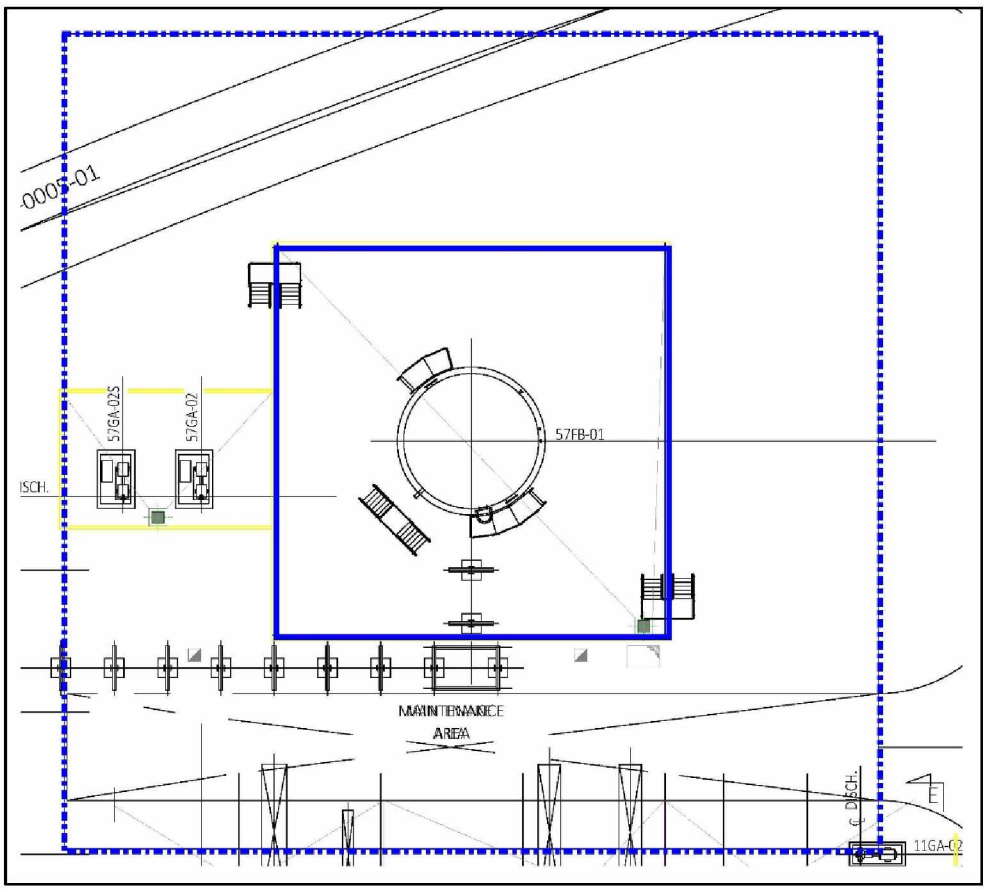
5.4.2. Fire Water Demand in Hot Oil Storage Tank Fire Scenario Area (Unit 57/11)

Hot Oil Storage Tank Fire Scenario Area is shown in Picture 5.4.2.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire scenario is considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire inside tank bund due to leakage from 57FB-01 flanges and piping.

Picture 5.4.2.a



Calculation of fire water demand for the above fire scenario has been performed as shown on table 5.4.2.a, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21GA-02S	5	20,4	6	
	TOTAL MONITOR		6	

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Table 5.4.2.a

Pool Fire scenario inside Hot Oil Storage Tank Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	No fixed spray system is required in the fire area and outside but in the radius of 12 m.	0
Total flow required for monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =6 m3/h Flowrate with additional margin =6*1,3= 8 m3/h.	8
	Monitor** required for control of burning liquid pool. Fire scenario area = 475 m2 (Bund + Tank area) Application rate = 12,2 l/min m2. Theoretical flowrate =475*12,2= 5795 l/min. Flowrate with additional margin =5795*1,3= 7534 l/min= 452 m3/h	452
Additional flow required for fire brigade	10000 l/min	600
Sub total		1060
Ageing safety margin (10%)		106
TOTAL FIRE WATER DEMAND		1166

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

**: It is to be noticed that minimum application rate of 12,2 l/min/m2 for control of burning liquid pool taken from para 9 of Ref. [1] has been used instead of 6,5 l/min/m2 application rate on the fuel surface taken from para 16.5 of Ref. [1] since no foam is provided in the area. Currently Detailed Firefighting Layout (082755C-057-DW-1931-0001) foresees only a monitor of 240 m3/h capacity. Monitor type and number will be defined according to outcomes of FHA - part 2.

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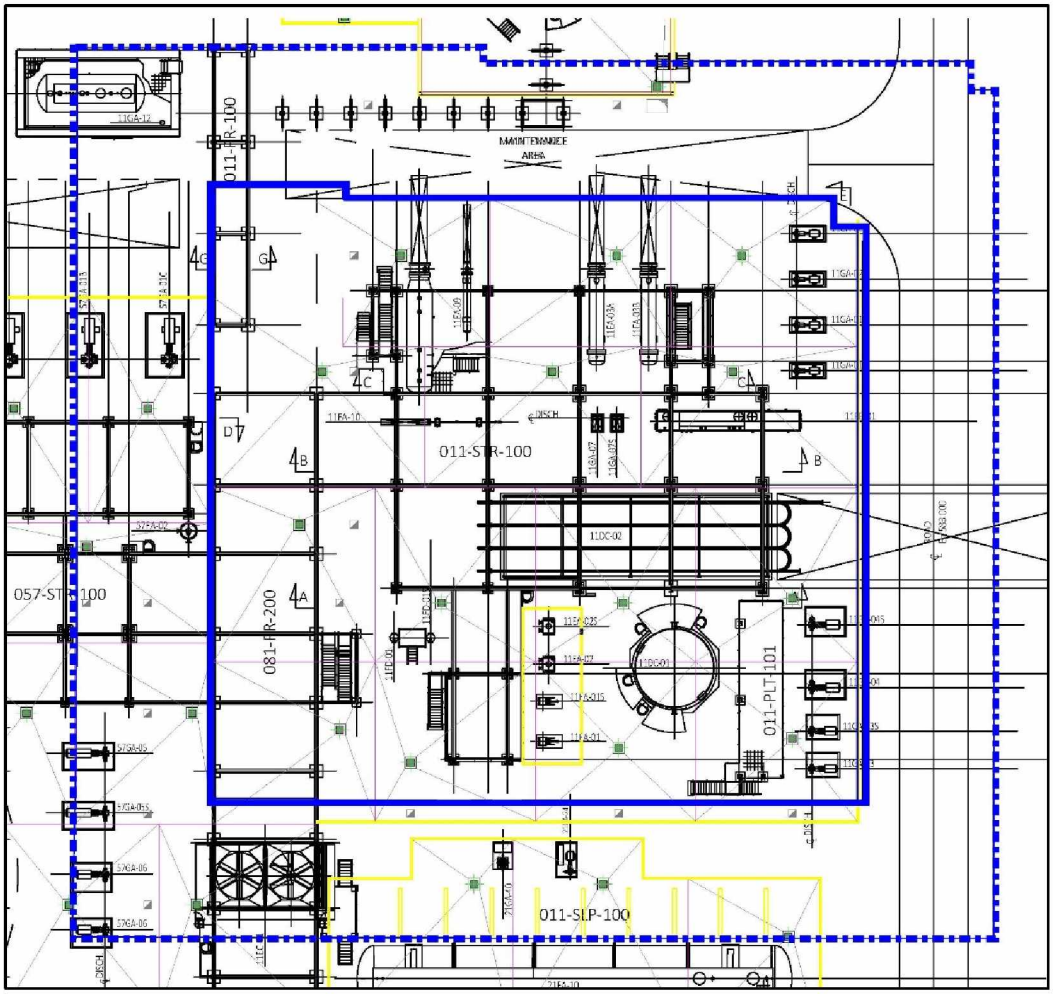
5.4.3. Fire Water Demand in HTU Fire Scenario Area 1 (Unit 57/11)

HTU Fire Scenario Area 1 is shown in Picture 5.4.3.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire due to leakage from 11DC-01 flanges;
- Jet fire due to release from 11GA-04/S flanges and pump seal.

Picture 5.4.3.a



Calculations of fire water demand for the above fire scenarios have been performed as shown on table 5.4.3.a and table 5.4.3.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
11DC-01	117	10,2	72	Protection up to 12 m
11GA-03/S	11	20,4	13	
11GA-04/S	16	20,4	20	
11EA-03A/B	60	10,2	36	
11DC-02	204	10,2	125	
11EA-05	35	10,2	22	
11EA-04	70	10,2	43	
11EA-09	10	10,2	6	
11EC-01A				Not applicable: no water consumption has been associated
11FA-08	97	10,2	59	
11GA-06			8	Firewater assumed based on 21GA-08 dimension
21GA-40	6	20,4	8	
21GA-24	5	20,4	6	
57GA-01A/B	32	20,4	40	
57GA-05/S	20	20,4	24	
57GA-06/S	16	20,4	20	
	TOTAL MONITOR		**502**	

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Table 5.4.3.a

Pool Fire scenario inside HTU Fire Scenario Area 1		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed / foam spray systems	No fixed spray system is required in the fire inside the fire area and outside but in the radius of 12m.	0
Total flow required for fire monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =502 m3/h Flowrate with additional margin =502*1,3= 653 m3/h.	653
	Monitor** required for local foam application. Fire area = 820 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =820*6,5= 5330 l/min. Flowrate with additional margin =5330*1,3= 6929 l/min= 416 m3/h.	416
Additional flow required for fire brigade	10000 l/min	600
Sub total		1669
Ageing safety margin (10%)		167
TOTAL FIRE WATER DEMAND		1836

*: Monitor type and number will be defined according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Currently Detailed Firefighting Layout (082755C-057-DW-1931-0001) foresees only a monitor with foam connection of 240 m3/h capacity. Monitor type and number will be defined according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering four catch basins in fire of 820 m2, which is the surface of the four catchment areas below the 11DC-01, considered as the worst pool fire scenario in the Fire Scenario Area examined.

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The required minimum foam concentrate is 4157 l (6929 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.4.3.b

Jet Fire scenario inside HTU Fire Scenario Area 1		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for monitor protection (fixed spray systems are not foreseen for items in the jet Fire impact Area HTU 1)	Monitor protection inside the jet fire impact area. Assumed conservatively the equipment with monitor protection 11DC-02 that requires largest amount of firewater, being characteristics of jet fire coming from 11GA-04/S (assumed only one equipment impinged by jet fire).	125
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 6000 l/min (360 m3/h).	360
Additional flow required for fire brigade	10000 l/min	600
Sub total		1085
Ageing safety margin (10%)		108
TOTAL FIRE WATER DEMAND		1193

*: Monitor type and number will be defined according to outcomes of FHA - part 2.

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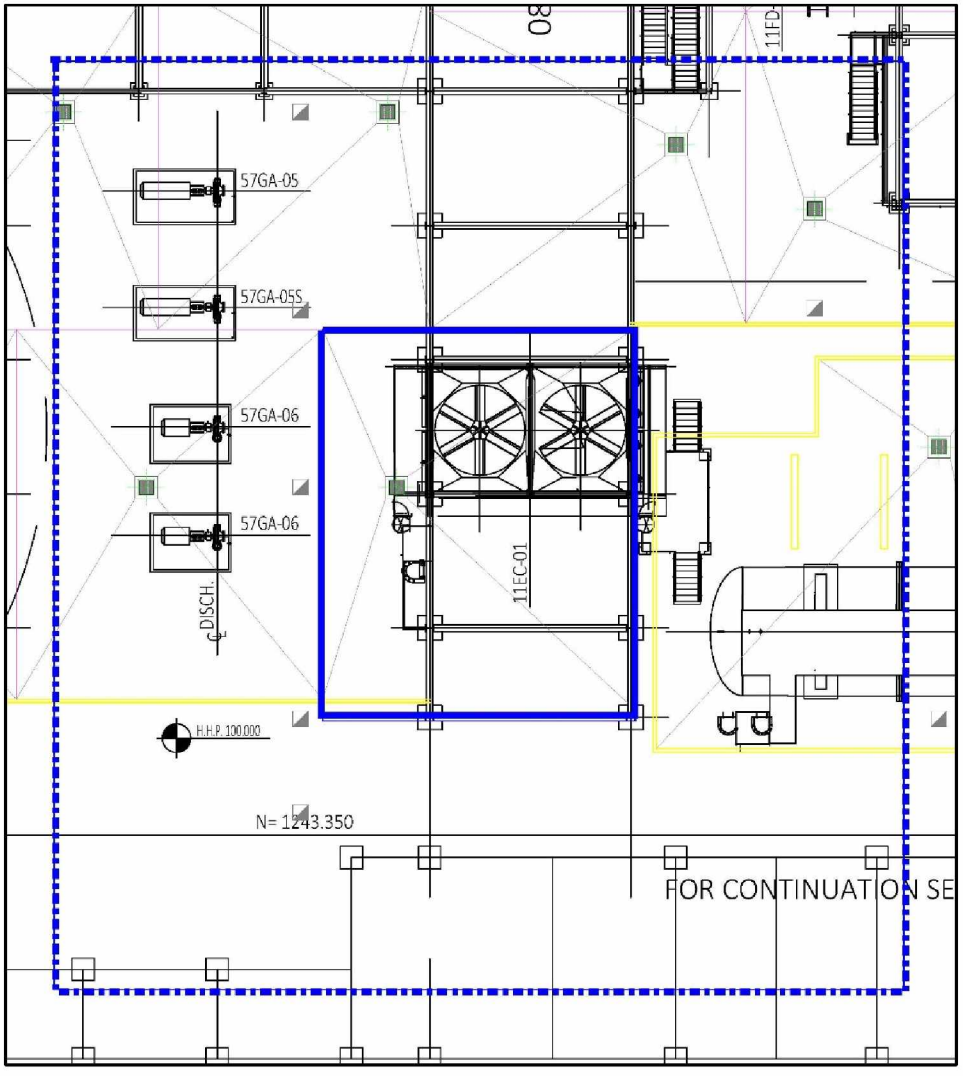
5.4.4. Fire Water demand in HTU Fire Scenario Area 2 (Unit 57/11)

HTU Fire Scenario Area 2 is shown in Picture 5.4.4.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, a pool fire scenario is considered credible due to fire coming from a release of the adjacent pumps (57GA-05/S and 57GA-06/S).

Picture 5.4.4.a



Calculation of fire water demand for above scenario has been performed as shown on table 5.4.4.a, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21FA-10	692	10.2	424	
TOTAL FIXED SPRAY SYSTEM			**424**	

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
57GA-05/S	20	20,4	24	
57GA-06/S	16	20,4	20	
TOTAL MONITOR			**44**	

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Table 5.4.4.a

Pool Fire scenario inside HTU Fire Scenario Area 2		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	424
Total flow required for monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =44 m3/h Flowrate with additional margin =44*1,3= 57 m3/h.	57
	Monitor** required for control of burning liquid pool. Fire area = 245 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =245*6,5= 1593 l/min. Flowrate with additional margin =1593*1,3= 2070 l/min= 124 m3/h.	124
Additional flow required for fire brigade	10000 l/min	600
Sub total		1205
Ageing safety margin (10%)		121
TOTAL FIRE WATER DEMAND		1326

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.
**: It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area and the items inside the annular area of 12 m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering one catch basin in fire of 245 m2, which is the surface of the catchment area where the pool fire has been considered credible.

The required minimum foam concentrate is 1242 l (2070 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

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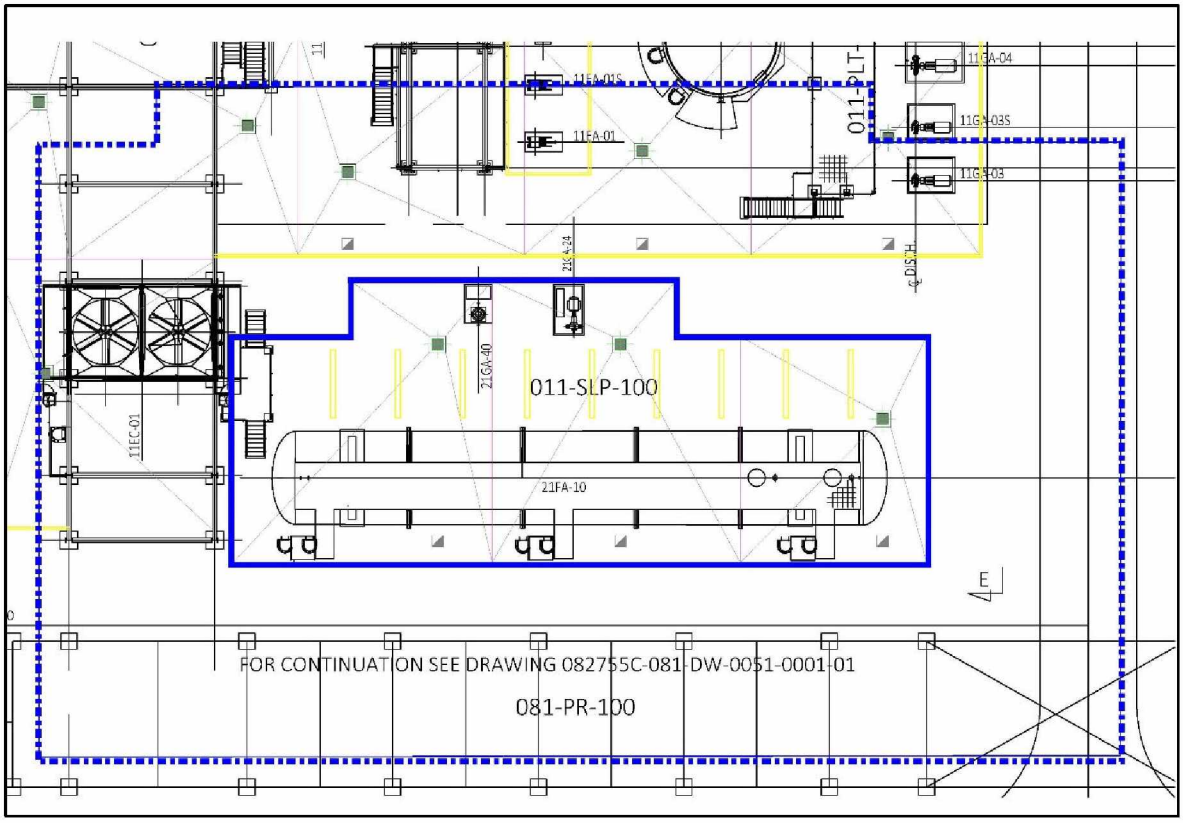
5.4.5. Fire Water demand in the rerun bullet Fire Scenario Area (Unit 57/11)

Rerun bullet Fire Scenario Area is shown in Picture 5.4.5.a in blue color and continuous line, 12 m heat radiation in blue dashed color.
In this area, pool fire and jet fire scenarios are considered credible. For the scope of the calculation, the worst fire scenarios have been selected:

- Pool fire inside rerun bullet curbed area due to flange leakage from 21FA-10;
- Jet fire due to release from 21GA-40 flange leakage.

Picture 5.4.5.a



Calculations of fire water demand for above scenarios have been performed as shown on table 5.4.5.a and table 5.4.5.b, based on the fire protection layouts developed.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

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Equipment requiring application of water through fixed spray systems for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
21FA-10	692	10.2	424	
TOTAL FIXED SPRAY SYSTEM			**424**	

Equipment requiring application of water through monitors for cooling inside the Fire Scenario Area and outside the Fire Scenario Area but in the radius of 12m:

Item	External wetted surface [m2]	Minimum application rate as per para 9 of Ref. [1] [l/min/m2]	Total Flowrate [m3/h]	Note
11GA-03	5	20,4	7	
11EC-01				Not applicable: no water consumption has been associated
21GA-40	6	20,4	8	
21GA-24	5	20,4	6	
TOTAL MONITOR			**21**	

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Table 5.4.5.a

Pool Fire scenario inside RERUN BULLET Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the fire area and outside but in the radius of 12m.	424
Total flow required for monitor application (with 30% additional margin)	Monitor* required for cooling inside the fire area and outside but in the radius of 12m. Theoretical flowrate =21 m3/h Flowrate with additional margin =21*1,3= 27 m3/h.	27
	Monitor** required for local foam application. Fire area = 663 m2. Application rate = 6,5 l/min m2. Theoretical flowrate =663*6,5= 4310 l/min. Flowrate with additional margin =4310*1,3= 5602 l/min= 336 m3/h.	336
Additional flow required for fire brigade	10000 l/min	600
Sub total		1387
Ageing safety margin (10%)		139
TOTAL FIRE WATER DEMAND		1526

*: Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

** It is to be noticed that minimum application rate 6,5 l/min/m2 on the fuel surface taken from para 16.5 of Ref. [1] has been used instead of 12,2 l/min/m2 application rate for control of burning liquid pool taken from para 9 of Ref. [1]. Currently Detailed Firefighting Layout (082755C-057-DW-1931-0001) foresees only a monitor with foam connection of 240 m3/h capacity. Monitor type will be defined during next phase of the Project according to outcomes of FHA - part 2.

The total flow required for cooling by means of fixed spray systems and monitors has been calculated conservatively considering the items inside the whole Fire Scenario Area

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and the items inside the annular area of 12m, exposed to the heat radiation, that has been considered from the border of the Fire Scenario Area.

Pool fire area has been calculated considering the whole curbed area in fire with a surface of 663 m2.
The required minimum foam concentrate is 3361 l (1526 l/min*0,03*20 min, considering monitor flowrate with additional margin, 3% by volume foam proportion rate and 20 minutes application).

Table 5.4.5.b

Jet Fire scenario inside RERUN BULLET Fire Scenario Area		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Fixed spray system inside the jet fire impact area. Assumed conservatively the equipment with fixed spray system 21FA-10 that requires largest amount of firewater, being characteristics of jet fire coming from 21GA-40 (assumed only one equipment impinged by jet fire).	424
Total flow required for monitor application (with 30% additional margin)	Monitor* required for jet fire application. Assumed one monitor application being characteristics of jet fire (assumed only one equipment impinged by jet fire). One monitor capacity is 6000 l/min (360 m3/h).	360
Additional flow required for fire brigade	10000 l/min	600
Sub total		1384
Ageing safety margin (10%)		138
TOTAL FIRE WATER DEMAND		1522

*: Monitor type and number will be defined according to outcomes of FHA - part 2.

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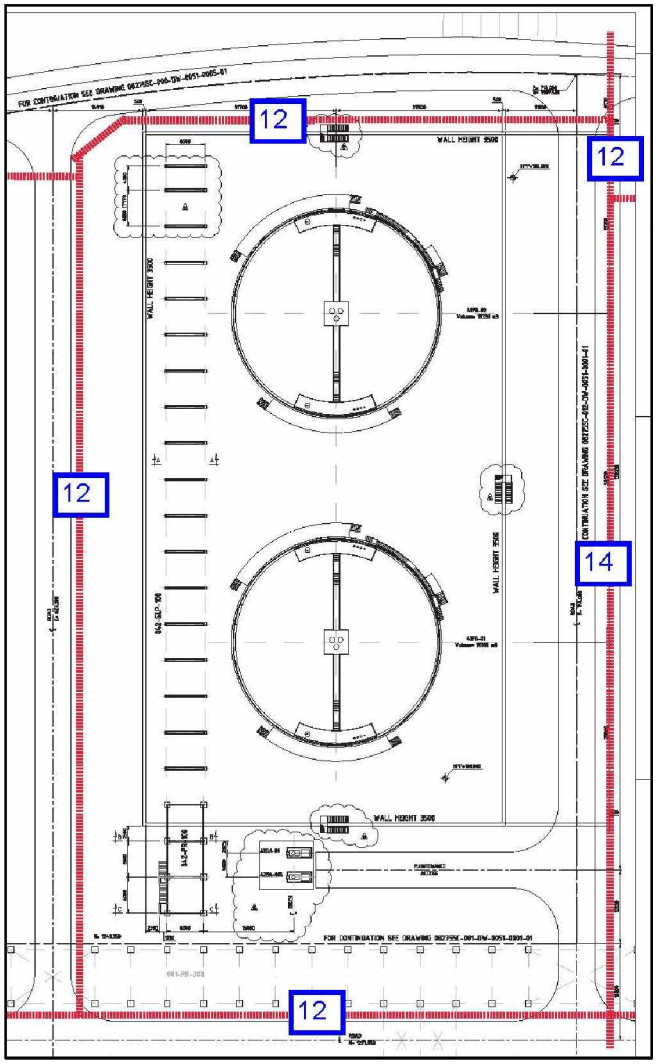
5.5. Fire Water demand in the intermediate storage area (Unit 42)

The intermediate storage area is shown in Picture 5.5.a.

The intermediate products are considered not flammable/combustible (according to definitions of flammable and combustible from Ref. [1]), therefore no active fire protection is needed for the intermediate tanks and relevant pumps and fire hydrants are deemed sufficient.
For above reasons, no fire scenario is presented in this document for the area.

Picture 5.5.a



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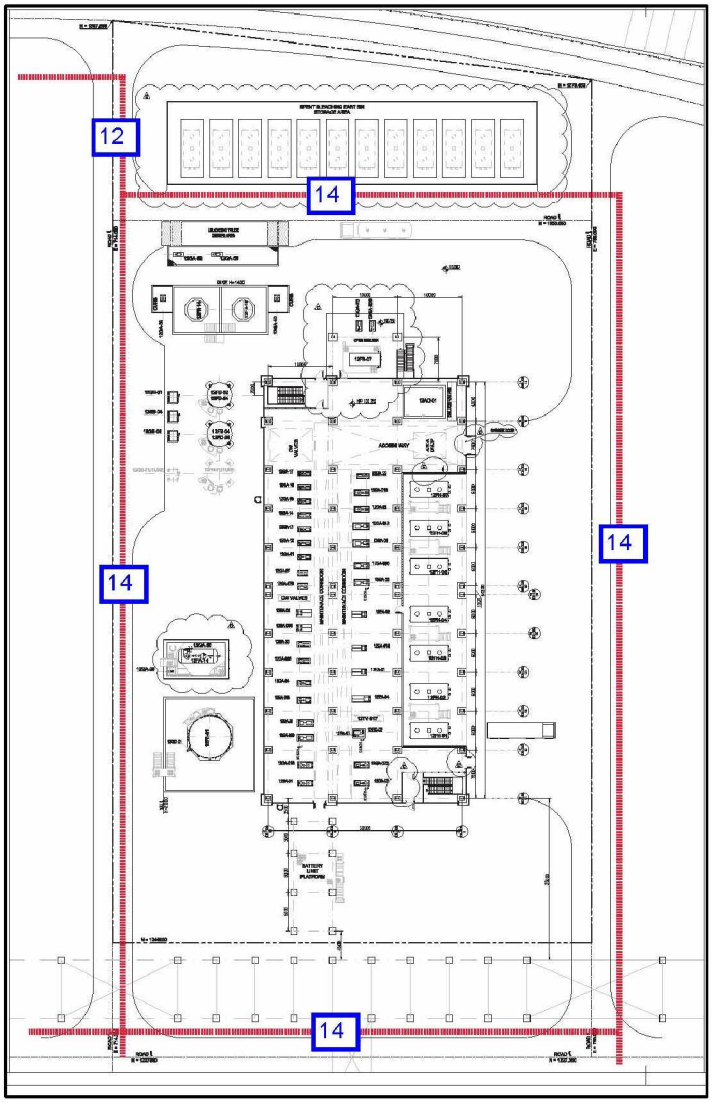
5.6. Fire Water demand in the PTU area (Unit 12)

PTU Area is shown in Picture 5.6.a.
In this area, material handled is considered not flammable/combustible (according to definitions of flammable and combustible in Ref. [1]), but installation of sprinkler system is foreseen inside PTU building since it is a process building.
Therefore no fire scenario is envisaged in the area outside PTU building, no calculation of water demand has been performed and installation of fire hydrants only is deemed sufficient.
The calculation of the fire water demand has been performed inside PTU building for the design of the sprinkler system.

Picture 5.6.a



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Calculation of fire water demand inside the building for the sprinkler design has been performed as shown on table 5.6.a.

The amount of FW inside PTU building has been estimated in order to protect four floors simultaneously by a sprinkler system. Fire water demand has been calculated considering the density indicated in EN 12845:2019 "Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance" (12,5 l/min/m2, chosen conservatively as the maximum design density of discharge for hazard class: high hazard, process class indicated in Table 3 of the code).
According to EN 12845: 2019 "Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance", the assumed area of operation is 260 m2 (in the hydraulically most unfavorable parts of the protected building), then a total flowrate of 195 m3/h has been considered for each floor.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Table 5.6.a

Fire scenario for PTU Building Sprinkler Design		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Sprinkler system is required for each floor= 195 m3/h . PTU building first floor is a solid floor and 2nd, 3rd and 4th floors are grated; FW assumed for sprinkler systems: 4x195=780m3/h	780
Total flow required for monitor application (with 30% additional margin)	No monitor is required for cooling inside the fire area and outside but in the radius of 12m	0
	No monitor required for local foam application.	0
Additional flow required for fire brigade	Not required	0
Sub total		780
Ageing safety margin (10%)		78
TOTAL FIRE WATER DEMAND		858

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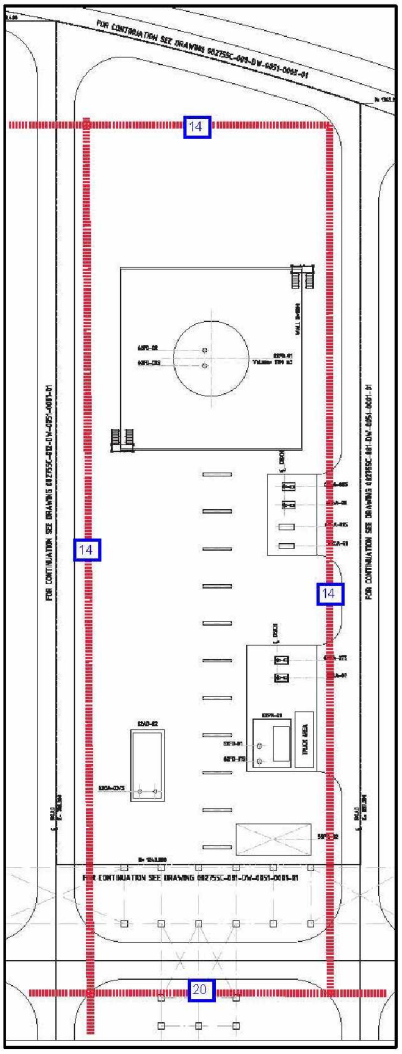
5.7. Fire Water demand in the pre-treatment section Area (Unit 62)

Pre-treatment section area is shown in Picture 5.7.a.

In this area, material handled is considered not flammable/combustible (according to definition of flammable and combustible in Ref [1]) with the exception of NEXPRE CPI PKG. Pool fire scenario is assumed not credible in this area due to the fact that CPI is blanketed with nitrogen and that it is present a concrete cover.
Therefore installation of fire hydrants in the area is considered sufficient.

For above reason, no fire scenario is presented in this document for the area.

Picture 5.7.a



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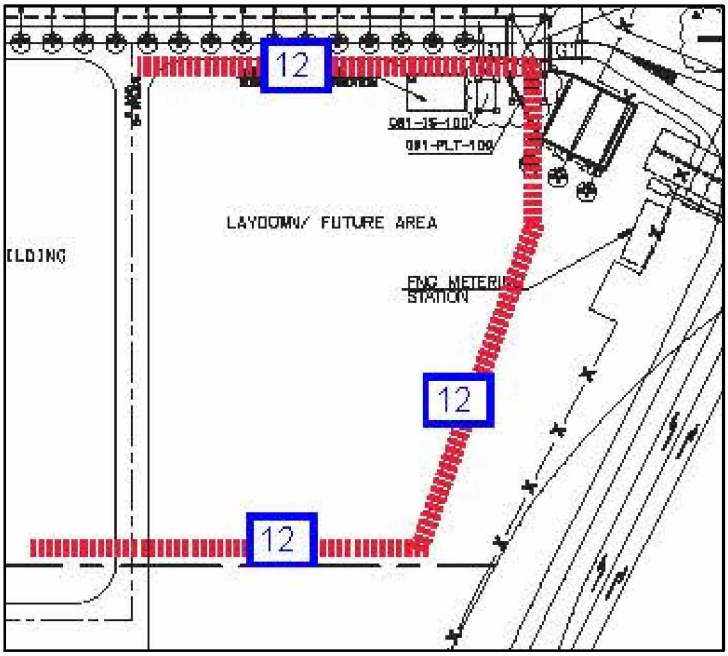
5.8. Fire Water demand in the pig launcher / receiver area (Unit 81)

Pig launcher/receiver area, on the east side of the unit 76 operator building and laboratory, is shown in Picture 5.8.a.
In this area only fuel gas and pig on feedstock and pretreated feedstock lines are present. Pool fire scenario is assumed not credible since materials handled are in gas phase (fuel gas) or considered not flammable/combustible (feedstock and pretreated feedstock, according to definition of flammable and combustible in Ref [1]). Only fire hydrants to be installed in the area.

For above reasons, no fire scenario is presented in this document for the area.

Picture 5.8.a



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5.9. Fire Water demand in the utilities Area (Unit 53)

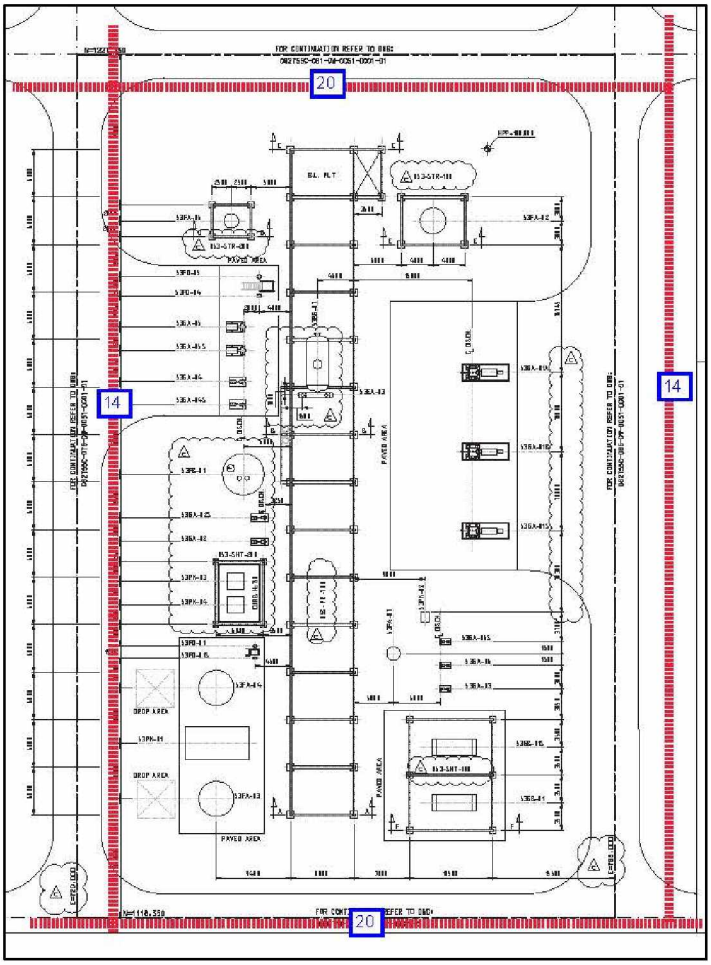
Utilities area is shown in Picture 5.9.a.
In this area, items handling material considered flammable/combustible (according to definition of flammable and combustible in Ref [1]) are not present with the exception of:

- air compressor lube oil and cooling water pumps lube oil: pool fire scenario is not credible due to the fact that lube oil is present in a small amount (minor 5 m3).
- CW surge drum in case of process exchanger failure and simultaneous vessel failure, but double jeopardy is not taken into account.

Therefore installation of fire hydrants in the area is considered sufficient.

For above reason, no fire scenario is presented in this document for the area.

Picture 5.9.a



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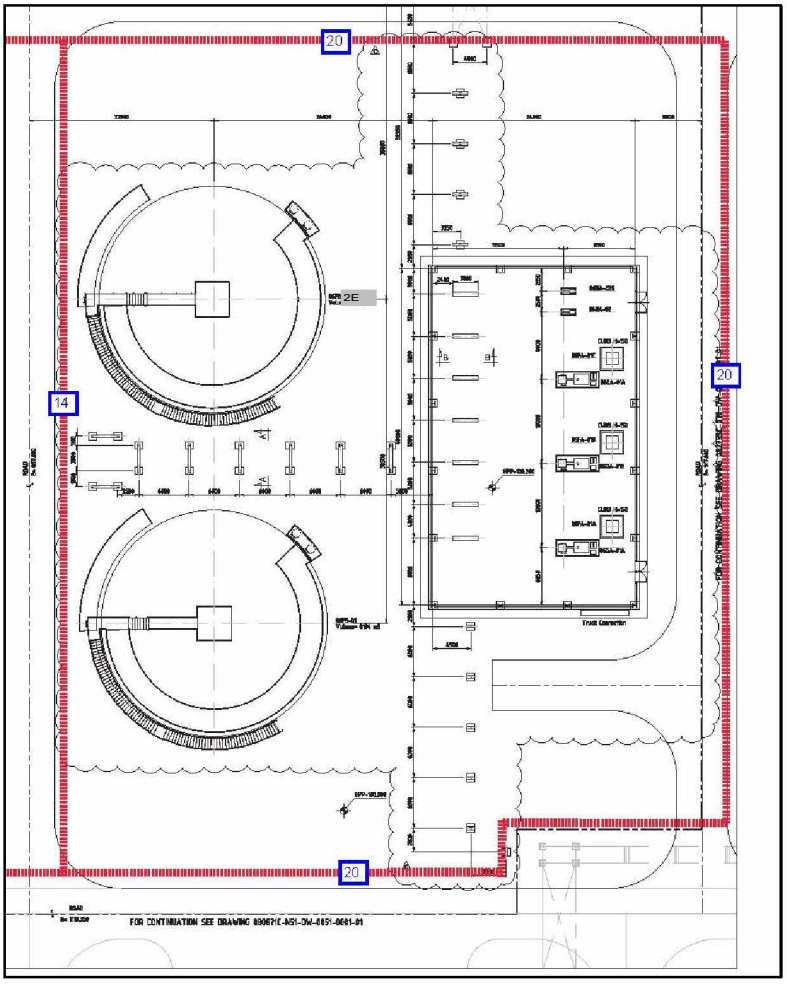
5.10. Fire Water demand inside FW pumps building (Unit 86)

FW pumps building area is shown in Picture 5.10.a.
In this area, only the diesel of FW pump motor is classified as flammable while fluid handled is water. Installation of sprinkler system is foreseen inside FW pump building since it is a process building
The calculation of the fire water demand has been performed inside FW pump building for the design of the sprinkler system

Picture 5.10.a



Calculation of fire water demand inside the building has been considered performed as shown on table 5.10.a, based on the fire protection layouts developed

The amount of FW inside the FW pumps building has been estimated in order to protect the ground floor by a sprinkler system. Fire water demand has been calculated considering the density indicated in EN 12845:2019 “Fixed firefighting systems – Automatic sprinkler systems– Design, installation and maintenance” (12,5 l/min/m2,

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chosen conservatively as the maximum design density of discharge for hazard class: high hazard, process class indicated in Table 3 of the code).
According to EN 12845: 2019 "Fixed firefighting systems – Automatic sprinkler systems– Design, installation and maintenance", the assumed area of operation is 260 m2 (in the hydraulically most unfavorable parts of the protected building), then a total flowrate of 195 m3/h has been considered.

Additional updating is required during Execution stage of Project to check any possible change in layout or equipment dimension.

Table 5.10.a

Fire scenario for FIRE WATER PUMPS Building Sprinkler Design		
TOTAL FLOW COMPONENTS	**Application rate details**	**Fire Water Flow Rate (m3/h)**
Total flow required for fixed spray systems	Sprinkler system is required for each floor= 195 m3/h (Ref. [5]). Fire water pumps building has a ground floor: 1x195 = 195m3/h	195
Total flow required for monitor application (with 30% additional margin)	No monitor is required for cooling inside the fire area and outside but in the radius of 12m	0
	No monitor required for local foam application.	0
Additional flow required for fire brigade	Not required	0
Sub total		195
Ageing safety margin (10%)		20
TOTAL FIRE WATER DEMAND		215

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6. NETWORK CONFIGURATION

Refer to picture 2.a, present in chapter 2.

In addition:

- the attachment 1.A presents the PIPENET schematic fire water layout (piping size):
- the attachment 1.B presents the PIPENET schematics fire water layout (length and elevation).

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7. RESULTS

7.1. Fire Water Demand

For the MNA area (picture 2.a in paragraph 2) the maximum fire water demand is 1870 m3/h on Hot Oil Area (Unit 11/57) according to chapter 5 above. Therefore the figure of 2000 m3/h from Feasibility Phase is confirmed in Definition Phase

7.2. Fire Water Network

The fire water main network functionality has been verified when:

- Case A:
  1. Flowrate: equal to the Water Demand figure at the reference area;
  2. Pressure: the minimum operating pressure shall not be lower than 9.0 barg at network take-off point to the reference area users.
  3. Configuration: the network grid shall be considered in operation with one the fire water main supply route (one branch comprised between post indicator isolation valves) is out of operation.

- Case B:
  1. Flowrate: 120% of the Water Demand figure at the reference area;
  2. Pressure: the minimum operating pressure shall not be lower than 7.0 barg at network take-off point to the reference area users.
  3. Configuration: the network grid shall be considered in operation with all branches in service.

The calculation report outputs are presented in the following Attachments :

- Attachment 2: Pool Fire scenarioin NEXBTL area – Fire Scenario Area 1 - Case A;
- Attachment 3: Pool Fire scenarioin NEXBTL area – Fire Scenario Area 1 - Case B;
- Attachment 4: Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 - Case A;
- Attachment 5: Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 - Case B;
- Attachment 6: Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 - Case A;
- Attachment 7: Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 - Case B;
- Attachment 8: Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case A;
- Attachment 9: Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case B;
- Attachment 10: Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case A;
- Attachment 11:Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case B;
- Attachment 12: Pool Fire scenario in Bio-propane Fire Scenario Area - Case A;
- Attachment 13:Pool Fire scenario in Bio-propane Fire Scenario Area - Case B;
- Attachment 14: Jet Fire scenario Bio-propane Fire Scenario Area - Case A;
- Attachment 15:Jet Fire scenario in Bio-propane Fire Scenario Area - Case B;
- Attachment 16: Toxic release scenario in ammonia loading area – Case A;

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- Attachment 17: Toxic release scenario in ammonia loading area – Case B;
- Attachment 18: Pool Fire scenario in storm water pond area – Case A;
- Attachment 19:Pool Fire scenario in storm water pond area – Case B;
- Attachment 20: Pool Fire scenario in flare area – Case A;
- Attachment 21:Pool Fire scenario in flare area – Case B;
- Attachment 22:Pool Fire scenario in Hot Oil Fire Scenario Area - Case A;
- Attachment 23:Pool Fire scenario in Hot Oil Fire Scenario Area - Case B;
- Attachment 24:Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area - Case A;
- Attachment 25:Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area - Case B;
- Attachment 26:Pool Fire scenario in HTU Fire Scenario Area 1 – Case A;
- Attachment 27:Pool Fire scenario in HTU Fire Scenario Area 1 – Case B;
- Attachment 28:Pool Fire scenario in HTU Fire Scenario Area 2 – Case A;
- Attachment 29:Pool Fire scenario in HTU Fire Scenario Area 2 – Case B;
- Attachment 30:Pool Fire scenario in rerun bullet Fire Scenario Area – Case A;
- Attachment 31: Pool Fire scenario in the rerun bullet Fire Scenario Area – Case B;
- Attachment 32: Fire scenario for PTU building sprinkler design – Case A;
- Attachment 33: Fire scenario for PTU building sprinkler design – Case B;
- Attachment 34: Fire scenario for FW pump building sprinkler design – Case A;
- Attachment 35: Fire scenario for FW pump building sprinkler design – Case B;

Note: When two simulations have been performed for the same user (i.e. pool fire and jet fire scenarios) and same number of FW pumps are activated, only the report relevant to the scenario with largest fire water demand has been included as Attachment in this document.

In the MNA area (picture 2.a in paragraph 2), as shown on the calculation report outputs in above mentioned Attachments, the resulting residual pressures, allowed by the network hydraulic, at network take-off point are greater than the minimum required at the designed flow rate; in addition the velocity in the main network piping does not exceed 3.5 m/s.

The results are summarized in following tables (table 7.2.1 for Case A and table 7.2.2 for case B).

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Table 7.2.1: Results at designed flow rate for each fire scenario (Case A):

FIRE SCENARIO	*FLOW RATE [m^3/h]*	*CALCULATED RESIDUAL PRESSURE AT USER REMOTE POINT [barg]*	*MAX VELOCITY IN NETWORK [m/s]*
Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case A	1857 (2x928,5)	9,8	2,5
Jet Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case A	1185 (2x592,5)	10,8	1,6
Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 - Case A	1470 (2x735)	10,4	2,0
Jet Fire scenario in NEXBTL area – Fire Scenario Area 2 – Case A	1103 (2x551,5)	10,9	1,5
Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 – Jet Fire - Case A	986 (1x986)	9,9	1,4
Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case A	1199 (2x599,5)	10,8	1,6
Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case A	872 (1x872)	10,3	1,2
Pool Fire scenario in Bio-propane Fire Scenario Area – Case A	1008 (2x504)	11,1	1,4
Jet Fire scenario in Bio-propane Fire Scenario Area - Case A	955 (1x955)	10,0	1,3
Toxic release scenario in ammonia loading area – Case A	1188 (2x594)	10,8	1,6

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FIRE SCENARIO	*FLOW RATE [m³/h]*	*CALCULATED RESIDUAL PRESSURE AT USER REMOTE POINT [barg]*	*MAX VELOCITY IN NETWORK [m/s]*
Pool Fire scenario in storm water pond area – Case A	660 (1x660)	10,8	0,9
Pool Fire scenario in flare area – Case A	1349 (2x674,5)	10,4	2,4
Pool Fire scenario in Hot Oil Fire Scenario Area – Case A	1870 (2x935,5)	9,8	2,6
Jet Fire scenario in Hot Oil Fire Scenario Area – Case A	1233 (2x616,5)	10,7	1,7
Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area – Case A	1166 (2x583,5)	10,8	1,6
Pool Fire scenario in HTU Fire Scenario 1 Area – Case A	1836 (2x918)	9,8	2,5
Jet Fire scenario in HTU Fire Scenario Area 1 – Case A	1193 (2x596,5)	10,8	1,6
Pool Fire scenario in HTU Fire Scenario 2 Area – Case A	1326 (2x663)	10,6	1,8
Pool Fire scenario in rerun bullet Fire Scenario Area – Case A	1526 (2x763)	10,3	2,1
Jet Fire scenario in rerun bullet Fire Scenario Area – Case A	1522 (2x761)	10,3	2,1
Fire scenario for PTU building sprinkler design – Case A	858 (1x858)	10,2	1,3
Fire scenario for FW pump building sprinkler design – Case A	215 (1x215)	11,9	0,3

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Table 7.2.2: Results at designed flow rate for each fire scenario (Case B):

FIRE SCENARIO	*FLOW RATE [m³/h]*	*CALCULATED RESIDUAL PRESSURE AT USER REMOTE POINT [barg]*	*MAX VELOCITY IN NETWORK [m/s]*
Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case B	2288 (2x1114)	9,4	2,2
Jet Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case B	1422 (2x711)	10,6	1,3
Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 - Case B	1764 (2x882)	10,2	1,7
Jet Fire scenario in NEXBTL area – Fire Scenario Area 2 – Case B	1324 (2x662)	10,7	1,2
Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 – Jet Fire - Case B	1183 (2x591.5)	10,9	1,1
Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case B	1439 (2x719,5)	10,6	1,4
Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 - Case B	1046 (2x523)	11,1	1,0
Pool Fire scenario in Bio-propane Fire Scenario Area – Case B	1210 (2x605)	10,9	1,1
Jet Fire scenario in Bio-propane Fire Scenario Area - Case B	1146 (2x573)	11,0	1,1
Toxic release scenario in ammonia loading area – Case B	1426 (2x713)	10,5	1,9
Pool Fire scenario in storm water pond area – Case B	792 (1x792)	10.5	0.7

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FIRE SCENARIO	*FLOW RATE [m^3/h]*	*CALCULATED RESIDUAL PRESSURE AT USER REMOTE POINT [barg]*	*MAX VELOCITY IN NETWORK [m/s]*
Pool Fire scenario in flare area – Case B	1619 (2x809,5)	10,1	2,9
Pool Fire scenario in Hot Oil Fire Scenario Area – Case B	2244 (2x1122)	9,4	2,1
Jet Fire scenario in Hot Oil Fire Scenario Area – Case B	1480 (2x740)	10,6	1,4
Pool Fire in scenario Hot Oil Storage Tank Fire Scenario Area – Case B	1399 (2x699,5)	10,6	1,7
Pool Fire scenario in HTU Fire Scenario 1 Area – Case B	2203 (2x1101.5)	9,4	2,1
Jet Fire scenario in HTU Fire Scenario Area 1 – Case B	1432 (2x716)	10,6	1,3
Pool Fire scenario in HTU Fire Scenario 2 Area – Case B	1591 (2x795,5)	10,4	1,5
Pool Fire scenario in rerun bullet Fire Scenario Area – Case B	1831 (2x915.5)	10,1	1,7
Jet Fire scenario in rerun bullet Fire Scenario Area – Case B	1826 (2x913)	10,1	1,7
Fire scenario for PTU building sprinkler design – Case B	1030 (2x515)	11,0	1,6
Fire scenario for FW pump building sprinkler design – Case A	258 (1x258)	11,8	0,2

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7.3. Fire Water Storage

- The fire water storage capacity has to be designed on the basis of the supply period for which the uninterrupted water supply is required: which is, for each fire scenario 4 hours for fire water application at the required design water demand (Ref. [2]).
  In MNA Area Two (2) x 100% Fire Water Storage Tanks (86FB-01 and 86FB-02) are provided to store the fire water and maximize fire water availability.
  Working volume of each tank (preliminary value: 8000 m3) is calculated considering 4 hours hold-up time based on design fire water demand (i.e. 2000 m3/h) (Ref. [8]).

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8. ATTACHMENTS

Attachment	1	PIPENET schematic fire water layout
	1.A	Piping size
	1.B	Length and elevation
Attachment	2	Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 – Case A
	2.A	PIPENET schematic layout with piping and nodes label
	2.B	PIPENET schematic layout with flow rate and pressure results
	2.C	PIPENET schematic layout with velocity results
	2.D	PIPENET input/output printout report
Attachment	3	Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 – Case B
	3.A	PIPENET schematic layout with piping and nodes label
	3.B	PIPENET schematic layout with flow rate and pressure results
	3.C	PIPENET schematic layout with velocity results
	3.D	PIPENET input/output printout report
Attachment	4	Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 – Case A
	4.A	PIPENET schematic layout with piping and nodes label
	4.B	PIPENET schematic layout with flow rate and pressure results
	4.C	PIPENET schematic layout with velocity results
	4.D	PIPENET input/output printout report
Attachment	5	Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 – Case B
	5.A	PIPENET schematic layout with piping and nodes label
	5.B	PIPENET schematic layout with flow rate and pressure results
	5.C	PIPENET schematic layout with velocity results
	5.D	PIPENET input/output printout report
Attachment	6	Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 – Case A
	6.A	PIPENET schematic layout with piping and nodes label
	6.B	PIPENET schematic layout with flow rate and pressure results
	6.C	PIPENET schematic layout with velocity results
	6.D	PIPENET input/output printout report

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Attachment 7 Jet Fire scenario in NEXBTL area – Fire Scenario Area 3 – Case B
7.A PIPENET schematic layout with piping and nodes label
7.B PIPENET schematic layout with flow rate and pressure results
7.C PIPENET schematic layout with velocity results
7.D PIPENET input/output printout report

Attachment 8 Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case A
8.A PIPENET schematic layout with piping and nodes label
8.B PIPENET schematic layout with flow rate and pressure results
8.C PIPENET schematic layout with velocity results
8.D PIPENET input/output printout report

Attachment 9 Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case B
9.A PIPENET schematic layout with piping and nodes label
9.B PIPENET schematic layout with flow rate and pressure results
9.C PIPENET schematic layout with velocity results
9.D PIPENET input/output printout report

Attachment 10 Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case A
10.A PIPENET schematic layout with piping and nodes label
10.B PIPENET schematic layout with flow rate and pressure results
10.C PIPENET schematic layout with velocity results
10.D PIPENET input/output printout report

Attachment 11 Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case B
11.A PIPENET schematic layout with piping and nodes label
11.B PIPENET schematic layout with flow rate and pressure results
11.C PIPENET schematic layout with velocity results
11.D PIPENET input/output printout report

Attachment 12 Pool Fire scenario in Bio-propane Fire Scenario Area – Case A
12.A PIPENET schematic layout with piping and nodes label
12.B PIPENET schematic layout with flow rate and pressure results
12.C PIPENET schematic layout with velocity results
12.D PIPENET input/output printout report

Attachment 13 Pool Fire scenario in Bio-propane Fire Scenario Area – Case B
13.A PIPENET schematic layout with piping and nodes label
13.B PIPENET schematic layout with flow rate and pressure results
13.C PIPENET schematic layout with velocity results
13.D PIPENET input/output printout report

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Attachment	14	Jet Fire scenario in Bio-propane Fire Scenario Area – Case A
	14.A	PIPENET schematic layout with piping and nodes label
	14.B	PIPENET schematic layout with flow rate and pressure results
	14.C	PIPENET schematic layout with velocity results
	14.D	PIPENET input/output printout report
Attachment	15	Jet Fire scenario in Bio-propane Fire Scenario Area – Case B
	15.A	PIPENET schematic layout with piping and nodes label
	15.B	PIPENET schematic layout with flow rate and pressure results
	15.C	PIPENET schematic layout with velocity results
	15.D	PIPENET input/output printout report
Attachment	16	Toxic release scenario in ammonia loading area – Case A
	16.A	PIPENET schematic layout with piping and nodes label
	16.B	PIPENET schematic layout with flow rate and pressure results
	16.C	PIPENET schematic layout with velocity results
	16.D	PIPENET input/output printout report
Attachment	17	Toxic release scenario in ammonia loading area – Case B
	17.A	PIPENET schematic layout with piping and nodes label
	17.B	PIPENET schematic layout with flow rate and pressure results
	17.C	PIPENET schematic layout with velocity results
	17.D	PIPENET input/output printout report
Attachment	18	Pool Fire scenario in storm water pond area – Case A
	18.A	PIPENET schematic layout with piping and nodes label
	18B	PIPENET schematic layout with flow rate and pressure results
	18.C	PIPENET schematic layout with velocity results
	18.D	PIPENET input/output printout report
Attachment	19	Pool Fire scenario in the storm water pond area – Case B
	19.A	PIPENET schematic layout with piping and nodes label
	19.B	PIPENET schematic layout with flow rate and pressure results
	19.C	PIPENET schematic layout with velocity results
	19.D	PIPENET input/output printout report
Attachment	20	Pool Fire scenario in flare area – Case A
	20.A	PIPENET schematic layout with piping and nodes label
	20.B	PIPENET schematic layout with flow rate and pressure results
	20.C	PIPENET schematic layout with velocity results
	20.D	PIPENET input/output printout report
Attachment	21	Pool Fire scenario in flare area – Case B
	21.A	PIPENET schematic layout with piping and nodes label
	21.B	PIPENET schematic layout with flow rate and pressure results
	21.C	PIPENET schematic layout with velocity results
	21.D	PIPENET input/output printout report

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Attachment	22	Pool Fire scenario in Hot Oil Fire Scenario Area – Case A
	22.A	PIPENET schematic layout with piping and nodes label
	22.B	PIPENET schematic layout with flow rate and pressure results
	22.C	PIPENET schematic layout with velocity results
	22.D	PIPENET input/output printout report
Attachment	23	Pool Fire scenario in Hot Oil Fire Scenario Area – Case B
	23.A	PIPENET schematic layout with piping and nodes label
	23.B	PIPENET schematic layout with flow rate and pressure results
	23.C	PIPENET schematic layout with velocity results
	23.D	PIPENET input/output printout report
Attachment	24	Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area – Case A
	24.A	PIPENET schematic layout with piping and nodes label
	24.B	PIPENET schematic layout with flow rate and pressure results
	24.C	PIPENET schematic layout with velocity results
	24.D	PIPENET input/output printout report
Attachment	25	Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area – Case B
	25.A	PIPENET schematic layout with piping and nodes label
	25.B	PIPENET schematic layout with flow rate and pressure results
	25.C	PIPENET schematic layout with velocity results
	25.D	PIPENET input/output printout report
Attachment	26	Pool Fire scenario in HTU Fire Scenario Area 1 – Case A
	26.A	PIPENET schematic layout with piping and nodes label
	26.B	PIPENET schematic layout with flow rate and pressure results
	26.C	PIPENET schematic layout with velocity results
	26.D	PIPENET input/output printout report
Attachment	27	Pool Fire scenario in HTU Fire Scenario Area 1 – Case B
	27.A	PIPENET schematic layout with piping and nodes label
	27.B	PIPENET schematic layout with flow rate and pressure results
	27.C	PIPENET schematic layout with velocity results
	27.D	PIPENET input/output printout report
Attachment	28	Pool Fire scenario in HTU Fire Scenario Area 2 – Case A
	28.A	PIPENET schematic layout with piping and nodes label
	28.B	PIPENET schematic layout with flow rate and pressure results
	28.C	PIPENET schematic layout with velocity results
	28.D	PIPENET input/output printout report

Attachment	29	Pool Fire scenario in HTU Fire Scenario Area 2 – Case B
	29.A	PIPENET schematic layout with piping and nodes label
	29.B	PIPENET schematic layout with flow rate and pressure results
	29.C	PIPENET schematic layout with velocity results
	29.D	PIPENET input/output printout report
Attachment	30	Pool Fire scenario in rerun bullet Fire Scenario Area – Case A
	30.A	PIPENET schematic layout with piping and nodes label
	30.B	PIPENET schematic layout with flow rate and pressure results
	30.C	PIPENET schematic layout with velocity results
	30.D	PIPENET input/output printout report
Attachment	31	Pool Fire scenario in rerun bullet Fire Scenario Area – Case B
	31.A	PIPENET schematic layout with piping and nodes label
	31.B	PIPENET schematic layout with flow rate and pressure results
	31.C	PIPENET schematic layout with velocity results
	31.D	PIPENET input/output printout report
Attachment	32	Fire scenario for PTU building sprinkler design – Case A
	32.A	PIPENET schematic layout with piping and nodes label
	32.B	PIPENET schematic layout with flow rate and pressure results
	32.C	PIPENET schematic layout with velocity results
	32.D	PIPENET input/output printout report
Attachment	33	Fire scenario for PTU building sprinkler design – Case B
	33.A	PIPENET schematic layout with piping and nodes label
	33.B	PIPENET schematic layout with flow rate and pressure results
	33.C	PIPENET schematic layout with velocity results
	33.D	PIPENET input/output printout report
Attachment	34	Fire scenario for FW pump building sprinkler design – Case A
	34.A	PIPENET schematic layout with piping and nodes label
	34.B	PIPENET schematic layout with flow rate and pressure results
	34.C	PIPENET schematic layout with velocity results
	34.D	PIPENET input/output printout report
Attachment	35	Fire scenario for FW pump building sprinkler design – Case B
	35.A	PIPENET schematic layout with piping and nodes label
	35.B	PIPENET schematic layout with flow rate and pressure results
	35.C	PIPENET schematic layout with velocity results
	35.D	PIPENET input/output printout report

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Attachment 1 PIPENET schematic fire water layout
1.A Piping size
1.B Length and elevation

Attachment 1.A contains 1 page
Attachment 1.B contains 1 page

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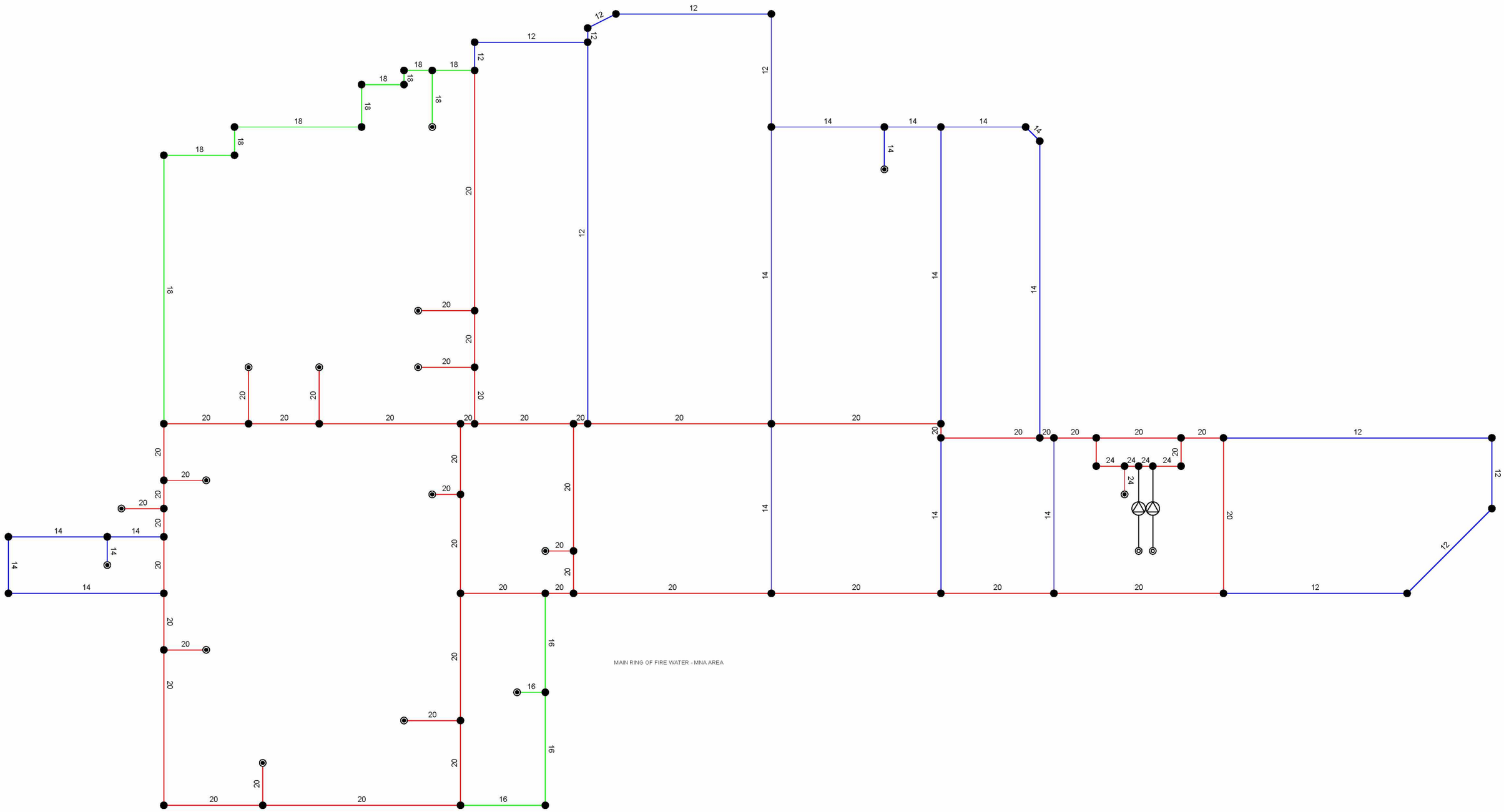
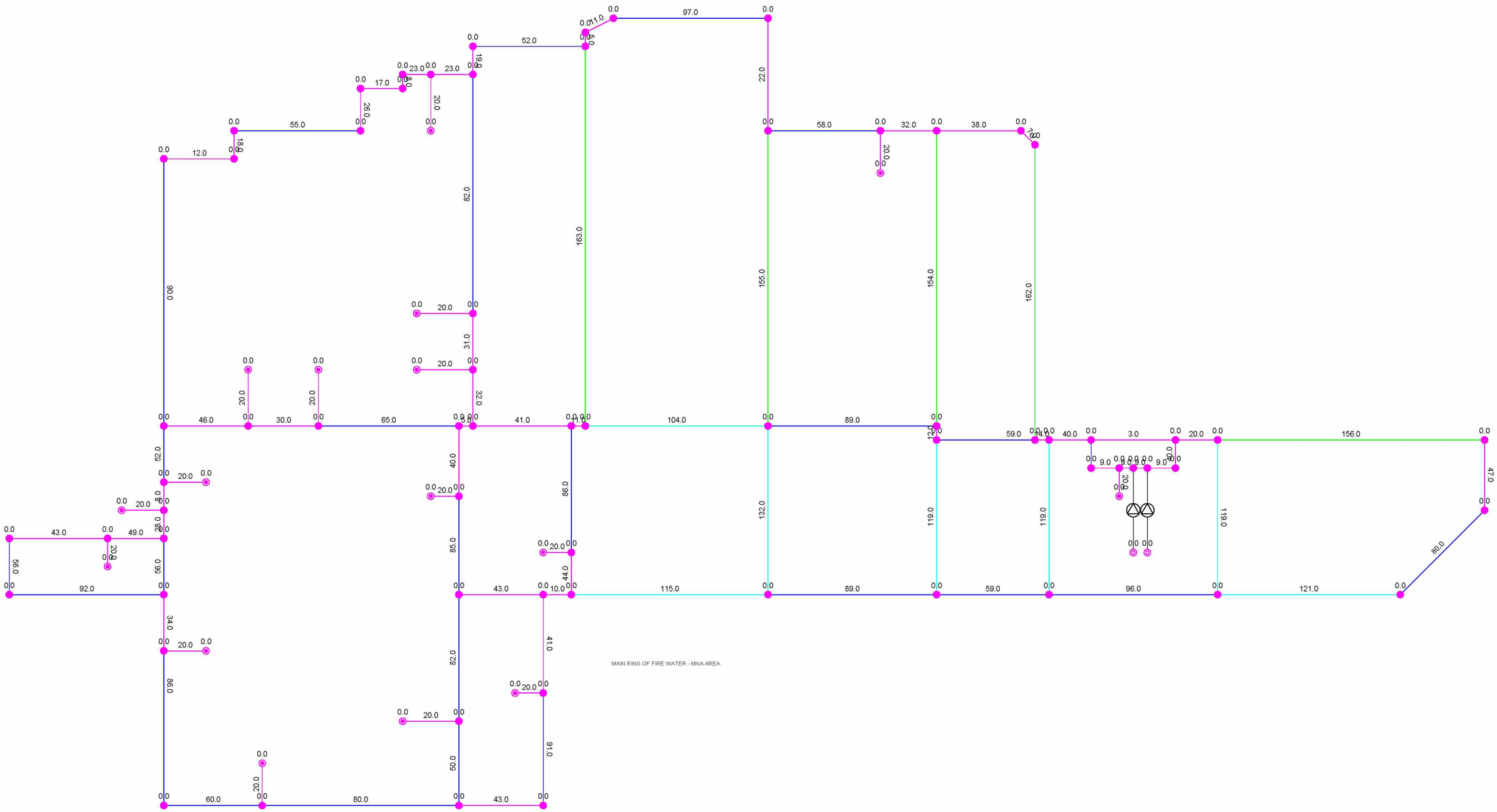


Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe bore (in)	< 12.000000	< 14.000000	< 16.000000
	< 18.000000	< 20.000000	> 20.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Elevation (m)	< 0.200000	< 0.400000	< 0.600000
	< 0.800000	< 1.000000	> 1.000000
Pipe length (m)	< 50.000000	< 100.000000	< 150.000000
	< 250.000000	< 300.000000	> 300.000000

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Attachment 2 Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case A

2.A PIPENET schematic layout with piping and nodes label
2.B PIPENET schematic layout with flow rate and pressure results
2.C PIPENET schematic layout with velocity results
2.D PIPENET input/output printout report

Attachment 2.A contains 1 page
Attachment 2.B contains 1 page
Attachment 2.C contains 1 page
Attachment 2.D contains 21 pages

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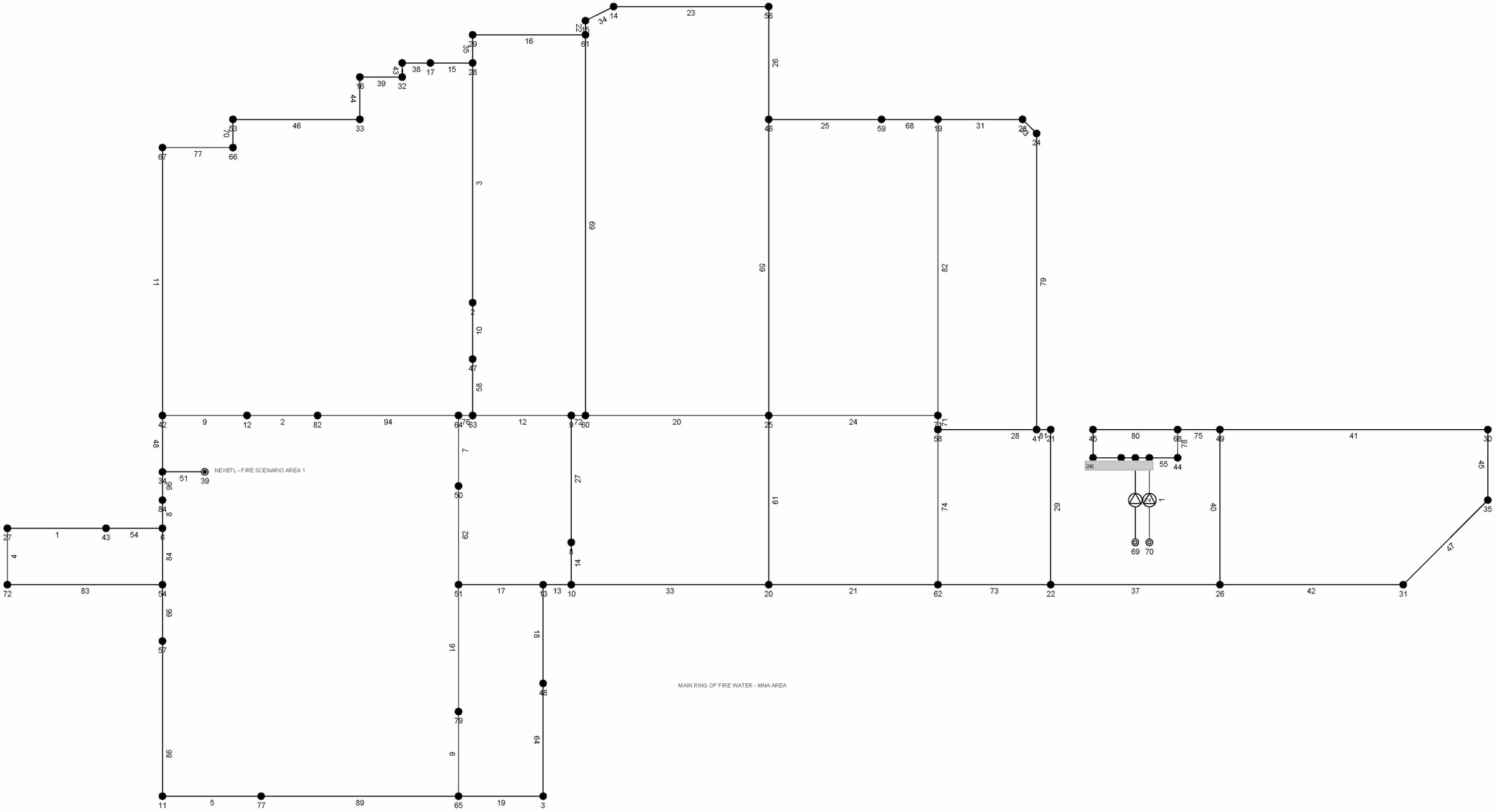
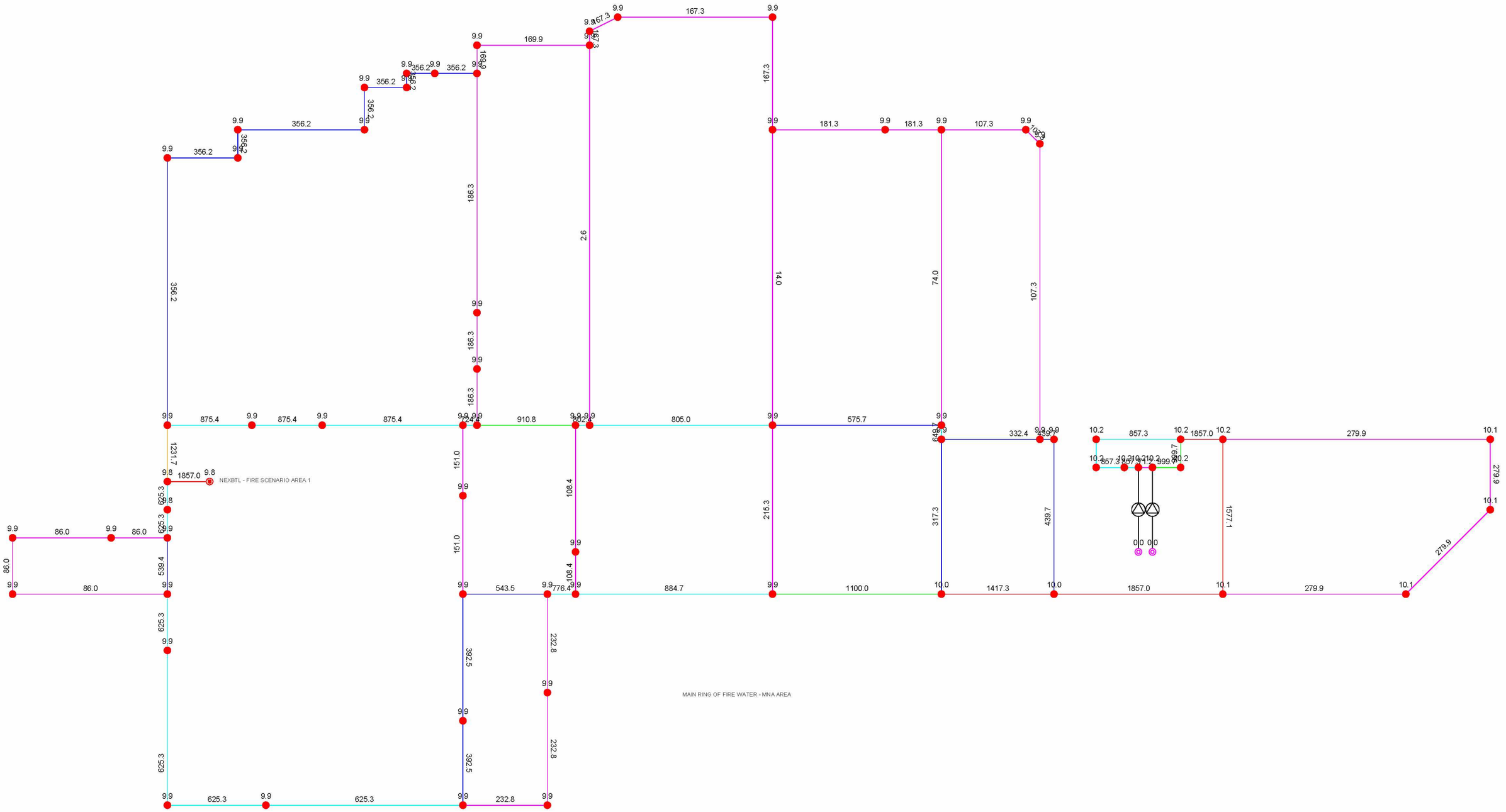
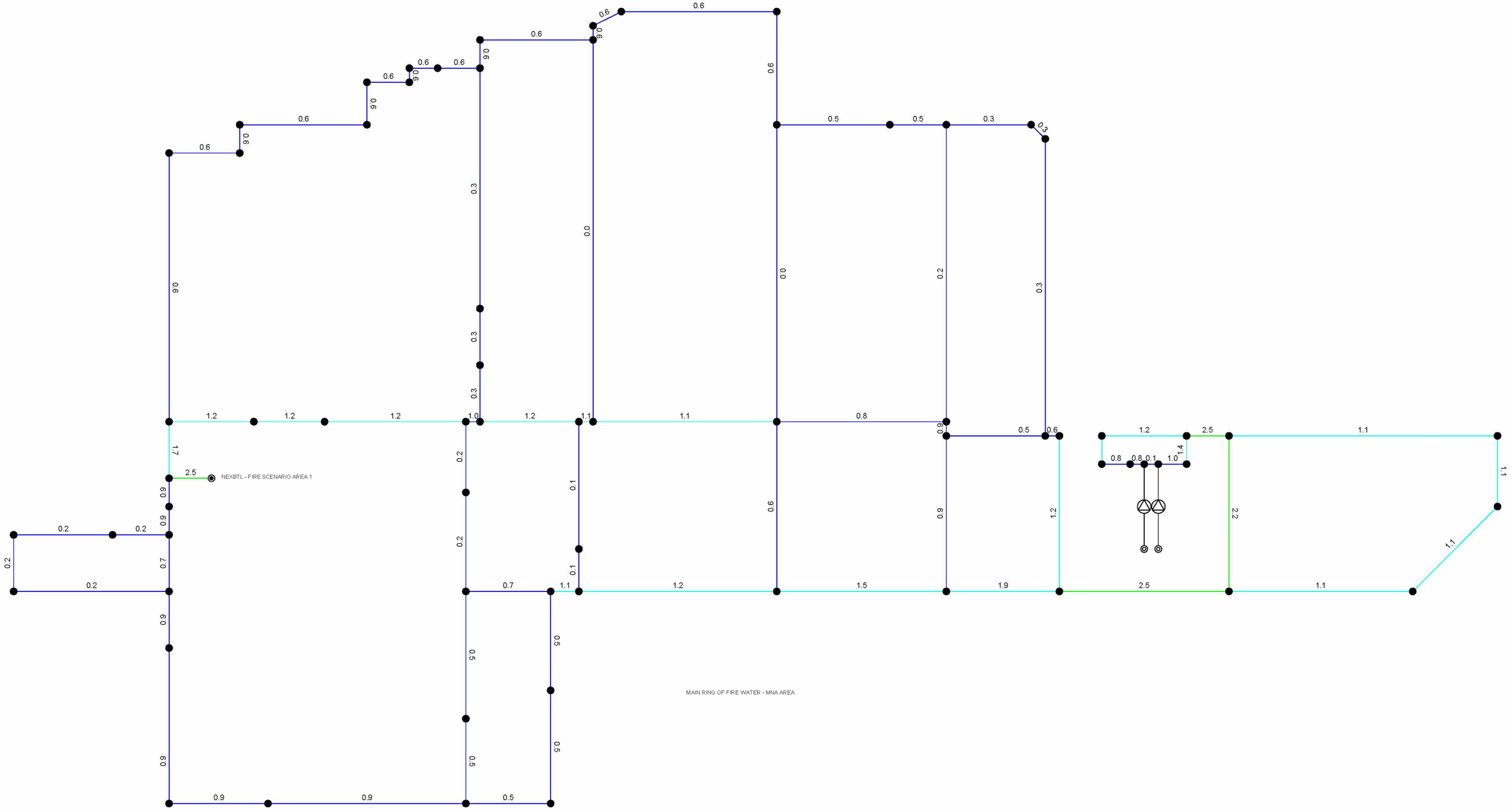


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

15:57 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
51	34	39	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
51	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	85.9538	9	14.0000	14.0000	*
2	82	12	875.4374	9	20.0000	20.0000	*
3	2	28	186.3476	9	20.0000	20.0000	*
4	72	27	85.9538	9	14.0000	14.0000	*
5	77	11	625.3207	9	20.0000	20.0000	*
6	79	65	392.5135	9	20.0000	20.0000	*
7	50	64	151.0312	9	20.0000	20.0000	*
8	6	84	625.3207	9	20.0000	20.0000	*
9	12	42	875.4374	9	20.0000	20.0000	*
10	47	2	186.3476	9	20.0000	20.0000	*
11	67	42	356.2462	9	18.0000	18.0000	*
12	9	63	910.7536	9	20.0000	20.0000	*
13	10	13	776.3519	9	20.0000	20.0000	*
14	10	8	108.3561	9	20.0000	20.0000	*
15	28	17	356.2462	9	18.0000	18.0000	*
16	61	29	169.8986	9	12.0000	12.0000	*
17	13	51	543.5447	9	20.0000	20.0000	*
18	13	48	232.8072	9	16.0000	16.0000	*
19	3	65	232.8072	9	16.0000	16.0000	*
20	25	60	805.0130	9	20.0000	20.0000	*
21	62	20	1099.9991	9	20.0000	20.0000	*
22	15	61	167.2831	9	12.0000	12.0000	*
23	56	14	167.2831	9	12.0000	12.0000	*
24	71	25	575.7106	9	20.0000	20.0000	*
25	59	46	181.2946	9	14.0000	14.0000	*
26	46	56	167.2831	9	12.0000	12.0000	*
27	8	9	108.3561	9	20.0000	20.0000	*
28	41	58	332.4029	9	20.0000	20.0000	*
29	22	21	439.7310	9	14.0000	14.0000	*
31	23	19	107.3281	9	14.0000	14.0000	*
33	20	10	884.7079	9	20.0000	20.0000	*
34	14	15	167.2831	9	12.0000	12.0000	*
35	29	28	169.8986	9	12.0000	12.0000	*
36	7	73	857.3081	9	24.0000	24.0000	*
37	26	22	1857.0042	9	20.0000	20.0000	*
38	17	1	356.2462	9	18.0000	18.0000	*
39	32	16	356.2462	9	18.0000	18.0000	*
40	49	26	1577.1158	9	20.0000	20.0000	*
41	49	30	279.8883	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	279.8883	9	12.0000	12.0000	*
43	1	32	356.2462	9	18.0000	18.0000	*
44	16	33	356.2462	9	18.0000	18.0000	*
45	30	35	279.8883	9	12.0000	12.0000	*
46	33	53	356.2462	9	18.0000	18.0000	*
47	35	31	279.8883	9	12.0000	12.0000	*
48	42	34	1231.6836	9	20.0000	20.0000	*
51	34	39	1857.0042	9	20.0000	20.0000	*
53	24	23	107.3281	9	14.0000	14.0000	*
54	43	6	85.9538	9	14.0000	14.0000	*
55	55	44	999.6961	9	24.0000	24.0000	*
56	7	55	71.1928	9	24.0000	24.0000	*
58	63	47	186.3476	9	20.0000	20.0000	*
59	46	25	14.0114	9	14.0000	14.0000	*
60	73	40	857.3081	9	24.0000	24.0000	*
61	20	25	215.2910	9	14.0000	14.0000	*
62	51	50	151.0312	9	20.0000	20.0000	*
64	48	3	232.8072	9	16.0000	16.0000	*
66	57	54	625.3207	9	20.0000	20.0000	*
67	40	45	857.3081	9	20.0000	20.0000	*
68	19	59	181.2946	9	14.0000	14.0000	*
69	60	61	2.6155	9	12.0000	12.0000	*
70	53	66	356.2462	9	18.0000	18.0000	*
71	58	71	649.6771	9	20.0000	20.0000	*
72	60	9	802.3976	9	20.0000	20.0000	*
73	22	62	1417.2732	9	20.0000	20.0000	*
74	62	58	317.2741	9	14.0000	14.0000	*
75	68	49	1857.0042	9	20.0000	20.0000	*
76	63	64	724.4061	9	20.0000	20.0000	*
77	66	67	356.2462	9	18.0000	18.0000	*
78	44	68	999.6961	9	20.0000	20.0000	*
79	41	24	107.3281	9	14.0000	14.0000	*
80	45	68	857.3081	9	20.0000	20.0000	*
81	21	41	439.7310	9	20.0000	20.0000	*
82	71	19	73.9665	9	14.0000	14.0000	*
83	54	72	85.9538	9	14.0000	14.0000	*
84	54	6	539.3669	9	20.0000	20.0000	*
86	11	57	625.3207	9	20.0000	20.0000	*
89	65	77	625.3207	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	392.5135	9	20.0000	20.0000	*
94	64	82	875.4374	9	20.0000	20.0000	*
96	84	34	625.3207	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.852	9.851	6.3801E-04	6.3801E-04	85.95	0.2404
2	82	12	20.00	9.880	9.874	5.7449E-03	5.7449E-03	875.4	1.200
3	2	28	20.00	9.892	9.891	8.9741E-04	8.9741E-04	186.3	0.2554
4	72	27	14.00	9.853	9.852	1.1873E-03	1.1873E-03	85.95	0.2404
5	77	11	20.00	9.879	9.871	7.9594E-03	7.9594E-03	625.3	0.8570
6	79	65	20.00	9.890	9.888	2.1706E-03	2.1706E-03	392.5	0.5379
7	50	64	20.00	9.893	9.892	6.3515E-04	6.3515E-04	151.0	0.2070
8	6	84	20.00	9.850	9.847	2.8782E-03	2.8782E-03	625.3	0.8570
9	12	42	20.00	9.874	9.865	8.8072E-03	8.8072E-03	875.4	1.200
10	47	2	20.00	9.892	9.892	3.3760E-04	3.3760E-04	186.3	0.2554
11	67	42	18.00	9.873	9.865	7.9298E-03	7.9298E-03	356.2	0.6028
12	9	63	20.00	9.901	9.893	8.4457E-03	8.4457E-03	910.8	1.248
13	10	13	20.00	9.902	9.900	1.5354E-03	1.5354E-03	776.4	1.064
14	10	8	20.00	9.902	9.902	1.7738E-04	1.7738E-04	108.4	0.1485
15	28	17	18.00	9.891	9.889	1.3924E-03	1.3924E-03	356.2	0.6028
16	61	29	12.00	9.903	9.896	7.1402E-03	7.1402E-03	169.9	0.6468
17	13	51	20.00	9.900	9.893	7.0219E-03	7.0219E-03	543.5	0.7449
18	13	48	16.00	9.900	9.897	3.7622E-03	3.7622E-03	232.8	0.4985
19	3	65	16.00	9.891	9.888	3.8633E-03	3.8633E-03	232.8	0.4985
20	25	60	20.00	9.920	9.903	1.7047E-02	1.7047E-02	805.0	1.103
21	62	20	20.00	9.959	9.933	2.5995E-02	2.5995E-02	1100.	1.508
22	15	61	12.00	9.904	9.903	1.1826E-03	1.1826E-03	167.3	0.6368
23	56	14	12.00	9.916	9.906	1.0448E-02	1.0448E-02	167.3	0.6368
24	71	25	20.00	9.928	9.920	7.8449E-03	7.8449E-03	575.7	0.7890
25	59	46	14.00	9.924	9.920	3.4218E-03	3.4218E-03	181.3	0.5071
26	46	56	12.00	9.920	9.916	3.7079E-03	3.7079E-03	167.3	0.6368
27	8	9	20.00	9.902	9.901	5.2738E-04	5.2738E-04	108.4	0.1485
28	41	58	20.00	9.931	9.929	1.8826E-03	1.8826E-03	332.4	0.4556
29	22	21	14.00	9.987	9.932	5.4953E-02	5.4953E-02	439.7	1.230
31	23	19	14.00	9.926	9.925	1.0042E-03	1.0042E-03	107.3	0.3002
33	20	10	20.00	9.933	9.902	3.1350E-02	3.1350E-02	884.7	1.212
34	14	15	12.00	9.906	9.904	1.8301E-03	1.8301E-03	167.3	0.6368
35	29	28	12.00	9.896	9.891	5.1699E-03	5.1699E-03	169.9	0.6468
36	7	73	24.00	10.23	10.22	4.8704E-03	4.8704E-03	857.3	0.8159
37	26	22	20.00	10.06	9.987	7.3862E-02	7.3862E-02	1857.	2.545
38	17	1	18.00	9.889	9.887	2.3403E-03	2.3403E-03	356.2	0.6028
39	32	16	18.00	9.886	9.884	1.9770E-03	1.9770E-03	356.2	0.6028
40	49	26	20.00	10.18	10.06	0.1196	0.1196	1577.	2.161
41	49	30	12.00	10.18	10.13	4.7008E-02	4.7008E-02	279.9	1.066
42	31	26	12.00	10.09	10.06	3.3768E-02	3.3768E-02	279.9	1.066
43	1	32	18.00	9.887	9.886	1.4324E-03	1.4324E-03	356.2	0.6028

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	9.884	9.881	2.5225E-03	2.5225E-03	356.2	0.6028
45	30	35	12.00	10.13	10.12	1.4788E-02	1.4788E-02	279.9	1.066
46	33	53	18.00	9.881	9.877	4.2801E-03	4.2801E-03	356.2	0.6028
47	35	31	12.00	10.12	10.09	2.3997E-02	2.3997E-02	279.9	1.066
48	42	34	20.00	9.865	9.846	1.8721E-02	1.8721E-02	1232.	1.688
51	34	39	20.00	9.846	9.796	5.0469E-02	5.0469E-02	1857.	2.545
53	24	23	14.00	9.927	9.926	3.0994E-04	3.0994E-04	107.3	0.3002
54	43	6	14.00	9.851	9.850	1.1845E-03	1.1845E-03	85.95	0.2404
55	55	44	24.00	10.23	10.22	8.5602E-03	8.5602E-03	999.7	0.9514
56	7	55	24.00	10.23	10.23	7.6294E-06	0.000	71.19	6.7757E-02
58	63	47	20.00	9.893	9.892	8.4972E-04	8.4972E-04	186.3	0.2554
59	46	25	14.00	9.920	9.920	1.1063E-04	1.1063E-04	14.01	3.9189E-02
60	73	40	24.00	10.22	10.22	2.2526E-03	2.2526E-03	857.3	0.8159
61	20	25	14.00	9.933	9.920	1.3218E-02	1.3218E-02	215.3	0.6022
62	51	50	20.00	9.893	9.893	6.3229E-04	6.3229E-04	151.0	0.2070
64	48	3	16.00	9.897	9.891	5.1270E-03	5.1270E-03	232.8	0.4985
66	57	54	20.00	9.863	9.854	8.1749E-03	8.1749E-03	625.3	0.8570
67	40	45	20.00	10.22	10.20	2.1837E-02	2.1837E-02	857.3	1.175
68	19	59	14.00	9.925	9.924	1.8883E-03	1.8883E-03	181.3	0.5071
69	60	61	12.00	9.903	9.903	1.0490E-05	1.0490E-05	2.615	9.9569E-03
70	53	66	18.00	9.877	9.875	2.0380E-03	2.0380E-03	356.2	0.6028
71	58	71	20.00	9.929	9.928	1.3227E-03	1.3227E-03	649.7	0.8904
72	60	9	20.00	9.903	9.901	1.7900E-03	1.7900E-03	802.4	1.100
73	22	62	20.00	9.987	9.959	2.7537E-02	2.7537E-02	1417.	1.942
74	62	58	14.00	9.959	9.929	3.0046E-02	3.0046E-02	317.3	0.8874
75	68	49	20.00	10.20	10.18	1.5388E-02	1.5388E-02	1857.	2.545
76	63	64	20.00	9.893	9.892	6.7425E-04	6.7425E-04	724.4	0.9928
77	66	67	18.00	9.875	9.873	1.6747E-03	1.6747E-03	356.2	0.6028
78	44	68	20.00	10.22	10.20	2.0945E-02	2.0945E-02	999.7	1.370
79	41	24	14.00	9.931	9.927	4.3154E-03	4.3154E-03	107.3	0.3002
80	45	68	20.00	10.20	10.20	5.5218E-04	5.5218E-04	857.3	1.175
81	21	41	20.00	9.932	9.931	7.4768E-04	7.4768E-04	439.7	0.6027
82	71	19	14.00	9.928	9.925	2.4242E-03	2.4242E-03	73.97	0.2069
83	54	72	14.00	9.854	9.853	1.3647E-03	1.3647E-03	85.95	0.2404
84	54	6	20.00	9.854	9.850	4.3745E-03	4.3745E-03	539.4	0.7392
86	11	57	20.00	9.871	9.863	8.8329E-03	8.8329E-03	625.3	0.8570
89	65	77	20.00	9.888	9.879	8.2150E-03	8.2150E-03	625.3	0.8570
91	51	79	20.00	9.893	9.890	3.5601E-03	3.5601E-03	392.5	0.5379
94	64	82	20.00	9.892	9.880	1.2445E-02	1.2445E-02	875.4	1.200
96	84	34	20.00	9.847	9.846	8.2016E-04	8.2016E-04	625.3	0.8570

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	928.5	0.000	10.23	10.23	10.17	9.7366E-02	2.6372E+05	100.0
2	928.5	0.000	10.23	10.23	10.17	9.7365E-02	2.6372E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	928.5	0.0000
69	0.000	*	928.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
39	9.796	1857.	*	593.32

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

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Attachment 3 Pool Fire scenario in NEXBTL area – Fire Scenario Area 1 - Case B

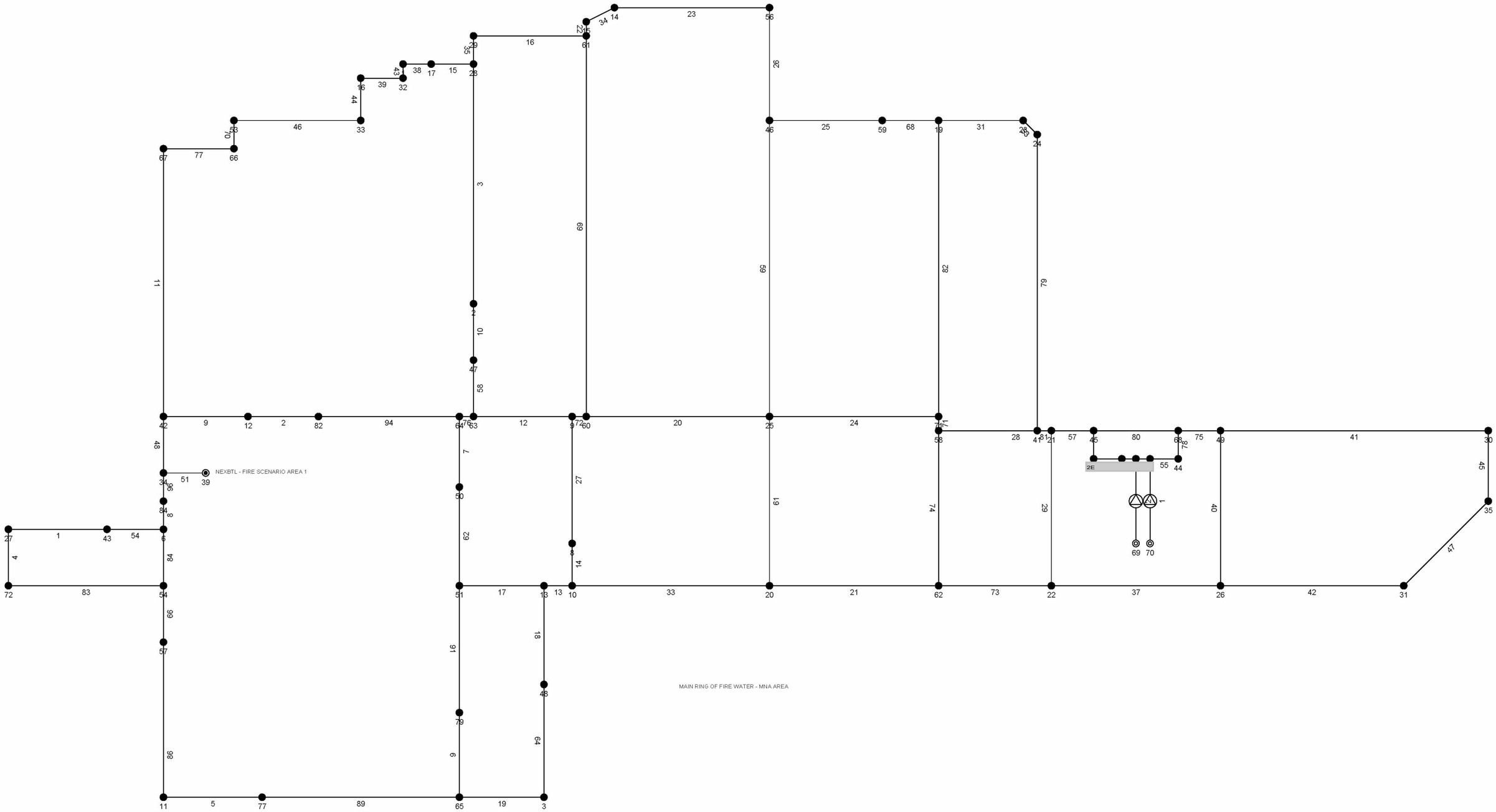
3.A PIPENET schematic layout with piping and nodes label

3.B PIPENET schematic layout with flow rate and pressure results

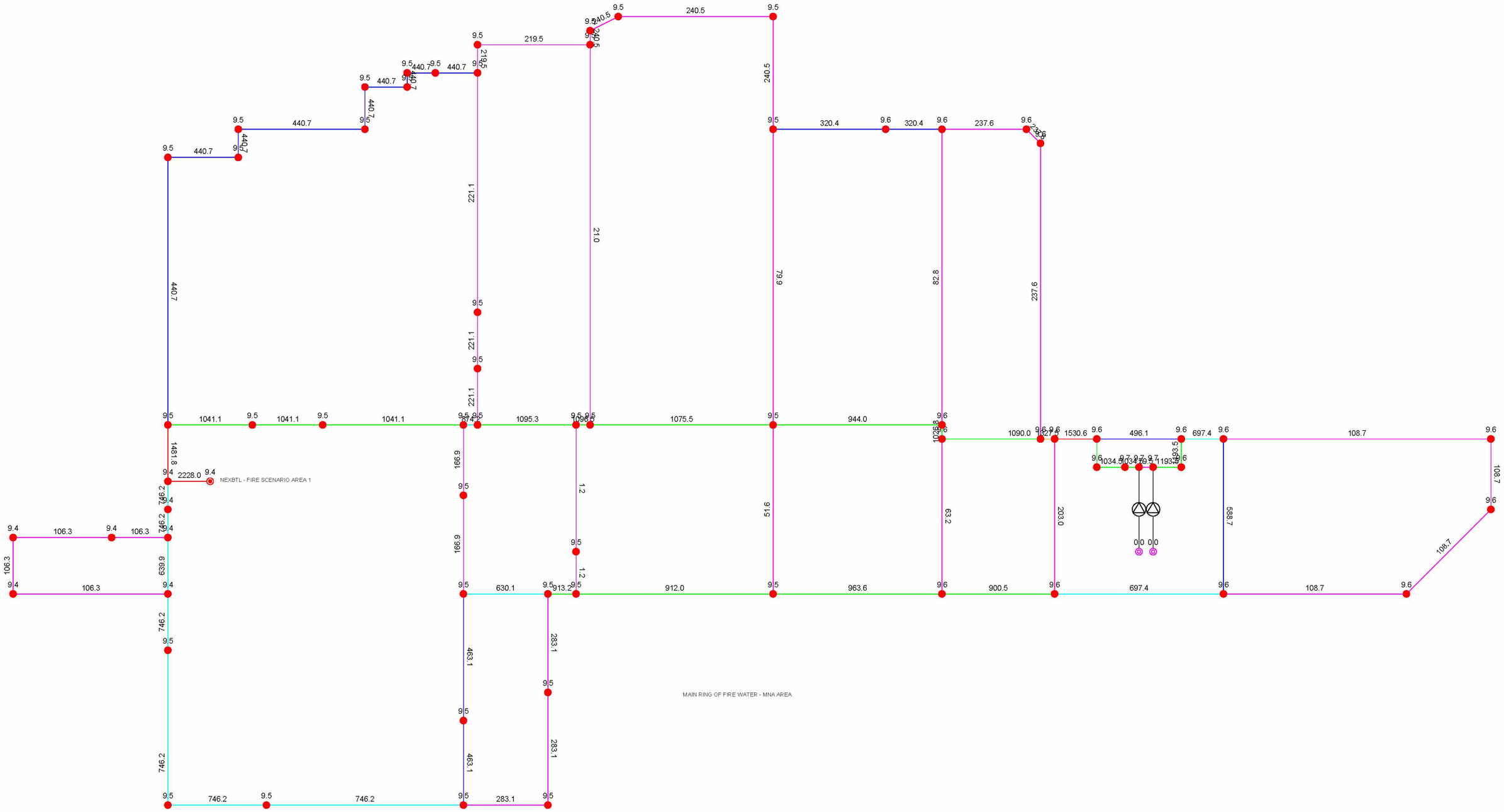
3.C PIPENET schematic layout with velocity results

3.D PIPENET input/output printout report

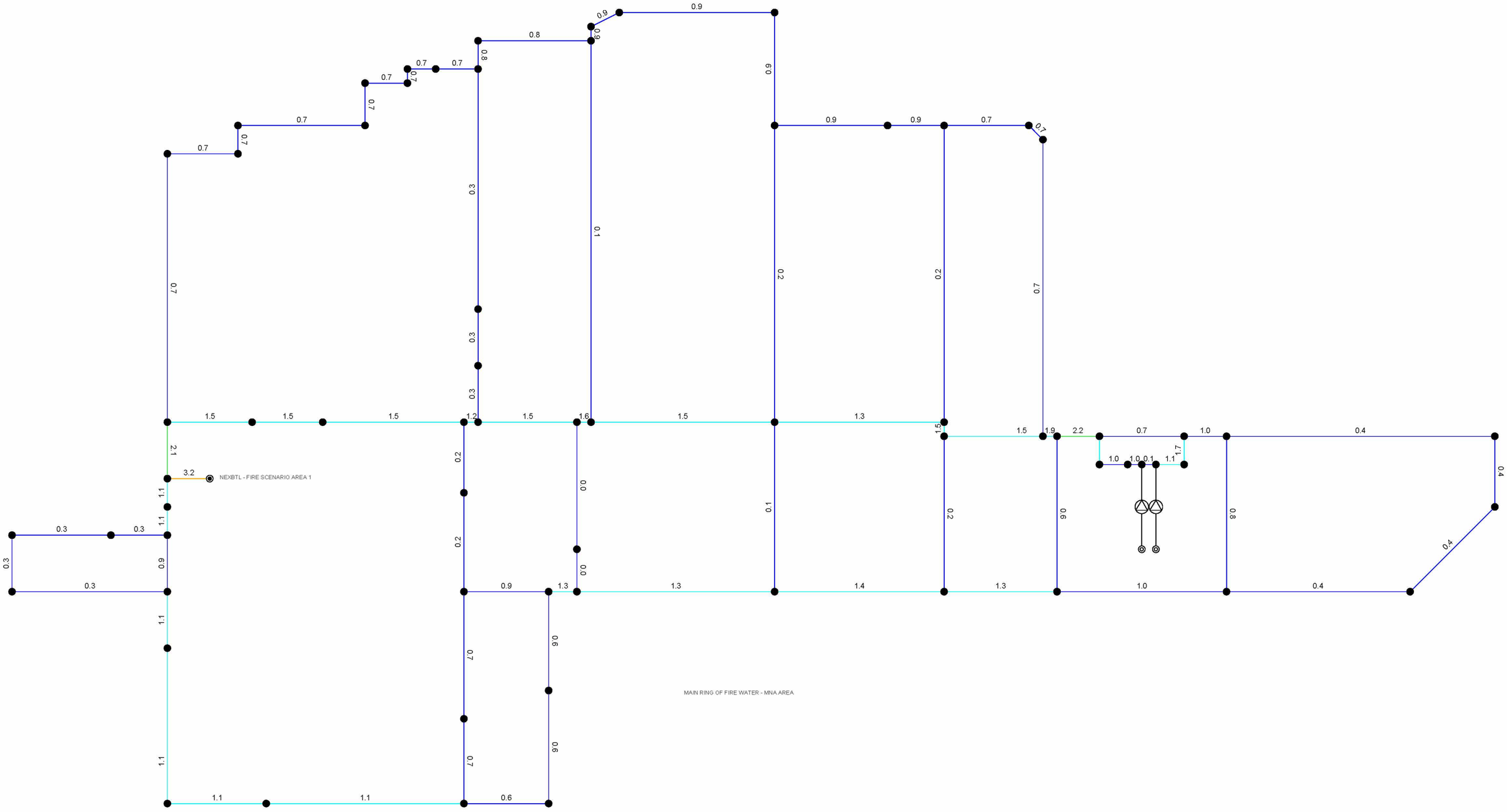
Attachment 3.A contains 1 page
Attachment 3.B contains 1 page
Attachment 3.C contains 1 page
Attachment 3.D contains 21 pages



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

16:11 on 7-Jul-2021

LIST OF CONTENTS
==========

	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	19.6850	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
51	34	39	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
51	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	106.3226	9	14.0000	14.0000	*
2	82	12	1041.1134	9	19.6850	20.0000	*
3	2	28	221.1181	9	19.6850	20.0000	*
4	72	27	106.3226	9	14.0000	14.0000	*
5	77	11	746.2350	9	19.6850	20.0000	*
6	79	65	463.1402	9	19.6850	20.0000	*
7	50	64	166.9457	9	19.6850	20.0000	*
8	6	84	746.2350	9	19.6850	20.0000	*
9	12	42	1041.1134	9	19.6850	20.0000	*
10	47	2	221.1181	9	19.6850	20.0000	*
11	67	42	440.6568	9	18.0000	18.0000	*
12	9	63	1095.2858	9	19.6850	20.0000	*
13	10	13	913.1808	9	19.6850	20.0000	*
14	8	10	1.1728	9	19.6850	20.0000	*
15	28	17	440.6568	9	18.0000	18.0000	*
16	61	29	219.5387	9	12.0000	12.0000	*
17	13	51	630.0859	9	19.6850	20.0000	*
18	13	48	283.0948	9	16.0000	16.0000	*
19	3	65	283.0948	9	16.0000	16.0000	*
20	25	60	1075.5040	9	19.6850	20.0000	*
21	62	20	963.6227	9	19.6850	20.0000	*
22	15	61	240.4933	9	12.0000	12.0000	*
23	56	14	240.4933	9	12.0000	12.0000	*
24	71	25	944.0200	9	19.6850	20.0000	*
25	59	46	320.3625	9	14.0000	14.0000	*
26	46	56	240.4933	9	12.0000	12.0000	*
27	9	8	1.1728	9	19.6850	20.0000	*
28	41	58	1089.9575	9	19.6850	20.0000	*
29	21	22	203.0440	9	14.0000	14.0000	*
31	23	19	237.5902	9	14.0000	14.0000	*
33	20	10	912.0080	9	19.6850	20.0000	*
34	14	15	240.4933	9	12.0000	12.0000	*
35	29	28	219.5387	9	12.0000	12.0000	*
36	7	73	1034.5079	9	24.0000	24.0000	*
37	26	22	697.4133	9	19.6850	20.0000	*
38	17	1	440.6568	9	18.0000	18.0000	*
39	32	16	440.6568	9	18.0000	18.0000	*
40	49	26	588.6969	9	19.6850	20.0000	*
41	49	30	108.7163	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	108.7163	9	12.0000	12.0000	*
43	1	32	440.6568	9	18.0000	18.0000	*
44	16	33	440.6568	9	18.0000	18.0000	*
45	30	35	108.7163	9	12.0000	12.0000	*
46	33	53	440.6568	9	18.0000	18.0000	*
47	35	31	108.7163	9	12.0000	12.0000	*
48	42	34	1481.7703	9	19.6850	20.0000	*
51	34	39	2228.0051	9	19.6850	20.0000	*
53	24	23	237.5902	9	14.0000	14.0000	*
54	43	6	106.3226	9	14.0000	14.0000	*
55	55	44	1193.4972	9	24.0000	24.0000	*
56	7	55	79.4934	9	24.0000	24.0000	*
57	45	21	1530.5919	9	19.6850	20.0000	*
58	63	47	221.1181	9	19.6850	20.0000	*
59	46	25	79.8692	9	14.0000	14.0000	*
60	73	40	1034.5079	9	24.0000	24.0000	*
61	20	25	51.6147	9	14.0000	14.0000	*
62	51	50	166.9457	9	19.6850	20.0000	*
64	48	3	283.0948	9	16.0000	16.0000	*
66	57	54	746.2350	9	19.6850	20.0000	*
67	40	45	1034.5078	9	19.6850	20.0000	*
68	19	59	320.3625	9	14.0000	14.0000	*
69	61	60	20.9547	9	12.0000	12.0000	*
70	53	66	440.6568	9	18.0000	18.0000	*
71	58	71	1026.7924	9	19.6850	20.0000	*
72	60	9	1096.4586	9	19.6850	20.0000	*
73	22	62	900.4572	9	19.6850	20.0000	*
74	58	62	63.1654	9	14.0000	14.0000	*
75	68	49	697.4133	9	19.6850	20.0000	*
76	63	64	874.1678	9	19.6850	20.0000	*
77	66	67	440.6568	9	18.0000	18.0000	*
78	44	68	1193.4973	9	19.6850	20.0000	*
79	41	24	237.5902	9	14.0000	14.0000	*
80	68	45	496.0840	9	19.6850	20.0000	*
81	21	41	1327.5480	9	19.6850	20.0000	*
82	71	19	82.7723	9	14.0000	14.0000	*
83	54	72	106.3226	9	14.0000	14.0000	*
84	54	6	639.9124	9	19.6850	20.0000	*
86	11	57	746.2350	9	19.6850	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	746.2350	9	19.6850	20.0000	*
91	51	79	463.1402	9	19.6850	20.0000	*
94	64	82	1041.1134	9	19.6850	20.0000	*
96	84	34	746.2350	9	19.6850	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.435	9.434	9.4795E-04	9.4795E-04	106.3	0.2974
2	82	12	20.00	9.477	9.468	8.5344E-03	8.5344E-03	1041.	1.473
3	2	28	20.00	9.494	9.493	1.3304E-03	1.3304E-03	221.1	0.3128
4	72	27	14.00	9.437	9.435	1.7595E-03	1.7595E-03	106.3	0.2974
5	77	11	20.00	9.476	9.464	1.1937E-02	1.1937E-02	746.2	1.056
6	79	65	20.00	9.492	9.488	3.1824E-03	3.1824E-03	463.1	0.6552
7	50	64	20.00	9.496	9.495	8.2493E-04	8.2493E-04	166.9	0.2362
8	6	84	20.00	9.432	9.428	4.3144E-03	4.3144E-03	746.2	1.056
9	12	42	20.00	9.468	9.455	1.3085E-02	1.3085E-02	1041.	1.473
10	47	2	20.00	9.495	9.494	5.0449E-04	5.0449E-04	221.1	0.3128
11	67	42	18.00	9.467	9.455	1.1792E-02	1.1792E-02	440.7	0.7456
12	9	63	20.00	9.509	9.496	1.2818E-02	1.2818E-02	1095.	1.550
13	10	13	20.00	9.509	9.507	2.2383E-03	2.2383E-03	913.2	1.292
14	8	10	20.00	9.509	9.509	0.000	0.000	1.173	1.6591E-03
15	28	17	18.00	9.493	9.491	2.0723E-03	2.0723E-03	440.7	0.7456
16	61	29	12.00	9.513	9.501	1.1528E-02	1.1528E-02	219.5	0.8358
17	13	51	20.00	9.507	9.497	9.9649E-03	9.9649E-03	630.1	0.8914
18	13	48	16.00	9.507	9.501	5.4197E-03	5.4197E-03	283.1	0.6062
19	3	65	16.00	9.494	9.488	5.5628E-03	5.5628E-03	283.1	0.6062
20	25	60	20.00	9.544	9.512	3.1441E-02	3.1441E-02	1076.	1.522
21	62	20	20.00	9.567	9.545	2.1992E-02	2.1992E-02	963.6	1.363
22	15	61	12.00	9.515	9.513	2.3251E-03	2.3251E-03	240.5	0.9155
23	56	14	12.00	9.539	9.519	2.0540E-02	2.0540E-02	240.5	0.9155
24	71	25	20.00	9.565	9.544	2.1120E-02	2.1120E-02	944.0	1.336
25	59	46	14.00	9.557	9.547	9.8581E-03	9.8581E-03	320.4	0.8960
26	46	56	12.00	9.547	9.539	7.2918E-03	7.2918E-03	240.5	0.9155
27	9	8	20.00	9.509	9.509	0.000	0.000	1.173	1.6591E-03
28	41	58	20.00	9.587	9.568	1.8275E-02	1.8275E-02	1090.	1.542
29	21	22	14.00	9.593	9.580	1.3172E-02	1.3172E-02	203.0	0.5679
31	23	19	14.00	9.566	9.562	4.3898E-03	4.3898E-03	237.6	0.6645
33	20	10	20.00	9.545	9.509	3.5832E-02	3.5832E-02	912.0	1.290
34	14	15	12.00	9.519	9.515	3.5973E-03	3.5973E-03	240.5	0.9155
35	29	28	12.00	9.501	9.493	8.3399E-03	8.3399E-03	219.5	0.8358
36	7	73	24.00	9.660	9.653	6.8979E-03	6.8979E-03	1035.	0.9846
37	26	22	20.00	9.593	9.580	1.3047E-02	1.3047E-02	697.4	0.9866
38	17	1	18.00	9.491	9.488	3.4800E-03	3.4800E-03	440.7	0.7456
39	32	16	18.00	9.485	9.482	2.9392E-03	2.9392E-03	440.7	0.7456
40	49	26	20.00	9.614	9.593	2.0870E-02	2.0870E-02	588.7	0.8328
41	49	30	12.00	9.614	9.605	8.2054E-03	8.2054E-03	108.7	0.4139
42	31	26	12.00	9.599	9.593	5.8947E-03	5.8947E-03	108.7	0.4139
43	1	32	18.00	9.488	9.485	2.1305E-03	2.1305E-03	440.7	0.7456

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	9.482	9.479	3.7508E-03	3.7508E-03	440.7	0.7456
45	30	35	12.00	9.605	9.603	2.5826E-03	2.5826E-03	108.7	0.4139
46	33	53	18.00	9.479	9.472	6.3601E-03	6.3601E-03	440.7	0.7456
47	35	31	12.00	9.603	9.599	4.1876E-03	4.1876E-03	108.7	0.4139
48	42	34	20.00	9.455	9.427	2.8455E-02	2.8455E-02	1482.	2.096
51	34	39	20.00	9.427	9.350	7.6375E-02	7.6375E-02	2228.	3.152
53	24	23	14.00	9.568	9.566	1.3599E-03	1.3599E-03	237.6	0.6645
54	43	6	14.00	9.434	9.432	1.7576E-03	1.7576E-03	106.3	0.2974
55	55	44	24.00	9.660	9.648	1.1875E-02	1.1875E-02	1193.	1.136
56	7	55	24.00	9.660	9.660	1.0490E-05	1.0490E-05	79.49	7.5657E-02
57	45	21	20.00	9.616	9.593	2.3245E-02	2.3245E-02	1531.	2.165
58	63	47	20.00	9.496	9.495	1.2598E-03	1.2598E-03	221.1	0.3128
59	46	25	14.00	9.547	9.544	2.8219E-03	2.8219E-03	79.87	0.2234
60	73	40	24.00	9.653	9.650	3.1900E-03	3.1900E-03	1035.	0.9846
61	20	25	14.00	9.545	9.544	9.4509E-04	9.4509E-04	51.61	0.1444
62	51	50	20.00	9.497	9.496	8.2016E-04	8.2016E-04	166.9	0.2362
64	48	3	16.00	9.501	9.494	7.3872E-03	7.3872E-03	283.1	0.6062
66	57	54	20.00	9.451	9.439	1.2263E-02	1.2263E-02	746.2	1.056
67	40	45	20.00	9.650	9.616	3.3410E-02	3.3410E-02	1035.	1.464
68	19	59	14.00	9.562	9.557	5.4398E-03	5.4398E-03	320.4	0.8960
69	61	60	12.00	9.513	9.512	5.0831E-04	5.0831E-04	20.95	7.9773E-02
70	53	66	18.00	9.472	9.469	3.0298E-03	3.0298E-03	440.7	0.7456
71	58	71	20.00	9.568	9.565	3.3274E-03	3.3274E-03	1027.	1.453
72	60	9	20.00	9.512	9.509	3.4466E-03	3.4466E-03	1096.	1.551
73	22	62	20.00	9.580	9.567	1.2863E-02	1.2863E-02	900.5	1.274
74	58	62	14.00	9.568	9.567	1.5106E-03	1.5106E-03	63.17	0.1767
75	68	49	20.00	9.616	9.614	2.7170E-03	2.7170E-03	697.4	0.9866
76	63	64	20.00	9.496	9.495	1.0300E-03	1.0300E-03	874.2	1.237
77	66	67	18.00	9.469	9.467	2.4900E-03	2.4900E-03	440.7	0.7456
78	44	68	20.00	9.648	9.616	3.1395E-02	3.1395E-02	1193.	1.688
79	41	24	14.00	9.587	9.568	1.8853E-02	1.8853E-02	237.6	0.6645
80	68	45	20.00	9.616	9.616	2.1744E-04	2.1744E-04	496.1	0.7018
81	21	41	20.00	9.593	9.587	6.2494E-03	6.2494E-03	1328.	1.878
82	71	19	14.00	9.565	9.562	3.0003E-03	3.0003E-03	82.77	0.2315
83	54	72	14.00	9.439	9.437	2.0247E-03	2.0247E-03	106.3	0.2974
84	54	6	20.00	9.439	9.432	6.4898E-03	6.4898E-03	639.9	0.9053
86	11	57	20.00	9.464	9.451	1.3247E-02	1.3247E-02	746.2	1.056
89	65	77	20.00	9.488	9.476	1.2322E-02	1.2322E-02	746.2	1.056
91	51	79	20.00	9.497	9.492	5.2223E-03	5.2223E-03	463.1	0.6552
94	64	82	20.00	9.495	9.477	1.8490E-02	1.8490E-02	1041.	1.473
96	84	34	20.00	9.428	9.427	1.2302E-03	1.2302E-03	746.2	1.056

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	1114.	0.000	9.660	9.660	10.17	0.1031	2.9891E+05	100.0
2	1114.	0.000	9.660	9.660	10.17	0.1031	2.9891E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	1114.	0.0000
69	0.000	*	1114.	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
39	9.350	2228.	*	728.62

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 4 Pool Fire scenario in NEXBTL area – Fire Scenario Area 2– Case A

4.A PIPENET schematic layout with piping and nodes label
4.B PIPENET schematic layout with flow rate and pressure results
4.C PIPENET schematic layout with velocity results
4.D PIPENET input/output printout report

Attachment 4.A contains 1 page
Attachment 4.B contains 1 page
Attachment 4.C contains 1 page
Attachment 4.D contains 21 pages

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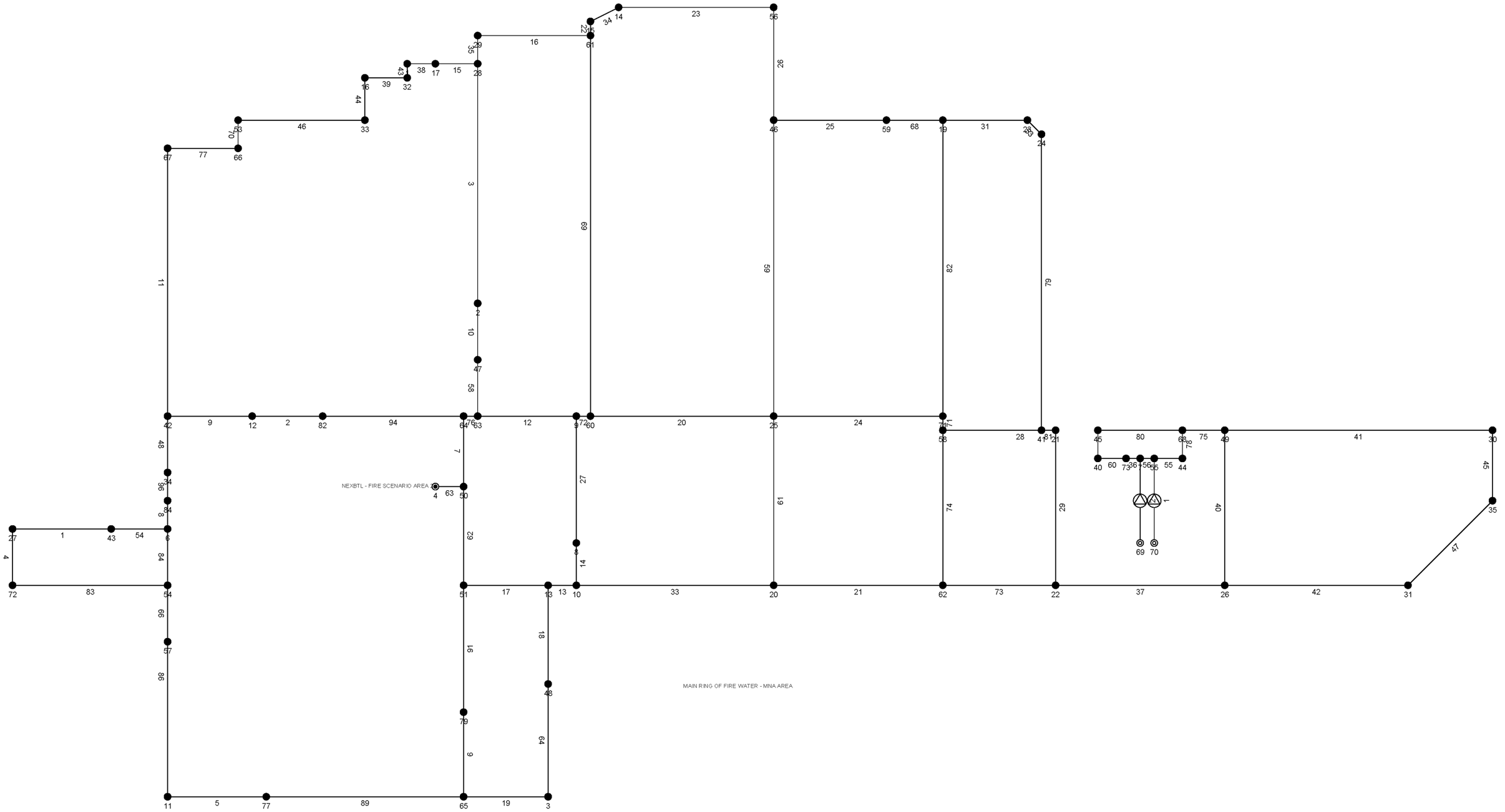
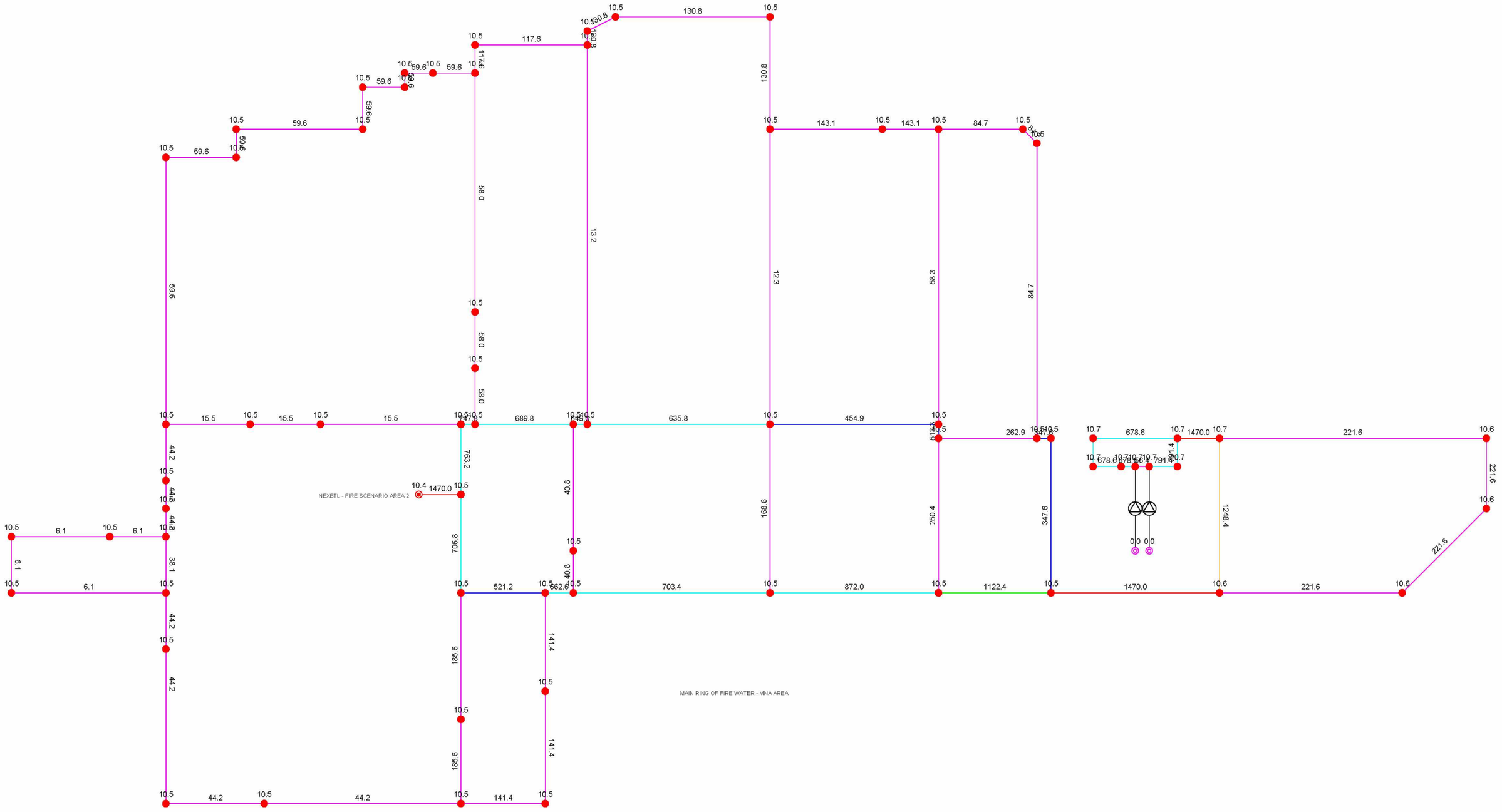
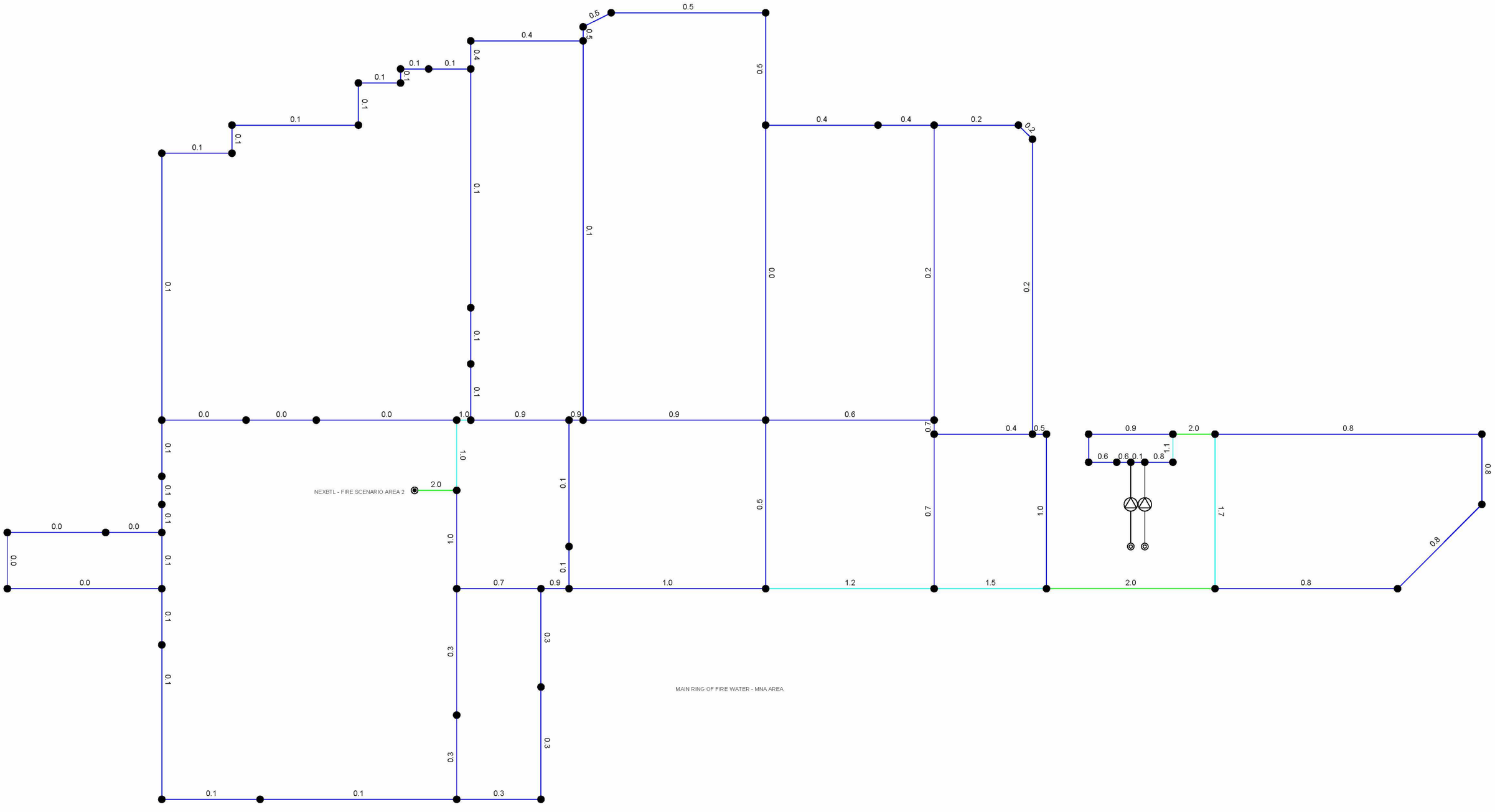


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

16:19 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
63	50	4	20.00	20.00	0.000	150.0	45.60
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	82	64	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
63	1 x 4	45.60		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	6.0612	9	14.0000	14.0000	*
2	12	82	15.4508	9	20.0000	20.0000	*
3	28	2	57.9712	9	20.0000	20.0000	*
4	27	72	6.0612	9	14.0000	14.0000	*
5	11	77	44.1648	9	20.0000	20.0000	*
6	65	79	185.5796	9	20.0000	20.0000	*
7	64	50	763.2352	9	20.0000	20.0000	*
8	84	6	44.1648	9	20.0000	20.0000	*
9	42	12	15.4508	9	20.0000	20.0000	*
10	2	47	57.9712	9	20.0000	20.0000	*
11	67	42	59.6156	9	18.0000	18.0000	*
12	9	63	689.8131	9	20.0000	20.0000	*
13	10	13	662.6033	9	20.0000	20.0000	*
14	10	8	40.8304	9	20.0000	20.0000	*
15	28	17	59.6156	9	18.0000	18.0000	*
16	61	29	117.5868	9	12.0000	12.0000	*
17	13	51	521.1886	9	20.0000	20.0000	*
18	13	48	141.4148	9	16.0000	16.0000	*
19	3	65	141.4148	9	16.0000	16.0000	*
20	25	60	635.7975	9	20.0000	20.0000	*
21	62	20	871.9937	9	20.0000	20.0000	*
22	15	61	130.7721	9	12.0000	12.0000	*
23	56	14	130.7721	9	12.0000	12.0000	*
24	71	25	454.9510	9	20.0000	20.0000	*
25	59	46	143.0588	9	14.0000	14.0000	*
26	46	56	130.7721	9	12.0000	12.0000	*
27	8	9	40.8304	9	20.0000	20.0000	*
28	41	58	262.8655	9	20.0000	20.0000	*
29	22	21	347.6128	9	14.0000	14.0000	*
31	23	19	84.7473	9	14.0000	14.0000	*
33	20	10	703.4338	9	20.0000	20.0000	*
34	14	15	130.7721	9	12.0000	12.0000	*
35	29	28	117.5868	9	12.0000	12.0000	*
36	7	73	678.6446	9	24.0000	24.0000	*
37	26	22	1470.0035	9	20.0000	20.0000	*
38	17	1	59.6156	9	18.0000	18.0000	*
39	32	16	59.6156	9	18.0000	18.0000	*
40	49	26	1248.4440	9	20.0000	20.0000	*
41	49	30	221.5594	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	221.5594	9	12.0000	12.0000	*
43	1	32	59.6156	9	18.0000	18.0000	*
44	16	33	59.6156	9	18.0000	18.0000	*
45	30	35	221.5594	9	12.0000	12.0000	*
46	33	53	59.6156	9	18.0000	18.0000	*
47	35	31	221.5594	9	12.0000	12.0000	*
48	42	34	44.1648	9	20.0000	20.0000	*
53	24	23	84.7473	9	14.0000	14.0000	*
54	6	43	6.0612	9	14.0000	14.0000	*
55	55	44	791.3588	9	24.0000	24.0000	*
56	7	55	56.3560	9	24.0000	24.0000	*
58	47	63	57.9712	9	20.0000	20.0000	*
59	46	25	12.2867	9	14.0000	14.0000	*
60	73	40	678.6446	9	24.0000	24.0000	*
61	20	25	168.5598	9	14.0000	14.0000	*
62	51	50	706.7682	9	20.0000	20.0000	*
63	50	4	1470.0035	9	20.0000	20.0000	*
64	48	3	141.4148	9	16.0000	16.0000	*
66	54	57	44.1648	9	20.0000	20.0000	*
67	40	45	678.6446	9	20.0000	20.0000	*
68	19	59	143.0588	9	14.0000	14.0000	*
69	61	60	13.1853	9	12.0000	12.0000	*
70	53	66	59.6156	9	18.0000	18.0000	*
71	58	71	513.2625	9	20.0000	20.0000	*
72	60	9	648.9827	9	20.0000	20.0000	*
73	22	62	1122.3905	9	20.0000	20.0000	*
74	62	58	250.3969	9	14.0000	14.0000	*
75	68	49	1470.0035	9	20.0000	20.0000	*
76	63	64	747.7844	9	20.0000	20.0000	*
77	66	67	59.6156	9	18.0000	18.0000	*
78	44	68	791.3588	9	20.0000	20.0000	*
79	41	24	84.7473	9	14.0000	14.0000	*
80	45	68	678.6446	9	20.0000	20.0000	*
81	21	41	347.6128	9	20.0000	20.0000	*
82	71	19	58.3115	9	14.0000	14.0000	*
83	72	54	6.0612	9	14.0000	14.0000	*
84	6	54	38.1036	9	20.0000	20.0000	*
86	57	11	44.1648	9	20.0000	20.0000	*
89	77	65	44.1648	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	79	51	185.5796	9	20.0000	20.0000	*
94	82	64	15.4508	9	20.0000	20.0000	*
96	34	84	44.1648	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.47	10.47	4.7684E-06	0.000	6.061	1.6953E-02
2	12	82	20.00	10.47	10.47	2.8610E-06	0.000	15.45	2.1175E-02
3	28	2	20.00	10.47	10.47	1.0300E-04	1.0300E-04	57.97	7.9450E-02
4	27	72	14.00	10.47	10.47	7.6294E-06	0.000	6.061	1.6953E-02
5	11	77	20.00	10.47	10.47	6.0081E-05	6.0081E-05	44.16	6.0528E-02
6	65	79	20.00	10.47	10.47	5.4264E-04	5.4264E-04	185.6	0.2543
7	64	50	20.00	10.47	10.46	1.2712E-02	1.2712E-02	763.2	1.046
8	84	6	20.00	10.47	10.47	2.0027E-05	2.0027E-05	44.16	6.0528E-02
9	42	12	20.00	10.47	10.47	4.7684E-06	0.000	15.45	2.1175E-02
10	2	47	20.00	10.47	10.47	4.0054E-05	4.0054E-05	57.97	7.9450E-02
11	67	42	18.00	10.47	10.47	2.9278E-04	2.9278E-04	59.62	0.1009
12	9	63	20.00	10.48	10.47	5.0497E-03	5.0497E-03	689.8	0.9454
13	10	13	20.00	10.48	10.48	1.1454E-03	1.1454E-03	662.6	0.9081
14	10	8	20.00	10.48	10.48	3.0518E-05	3.0518E-05	40.83	5.5958E-02
15	28	17	18.00	10.47	10.47	5.0545E-05	5.0545E-05	59.62	0.1009
16	61	29	12.00	10.48	10.47	3.6182E-03	3.6182E-03	117.6	0.4476
17	13	51	20.00	10.48	10.47	6.4974E-03	6.4974E-03	521.2	0.7143
18	13	48	16.00	10.48	10.47	1.4954E-03	1.4954E-03	141.4	0.3028
19	3	65	16.00	10.47	10.47	1.5354E-03	1.5354E-03	141.4	0.3028
20	25	60	20.00	10.49	10.48	1.1015E-02	1.1015E-02	635.8	0.8714
21	62	20	20.00	10.51	10.50	1.6915E-02	1.6915E-02	872.0	1.195
22	15	61	12.00	10.48	10.48	7.4959E-04	7.4959E-04	130.8	0.4978
23	56	14	12.00	10.49	10.48	6.6252E-03	6.6252E-03	130.8	0.4978
24	71	25	20.00	10.49	10.49	5.0755E-03	5.0755E-03	454.9	0.6235
25	59	46	14.00	10.49	10.49	2.2078E-03	2.2078E-03	143.1	0.4001
26	46	56	12.00	10.49	10.49	2.3527E-03	2.3527E-03	130.8	0.4978
27	8	9	20.00	10.48	10.48	8.7738E-05	8.7738E-05	40.83	5.5958E-02
28	41	58	20.00	10.50	10.49	1.2197E-03	1.2197E-03	262.9	0.3603
29	22	21	14.00	10.53	10.50	3.5570E-02	3.5570E-02	347.6	0.9723
31	23	19	14.00	10.49	10.49	6.4754E-04	6.4754E-04	84.75	0.2370
33	20	10	20.00	10.50	10.48	2.0512E-02	2.0512E-02	703.4	0.9641
34	14	15	12.00	10.48	10.48	1.1597E-03	1.1597E-03	130.8	0.4978
35	29	28	12.00	10.47	10.47	2.6169E-03	2.6169E-03	117.6	0.4476
36	7	73	24.00	10.69	10.68	3.1605E-03	3.1605E-03	678.6	0.6459
37	26	22	20.00	10.58	10.53	4.7937E-02	4.7937E-02	1470.	2.015
38	17	1	18.00	10.47	10.47	8.7738E-05	8.7738E-05	59.62	0.1009
39	32	16	18.00	10.47	10.47	7.2479E-05	7.2479E-05	59.62	0.1009
40	49	26	20.00	10.66	10.58	7.7593E-02	7.7593E-02	1248.	1.711
41	49	30	12.00	10.66	10.63	3.0508E-02	3.0508E-02	221.6	0.8435
42	31	26	12.00	10.60	10.58	2.1915E-02	2.1915E-02	221.6	0.8435
43	1	32	18.00	10.47	10.47	5.2452E-05	5.2452E-05	59.62	0.1009

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.47	10.47	9.2506E-05	9.2506E-05	59.62	0.1009
45	30	35	12.00	10.63	10.62	9.5978E-03	9.5978E-03	221.6	0.8435
46	33	53	18.00	10.47	10.47	1.5736E-04	1.5736E-04	59.62	0.1009
47	35	31	12.00	10.62	10.60	1.5572E-02	1.5572E-02	221.6	0.8435
48	42	34	20.00	10.47	10.47	3.7193E-05	3.7193E-05	44.16	6.0528E-02
53	24	23	14.00	10.49	10.49	2.0027E-04	2.0027E-04	84.75	0.2370
54	6	43	14.00	10.47	10.47	1.0490E-05	1.0490E-05	6.061	1.6953E-02
55	55	44	24.00	10.69	10.68	5.5552E-03	5.5552E-03	791.4	0.7532
56	7	55	24.00	10.69	10.69	2.8610E-06	0.000	56.36	5.3636E-02
58	47	63	20.00	10.47	10.47	9.7275E-05	9.7275E-05	57.97	7.9450E-02
59	46	25	14.00	10.49	10.49	8.7738E-05	8.7738E-05	12.29	3.4365E-02
60	73	40	24.00	10.68	10.68	1.4601E-03	1.4601E-03	678.6	0.6459
61	20	25	14.00	10.50	10.49	8.4047E-03	8.4047E-03	168.6	0.4715
62	51	50	20.00	10.47	10.46	1.0953E-02	1.0953E-02	706.8	0.9686
63	50	4	20.00	10.46	10.43	3.2752E-02	3.2752E-02	1470.	2.015
64	48	3	16.00	10.47	10.47	2.0370E-03	2.0370E-03	141.4	0.3028
66	54	57	20.00	10.47	10.47	6.2943E-05	6.2943E-05	44.16	6.0528E-02
67	40	45	20.00	10.68	10.67	1.4173E-02	1.4173E-02	678.6	0.9301
68	19	59	14.00	10.49	10.49	1.2197E-03	1.2197E-03	143.1	0.4001
69	61	60	12.00	10.48	10.48	2.1553E-04	2.1553E-04	13.19	5.0196E-02
70	53	66	18.00	10.47	10.47	7.4387E-05	7.4387E-05	59.62	0.1009
71	58	71	20.00	10.49	10.49	8.5449E-04	8.5449E-04	513.3	0.7034
72	60	9	20.00	10.48	10.48	1.2102E-03	1.2102E-03	649.0	0.8894
73	22	62	20.00	10.53	10.51	1.7885E-02	1.7885E-02	1122.	1.538
74	62	58	14.00	10.51	10.49	1.9390E-02	1.9390E-02	250.4	0.7003
75	68	49	20.00	10.67	10.66	9.9869E-03	9.9869E-03	1470.	2.015
76	63	64	20.00	10.47	10.47	7.1526E-04	7.1526E-04	747.8	1.025
77	66	67	18.00	10.47	10.47	6.0081E-05	6.0081E-05	59.62	0.1009
78	44	68	20.00	10.68	10.67	1.3593E-02	1.3593E-02	791.4	1.085
79	41	24	14.00	10.50	10.49	2.7866E-03	2.7866E-03	84.75	0.2370
80	45	68	20.00	10.67	10.67	3.5763E-04	3.5763E-04	678.6	0.9301
81	21	41	20.00	10.50	10.50	4.8542E-04	4.8542E-04	347.6	0.4764
82	71	19	14.00	10.49	10.49	1.5602E-03	1.5602E-03	58.31	0.1631
83	72	54	14.00	10.47	10.47	9.5367E-06	0.000	6.061	1.6953E-02
84	6	54	20.00	10.47	10.47	3.2425E-05	3.2425E-05	38.10	5.2221E-02
86	57	11	20.00	10.47	10.47	6.4850E-05	6.4850E-05	44.16	6.0528E-02
89	77	65	20.00	10.47	10.47	6.0081E-05	6.0081E-05	44.16	6.0528E-02
91	79	51	20.00	10.47	10.47	8.8692E-04	8.8692E-04	185.6	0.2543
94	82	64	20.00	10.47	10.47	7.6294E-06	0.000	15.45	2.1175E-02
96	34	84	20.00	10.47	10.47	7.6294E-06	0.000	44.16	6.0528E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	735.0	0.000	10.69	10.69	10.17	9.3159E-02	2.1819E+05	100.0
2	735.0	0.000	10.69	10.69	10.17	9.3159E-02	2.1819E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	735.0	0.0000
69	0.000	*	735.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
4	10.43	1470.	*	455.27

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 5 Pool Fire scenario in NEXBTL area – Fire Scenario Area 2 – Case B

5.A PIPENET schematic layout with piping and nodes label
5.B PIPENET schematic layout with flow rate and pressure results
5.C PIPENET schematic layout with velocity results
5.D PIPENET input/output printout report

Attachment 5.A contains 1 page
Attachment 5.B contains 1 page
Attachment 5.C contains 1 page
Attachment 5.D contains 21 pages

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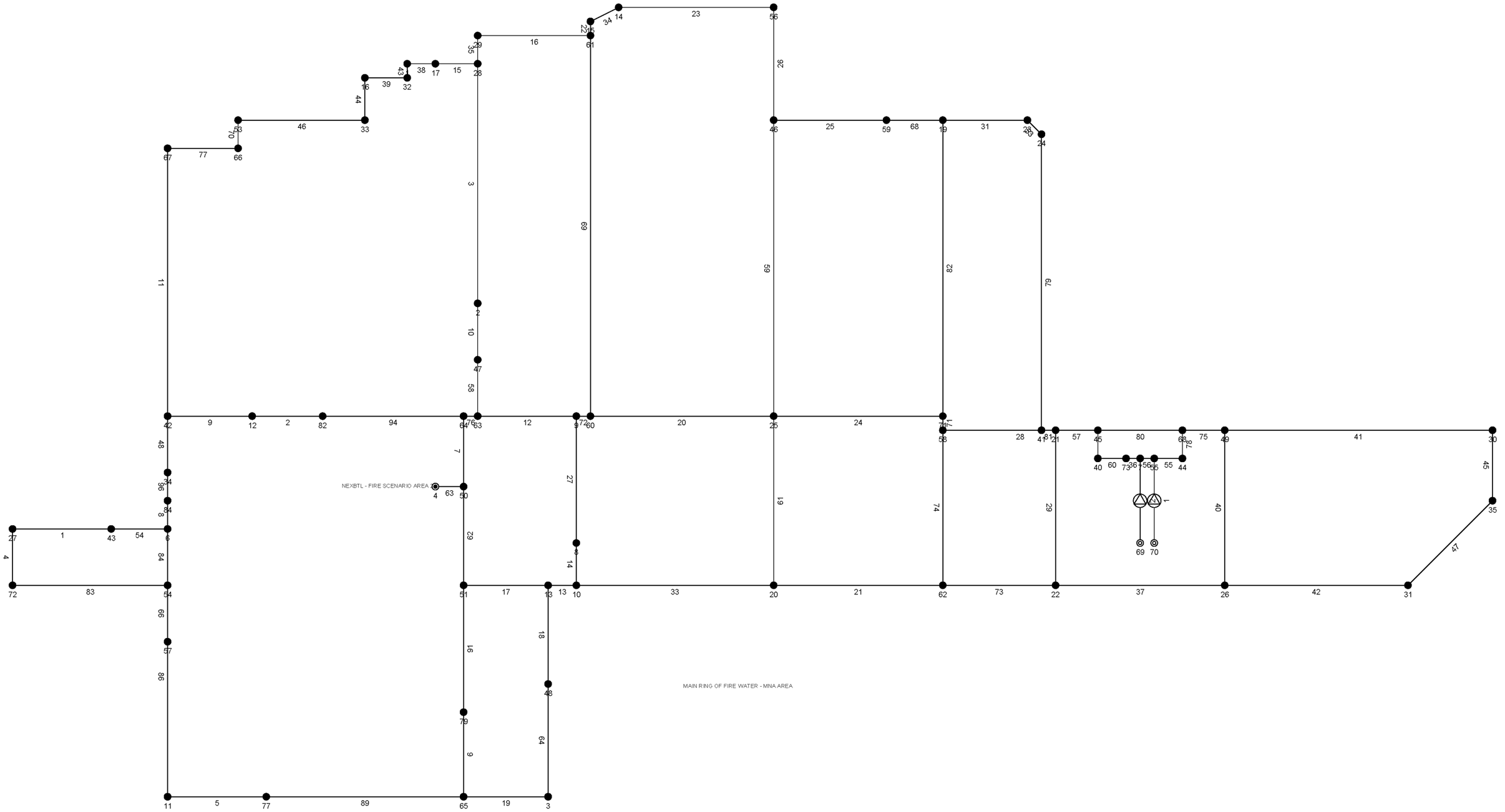
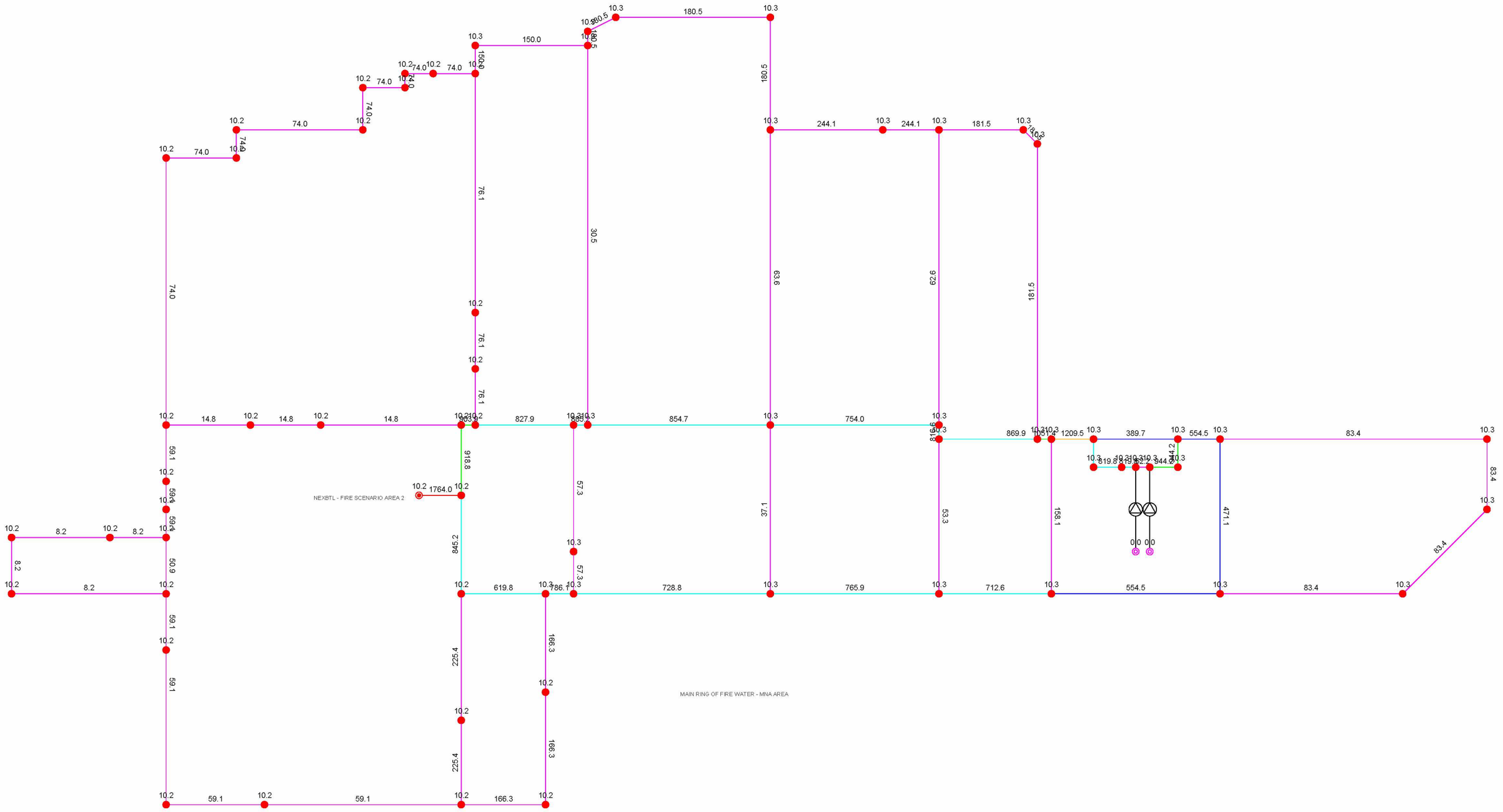
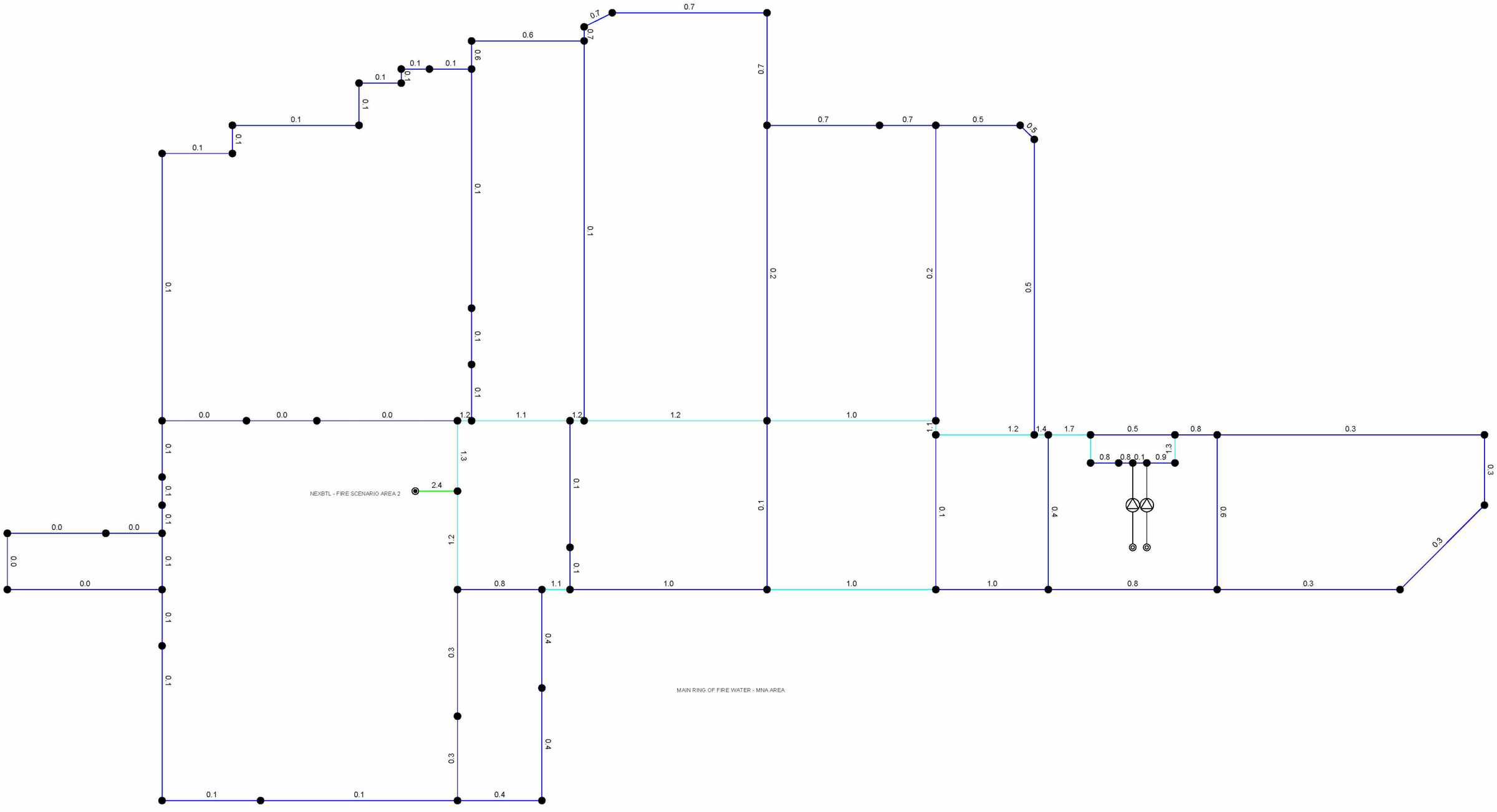


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

16:30 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
63	50	4	20.00	20.00	0.000	150.0	45.60
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	82	64	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
63	1 x 4	45.60		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	8.2076	9	14.0000	14.0000	*
2	12	82	14.8353	9	20.0000	20.0000	*
3	28	2	76.0796	9	20.0000	20.0000	*
4	27	72	8.2076	9	14.0000	14.0000	*
5	11	77	59.1166	9	20.0000	20.0000	*
6	65	79	225.4386	9	20.0000	20.0000	*
7	64	50	918.7752	9	20.0000	20.0000	*
8	84	6	59.1166	9	20.0000	20.0000	*
9	42	12	14.8353	9	20.0000	20.0000	*
10	2	47	76.0796	9	20.0000	20.0000	*
11	67	42	73.9519	9	18.0000	18.0000	*
12	9	63	827.8604	9	20.0000	20.0000	*
13	10	13	786.1122	9	20.0000	20.0000	*
14	8	10	57.2976	9	20.0000	20.0000	*
15	28	17	73.9519	9	18.0000	18.0000	*
16	61	29	150.0314	9	12.0000	12.0000	*
17	13	51	619.7903	9	20.0000	20.0000	*
18	13	48	166.3219	9	16.0000	16.0000	*
19	3	65	166.3219	9	16.0000	16.0000	*
20	25	60	854.6769	9	20.0000	20.0000	*
21	62	20	765.9019	9	20.0000	20.0000	*
22	15	61	180.5125	9	12.0000	12.0000	*
23	56	14	180.5125	9	12.0000	12.0000	*
24	71	25	753.9623	9	20.0000	20.0000	*
25	59	46	244.1398	9	14.0000	14.0000	*
26	46	56	180.5125	9	12.0000	12.0000	*
27	9	8	57.2976	9	20.0000	20.0000	*
28	41	58	869.9283	9	20.0000	20.0000	*
29	21	22	158.0591	9	14.0000	14.0000	*
31	23	19	181.5063	9	14.0000	14.0000	*
33	20	10	728.8147	9	20.0000	20.0000	*
34	14	15	180.5125	9	12.0000	12.0000	*
35	29	28	150.0314	9	12.0000	12.0000	*
36	7	73	819.8198	9	24.0000	24.0000	*
37	26	22	554.5104	9	20.0000	20.0000	*
38	17	1	73.9519	9	18.0000	18.0000	*
39	32	16	73.9519	9	18.0000	18.0000	*
40	49	26	471.0897	9	20.0000	20.0000	*
41	49	30	83.4208	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	83.4208	9	12.0000	12.0000	*
43	1	32	73.9519	9	18.0000	18.0000	*
44	16	33	73.9519	9	18.0000	18.0000	*
45	30	35	83.4208	9	12.0000	12.0000	*
46	33	53	73.9519	9	18.0000	18.0000	*
47	35	31	83.4208	9	12.0000	12.0000	*
48	42	34	59.1166	9	20.0000	20.0000	*
53	24	23	181.5063	9	14.0000	14.0000	*
54	6	43	8.2076	9	14.0000	14.0000	*
55	55	44	944.1844	9	24.0000	24.0000	*
56	7	55	62.1812	9	24.0000	24.0000	*
57	45	21	1209.4938	9	20.0000	20.0000	*
58	47	63	76.0796	9	20.0000	20.0000	*
59	46	25	63.6274	9	14.0000	14.0000	*
60	73	40	819.8198	9	24.0000	24.0000	*
61	20	25	37.0872	9	14.0000	14.0000	*
62	51	50	845.2288	9	20.0000	20.0000	*
63	50	4	1764.0042	9	20.0000	20.0000	*
64	48	3	166.3219	9	16.0000	16.0000	*
66	54	57	59.1166	9	20.0000	20.0000	*
67	40	45	819.8198	9	20.0000	20.0000	*
68	19	59	244.1398	9	14.0000	14.0000	*
69	61	60	30.4810	9	12.0000	12.0000	*
70	53	66	73.9519	9	18.0000	18.0000	*
71	58	71	816.5958	9	20.0000	20.0000	*
72	60	9	885.1580	9	20.0000	20.0000	*
73	22	62	712.5695	9	20.0000	20.0000	*
74	58	62	53.3324	9	14.0000	14.0000	*
75	68	49	554.5104	9	20.0000	20.0000	*
76	63	64	903.9399	9	20.0000	20.0000	*
77	66	67	73.9519	9	18.0000	18.0000	*
78	44	68	944.1844	9	20.0000	20.0000	*
79	41	24	181.5063	9	14.0000	14.0000	*
80	68	45	389.6739	9	20.0000	20.0000	*
81	21	41	1051.4346	9	20.0000	20.0000	*
82	71	19	62.6335	9	14.0000	14.0000	*
83	72	54	8.2076	9	14.0000	14.0000	*
84	6	54	50.9090	9	20.0000	20.0000	*
86	57	11	59.1166	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	77	65	59.1166	9	20.0000	20.0000	*
91	79	51	225.4386	9	20.0000	20.0000	*
94	82	64	14.8353	9	20.0000	20.0000	*
96	34	84	59.1166	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.25	10.25	7.6294E-06	0.000	8.208	2.2956E-02
2	12	82	20.00	10.25	10.25	4.7684E-06	0.000	14.84	2.0332E-02
3	28	2	20.00	10.25	10.25	1.7262E-04	1.7262E-04	76.08	0.1043
4	27	72	14.00	10.25	10.25	1.4305E-05	1.4305E-05	8.208	2.2956E-02
5	11	77	20.00	10.24	10.24	1.0204E-04	1.0204E-04	59.12	8.1019E-02
6	65	79	20.00	10.24	10.24	7.8297E-04	7.8297E-04	225.4	0.3090
7	64	50	20.00	10.25	10.23	1.7904E-02	1.7904E-02	918.8	1.259
8	84	6	20.00	10.25	10.25	3.7193E-05	3.7193E-05	59.12	8.1019E-02
9	42	12	20.00	10.25	10.25	2.8610E-06	0.000	14.84	2.0332E-02
10	2	47	20.00	10.25	10.25	6.4850E-05	6.4850E-05	76.08	0.1043
11	67	42	18.00	10.25	10.25	4.3488E-04	4.3488E-04	73.95	0.1251
12	9	63	20.00	10.25	10.25	7.0696E-03	7.0696E-03	827.9	1.135
13	10	13	20.00	10.25	10.25	1.5697E-03	1.5697E-03	786.1	1.077
14	8	10	20.00	10.25	10.25	5.2452E-05	5.2452E-05	57.30	7.8526E-02
15	28	17	18.00	10.25	10.25	7.7248E-05	7.7248E-05	73.95	0.1251
16	61	29	12.00	10.26	10.25	5.7030E-03	5.7030E-03	150.0	0.5712
17	13	51	20.00	10.25	10.24	8.9455E-03	8.9455E-03	619.8	0.8494
18	13	48	16.00	10.25	10.25	2.0304E-03	2.0304E-03	166.3	0.3562
19	3	65	16.00	10.25	10.24	2.0819E-03	2.0819E-03	166.3	0.3562
20	25	60	20.00	10.27	10.26	1.9026E-02	1.9026E-02	854.7	1.171
21	62	20	20.00	10.29	10.27	1.3305E-02	1.3305E-02	765.9	1.050
22	15	61	12.00	10.26	10.26	1.3676E-03	1.3676E-03	180.5	0.6872
23	56	14	12.00	10.27	10.26	1.2088E-02	1.2088E-02	180.5	0.6872
24	71	25	20.00	10.29	10.27	1.2902E-02	1.2902E-02	754.0	1.033
25	59	46	14.00	10.28	10.28	5.9671E-03	5.9671E-03	244.1	0.6828
26	46	56	12.00	10.28	10.27	4.2896E-03	4.2896E-03	180.5	0.6872
27	9	8	20.00	10.25	10.25	1.6499E-04	1.6499E-04	57.30	7.8526E-02
28	41	58	20.00	10.30	10.29	1.1146E-02	1.1146E-02	869.9	1.192
29	21	22	14.00	10.30	10.30	8.2874E-03	8.2874E-03	158.1	0.4421
31	23	19	14.00	10.29	10.29	2.6703E-03	2.6703E-03	181.5	0.5077
33	20	10	20.00	10.27	10.25	2.1900E-02	2.1900E-02	728.8	0.9988
34	14	15	12.00	10.26	10.26	2.1172E-03	2.1172E-03	180.5	0.6872
35	29	28	12.00	10.25	10.25	4.1275E-03	4.1275E-03	150.0	0.5712
36	7	73	24.00	10.34	10.34	4.4842E-03	4.4842E-03	819.8	0.7803
37	26	22	20.00	10.30	10.30	7.9002E-03	7.9002E-03	554.5	0.7600
38	17	1	18.00	10.25	10.25	1.2779E-04	1.2779E-04	73.95	0.1251
39	32	16	18.00	10.25	10.25	1.0967E-04	1.0967E-04	73.95	0.1251
40	49	26	20.00	10.32	10.30	1.2788E-02	1.2788E-02	471.1	0.6456
41	49	30	12.00	10.32	10.31	5.0278E-03	5.0278E-03	83.42	0.3176
42	31	26	12.00	10.31	10.30	3.6125E-03	3.6125E-03	83.42	0.3176
43	1	32	18.00	10.25	10.25	7.7248E-05	7.7248E-05	73.95	0.1251

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.25	10.25	1.3828E-04	1.3828E-04	73.95	0.1251
45	30	35	12.00	10.31	10.31	1.5802E-03	1.5802E-03	83.42	0.3176
46	33	53	18.00	10.25	10.25	2.3460E-04	2.3460E-04	73.95	0.1251
47	35	31	12.00	10.31	10.31	2.5673E-03	2.5673E-03	83.42	0.3176
48	42	34	20.00	10.25	10.25	6.7711E-05	6.7711E-05	59.12	8.1019E-02
53	24	23	14.00	10.29	10.29	8.2493E-04	8.2493E-04	181.5	0.5077
54	6	43	14.00	10.25	10.25	1.5259E-05	1.5259E-05	8.208	2.2956E-02
55	55	44	24.00	10.34	10.34	7.6971E-03	7.6971E-03	944.2	0.8986
56	7	55	24.00	10.34	10.34	4.7684E-06	0.000	62.18	5.9180E-02
57	45	21	20.00	10.32	10.30	1.3918E-02	1.3918E-02	1209.	1.658
58	47	63	20.00	10.25	10.25	1.6212E-04	1.6212E-04	76.08	0.1043
59	46	25	14.00	10.28	10.27	1.8520E-03	1.8520E-03	63.63	0.1780
60	73	40	24.00	10.34	10.34	2.0733E-03	2.0733E-03	819.8	0.7803
61	20	25	14.00	10.27	10.27	5.1212E-04	5.1212E-04	37.09	0.1037
62	51	50	20.00	10.24	10.23	1.5257E-02	1.5257E-02	845.2	1.158
63	50	4	20.00	10.23	10.18	4.5893E-02	4.5893E-02	1764.	2.418
64	48	3	16.00	10.25	10.25	2.7676E-03	2.7676E-03	166.3	0.3562
66	54	57	20.00	10.25	10.24	1.0490E-04	1.0490E-04	59.12	8.1019E-02
67	40	45	20.00	10.34	10.32	2.0112E-02	2.0112E-02	819.8	1.124
68	19	59	14.00	10.29	10.28	3.2902E-03	3.2902E-03	244.1	0.6828
69	61	60	12.00	10.26	10.26	1.0157E-03	1.0157E-03	30.48	0.1160
70	53	66	18.00	10.25	10.25	1.0967E-04	1.0967E-04	73.95	0.1251
71	58	71	20.00	10.29	10.29	2.0170E-03	2.0170E-03	816.6	1.119
72	60	9	20.00	10.26	10.25	2.1448E-03	2.1448E-03	885.2	1.213
73	22	62	20.00	10.30	10.29	7.7200E-03	7.7200E-03	712.6	0.9766
74	58	62	14.00	10.29	10.29	1.1024E-03	1.1024E-03	53.33	0.1492
75	68	49	20.00	10.32	10.32	1.6470E-03	1.6470E-03	554.5	0.7600
76	63	64	20.00	10.25	10.25	1.0157E-03	1.0157E-03	903.9	1.239
77	66	67	18.00	10.25	10.25	9.2506E-05	9.2506E-05	73.95	0.1251
78	44	68	20.00	10.34	10.32	1.8838E-02	1.8838E-02	944.2	1.294
79	41	24	14.00	10.30	10.29	1.1460E-02	1.1460E-02	181.5	0.5077
80	68	45	20.00	10.32	10.32	1.2970E-04	1.2970E-04	389.7	0.5340
81	21	41	20.00	10.30	10.30	3.7594E-03	3.7594E-03	1051.	1.441
82	71	19	14.00	10.29	10.29	1.7929E-03	1.7929E-03	62.63	0.1752
83	72	54	14.00	10.25	10.25	1.8120E-05	1.8120E-05	8.208	2.2956E-02
84	6	54	20.00	10.25	10.25	5.5313E-05	5.5313E-05	50.91	6.9771E-02
86	57	11	20.00	10.24	10.24	1.1253E-04	1.1253E-04	59.12	8.1019E-02
89	77	65	20.00	10.24	10.24	1.0490E-04	1.0490E-04	59.12	8.1019E-02
91	79	51	20.00	10.24	10.24	1.2827E-03	1.2827E-03	225.4	0.3090
94	82	64	20.00	10.25	10.25	5.7220E-06	0.000	14.84	2.0332E-02
96	34	84	20.00	10.25	10.25	1.0490E-05	1.0490E-05	59.12	8.1019E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	882.0	0.000	10.34	10.34	10.17	9.6239E-02	2.5345E+05	100.0
2	882.0	0.000	10.34	10.34	10.17	9.6238E-02	2.5345E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	882.0	0.0000
69	0.000	*	882.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
4	10.18	1764.	*	552.83

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 6 Jet Fire scenario in NEXBTL Area – – Fire Scenario Area 3 Case A

6.A PIPENET schematic layout with piping and nodes label

6.B PIPENET schematic layout with flow rate and pressure results

6.C PIPENET schematic layout with velocity results

6.D PIPENET input/output printout report

Attachment 6.A contains 1 page
Attachment 6.B contains 1 page
Attachment 6.C contains 1 pages
Attachment 6.D contains 21 pages

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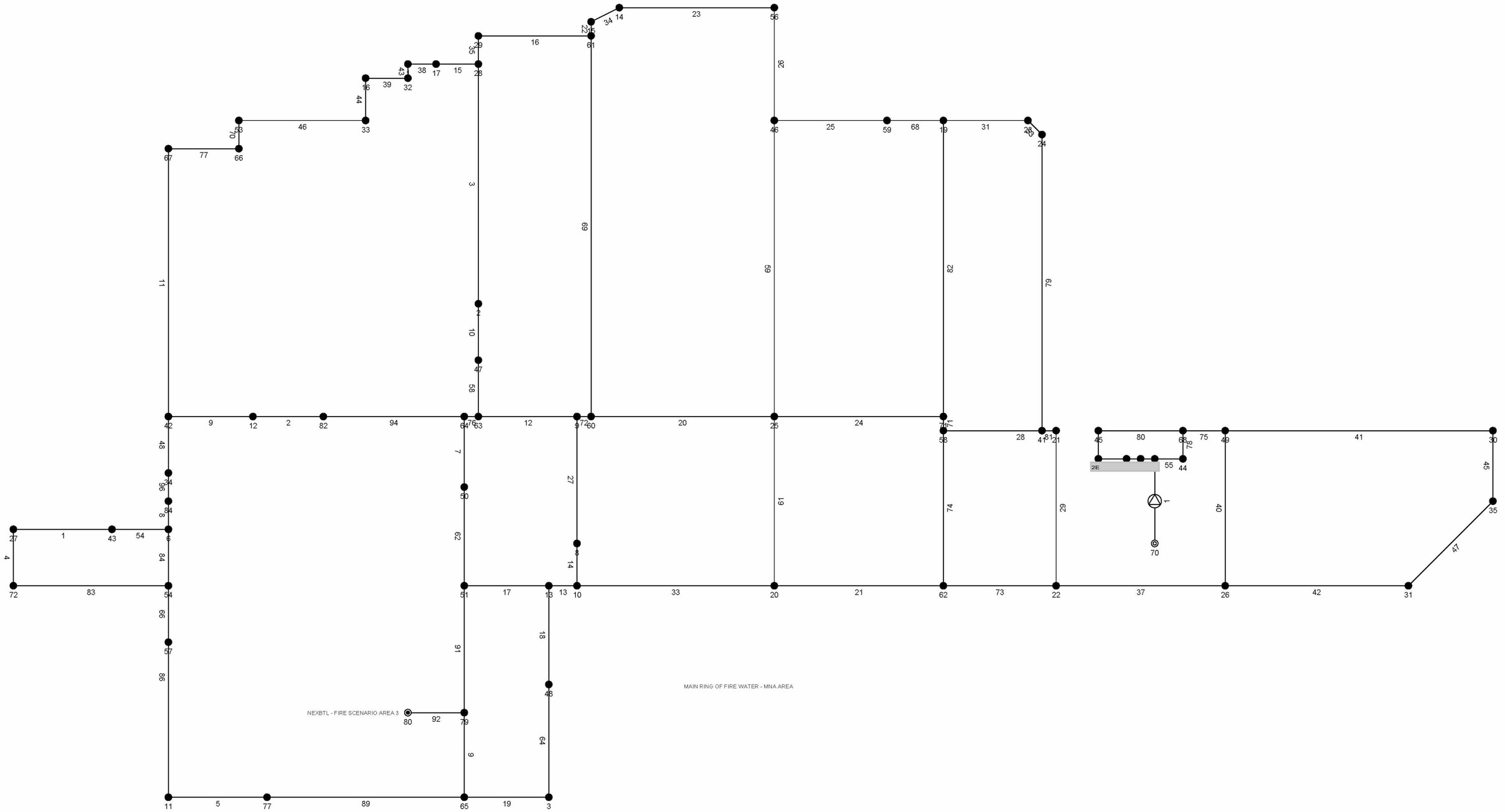
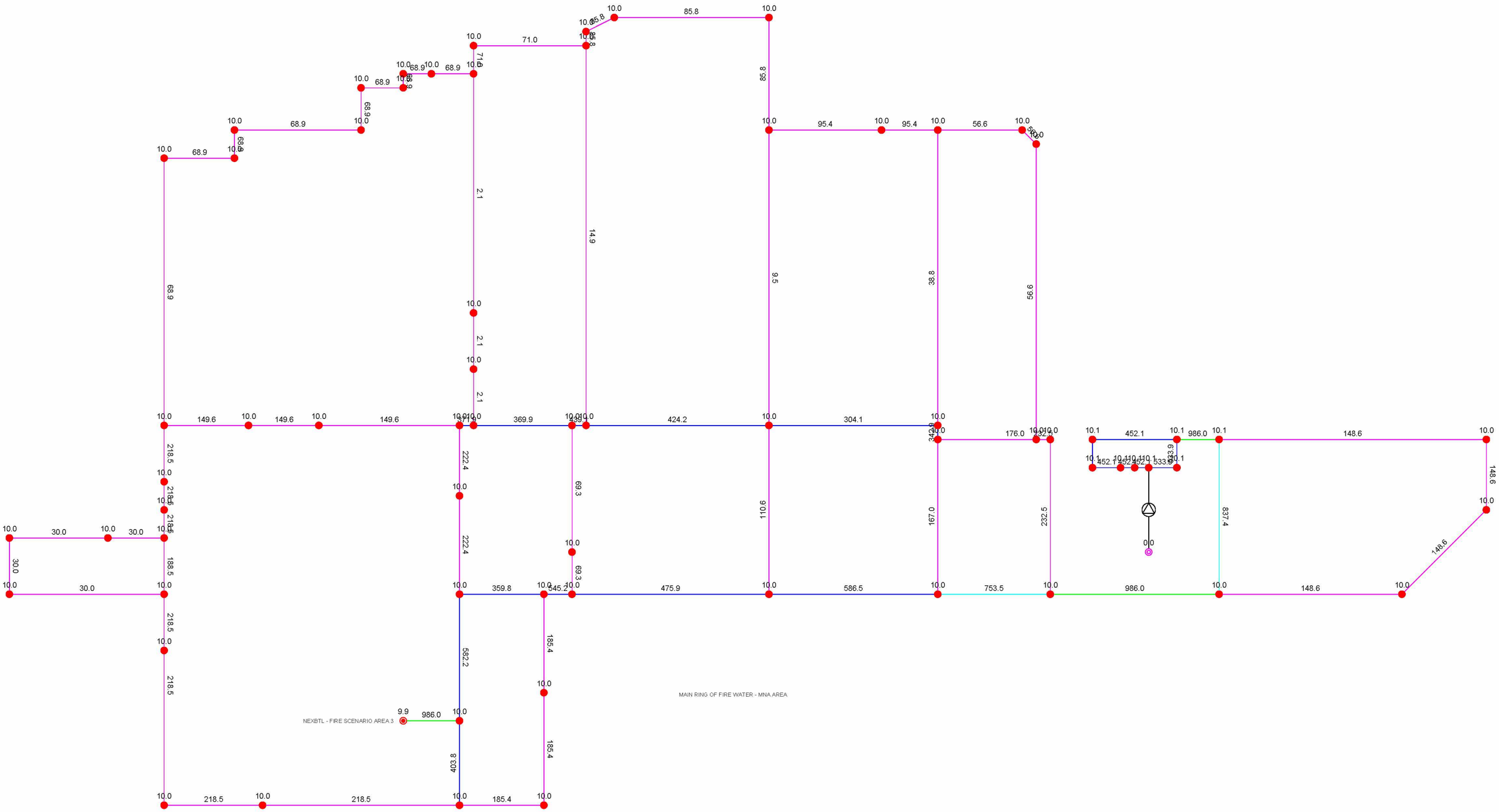
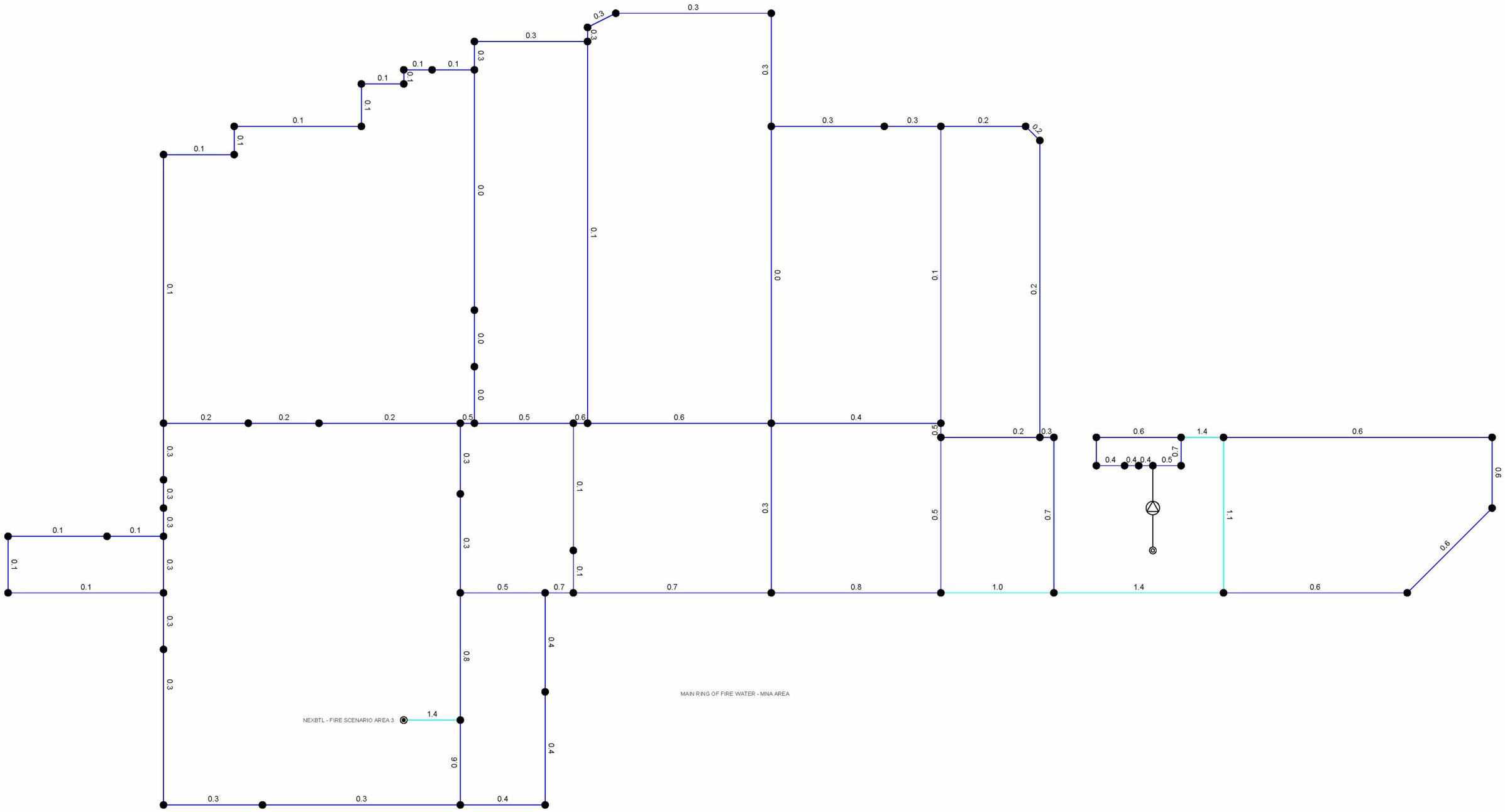


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

19:14 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	55	7	24.00	9.000	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
92	79	80	20.00	20.00	0.000	150.0	45.60
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
92	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	29.9976	9	14.0000	14.0000	*
2	82	12	149.5805	9	20.0000	20.0000	*
3	28	2	2.0859	9	20.0000	20.0000	*
4	27	72	29.9976	9	14.0000	14.0000	*
5	11	77	218.4620	9	20.0000	20.0000	*
6	65	79	403.8481	9	20.0000	20.0000	*
7	64	50	222.3622	9	20.0000	20.0000	*
8	84	6	218.4620	9	20.0000	20.0000	*
9	12	42	149.5805	9	20.0000	20.0000	*
10	2	47	2.0859	9	20.0000	20.0000	*
11	67	42	68.8815	9	18.0000	18.0000	*
12	9	63	369.8567	9	20.0000	20.0000	*
13	10	13	545.1780	9	20.0000	20.0000	*
14	8	10	69.2589	9	20.0000	20.0000	*
15	28	17	68.8815	9	18.0000	18.0000	*
16	61	29	70.9674	9	12.0000	12.0000	*
17	13	51	359.7919	9	20.0000	20.0000	*
18	13	48	185.3861	9	16.0000	16.0000	*
19	3	65	185.3861	9	16.0000	16.0000	*
20	25	60	424.2491	9	20.0000	20.0000	*
21	62	20	586.5056	9	20.0000	20.0000	*
22	15	61	85.8340	9	12.0000	12.0000	*
23	56	14	85.8340	9	12.0000	12.0000	*
24	71	25	304.1201	9	20.0000	20.0000	*
25	59	46	95.3766	9	14.0000	14.0000	*
26	46	56	85.8340	9	12.0000	12.0000	*
27	9	8	69.2589	9	20.0000	20.0000	*
28	41	58	175.9690	9	20.0000	20.0000	*
29	22	21	232.5354	9	14.0000	14.0000	*
31	23	19	56.5664	9	14.0000	14.0000	*
33	20	10	475.9191	9	20.0000	20.0000	*
34	14	15	85.8340	9	12.0000	12.0000	*
35	29	28	70.9674	9	12.0000	12.0000	*
36	7	73	452.1475	9	24.0000	24.0000	*
37	26	22	986.0022	9	20.0000	20.0000	*
38	17	1	68.8815	9	18.0000	18.0000	*
39	32	16	68.8815	9	18.0000	18.0000	*
40	49	26	837.3917	9	20.0000	20.0000	*
41	49	30	148.6106	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	148.6106	9	12.0000	12.0000	*
43	1	32	68.8815	9	18.0000	18.0000	*
44	16	33	68.8815	9	18.0000	18.0000	*
45	30	35	148.6106	9	12.0000	12.0000	*
46	33	53	68.8815	9	18.0000	18.0000	*
47	35	31	148.6106	9	12.0000	12.0000	*
48	42	34	218.4620	9	20.0000	20.0000	*
53	24	23	56.5664	9	14.0000	14.0000	*
54	6	43	29.9976	9	14.0000	14.0000	*
55	55	44	533.8547	9	24.0000	24.0000	*
56	55	7	452.1475	9	24.0000	24.0000	*
58	47	63	2.0859	9	20.0000	20.0000	*
59	46	25	9.5426	9	14.0000	14.0000	*
60	73	40	452.1475	9	24.0000	24.0000	*
61	20	25	110.5864	9	14.0000	14.0000	*
62	50	51	222.3622	9	20.0000	20.0000	*
64	48	3	185.3861	9	16.0000	16.0000	*
66	54	57	218.4620	9	20.0000	20.0000	*
67	40	45	452.1475	9	20.0000	20.0000	*
68	19	59	95.3766	9	14.0000	14.0000	*
69	61	60	14.8666	9	12.0000	12.0000	*
70	53	66	68.8815	9	18.0000	18.0000	*
71	58	71	342.9303	9	20.0000	20.0000	*
72	60	9	439.1157	9	20.0000	20.0000	*
73	22	62	753.4668	9	20.0000	20.0000	*
74	62	58	166.9612	9	14.0000	14.0000	*
75	68	49	986.0022	9	20.0000	20.0000	*
76	63	64	371.9427	9	20.0000	20.0000	*
77	66	67	68.8815	9	18.0000	18.0000	*
78	44	68	533.8547	9	20.0000	20.0000	*
79	41	24	56.5664	9	14.0000	14.0000	*
80	45	68	452.1475	9	20.0000	20.0000	*
81	21	41	232.5355	9	20.0000	20.0000	*
82	71	19	38.8102	9	14.0000	14.0000	*
83	72	54	29.9976	9	14.0000	14.0000	*
84	6	54	188.4644	9	20.0000	20.0000	*
86	57	11	218.4620	9	20.0000	20.0000	*
89	77	65	218.4620	9	20.0000	20.0000	*
91	51	79	582.1541	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
92	79	80	986.0022	9	20.0000	20.0000	*
94	64	82	149.5805	9	20.0000	20.0000	*
96	34	84	218.4620	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	9.962	9.962	9.0599E-05	9.0599E-05	30.00	8.3901E-02
2	82	12	20.00	9.964	9.964	2.1935E-04	2.1935E-04	149.6	0.2050
3	28	2	20.00	9.964	9.964	0.000	0.000	2.086	2.8587E-03
4	27	72	14.00	9.962	9.962	1.6975E-04	1.6975E-04	30.00	8.3901E-02
5	11	77	20.00	9.959	9.958	1.1368E-03	1.1368E-03	218.5	0.2994
6	65	79	20.00	9.957	9.954	2.2869E-03	2.2869E-03	403.8	0.5535
7	64	50	20.00	9.964	9.963	1.2980E-03	1.2980E-03	222.4	0.3047
8	84	6	20.00	9.962	9.962	4.1008E-04	4.1008E-04	218.5	0.2994
9	12	42	20.00	9.964	9.963	3.3569E-04	3.3569E-04	149.6	0.2050
10	2	47	20.00	9.964	9.964	0.000	0.000	2.086	2.8587E-03
11	67	42	18.00	9.964	9.963	3.8052E-04	3.8052E-04	68.88	0.1165
12	9	63	20.00	9.966	9.964	1.5926E-03	1.5926E-03	369.9	0.5069
13	10	13	20.00	9.966	9.965	7.9441E-04	7.9441E-04	545.2	0.7472
14	8	10	20.00	9.966	9.966	7.8201E-05	7.8201E-05	69.26	9.4919E-02
15	28	17	18.00	9.964	9.964	6.7711E-05	6.7711E-05	68.88	0.1165
16	61	29	12.00	9.967	9.965	1.4200E-03	1.4200E-03	70.97	0.2702
17	13	51	20.00	9.965	9.962	3.2749E-03	3.2749E-03	359.8	0.4931
18	13	48	16.00	9.965	9.962	2.4700E-03	2.4700E-03	185.4	0.3970
19	3	65	16.00	9.959	9.957	2.5349E-03	2.5349E-03	185.4	0.3970
20	25	60	20.00	9.972	9.967	5.2099E-03	5.2099E-03	424.2	0.5814
21	62	20	20.00	9.984	9.976	8.1205E-03	8.1205E-03	586.5	0.8038
22	15	61	12.00	9.967	9.967	3.4523E-04	3.4523E-04	85.83	0.3268
23	56	14	12.00	9.971	9.968	3.0422E-03	3.0422E-03	85.83	0.3268
24	71	25	20.00	9.974	9.972	2.4099E-03	2.4099E-03	304.1	0.4168
25	59	46	14.00	9.973	9.972	1.0443E-03	1.0443E-03	95.38	0.2668
26	46	56	12.00	9.972	9.971	1.0777E-03	1.0777E-03	85.83	0.3268
27	9	8	20.00	9.966	9.966	2.2984E-04	2.2984E-04	69.26	9.4919E-02
28	41	58	20.00	9.975	9.975	5.7983E-04	5.7983E-04	176.0	0.2412
29	22	21	14.00	9.992	9.975	1.6908E-02	1.6908E-02	232.5	0.6504
31	23	19	14.00	9.974	9.974	3.0804E-04	3.0804E-04	56.57	0.1582
33	20	10	20.00	9.976	9.966	9.9602E-03	9.9602E-03	475.9	0.6522
34	14	15	12.00	9.968	9.967	5.3310E-04	5.3310E-04	85.83	0.3268
35	29	28	12.00	9.965	9.964	1.0271E-03	1.0271E-03	70.97	0.2702
36	7	73	24.00	10.07	10.06	1.4906E-03	1.4906E-03	452.1	0.4303
37	26	22	20.00	10.02	9.992	2.2898E-02	2.2898E-02	986.0	1.351
38	17	1	18.00	9.964	9.964	1.1253E-04	1.1253E-04	68.88	0.1165
39	32	16	18.00	9.964	9.964	9.4414E-05	9.4414E-05	68.88	0.1165
40	49	26	20.00	10.05	10.02	3.7065E-02	3.7065E-02	837.4	1.148
41	49	30	12.00	10.05	10.04	1.4572E-02	1.4572E-02	148.6	0.5658
42	31	26	12.00	10.03	10.02	1.0468E-02	1.0468E-02	148.6	0.5658
43	1	32	18.00	9.964	9.964	6.7711E-05	6.7711E-05	68.88	0.1165

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	9.964	9.964	1.2016E-04	1.2016E-04	68.88	0.1165
45	30	35	12.00	10.04	10.03	4.5853E-03	4.5853E-03	148.6	0.5658
46	33	53	18.00	9.964	9.964	2.0504E-04	2.0504E-04	68.88	0.1165
47	35	31	12.00	10.03	10.03	7.4396E-03	7.4396E-03	148.6	0.5658
48	42	34	20.00	9.963	9.962	7.6199E-04	7.6199E-04	218.5	0.2994
53	24	23	14.00	9.974	9.974	9.4414E-05	9.4414E-05	56.57	0.1582
54	6	43	14.00	9.962	9.962	1.6975E-04	1.6975E-04	30.00	8.3901E-02
55	55	44	24.00	10.07	10.06	2.6827E-03	2.6827E-03	533.9	0.5081
56	55	7	24.00	10.07	10.07	2.0981E-04	2.0981E-04	452.1	0.4303
58	47	63	20.00	9.964	9.964	0.000	0.000	2.086	2.8587E-03
59	46	25	14.00	9.972	9.972	5.5313E-05	5.5313E-05	9.543	2.6690E-02
60	73	40	24.00	10.06	10.06	6.8951E-04	6.8951E-04	452.1	0.4303
61	20	25	14.00	9.976	9.972	3.8548E-03	3.8548E-03	110.6	0.3093
62	50	51	20.00	9.963	9.962	1.2894E-03	1.2894E-03	222.4	0.3047
64	48	3	16.00	9.962	9.959	3.3655E-03	3.3655E-03	185.4	0.3970
66	54	57	20.00	9.961	9.960	1.1673E-03	1.1673E-03	218.5	0.2994
67	40	45	20.00	10.06	10.06	6.6853E-03	6.6853E-03	452.1	0.6197
68	19	59	14.00	9.974	9.973	5.7507E-04	5.7507E-04	95.38	0.2668
69	61	60	12.00	9.967	9.967	2.6703E-04	2.6703E-04	14.87	5.6596E-02
70	53	66	18.00	9.964	9.964	9.7275E-05	9.7275E-05	68.88	0.1165
71	58	71	20.00	9.975	9.974	4.0531E-04	4.0531E-04	342.9	0.4700
72	60	9	20.00	9.967	9.966	5.8746E-04	5.8746E-04	439.1	0.6018
73	22	62	20.00	9.992	9.984	8.5573E-03	8.5573E-03	753.5	1.033
74	62	58	14.00	9.984	9.975	9.1600E-03	9.1600E-03	167.0	0.4670
75	68	49	20.00	10.06	10.05	4.7703E-03	4.7703E-03	986.0	1.351
76	63	64	20.00	9.964	9.964	1.9741E-04	1.9741E-04	371.9	0.5097
77	66	67	18.00	9.964	9.964	8.0109E-05	8.0109E-05	68.88	0.1165
78	44	68	20.00	10.06	10.06	6.5622E-03	6.5622E-03	533.9	0.7316
79	41	24	14.00	9.975	9.974	1.3180E-03	1.3180E-03	56.57	0.1582
80	45	68	20.00	10.06	10.06	1.6975E-04	1.6975E-04	452.1	0.6197
81	21	41	20.00	9.975	9.975	2.2984E-04	2.2984E-04	232.5	0.3187
82	71	19	14.00	9.974	9.974	7.3528E-04	7.3528E-04	38.81	0.1085
83	72	54	14.00	9.962	9.961	1.9550E-04	1.9550E-04	30.00	8.3901E-02
84	6	54	20.00	9.962	9.961	6.2561E-04	6.2561E-04	188.5	0.2583
86	57	11	20.00	9.960	9.959	1.2627E-03	1.2627E-03	218.5	0.2994
89	77	65	20.00	9.958	9.957	1.1730E-03	1.1730E-03	218.5	0.2994
91	51	79	20.00	9.962	9.954	7.3824E-03	7.3824E-03	582.2	0.7978
92	79	80	20.00	9.954	9.939	1.5645E-02	1.5645E-02	986.0	1.351
94	64	82	20.00	9.964	9.964	4.7302E-04	4.7302E-04	149.6	0.2050
96	34	84	20.00	9.962	9.962	1.1730E-04	1.1730E-04	218.5	0.2994

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	986.0	0.000	10.07	10.07	10.17	9.8901E-02	2.7571E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	986.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
80	9.939	986.0	*	312.76

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 7 Jet Fire scenario in NEXBTL Area – Fire Scenario Area 3 – Case B

7.A PIPENET schematic layout with piping and nodes label
7.B PIPENET schematic layout with flow rate and pressure results
7.C PIPENET schematic layout with velocity results
7.D PIPENET input/output printout report

Attachment 7.A contains 1 page
Attachment 7.B contains 1 page
Attachment 7.C contains 1 page
Attachment 7.D contains 21 pages

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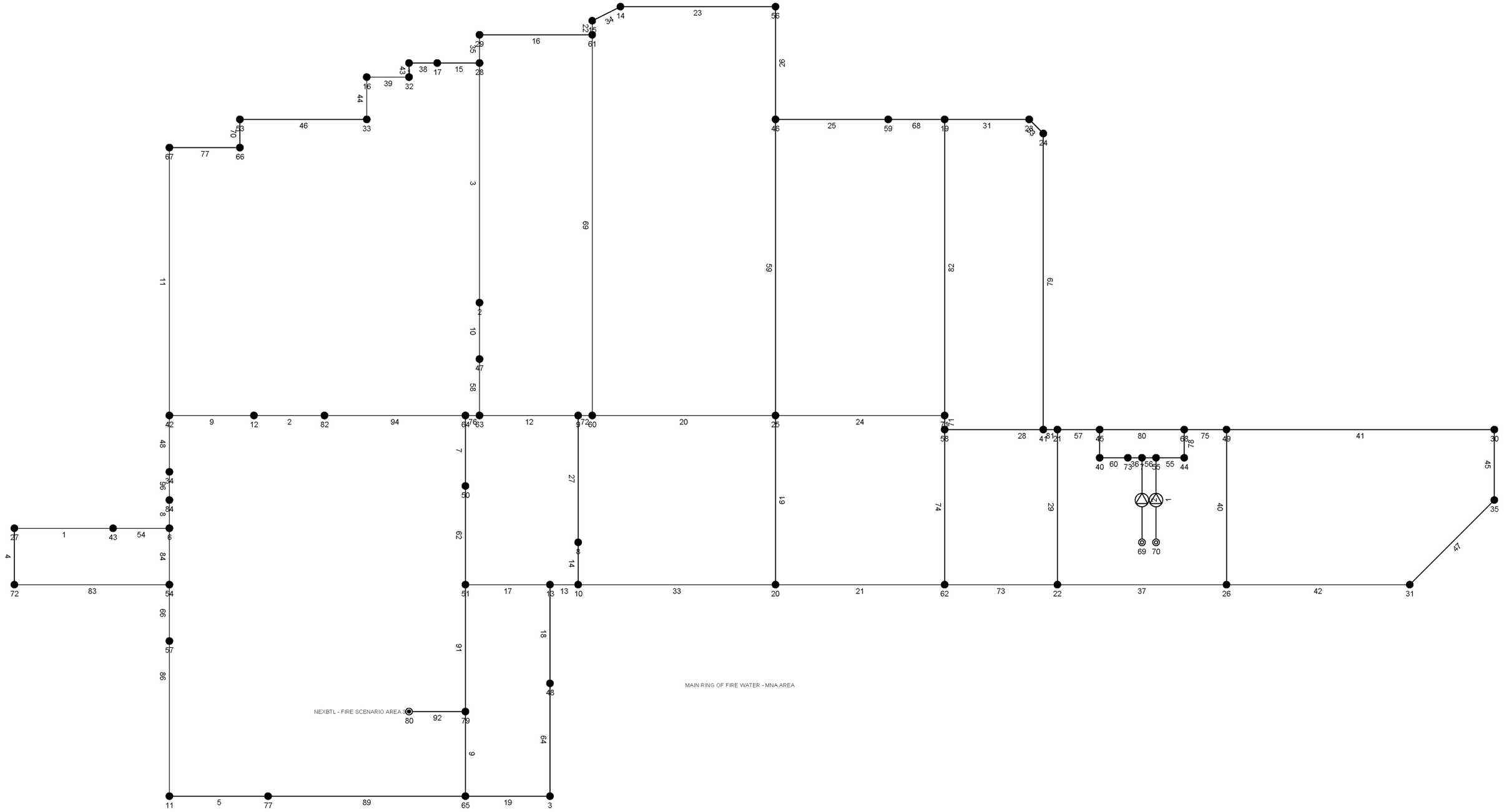
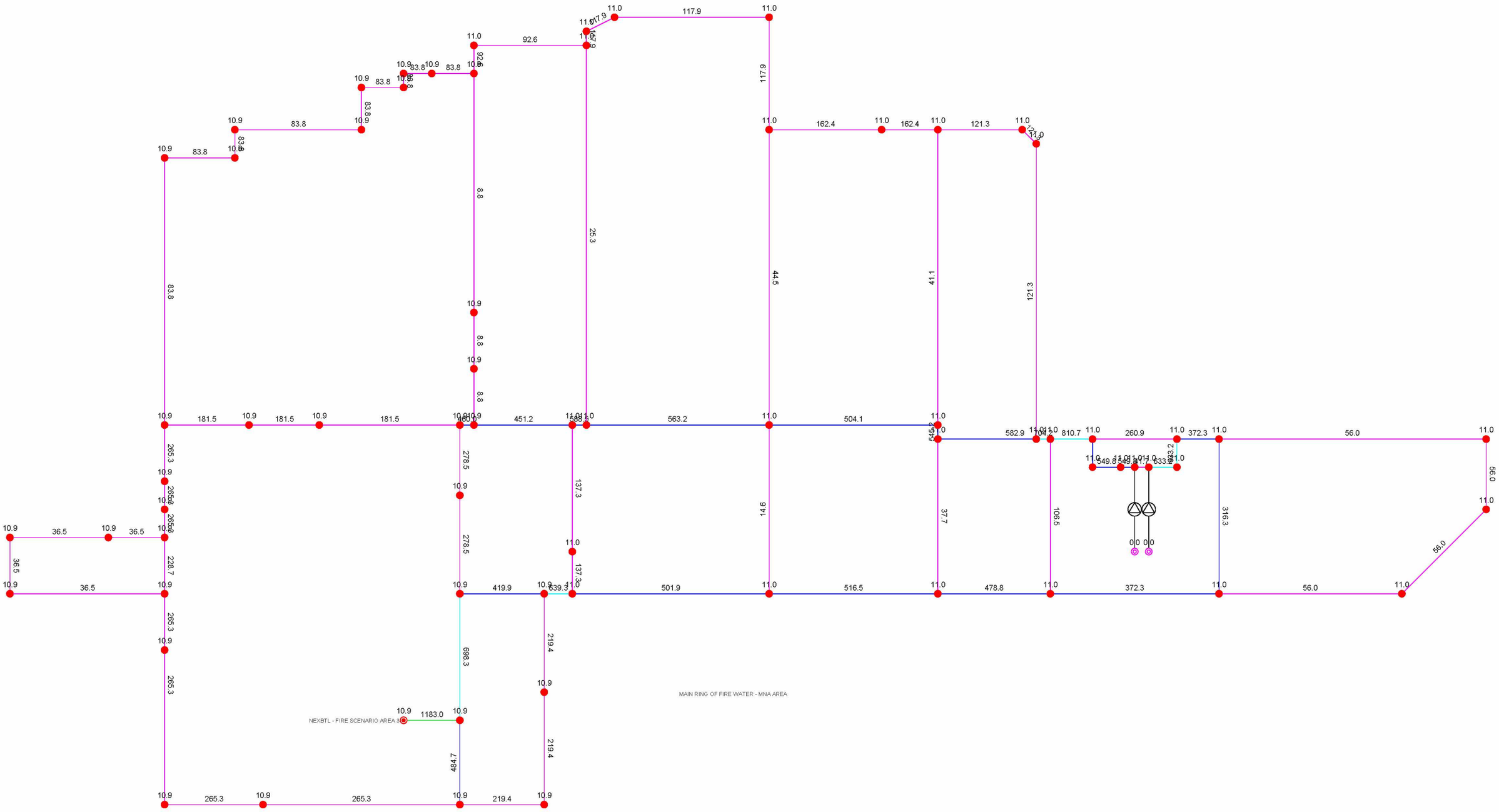
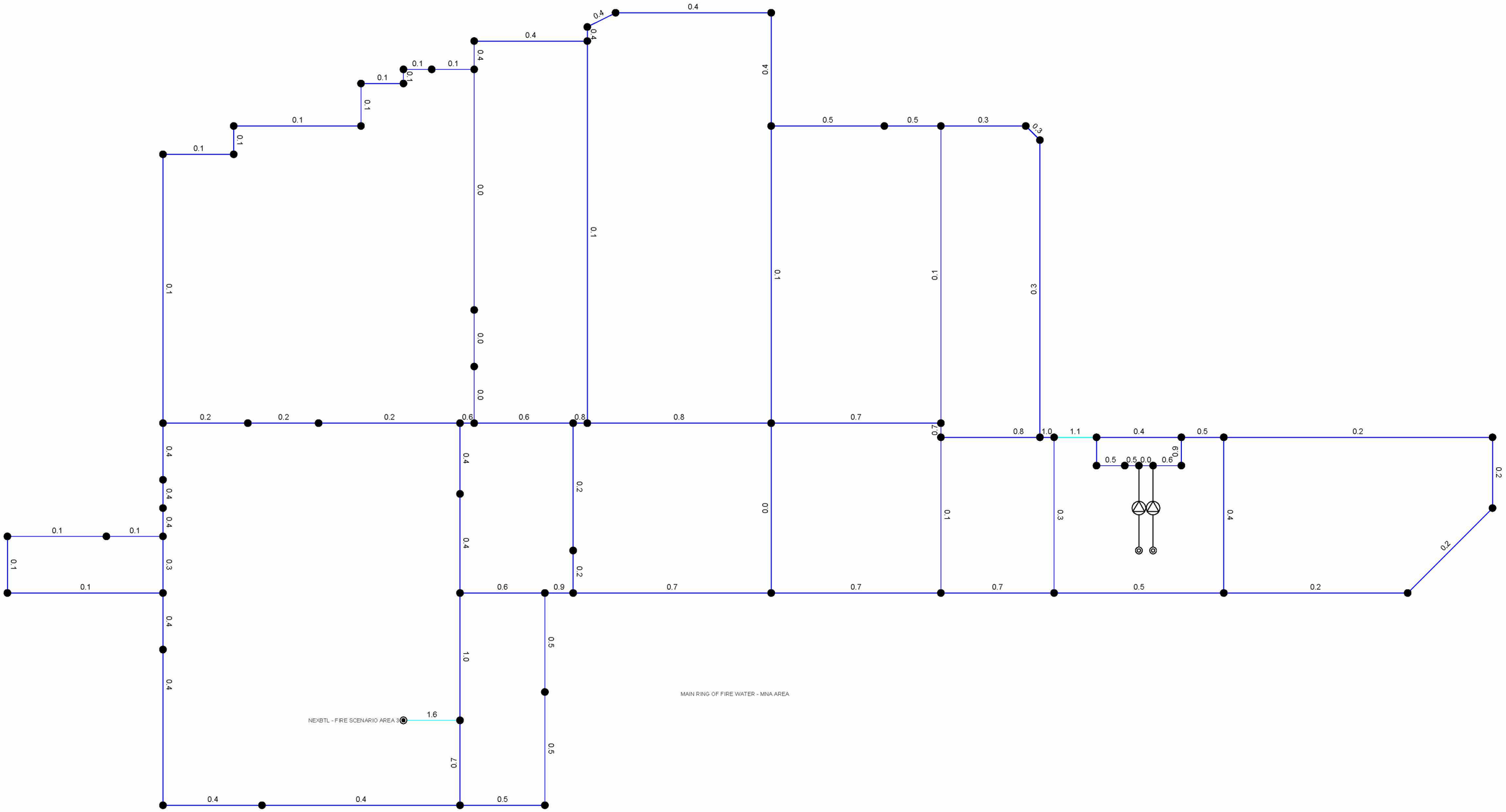


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

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19:24 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
92	79	80	20.00	20.00	0.000	150.0	45.60
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
92	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	36.5446	9	14.0000	14.0000	*
2	82	12	181.4963	9	20.0000	20.0000	*
3	28	2	8.7597	9	20.0000	20.0000	*
4	27	72	36.5446	9	14.0000	14.0000	*
5	11	77	265.2891	9	20.0000	20.0000	*
6	65	79	484.6739	9	20.0000	20.0000	*
7	64	50	278.4611	9	20.0000	20.0000	*
8	84	6	265.2891	9	20.0000	20.0000	*
9	12	42	181.4963	9	20.0000	20.0000	*
10	2	47	8.7597	9	20.0000	20.0000	*
11	67	42	83.7928	9	18.0000	18.0000	*
12	9	63	451.1977	9	20.0000	20.0000	*
13	10	13	639.2524	9	20.0000	20.0000	*
14	8	10	137.3182	9	20.0000	20.0000	*
15	28	17	83.7928	9	18.0000	18.0000	*
16	61	29	92.5525	9	12.0000	12.0000	*
17	13	51	419.8677	9	20.0000	20.0000	*
18	13	48	219.3847	9	16.0000	16.0000	*
19	3	65	219.3847	9	16.0000	16.0000	*
20	25	60	563.1848	9	20.0000	20.0000	*
21	62	20	516.5044	9	20.0000	20.0000	*
22	15	61	117.8836	9	12.0000	12.0000	*
23	56	14	117.8836	9	12.0000	12.0000	*
24	71	25	504.1388	9	20.0000	20.0000	*
25	59	46	162.3595	9	14.0000	14.0000	*
26	46	56	117.8836	9	12.0000	12.0000	*
27	9	8	137.3182	9	20.0000	20.0000	*
28	41	58	582.9297	9	20.0000	20.0000	*
29	21	22	106.4645	9	14.0000	14.0000	*
31	23	19	121.2669	9	14.0000	14.0000	*
33	20	10	501.9342	9	20.0000	20.0000	*
34	14	15	117.8836	9	12.0000	12.0000	*
35	29	28	92.5525	9	12.0000	12.0000	*
36	7	73	549.7968	9	24.0000	24.0000	*
37	26	22	372.3416	9	20.0000	20.0000	*
38	17	1	83.7928	9	18.0000	18.0000	*
39	32	16	83.7928	9	18.0000	18.0000	*
40	49	26	316.3455	9	20.0000	20.0000	*
41	49	30	55.9961	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	55.9961	9	12.0000	12.0000	*
43	1	32	83.7928	9	18.0000	18.0000	*
44	16	33	83.7928	9	18.0000	18.0000	*
45	30	35	55.9961	9	12.0000	12.0000	*
46	33	53	83.7928	9	18.0000	18.0000	*
47	35	31	55.9961	9	12.0000	12.0000	*
48	42	34	265.2891	9	20.0000	20.0000	*
53	24	23	121.2669	9	14.0000	14.0000	*
54	6	43	36.5446	9	14.0000	14.0000	*
55	55	44	633.2059	9	24.0000	24.0000	*
56	7	55	41.7042	9	24.0000	24.0000	*
57	45	21	810.6611	9	20.0000	20.0000	*
58	47	63	8.7597	9	20.0000	20.0000	*
59	46	25	44.4758	9	14.0000	14.0000	*
60	73	40	549.7968	9	24.0000	24.0000	*
61	20	25	14.5702	9	14.0000	14.0000	*
62	50	51	278.4611	9	20.0000	20.0000	*
64	48	3	219.3847	9	16.0000	16.0000	*
66	54	57	265.2891	9	20.0000	20.0000	*
67	40	45	549.7968	9	20.0000	20.0000	*
68	19	59	162.3595	9	14.0000	14.0000	*
69	61	60	25.3311	9	12.0000	12.0000	*
70	53	66	83.7928	9	18.0000	18.0000	*
71	58	71	545.2314	9	20.0000	20.0000	*
72	60	9	588.5160	9	20.0000	20.0000	*
73	22	62	478.8061	9	20.0000	20.0000	*
74	58	62	37.6983	9	14.0000	14.0000	*
75	68	49	372.3416	9	20.0000	20.0000	*
76	63	64	459.9574	9	20.0000	20.0000	*
77	66	67	83.7928	9	18.0000	18.0000	*
78	44	68	633.2059	9	20.0000	20.0000	*
79	41	24	121.2669	9	14.0000	14.0000	*
80	68	45	260.8643	9	20.0000	20.0000	*
81	21	41	704.1966	9	20.0000	20.0000	*
82	71	19	41.0926	9	14.0000	14.0000	*
83	72	54	36.5446	9	14.0000	14.0000	*
84	6	54	228.7446	9	20.0000	20.0000	*
86	57	11	265.2891	9	20.0000	20.0000	*
89	77	65	265.2891	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	698.3287	9	20.0000	20.0000	*
92	79	80	1183.0027	9	20.0000	20.0000	*
94	64	82	181.4963	9	20.0000	20.0000	*
96	34	84	265.2891	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.95	10.95	1.2970E-04	1.2970E-04	36.54	0.1022
2	82	12	20.00	10.95	10.95	3.1185E-04	3.1185E-04	181.5	0.2487
3	28	2	20.00	10.95	10.95	2.8610E-06	0.000	8.760	1.2005E-02
4	27	72	14.00	10.95	10.94	2.4319E-04	2.4319E-04	36.54	0.1022
5	11	77	20.00	10.94	10.94	1.6327E-03	1.6327E-03	265.3	0.3636
6	65	79	20.00	10.94	10.93	3.2120E-03	3.2120E-03	484.7	0.6642
7	64	50	20.00	10.95	10.95	1.9674E-03	1.9674E-03	278.5	0.3816
8	84	6	20.00	10.95	10.95	5.9032E-04	5.9032E-04	265.3	0.3636
9	12	42	20.00	10.95	10.95	4.8065E-04	4.8065E-04	181.5	0.2487
10	2	47	20.00	10.95	10.95	2.8610E-06	0.000	8.760	1.2005E-02
11	67	42	18.00	10.95	10.95	5.4741E-04	5.4741E-04	83.79	0.1418
12	9	63	20.00	10.95	10.95	2.2993E-03	2.2993E-03	451.2	0.6184
13	10	13	20.00	10.95	10.95	1.0691E-03	1.0691E-03	639.3	0.8761
14	8	10	20.00	10.95	10.95	2.7275E-04	2.7275E-04	137.3	0.1882
15	28	17	18.00	10.95	10.95	9.8228E-05	9.8228E-05	83.79	0.1418
16	61	29	12.00	10.95	10.95	2.3346E-03	2.3346E-03	92.55	0.3523
17	13	51	20.00	10.95	10.94	4.3507E-03	4.3507E-03	419.9	0.5754
18	13	48	16.00	10.95	10.95	3.3808E-03	3.3808E-03	219.4	0.4698
19	3	65	16.00	10.94	10.94	3.4676E-03	3.4676E-03	219.4	0.4698
20	25	60	20.00	10.96	10.95	8.7948E-03	8.7948E-03	563.2	0.7718
21	62	20	20.00	10.97	10.96	6.4154E-03	6.4154E-03	516.5	0.7079
22	15	61	12.00	10.95	10.95	6.2275E-04	6.2275E-04	117.9	0.4488
23	56	14	12.00	10.96	10.95	5.4951E-03	5.4951E-03	117.9	0.4488
24	71	25	20.00	10.97	10.96	6.1302E-03	6.1302E-03	504.1	0.6909
25	59	46	14.00	10.97	10.96	2.8048E-03	2.8048E-03	162.4	0.4541
26	46	56	12.00	10.96	10.96	1.9503E-03	1.9503E-03	117.9	0.4488
27	9	8	20.00	10.95	10.95	8.1730E-04	8.1730E-04	137.3	0.1882
28	41	58	20.00	10.97	10.97	5.3148E-03	5.3148E-03	582.9	0.7989
29	21	22	14.00	10.98	10.97	3.9883E-03	3.9883E-03	106.5	0.2978
31	23	19	14.00	10.97	10.97	1.2646E-03	1.2646E-03	121.3	0.3392
33	20	10	20.00	10.96	10.95	1.0985E-02	1.0985E-02	501.9	0.6879
34	14	15	12.00	10.95	10.95	9.6226E-04	9.6226E-04	117.9	0.4488
35	29	28	12.00	10.95	10.95	1.6870E-03	1.6870E-03	92.55	0.3523
36	7	73	24.00	10.99	10.99	2.1429E-03	2.1429E-03	549.8	0.5233
37	26	22	20.00	10.98	10.97	3.7804E-03	3.7804E-03	372.3	0.5103
38	17	1	18.00	10.95	10.95	1.5926E-04	1.5926E-04	83.79	0.1418
39	32	16	18.00	10.95	10.95	1.3733E-04	1.3733E-04	83.79	0.1418
40	49	26	20.00	10.98	10.98	6.1197E-03	6.1197E-03	316.3	0.4336
41	49	30	12.00	10.98	10.98	2.4042E-03	2.4042E-03	56.00	0.2132
42	31	26	12.00	10.98	10.98	1.7300E-03	1.7300E-03	56.00	0.2132
43	1	32	18.00	10.95	10.95	1.0014E-04	1.0014E-04	83.79	0.1418

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.95	10.95	1.7262E-04	1.7262E-04	83.79	0.1418
45	30	35	12.00	10.98	10.98	7.5817E-04	7.5817E-04	56.00	0.2132
46	33	53	18.00	10.95	10.95	2.9564E-04	2.9564E-04	83.79	0.1418
47	35	31	12.00	10.98	10.98	1.2274E-03	1.2274E-03	56.00	0.2132
48	42	34	20.00	10.95	10.95	1.0948E-03	1.0948E-03	265.3	0.3636
53	24	23	14.00	10.97	10.97	3.9291E-04	3.9291E-04	121.3	0.3392
54	6	43	14.00	10.95	10.95	2.4223E-04	2.4223E-04	36.54	0.1022
55	55	44	24.00	10.99	10.99	3.6745E-03	3.6745E-03	633.2	0.6026
56	7	55	24.00	10.99	10.99	2.8610E-06	0.000	41.70	3.9691E-02
57	45	21	20.00	10.98	10.98	6.6395E-03	6.6395E-03	810.7	1.111
58	47	63	20.00	10.95	10.95	1.9073E-06	0.000	8.760	1.2005E-02
59	46	25	14.00	10.96	10.96	9.5463E-04	9.5463E-04	44.48	0.1244
60	73	40	24.00	10.99	10.99	9.8991E-04	9.8991E-04	549.8	0.5233
61	20	25	14.00	10.96	10.96	8.9645E-05	8.9645E-05	14.57	4.0752E-02
62	50	51	20.00	10.95	10.94	1.9531E-03	1.9531E-03	278.5	0.3816
64	48	3	16.00	10.95	10.94	4.6072E-03	4.6072E-03	219.4	0.4698
66	54	57	20.00	10.94	10.94	1.6775E-03	1.6775E-03	265.3	0.3636
67	40	45	20.00	10.99	10.98	9.6025E-03	9.6025E-03	549.8	0.7535
68	19	59	14.00	10.97	10.97	1.5478E-03	1.5478E-03	162.4	0.4541
69	61	60	12.00	10.95	10.95	7.1907E-04	7.1907E-04	25.33	9.6434E-02
70	53	66	18.00	10.95	10.95	1.4210E-04	1.4210E-04	83.79	0.1418
71	58	71	20.00	10.97	10.97	9.5463E-04	9.5463E-04	545.2	0.7472
72	60	9	20.00	10.95	10.95	1.0109E-03	1.0109E-03	588.5	0.8066
73	22	62	20.00	10.97	10.97	3.6993E-03	3.6993E-03	478.8	0.6562
74	58	62	14.00	10.97	10.97	5.7983E-04	5.7983E-04	37.70	0.1054
75	68	49	20.00	10.98	10.98	7.8773E-04	7.8773E-04	372.3	0.5103
76	63	64	20.00	10.95	10.95	2.8992E-04	2.8992E-04	460.0	0.6304
77	66	67	18.00	10.95	10.95	1.1539E-04	1.1539E-04	83.79	0.1418
78	44	68	20.00	10.99	10.98	8.9979E-03	8.9979E-03	633.2	0.8678
79	41	24	14.00	10.97	10.97	5.4350E-03	5.4350E-03	121.3	0.3392
80	68	45	20.00	10.98	10.98	6.0081E-05	6.0081E-05	260.9	0.3575
81	21	41	20.00	10.98	10.97	1.7929E-03	1.7929E-03	704.2	0.9651
82	71	19	14.00	10.97	10.97	8.2302E-04	8.2302E-04	41.09	0.1149
83	72	54	14.00	10.94	10.94	2.7943E-04	2.7943E-04	36.54	0.1022
84	6	54	20.00	10.95	10.94	8.9455E-04	8.9455E-04	228.7	0.3135
86	57	11	20.00	10.94	10.94	1.8101E-03	1.8101E-03	265.3	0.3636
89	77	65	20.00	10.94	10.94	1.6851E-03	1.6851E-03	265.3	0.3636
91	51	79	20.00	10.94	10.93	1.0317E-02	1.0317E-02	698.3	0.9571
92	79	80	20.00	10.93	10.91	2.1915E-02	2.1915E-02	1183.	1.621
94	64	82	20.00	10.95	10.95	6.7806E-04	6.7806E-04	181.5	0.2487
96	34	84	20.00	10.95	10.95	1.6975E-04	1.6975E-04	265.3	0.3636

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	591.5	0.000	10.99	10.99	10.17	9.0549E-02	1.8065E+05	100.0
2	591.5	0.000	10.99	10.99	10.17	9.0549E-02	1.8065E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	591.5	0.0000
69	0.000	*	591.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
80	10.91	1183.	*	358.11

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

Attachment 8 Pool Fire scenario in NEXBTL area - Fire Scenario Area 4 – Case A

8.A PIPENET schematic layout with piping and nodes label

8.B PIPENET schematic layout with flow rate and pressure results

8.C PIPENET schematic layout with velocity results

8.D PIPENET input/output printout report

Attachment 8.A contains 1 page
Attachment 8.B contains 1 page
Attachment 8.C contains 1 page
Attachment 8.D contains 21 pages

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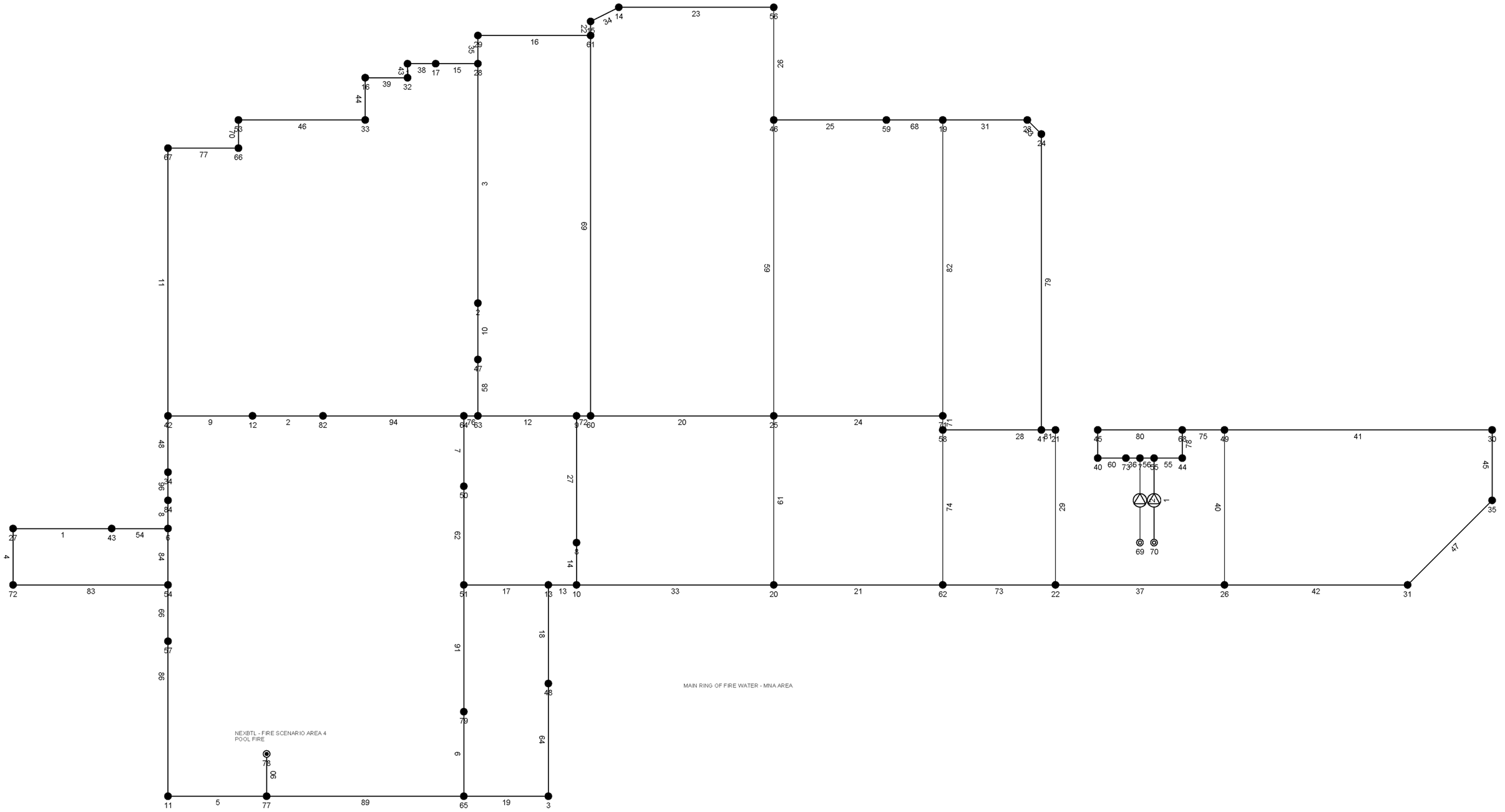
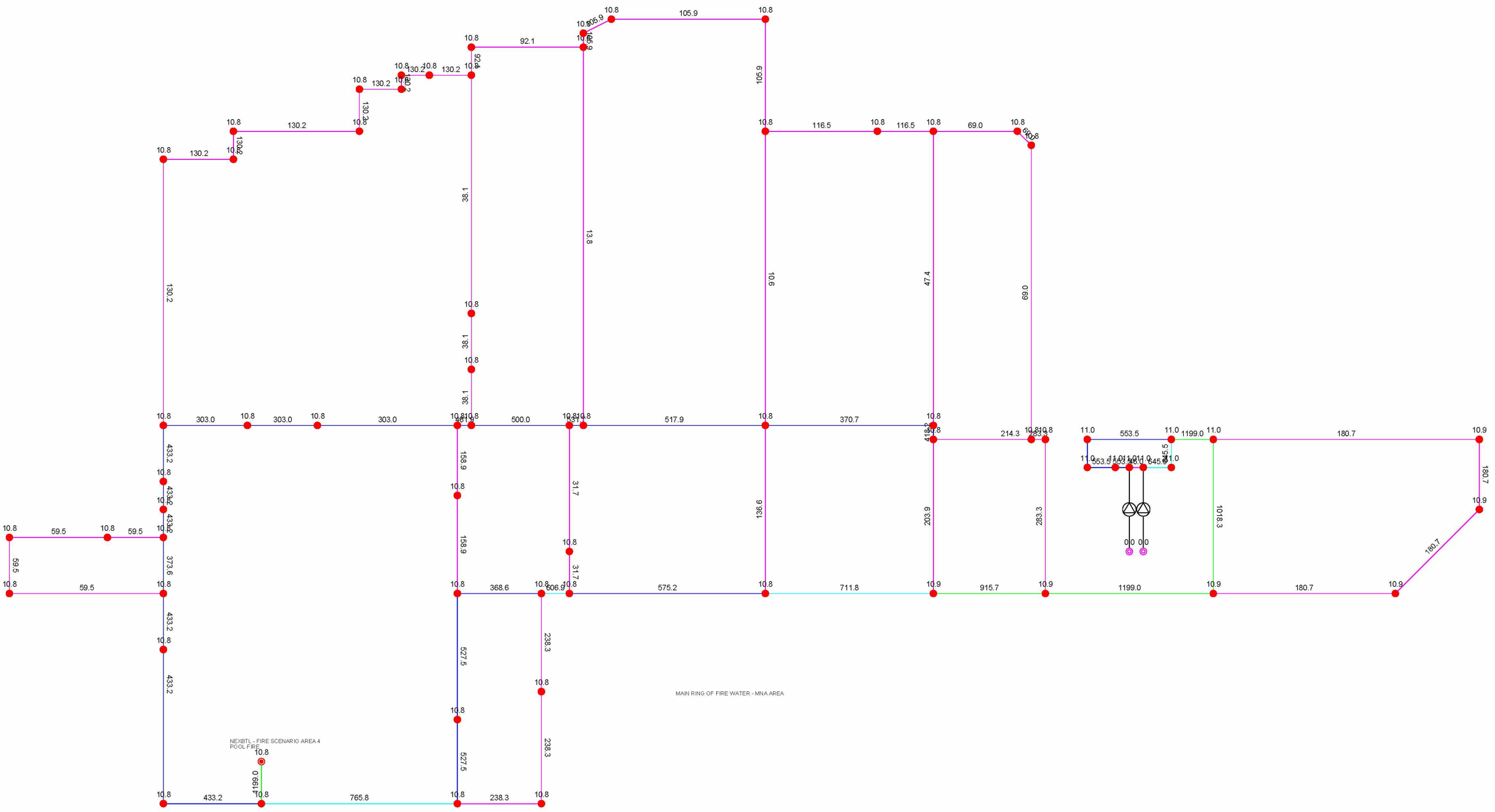
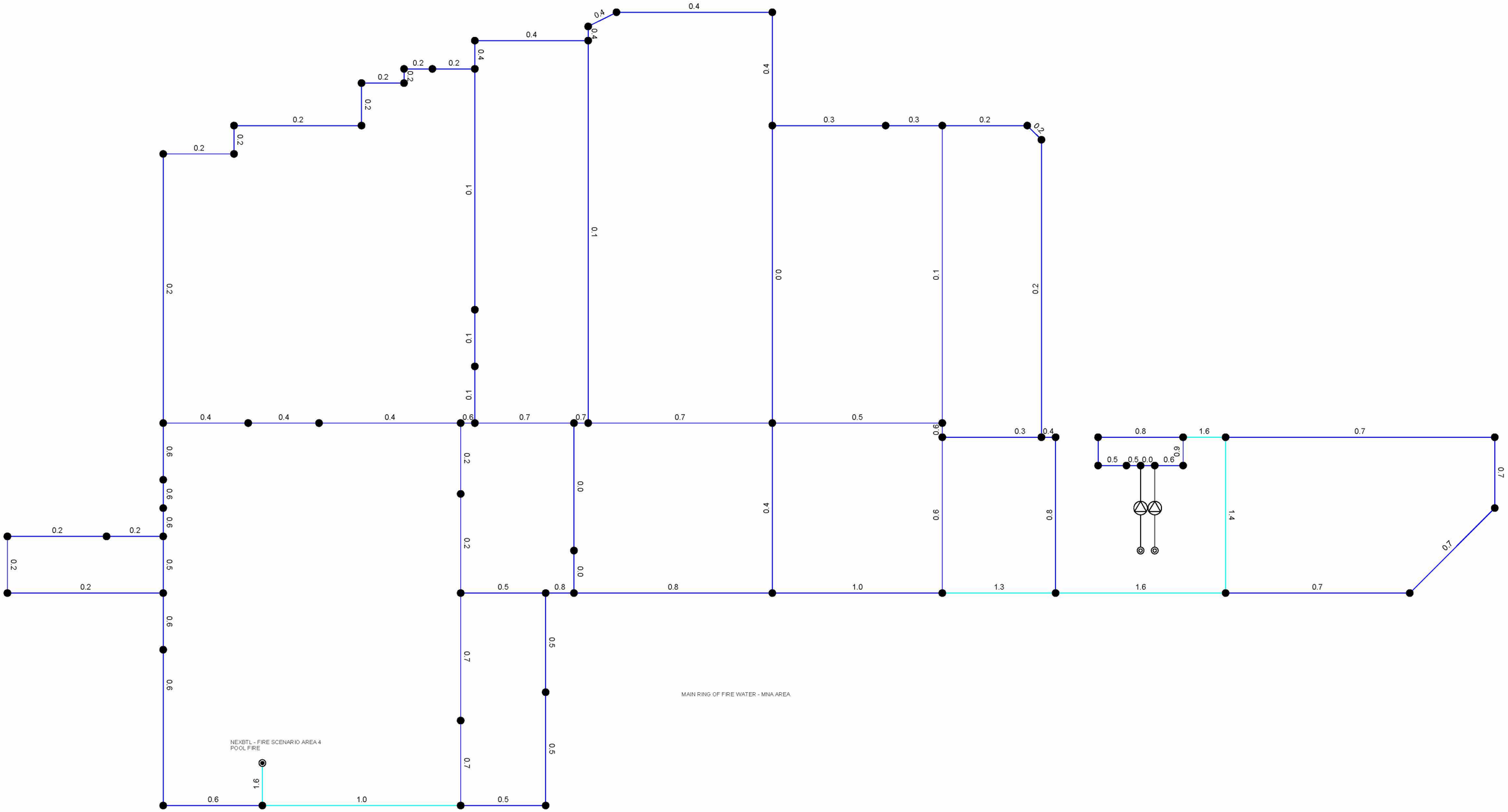


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

19:35 on 7-Jul-2021

LIST OF CONTENTS
==========

	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
90	77	78	20.00	20.00	0.000	150.0	45.60
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
90	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	59.5233	9	14.0000	14.0000	*
2	82	12	302.9770	9	20.0000	20.0000	*
3	2	28	38.1014	9	20.0000	20.0000	*
4	27	72	59.5233	9	14.0000	14.0000	*
5	11	77	433.1696	9	20.0000	20.0000	*
6	79	65	527.4988	9	20.0000	20.0000	*
7	64	50	158.9368	9	20.0000	20.0000	*
8	84	6	433.1696	9	20.0000	20.0000	*
9	12	42	302.9770	9	20.0000	20.0000	*
10	47	2	38.1014	9	20.0000	20.0000	*
11	67	42	130.1926	9	18.0000	18.0000	*
12	9	63	500.0151	9	20.0000	20.0000	*
13	10	13	606.8964	9	20.0000	20.0000	*
14	8	10	31.6556	9	20.0000	20.0000	*
15	28	17	130.1926	9	18.0000	18.0000	*
16	61	29	92.0912	9	12.0000	12.0000	*
17	13	51	368.5620	9	20.0000	20.0000	*
18	13	48	238.3344	9	16.0000	16.0000	*
19	3	65	238.3344	9	16.0000	16.0000	*
20	25	60	517.8751	9	20.0000	20.0000	*
21	62	20	711.8274	9	20.0000	20.0000	*
22	15	61	105.8869	9	12.0000	12.0000	*
23	56	14	105.8869	9	12.0000	12.0000	*
24	71	25	370.7109	9	20.0000	20.0000	*
25	59	46	116.4644	9	14.0000	14.0000	*
26	46	56	105.8869	9	12.0000	12.0000	*
27	9	8	31.6556	9	20.0000	20.0000	*
28	41	58	214.2830	9	20.0000	20.0000	*
29	22	21	283.3016	9	14.0000	14.0000	*
31	23	19	69.0186	9	14.0000	14.0000	*
33	20	10	575.2407	9	20.0000	20.0000	*
34	14	15	105.8869	9	12.0000	12.0000	*
35	29	28	92.0912	9	12.0000	12.0000	*
36	7	73	553.5339	9	24.0000	24.0000	*
37	26	22	1199.0028	9	20.0000	20.0000	*
38	17	1	130.1926	9	18.0000	18.0000	*
39	32	16	130.1926	9	18.0000	18.0000	*
40	49	26	1018.2886	9	20.0000	20.0000	*
41	49	30	180.7141	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	180.7141	9	12.0000	12.0000	*
43	1	32	130.1926	9	18.0000	18.0000	*
44	16	33	130.1926	9	18.0000	18.0000	*
45	30	35	180.7141	9	12.0000	12.0000	*
46	33	53	130.1926	9	18.0000	18.0000	*
47	35	31	180.7141	9	12.0000	12.0000	*
48	42	34	433.1696	9	20.0000	20.0000	*
53	24	23	69.0186	9	14.0000	14.0000	*
54	6	43	59.5233	9	14.0000	14.0000	*
55	55	44	645.4688	9	24.0000	24.0000	*
56	7	55	45.9667	9	24.0000	24.0000	*
58	63	47	38.1014	9	20.0000	20.0000	*
59	46	25	10.5774	9	14.0000	14.0000	*
60	73	40	553.5339	9	24.0000	24.0000	*
61	20	25	136.5867	9	14.0000	14.0000	*
62	50	51	158.9368	9	20.0000	20.0000	*
64	48	3	238.3344	9	16.0000	16.0000	*
66	54	57	433.1696	9	20.0000	20.0000	*
67	40	45	553.5339	9	20.0000	20.0000	*
68	19	59	116.4644	9	14.0000	14.0000	*
69	61	60	13.7957	9	12.0000	12.0000	*
70	53	66	130.1926	9	18.0000	18.0000	*
71	58	71	418.1567	9	20.0000	20.0000	*
72	60	9	531.6707	9	20.0000	20.0000	*
73	22	62	915.7011	9	20.0000	20.0000	*
74	62	58	203.8736	9	14.0000	14.0000	*
75	68	49	1199.0028	9	20.0000	20.0000	*
76	63	64	461.9138	9	20.0000	20.0000	*
77	66	67	130.1926	9	18.0000	18.0000	*
78	44	68	645.4688	9	20.0000	20.0000	*
79	41	24	69.0186	9	14.0000	14.0000	*
80	45	68	553.5339	9	20.0000	20.0000	*
81	21	41	283.3017	9	20.0000	20.0000	*
82	71	19	47.4457	9	14.0000	14.0000	*
83	72	54	59.5233	9	14.0000	14.0000	*
84	6	54	373.6463	9	20.0000	20.0000	*
86	57	11	433.1696	9	20.0000	20.0000	*
89	65	77	765.8332	9	20.0000	20.0000	*
90	77	78	1199.0028	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	527.4988	9	20.0000	20.0000	*
94	64	82	302.9770	9	20.0000	20.0000	*
96	34	84	433.1696	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.82	10.82	3.2234E-04	3.2234E-04	59.52	0.1665
2	82	12	20.00	10.83	10.83	8.0776E-04	8.0776E-04	303.0	0.4152
3	2	28	20.00	10.83	10.83	4.7684E-05	4.7684E-05	38.10	5.2218E-02
4	27	72	14.00	10.82	10.82	6.0177E-04	6.0177E-04	59.52	0.1665
5	11	77	20.00	10.81	10.81	4.0350E-03	4.0350E-03	433.2	0.5937
6	79	65	20.00	10.82	10.82	3.7498E-03	3.7498E-03	527.5	0.7229
7	64	50	20.00	10.83	10.83	6.9714E-04	6.9714E-04	158.9	0.2178
8	84	6	20.00	10.82	10.82	1.4582E-03	1.4582E-03	433.2	0.5937
9	12	42	20.00	10.83	10.83	1.2350E-03	1.2350E-03	303.0	0.4152
10	47	2	20.00	10.83	10.83	1.7166E-05	1.7166E-05	38.10	5.2218E-02
11	67	42	18.00	10.83	10.83	1.2302E-03	1.2302E-03	130.2	0.2203
12	9	63	20.00	10.83	10.83	2.7847E-03	2.7847E-03	500.0	0.6853
13	10	13	20.00	10.83	10.83	9.7179E-04	9.7179E-04	606.9	0.8318
14	8	10	20.00	10.83	10.83	1.8120E-05	1.8120E-05	31.66	4.3384E-02
15	28	17	18.00	10.83	10.83	2.1744E-04	2.1744E-04	130.2	0.2203
16	61	29	12.00	10.83	10.83	2.2993E-03	2.2993E-03	92.09	0.3506
17	13	51	20.00	10.83	10.83	3.4227E-03	3.4227E-03	368.6	0.5051
18	13	48	16.00	10.83	10.83	3.9330E-03	3.9330E-03	238.3	0.5104
19	3	65	16.00	10.82	10.82	4.0321E-03	4.0321E-03	238.3	0.5104
20	25	60	20.00	10.84	10.83	7.5350E-03	7.5350E-03	517.9	0.7097
21	62	20	20.00	10.86	10.85	1.1621E-02	1.1621E-02	711.8	0.9756
22	15	61	12.00	10.84	10.83	5.0831E-04	5.0831E-04	105.9	0.4031
23	56	14	12.00	10.84	10.84	4.4851E-03	4.4851E-03	105.9	0.4031
24	71	25	20.00	10.85	10.84	3.4742E-03	3.4742E-03	370.7	0.5081
25	59	46	14.00	10.84	10.84	1.5097E-03	1.5097E-03	116.5	0.3257
26	46	56	12.00	10.84	10.84	1.5898E-03	1.5898E-03	105.9	0.4031
27	9	8	20.00	10.83	10.83	5.4359E-05	5.4359E-05	31.66	4.3384E-02
28	41	58	20.00	10.85	10.85	8.3447E-04	8.3447E-04	214.3	0.2937
29	22	21	14.00	10.87	10.85	2.4363E-02	2.4363E-02	283.3	0.7924
31	23	19	14.00	10.84	10.84	4.4537E-04	4.4537E-04	69.02	0.1930
33	20	10	20.00	10.85	10.83	1.4140E-02	1.4140E-02	575.2	0.7884
34	14	15	12.00	10.84	10.84	7.8487E-04	7.8487E-04	105.9	0.4031
35	29	28	12.00	10.83	10.83	1.6651E-03	1.6651E-03	92.09	0.3506
36	7	73	24.00	10.98	10.98	2.1667E-03	2.1667E-03	553.5	0.5268
37	26	22	20.00	10.90	10.87	3.2880E-02	3.2880E-02	1199.	1.643
38	17	1	18.00	10.83	10.83	3.6240E-04	3.6240E-04	130.2	0.2203
39	32	16	18.00	10.83	10.83	3.0708E-04	3.0708E-04	130.2	0.2203
40	49	26	20.00	10.96	10.90	5.3223E-02	5.3223E-02	1018.	1.396
41	49	30	12.00	10.96	10.94	2.0925E-02	2.0925E-02	180.7	0.6880
42	31	26	12.00	10.92	10.90	1.5033E-02	1.5033E-02	180.7	0.6880
43	1	32	18.00	10.83	10.83	2.2316E-04	2.2316E-04	130.2	0.2203

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.83	10.83	3.9005E-04	3.9005E-04	130.2	0.2203
45	30	35	12.00	10.94	10.93	6.5832E-03	6.5832E-03	180.7	0.6880
46	33	53	18.00	10.83	10.83	6.6471E-04	6.6471E-04	130.2	0.2203
47	35	31	12.00	10.93	10.92	1.0682E-02	1.0682E-02	180.7	0.6880
48	42	34	20.00	10.83	10.82	2.7075E-03	2.7075E-03	433.2	0.5937
53	24	23	14.00	10.85	10.84	1.3733E-04	1.3733E-04	69.02	0.1930
54	6	43	14.00	10.82	10.82	6.0272E-04	6.0272E-04	59.52	0.1665
55	55	44	24.00	10.98	10.97	3.8099E-03	3.8099E-03	645.5	0.6143
56	7	55	24.00	10.98	10.98	1.9073E-06	0.000	45.97	4.3748E-02
58	63	47	20.00	10.83	10.83	4.4823E-05	4.4823E-05	38.10	5.2218E-02
59	46	25	14.00	10.84	10.84	6.4850E-05	6.4850E-05	10.58	2.9584E-02
60	73	40	24.00	10.98	10.97	1.0033E-03	1.0033E-03	553.5	0.5268
61	20	25	14.00	10.85	10.84	5.6944E-03	5.6944E-03	136.6	0.3820
62	50	51	20.00	10.83	10.83	6.9237E-04	6.9237E-04	158.9	0.2178
64	48	3	16.00	10.83	10.82	5.3577E-03	5.3577E-03	238.3	0.5104
66	54	57	20.00	10.82	10.82	4.1447E-03	4.1447E-03	433.2	0.5937
67	40	45	20.00	10.97	10.96	9.7218E-03	9.7218E-03	553.5	0.7586
68	19	59	14.00	10.84	10.84	8.3256E-04	8.3256E-04	116.5	0.3257
69	61	60	12.00	10.83	10.83	2.3174E-04	2.3174E-04	13.80	5.2520E-02
70	53	66	18.00	10.83	10.83	3.1757E-04	3.1757E-04	130.2	0.2203
71	58	71	20.00	10.85	10.85	5.8556E-04	5.8556E-04	418.2	0.5731
72	60	9	20.00	10.83	10.83	8.3828E-04	8.3828E-04	531.7	0.7287
73	22	62	20.00	10.87	10.86	1.2275E-02	1.2275E-02	915.7	1.255
74	62	58	14.00	10.86	10.85	1.3255E-02	1.3255E-02	203.9	0.5702
75	68	49	20.00	10.96	10.96	6.8502E-03	6.8502E-03	1199.	1.643
76	63	64	20.00	10.83	10.83	2.9278E-04	2.9278E-04	461.9	0.6331
77	66	67	18.00	10.83	10.83	2.6035E-04	2.6035E-04	130.2	0.2203
78	44	68	20.00	10.97	10.96	9.3250E-03	9.3250E-03	645.5	0.8846
79	41	24	14.00	10.85	10.85	1.9045E-03	1.9045E-03	69.02	0.1930
80	45	68	20.00	10.96	10.96	2.4509E-04	2.4509E-04	553.5	0.7586
81	21	41	20.00	10.85	10.85	3.3283E-04	3.3283E-04	283.3	0.3883
82	71	19	14.00	10.85	10.84	1.0672E-03	1.0672E-03	47.45	0.1327
83	72	54	14.00	10.82	10.82	6.9046E-04	6.9046E-04	59.52	0.1665
84	6	54	20.00	10.82	10.82	2.2173E-03	2.2173E-03	373.6	0.5121
86	57	11	20.00	10.82	10.81	4.4775E-03	4.4775E-03	433.2	0.5937
89	65	77	20.00	10.82	10.81	1.1957E-02	1.1957E-02	765.8	1.050
90	77	78	20.00	10.81	10.78	2.2468E-02	2.2468E-02	1199.	1.643
91	51	79	20.00	10.83	10.82	6.1502E-03	6.1502E-03	527.5	0.7229
94	64	82	20.00	10.83	10.83	1.7471E-03	1.7471E-03	303.0	0.4152
96	34	84	20.00	10.82	10.82	4.1676E-04	4.1676E-04	433.2	0.5937

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	599.5	0.000	10.98	10.98	10.17	9.0690E-02	1.8281E+05	100.0
2	599.5	0.000	10.98	10.98	10.17	9.0690E-02	1.8281E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	599.5	0.0000
69	0.000	*	599.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
78	10.78	1199.	*	365.10

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 9 Pool Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case B

9.A PIPENET schematic layout with piping and nodes label
9.B PIPENET schematic layout with flow rate and pressure results
9.C PIPENET schematic layout with velocity results
9.D PIPENET input/output printout report

Attachment 9.A contains 1 page
Attachment 9.B contains 1 page
Attachment 9.C contains 1 page
Attachment 9.D contains 21 pages

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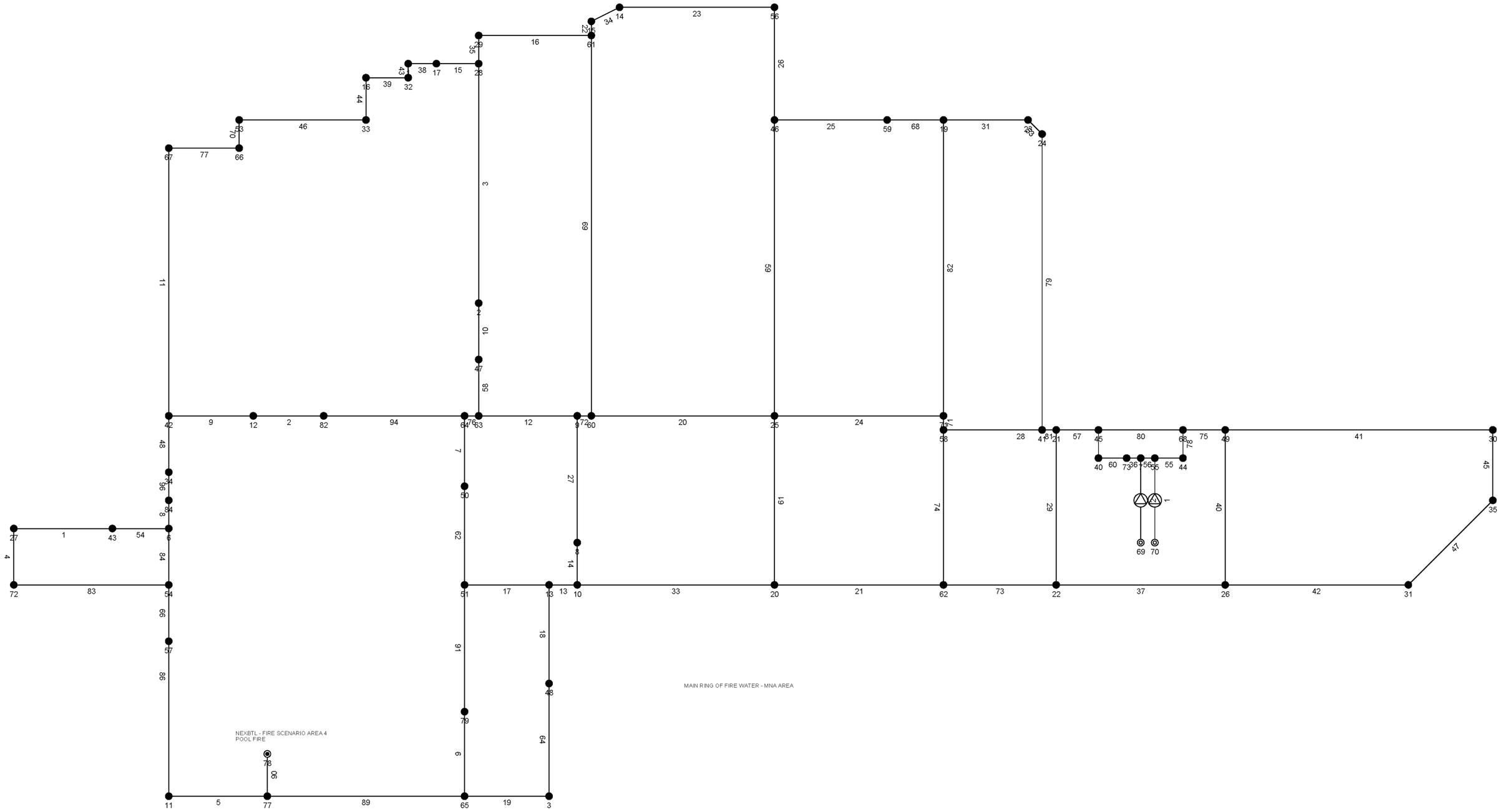
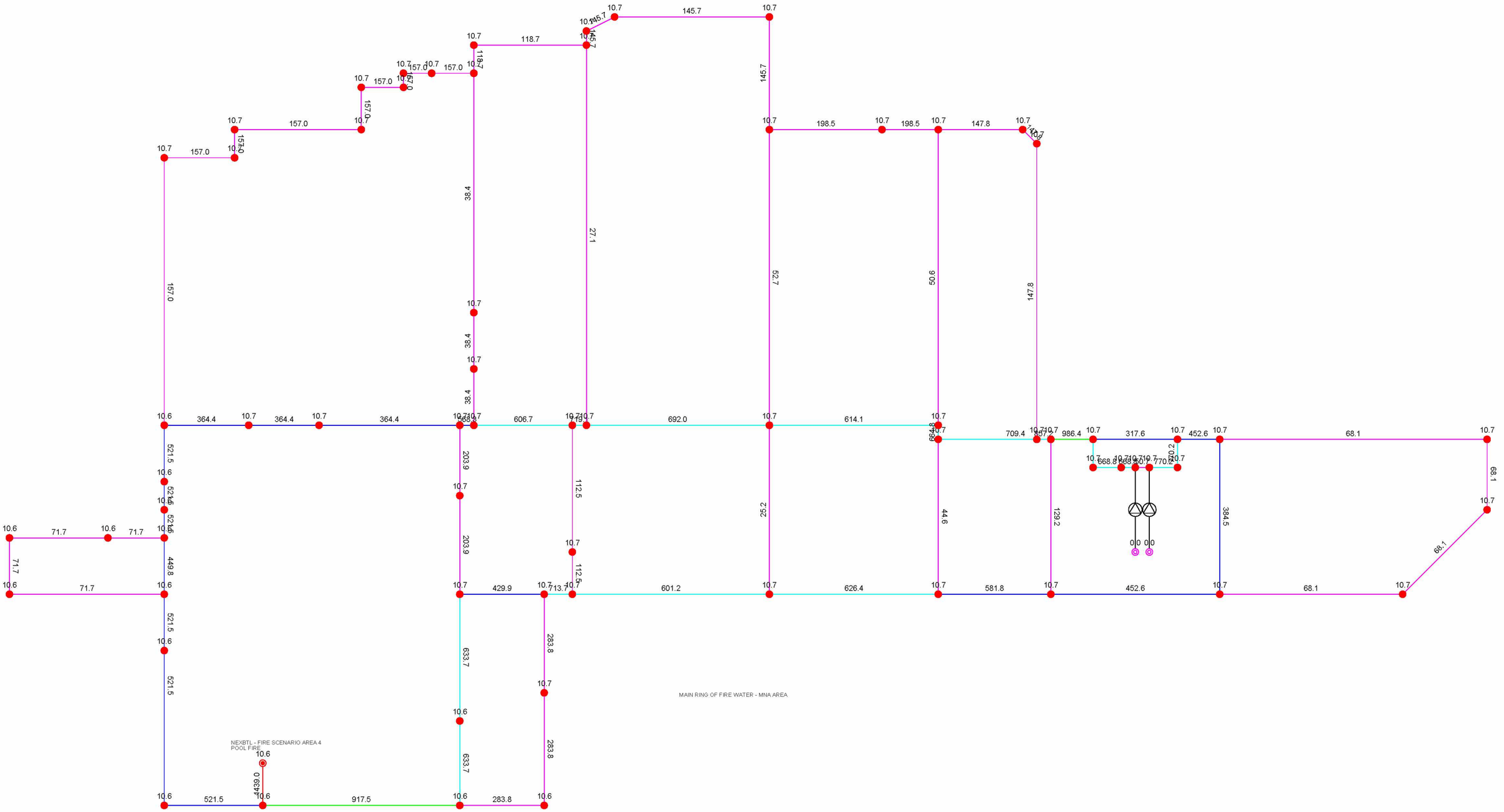
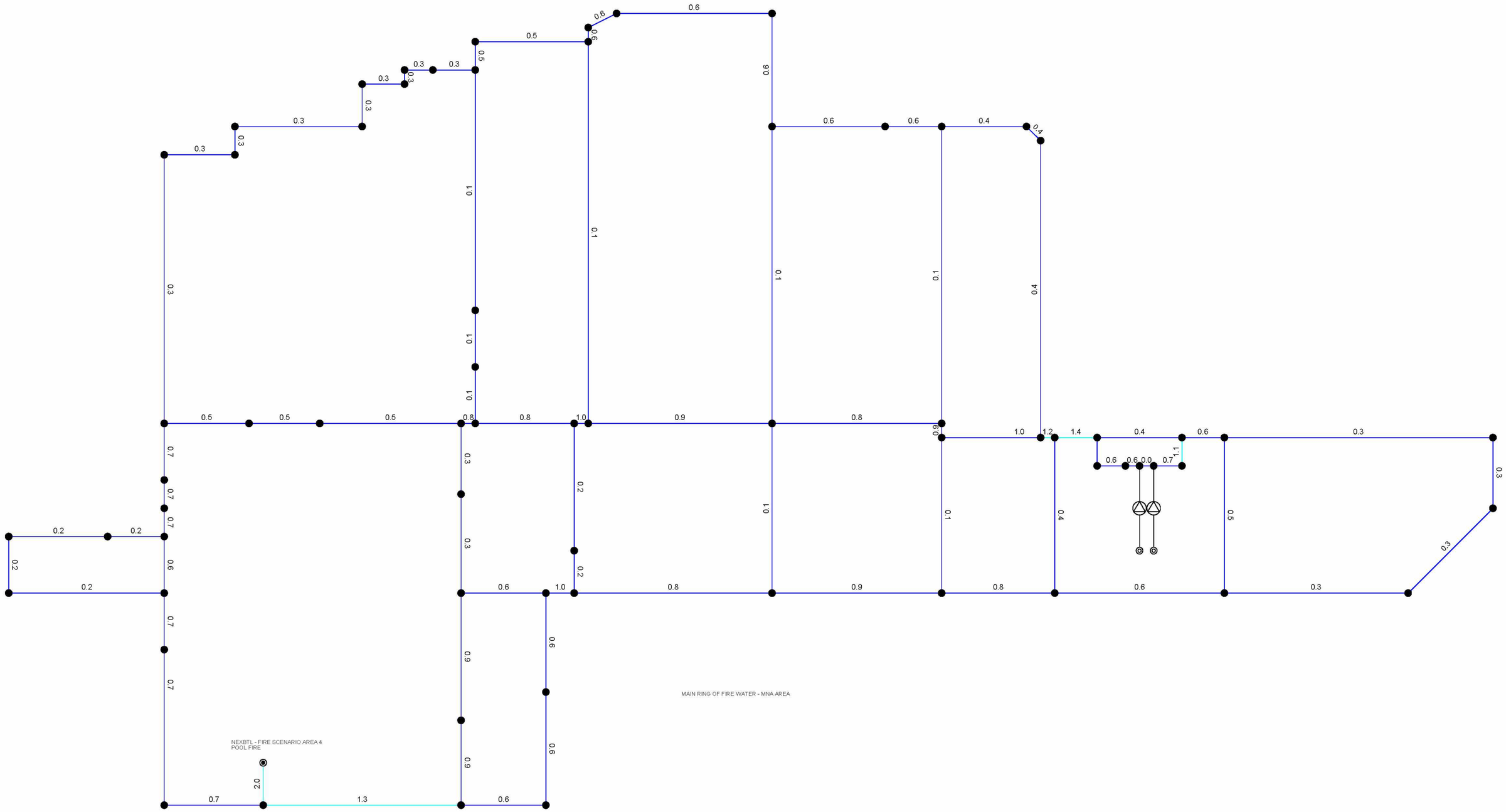


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

19:46 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
90	77	78	20.00	20.00	0.000	150.0	45.60
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
90	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	71.6659	9	14.0000	14.0000	*
2	82	12	364.4410	9	20.0000	20.0000	*
3	2	28	38.3647	9	20.0000	20.0000	*
4	27	72	71.6659	9	14.0000	14.0000	*
5	11	77	521.4595	9	20.0000	20.0000	*
6	79	65	633.7380	9	20.0000	20.0000	*
7	64	50	203.8591	9	20.0000	20.0000	*
8	84	6	521.4595	9	20.0000	20.0000	*
9	12	42	364.4410	9	20.0000	20.0000	*
10	47	2	38.3647	9	20.0000	20.0000	*
11	67	42	157.0186	9	18.0000	18.0000	*
12	9	63	606.6647	9	20.0000	20.0000	*
13	10	13	713.6846	9	20.0000	20.0000	*
14	8	10	112.4556	9	20.0000	20.0000	*
15	28	17	157.0186	9	18.0000	18.0000	*
16	61	29	118.6539	9	12.0000	12.0000	*
17	13	51	429.8790	9	20.0000	20.0000	*
18	13	48	283.8056	9	16.0000	16.0000	*
19	3	65	283.8056	9	16.0000	16.0000	*
20	25	60	692.0350	9	20.0000	20.0000	*
21	62	20	626.4084	9	20.0000	20.0000	*
22	15	61	145.7393	9	12.0000	12.0000	*
23	56	14	145.7393	9	12.0000	12.0000	*
24	71	25	614.1234	9	20.0000	20.0000	*
25	59	46	198.4715	9	14.0000	14.0000	*
26	46	56	145.7393	9	12.0000	12.0000	*
27	9	8	112.4556	9	20.0000	20.0000	*
28	41	58	709.3643	9	20.0000	20.0000	*
29	21	22	129.2010	9	14.0000	14.0000	*
31	23	19	147.8272	9	14.0000	14.0000	*
33	20	10	601.2290	9	20.0000	20.0000	*
34	14	15	145.7393	9	12.0000	12.0000	*
35	29	28	118.6539	9	12.0000	12.0000	*
36	7	73	668.7740	9	24.0000	24.0000	*
37	26	22	452.6108	9	20.0000	20.0000	*
38	17	1	157.0186	9	18.0000	18.0000	*
39	32	16	157.0186	9	18.0000	18.0000	*
40	49	26	384.5352	9	20.0000	20.0000	*
41	49	30	68.0757	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	68.0757	9	12.0000	12.0000	*
43	1	32	157.0186	9	18.0000	18.0000	*
44	16	33	157.0186	9	18.0000	18.0000	*
45	30	35	68.0757	9	12.0000	12.0000	*
46	33	53	157.0186	9	18.0000	18.0000	*
47	35	31	68.0757	9	12.0000	12.0000	*
48	42	34	521.4595	9	20.0000	20.0000	*
53	24	23	147.8272	9	14.0000	14.0000	*
54	6	43	71.6659	9	14.0000	14.0000	*
55	55	44	770.2293	9	24.0000	24.0000	*
56	7	55	50.7268	9	24.0000	24.0000	*
57	45	21	986.3925	9	20.0000	20.0000	*
58	63	47	38.3647	9	20.0000	20.0000	*
59	46	25	52.7322	9	14.0000	14.0000	*
60	73	40	668.7740	9	24.0000	24.0000	*
61	20	25	25.1794	9	14.0000	14.0000	*
62	50	51	203.8591	9	20.0000	20.0000	*
64	48	3	283.8056	9	16.0000	16.0000	*
66	54	57	521.4595	9	20.0000	20.0000	*
67	40	45	668.7740	9	20.0000	20.0000	*
68	19	59	198.4715	9	14.0000	14.0000	*
69	61	60	27.0854	9	12.0000	12.0000	*
70	53	66	157.0186	9	18.0000	18.0000	*
71	58	71	664.7677	9	20.0000	20.0000	*
72	60	9	719.1204	9	20.0000	20.0000	*
73	22	62	581.8119	9	20.0000	20.0000	*
74	58	62	44.5966	9	14.0000	14.0000	*
75	68	49	452.6108	9	20.0000	20.0000	*
76	63	64	568.3000	9	20.0000	20.0000	*
77	66	67	157.0186	9	18.0000	18.0000	*
78	44	68	770.2294	9	20.0000	20.0000	*
79	41	24	147.8272	9	14.0000	14.0000	*
80	68	45	317.6184	9	20.0000	20.0000	*
81	21	41	857.1915	9	20.0000	20.0000	*
82	71	19	50.6443	9	14.0000	14.0000	*
83	72	54	71.6659	9	14.0000	14.0000	*
84	6	54	449.7937	9	20.0000	20.0000	*
86	57	11	521.4595	9	20.0000	20.0000	*
89	65	77	917.5438	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
90	77	78	1439.0033	9	20.0000	20.0000	*
91	51	79	633.7380	9	20.0000	20.0000	*
94	64	82	364.4410	9	20.0000	20.0000	*
96	34	84	521.4595	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.64	10.64	4.5776E-04	4.5776E-04	71.67	0.2004
2	82	12	20.00	10.65	10.65	1.1349E-03	1.1349E-03	364.4	0.4995
3	2	28	20.00	10.65	10.65	4.7684E-05	4.7684E-05	38.36	5.2579E-02
4	27	72	14.00	10.64	10.64	8.4782E-04	8.4782E-04	71.67	0.2004
5	11	77	20.00	10.63	10.62	5.6925E-03	5.6925E-03	521.5	0.7147
6	79	65	20.00	10.64	10.64	5.2605E-03	5.2605E-03	633.7	0.8685
7	64	50	20.00	10.65	10.65	1.1044E-03	1.1044E-03	203.9	0.2794
8	84	6	20.00	10.64	10.64	2.0580E-03	2.0580E-03	521.5	0.7147
9	12	42	20.00	10.65	10.65	1.7395E-03	1.7395E-03	364.4	0.4995
10	47	2	20.00	10.65	10.65	1.7166E-05	1.7166E-05	38.36	5.2579E-02
11	67	42	18.00	10.65	10.65	1.7519E-03	1.7519E-03	157.0	0.2657
12	9	63	20.00	10.66	10.65	3.9797E-03	3.9797E-03	606.7	0.8314
13	10	13	20.00	10.66	10.66	1.3123E-03	1.3123E-03	713.7	0.9781
14	8	10	20.00	10.66	10.66	1.8787E-04	1.8787E-04	112.5	0.1541
15	28	17	18.00	10.65	10.65	3.0708E-04	3.0708E-04	157.0	0.2657
16	61	29	12.00	10.66	10.66	3.6945E-03	3.6945E-03	118.7	0.4517
17	13	51	20.00	10.66	10.65	4.5452E-03	4.5452E-03	429.9	0.5891
18	13	48	16.00	10.66	10.65	5.4379E-03	5.4379E-03	283.8	0.6077
19	3	65	16.00	10.64	10.64	5.5799E-03	5.5799E-03	283.8	0.6077
20	25	60	20.00	10.67	10.66	1.2876E-02	1.2876E-02	692.0	0.9484
21	62	20	20.00	10.68	10.67	9.1705E-03	9.1705E-03	626.4	0.8585
22	15	61	12.00	10.66	10.66	9.2030E-04	9.2030E-04	145.7	0.5548
23	56	14	12.00	10.67	10.66	8.1377E-03	8.1377E-03	145.7	0.5548
24	71	25	20.00	10.68	10.67	8.8301E-03	8.8301E-03	614.1	0.8417
25	59	46	14.00	10.68	10.67	4.0674E-03	4.0674E-03	198.5	0.5551
26	46	56	12.00	10.67	10.67	2.8877E-03	2.8877E-03	145.7	0.5548
27	9	8	20.00	10.66	10.66	5.6458E-04	5.6458E-04	112.5	0.1541
28	41	58	20.00	10.69	10.68	7.6427E-03	7.6427E-03	709.4	0.9722
29	21	22	14.00	10.69	10.69	5.7030E-03	5.7030E-03	129.2	0.3614
31	23	19	14.00	10.68	10.68	1.8253E-03	1.8253E-03	147.8	0.4135
33	20	10	20.00	10.67	10.66	1.5337E-02	1.5337E-02	601.2	0.8240
34	14	15	12.00	10.66	10.66	1.4248E-03	1.4248E-03	145.7	0.5548
35	29	28	12.00	10.66	10.65	2.6731E-03	2.6731E-03	118.7	0.4517
36	7	73	24.00	10.72	10.72	3.0775E-03	3.0775E-03	668.8	0.6365
37	26	22	20.00	10.69	10.69	5.4255E-03	5.4255E-03	452.6	0.6203
38	17	1	18.00	10.65	10.65	5.1785E-04	5.1785E-04	157.0	0.2657
39	32	16	18.00	10.65	10.65	4.3488E-04	4.3488E-04	157.0	0.2657
40	49	26	20.00	10.70	10.69	8.7824E-03	8.7824E-03	384.5	0.5270
41	49	30	12.00	10.70	10.70	3.4552E-03	3.4552E-03	68.08	0.2592
42	31	26	12.00	10.70	10.69	2.4796E-03	2.4796E-03	68.08	0.2592
43	1	32	18.00	10.65	10.65	3.1757E-04	3.1757E-04	157.0	0.2657

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.65	10.65	5.5695E-04	5.5695E-04	157.0	0.2657
45	30	35	12.00	10.70	10.70	1.0853E-03	1.0853E-03	68.08	0.2592
46	33	53	18.00	10.65	10.65	9.4509E-04	9.4509E-04	157.0	0.2657
47	35	31	12.00	10.70	10.70	1.7624E-03	1.7624E-03	68.08	0.2592
48	42	34	20.00	10.65	10.64	3.8176E-03	3.8176E-03	521.5	0.7147
53	24	23	14.00	10.68	10.68	5.6744E-04	5.6744E-04	147.8	0.4135
54	6	43	14.00	10.64	10.64	8.4686E-04	8.4686E-04	71.67	0.2004
55	55	44	24.00	10.72	10.72	5.2795E-03	5.2795E-03	770.2	0.7331
56	7	55	24.00	10.72	10.72	4.7684E-06	0.000	50.73	4.8279E-02
57	45	21	20.00	10.70	10.69	9.5472E-03	9.5472E-03	986.4	1.352
58	63	47	20.00	10.65	10.65	4.5776E-05	4.5776E-05	38.36	5.2579E-02
59	46	25	14.00	10.67	10.67	1.3103E-03	1.3103E-03	52.73	0.1475
60	73	40	24.00	10.72	10.72	1.4219E-03	1.4219E-03	668.8	0.6365
61	20	25	14.00	10.67	10.67	2.4700E-04	2.4700E-04	25.18	7.0425E-02
62	50	51	20.00	10.65	10.65	1.0977E-03	1.0977E-03	203.9	0.2794
64	48	3	16.00	10.65	10.64	7.4100E-03	7.4100E-03	283.8	0.6077
66	54	57	20.00	10.64	10.63	5.8451E-03	5.8451E-03	521.5	0.7147
67	40	45	20.00	10.72	10.70	1.3798E-02	1.3798E-02	668.8	0.9166
68	19	59	14.00	10.68	10.68	2.2421E-03	2.2421E-03	198.5	0.5551
69	61	60	12.00	10.66	10.66	8.1539E-04	8.1539E-04	27.09	0.1031
70	53	66	18.00	10.65	10.65	4.4823E-04	4.4823E-04	157.0	0.2657
71	58	71	20.00	10.68	10.68	1.3800E-03	1.3800E-03	664.8	0.9111
72	60	9	20.00	10.66	10.66	1.4620E-03	1.4620E-03	719.1	0.9856
73	22	62	20.00	10.69	10.68	5.3072E-03	5.3072E-03	581.8	0.7974
74	58	62	14.00	10.68	10.68	7.9250E-04	7.9250E-04	44.60	0.1247
75	68	49	20.00	10.70	10.70	1.1301E-03	1.1301E-03	452.6	0.6203
76	63	64	20.00	10.65	10.65	4.2820E-04	4.2820E-04	568.3	0.7789
77	66	67	18.00	10.65	10.65	3.7003E-04	3.7003E-04	157.0	0.2657
78	44	68	20.00	10.72	10.70	1.2925E-02	1.2925E-02	770.2	1.056
79	41	24	14.00	10.69	10.68	7.8402E-03	7.8402E-03	147.8	0.4135
80	68	45	20.00	10.70	10.70	8.7738E-05	8.7738E-05	317.6	0.4353
81	21	41	20.00	10.69	10.69	2.5749E-03	2.5749E-03	857.2	1.175
82	71	19	14.00	10.68	10.68	1.2102E-03	1.2102E-03	50.64	0.1416
83	72	54	14.00	10.64	10.64	9.7752E-04	9.7752E-04	71.67	0.2004
84	6	54	20.00	10.64	10.64	3.1300E-03	3.1300E-03	449.8	0.6164
86	57	11	20.00	10.63	10.63	6.3171E-03	6.3171E-03	521.5	0.7147
89	65	77	20.00	10.64	10.62	1.6695E-02	1.6695E-02	917.5	1.257
90	77	78	20.00	10.62	10.59	3.1487E-02	3.1487E-02	1439.	1.972
91	51	79	20.00	10.65	10.64	8.6222E-03	8.6222E-03	633.7	0.8685
94	64	82	20.00	10.65	10.65	2.4576E-03	2.4576E-03	364.4	0.4995
96	34	84	20.00	10.64	10.64	5.8746E-04	5.8746E-04	521.5	0.7147

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	719.5	0.000	10.72	10.72	10.17	9.2865E-02	2.1426E+05	100.0
2	719.5	0.000	10.72	10.72	10.17	9.2865E-02	2.1426E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	719.5	0.0000
69	0.000	*	719.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
78	10.59	1439.	*	442.21

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 10 Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case A

10.A PIPENET schematic layout with piping and nodes label

10.B PIPENET schematic layout with flow rate and pressure results

10.C PIPENET schematic layout with velocity results

10.D PIPENET input/output printout report

Attachment 10.A contains 1 page
Attachment 10.B contains 1 page
Attachment 10.C contains 1 page
Attachment 10.D contains 21 pages

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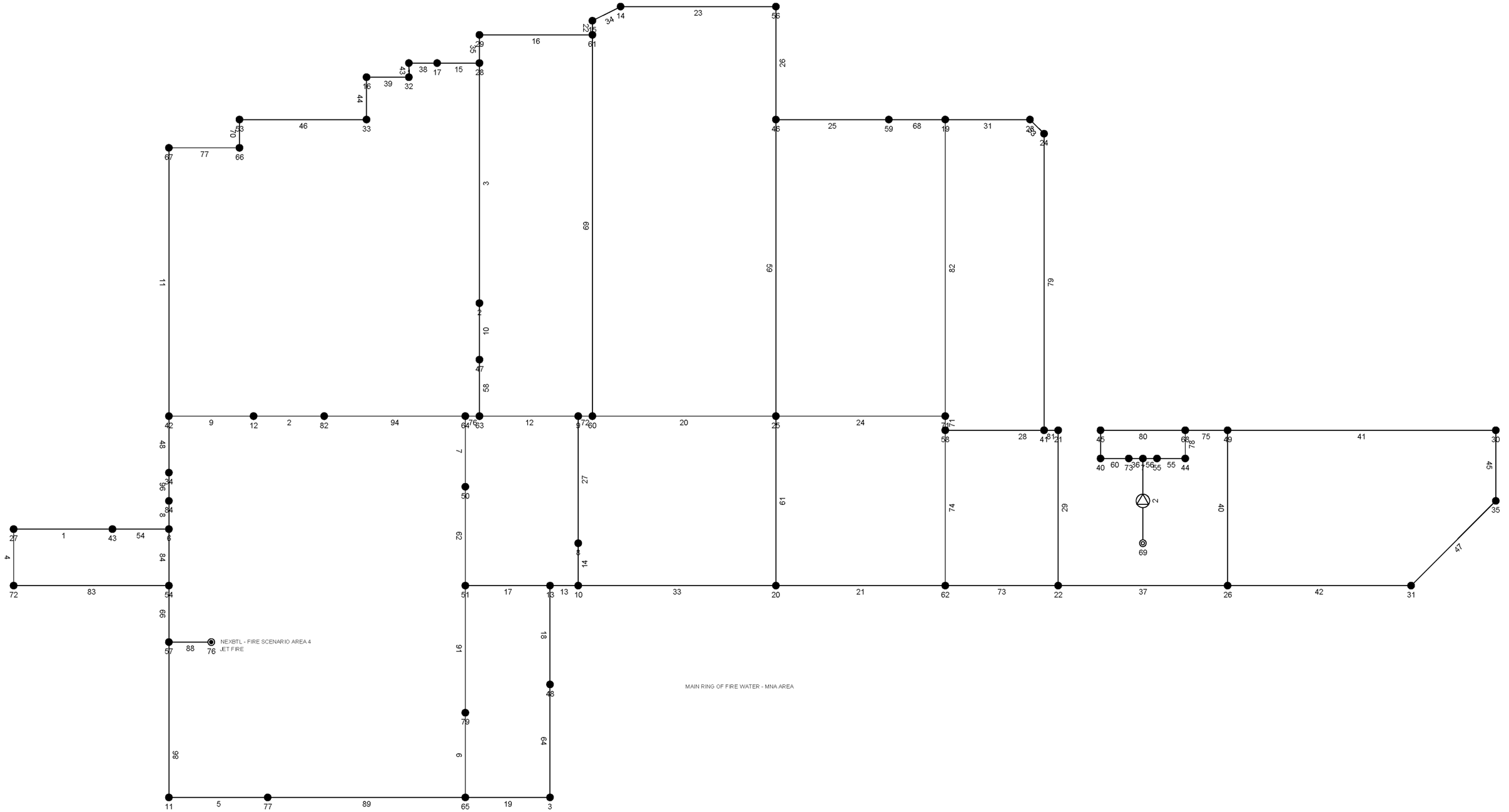
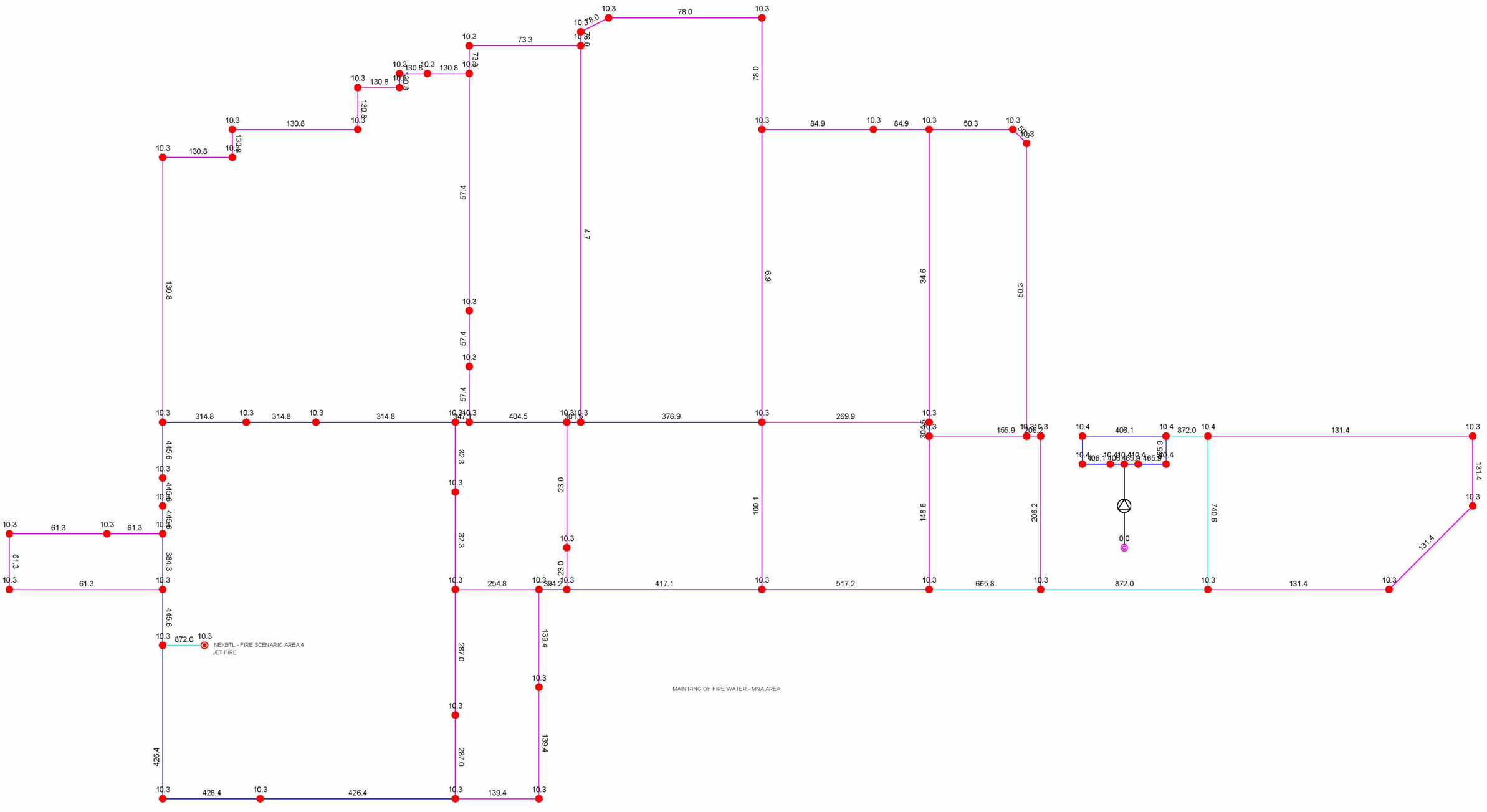
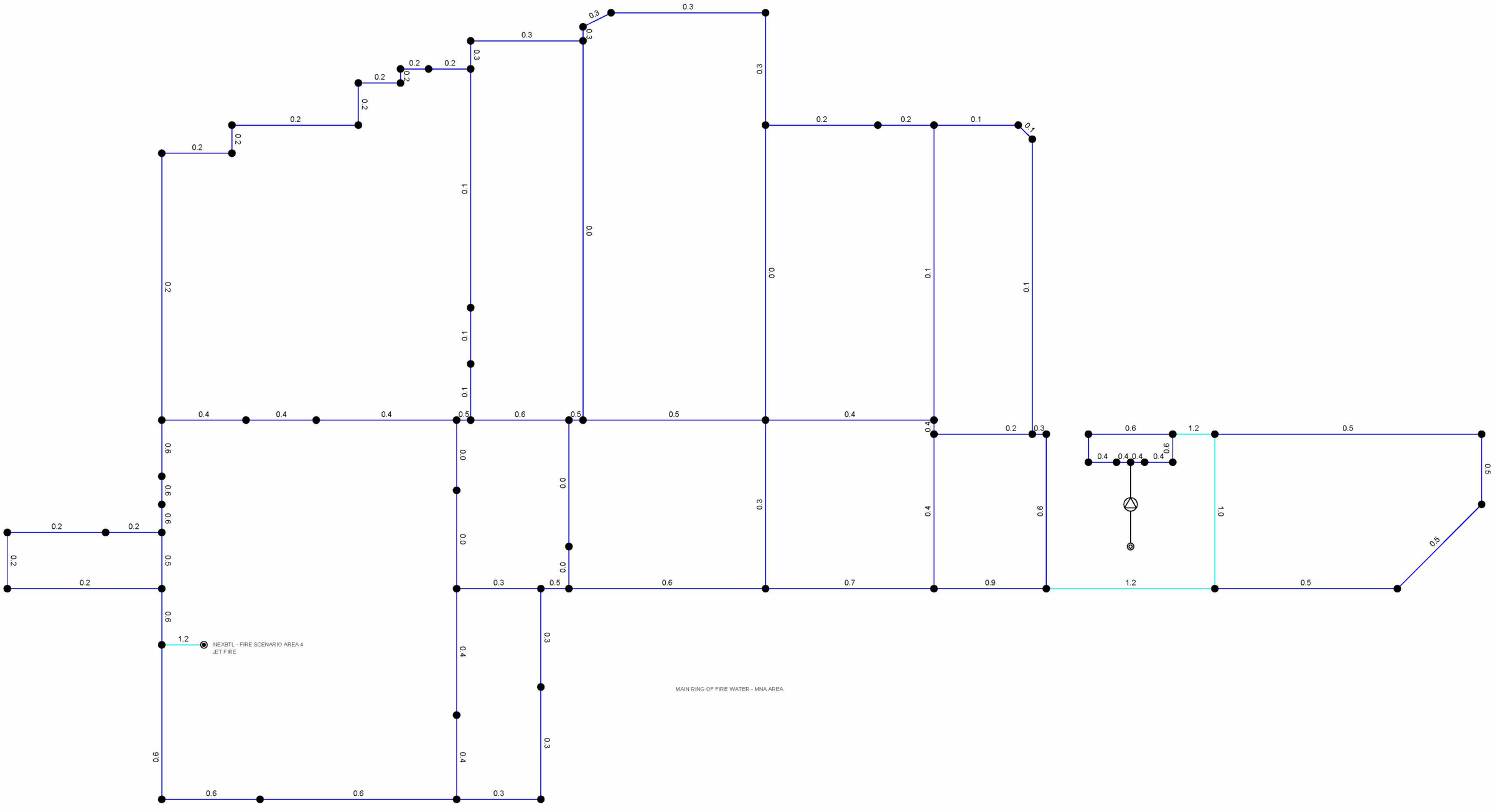


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

20:00 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
88	57	76	20.00	20.00	0.000	150.0	45.60
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
88	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	61.2552	9	14.0000	14.0000	*
2	82	12	314.8035	9	20.0000	20.0000	*
3	2	28	57.4324	9	20.0000	20.0000	*
4	27	72	61.2552	9	14.0000	14.0000	*
5	77	11	426.4341	9	20.0000	20.0000	*
6	79	65	287.0230	9	20.0000	20.0000	*
7	64	50	32.2598	9	20.0000	20.0000	*
8	84	6	445.5679	9	20.0000	20.0000	*
9	12	42	314.8035	9	20.0000	20.0000	*
10	47	2	57.4324	9	20.0000	20.0000	*
11	67	42	130.7645	9	18.0000	18.0000	*
12	9	63	404.4957	9	20.0000	20.0000	*
13	10	13	394.1743	9	20.0000	20.0000	*
14	10	8	22.9613	9	20.0000	20.0000	*
15	28	17	130.7645	9	18.0000	18.0000	*
16	61	29	73.3320	9	12.0000	12.0000	*
17	13	51	254.7632	9	20.0000	20.0000	*
18	13	48	139.4111	9	16.0000	16.0000	*
19	3	65	139.4111	9	16.0000	16.0000	*
20	25	60	376.8708	9	20.0000	20.0000	*
21	62	20	517.2042	9	20.0000	20.0000	*
22	15	61	77.9956	9	12.0000	12.0000	*
23	56	14	77.9956	9	12.0000	12.0000	*
24	71	25	269.8730	9	20.0000	20.0000	*
25	59	46	84.9248	9	14.0000	14.0000	*
26	46	56	77.9956	9	12.0000	12.0000	*
27	8	9	22.9613	9	20.0000	20.0000	*
28	41	58	155.9310	9	20.0000	20.0000	*
29	22	21	206.2266	9	14.0000	14.0000	*
31	23	19	50.2957	9	14.0000	14.0000	*
33	20	10	417.1356	9	20.0000	20.0000	*
34	14	15	77.9956	9	12.0000	12.0000	*
35	29	28	73.3320	9	12.0000	12.0000	*
36	7	73	406.0873	9	24.0000	24.0000	*
37	26	22	872.0021	9	20.0000	20.0000	*
38	17	1	130.7645	9	18.0000	18.0000	*
39	32	16	130.7645	9	18.0000	18.0000	*
40	49	26	740.5735	9	20.0000	20.0000	*
41	49	30	131.4285	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	131.4285	9	12.0000	12.0000	*
43	1	32	130.7645	9	18.0000	18.0000	*
44	16	33	130.7645	9	18.0000	18.0000	*
45	30	35	131.4285	9	12.0000	12.0000	*
46	33	53	130.7645	9	18.0000	18.0000	*
47	35	31	131.4285	9	12.0000	12.0000	*
48	42	34	445.5679	9	20.0000	20.0000	*
53	24	23	50.2957	9	14.0000	14.0000	*
54	6	43	61.2552	9	14.0000	14.0000	*
55	55	44	465.9148	9	24.0000	24.0000	*
56	7	55	465.9148	9	24.0000	24.0000	*
58	63	47	57.4324	9	20.0000	20.0000	*
59	46	25	6.9292	9	14.0000	14.0000	*
60	73	40	406.0873	9	24.0000	24.0000	*
61	20	25	100.0686	9	14.0000	14.0000	*
62	50	51	32.2598	9	20.0000	20.0000	*
64	48	3	139.4111	9	16.0000	16.0000	*
66	54	57	445.5679	9	20.0000	20.0000	*
67	40	45	406.0872	9	20.0000	20.0000	*
68	19	59	84.9248	9	14.0000	14.0000	*
69	61	60	4.6635	9	12.0000	12.0000	*
70	53	66	130.7645	9	18.0000	18.0000	*
71	58	71	304.5021	9	20.0000	20.0000	*
72	60	9	381.5344	9	20.0000	20.0000	*
73	22	62	665.7754	9	20.0000	20.0000	*
74	62	58	148.5711	9	14.0000	14.0000	*
75	68	49	872.0021	9	20.0000	20.0000	*
76	63	64	347.0632	9	20.0000	20.0000	*
77	66	67	130.7645	9	18.0000	18.0000	*
78	44	68	465.9147	9	20.0000	20.0000	*
79	41	24	50.2957	9	14.0000	14.0000	*
80	45	68	406.0872	9	20.0000	20.0000	*
81	21	41	206.2266	9	20.0000	20.0000	*
82	71	19	34.6291	9	14.0000	14.0000	*
83	72	54	61.2552	9	14.0000	14.0000	*
84	6	54	384.3127	9	20.0000	20.0000	*
86	11	57	426.4341	9	20.0000	20.0000	*
88	57	76	872.0021	9	20.0000	20.0000	*
89	65	77	426.4341	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	287.0230	9	20.0000	20.0000	*
94	64	82	314.8035	9	20.0000	20.0000	*
96	34	84	445.5679	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.28	10.28	3.4237E-04	3.4237E-04	61.26	0.1713
2	82	12	20.00	10.29	10.28	8.6784E-04	8.6784E-04	314.8	0.4314
3	2	28	20.00	10.29	10.29	9.9182E-05	9.9182E-05	57.43	7.8711E-02
4	27	72	14.00	10.28	10.28	6.3229E-04	6.3229E-04	61.26	0.1713
5	77	11	20.00	10.28	10.28	3.9225E-03	3.9225E-03	426.4	0.5844
6	79	65	20.00	10.29	10.28	1.2150E-03	1.2150E-03	287.0	0.3934
7	64	50	20.00	10.29	10.29	3.5286E-05	3.5286E-05	32.26	4.4212E-02
8	84	6	20.00	10.28	10.28	1.5354E-03	1.5354E-03	445.6	0.6107
9	12	42	20.00	10.28	10.28	1.3275E-03	1.3275E-03	314.8	0.4314
10	47	2	20.00	10.29	10.29	4.0054E-05	4.0054E-05	57.43	7.8711E-02
11	67	42	18.00	10.28	10.28	1.2426E-03	1.2426E-03	130.8	0.2213
12	9	63	20.00	10.29	10.29	1.8826E-03	1.8826E-03	404.5	0.5544
13	10	13	20.00	10.29	10.29	4.3774E-04	4.3774E-04	394.2	0.5402
14	10	8	20.00	10.29	10.29	1.0490E-05	1.0490E-05	22.96	3.1468E-02
15	28	17	18.00	10.29	10.29	2.1839E-04	2.1839E-04	130.8	0.2213
16	61	29	12.00	10.29	10.29	1.5078E-03	1.5078E-03	73.33	0.2792
17	13	51	20.00	10.29	10.29	1.7300E-03	1.7300E-03	254.8	0.3492
18	13	48	16.00	10.29	10.29	1.4572E-03	1.4572E-03	139.4	0.2985
19	3	65	16.00	10.29	10.28	1.4954E-03	1.4954E-03	139.4	0.2985
20	25	60	20.00	10.29	10.29	4.1857E-03	4.1857E-03	376.9	0.5165
21	62	20	20.00	10.30	10.30	6.4373E-03	6.4373E-03	517.2	0.7088
22	15	61	12.00	10.29	10.29	2.8992E-04	2.8992E-04	78.00	0.2969
23	56	14	12.00	10.29	10.29	2.5473E-03	2.5473E-03	78.00	0.2969
24	71	25	20.00	10.30	10.29	1.9321E-03	1.9321E-03	269.9	0.3699
25	59	46	14.00	10.30	10.29	8.4305E-04	8.4305E-04	84.92	0.2375
26	46	56	12.00	10.29	10.29	9.0218E-04	9.0218E-04	78.00	0.2969
27	8	9	20.00	10.29	10.29	2.9564E-05	2.9564E-05	22.96	3.1468E-02
28	41	58	20.00	10.30	10.30	4.6444E-04	4.6444E-04	155.9	0.2137
29	22	21	14.00	10.31	10.30	1.3540E-02	1.3540E-02	206.2	0.5768
31	23	19	14.00	10.30	10.30	2.4509E-04	2.4509E-04	50.30	0.1407
33	20	10	20.00	10.30	10.29	7.8001E-03	7.8001E-03	417.1	0.5717
34	14	15	12.00	10.29	10.29	4.4537E-04	4.4537E-04	78.00	0.2969
35	29	28	12.00	10.29	10.29	1.0920E-03	1.0920E-03	73.33	0.2792
36	7	73	24.00	10.37	10.37	1.2197E-03	1.2197E-03	406.1	0.3865
37	26	22	20.00	10.33	10.31	1.8242E-02	1.8242E-02	872.0	1.195
38	17	1	18.00	10.29	10.29	3.6716E-04	3.6716E-04	130.8	0.2213
39	32	16	18.00	10.29	10.29	3.0994E-04	3.0994E-04	130.8	0.2213
40	49	26	20.00	10.36	10.33	2.9531E-02	2.9531E-02	740.6	1.015
41	49	30	12.00	10.36	10.35	1.1610E-02	1.1610E-02	131.4	0.5003
42	31	26	12.00	10.34	10.33	8.3399E-03	8.3399E-03	131.4	0.5003
43	1	32	18.00	10.29	10.29	2.2507E-04	2.2507E-04	130.8	0.2213

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.29	10.29	3.9482E-04	3.9482E-04	130.8	0.2213
45	30	35	12.00	10.35	10.34	3.6526E-03	3.6526E-03	131.4	0.5003
46	33	53	18.00	10.29	10.29	6.7043E-04	6.7043E-04	130.8	0.2213
47	35	31	12.00	10.34	10.34	5.9280E-03	5.9280E-03	131.4	0.5003
48	42	34	20.00	10.28	10.28	2.8524E-03	2.8524E-03	445.6	0.6107
53	24	23	14.00	10.30	10.30	7.7248E-05	7.7248E-05	50.30	0.1407
54	6	43	14.00	10.28	10.28	6.3229E-04	6.3229E-04	61.26	0.1713
55	55	44	24.00	10.37	10.37	2.0847E-03	2.0847E-03	465.9	0.4434
56	7	55	24.00	10.37	10.37	2.2030E-04	2.2030E-04	465.9	0.4434
58	63	47	20.00	10.29	10.29	9.5367E-05	9.5367E-05	57.43	7.8711E-02
59	46	25	14.00	10.29	10.29	2.9564E-05	2.9564E-05	6.929	1.9381E-02
60	73	40	24.00	10.37	10.37	5.6744E-04	5.6744E-04	406.1	0.3865
61	20	25	14.00	10.30	10.29	3.2024E-03	3.2024E-03	100.1	0.2799
62	50	51	20.00	10.29	10.29	3.7193E-05	3.7193E-05	32.26	4.4212E-02
64	48	3	16.00	10.29	10.29	1.9875E-03	1.9875E-03	139.4	0.2985
66	54	57	20.00	10.28	10.27	4.3669E-03	4.3669E-03	445.6	0.6107
67	40	45	20.00	10.37	10.36	5.4808E-03	5.4808E-03	406.1	0.5565
68	19	59	14.00	10.30	10.30	4.6444E-04	4.6444E-04	84.92	0.2375
69	61	60	12.00	10.29	10.29	3.0518E-05	3.0518E-05	4.664	1.7754E-02
70	53	66	18.00	10.29	10.29	3.1757E-04	3.1757E-04	130.8	0.2213
71	58	71	20.00	10.30	10.30	3.2520E-04	3.2520E-04	304.5	0.4173
72	60	9	20.00	10.29	10.29	4.5204E-04	4.5204E-04	381.5	0.5229
73	22	62	20.00	10.31	10.30	6.8054E-03	6.8054E-03	665.8	0.9124
74	62	58	14.00	10.30	10.30	7.3824E-03	7.3824E-03	148.6	0.4155
75	68	49	20.00	10.36	10.36	3.7994E-03	3.7994E-03	872.0	1.195
76	63	64	20.00	10.29	10.29	1.7262E-04	1.7262E-04	347.1	0.4757
77	66	67	18.00	10.29	10.28	2.6226E-04	2.6226E-04	130.8	0.2213
78	44	68	20.00	10.37	10.36	5.1003E-03	5.1003E-03	465.9	0.6385
79	41	24	14.00	10.30	10.30	1.0624E-03	1.0624E-03	50.30	0.1407
80	45	68	20.00	10.36	10.36	1.3733E-04	1.3733E-04	406.1	0.5565
81	21	41	20.00	10.30	10.30	1.8311E-04	1.8311E-04	206.2	0.2826
82	71	19	14.00	10.30	10.30	5.9509E-04	5.9509E-04	34.63	9.6856E-02
83	72	54	14.00	10.28	10.28	7.3051E-04	7.3051E-04	61.26	0.1713
84	6	54	20.00	10.28	10.28	2.3375E-03	2.3375E-03	384.3	0.5267
86	11	57	20.00	10.28	10.27	4.3497E-03	4.3497E-03	426.4	0.5844
88	57	76	20.00	10.27	10.26	1.2465E-02	1.2465E-02	872.0	1.195
89	65	77	20.00	10.28	10.28	4.0474E-03	4.0474E-03	426.4	0.5844
91	51	79	20.00	10.29	10.29	1.9951E-03	1.9951E-03	287.0	0.3934
94	64	82	20.00	10.29	10.29	1.8749E-03	1.8749E-03	314.8	0.4314
96	34	84	20.00	10.28	10.28	4.3964E-04	4.3964E-04	445.6	0.6107

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
2	872.0	0.000	10.37	10.37	10.17	9.6008E-02	2.5118E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
69	0.000	*	872.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
76	10.26	872.0	*	272.24

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 11 Jet Fire scenario in NEXBTL area – Fire Scenario Area 4 – Case B

11.A PIPENET schematic layout with piping and nodes label

11.B PIPENET schematic layout with flow rate and pressure results

11.C PIPENET schematic layout with velocity results

11.D PIPENET input/output printout report

Attachment 11.A contains 1 page
Attachment 11.B contains 1 page
Attachment 11.C contains 1 page
Attachment 11.D contains 21 pages

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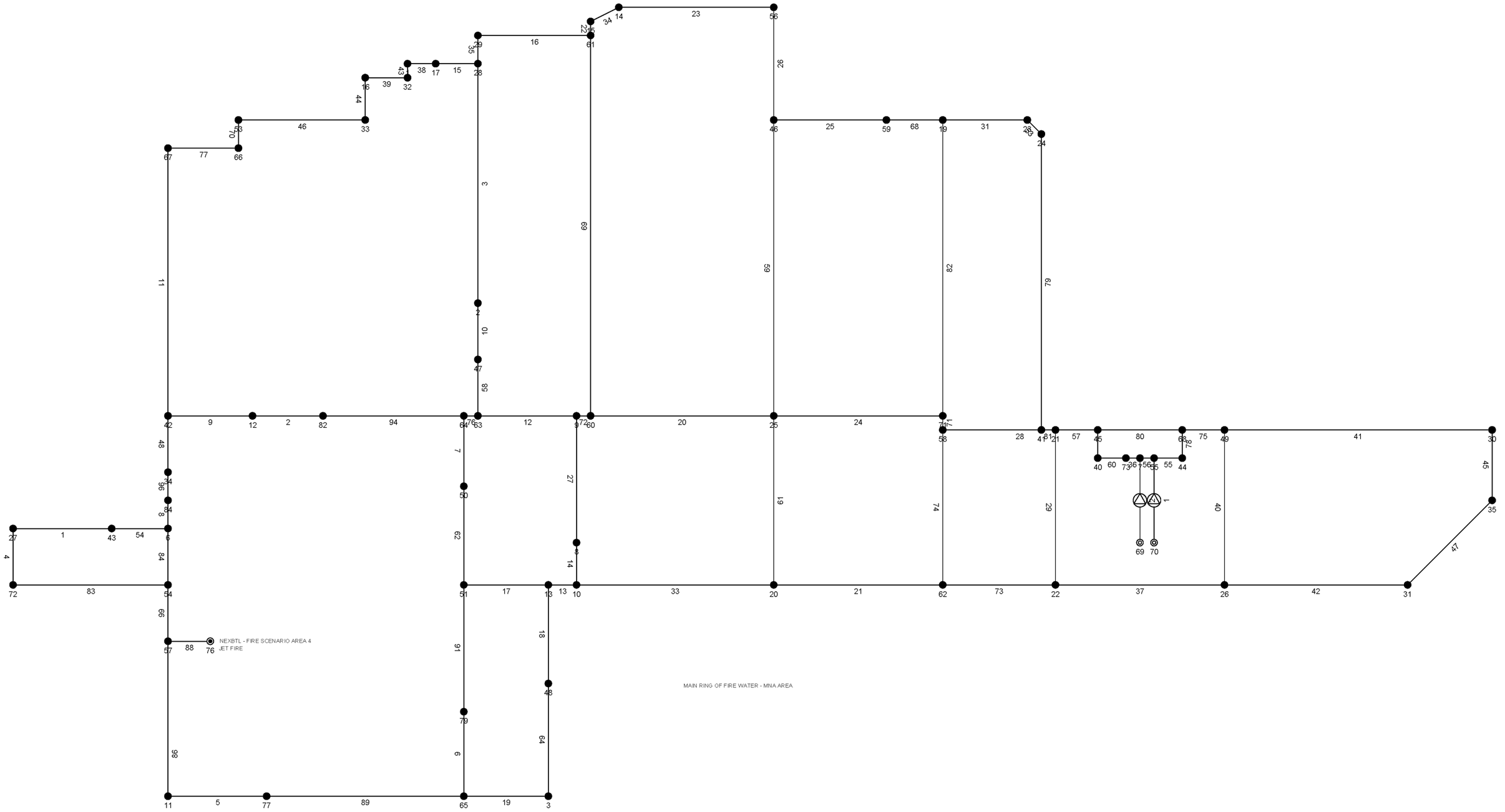
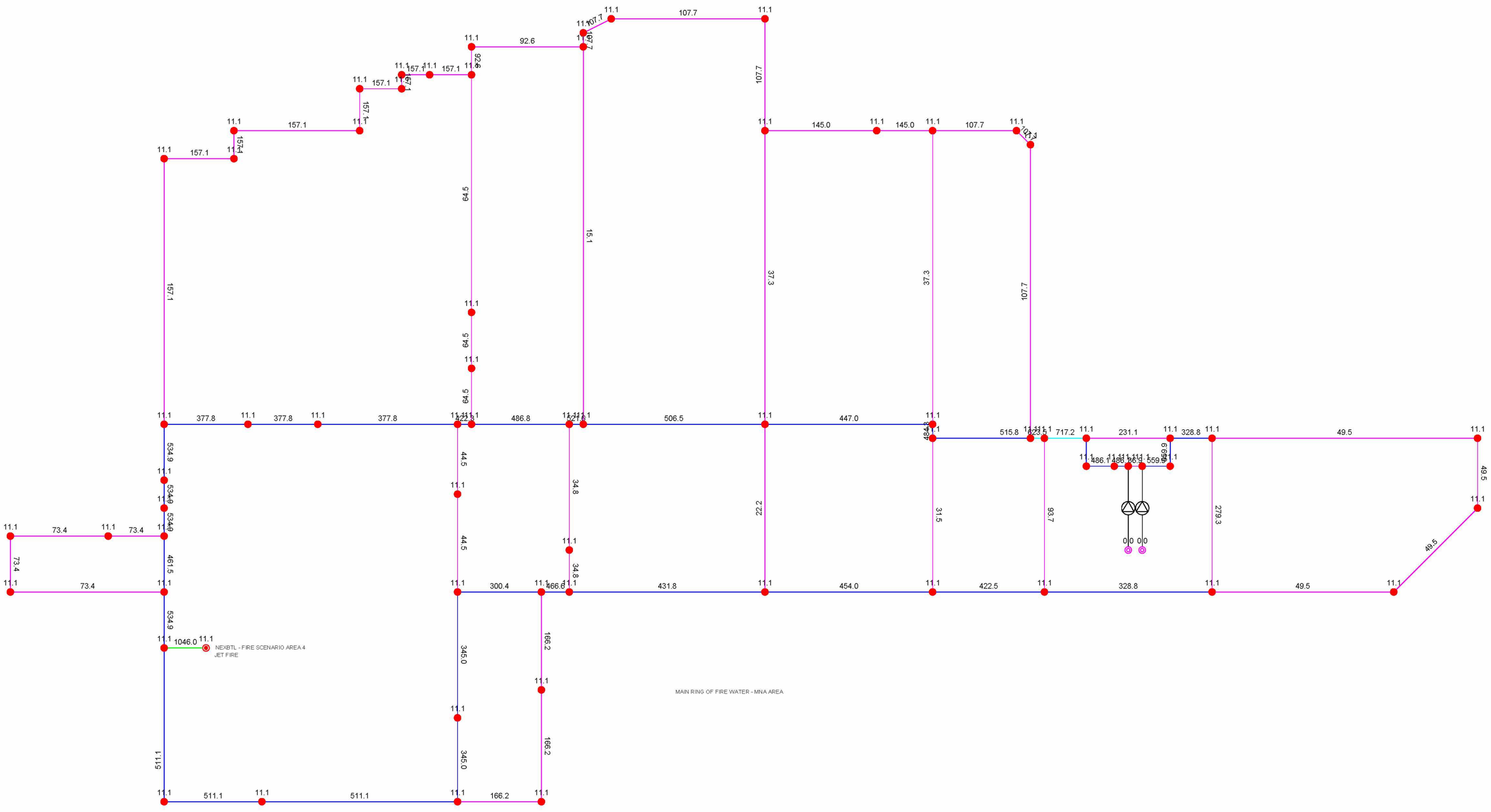
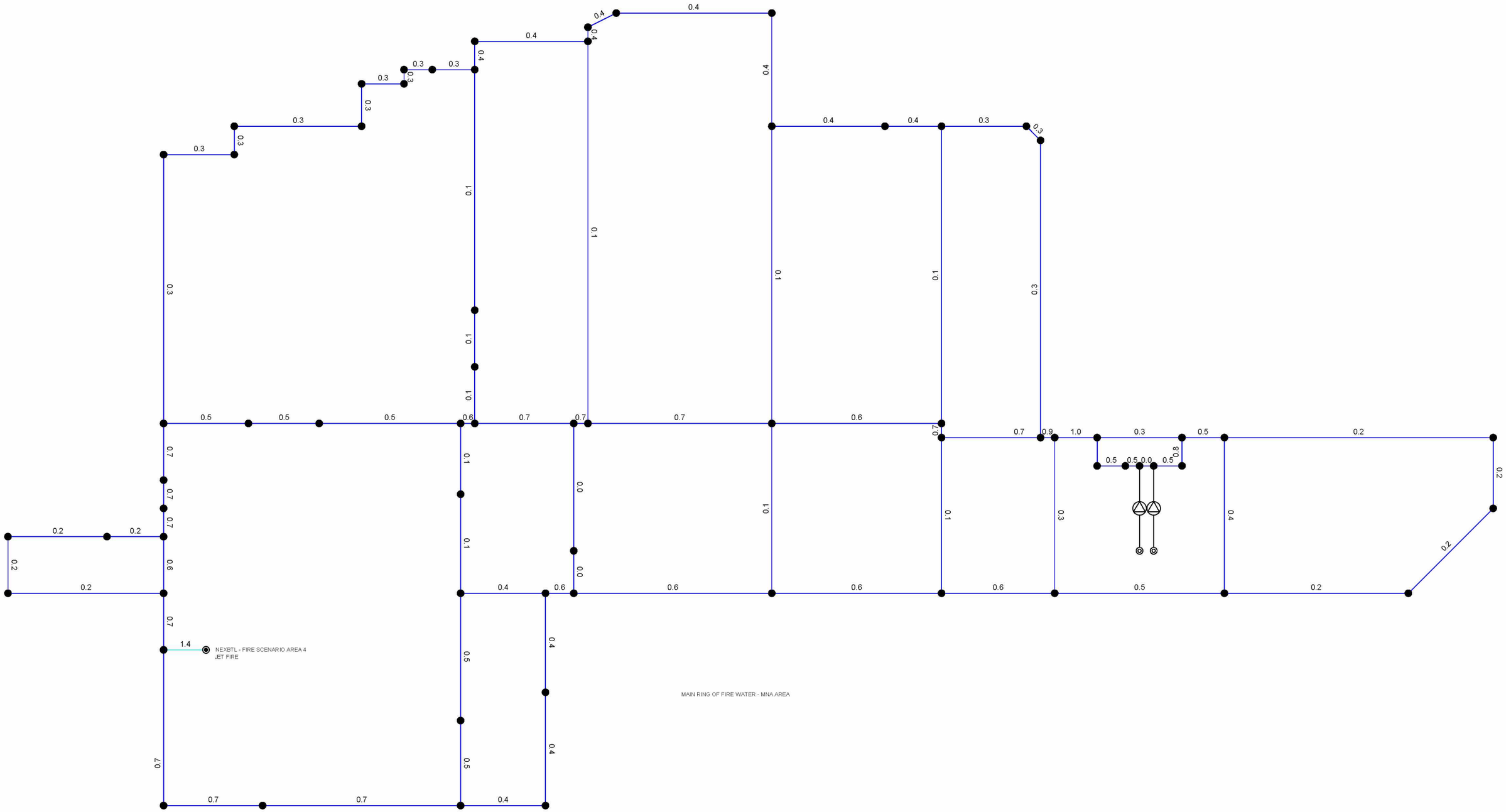


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

20:15 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
88	57	76	20.00	20.00	0.000	150.0	45.60
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
88	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	73.3939	9	14.0000	14.0000	*
2	82	12	377.7895	9	20.0000	20.0000	*
3	2	28	64.4886	9	20.0000	20.0000	*
4	27	72	73.3939	9	14.0000	14.0000	*
5	77	11	511.1301	9	20.0000	20.0000	*
6	79	65	344.9535	9	20.0000	20.0000	*
7	64	50	44.5091	9	20.0000	20.0000	*
8	84	6	534.8724	9	20.0000	20.0000	*
9	12	42	377.7895	9	20.0000	20.0000	*
10	47	2	64.4886	9	20.0000	20.0000	*
11	67	42	157.0829	9	18.0000	18.0000	*
12	9	63	486.7872	9	20.0000	20.0000	*
13	10	13	466.6209	9	20.0000	20.0000	*
14	8	10	34.7744	9	20.0000	20.0000	*
15	28	17	157.0829	9	18.0000	18.0000	*
16	61	29	92.5943	9	12.0000	12.0000	*
17	13	51	300.4443	9	20.0000	20.0000	*
18	13	48	166.1765	9	16.0000	16.0000	*
19	3	65	166.1765	9	16.0000	16.0000	*
20	25	60	506.4602	9	20.0000	20.0000	*
21	62	20	454.0359	9	20.0000	20.0000	*
22	15	61	107.6957	9	12.0000	12.0000	*
23	56	14	107.6957	9	12.0000	12.0000	*
24	71	25	446.9960	9	20.0000	20.0000	*
25	59	46	144.9705	9	14.0000	14.0000	*
26	46	56	107.6957	9	12.0000	12.0000	*
27	9	8	34.7744	9	20.0000	20.0000	*
28	41	58	515.8275	9	20.0000	20.0000	*
29	21	22	93.7040	9	14.0000	14.0000	*
31	23	19	107.6825	9	14.0000	14.0000	*
33	20	10	431.8465	9	20.0000	20.0000	*
34	14	15	107.6957	9	12.0000	12.0000	*
35	29	28	92.5943	9	12.0000	12.0000	*
36	7	73	486.1290	9	24.0000	24.0000	*
37	26	22	328.7885	9	20.0000	20.0000	*
38	17	1	157.0829	9	18.0000	18.0000	*
39	32	16	157.0829	9	18.0000	18.0000	*
40	49	26	279.3257	9	20.0000	20.0000	*
41	49	30	49.4628	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	49.4628	9	12.0000	12.0000	*
43	1	32	157.0829	9	18.0000	18.0000	*
44	16	33	157.0829	9	18.0000	18.0000	*
45	30	35	49.4628	9	12.0000	12.0000	*
46	33	53	157.0829	9	18.0000	18.0000	*
47	35	31	49.4628	9	12.0000	12.0000	*
48	42	34	534.8724	9	20.0000	20.0000	*
53	24	23	107.6825	9	14.0000	14.0000	*
54	6	43	73.3939	9	14.0000	14.0000	*
55	55	44	559.8734	9	24.0000	24.0000	*
56	7	55	36.8717	9	24.0000	24.0000	*
57	45	21	717.2139	9	20.0000	20.0000	*
58	63	47	64.4886	9	20.0000	20.0000	*
59	46	25	37.2748	9	14.0000	14.0000	*
60	73	40	486.1290	9	24.0000	24.0000	*
61	20	25	22.1894	9	14.0000	14.0000	*
62	50	51	44.5091	9	20.0000	20.0000	*
64	48	3	166.1765	9	16.0000	16.0000	*
66	54	57	534.8724	9	20.0000	20.0000	*
67	40	45	486.1290	9	20.0000	20.0000	*
68	19	59	144.9705	9	14.0000	14.0000	*
69	61	60	15.1014	9	12.0000	12.0000	*
70	53	66	157.0829	9	18.0000	18.0000	*
71	58	71	484.2840	9	20.0000	20.0000	*
72	60	9	521.5616	9	20.0000	20.0000	*
73	22	62	422.4924	9	20.0000	20.0000	*
74	58	62	31.5435	9	14.0000	14.0000	*
75	68	49	328.7885	9	20.0000	20.0000	*
76	63	64	422.2986	9	20.0000	20.0000	*
77	66	67	157.0829	9	18.0000	18.0000	*
78	44	68	559.8734	9	20.0000	20.0000	*
79	41	24	107.6825	9	14.0000	14.0000	*
80	68	45	231.0850	9	20.0000	20.0000	*
81	21	41	623.5100	9	20.0000	20.0000	*
82	71	19	37.2880	9	14.0000	14.0000	*
83	72	54	73.3939	9	14.0000	14.0000	*
84	6	54	461.4785	9	20.0000	20.0000	*
86	11	57	511.1301	9	20.0000	20.0000	*
88	57	76	1046.0024	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	511.1301	9	20.0000	20.0000	*
91	51	79	344.9535	9	20.0000	20.0000	*
94	64	82	377.7895	9	20.0000	20.0000	*
96	34	84	534.8724	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	11.09	11.09	4.7684E-04	4.7684E-04	73.39	0.2053
2	82	12	20.00	11.10	11.10	1.2131E-03	1.2131E-03	377.8	0.5178
3	2	28	20.00	11.11	11.11	1.2684E-04	1.2684E-04	64.49	8.8382E-02
4	27	72	14.00	11.09	11.09	8.9073E-04	8.9073E-04	73.39	0.2053
5	77	11	20.00	11.10	11.09	5.4827E-03	5.4827E-03	511.1	0.7005
6	79	65	20.00	11.10	11.10	1.7071E-03	1.7071E-03	345.0	0.4728
7	64	50	20.00	11.11	11.11	6.4850E-05	6.4850E-05	44.51	6.1000E-02
8	84	6	20.00	11.10	11.09	2.1553E-03	2.1553E-03	534.9	0.7330
9	12	42	20.00	11.10	11.10	1.8568E-03	1.8568E-03	377.8	0.5178
10	47	2	20.00	11.11	11.11	4.7684E-05	4.7684E-05	64.49	8.8382E-02
11	67	42	18.00	11.10	11.10	1.7500E-03	1.7500E-03	157.1	0.2658
12	9	63	20.00	11.11	11.11	2.6445E-03	2.6445E-03	486.8	0.6671
13	10	13	20.00	11.11	11.11	5.9700E-04	5.9700E-04	466.6	0.6395
14	8	10	20.00	11.11	11.11	2.2888E-05	2.2888E-05	34.77	4.7658E-02
15	28	17	18.00	11.11	11.11	3.0804E-04	3.0804E-04	157.1	0.2658
16	61	29	12.00	11.11	11.11	2.3346E-03	2.3346E-03	92.59	0.3525
17	13	51	20.00	11.11	11.11	2.3432E-03	2.3432E-03	300.4	0.4118
18	13	48	16.00	11.11	11.11	2.0227E-03	2.0227E-03	166.2	0.3559
19	3	65	16.00	11.10	11.10	2.0723E-03	2.0723E-03	166.2	0.3559
20	25	60	20.00	11.12	11.11	7.2279E-03	7.2279E-03	506.5	0.6941
21	62	20	20.00	11.12	11.12	5.0573E-03	5.0573E-03	454.0	0.6223
22	15	61	12.00	11.11	11.11	5.2547E-04	5.2547E-04	107.7	0.4100
23	56	14	12.00	11.12	11.11	4.6473E-03	4.6473E-03	107.7	0.4100
24	71	25	20.00	11.12	11.12	4.9047E-03	4.9047E-03	447.0	0.6126
25	59	46	14.00	11.12	11.12	2.2745E-03	2.2745E-03	145.0	0.4055
26	46	56	12.00	11.12	11.12	1.6508E-03	1.6508E-03	107.7	0.4100
27	9	8	20.00	11.11	11.11	6.1989E-05	6.1989E-05	34.77	4.7658E-02
28	41	58	20.00	11.13	11.12	4.2372E-03	4.2372E-03	515.8	0.7069
29	21	22	14.00	11.13	11.12	3.1500E-03	3.1500E-03	93.70	0.2621
31	23	19	14.00	11.12	11.12	1.0147E-03	1.0147E-03	107.7	0.3012
33	20	10	20.00	11.12	11.11	8.3179E-03	8.3179E-03	431.8	0.5918
34	14	15	12.00	11.11	11.11	8.1444E-04	8.1444E-04	107.7	0.4100
35	29	28	12.00	11.11	11.11	1.6899E-03	1.6899E-03	92.59	0.3525
36	7	73	24.00	11.14	11.14	1.7052E-03	1.7052E-03	486.1	0.4627
37	26	22	20.00	11.13	11.12	3.0050E-03	3.0050E-03	328.8	0.4506
38	17	1	18.00	11.11	11.10	5.1498E-04	5.1498E-04	157.1	0.2658
39	32	16	18.00	11.10	11.10	4.3774E-04	4.3774E-04	157.1	0.2658
40	49	26	20.00	11.13	11.13	4.8609E-03	4.8609E-03	279.3	0.3828
41	49	30	12.00	11.13	11.13	1.9102E-03	1.9102E-03	49.46	0.1883
42	31	26	12.00	11.13	11.13	1.3733E-03	1.3733E-03	49.46	0.1883
43	1	32	18.00	11.10	11.10	3.1757E-04	3.1757E-04	157.1	0.2658

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	11.10	11.10	5.5504E-04	5.5504E-04	157.1	0.2658
45	30	35	12.00	11.13	11.13	6.0272E-04	6.0272E-04	49.46	0.1883
46	33	53	18.00	11.10	11.10	9.4414E-04	9.4414E-04	157.1	0.2658
47	35	31	12.00	11.13	11.13	9.7466E-04	9.7466E-04	49.46	0.1883
48	42	34	20.00	11.10	11.10	4.0007E-03	4.0007E-03	534.9	0.7330
53	24	23	14.00	11.12	11.12	3.1567E-04	3.1567E-04	107.7	0.3012
54	6	43	14.00	11.09	11.09	8.8787E-04	8.8787E-04	73.39	0.2053
55	55	44	24.00	11.14	11.14	2.9278E-03	2.9278E-03	559.9	0.5329
56	7	55	24.00	11.14	11.14	1.9073E-06	0.000	36.87	3.5092E-02
57	45	21	20.00	11.13	11.13	5.2929E-03	5.2929E-03	717.2	0.9829
58	63	47	20.00	11.11	11.11	1.2016E-04	1.2016E-04	64.49	8.8382E-02
59	46	25	14.00	11.12	11.12	6.8760E-04	6.8760E-04	37.27	0.1043
60	73	40	24.00	11.14	11.14	7.8964E-04	7.8964E-04	486.1	0.4627
61	20	25	14.00	11.12	11.12	1.9741E-04	1.9741E-04	22.19	6.2062E-02
62	50	51	20.00	11.11	11.11	6.5804E-05	6.5804E-05	44.51	6.1000E-02
64	48	3	16.00	11.11	11.10	2.7552E-03	2.7552E-03	166.2	0.3559
66	54	57	20.00	11.09	11.08	6.1226E-03	6.1226E-03	534.9	0.7330
67	40	45	20.00	11.14	11.13	7.6475E-03	7.6475E-03	486.1	0.6662
68	19	59	14.00	11.12	11.12	1.2550E-03	1.2550E-03	145.0	0.4055
69	61	60	12.00	11.11	11.11	2.7752E-04	2.7752E-04	15.10	5.7490E-02
70	53	66	18.00	11.10	11.10	4.5013E-04	4.5013E-04	157.1	0.2658
71	58	71	20.00	11.12	11.12	7.6771E-04	7.6771E-04	484.3	0.6637
72	60	9	20.00	11.11	11.11	8.0776E-04	8.0776E-04	521.6	0.7148
73	22	62	20.00	11.12	11.12	2.9345E-03	2.9345E-03	422.5	0.5790
74	58	62	14.00	11.12	11.12	4.1771E-04	4.1771E-04	31.54	8.8225E-02
75	68	49	20.00	11.13	11.13	6.2752E-04	6.2752E-04	328.8	0.4506
76	63	64	20.00	11.11	11.11	2.4986E-04	2.4986E-04	422.3	0.5788
77	66	67	18.00	11.10	11.10	3.7003E-04	3.7003E-04	157.1	0.2658
78	44	68	20.00	11.14	11.13	7.1621E-03	7.1621E-03	559.9	0.7673
79	41	24	14.00	11.13	11.12	4.3621E-03	4.3621E-03	107.7	0.3012
80	68	45	20.00	11.13	11.13	5.0545E-05	5.0545E-05	231.1	0.3167
81	21	41	20.00	11.13	11.13	1.4296E-03	1.4296E-03	623.5	0.8545
82	71	19	14.00	11.12	11.12	6.8760E-04	6.8760E-04	37.29	0.1043
83	72	54	14.00	11.09	11.09	1.0223E-03	1.0223E-03	73.39	0.2053
84	6	54	20.00	11.09	11.09	3.2778E-03	3.2778E-03	461.5	0.6325
86	11	57	20.00	11.09	11.08	6.0825E-03	6.0825E-03	511.1	0.7005
88	57	76	20.00	11.08	11.07	1.7452E-02	1.7452E-02	1046.	1.434
89	65	77	20.00	11.10	11.10	5.6601E-03	5.6601E-03	511.1	0.7005
91	51	79	20.00	11.11	11.10	2.8000E-03	2.8000E-03	345.0	0.4728
94	64	82	20.00	11.11	11.10	2.6226E-03	2.6226E-03	377.8	0.5178
96	34	84	20.00	11.10	11.10	6.1417E-04	6.1417E-04	534.9	0.7330

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	523.0	0.000	11.14	11.14	10.17	8.9342E-02	1.6189E+05	100.0
2	523.0	0.000	11.14	11.14	10.17	8.9342E-02	1.6189E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	523.0	0.0000
69	0.000	*	523.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
76	11.07	1046.	*	314.43

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 12 Pool Fire scenario in bio-propane Fire Scenario Area – Case A

12.A PIPENET schematic layout with piping and nodes label
12.B PIPENET schematic layout with flow rate and pressure results
12.C PIPENET schematic layout with velocity results
12.D PIPENET input/output printout report

Attachment 12.A contains 1 page
Attachment 12.B contains 1 page
Attachment 12.C contains 1 page
Attachment 12.D contains 21 pages

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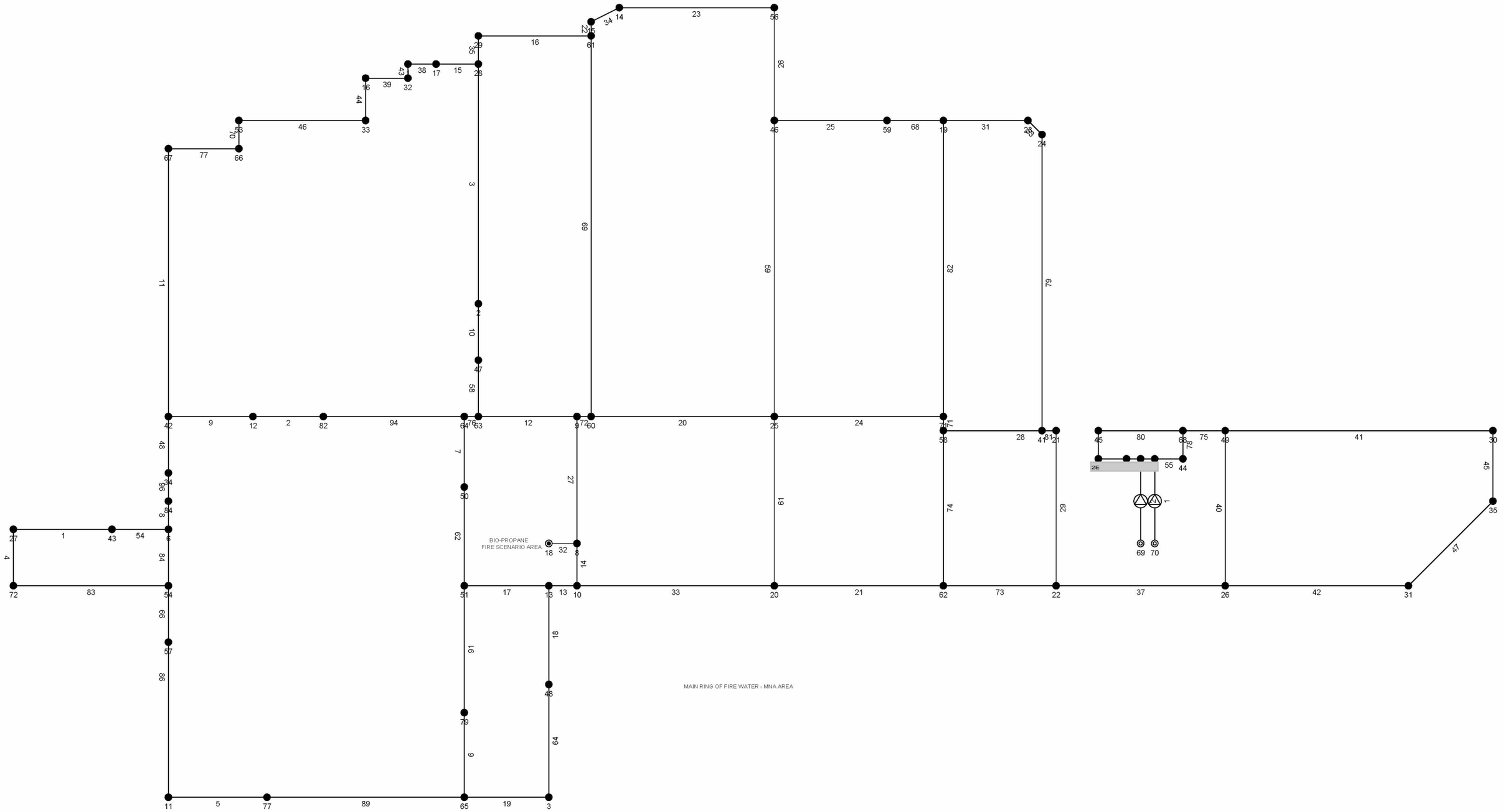
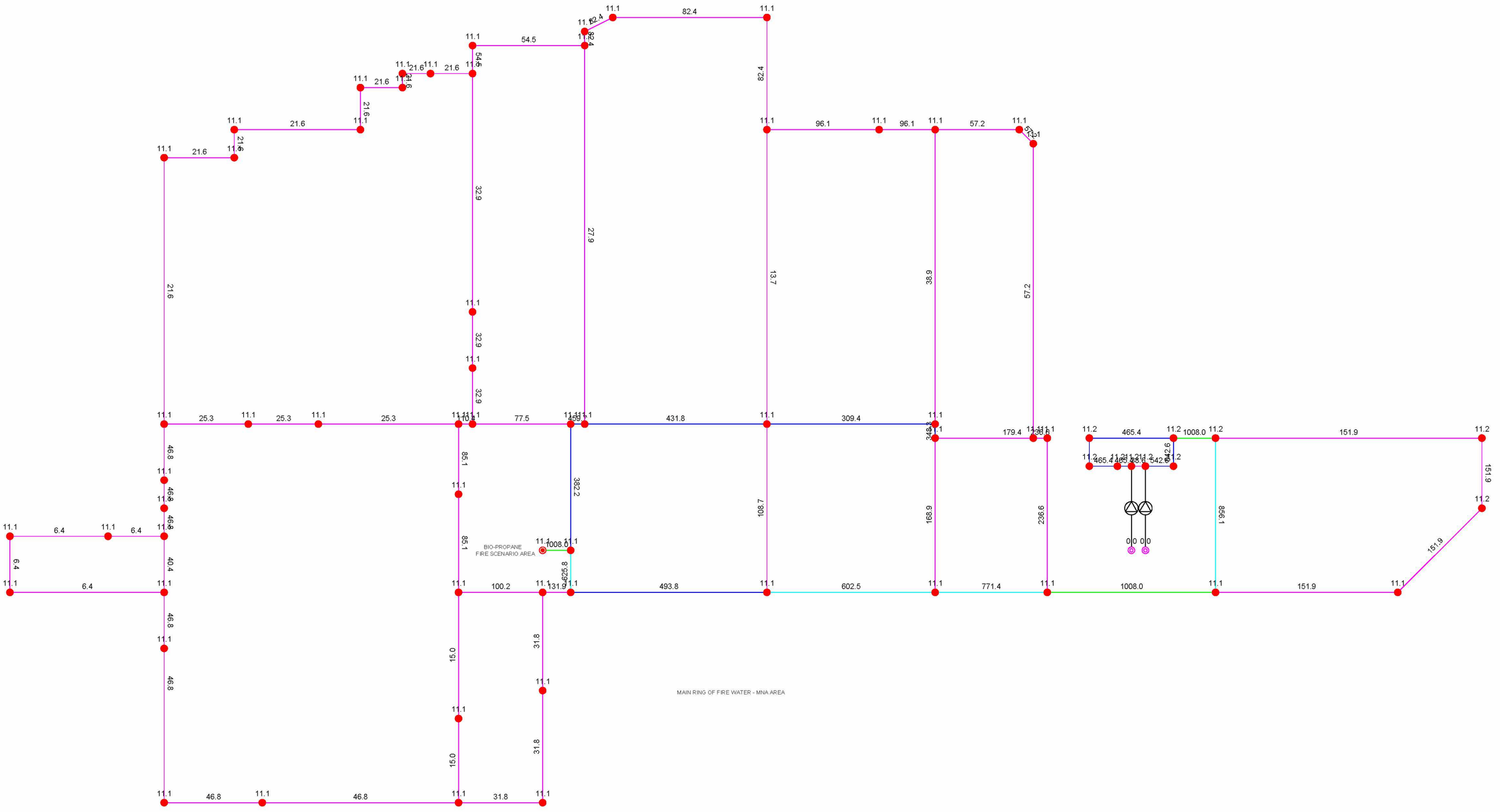
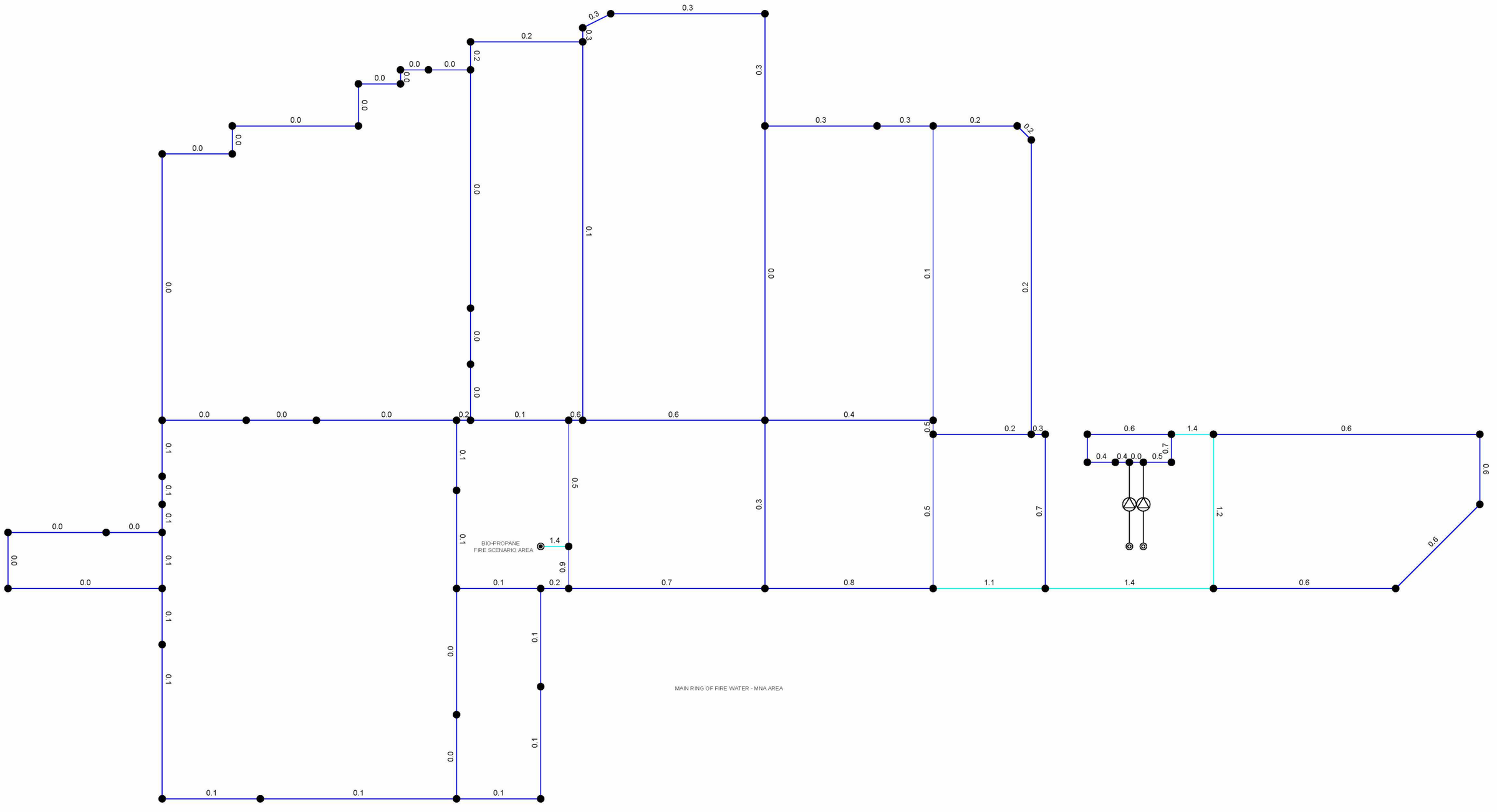


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

21:35 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	13	10	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	51	13	20.00	43.00	0.000	150.0	45.60
18	48	13	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
32	8	18	20.00	20.00	0.000	150.0	45.60
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
32	1 x 4	45.60		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	6.4200	9	14.0000	14.0000	*
2	82	12	25.2575	9	20.0000	20.0000	*
3	28	2	32.8855	9	20.0000	20.0000	*
4	27	72	6.4200	9	14.0000	14.0000	*
5	11	77	46.8327	9	20.0000	20.0000	*
6	65	79	15.0484	9	20.0000	20.0000	*
7	64	50	85.1043	9	20.0000	20.0000	*
8	84	6	46.8327	9	20.0000	20.0000	*
9	12	42	25.2575	9	20.0000	20.0000	*
10	2	47	32.8855	9	20.0000	20.0000	*
11	67	42	21.5752	9	18.0000	18.0000	*
12	9	63	77.4763	9	20.0000	20.0000	*
13	13	10	131.9370	9	20.0000	20.0000	*
14	10	8	625.7591	9	20.0000	20.0000	*
15	28	17	21.5752	9	18.0000	18.0000	*
16	61	29	54.4607	9	12.0000	12.0000	*
17	51	13	100.1527	9	20.0000	20.0000	*
18	48	13	31.7843	9	16.0000	16.0000	*
19	65	3	31.7843	9	16.0000	16.0000	*
20	25	60	431.8056	9	20.0000	20.0000	*
21	62	20	602.4737	9	20.0000	20.0000	*
22	15	61	82.3746	9	12.0000	12.0000	*
23	56	14	82.3746	9	12.0000	12.0000	*
24	71	25	309.4392	9	20.0000	20.0000	*
25	59	46	96.0894	9	14.0000	14.0000	*
26	46	56	82.3746	9	12.0000	12.0000	*
27	9	8	382.2432	9	20.0000	20.0000	*
28	41	58	179.4059	9	20.0000	20.0000	*
29	22	21	236.6080	9	14.0000	14.0000	*
31	23	19	57.2021	9	14.0000	14.0000	*
32	8	18	1008.0023	9	20.0000	20.0000	*
33	20	10	493.8221	9	20.0000	20.0000	*
34	14	15	82.3746	9	12.0000	12.0000	*
35	29	28	54.4607	9	12.0000	12.0000	*
36	7	73	465.3563	9	24.0000	24.0000	*
37	26	22	1008.0023	9	20.0000	20.0000	*
38	17	1	21.5752	9	18.0000	18.0000	*
39	32	16	21.5752	9	18.0000	18.0000	*
40	49	26	856.0759	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	151.9265	9	12.0000	12.0000	*
42	31	26	151.9265	9	12.0000	12.0000	*
43	1	32	21.5752	9	18.0000	18.0000	*
44	16	33	21.5752	9	18.0000	18.0000	*
45	30	35	151.9265	9	12.0000	12.0000	*
46	33	53	21.5752	9	18.0000	18.0000	*
47	35	31	151.9265	9	12.0000	12.0000	*
48	42	34	46.8327	9	20.0000	20.0000	*
53	24	23	57.2021	9	14.0000	14.0000	*
54	6	43	6.4200	9	14.0000	14.0000	*
55	55	44	542.6461	9	24.0000	24.0000	*
56	7	55	38.6445	9	24.0000	24.0000	*
58	47	63	32.8855	9	20.0000	20.0000	*
59	46	25	13.7148	9	14.0000	14.0000	*
60	73	40	465.3563	9	24.0000	24.0000	*
61	20	25	108.6516	9	14.0000	14.0000	*
62	50	51	85.1043	9	20.0000	20.0000	*
64	3	48	31.7843	9	16.0000	16.0000	*
66	54	57	46.8327	9	20.0000	20.0000	*
67	40	45	465.3563	9	20.0000	20.0000	*
68	19	59	96.0894	9	14.0000	14.0000	*
69	61	60	27.9138	9	12.0000	12.0000	*
70	53	66	21.5752	9	18.0000	18.0000	*
71	58	71	348.3265	9	20.0000	20.0000	*
72	60	9	459.7195	9	20.0000	20.0000	*
73	22	62	771.3942	9	20.0000	20.0000	*
74	62	58	168.9206	9	14.0000	14.0000	*
75	68	49	1008.0023	9	20.0000	20.0000	*
76	63	64	110.3618	9	20.0000	20.0000	*
77	66	67	21.5752	9	18.0000	18.0000	*
78	44	68	542.6460	9	20.0000	20.0000	*
79	41	24	57.2021	9	14.0000	14.0000	*
80	45	68	465.3563	9	20.0000	20.0000	*
81	21	41	236.6080	9	20.0000	20.0000	*
82	71	19	38.8873	9	14.0000	14.0000	*
83	72	54	6.4200	9	14.0000	14.0000	*
84	6	54	40.4127	9	20.0000	20.0000	*
86	57	11	46.8327	9	20.0000	20.0000	*
89	77	65	46.8327	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	79	51	15.0484	9	20.0000	20.0000	*
94	64	82	25.2575	9	20.0000	20.0000	*
96	34	84	46.8327	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	11.08	11.08	4.7684E-06	0.000	6.420	1.7956E-02
2	82	12	20.00	11.08	11.08	1.0490E-05	1.0490E-05	25.26	3.4615E-02
3	28	2	20.00	11.08	11.08	3.7193E-05	3.7193E-05	32.89	4.5070E-02
4	27	72	14.00	11.08	11.08	1.0490E-05	1.0490E-05	6.420	1.7956E-02
5	11	77	20.00	11.08	11.08	6.7711E-05	6.7711E-05	46.83	6.4184E-02
6	65	79	20.00	11.08	11.08	4.7684E-06	0.000	15.05	2.0624E-02
7	64	50	20.00	11.08	11.08	2.2030E-04	2.2030E-04	85.10	0.1166
8	84	6	20.00	11.08	11.08	2.5749E-05	2.5749E-05	46.83	6.4184E-02
9	12	42	20.00	11.08	11.08	1.2398E-05	1.2398E-05	25.26	3.4615E-02
10	2	47	20.00	11.08	11.08	1.2398E-05	1.2398E-05	32.89	4.5070E-02
11	67	42	18.00	11.08	11.08	4.4823E-05	4.4823E-05	21.58	3.6505E-02
12	9	63	20.00	11.08	11.08	8.7738E-05	8.7738E-05	77.48	0.1062
13	13	10	20.00	11.08	11.08	5.8174E-05	5.8174E-05	131.9	0.1808
14	10	8	20.00	11.08	11.08	4.5242E-03	4.5242E-03	625.8	0.8576
15	28	17	18.00	11.08	11.08	9.5367E-06	0.000	21.58	3.6505E-02
16	61	29	12.00	11.08	11.08	8.6975E-04	8.6975E-04	54.46	0.2073
17	51	13	20.00	11.08	11.08	3.0708E-04	3.0708E-04	100.2	0.1373
18	48	13	16.00	11.08	11.08	9.4414E-05	9.4414E-05	31.78	6.8063E-02
19	65	3	16.00	11.08	11.08	9.7275E-05	9.7275E-05	31.78	6.8063E-02
20	25	60	20.00	11.09	11.08	5.3825E-03	5.3825E-03	431.8	0.5918
21	62	20	20.00	11.10	11.09	8.5344E-03	8.5344E-03	602.5	0.8257
22	15	61	12.00	11.08	11.08	3.1948E-04	3.1948E-04	82.37	0.3136
23	56	14	12.00	11.09	11.08	2.8200E-03	2.8200E-03	82.37	0.3136
24	71	25	20.00	11.09	11.09	2.4872E-03	2.4872E-03	309.4	0.4241
25	59	46	14.00	11.09	11.09	1.0576E-03	1.0576E-03	96.09	0.2688
26	46	56	12.00	11.09	11.09	9.9945E-04	9.9945E-04	82.37	0.3136
27	9	8	20.00	11.08	11.08	5.4350E-03	5.4350E-03	382.2	0.5239
28	41	58	20.00	11.09	11.09	5.9986E-04	5.9986E-04	179.4	0.2459
29	22	21	14.00	11.11	11.09	1.7457E-02	1.7457E-02	236.6	0.6618
31	23	19	14.00	11.09	11.09	3.1185E-04	3.1185E-04	57.20	0.1600
32	8	18	20.00	11.08	11.06	1.6300E-02	1.6300E-02	1008.	1.381
33	20	10	20.00	11.09	11.08	1.0663E-02	1.0663E-02	493.8	0.6768
34	14	15	12.00	11.08	11.08	4.9305E-04	4.9305E-04	82.37	0.3136
35	29	28	12.00	11.08	11.08	6.3038E-04	6.3038E-04	54.46	0.2073
36	7	73	24.00	11.19	11.18	1.5726E-03	1.5726E-03	465.4	0.4429
37	26	22	20.00	11.13	11.11	2.3852E-02	2.3852E-02	1008.	1.381
38	17	1	18.00	11.08	11.08	1.3351E-05	1.3351E-05	21.58	3.6505E-02
39	32	16	18.00	11.08	11.08	1.0490E-05	1.0490E-05	21.58	3.6505E-02
40	49	26	20.00	11.17	11.13	3.8608E-02	3.8608E-02	856.1	1.173
41	49	30	12.00	11.17	11.16	1.5180E-02	1.5180E-02	151.9	0.5784
42	31	26	12.00	11.14	11.13	1.0902E-02	1.0902E-02	151.9	0.5784

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	1	32	18.00	11.08	11.08	6.6757E-06	0.000	21.58	3.6505E-02
44	16	33	18.00	11.08	11.08	1.5259E-05	1.5259E-05	21.58	3.6505E-02
45	30	35	12.00	11.16	11.15	4.7750E-03	4.7750E-03	151.9	0.5784
46	33	53	18.00	11.08	11.08	2.4796E-05	2.4796E-05	21.58	3.6505E-02
47	35	31	12.00	11.15	11.14	7.7505E-03	7.7505E-03	151.9	0.5784
48	42	34	20.00	11.08	11.08	4.2915E-05	4.2915E-05	46.83	6.4184E-02
53	24	23	14.00	11.09	11.09	9.8228E-05	9.8228E-05	57.20	0.1600
54	6	43	14.00	11.08	11.08	9.5367E-06	0.000	6.420	1.7956E-02
55	55	44	24.00	11.19	11.18	2.7647E-03	2.7647E-03	542.6	0.5165
56	7	55	24.00	11.19	11.19	2.8610E-06	0.000	38.64	3.6779E-02
58	47	63	20.00	11.08	11.08	3.5286E-05	3.5286E-05	32.89	4.5070E-02
59	46	25	14.00	11.09	11.09	1.0681E-04	1.0681E-04	13.71	3.8360E-02
60	73	40	24.00	11.18	11.18	7.2765E-04	7.2765E-04	465.4	0.4429
61	20	25	14.00	11.09	11.09	3.7298E-03	3.7298E-03	108.7	0.3039
62	50	51	20.00	11.08	11.08	2.1744E-04	2.1744E-04	85.10	0.1166
64	3	48	16.00	11.08	11.08	1.2779E-04	1.2779E-04	31.78	6.8063E-02
66	54	57	20.00	11.08	11.08	6.7711E-05	6.7711E-05	46.83	6.4184E-02
67	40	45	20.00	11.18	11.18	7.0524E-03	7.0524E-03	465.4	0.6378
68	19	59	14.00	11.09	11.09	5.8556E-04	5.8556E-04	96.09	0.2688
69	61	60	12.00	11.08	11.08	8.5735E-04	8.5735E-04	27.91	0.1063
70	53	66	18.00	11.08	11.08	9.5367E-06	0.000	21.58	3.6505E-02
71	58	71	20.00	11.09	11.09	4.1771E-04	4.1771E-04	348.3	0.4774
72	60	9	20.00	11.08	11.08	6.3992E-04	6.3992E-04	459.7	0.6300
73	22	62	20.00	11.11	11.10	8.9378E-03	8.9378E-03	771.4	1.057
74	62	58	14.00	11.10	11.09	9.3594E-03	9.3594E-03	168.9	0.4725
75	68	49	20.00	11.18	11.17	4.9706E-03	4.9706E-03	1008.	1.381
76	63	64	20.00	11.08	11.08	2.0027E-05	2.0027E-05	110.4	0.1513
77	66	67	18.00	11.08	11.08	1.0490E-05	1.0490E-05	21.58	3.6505E-02
78	44	68	20.00	11.18	11.18	6.7625E-03	6.7625E-03	542.6	0.7437
79	41	24	14.00	11.09	11.09	1.3447E-03	1.3447E-03	57.20	0.1600
80	45	68	20.00	11.18	11.18	1.7738E-04	1.7738E-04	465.4	0.6378
81	21	41	20.00	11.09	11.09	2.4033E-04	2.4033E-04	236.6	0.3243
82	71	19	14.00	11.09	11.09	7.3719E-04	7.3719E-04	38.89	0.1088
83	72	54	14.00	11.08	11.08	9.5367E-06	0.000	6.420	1.7956E-02
84	6	54	20.00	11.08	11.08	3.4332E-05	3.4332E-05	40.41	5.5386E-02
86	57	11	20.00	11.08	11.08	7.2479E-05	7.2479E-05	46.83	6.4184E-02
89	77	65	20.00	11.08	11.08	6.7711E-05	6.7711E-05	46.83	6.4184E-02
91	79	51	20.00	11.08	11.08	7.6294E-06	0.000	15.05	2.0624E-02
94	64	82	20.00	11.08	11.08	1.7166E-05	1.7166E-05	25.26	3.4615E-02
96	34	84	20.00	11.08	11.08	6.6757E-06	0.000	46.83	6.4184E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	504.0	0.000	11.19	11.19	10.17	8.9006E-02	1.5660E+05	100.0
2	504.0	0.000	11.19	11.19	10.17	8.9006E-02	1.5660E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	504.0	0.0000
69	0.000	*	504.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
18	11.06	1008.	*	303.10

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 13 Pool Fire scenario in Bio-propane Fire Scenario Area – Case B

13.A PIPENET schematic layout with piping and nodes label
13.B PIPENET schematic layout with flow rate and pressure results
13.C PIPENET schematic layout with velocity results
13.D PIPENET input/output printout report

Attachment 13.A contains 1 page
Attachment 13.B contains 1 page
Attachment 13.C contains 1 page
Attachment 13.D contains 21 pages

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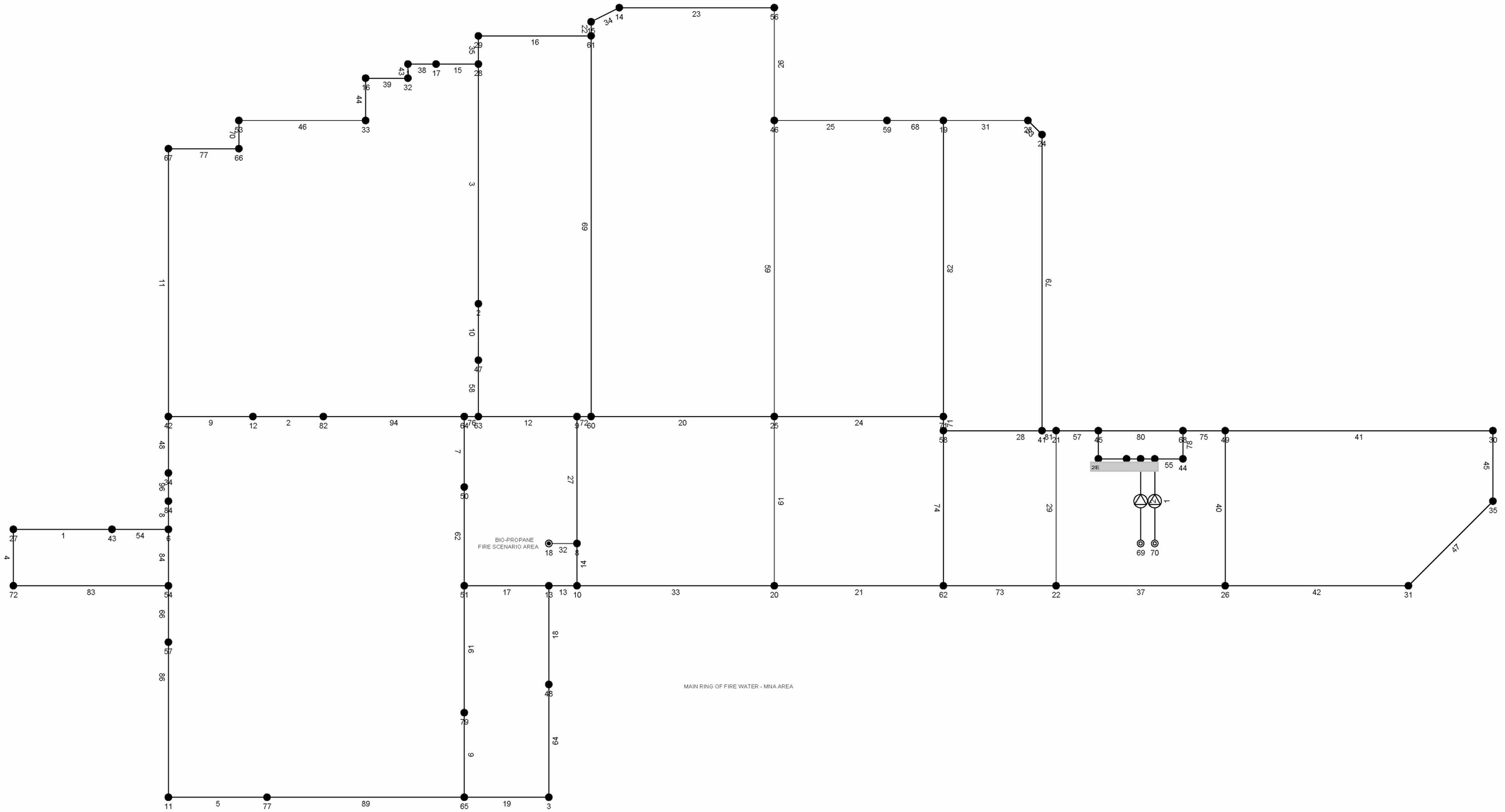
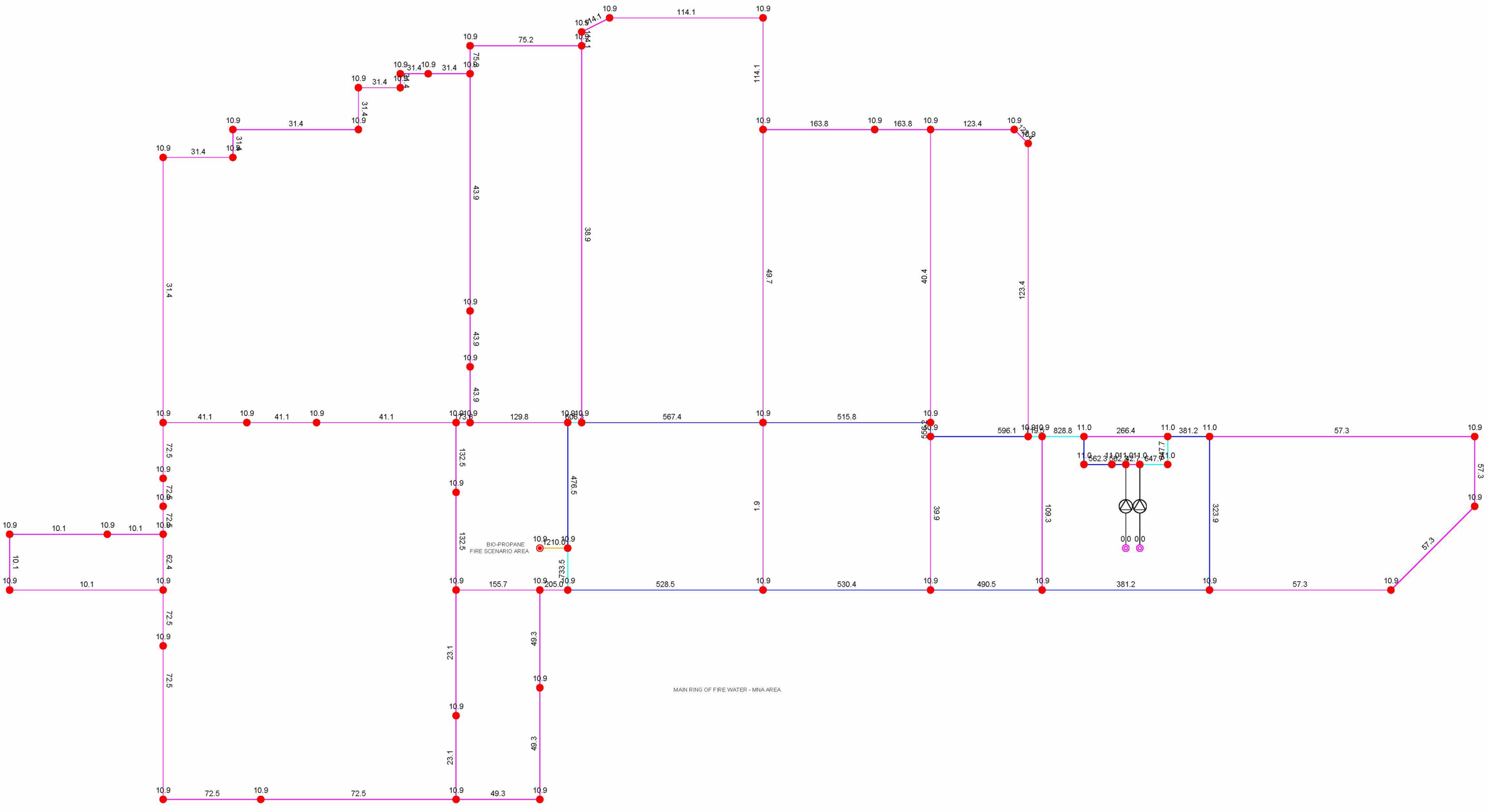
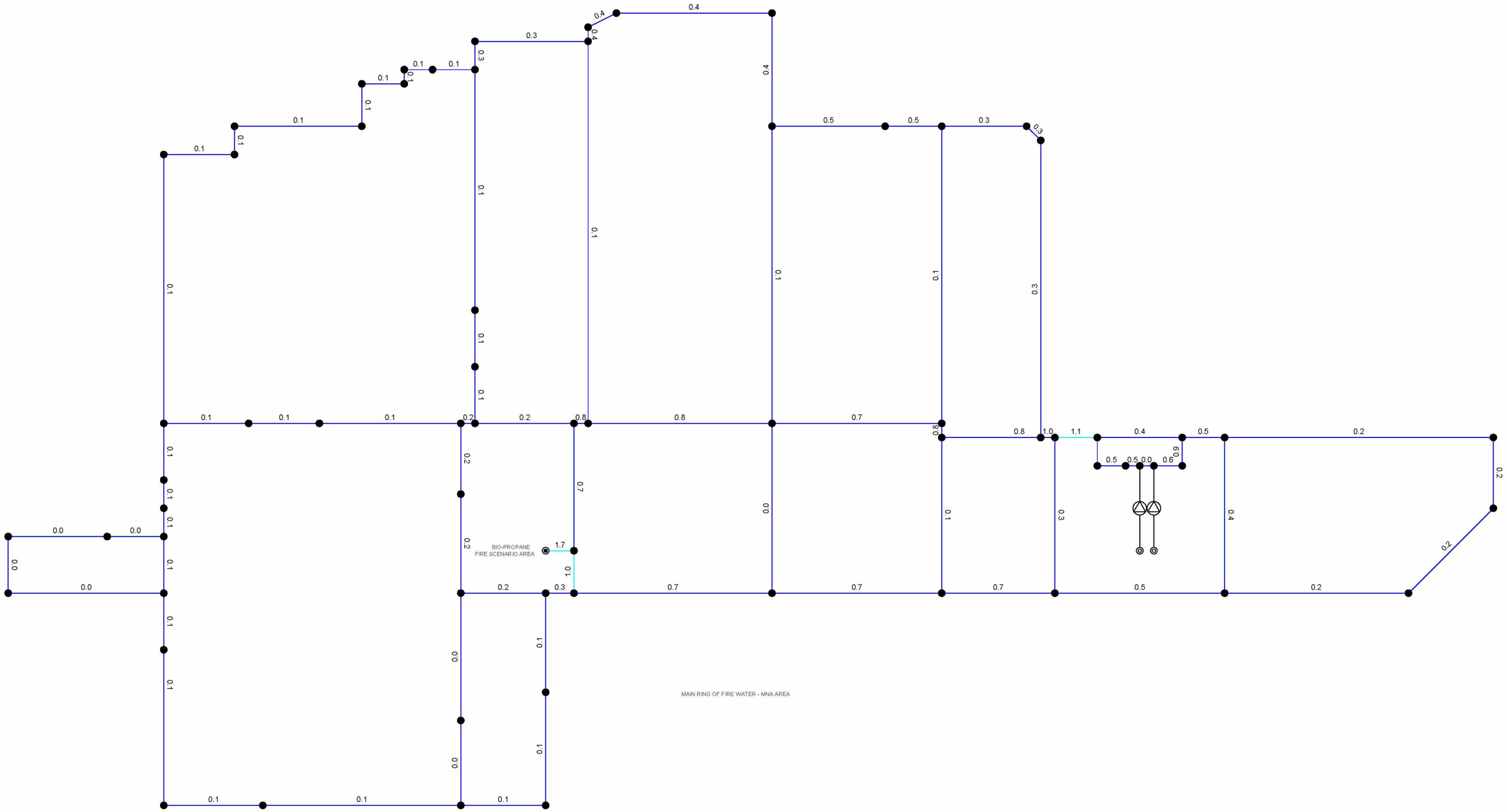


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

21:47 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	1.9685	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	13	10	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	51	13	20.00	43.00	0.000	150.0	45.60
18	48	13	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
32	8	18	20.00	20.00	0.000	150.0	45.60
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
32	1 x 4	45.60		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	10.0645	9	14.0000	14.0000	*
2	82	12	41.1245	9	20.0000	20.0000	*
3	28	2	43.8548	9	20.0000	20.0000	*
4	27	72	10.0645	9	14.0000	14.0000	*
5	11	77	72.4864	9	20.0000	20.0000	*
6	65	79	23.1424	9	20.0000	20.0000	*
7	64	50	132.5191	9	20.0000	20.0000	*
8	84	6	72.4864	9	20.0000	20.0000	*
9	12	42	41.1245	9	20.0000	20.0000	*
10	2	47	43.8548	9	20.0000	20.0000	*
11	67	42	31.3619	9	18.0000	18.0000	*
12	9	63	129.7888	9	20.0000	20.0000	*
13	13	10	205.0054	9	20.0000	20.0000	*
14	10	8	733.5003	9	20.0000	20.0000	*
15	28	17	31.3619	9	18.0000	18.0000	*
16	61	29	75.2166	9	12.0000	12.0000	*
17	51	13	155.6615	9	20.0000	20.0000	*
18	48	13	49.3440	9	16.0000	16.0000	*
19	65	3	49.3440	9	16.0000	16.0000	*
20	25	60	567.3979	9	20.0000	20.0000	*
21	62	20	530.4067	9	20.0000	20.0000	*
22	15	61	114.1101	9	12.0000	12.0000	*
23	56	14	114.1101	9	12.0000	12.0000	*
24	71	25	515.7824	9	20.0000	20.0000	*
25	59	46	163.8137	9	14.0000	14.0000	*
26	46	56	114.1101	9	12.0000	12.0000	*
27	9	8	476.5026	9	20.0000	20.0000	*
28	41	58	596.1069	9	20.0000	20.0000	*
29	21	22	109.2644	9	14.0000	14.0000	*
31	23	19	123.4165	9	14.0000	14.0000	*
32	8	18	1210.0027	9	20.0000	20.0000	*
33	20	10	528.4948	9	20.0000	20.0000	*
34	14	15	114.1101	9	12.0000	12.0000	*
35	29	28	75.2166	9	12.0000	12.0000	*
36	7	73	562.3428	9	24.0000	24.0000	*
37	26	22	381.2151	9	20.0000	20.0000	*
38	17	1	31.3619	9	18.0000	18.0000	*
39	32	16	31.3619	9	18.0000	18.0000	*
40	49	26	323.8923	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	57.3227	9	12.0000	12.0000	*
42	31	26	57.3227	9	12.0000	12.0000	*
43	1	32	31.3619	9	18.0000	18.0000	*
44	16	33	31.3619	9	18.0000	18.0000	*
45	30	35	57.3227	9	12.0000	12.0000	*
46	33	53	31.3619	9	18.0000	18.0000	*
47	35	31	57.3227	9	12.0000	12.0000	*
48	42	34	72.4864	9	20.0000	20.0000	*
53	24	23	123.4165	9	14.0000	14.0000	*
54	6	43	10.0645	9	14.0000	14.0000	*
55	55	44	647.6601	9	24.0000	24.0000	*
56	7	55	42.6580	9	24.0000	24.0000	*
57	45	21	828.7878	9	20.0000	20.0000	*
58	47	63	43.8548	9	20.0000	20.0000	*
59	46	25	49.7036	9	14.0000	14.0000	*
60	73	40	562.3428	9	24.0000	24.0000	*
61	20	25	1.9119	9	14.0000	14.0000	*
62	50	51	132.5191	9	20.0000	20.0000	*
64	3	48	49.3440	9	16.0000	16.0000	*
66	54	57	72.4864	9	20.0000	20.0000	*
67	40	45	562.3428	9	20.0000	20.0000	*
68	19	59	163.8137	9	14.0000	14.0000	*
69	61	60	38.8935	9	12.0000	12.0000	*
70	53	66	31.3619	9	18.0000	18.0000	*
71	58	71	556.1796	9	20.0000	20.0000	*
72	60	9	606.2913	9	20.0000	20.0000	*
73	22	62	490.4794	9	20.0000	20.0000	*
74	58	62	39.9273	9	14.0000	14.0000	*
75	68	49	381.2151	9	20.0000	20.0000	*
76	63	64	173.6436	9	20.0000	20.0000	*
77	66	67	31.3619	9	18.0000	18.0000	*
78	44	68	647.6600	9	20.0000	20.0000	*
79	41	24	123.4165	9	14.0000	14.0000	*
80	68	45	266.4450	9	20.0000	20.0000	*
81	21	41	719.5235	9	20.0000	20.0000	*
82	71	19	40.3972	9	14.0000	14.0000	*
83	72	54	10.0645	9	14.0000	14.0000	*
84	6	54	62.4219	9	20.0000	20.0000	*
86	57	11	72.4864	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	77	65	72.4864	9	20.0000	20.0000	*
91	79	51	23.1424	9	20.0000	20.0000	*
94	64	82	41.1245	9	20.0000	20.0000	*
96	34	84	72.4864	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.92	10.92	1.2398E-05	1.2398E-05	10.06	2.8150E-02
2	82	12	20.00	10.92	10.92	2.0027E-05	2.0027E-05	41.12	5.6361E-02
3	28	2	20.00	10.92	10.92	6.1989E-05	6.1989E-05	43.85	6.0103E-02
4	27	72	14.00	10.92	10.92	2.2888E-05	2.2888E-05	10.06	2.8150E-02
5	11	77	20.00	10.92	10.92	1.4782E-04	1.4782E-04	72.49	9.9343E-02
6	65	79	20.00	10.92	10.92	1.2398E-05	1.2398E-05	23.14	3.1717E-02
7	64	50	20.00	10.92	10.92	5.0068E-04	5.0068E-04	132.5	0.1816
8	84	6	20.00	10.92	10.92	5.2452E-05	5.2452E-05	72.49	9.9343E-02
9	12	42	20.00	10.92	10.92	2.9564E-05	2.9564E-05	41.12	5.6361E-02
10	2	47	20.00	10.92	10.92	2.4796E-05	2.4796E-05	43.85	6.0103E-02
11	67	42	18.00	10.92	10.92	8.7738E-05	8.7738E-05	31.36	5.3064E-02
12	9	63	20.00	10.92	10.92	2.3079E-04	2.3079E-04	129.8	0.1779
13	13	10	20.00	10.92	10.92	1.3065E-04	1.3065E-04	205.0	0.2810
14	10	8	20.00	10.92	10.91	6.0720E-03	6.0720E-03	733.5	1.005
15	28	17	18.00	10.92	10.92	1.7166E-05	1.7166E-05	31.36	5.3064E-02
16	61	29	12.00	10.92	10.92	1.5907E-03	1.5907E-03	75.22	0.2863
17	51	13	20.00	10.92	10.92	6.9427E-04	6.9427E-04	155.7	0.2133
18	48	13	16.00	10.92	10.92	2.1458E-04	2.1458E-04	49.34	0.1057
19	65	3	16.00	10.92	10.92	2.1935E-04	2.1935E-04	49.34	0.1057
20	25	60	20.00	10.93	10.92	8.9178E-03	8.9178E-03	567.4	0.7776
21	62	20	20.00	10.94	10.93	6.7396E-03	6.7396E-03	530.4	0.7269
22	15	61	12.00	10.92	10.92	5.8460E-04	5.8460E-04	114.1	0.4344
23	56	14	12.00	10.93	10.93	5.1718E-03	5.1718E-03	114.1	0.4344
24	71	25	20.00	10.94	10.93	6.3953E-03	6.3953E-03	515.8	0.7069
25	59	46	14.00	10.94	10.93	2.8524E-03	2.8524E-03	163.8	0.4582
26	46	56	12.00	10.93	10.93	1.8377E-03	1.8377E-03	114.1	0.4344
27	9	8	20.00	10.92	10.91	8.1701E-03	8.1701E-03	476.5	0.6530
28	41	58	20.00	10.94	10.94	5.5399E-03	5.5399E-03	596.1	0.8170
29	21	22	14.00	10.95	10.94	4.1828E-03	4.1828E-03	109.3	0.3056
31	23	19	14.00	10.94	10.94	1.3075E-03	1.3075E-03	123.4	0.3452
32	8	18	20.00	10.91	10.89	2.2850E-02	2.2850E-02	1210.	1.658
33	20	10	20.00	10.93	10.92	1.2083E-02	1.2083E-02	528.5	0.7243
34	14	15	12.00	10.93	10.92	9.0790E-04	9.0790E-04	114.1	0.4344
35	29	28	12.00	10.92	10.92	1.1501E-03	1.1501E-03	75.22	0.2863
36	7	73	24.00	10.97	10.96	2.2326E-03	2.2326E-03	562.3	0.5352
37	26	22	20.00	10.95	10.94	3.9501E-03	3.9501E-03	381.2	0.5225
38	17	1	18.00	10.92	10.92	2.4796E-05	2.4796E-05	31.36	5.3064E-02
39	32	16	18.00	10.92	10.92	2.0027E-05	2.0027E-05	31.36	5.3064E-02
40	49	26	20.00	10.95	10.95	6.3906E-03	6.3906E-03	323.9	0.4439
41	49	30	12.00	10.95	10.95	2.5129E-03	2.5129E-03	57.32	0.2182
42	31	26	12.00	10.95	10.95	1.8053E-03	1.8053E-03	57.32	0.2182

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	1	32	18.00	10.92	10.92	1.7166E-05	1.7166E-05	31.36	5.3064E-02
44	16	33	18.00	10.92	10.92	3.0518E-05	3.0518E-05	31.36	5.3064E-02
45	30	35	12.00	10.95	10.95	7.8964E-04	7.8964E-04	57.32	0.2182
46	33	53	18.00	10.92	10.92	4.7684E-05	4.7684E-05	31.36	5.3064E-02
47	35	31	12.00	10.95	10.95	1.2827E-03	1.2827E-03	57.32	0.2182
48	42	34	20.00	10.92	10.92	1.0014E-04	1.0014E-04	72.49	9.9343E-02
53	24	23	14.00	10.94	10.94	4.0531E-04	4.0531E-04	123.4	0.3452
54	6	43	14.00	10.92	10.92	2.1935E-05	2.1935E-05	10.06	2.8150E-02
55	55	44	24.00	10.97	10.96	3.8319E-03	3.8319E-03	647.7	0.6164
56	7	55	24.00	10.97	10.97	2.8610E-06	0.000	42.66	4.0599E-02
57	45	21	20.00	10.95	10.95	6.9180E-03	6.9180E-03	828.8	1.136
58	47	63	20.00	10.92	10.92	5.8174E-05	5.8174E-05	43.85	6.0103E-02
59	46	25	14.00	10.93	10.93	1.1749E-03	1.1749E-03	49.70	0.1390
60	73	40	24.00	10.96	10.96	1.0328E-03	1.0328E-03	562.3	0.5352
61	20	25	14.00	10.93	10.93	2.8610E-06	0.000	1.912	5.3474E-03
62	50	51	20.00	10.92	10.92	4.9496E-04	4.9496E-04	132.5	0.1816
64	3	48	16.00	10.92	10.92	2.9278E-04	2.9278E-04	49.34	0.1057
66	54	57	20.00	10.92	10.92	1.5259E-04	1.5259E-04	72.49	9.9343E-02
67	40	45	20.00	10.96	10.95	1.0012E-02	1.0012E-02	562.3	0.7707
68	19	59	14.00	10.94	10.94	1.5726E-03	1.5726E-03	163.8	0.4582
69	61	60	12.00	10.92	10.92	1.5907E-03	1.5907E-03	38.89	0.1481
70	53	66	18.00	10.92	10.92	2.1935E-05	2.1935E-05	31.36	5.3064E-02
71	58	71	20.00	10.94	10.94	9.9182E-04	9.9182E-04	556.2	0.7622
72	60	9	20.00	10.92	10.92	1.0643E-03	1.0643E-03	606.3	0.8309
73	22	62	20.00	10.94	10.94	3.8671E-03	3.8671E-03	490.5	0.6722
74	58	62	14.00	10.94	10.94	6.4468E-04	6.4468E-04	39.93	0.1117
75	68	49	20.00	10.95	10.95	8.2207E-04	8.2207E-04	381.2	0.5225
76	63	64	20.00	10.92	10.92	4.6730E-05	4.6730E-05	173.6	0.2380
77	66	67	18.00	10.92	10.92	2.0027E-05	2.0027E-05	31.36	5.3064E-02
78	44	68	20.00	10.96	10.95	9.3803E-03	9.3803E-03	647.7	0.8876
79	41	24	14.00	10.94	10.94	5.6143E-03	5.6143E-03	123.4	0.3452
80	68	45	20.00	10.95	10.95	6.1989E-05	6.1989E-05	266.4	0.3652
81	21	41	20.00	10.95	10.94	1.8654E-03	1.8654E-03	719.5	0.9861
82	71	19	14.00	10.94	10.94	7.9536E-04	7.9536E-04	40.40	0.1130
83	72	54	14.00	10.92	10.92	2.4796E-05	2.4796E-05	10.06	2.8150E-02
84	6	54	20.00	10.92	10.92	8.2016E-05	8.2016E-05	62.42	8.5549E-02
86	57	11	20.00	10.92	10.92	1.6499E-04	1.6499E-04	72.49	9.9343E-02
89	77	65	20.00	10.92	10.92	1.5259E-04	1.5259E-04	72.49	9.9343E-02
91	79	51	20.00	10.92	10.92	2.0027E-05	2.0027E-05	23.14	3.1717E-02
94	64	82	20.00	10.92	10.92	4.5776E-05	4.5776E-05	41.12	5.6361E-02
96	34	84	20.00	10.92	10.92	1.5259E-05	1.5259E-05	72.49	9.9343E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	605.0	0.000	10.97	10.97	10.17	9.0787E-02	1.8429E+05	100.0
2	605.0	0.000	10.97	10.97	10.17	9.0787E-02	1.8429E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	605.0	0.0000
69	0.000	*	605.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
18	10.89	1210.	*	366.67

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 14 Jet Fire scenario in Bio-propane Fire Scenario Area – Case A

14.A PIPENET schematic layout with piping and nodes label
14.B PIPENET schematic layout with flow rate and pressure results
14.C PIPENET schematic layout with velocity results
14.D PIPENET input/output printout report

Attachment 14.A contains 1 page
Attachment 14.B contains 1 page
Attachment 14.C contains 1 page
Attachment 14.D contains 21 pages

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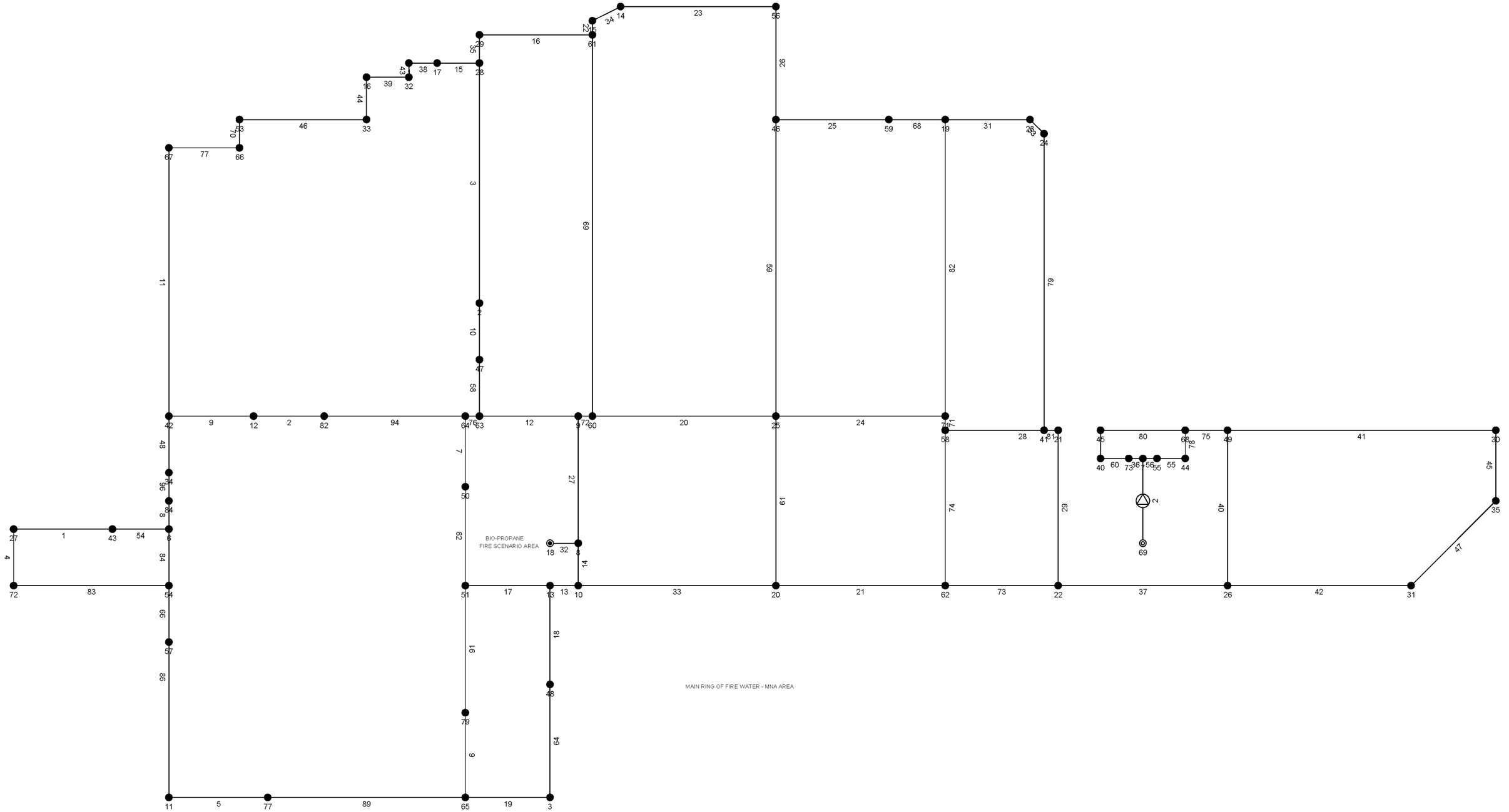
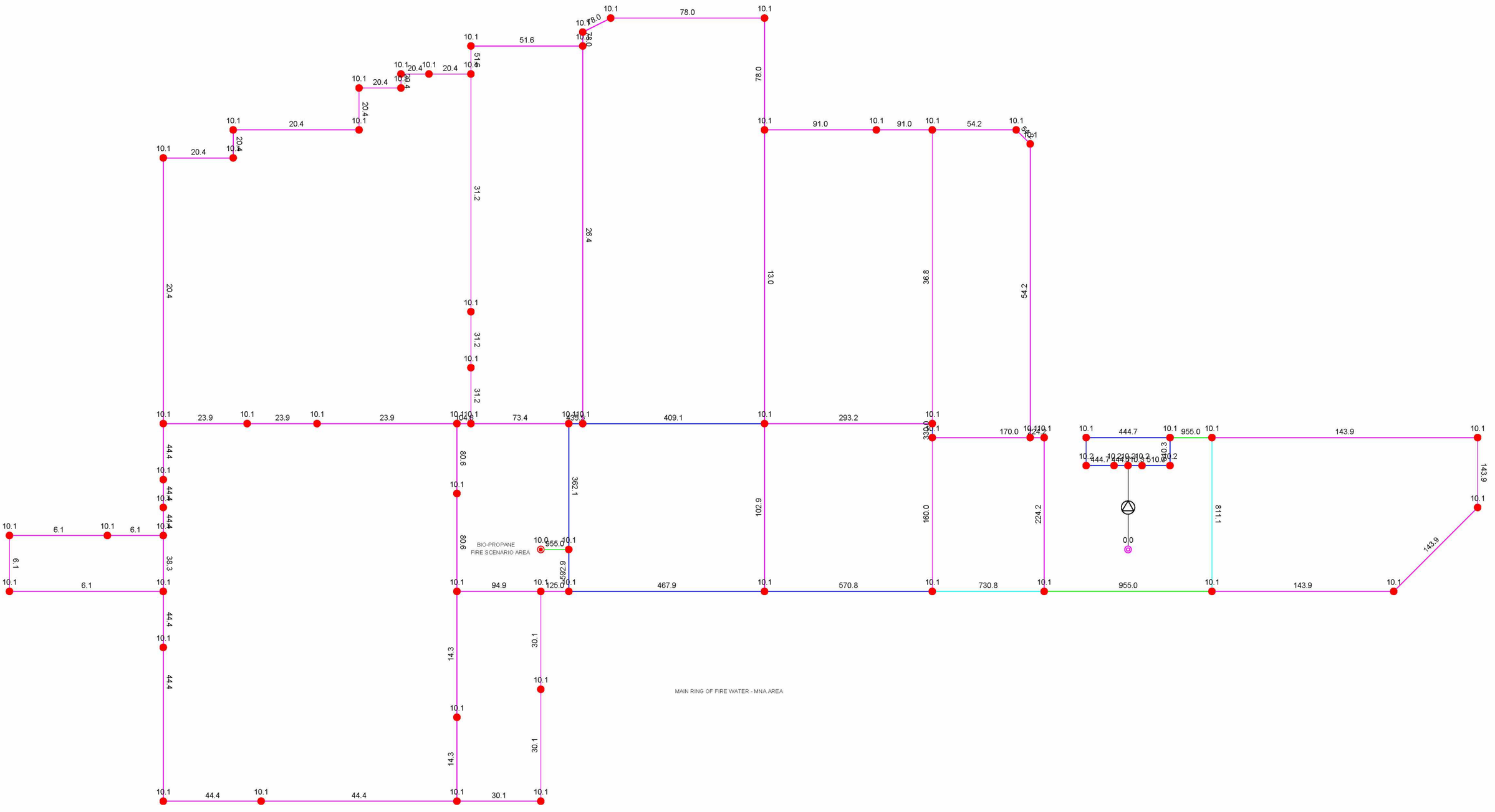
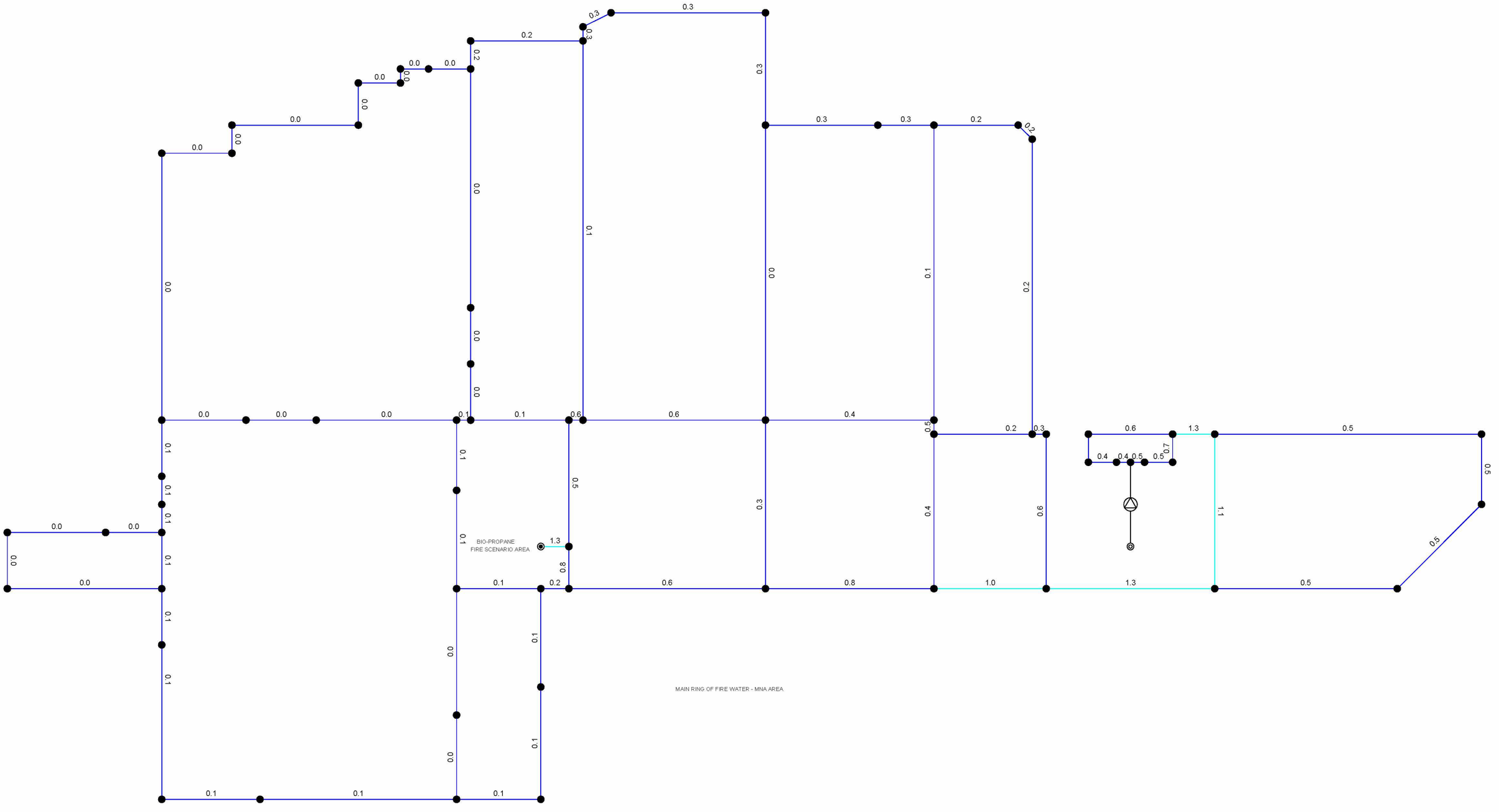


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

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21:57 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	13	10	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	51	13	20.00	43.00	0.000	150.0	45.60
18	48	13	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
32	8	18	20.00	20.00	0.000	150.0	45.60
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
32	1 x 4	45.60		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	6.0824	9	14.0000	14.0000	*
2	82	12	23.9295	9	20.0000	20.0000	*
3	28	2	31.1564	9	20.0000	20.0000	*
4	27	72	6.0824	9	14.0000	14.0000	*
5	11	77	44.3703	9	20.0000	20.0000	*
6	65	79	14.2572	9	20.0000	20.0000	*
7	64	50	80.6295	9	20.0000	20.0000	*
8	84	6	44.3703	9	20.0000	20.0000	*
9	12	42	23.9295	9	20.0000	20.0000	*
10	2	47	31.1564	9	20.0000	20.0000	*
11	67	42	20.4408	9	18.0000	18.0000	*
12	9	63	73.4026	9	20.0000	20.0000	*
13	13	10	124.9998	9	20.0000	20.0000	*
14	10	8	592.8570	9	20.0000	20.0000	*
15	28	17	20.4408	9	18.0000	18.0000	*
16	61	29	51.5972	9	12.0000	12.0000	*
17	51	13	94.8867	9	20.0000	20.0000	*
18	48	13	30.1131	9	16.0000	16.0000	*
19	65	3	30.1131	9	16.0000	16.0000	*
20	25	60	409.1016	9	20.0000	20.0000	*
21	62	20	570.7960	9	20.0000	20.0000	*
22	15	61	78.0434	9	12.0000	12.0000	*
23	56	14	78.0434	9	12.0000	12.0000	*
24	71	25	293.1691	9	20.0000	20.0000	*
25	59	46	91.0371	9	14.0000	14.0000	*
26	46	56	78.0434	9	12.0000	12.0000	*
27	9	8	362.1451	9	20.0000	20.0000	*
28	41	58	169.9729	9	20.0000	20.0000	*
29	22	21	224.1673	9	14.0000	14.0000	*
31	23	19	54.1945	9	14.0000	14.0000	*
32	8	18	955.0022	9	20.0000	20.0000	*
33	20	10	467.8573	9	20.0000	20.0000	*
34	14	15	78.0434	9	12.0000	12.0000	*
35	29	28	51.5972	9	12.0000	12.0000	*
36	7	73	444.7400	9	24.0000	24.0000	*
37	26	22	955.0022	9	20.0000	20.0000	*
38	17	1	20.4408	9	18.0000	18.0000	*
39	32	16	20.4408	9	18.0000	18.0000	*
40	49	26	811.0640	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	143.9383	9	12.0000	12.0000	*
42	31	26	143.9383	9	12.0000	12.0000	*
43	1	32	20.4408	9	18.0000	18.0000	*
44	16	33	20.4408	9	18.0000	18.0000	*
45	30	35	143.9383	9	12.0000	12.0000	*
46	33	53	20.4408	9	18.0000	18.0000	*
47	35	31	143.9383	9	12.0000	12.0000	*
48	42	34	44.3703	9	20.0000	20.0000	*
53	24	23	54.1945	9	14.0000	14.0000	*
54	6	43	6.0824	9	14.0000	14.0000	*
55	55	44	510.2621	9	24.0000	24.0000	*
56	7	55	510.2621	9	24.0000	24.0000	*
58	47	63	31.1564	9	20.0000	20.0000	*
59	46	25	12.9937	9	14.0000	14.0000	*
60	73	40	444.7400	9	24.0000	24.0000	*
61	20	25	102.9387	9	14.0000	14.0000	*
62	50	51	80.6295	9	20.0000	20.0000	*
64	3	48	30.1131	9	16.0000	16.0000	*
66	54	57	44.3703	9	20.0000	20.0000	*
67	40	45	444.7400	9	20.0000	20.0000	*
68	19	59	91.0371	9	14.0000	14.0000	*
69	61	60	26.4461	9	12.0000	12.0000	*
70	53	66	20.4408	9	18.0000	18.0000	*
71	58	71	330.0117	9	20.0000	20.0000	*
72	60	9	435.5477	9	20.0000	20.0000	*
73	22	62	730.8348	9	20.0000	20.0000	*
74	62	58	160.0388	9	14.0000	14.0000	*
75	68	49	955.0022	9	20.0000	20.0000	*
76	63	64	104.5590	9	20.0000	20.0000	*
77	66	67	20.4408	9	18.0000	18.0000	*
78	44	68	510.2621	9	20.0000	20.0000	*
79	41	24	54.1945	9	14.0000	14.0000	*
80	45	68	444.7400	9	20.0000	20.0000	*
81	21	41	224.1674	9	20.0000	20.0000	*
82	71	19	36.8426	9	14.0000	14.0000	*
83	72	54	6.0824	9	14.0000	14.0000	*
84	6	54	38.2879	9	20.0000	20.0000	*
86	57	11	44.3703	9	20.0000	20.0000	*
89	77	65	44.3703	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	79	51	14.2572	9	20.0000	20.0000	*
94	64	82	23.9295	9	20.0000	20.0000	*
96	34	84	44.3703	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.06	10.06	2.8610E-06	0.000	6.082	1.7012E-02
2	82	12	20.00	10.06	10.06	7.6294E-06	0.000	23.93	3.2795E-02
3	28	2	20.00	10.06	10.06	3.2425E-05	3.2425E-05	31.16	4.2700E-02
4	27	72	14.00	10.06	10.06	9.5367E-06	0.000	6.082	1.7012E-02
5	11	77	20.00	10.06	10.06	5.9128E-05	5.9128E-05	44.37	6.0810E-02
6	65	79	20.00	10.06	10.06	5.7220E-06	0.000	14.26	1.9539E-02
7	64	50	20.00	10.06	10.06	2.0027E-04	2.0027E-04	80.63	0.1105
8	84	6	20.00	10.06	10.06	2.2888E-05	2.2888E-05	44.37	6.0810E-02
9	12	42	20.00	10.06	10.06	1.2398E-05	1.2398E-05	23.93	3.2795E-02
10	2	47	20.00	10.06	10.06	1.2398E-05	1.2398E-05	31.16	4.2700E-02
11	67	42	18.00	10.06	10.06	4.0054E-05	4.0054E-05	20.44	3.4585E-02
12	9	63	20.00	10.06	10.06	8.0109E-05	8.0109E-05	73.40	0.1006
13	13	10	20.00	10.06	10.06	5.3406E-05	5.3406E-05	125.0	0.1713
14	10	8	20.00	10.06	10.05	4.0970E-03	4.0970E-03	592.9	0.8125
15	28	17	18.00	10.06	10.06	7.6294E-06	0.000	20.44	3.4585E-02
16	61	29	12.00	10.06	10.06	7.8773E-04	7.8773E-04	51.60	0.1964
17	51	13	20.00	10.06	10.06	2.7752E-04	2.7752E-04	94.89	0.1300
18	48	13	16.00	10.06	10.06	8.4877E-05	8.4877E-05	30.11	6.4484E-02
19	65	3	16.00	10.06	10.06	9.0599E-05	9.0599E-05	30.11	6.4484E-02
20	25	60	20.00	10.06	10.06	4.8704E-03	4.8704E-03	409.1	0.5607
21	62	20	20.00	10.08	10.07	7.7219E-03	7.7219E-03	570.8	0.7823
22	15	61	12.00	10.06	10.06	2.8992E-04	2.8992E-04	78.04	0.2971
23	56	14	12.00	10.06	10.06	2.5530E-03	2.5530E-03	78.04	0.2971
24	71	25	20.00	10.07	10.06	2.2497E-03	2.2497E-03	293.2	0.4018
25	59	46	14.00	10.07	10.06	9.5749E-04	9.5749E-04	91.04	0.2546
26	46	56	12.00	10.06	10.06	9.0504E-04	9.0504E-04	78.04	0.2971
27	9	8	20.00	10.06	10.05	4.9200E-03	4.9200E-03	362.1	0.4963
28	41	58	20.00	10.07	10.07	5.4455E-04	5.4455E-04	170.0	0.2329
29	22	21	14.00	10.08	10.07	1.5798E-02	1.5798E-02	224.2	0.6270
31	23	19	14.00	10.07	10.07	2.8515E-04	2.8515E-04	54.19	0.1516
32	8	18	20.00	10.05	10.04	1.4748E-02	1.4748E-02	955.0	1.309
33	20	10	20.00	10.07	10.06	9.6483E-03	9.6483E-03	467.9	0.6412
34	14	15	12.00	10.06	10.06	4.4441E-04	4.4441E-04	78.04	0.2971
35	29	28	12.00	10.06	10.06	5.7030E-04	5.7030E-04	51.60	0.1964
36	7	73	24.00	10.15	10.15	1.4448E-03	1.4448E-03	444.7	0.4233
37	26	22	20.00	10.11	10.08	2.1585E-02	2.1585E-02	955.0	1.309
38	17	1	18.00	10.06	10.06	1.2398E-05	1.2398E-05	20.44	3.4585E-02
39	32	16	18.00	10.06	10.06	9.5367E-06	0.000	20.44	3.4585E-02
40	49	26	20.00	10.14	10.11	3.4938E-02	3.4938E-02	811.1	1.112
41	49	30	12.00	10.14	10.13	1.3735E-02	1.3735E-02	143.9	0.5480
42	31	26	12.00	10.12	10.11	9.8677E-03	9.8677E-03	143.9	0.5480

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	1	32	18.00	10.06	10.06	7.6294E-06	0.000	20.44	3.4585E-02
44	16	33	18.00	10.06	10.06	1.2398E-05	1.2398E-05	20.44	3.4585E-02
45	30	35	12.00	10.13	10.12	4.3230E-03	4.3230E-03	143.9	0.5480
46	33	53	18.00	10.06	10.06	2.0027E-05	2.0027E-05	20.44	3.4585E-02
47	35	31	12.00	10.12	10.12	7.0124E-03	7.0124E-03	143.9	0.5480
48	42	34	20.00	10.06	10.06	4.0054E-05	4.0054E-05	44.37	6.0810E-02
53	24	23	14.00	10.07	10.07	8.7738E-05	8.7738E-05	54.19	0.1516
54	6	43	14.00	10.06	10.06	9.5367E-06	0.000	6.082	1.7012E-02
55	55	44	24.00	10.15	10.15	2.4672E-03	2.4672E-03	510.3	0.4856
56	7	55	24.00	10.15	10.15	2.6035E-04	2.6035E-04	510.3	0.4856
58	47	63	20.00	10.06	10.06	3.2425E-05	3.2425E-05	31.16	4.2700E-02
59	46	25	14.00	10.06	10.06	9.7275E-05	9.7275E-05	12.99	3.6343E-02
60	73	40	24.00	10.15	10.15	6.7043E-04	6.7043E-04	444.7	0.4233
61	20	25	14.00	10.07	10.06	3.3751E-03	3.3751E-03	102.9	0.2879
62	50	51	20.00	10.06	10.06	1.9455E-04	1.9455E-04	80.63	0.1105
64	3	48	16.00	10.06	10.06	1.1444E-04	1.1444E-04	30.11	6.4484E-02
66	54	57	20.00	10.06	10.06	6.1989E-05	6.1989E-05	44.37	6.0810E-02
67	40	45	20.00	10.15	10.14	6.4850E-03	6.4850E-03	444.7	0.6095
68	19	59	14.00	10.07	10.07	5.2738E-04	5.2738E-04	91.04	0.2546
69	61	60	12.00	10.06	10.06	7.7534E-04	7.7534E-04	26.45	0.1007
70	53	66	18.00	10.06	10.06	1.0490E-05	1.0490E-05	20.44	3.4585E-02
71	58	71	20.00	10.07	10.07	3.7766E-04	3.7766E-04	330.0	0.4523
72	60	9	20.00	10.06	10.06	5.7983E-04	5.7983E-04	435.5	0.5969
73	22	62	20.00	10.08	10.08	8.0881E-03	8.0881E-03	730.8	1.002
74	62	58	14.00	10.08	10.07	8.4696E-03	8.4696E-03	160.0	0.4476
75	68	49	20.00	10.14	10.14	4.4975E-03	4.4975E-03	955.0	1.309
76	63	64	20.00	10.06	10.06	1.7166E-05	1.7166E-05	104.6	0.1433
77	66	67	18.00	10.06	10.06	9.5367E-06	0.000	20.44	3.4585E-02
78	44	68	20.00	10.15	10.14	6.0349E-03	6.0349E-03	510.3	0.6993
79	41	24	14.00	10.07	10.07	1.2169E-03	1.2169E-03	54.19	0.1516
80	45	68	20.00	10.14	10.14	1.6212E-04	1.6212E-04	444.7	0.6095
81	21	41	20.00	10.07	10.07	2.1553E-04	2.1553E-04	224.2	0.3072
82	71	19	14.00	10.07	10.07	6.6757E-04	6.6757E-04	36.84	0.1030
83	72	54	14.00	10.06	10.06	1.0490E-05	1.0490E-05	6.082	1.7012E-02
84	6	54	20.00	10.06	10.06	3.2425E-05	3.2425E-05	38.29	5.2474E-02
86	57	11	20.00	10.06	10.06	6.5804E-05	6.5804E-05	44.37	6.0810E-02
89	77	65	20.00	10.06	10.06	6.0081E-05	6.0081E-05	44.37	6.0810E-02
91	79	51	20.00	10.06	10.06	6.6757E-06	0.000	14.26	1.9539E-02
94	64	82	20.00	10.06	10.06	1.5259E-05	1.5259E-05	23.93	3.2795E-02
96	34	84	20.00	10.06	10.06	4.7684E-06	0.000	44.37	6.0810E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
2	955.0	0.000	10.15	10.15	10.17	9.8052E-02	2.6935E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
69	0.000	*	955.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
18	10.04	955.0	*	301.40

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

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RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 15 Jet Fire scenario in Bio-propane Fire Scenario Area – Case B

15.A PIPENET schematic layout with piping and nodes label
15.B PIPENET schematic layout with flow rate and pressure results
15.C PIPENET schematic layout with velocity results
15.D PIPENET input/output printout report

Attachment 15.A contains 1 page
Attachment 15.B contains 1 page
Attachment 15.C contains 1 page
Attachment 15.D contains 21 pages

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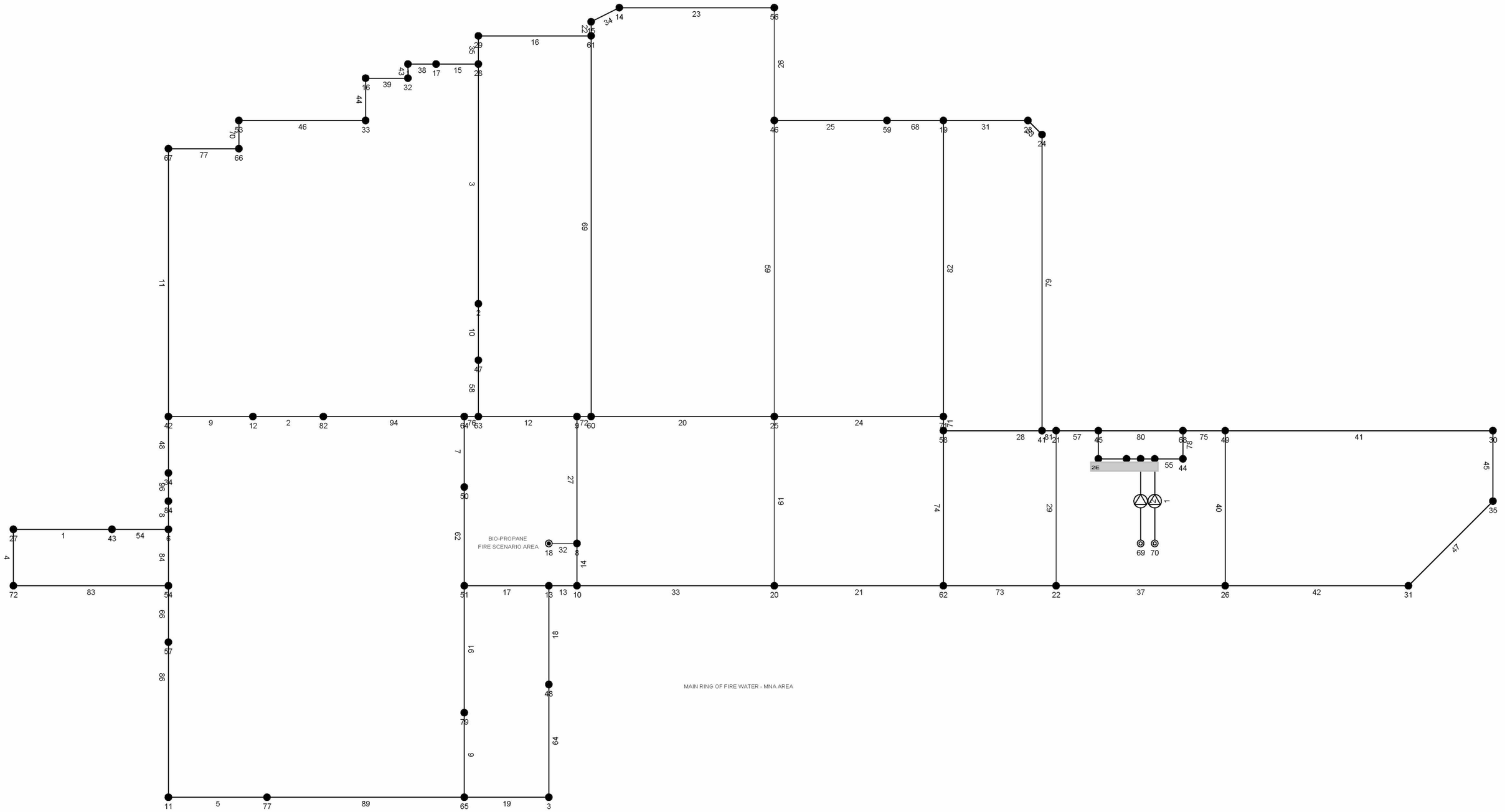
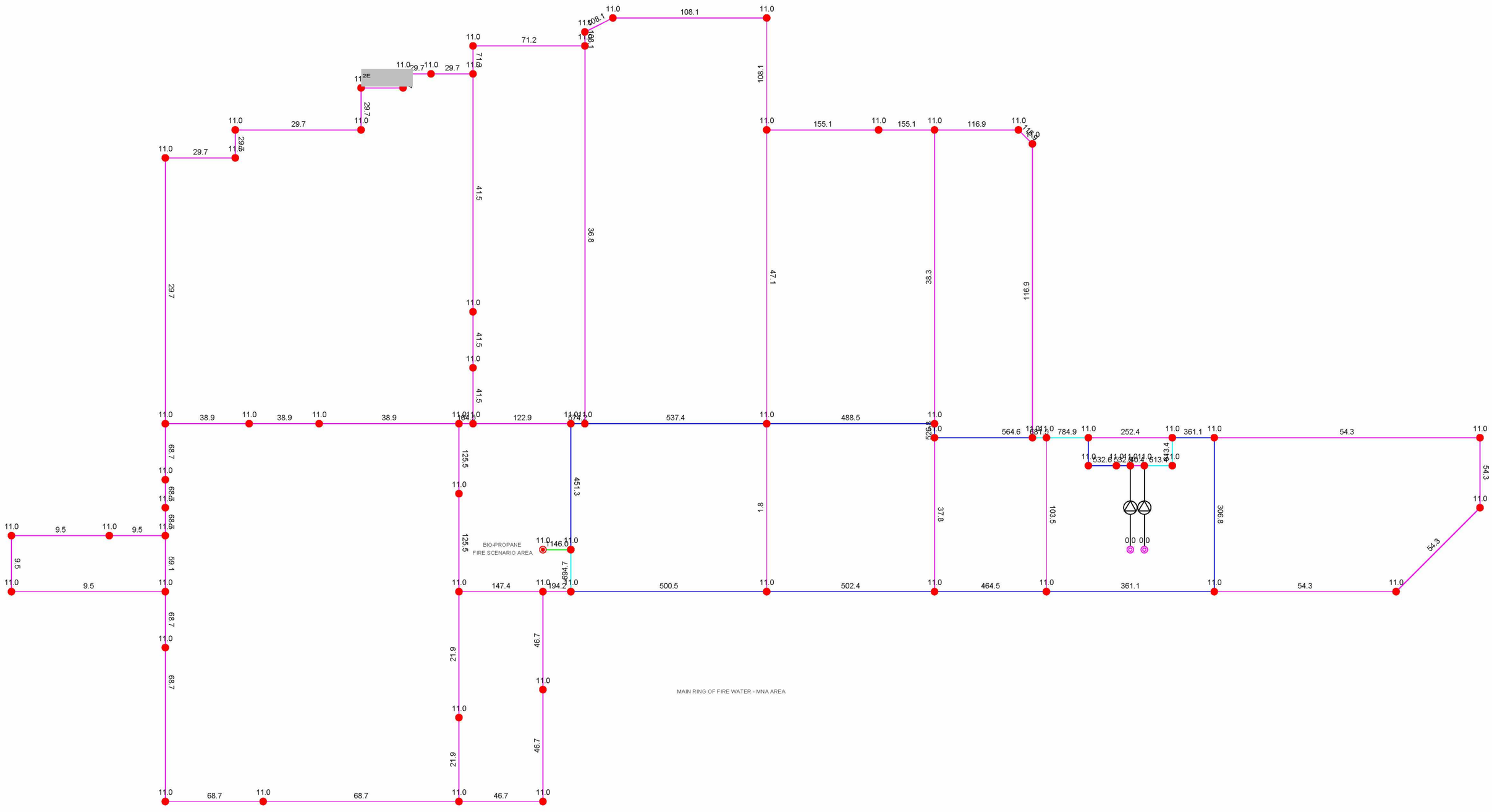
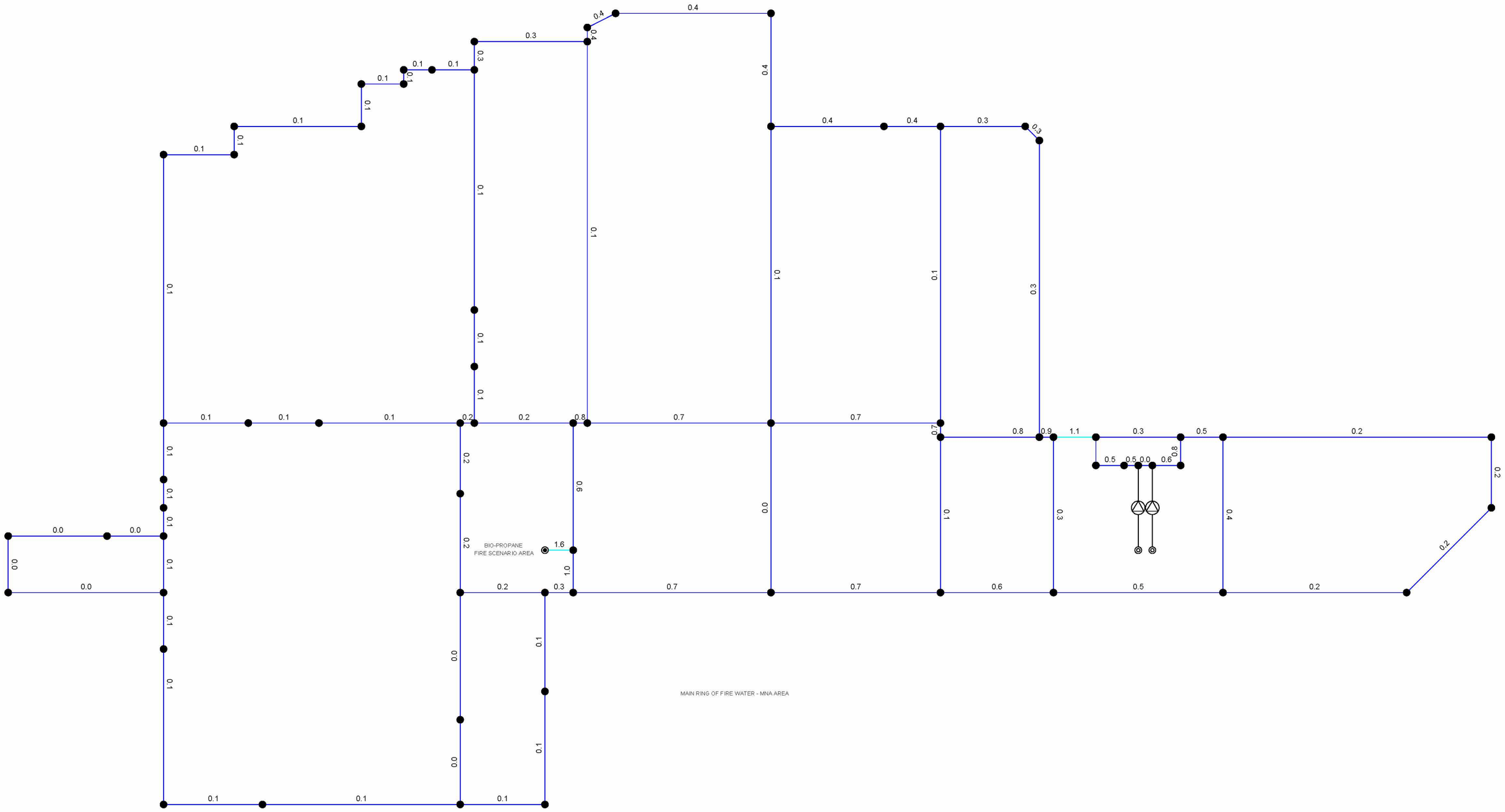


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

22:11 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	65	79	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	13	10	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	51	13	20.00	43.00	0.000	150.0	45.60
18	48	13	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
32	8	18	20.00	20.00	0.000	150.0	45.60
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	79	51	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
32	1 x 4	45.60		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	9.5322	9	14.0000	14.0000	*
2	82	12	38.9493	9	20.0000	20.0000	*
3	28	2	41.5352	9	20.0000	20.0000	*
4	27	72	9.5322	9	14.0000	14.0000	*
5	11	77	68.6524	9	20.0000	20.0000	*
6	65	79	21.9183	9	20.0000	20.0000	*
7	64	50	125.5098	9	20.0000	20.0000	*
8	84	6	68.6524	9	20.0000	20.0000	*
9	12	42	38.9493	9	20.0000	20.0000	*
10	2	47	41.5352	9	20.0000	20.0000	*
11	67	42	29.7030	9	18.0000	18.0000	*
12	9	63	122.9239	9	20.0000	20.0000	*
13	13	10	194.1621	9	20.0000	20.0000	*
14	10	8	694.7035	9	20.0000	20.0000	*
15	28	17	29.7030	9	18.0000	18.0000	*
16	61	29	71.2382	9	12.0000	12.0000	*
17	51	13	147.4281	9	20.0000	20.0000	*
18	48	13	46.7340	9	16.0000	16.0000	*
19	65	3	46.7340	9	16.0000	16.0000	*
20	25	60	537.3867	9	20.0000	20.0000	*
21	62	20	502.3521	9	20.0000	20.0000	*
22	15	61	108.0745	9	12.0000	12.0000	*
23	56	14	108.0745	9	12.0000	12.0000	*
24	71	25	488.5013	9	20.0000	20.0000	*
25	59	46	155.1492	9	14.0000	14.0000	*
26	46	56	108.0745	9	12.0000	12.0000	*
27	9	8	451.2991	9	20.0000	20.0000	*
28	41	58	564.5773	9	20.0000	20.0000	*
29	21	22	103.4851	9	14.0000	14.0000	*
31	23	19	116.8886	9	14.0000	14.0000	*
32	8	18	1146.0026	9	20.0000	20.0000	*
33	20	10	500.5414	9	20.0000	20.0000	*
34	14	15	108.0745	9	12.0000	12.0000	*
35	29	28	71.2382	9	12.0000	12.0000	*
36	7	73	532.5991	9	24.0000	24.0000	*
37	26	22	361.0515	9	20.0000	20.0000	*
38	17	1	29.7030	9	18.0000	18.0000	*
39	32	16	29.7030	9	18.0000	18.0000	*
40	49	26	306.7608	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	54.2908	9	12.0000	12.0000	*
42	31	26	54.2908	9	12.0000	12.0000	*
43	1	32	29.7030	9	18.0000	18.0000	*
44	16	33	29.7030	9	18.0000	18.0000	*
45	30	35	54.2908	9	12.0000	12.0000	*
46	33	53	29.7030	9	18.0000	18.0000	*
47	35	31	54.2908	9	12.0000	12.0000	*
48	42	34	68.6524	9	20.0000	20.0000	*
53	24	23	116.8886	9	14.0000	14.0000	*
54	6	43	9.5322	9	14.0000	14.0000	*
55	55	44	613.4036	9	24.0000	24.0000	*
56	7	55	40.4016	9	24.0000	24.0000	*
57	45	21	784.9510	9	20.0000	20.0000	*
58	47	63	41.5352	9	20.0000	20.0000	*
59	46	25	47.0746	9	14.0000	14.0000	*
60	73	40	532.5991	9	24.0000	24.0000	*
61	20	25	1.8108	9	14.0000	14.0000	*
62	50	51	125.5098	9	20.0000	20.0000	*
64	3	48	46.7340	9	16.0000	16.0000	*
66	54	57	68.6524	9	20.0000	20.0000	*
67	40	45	532.5991	9	20.0000	20.0000	*
68	19	59	155.1492	9	14.0000	14.0000	*
69	61	60	36.8363	9	12.0000	12.0000	*
70	53	66	29.7030	9	18.0000	18.0000	*
71	58	71	526.7618	9	20.0000	20.0000	*
72	60	9	574.2230	9	20.0000	20.0000	*
73	22	62	464.5367	9	20.0000	20.0000	*
74	58	62	37.8155	9	14.0000	14.0000	*
75	68	49	361.0515	9	20.0000	20.0000	*
76	63	64	164.4591	9	20.0000	20.0000	*
77	66	67	29.7030	9	18.0000	18.0000	*
78	44	68	613.4036	9	20.0000	20.0000	*
79	41	24	116.8886	9	14.0000	14.0000	*
80	68	45	252.3520	9	20.0000	20.0000	*
81	21	41	681.4659	9	20.0000	20.0000	*
82	71	19	38.2605	9	14.0000	14.0000	*
83	72	54	9.5322	9	14.0000	14.0000	*
84	6	54	59.1202	9	20.0000	20.0000	*
86	57	11	68.6524	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	77	65	68.6524	9	20.0000	20.0000	*
91	79	51	21.9183	9	20.0000	20.0000	*
94	64	82	38.9493	9	20.0000	20.0000	*
96	34	84	68.6524	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.99	10.99	9.5367E-06	0.000	9.532	2.6661E-02
2	82	12	20.00	10.99	10.99	1.7166E-05	1.7166E-05	38.95	5.3380E-02
3	28	2	20.00	10.99	10.99	5.5313E-05	5.5313E-05	41.54	5.6924E-02
4	27	72	14.00	10.99	10.99	2.0027E-05	2.0027E-05	9.532	2.6661E-02
5	11	77	20.00	10.99	10.99	1.3256E-04	1.3256E-04	68.65	9.4088E-02
6	65	79	20.00	10.99	10.99	9.5367E-06	0.000	21.92	3.0039E-02
7	64	50	20.00	10.99	10.99	4.5204E-04	4.5204E-04	125.5	0.1720
8	84	6	20.00	10.99	10.99	5.0545E-05	5.0545E-05	68.65	9.4088E-02
9	12	42	20.00	10.99	10.99	3.0518E-05	3.0518E-05	38.95	5.3380E-02
10	2	47	20.00	10.99	10.99	2.1935E-05	2.1935E-05	41.54	5.6924E-02
11	67	42	18.00	10.99	10.99	8.2970E-05	8.2970E-05	29.70	5.0257E-02
12	9	63	20.00	10.99	10.99	2.0695E-04	2.0695E-04	122.9	0.1685
13	13	10	20.00	10.99	10.99	1.2016E-04	1.2016E-04	194.2	0.2661
14	10	8	20.00	10.99	10.99	5.4922E-03	5.4922E-03	694.7	0.9521
15	28	17	18.00	10.99	10.99	1.5259E-05	1.5259E-05	29.70	5.0257E-02
16	61	29	12.00	11.00	10.99	1.4400E-03	1.4400E-03	71.24	0.2712
17	51	13	20.00	10.99	10.99	6.2752E-04	6.2752E-04	147.4	0.2021
18	48	13	16.00	10.99	10.99	1.9264E-04	1.9264E-04	46.73	0.1001
19	65	3	16.00	10.99	10.99	1.9741E-04	1.9741E-04	46.73	0.1001
20	25	60	20.00	11.00	10.99	8.0652E-03	8.0652E-03	537.4	0.7365
21	62	20	20.00	11.01	11.00	6.0949E-03	6.0949E-03	502.4	0.6885
22	15	61	12.00	11.00	11.00	5.3024E-04	5.3024E-04	108.1	0.4114
23	56	14	12.00	11.00	11.00	4.6806E-03	4.6806E-03	108.1	0.4114
24	71	25	20.00	11.01	11.00	5.7821E-03	5.7821E-03	488.5	0.6695
25	59	46	14.00	11.01	11.00	2.5806E-03	2.5806E-03	155.1	0.4339
26	46	56	12.00	11.00	11.00	1.6594E-03	1.6594E-03	108.1	0.4114
27	9	8	20.00	10.99	10.99	7.3900E-03	7.3900E-03	451.3	0.6185
28	41	58	20.00	11.01	11.01	5.0106E-03	5.0106E-03	564.6	0.7738
29	21	22	14.00	11.02	11.01	3.7832E-03	3.7832E-03	103.5	0.2894
31	23	19	14.00	11.01	11.01	1.1826E-03	1.1826E-03	116.9	0.3269
32	8	18	20.00	10.99	10.97	2.0662E-02	2.0662E-02	1146.	1.571
33	20	10	20.00	11.00	10.99	1.0928E-02	1.0928E-02	500.5	0.6860
34	14	15	12.00	11.00	11.00	8.1730E-04	8.1730E-04	108.1	0.4114
35	29	28	12.00	10.99	10.99	1.0395E-03	1.0395E-03	71.24	0.2712
36	7	73	24.00	11.03	11.03	2.0199E-03	2.0199E-03	532.6	0.5069
37	26	22	20.00	11.02	11.01	3.5725E-03	3.5725E-03	361.1	0.4948
38	17	1	18.00	10.99	10.99	2.1935E-05	2.1935E-05	29.70	5.0257E-02
39	32	16	18.00	10.99	10.99	2.0027E-05	2.0027E-05	29.70	5.0257E-02
40	49	26	20.00	11.02	11.02	5.7802E-03	5.7802E-03	306.8	0.4204
41	49	30	12.00	11.02	11.02	2.2726E-03	2.2726E-03	54.29	0.2067
42	31	26	12.00	11.02	11.02	1.6327E-03	1.6327E-03	54.29	0.2067

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	1	32	18.00	10.99	10.99	1.5259E-05	1.5259E-05	29.70	5.0257E-02
44	16	33	18.00	10.99	10.99	2.4796E-05	2.4796E-05	29.70	5.0257E-02
45	30	35	12.00	11.02	11.02	7.1526E-04	7.1526E-04	54.29	0.2067
46	33	53	18.00	10.99	10.99	4.2915E-05	4.2915E-05	29.70	5.0257E-02
47	35	31	12.00	11.02	11.02	1.1597E-03	1.1597E-03	54.29	0.2067
48	42	34	20.00	10.99	10.99	8.9645E-05	8.9645E-05	68.65	9.4088E-02
53	24	23	14.00	11.01	11.01	3.6812E-04	3.6812E-04	116.9	0.3269
54	6	43	14.00	10.99	10.99	2.0027E-05	2.0027E-05	9.532	2.6661E-02
55	55	44	24.00	11.03	11.03	3.4676E-03	3.4676E-03	613.4	0.5838
56	7	55	24.00	11.03	11.03	2.8610E-06	0.000	40.40	3.8452E-02
57	45	21	20.00	11.02	11.02	6.2571E-03	6.2571E-03	784.9	1.076
58	47	63	20.00	10.99	10.99	5.2452E-05	5.2452E-05	41.54	5.6924E-02
59	46	25	14.00	11.00	11.00	1.0595E-03	1.0595E-03	47.07	0.1317
60	73	40	24.00	11.03	11.03	9.3269E-04	9.3269E-04	532.6	0.5069
61	20	25	14.00	11.00	11.00	0.000	0.000	1.811	5.0646E-03
62	50	51	20.00	10.99	10.99	4.4823E-04	4.4823E-04	125.5	0.1720
64	3	48	16.00	10.99	10.99	2.6512E-04	2.6512E-04	46.73	0.1001
66	54	57	20.00	10.99	10.99	1.3733E-04	1.3733E-04	68.65	9.4088E-02
67	40	45	20.00	11.03	11.02	9.0551E-03	9.0551E-03	532.6	0.7299
68	19	59	14.00	11.01	11.01	1.4219E-03	1.4219E-03	155.1	0.4339
69	61	60	12.00	11.00	10.99	1.4372E-03	1.4372E-03	36.84	0.1402
70	53	66	18.00	10.99	10.99	2.1935E-05	2.1935E-05	29.70	5.0257E-02
71	58	71	20.00	11.01	11.01	8.9741E-04	8.9741E-04	526.8	0.7219
72	60	9	20.00	10.99	10.99	9.6512E-04	9.6512E-04	574.2	0.7870
73	22	62	20.00	11.01	11.01	3.4971E-03	3.4971E-03	464.5	0.6366
74	58	62	14.00	11.01	11.01	5.8460E-04	5.8460E-04	37.82	0.1058
75	68	49	20.00	11.02	11.02	7.4291E-04	7.4291E-04	361.1	0.4948
76	63	64	20.00	10.99	10.99	4.2915E-05	4.2915E-05	164.5	0.2254
77	66	67	18.00	10.99	10.99	1.5259E-05	1.5259E-05	29.70	5.0257E-02
78	44	68	20.00	11.03	11.02	8.4820E-03	8.4820E-03	613.4	0.8407
79	41	24	14.00	11.01	11.01	5.0774E-03	5.0774E-03	116.9	0.3269
80	68	45	20.00	11.02	11.02	5.5313E-05	5.5313E-05	252.4	0.3458
81	21	41	20.00	11.02	11.01	1.6851E-03	1.6851E-03	681.5	0.9339
82	71	19	14.00	11.01	11.01	7.2002E-04	7.2002E-04	38.26	0.1070
83	72	54	14.00	10.99	10.99	2.2888E-05	2.2888E-05	9.532	2.6661E-02
84	6	54	20.00	10.99	10.99	7.2479E-05	7.2479E-05	59.12	8.1024E-02
86	57	11	20.00	10.99	10.99	1.4973E-04	1.4973E-04	68.65	9.4088E-02
89	77	65	20.00	10.99	10.99	1.4019E-04	1.4019E-04	68.65	9.4088E-02
91	79	51	20.00	10.99	10.99	1.8120E-05	1.8120E-05	21.92	3.0039E-02
94	64	82	20.00	10.99	10.99	4.0054E-05	4.0054E-05	38.95	5.3380E-02
96	34	84	20.00	10.99	10.99	1.2398E-05	1.2398E-05	68.65	9.4088E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	573.0	0.000	11.03	11.03	10.17	9.0223E-02	1.7563E+05	100.0
2	573.0	0.000	11.03	11.03	10.17	9.0223E-02	1.7563E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	573.0	0.0000
69	0.000	*	573.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
18	10.97	1146.	*	346.07

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 16 Toxic release scenario in ammonia loading area – Case A
16.A PIPENET schematic layout with piping and nodes label
16.B PIPENET schematic layout with flow rate and pressure results
16.C PIPENET schematic layout with velocity results
16.D PIPENET input/output printout report

Attachment 16.A contains 1 page
Attachment 16.B contains 1 page
Attachment 16.C contains 1 page
Attachment 16.D contains 21 pages

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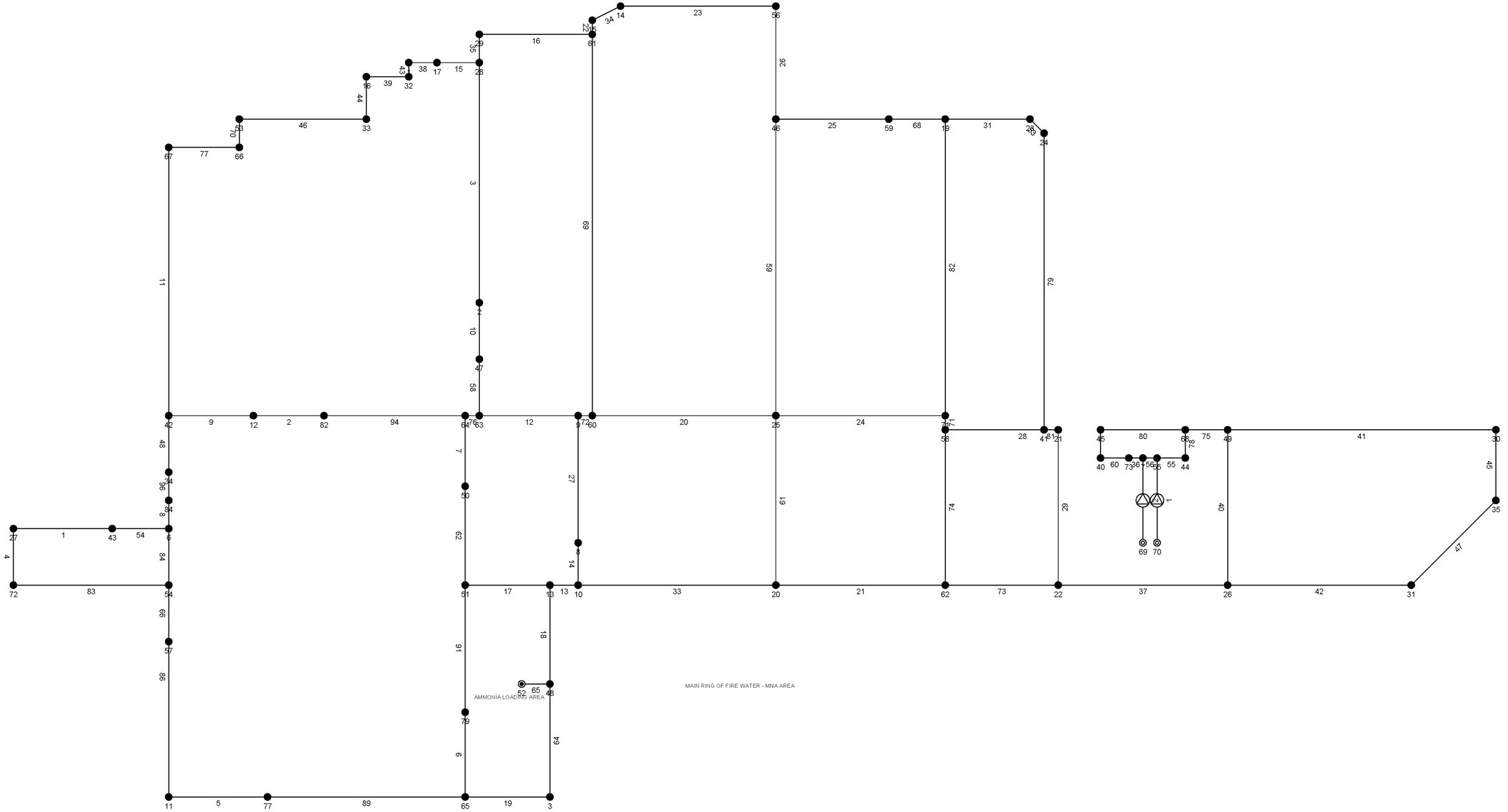
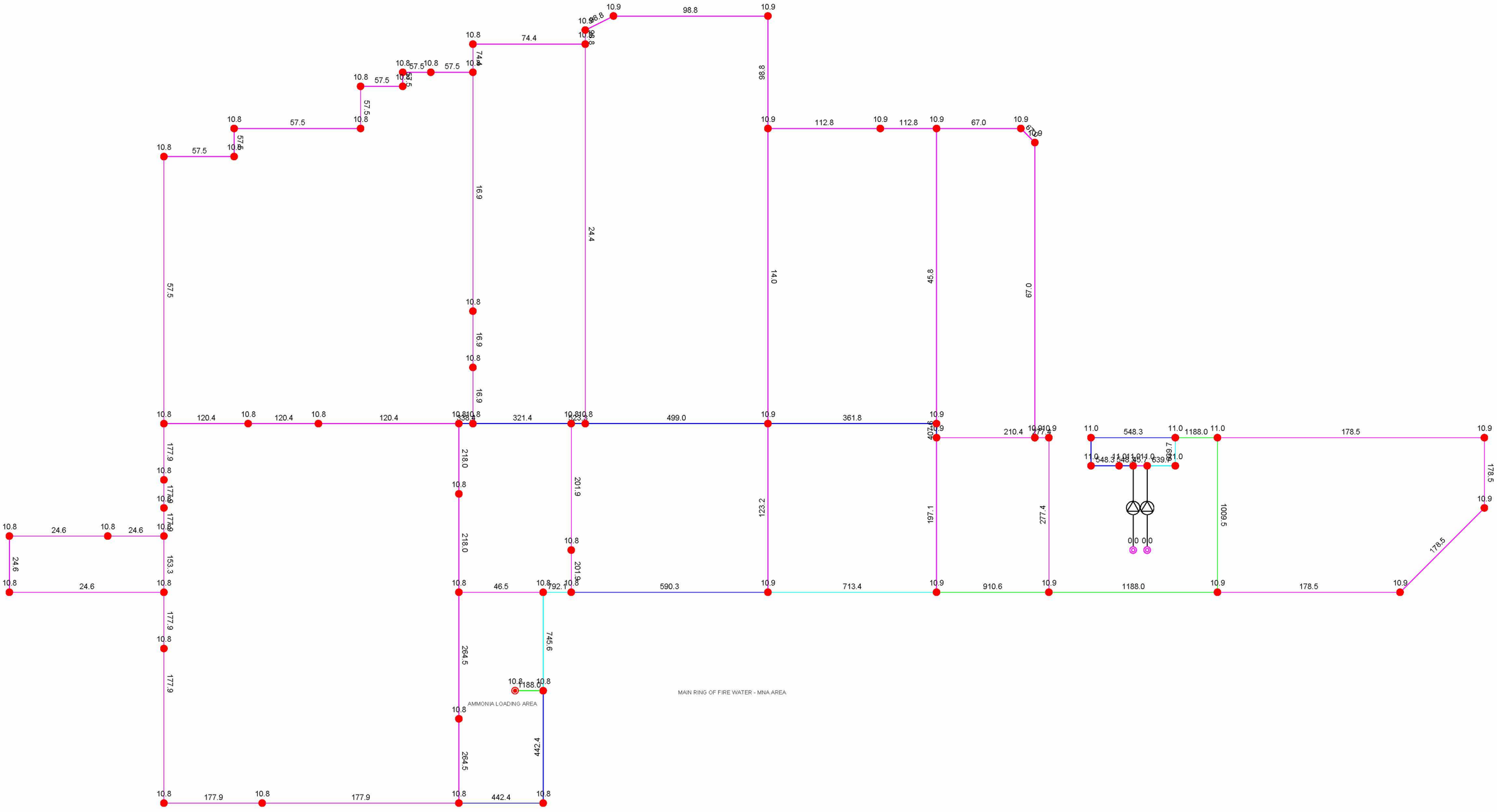
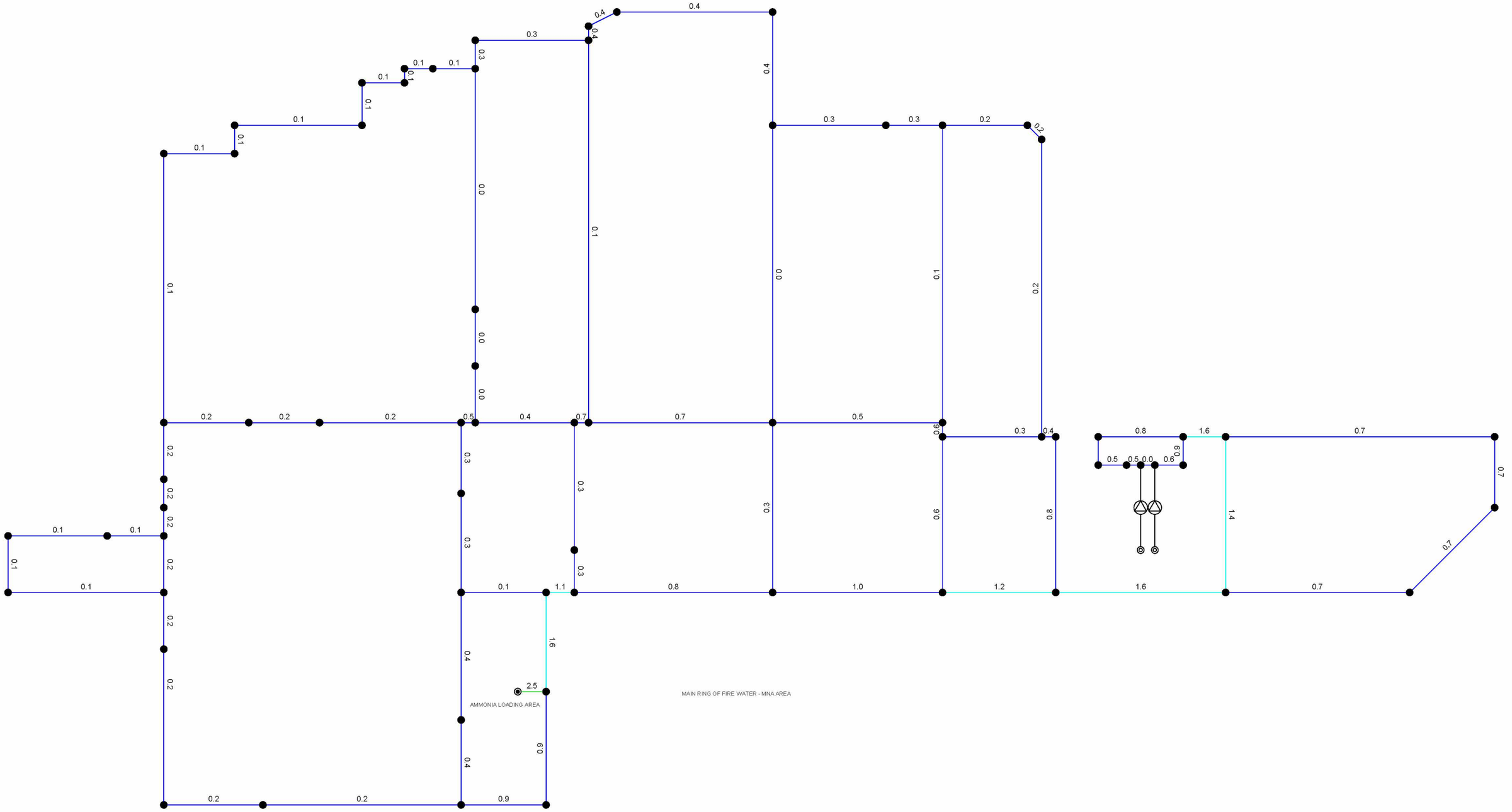


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

22:19 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.3000	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
65	48	52	16.00	20.00	0.000	150.0	35.92
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
65	1 x 4	35.92		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	24.6265	9	14.0000	14.0000	*
2	82	12	120.4079	9	20.0000	20.0000	*
3	28	2	16.9283	9	20.0000	20.0000	*
4	27	72	24.6265	9	14.0000	14.0000	*
5	11	77	177.8956	9	20.0000	20.0000	*
6	79	65	264.4798	9	20.0000	20.0000	*
7	64	50	217.9703	9	20.0000	20.0000	*
8	84	6	177.8956	9	20.0000	20.0000	*
9	12	42	120.4079	9	20.0000	20.0000	*
10	2	47	16.9283	9	20.0000	20.0000	*
11	67	42	57.4878	9	18.0000	18.0000	*
12	9	63	321.4499	9	20.0000	20.0000	*
13	10	13	792.1369	9	20.0000	20.0000	*
14	8	10	201.8763	9	20.0000	20.0000	*
15	28	17	57.4878	9	18.0000	18.0000	*
16	61	29	74.4161	9	12.0000	12.0000	*
17	13	51	46.5095	9	20.0000	20.0000	*
18	13	48	745.6273	9	16.0000	16.0000	*
19	65	3	442.3754	9	16.0000	16.0000	*
20	25	60	498.9638	9	20.0000	20.0000	*
21	62	20	713.4476	9	20.0000	20.0000	*
22	15	61	98.7784	9	12.0000	12.0000	*
23	56	14	98.7784	9	12.0000	12.0000	*
24	71	25	361.7889	9	20.0000	20.0000	*
25	59	46	112.7662	9	14.0000	14.0000	*
26	46	56	98.7784	9	12.0000	12.0000	*
27	9	8	201.8763	9	20.0000	20.0000	*
28	41	58	210.4371	9	20.0000	20.0000	*
29	22	21	277.4323	9	14.0000	14.0000	*
31	23	19	66.9952	9	14.0000	14.0000	*
33	20	10	590.2606	9	20.0000	20.0000	*
34	14	15	98.7784	9	12.0000	12.0000	*
35	29	28	74.4161	9	12.0000	12.0000	*
36	7	73	548.3260	9	24.0000	24.0000	*
37	26	22	1188.0028	9	20.0000	20.0000	*
38	17	1	57.4878	9	18.0000	18.0000	*
39	32	16	57.4878	9	18.0000	18.0000	*
40	49	26	1009.4633	9	20.0000	20.0000	*
41	49	30	178.5395	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	178.5395	9	12.0000	12.0000	*
43	1	32	57.4878	9	18.0000	18.0000	*
44	16	33	57.4878	9	18.0000	18.0000	*
45	30	35	178.5395	9	12.0000	12.0000	*
46	33	53	57.4878	9	18.0000	18.0000	*
47	35	31	178.5395	9	12.0000	12.0000	*
48	42	34	177.8956	9	20.0000	20.0000	*
53	24	23	66.9952	9	14.0000	14.0000	*
54	6	43	24.6265	9	14.0000	14.0000	*
55	55	44	639.6768	9	24.0000	24.0000	*
56	7	55	45.6746	9	24.0000	24.0000	*
58	47	63	16.9283	9	20.0000	20.0000	*
59	46	25	13.9879	9	14.0000	14.0000	*
60	73	40	548.3260	9	24.0000	24.0000	*
61	20	25	123.1870	9	14.0000	14.0000	*
62	50	51	217.9703	9	20.0000	20.0000	*
64	3	48	442.3754	9	16.0000	16.0000	*
65	48	52	1188.0027	9	16.0000	16.0000	*
66	54	57	177.8956	9	20.0000	20.0000	*
67	40	45	548.3260	9	20.0000	20.0000	*
68	19	59	112.7662	9	14.0000	14.0000	*
69	61	60	24.3623	9	12.0000	12.0000	*
70	53	66	57.4878	9	18.0000	18.0000	*
71	58	71	407.5599	9	20.0000	20.0000	*
72	60	9	523.3261	9	20.0000	20.0000	*
73	22	62	910.5704	9	20.0000	20.0000	*
74	62	58	197.1228	9	14.0000	14.0000	*
75	68	49	1188.0028	9	20.0000	20.0000	*
76	63	64	338.3781	9	20.0000	20.0000	*
77	66	67	57.4878	9	18.0000	18.0000	*
78	44	68	639.6768	9	20.0000	20.0000	*
79	41	24	66.9952	9	14.0000	14.0000	*
80	45	68	548.3260	9	20.0000	20.0000	*
81	21	41	277.4323	9	20.0000	20.0000	*
82	71	19	45.7710	9	14.0000	14.0000	*
83	72	54	24.6265	9	14.0000	14.0000	*
84	6	54	153.2691	9	20.0000	20.0000	*
86	57	11	177.8956	9	20.0000	20.0000	*
89	77	65	177.8956	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	264.4798	9	20.0000	20.0000	*
94	64	82	120.4079	9	20.0000	20.0000	*
96	34	84	177.8956	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.85	10.85	6.2943E-05	6.2943E-05	24.63	6.8879E-02
2	82	12	20.00	10.85	10.85	1.4687E-04	1.4687E-04	120.4	0.1650
3	28	2	20.00	10.85	10.85	9.5367E-06	0.000	16.93	2.3200E-02
4	27	72	14.00	10.85	10.85	1.1539E-04	1.1539E-04	24.63	6.8879E-02
5	11	77	20.00	10.84	10.84	7.8011E-04	7.8011E-04	177.9	0.2438
6	79	65	20.00	10.84	10.84	1.0452E-03	1.0452E-03	264.5	0.3625
7	64	50	20.00	10.85	10.85	1.2522E-03	1.2522E-03	218.0	0.2987
8	84	6	20.00	10.85	10.85	2.8229E-04	2.8229E-04	177.9	0.2438
9	12	42	20.00	10.85	10.85	2.2507E-04	2.2507E-04	120.4	0.1650
10	2	47	20.00	10.85	10.85	4.7684E-06	0.000	16.93	2.3200E-02
11	67	42	18.00	10.85	10.85	2.7180E-04	2.7180E-04	57.49	9.7268E-02
12	9	63	20.00	10.85	10.85	1.2331E-03	1.2331E-03	321.4	0.4405
13	10	13	20.00	10.85	10.85	1.5869E-03	1.5869E-03	792.1	1.086
14	8	10	20.00	10.85	10.85	5.5981E-04	5.5981E-04	201.9	0.2767
15	28	17	18.00	10.85	10.85	4.6730E-05	4.6730E-05	57.49	9.7268E-02
16	61	29	12.00	10.85	10.85	1.5574E-03	1.5574E-03	74.42	0.2833
17	13	51	20.00	10.85	10.84	7.5340E-05	7.5340E-05	46.51	6.3741E-02
18	13	48	16.00	10.85	10.81	3.2395E-02	3.2395E-02	745.6	1.597
19	65	3	16.00	10.84	10.83	1.2697E-02	1.2697E-02	442.4	0.9473
20	25	60	20.00	10.86	10.85	7.0448E-03	7.0448E-03	499.0	0.6838
21	62	20	20.00	10.87	10.86	1.1652E-02	1.1652E-02	713.4	0.9778
22	15	61	12.00	10.85	10.85	4.4727E-04	4.4727E-04	98.78	0.3760
23	56	14	12.00	10.86	10.85	3.9530E-03	3.9530E-03	98.78	0.3760
24	71	25	20.00	10.86	10.86	3.3283E-03	3.3283E-03	361.8	0.4958
25	59	46	14.00	10.86	10.86	1.4248E-03	1.4248E-03	112.8	0.3154
26	46	56	12.00	10.86	10.86	1.4048E-03	1.4048E-03	98.78	0.3760
27	9	8	20.00	10.85	10.85	1.6708E-03	1.6708E-03	201.9	0.2767
28	41	58	20.00	10.86	10.86	8.0681E-04	8.0681E-04	210.4	0.2884
29	22	21	14.00	10.89	10.86	2.3490E-02	2.3490E-02	277.4	0.7760
31	23	19	14.00	10.86	10.86	4.2248E-04	4.2248E-04	67.00	0.1874
33	20	10	20.00	10.86	10.85	1.4803E-02	1.4803E-02	590.3	0.8090
34	14	15	12.00	10.85	10.85	6.9237E-04	6.9237E-04	98.78	0.3760
35	29	28	12.00	10.85	10.85	1.1282E-03	1.1282E-03	74.42	0.2833
36	7	73	24.00	10.99	10.99	2.1296E-03	2.1296E-03	548.3	0.5219
37	26	22	20.00	10.92	10.89	3.2323E-02	3.2323E-02	1188.	1.628
38	17	1	18.00	10.85	10.85	8.0109E-05	8.0109E-05	57.49	9.7268E-02
39	32	16	18.00	10.85	10.85	6.6757E-05	6.6757E-05	57.49	9.7268E-02
40	49	26	20.00	10.97	10.92	5.2324E-02	5.2324E-02	1009.	1.383
41	49	30	12.00	10.97	10.95	2.0572E-02	2.0572E-02	178.5	0.6797
42	31	26	12.00	10.93	10.92	1.4780E-02	1.4780E-02	178.5	0.6797
43	1	32	18.00	10.85	10.85	5.0545E-05	5.0545E-05	57.49	9.7268E-02

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.85	10.85	8.7738E-05	8.7738E-05	57.49	9.7268E-02
45	30	35	12.00	10.95	10.94	6.4726E-03	6.4726E-03	178.5	0.6797
46	33	53	18.00	10.85	10.85	1.4496E-04	1.4496E-04	57.49	9.7268E-02
47	35	31	12.00	10.94	10.93	1.0500E-02	1.0500E-02	178.5	0.6797
48	42	34	20.00	10.85	10.85	5.2261E-04	5.2261E-04	177.9	0.2438
53	24	23	14.00	10.86	10.86	1.3256E-04	1.3256E-04	67.00	0.1874
54	6	43	14.00	10.85	10.85	1.1730E-04	1.1730E-04	24.63	6.8879E-02
55	55	44	24.00	10.99	10.99	3.7451E-03	3.7451E-03	639.7	0.6088
56	7	55	24.00	10.99	10.99	1.9073E-06	0.000	45.67	4.3470E-02
58	47	63	20.00	10.85	10.85	1.0490E-05	1.0490E-05	16.93	2.3200E-02
59	46	25	14.00	10.86	10.86	1.1539E-04	1.1539E-04	13.99	3.9123E-02
60	73	40	24.00	10.99	10.99	9.8801E-04	9.8801E-04	548.3	0.5219
61	20	25	14.00	10.86	10.86	4.7131E-03	4.7131E-03	123.2	0.3445
62	50	51	20.00	10.85	10.84	1.2426E-03	1.2426E-03	218.0	0.2987
64	3	48	16.00	10.83	10.81	1.6860E-02	1.6860E-02	442.4	0.9473
65	48	52	16.00	10.81	10.76	5.5822E-02	5.5822E-02	1188.	2.544
66	54	57	20.00	10.85	10.84	8.0013E-04	8.0013E-04	177.9	0.2438
67	40	45	20.00	10.99	10.98	9.5549E-03	9.5549E-03	548.3	0.7515
68	19	59	14.00	10.86	10.86	7.8773E-04	7.8773E-04	112.8	0.3154
69	61	60	12.00	10.85	10.85	6.6280E-04	6.6280E-04	24.36	9.2746E-02
70	53	66	18.00	10.85	10.85	7.2479E-05	7.2479E-05	57.49	9.7268E-02
71	58	71	20.00	10.86	10.86	5.5981E-04	5.5981E-04	407.6	0.5586
72	60	9	20.00	10.85	10.85	8.1444E-04	8.1444E-04	523.3	0.7172
73	22	62	20.00	10.89	10.87	1.2140E-02	1.2140E-02	910.6	1.248
74	62	58	14.00	10.87	10.86	1.2477E-02	1.2477E-02	197.1	0.5513
75	68	49	20.00	10.98	10.97	6.7329E-03	6.7329E-03	1188.	1.628
76	63	64	20.00	10.85	10.85	1.6499E-04	1.6499E-04	338.4	0.4637
77	66	67	18.00	10.85	10.85	5.8174E-05	5.8174E-05	57.49	9.7268E-02
78	44	68	20.00	10.99	10.98	9.1677E-03	9.1677E-03	639.7	0.8767
79	41	24	14.00	10.86	10.86	1.8120E-03	1.8120E-03	67.00	0.1874
80	45	68	20.00	10.98	10.98	2.4223E-04	2.4223E-04	548.3	0.7515
81	21	41	20.00	10.86	10.86	3.2043E-04	3.2043E-04	277.4	0.3802
82	71	19	14.00	10.86	10.86	1.0004E-03	1.0004E-03	45.77	0.1280
83	72	54	14.00	10.85	10.85	1.3447E-04	1.3447E-04	24.63	6.8879E-02
84	6	54	20.00	10.85	10.85	4.3011E-04	4.3011E-04	153.3	0.2101
86	57	11	20.00	10.84	10.84	8.6784E-04	8.6784E-04	177.9	0.2438
89	77	65	20.00	10.84	10.84	8.0490E-04	8.0490E-04	177.9	0.2438
91	51	79	20.00	10.84	10.84	1.7176E-03	1.7176E-03	264.5	0.3625
94	64	82	20.00	10.85	10.85	3.1757E-04	3.1757E-04	120.4	0.1650
96	34	84	20.00	10.85	10.85	8.0109E-05	8.0109E-05	177.9	0.2438

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	594.0	0.000	10.99	10.99	10.17	9.0593E-02	1.8133E+05	100.0
2	594.0	0.000	10.99	10.99	10.17	9.0593E-02	1.8133E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	594.0	0.0000
69	0.000	*	594.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
52	10.76	1188.	*	362.22

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 17 Toxic release scenario in ammonia loading area – Case B
17.A PIPENET schematic layout with piping and nodes label
17.B PIPENET schematic layout with flow rate and pressure results
17.C PIPENET schematic layout with velocity results
17.D PIPENET input/output printout report

Attachment 17.A contains 1 page
Attachment 17.B contains 1 page
Attachment 17.C contains 1 page
Attachment 17.D contains 21 pages

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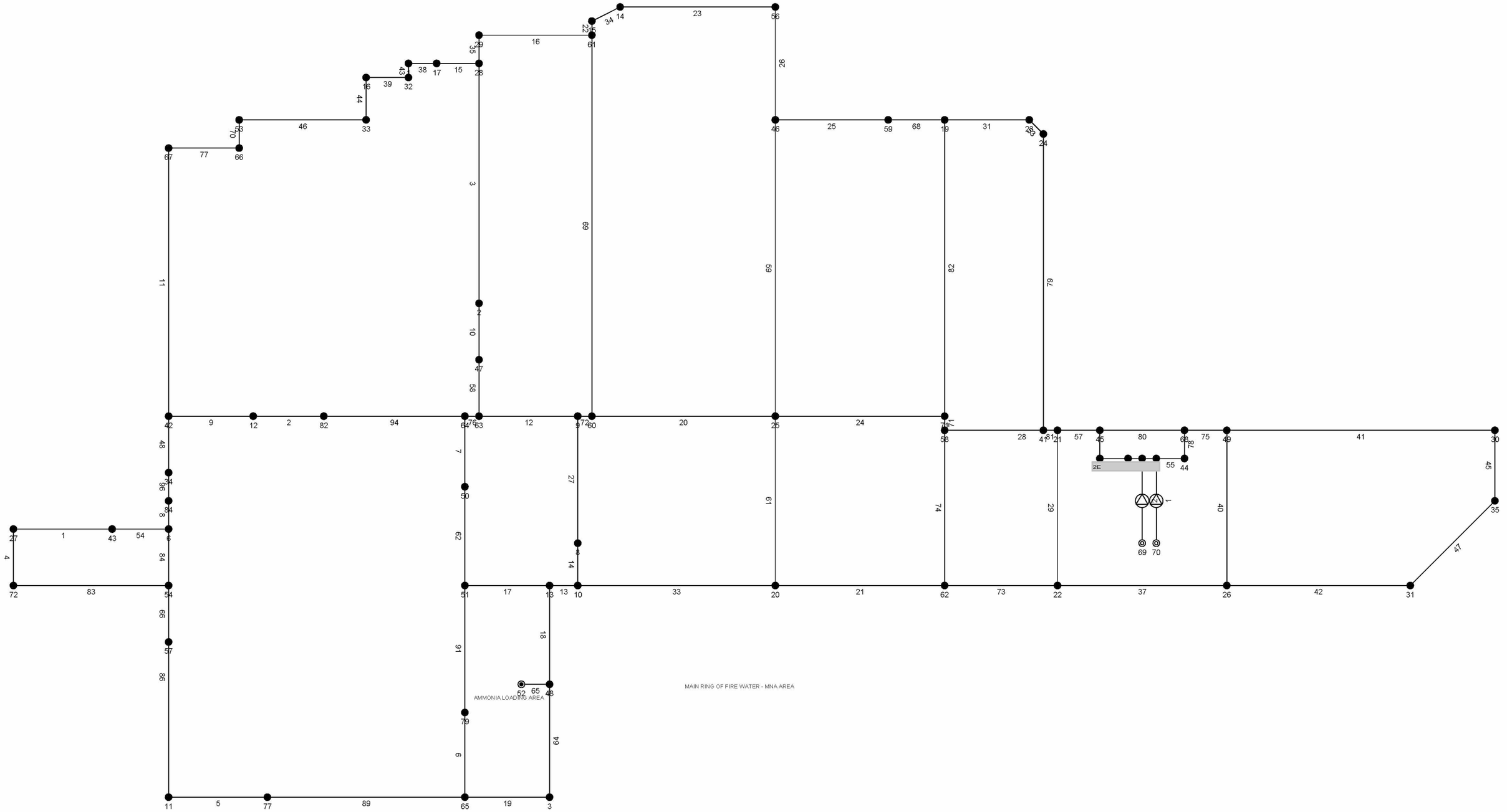
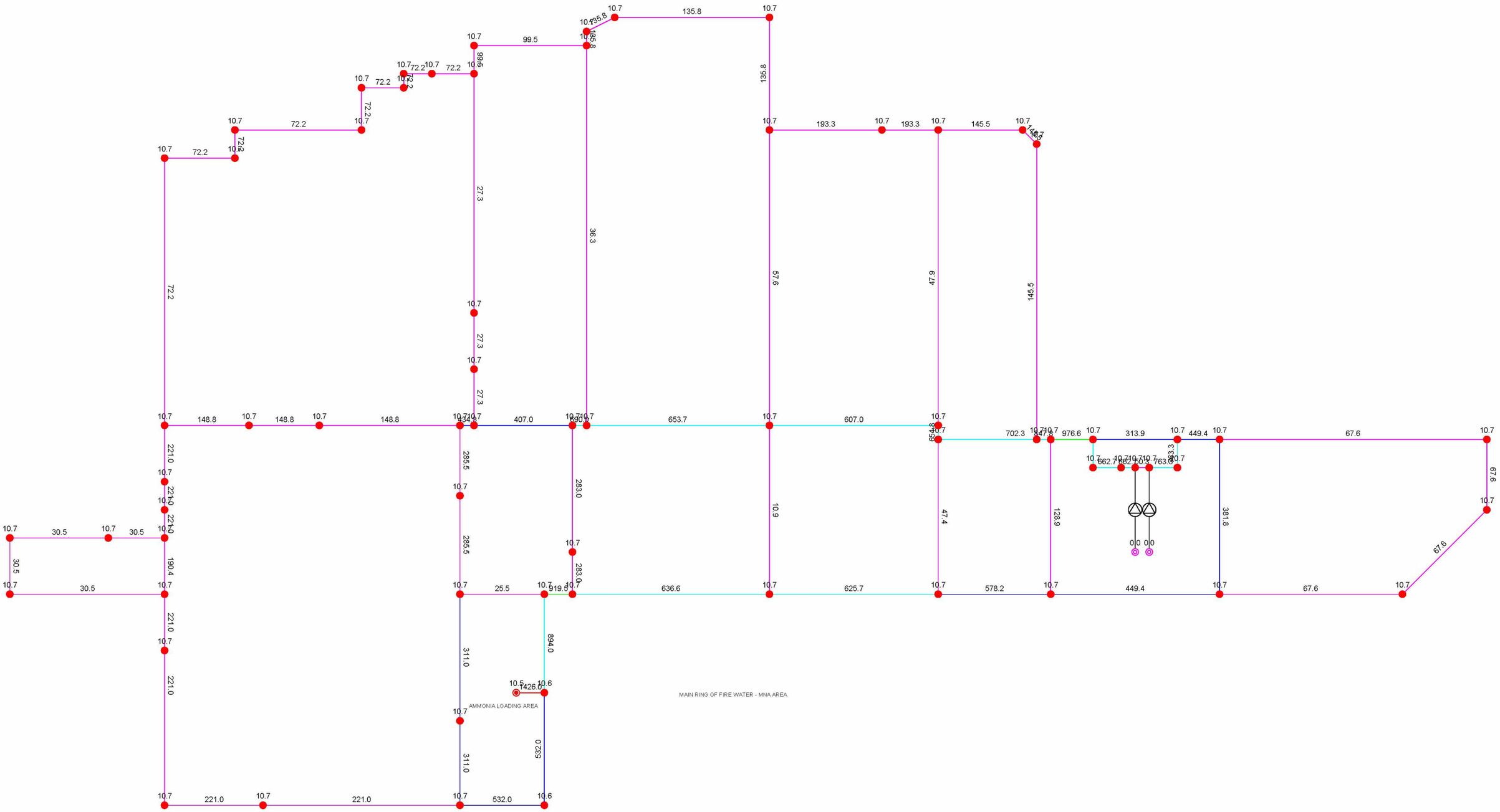
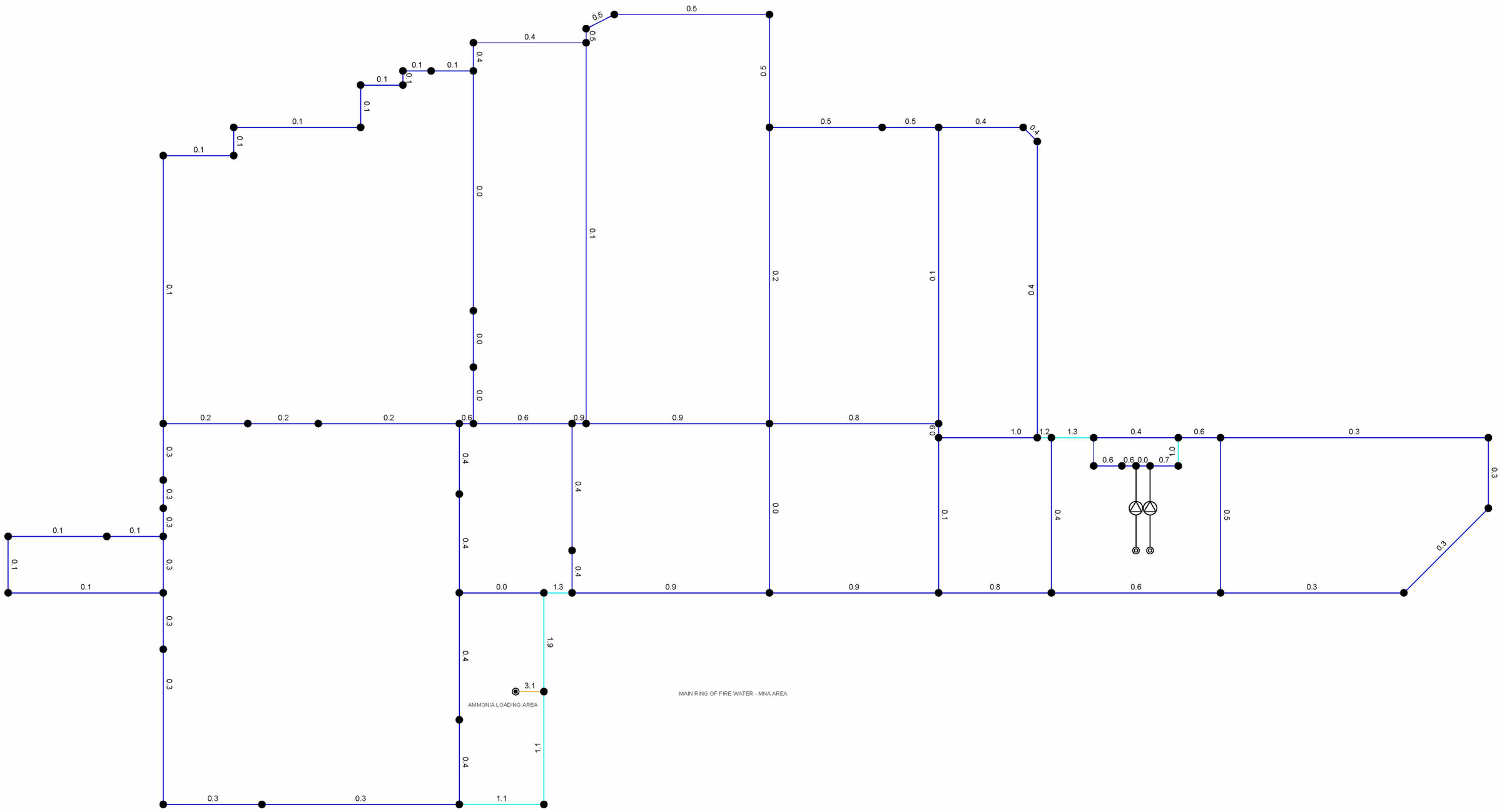


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m³/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

22:31 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	11	77	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	64	50	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	65	3	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	47	63	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	25	20	14.00	132.0	0.000	150.0	30.86
62	50	51	20.00	85.00	0.000	150.0	0.000
64	3	48	16.00	91.00	0.000	150.0	13.82
65	48	52	16.00	20.00	0.000	150.0	35.92
66	54	57	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	6	54	20.00	56.00	0.000	150.0	0.000
86	57	11	20.00	86.00	0.000	150.0	0.000
89	77	65	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
65	1 x 4	35.92		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	30.5188	9	14.0000	14.0000	*
2	82	12	148.7875	9	20.0000	20.0000	*
3	28	2	27.3078	9	20.0000	20.0000	*
4	27	72	30.5188	9	14.0000	14.0000	*
5	11	77	220.9591	9	20.0000	20.0000	*
6	79	65	311.0446	9	20.0000	20.0000	*
7	64	50	285.5274	9	20.0000	20.0000	*
8	84	6	220.9591	9	20.0000	20.0000	*
9	12	42	148.7875	9	20.0000	20.0000	*
10	2	47	27.3078	9	20.0000	20.0000	*
11	67	42	72.1716	9	18.0000	18.0000	*
12	9	63	407.0070	9	20.0000	20.0000	*
13	10	13	919.5169	9	20.0000	20.0000	*
14	8	10	282.9577	9	20.0000	20.0000	*
15	28	17	72.1716	9	18.0000	18.0000	*
16	61	29	99.4794	9	12.0000	12.0000	*
17	13	51	25.5172	9	20.0000	20.0000	*
18	13	48	893.9997	9	16.0000	16.0000	*
19	65	3	532.0035	9	16.0000	16.0000	*
20	25	60	653.6622	9	20.0000	20.0000	*
21	62	20	625.6700	9	20.0000	20.0000	*
22	15	61	135.7820	9	12.0000	12.0000	*
23	56	14	135.7820	9	12.0000	12.0000	*
24	71	25	606.9861	9	20.0000	20.0000	*
25	59	46	193.3472	9	14.0000	14.0000	*
26	46	56	135.7820	9	12.0000	12.0000	*
27	9	8	282.9577	9	20.0000	20.0000	*
28	41	58	702.2834	9	20.0000	20.0000	*
29	21	22	128.8670	9	14.0000	14.0000	*
31	23	19	145.4825	9	14.0000	14.0000	*
33	20	10	636.5593	9	20.0000	20.0000	*
34	14	15	135.7820	9	12.0000	12.0000	*
35	29	28	99.4794	9	12.0000	12.0000	*
36	7	73	662.7271	9	24.0000	24.0000	*
37	26	22	449.3704	9	20.0000	20.0000	*
38	17	1	72.1716	9	18.0000	18.0000	*
39	32	16	72.1716	9	18.0000	18.0000	*
40	49	26	381.8068	9	20.0000	20.0000	*
41	49	30	67.5636	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	67.5636	9	12.0000	12.0000	*
43	1	32	72.1716	9	18.0000	18.0000	*
44	16	33	72.1716	9	18.0000	18.0000	*
45	30	35	67.5636	9	12.0000	12.0000	*
46	33	53	72.1716	9	18.0000	18.0000	*
47	35	31	67.5636	9	12.0000	12.0000	*
48	42	34	220.9591	9	20.0000	20.0000	*
53	24	23	145.4825	9	14.0000	14.0000	*
54	6	43	30.5188	9	14.0000	14.0000	*
55	55	44	763.2761	9	24.0000	24.0000	*
56	7	55	50.2736	9	24.0000	24.0000	*
57	45	21	976.6329	9	20.0000	20.0000	*
58	47	63	27.3078	9	20.0000	20.0000	*
59	46	25	57.5652	9	14.0000	14.0000	*
60	73	40	662.7271	9	24.0000	24.0000	*
61	25	20	10.8892	9	14.0000	14.0000	*
62	50	51	285.5274	9	20.0000	20.0000	*
64	3	48	532.0035	9	16.0000	16.0000	*
65	48	52	1426.0032	9	16.0000	16.0000	*
66	54	57	220.9591	9	20.0000	20.0000	*
67	40	45	662.7272	9	20.0000	20.0000	*
68	19	59	193.3472	9	14.0000	14.0000	*
69	61	60	36.3026	9	12.0000	12.0000	*
70	53	66	72.1716	9	18.0000	18.0000	*
71	58	71	654.8508	9	20.0000	20.0000	*
72	60	9	689.9648	9	20.0000	20.0000	*
73	22	62	578.2374	9	20.0000	20.0000	*
74	58	62	47.4326	9	14.0000	14.0000	*
75	68	49	449.3704	9	20.0000	20.0000	*
76	63	64	434.3148	9	20.0000	20.0000	*
77	66	67	72.1716	9	18.0000	18.0000	*
78	44	68	763.2762	9	20.0000	20.0000	*
79	41	24	145.4825	9	14.0000	14.0000	*
80	68	45	313.9057	9	20.0000	20.0000	*
81	21	41	847.7658	9	20.0000	20.0000	*
82	71	19	47.8647	9	14.0000	14.0000	*
83	72	54	30.5188	9	14.0000	14.0000	*
84	6	54	190.4403	9	20.0000	20.0000	*
86	57	11	220.9591	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	77	65	220.9591	9	20.0000	20.0000	*
91	51	79	311.0446	9	20.0000	20.0000	*
94	64	82	148.7875	9	20.0000	20.0000	*
96	34	84	220.9591	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	10.67	10.67	9.4414E-05	9.4414E-05	30.52	8.5359E-02
2	82	12	20.00	10.67	10.67	2.1744E-04	2.1744E-04	148.8	0.2039
3	28	2	20.00	10.67	10.67	2.4796E-05	2.4796E-05	27.31	3.7425E-02
4	27	72	14.00	10.67	10.67	1.7262E-04	1.7262E-04	30.52	8.5359E-02
5	11	77	20.00	10.67	10.67	1.1644E-03	1.1644E-03	221.0	0.3028
6	79	65	20.00	10.67	10.66	1.4124E-03	1.4124E-03	311.0	0.4263
7	64	50	20.00	10.67	10.67	2.0628E-03	2.0628E-03	285.5	0.3913
8	84	6	20.00	10.67	10.67	4.2057E-04	4.2057E-04	221.0	0.3028
9	12	42	20.00	10.67	10.67	3.3283E-04	3.3283E-04	148.8	0.2039
10	2	47	20.00	10.67	10.67	1.0490E-05	1.0490E-05	27.31	3.7425E-02
11	67	42	18.00	10.67	10.67	4.1485E-04	4.1485E-04	72.17	0.1221
12	9	63	20.00	10.67	10.67	1.9054E-03	1.9054E-03	407.0	0.5578
13	10	13	20.00	10.67	10.67	2.0952E-03	2.0952E-03	919.5	1.260
14	8	10	20.00	10.67	10.67	1.0395E-03	1.0395E-03	283.0	0.3878
15	28	17	18.00	10.67	10.67	7.2479E-05	7.2479E-05	72.17	0.1221
16	61	29	12.00	10.68	10.67	2.6674E-03	2.6674E-03	99.48	0.3787
17	13	51	20.00	10.67	10.67	2.4796E-05	2.4796E-05	25.52	3.4971E-02
18	13	48	16.00	10.67	10.62	4.5325E-02	4.5325E-02	894.0	1.914
19	65	3	16.00	10.66	10.65	1.7856E-02	1.7856E-02	532.0	1.139
20	25	60	20.00	10.69	10.68	1.1587E-02	1.1587E-02	653.7	0.8958
21	62	20	20.00	10.70	10.69	9.1476E-03	9.1476E-03	625.7	0.8575
22	15	61	12.00	10.68	10.68	8.0967E-04	8.0967E-04	135.8	0.5169
23	56	14	12.00	10.69	10.68	7.1373E-03	7.1373E-03	135.8	0.5169
24	71	25	20.00	10.70	10.69	8.6422E-03	8.6422E-03	607.0	0.8319
25	59	46	14.00	10.69	10.69	3.8748E-03	3.8748E-03	193.3	0.5408
26	46	56	12.00	10.69	10.69	2.5330E-03	2.5330E-03	135.8	0.5169
27	9	8	20.00	10.67	10.67	3.1157E-03	3.1157E-03	283.0	0.3878
28	41	58	20.00	10.70	10.70	7.5054E-03	7.5054E-03	702.3	0.9625
29	21	22	14.00	10.71	10.70	5.6734E-03	5.6734E-03	128.9	0.3604
31	23	19	14.00	10.70	10.69	1.7729E-03	1.7729E-03	145.5	0.4069
33	20	10	20.00	10.69	10.67	1.7045E-02	1.7045E-02	636.6	0.8724
34	14	15	12.00	10.68	10.68	1.2503E-03	1.2503E-03	135.8	0.5169
35	29	28	12.00	10.67	10.67	1.9302E-03	1.9302E-03	99.48	0.3787
36	7	73	24.00	10.73	10.73	3.0251E-03	3.0251E-03	662.7	0.6307
37	26	22	20.00	10.71	10.70	5.3530E-03	5.3530E-03	449.4	0.6159
38	17	1	18.00	10.67	10.67	1.2207E-04	1.2207E-04	72.17	0.1221
39	32	16	18.00	10.67	10.67	1.0300E-04	1.0300E-04	72.17	0.1221
40	49	26	20.00	10.72	10.71	8.6622E-03	8.6622E-03	381.8	0.5233
41	49	30	12.00	10.72	10.71	3.4046E-03	3.4046E-03	67.56	0.2572
42	31	26	12.00	10.71	10.71	2.4471E-03	2.4471E-03	67.56	0.2572
43	1	32	18.00	10.67	10.67	7.5340E-05	7.5340E-05	72.17	0.1221

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.67	10.67	1.3161E-04	1.3161E-04	72.17	0.1221
45	30	35	12.00	10.71	10.71	1.0729E-03	1.0729E-03	67.56	0.2572
46	33	53	18.00	10.67	10.67	2.2507E-04	2.2507E-04	72.17	0.1221
47	35	31	12.00	10.71	10.71	1.7376E-03	1.7376E-03	67.56	0.2572
48	42	34	20.00	10.67	10.67	7.8297E-04	7.8297E-04	221.0	0.3028
53	24	23	14.00	10.70	10.70	5.5027E-04	5.5027E-04	145.5	0.4069
54	6	43	14.00	10.67	10.67	1.7262E-04	1.7262E-04	30.52	8.5359E-02
55	55	44	24.00	10.73	10.73	5.1947E-03	5.1947E-03	763.3	0.7264
56	7	55	24.00	10.73	10.73	2.8610E-06	0.000	50.27	4.7847E-02
57	45	21	20.00	10.72	10.71	9.3718E-03	9.3718E-03	976.6	1.338
58	47	63	20.00	10.67	10.67	2.4796E-05	2.4796E-05	27.31	3.7425E-02
59	46	25	14.00	10.69	10.69	1.5402E-03	1.5402E-03	57.57	0.1610
60	73	40	24.00	10.73	10.73	1.4000E-03	1.4000E-03	662.7	0.6307
61	25	20	14.00	10.69	10.69	5.2452E-05	5.2452E-05	10.89	3.0456E-02
62	50	51	20.00	10.67	10.67	2.0475E-03	2.0475E-03	285.5	0.3913
64	3	48	16.00	10.65	10.62	2.3715E-02	2.3715E-02	532.0	1.139
65	48	52	16.00	10.62	10.54	7.8258E-02	7.8258E-02	1426.	3.054
66	54	57	20.00	10.67	10.67	1.1978E-03	1.1978E-03	221.0	0.3028
67	40	45	20.00	10.73	10.72	1.3568E-02	1.3568E-02	662.7	0.9083
68	19	59	14.00	10.69	10.69	2.1372E-03	2.1372E-03	193.3	0.5408
69	61	60	12.00	10.68	10.68	1.3971E-03	1.3971E-03	36.30	0.1382
70	53	66	18.00	10.67	10.67	1.0777E-04	1.0777E-04	72.17	0.1221
71	58	71	20.00	10.70	10.70	1.3399E-03	1.3399E-03	654.8	0.8975
72	60	9	20.00	10.68	10.67	1.3552E-03	1.3552E-03	690.0	0.9456
73	22	62	20.00	10.70	10.70	5.2443E-03	5.2443E-03	578.2	0.7925
74	58	62	14.00	10.70	10.70	8.8692E-04	8.8692E-04	47.43	0.1327
75	68	49	20.00	10.72	10.72	1.1148E-03	1.1148E-03	449.4	0.6159
76	63	64	20.00	10.67	10.67	2.5940E-04	2.5940E-04	434.3	0.5952
77	66	67	18.00	10.67	10.67	8.7738E-05	8.7738E-05	72.17	0.1221
78	44	68	20.00	10.73	10.72	1.2711E-02	1.2711E-02	763.3	1.046
79	41	24	14.00	10.70	10.70	7.6122E-03	7.6122E-03	145.5	0.4069
80	68	45	20.00	10.72	10.72	8.4877E-05	8.4877E-05	313.9	0.4302
81	21	41	20.00	10.71	10.70	2.5253E-03	2.5253E-03	847.8	1.162
82	71	19	14.00	10.70	10.69	1.0900E-03	1.0900E-03	47.86	0.1339
83	72	54	14.00	10.67	10.67	2.0027E-04	2.0027E-04	30.52	8.5359E-02
84	6	54	20.00	10.67	10.67	6.3992E-04	6.3992E-04	190.4	0.2610
86	57	11	20.00	10.67	10.67	1.2922E-03	1.2922E-03	221.0	0.3028
89	77	65	20.00	10.67	10.66	1.2026E-03	1.2026E-03	221.0	0.3028
91	51	79	20.00	10.67	10.67	2.3174E-03	2.3174E-03	311.0	0.4263
94	64	82	20.00	10.67	10.67	4.7016E-04	4.7016E-04	148.8	0.2039
96	34	84	20.00	10.67	10.67	1.1921E-04	1.1921E-04	221.0	0.3028

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	713.0	0.000	10.73	10.73	10.17	9.2743E-02	2.1261E+05	100.0
2	713.0	0.000	10.73	10.73	10.17	9.2743E-02	2.1261E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	713.0	0.0000
69	0.000	*	713.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
52	10.54	1426.	*	439.14

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 18 Pool Fire scenario in storm water pond area – Case A
18.A PIPENET schematic layout with piping and nodes label
18.B PIPENET schematic layout with flow rate and pressure results
18.C PIPENET schematic layout with velocity results
18.D PIPENET input/output printout report

Attachment 18.A contains 1 page
Attachment 18.B contains 1 page
Attachment 18.C contains 1 page
Attachment 18.D contains 21 pages

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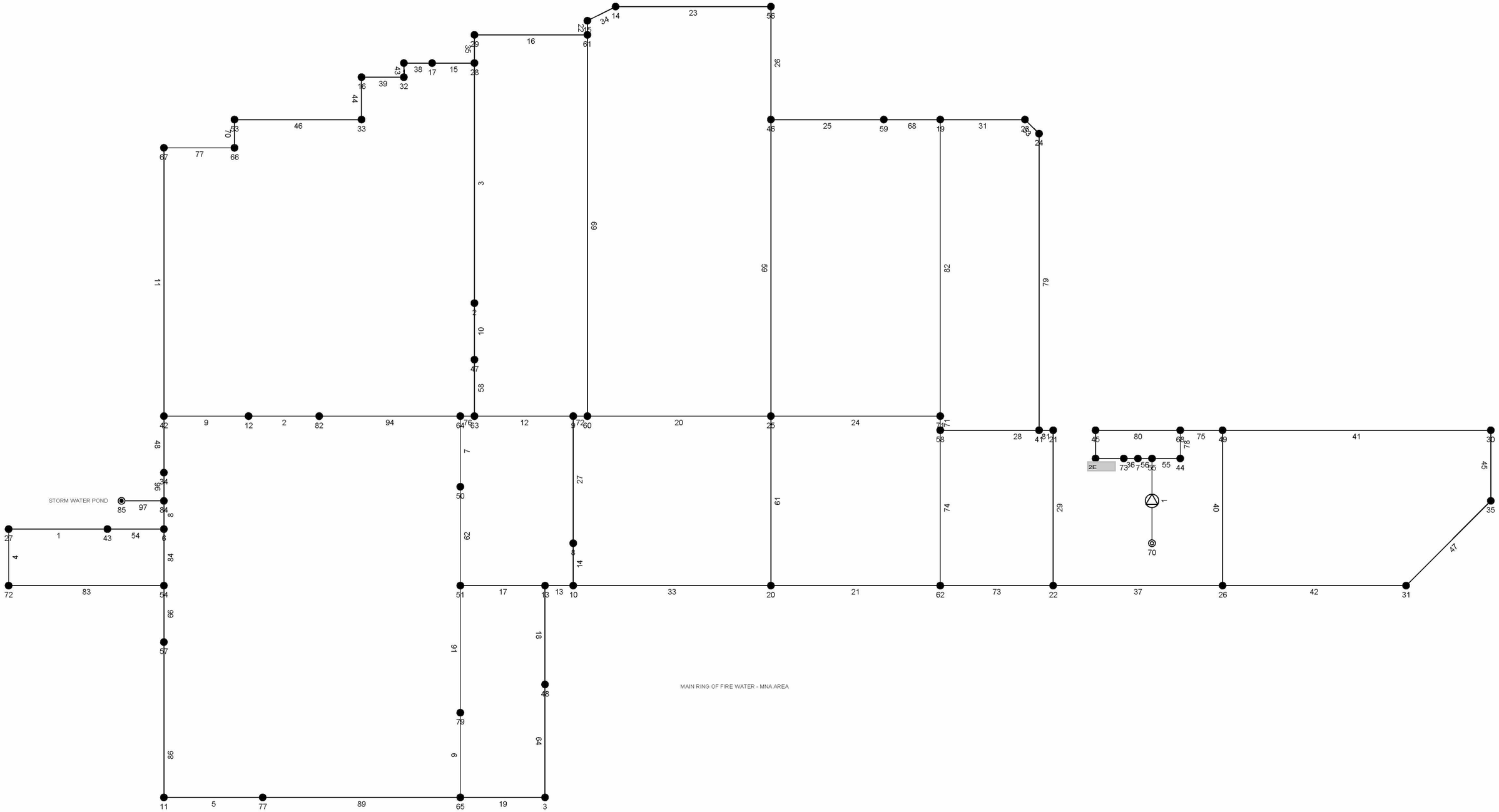
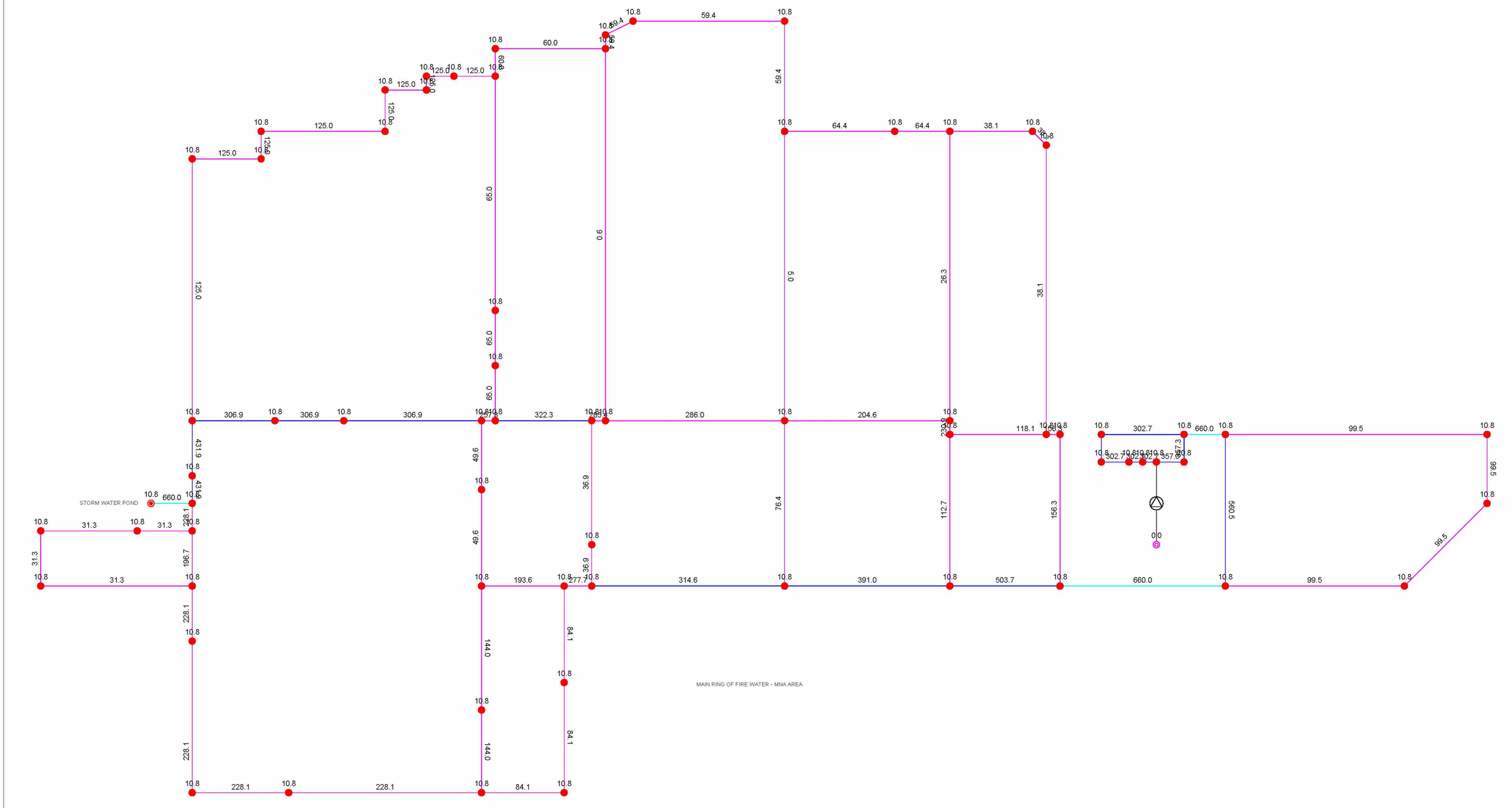
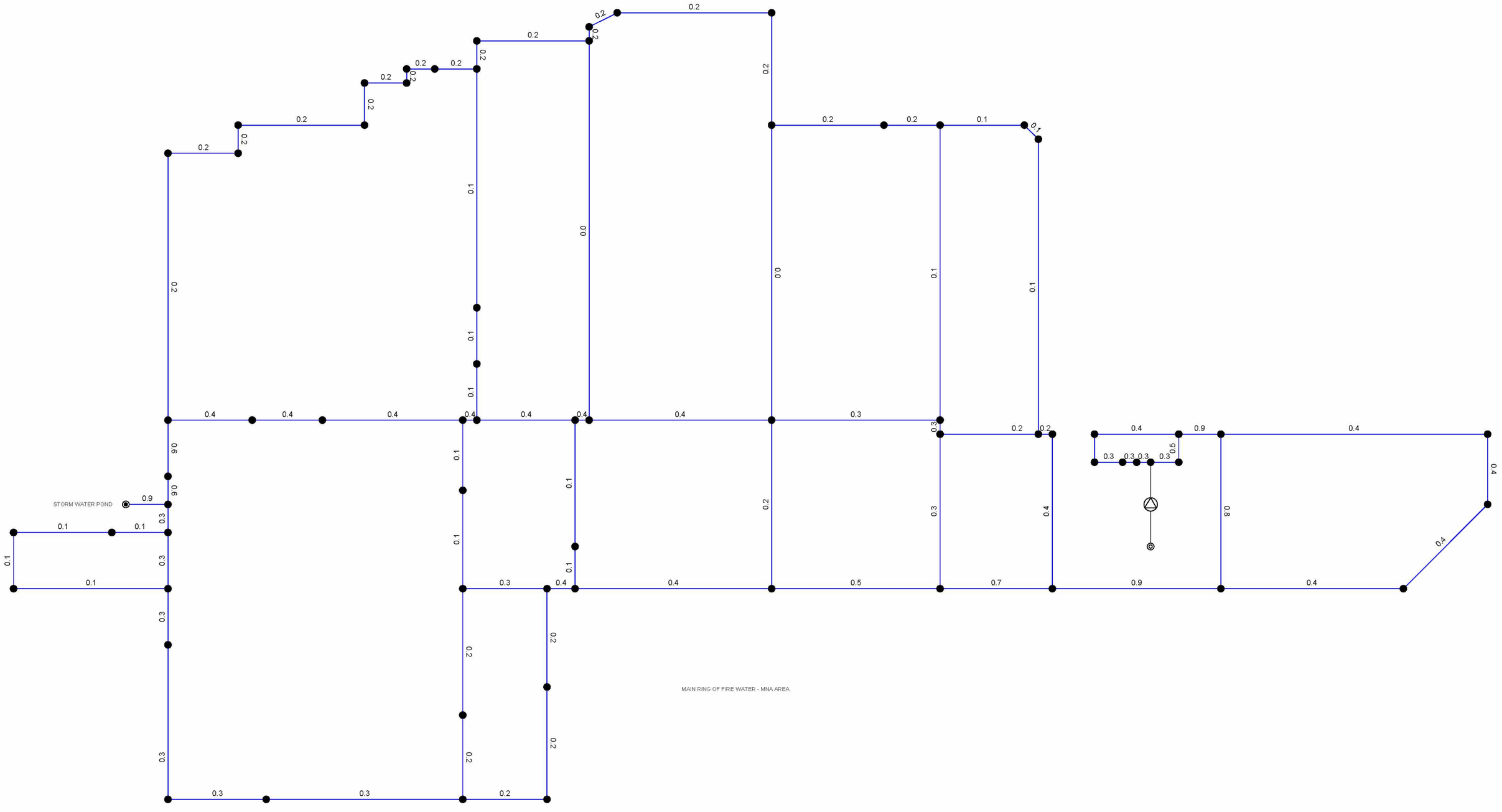


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1
Pipe velocity (m/sec)	< 0.000000 < 3.000000	< 1.000000 < 3.500000 < 2.000000 > 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

22:44 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	55	7	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000
97	84	85	20.00	20.00	0.000	150.0	45.60

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
97	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	31.3499	9	14.0000	14.0000	*
2	82	12	306.9304	9	20.0000	20.0000	*
3	2	28	64.9684	9	20.0000	20.0000	*
4	72	27	31.3499	9	14.0000	14.0000	*
5	77	11	228.0702	9	20.0000	20.0000	*
6	79	65	144.0133	9	20.0000	20.0000	*
7	50	64	49.6163	9	20.0000	20.0000	*
8	6	84	228.0702	9	20.0000	20.0000	*
9	12	42	306.9304	9	20.0000	20.0000	*
10	47	2	64.9684	9	20.0000	20.0000	*
11	67	42	125.0010	9	18.0000	18.0000	*
12	9	63	322.2824	9	20.0000	20.0000	*
13	10	13	277.6865	9	20.0000	20.0000	*
14	10	8	36.8729	9	20.0000	20.0000	*
15	28	17	125.0010	9	18.0000	18.0000	*
16	61	29	60.0326	9	12.0000	12.0000	*
17	13	51	193.6296	9	20.0000	20.0000	*
18	13	48	84.0569	9	16.0000	16.0000	*
19	3	65	84.0569	9	16.0000	16.0000	*
20	25	60	286.0172	9	20.0000	20.0000	*
21	62	20	391.0017	9	20.0000	20.0000	*
22	15	61	59.4250	9	12.0000	12.0000	*
23	56	14	59.4250	9	12.0000	12.0000	*
24	71	25	204.5792	9	20.0000	20.0000	*
25	59	46	64.4206	9	14.0000	14.0000	*
26	46	56	59.4250	9	12.0000	12.0000	*
27	8	9	36.8729	9	20.0000	20.0000	*
28	41	58	118.1281	9	20.0000	20.0000	*
29	22	21	156.2667	9	14.0000	14.0000	*
31	23	19	38.1387	9	14.0000	14.0000	*
33	20	10	314.5594	9	20.0000	20.0000	*
34	14	15	59.4250	9	12.0000	12.0000	*
35	29	28	60.0326	9	12.0000	12.0000	*
36	7	73	302.6545	9	24.0000	24.0000	*
37	26	22	660.0015	9	20.0000	20.0000	*
38	17	1	125.0010	9	18.0000	18.0000	*
39	32	16	125.0010	9	18.0000	18.0000	*
40	49	26	560.5259	9	20.0000	20.0000	*
41	49	30	99.4757	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	99.4757	9	12.0000	12.0000	*
43	1	32	125.0010	9	18.0000	18.0000	*
44	16	33	125.0010	9	18.0000	18.0000	*
45	30	35	99.4757	9	12.0000	12.0000	*
46	33	53	125.0010	9	18.0000	18.0000	*
47	35	31	99.4757	9	12.0000	12.0000	*
48	42	34	431.9314	9	20.0000	20.0000	*
53	24	23	38.1387	9	14.0000	14.0000	*
54	43	6	31.3499	9	14.0000	14.0000	*
55	55	44	357.3470	9	24.0000	24.0000	*
56	55	7	302.6545	9	24.0000	24.0000	*
58	63	47	64.9684	9	20.0000	20.0000	*
59	46	25	4.9956	9	14.0000	14.0000	*
60	73	40	302.6545	9	24.0000	24.0000	*
61	20	25	76.4424	9	14.0000	14.0000	*
62	51	50	49.6163	9	20.0000	20.0000	*
64	48	3	84.0569	9	16.0000	16.0000	*
66	57	54	228.0702	9	20.0000	20.0000	*
67	40	45	302.6545	9	20.0000	20.0000	*
68	19	59	64.4206	9	14.0000	14.0000	*
69	60	61	0.6076	9	12.0000	12.0000	*
70	53	66	125.0010	9	18.0000	18.0000	*
71	58	71	230.8611	9	20.0000	20.0000	*
72	60	9	285.4096	9	20.0000	20.0000	*
73	22	62	503.7348	9	20.0000	20.0000	*
74	62	58	112.7330	9	14.0000	14.0000	*
75	68	49	660.0015	9	20.0000	20.0000	*
76	63	64	257.3140	9	20.0000	20.0000	*
77	66	67	125.0010	9	18.0000	18.0000	*
78	44	68	357.3470	9	20.0000	20.0000	*
79	41	24	38.1387	9	14.0000	14.0000	*
80	45	68	302.6545	9	20.0000	20.0000	*
81	21	41	156.2668	9	20.0000	20.0000	*
82	71	19	26.2819	9	14.0000	14.0000	*
83	54	72	31.3499	9	14.0000	14.0000	*
84	54	6	196.7202	9	20.0000	20.0000	*
86	11	57	228.0702	9	20.0000	20.0000	*
89	65	77	228.0702	9	20.0000	20.0000	*
91	51	79	144.0133	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
94	64	82	306.9304	9	20.0000	20.0000	*
96	34	84	431.9314	9	20.0000	20.0000	*
97	84	85	660.0015	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.79	10.79	9.7275E-05	9.7275E-05	31.35	8.7684E-02
2	82	12	20.00	10.80	10.80	8.2493E-04	8.2493E-04	306.9	0.4206
3	2	28	20.00	10.80	10.80	1.2779E-04	1.2779E-04	64.97	8.9039E-02
4	72	27	14.00	10.79	10.79	1.8501E-04	1.8501E-04	31.35	8.7684E-02
5	77	11	20.00	10.80	10.80	1.2321E-03	1.2321E-03	228.1	0.3126
6	79	65	20.00	10.80	10.80	3.3951E-04	3.3951E-04	144.0	0.1974
7	50	64	20.00	10.80	10.80	8.2970E-05	8.2970E-05	49.62	6.7999E-02
8	6	84	20.00	10.79	10.79	4.4537E-04	4.4537E-04	228.1	0.3126
9	12	42	20.00	10.80	10.80	1.2674E-03	1.2674E-03	306.9	0.4206
10	47	2	20.00	10.80	10.80	4.9591E-05	4.9591E-05	64.97	8.9039E-02
11	67	42	18.00	10.80	10.80	1.1425E-03	1.1425E-03	125.0	0.2115
12	9	63	20.00	10.80	10.80	1.2350E-03	1.2350E-03	322.3	0.4417
13	10	13	20.00	10.80	10.80	2.2984E-04	2.2984E-04	277.7	0.3806
14	10	8	20.00	10.80	10.80	2.4796E-05	2.4796E-05	36.87	5.0534E-02
15	28	17	18.00	10.80	10.80	1.9932E-04	1.9932E-04	125.0	0.2115
16	61	29	12.00	10.80	10.80	1.0424E-03	1.0424E-03	60.03	0.2285
17	13	51	20.00	10.80	10.80	1.0395E-03	1.0395E-03	193.6	0.2654
18	13	48	16.00	10.80	10.80	5.7220E-04	5.7220E-04	84.06	0.1800
19	3	65	16.00	10.80	10.80	5.8746E-04	5.8746E-04	84.06	0.1800
20	25	60	20.00	10.80	10.80	2.5129E-03	2.5129E-03	286.0	0.3920
21	62	20	20.00	10.81	10.81	3.8347E-03	3.8347E-03	391.0	0.5359
22	15	61	12.00	10.80	10.80	1.7548E-04	1.7548E-04	59.42	0.2262
23	56	14	12.00	10.80	10.80	1.5373E-03	1.5373E-03	59.42	0.2262
24	71	25	20.00	10.80	10.80	1.1568E-03	1.1568E-03	204.6	0.2804
25	59	46	14.00	10.80	10.80	5.0449E-04	5.0449E-04	64.42	0.1802
26	46	56	12.00	10.80	10.80	5.4741E-04	5.4741E-04	59.42	0.2262
27	8	9	20.00	10.80	10.80	7.2479E-05	7.2479E-05	36.87	5.0534E-02
28	41	58	20.00	10.81	10.81	2.7752E-04	2.7752E-04	118.1	0.1619
29	22	21	14.00	10.81	10.81	8.1053E-03	8.1053E-03	156.3	0.4371
31	23	19	14.00	10.80	10.80	1.4782E-04	1.4782E-04	38.14	0.1067
33	20	10	20.00	10.81	10.80	4.6282E-03	4.6282E-03	314.6	0.4311
34	14	15	12.00	10.80	10.80	2.6989E-04	2.6989E-04	59.42	0.2262
35	29	28	12.00	10.80	10.80	7.5531E-04	7.5531E-04	60.03	0.2285
36	7	73	24.00	10.85	10.85	7.0953E-04	7.0953E-04	302.7	0.2880
37	26	22	20.00	10.82	10.81	1.0898E-02	1.0898E-02	660.0	0.9045
38	17	1	18.00	10.80	10.80	3.3760E-04	3.3760E-04	125.0	0.2115
39	32	16	18.00	10.80	10.80	2.8515E-04	2.8515E-04	125.0	0.2115
40	49	26	20.00	10.84	10.82	1.7637E-02	1.7637E-02	560.5	0.7682
41	49	30	12.00	10.84	10.84	6.9351E-03	6.9351E-03	99.48	0.3787
42	31	26	12.00	10.83	10.82	4.9801E-03	4.9801E-03	99.48	0.3787
43	1	32	18.00	10.80	10.80	2.0504E-04	2.0504E-04	125.0	0.2115

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.80	10.80	3.6526E-04	3.6526E-04	125.0	0.2115
45	30	35	12.00	10.84	10.83	2.1801E-03	2.1801E-03	99.48	0.3787
46	33	53	18.00	10.80	10.80	6.1512E-04	6.1512E-04	125.0	0.2115
47	35	31	12.00	10.83	10.83	3.5419E-03	3.5419E-03	99.48	0.3787
48	42	34	20.00	10.80	10.79	2.6951E-03	2.6951E-03	431.9	0.5920
53	24	23	14.00	10.80	10.80	4.7684E-05	4.7684E-05	38.14	0.1067
54	43	6	14.00	10.79	10.79	1.8501E-04	1.8501E-04	31.35	8.7684E-02
55	55	44	24.00	10.85	10.85	1.2779E-03	1.2779E-03	357.3	0.3401
56	55	7	24.00	10.85	10.85	1.0014E-04	1.0014E-04	302.7	0.2880
58	63	47	20.00	10.80	10.80	1.2016E-04	1.2016E-04	64.97	8.9039E-02
59	46	25	14.00	10.80	10.80	1.7166E-05	1.7166E-05	4.996	1.3972E-02
60	73	40	24.00	10.85	10.85	3.2806E-04	3.2806E-04	302.7	0.2880
61	20	25	14.00	10.81	10.80	1.9474E-03	1.9474E-03	76.44	0.2138
62	51	50	20.00	10.80	10.80	8.0109E-05	8.0109E-05	49.62	6.7999E-02
64	48	3	16.00	10.80	10.80	7.7724E-04	7.7724E-04	84.06	0.1800
66	57	54	20.00	10.79	10.79	1.2655E-03	1.2655E-03	228.1	0.3126
67	40	45	20.00	10.85	10.84	3.1824E-03	3.1824E-03	302.7	0.4148
68	19	59	14.00	10.80	10.80	2.7752E-04	2.7752E-04	64.42	0.1802
69	60	61	12.00	10.80	10.80	0.000	0.000	0.6076	2.3131E-03
70	53	66	18.00	10.80	10.80	2.9469E-04	2.9469E-04	125.0	0.2115
71	58	71	20.00	10.81	10.80	1.9550E-04	1.9550E-04	230.9	0.3164
72	60	9	20.00	10.80	10.80	2.6512E-04	2.6512E-04	285.4	0.3912
73	22	62	20.00	10.81	10.81	4.0627E-03	4.0627E-03	503.7	0.6904
74	62	58	14.00	10.81	10.81	4.4298E-03	4.4298E-03	112.7	0.3153
75	68	49	20.00	10.84	10.84	2.2697E-03	2.2697E-03	660.0	0.9045
76	63	64	20.00	10.80	10.80	1.0014E-04	1.0014E-04	257.3	0.3526
77	66	67	18.00	10.80	10.80	2.4033E-04	2.4033E-04	125.0	0.2115
78	44	68	20.00	10.85	10.84	3.1223E-03	3.1223E-03	357.3	0.4897
79	41	24	14.00	10.81	10.80	6.3515E-04	6.3515E-04	38.14	0.1067
80	45	68	20.00	10.84	10.84	8.0109E-05	8.0109E-05	302.7	0.4148
81	21	41	20.00	10.81	10.81	1.0967E-04	1.0967E-04	156.3	0.2142
82	71	19	14.00	10.80	10.80	3.5763E-04	3.5763E-04	26.28	7.3509E-02
83	54	72	14.00	10.79	10.79	2.0981E-04	2.0981E-04	31.35	8.7684E-02
84	54	6	20.00	10.79	10.79	6.7711E-04	6.7711E-04	196.7	0.2696
86	11	57	20.00	10.80	10.79	1.3676E-03	1.3676E-03	228.1	0.3126
89	65	77	20.00	10.80	10.80	1.2703E-03	1.2703E-03	228.1	0.3126
91	51	79	20.00	10.80	10.80	5.5790E-04	5.5790E-04	144.0	0.1974
94	64	82	20.00	10.80	10.80	1.7900E-03	1.7900E-03	306.9	0.4206
96	34	84	20.00	10.79	10.79	4.1485E-04	4.1485E-04	431.9	0.5920
97	84	85	20.00	10.79	10.79	7.4444E-03	7.4444E-03	660.0	0.9045

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	660.0	0.000	10.85	10.85	10.17	9.1769E-02	1.9889E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	660.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
85	10.79	660.0	*	200.97

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 19 Pool Fire scenario in storm water pond area – Case B
19.A PIPENET schematic layout with piping and nodes label
19.B PIPENET schematic layout with flow rate and pressure results
19.C PIPENET schematic layout with velocity results
19.D PIPENET input/output printout report

Attachment 19.A contains 1 page
Attachment 19.B contains 1 page
Attachment 19.C contains 1 page
Attachment 19.D contains 21 pages

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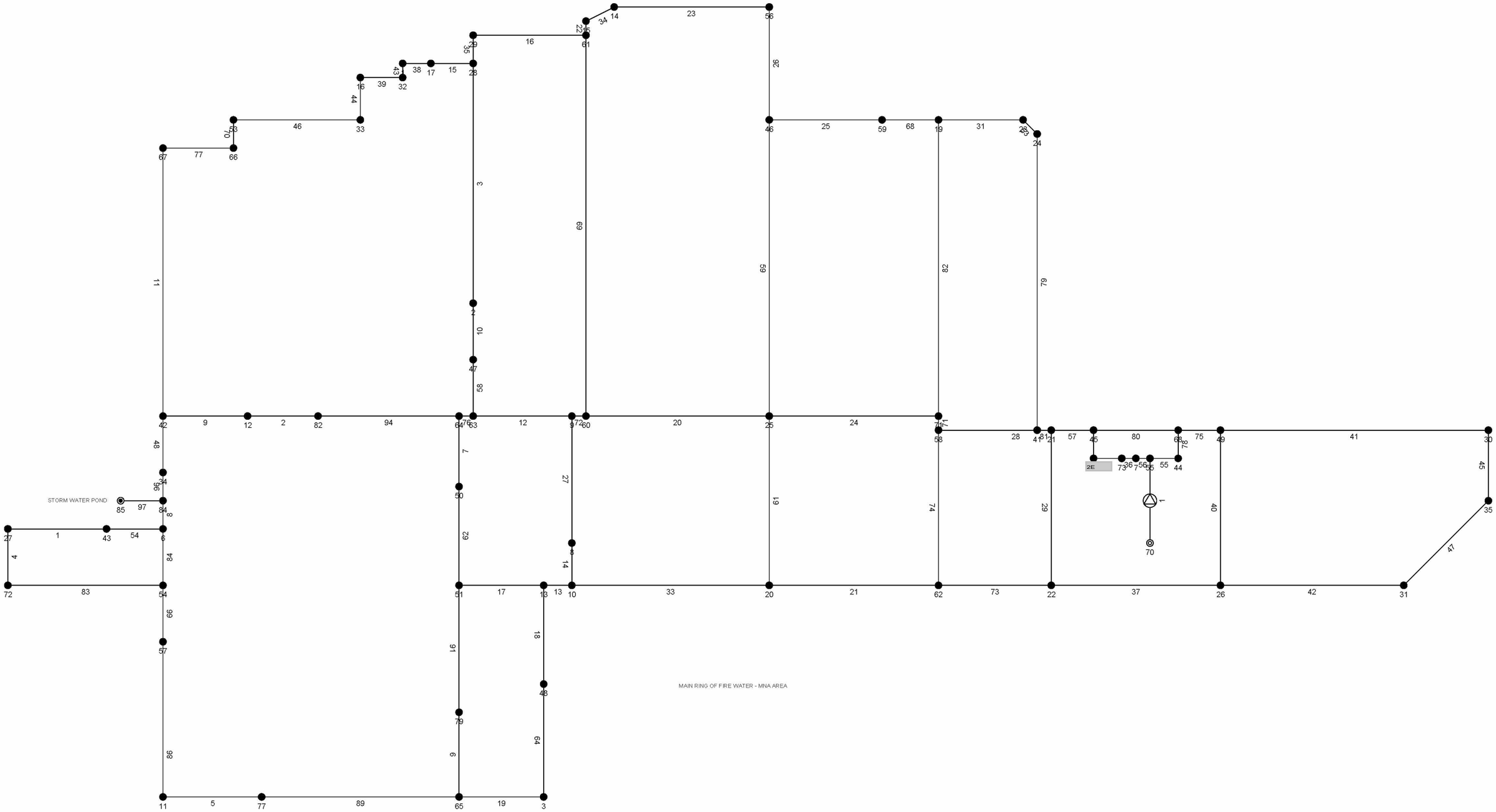
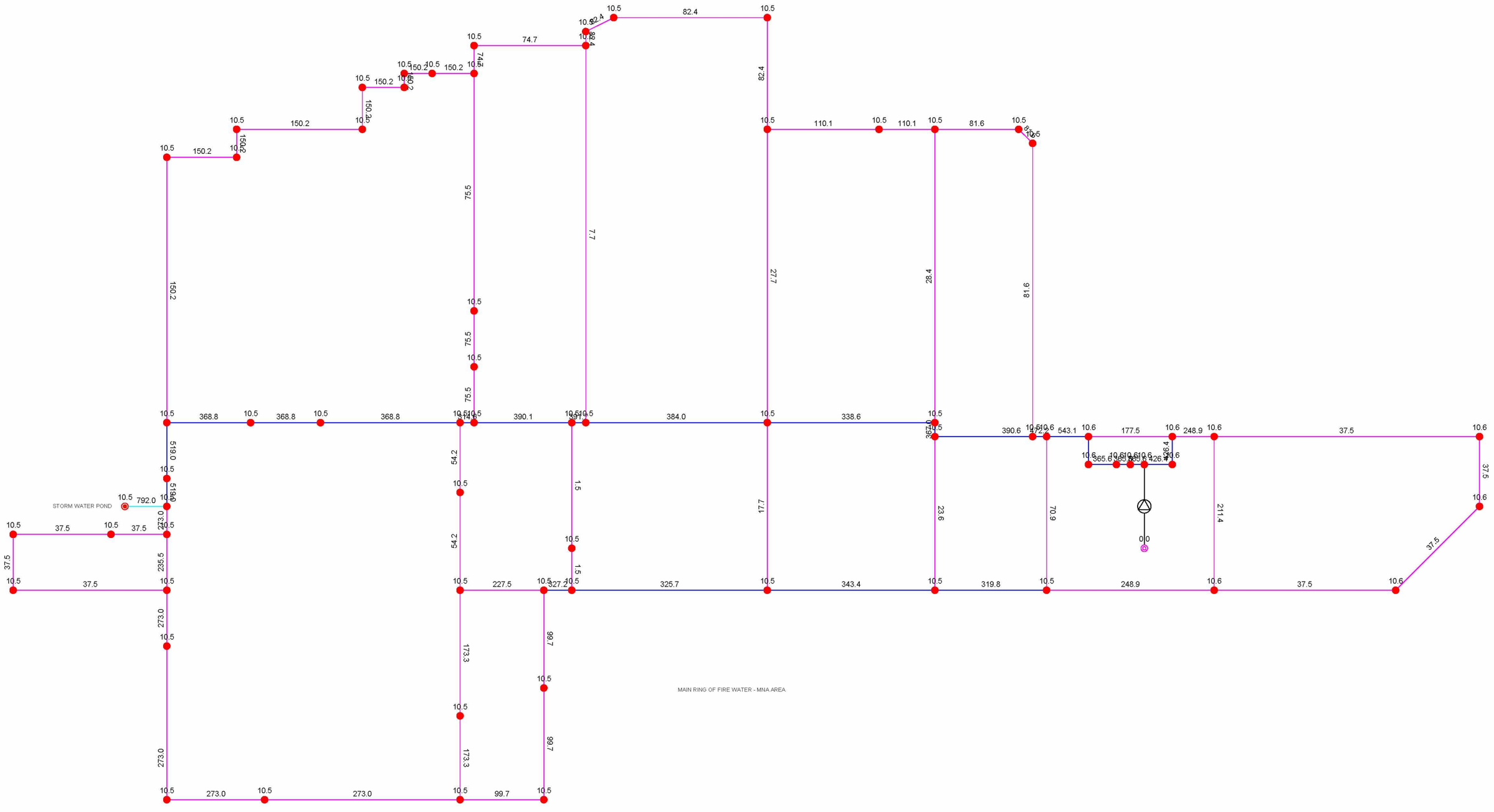
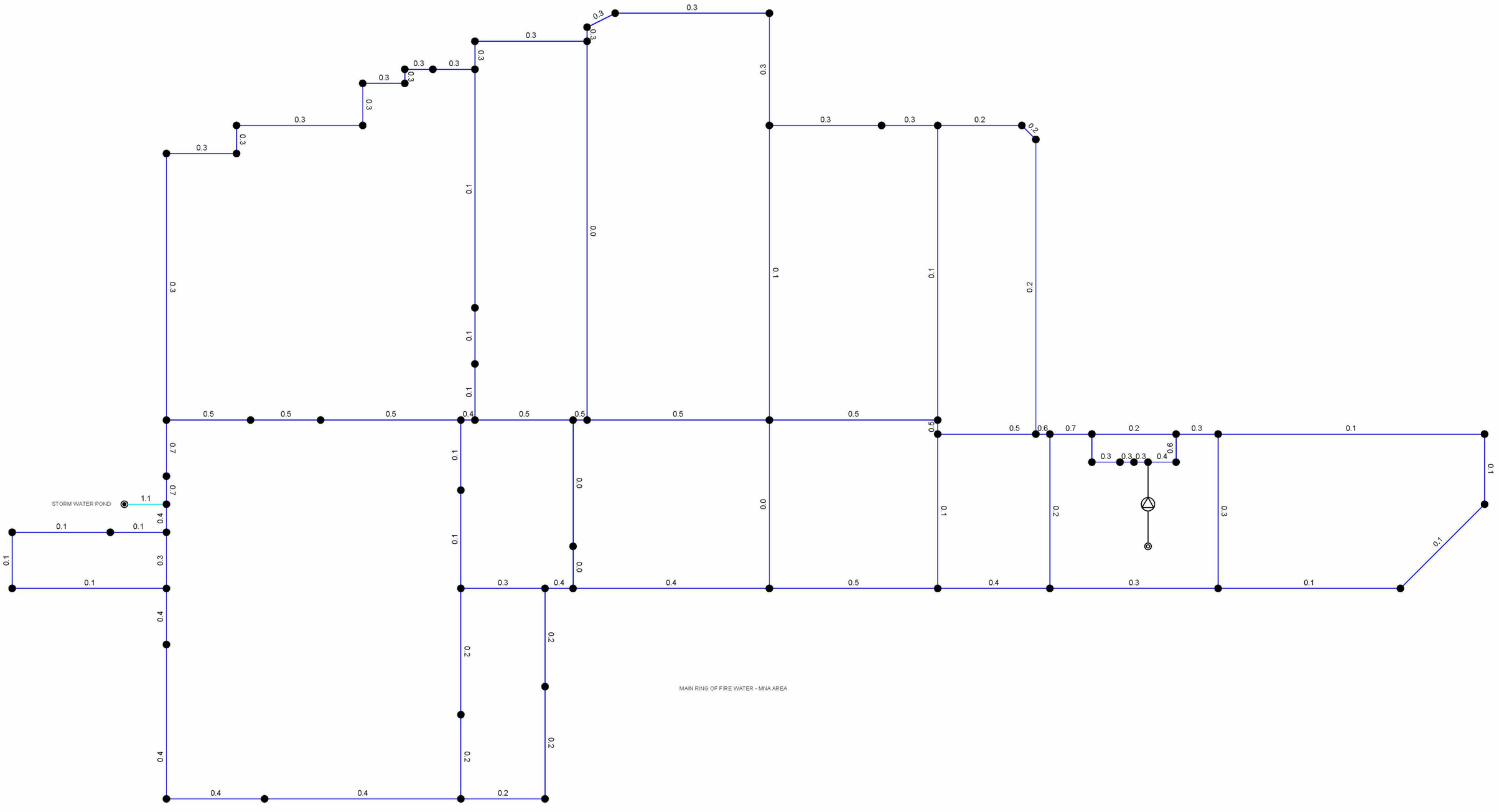


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

22:53 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	55	7	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000
97	84	85	20.00	20.00	0.000	150.0	45.60

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
97	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	37.5297	9	14.0000	14.0000	*
2	82	12	368.8110	9	20.0000	20.0000	*
3	2	28	75.5053	9	20.0000	20.0000	*
4	72	27	37.5297	9	14.0000	14.0000	*
5	77	11	272.9942	9	20.0000	20.0000	*
6	79	65	173.3211	9	20.0000	20.0000	*
7	50	64	54.1807	9	20.0000	20.0000	*
8	6	84	272.9942	9	20.0000	20.0000	*
9	12	42	368.8110	9	20.0000	20.0000	*
10	47	2	75.5053	9	20.0000	20.0000	*
11	67	42	150.1965	9	18.0000	18.0000	*
12	9	63	390.1356	9	20.0000	20.0000	*
13	10	13	327.1749	9	20.0000	20.0000	*
14	8	10	1.5203	9	20.0000	20.0000	*
15	28	17	150.1965	9	18.0000	18.0000	*
16	61	29	74.6913	9	12.0000	12.0000	*
17	13	51	227.5018	9	20.0000	20.0000	*
18	13	48	99.6731	9	16.0000	16.0000	*
19	3	65	99.6731	9	16.0000	16.0000	*
20	25	60	383.9967	9	20.0000	20.0000	*
21	62	20	343.3628	9	20.0000	20.0000	*
22	15	61	82.3505	9	12.0000	12.0000	*
23	56	14	82.3505	9	12.0000	12.0000	*
24	71	25	338.5847	9	20.0000	20.0000	*
25	59	46	110.0543	9	14.0000	14.0000	*
26	46	56	82.3505	9	12.0000	12.0000	*
27	9	8	1.5203	9	20.0000	20.0000	*
28	41	58	390.6182	9	20.0000	20.0000	*
29	21	22	70.8725	9	14.0000	14.0000	*
31	23	19	81.6223	9	14.0000	14.0000	*
33	20	10	325.6547	9	20.0000	20.0000	*
34	14	15	82.3505	9	12.0000	12.0000	*
35	29	28	74.6913	9	12.0000	12.0000	*
36	7	73	365.5818	9	24.0000	24.0000	*
37	26	22	248.8888	9	20.0000	20.0000	*
38	17	1	150.1965	9	18.0000	18.0000	*
39	32	16	150.1965	9	18.0000	18.0000	*
40	49	26	211.4372	9	20.0000	20.0000	*
41	49	30	37.4516	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	37.4516	9	12.0000	12.0000	*
43	1	32	150.1965	9	18.0000	18.0000	*
44	16	33	150.1965	9	18.0000	18.0000	*
45	30	35	37.4516	9	12.0000	12.0000	*
46	33	53	150.1965	9	18.0000	18.0000	*
47	35	31	37.4516	9	12.0000	12.0000	*
48	42	34	519.0076	9	20.0000	20.0000	*
53	24	23	81.6223	9	14.0000	14.0000	*
54	43	6	37.5297	9	14.0000	14.0000	*
55	55	44	426.4200	9	24.0000	24.0000	*
56	55	7	365.5818	9	24.0000	24.0000	*
57	45	21	543.1130	9	20.0000	20.0000	*
58	63	47	75.5053	9	20.0000	20.0000	*
59	46	25	27.7038	9	14.0000	14.0000	*
60	73	40	365.5818	9	24.0000	24.0000	*
61	20	25	17.7082	9	14.0000	14.0000	*
62	51	50	54.1807	9	20.0000	20.0000	*
64	48	3	99.6731	9	16.0000	16.0000	*
66	57	54	272.9942	9	20.0000	20.0000	*
67	40	45	365.5818	9	20.0000	20.0000	*
68	19	59	110.0543	9	14.0000	14.0000	*
69	61	60	7.6592	9	12.0000	12.0000	*
70	53	66	150.1965	9	18.0000	18.0000	*
71	58	71	367.0167	9	20.0000	20.0000	*
72	60	9	391.6559	9	20.0000	20.0000	*
73	22	62	319.7613	9	20.0000	20.0000	*
74	58	62	23.6015	9	14.0000	14.0000	*
75	68	49	248.8888	9	20.0000	20.0000	*
76	63	64	314.6303	9	20.0000	20.0000	*
77	66	67	150.1965	9	18.0000	18.0000	*
78	44	68	426.4199	9	20.0000	20.0000	*
79	41	24	81.6223	9	14.0000	14.0000	*
80	68	45	177.5312	9	20.0000	20.0000	*
81	21	41	472.2405	9	20.0000	20.0000	*
82	71	19	28.4320	9	14.0000	14.0000	*
83	54	72	37.5297	9	14.0000	14.0000	*
84	54	6	235.4646	9	20.0000	20.0000	*
86	11	57	272.9942	9	20.0000	20.0000	*
89	65	77	272.9942	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	173.3211	9	20.0000	20.0000	*
94	64	82	368.8110	9	20.0000	20.0000	*
96	34	84	519.0076	9	20.0000	20.0000	*
97	84	85	792.0018	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.53	10.53	1.3733E-04	1.3733E-04	37.53	0.1050
2	82	12	20.00	10.53	10.53	1.1568E-03	1.1568E-03	368.8	0.5055
3	2	28	20.00	10.54	10.54	1.6975E-04	1.6975E-04	75.51	0.1035
4	72	27	14.00	10.53	10.53	2.5463E-04	2.5463E-04	37.53	0.1050
5	77	11	20.00	10.53	10.53	1.7204E-03	1.7204E-03	273.0	0.3741
6	79	65	20.00	10.54	10.54	4.7684E-04	4.7684E-04	173.3	0.2375
7	50	64	20.00	10.54	10.54	9.5367E-05	9.5367E-05	54.18	7.4255E-02
8	6	84	20.00	10.53	10.53	6.2084E-04	6.2084E-04	273.0	0.3741
9	12	42	20.00	10.53	10.53	1.7776E-03	1.7776E-03	368.8	0.5055
10	47	2	20.00	10.54	10.54	6.2943E-05	6.2943E-05	75.51	0.1035
11	67	42	18.00	10.53	10.53	1.6098E-03	1.6098E-03	150.2	0.2541
12	9	63	20.00	10.54	10.54	1.7576E-03	1.7576E-03	390.1	0.5347
13	10	13	20.00	10.54	10.54	3.0994E-04	3.0994E-04	327.2	0.4484
14	8	10	20.00	10.54	10.54	0.000	0.000	1.520	2.0836E-03
15	28	17	18.00	10.54	10.54	2.8229E-04	2.8229E-04	150.2	0.2541
16	61	29	12.00	10.54	10.54	1.5707E-03	1.5707E-03	74.69	0.2843
17	13	51	20.00	10.54	10.54	1.4000E-03	1.4000E-03	227.5	0.3118
18	13	48	16.00	10.54	10.54	7.8583E-04	7.8583E-04	99.67	0.2134
19	3	65	16.00	10.54	10.54	8.0490E-04	8.0490E-04	99.67	0.2134
20	25	60	20.00	10.54	10.54	4.3297E-03	4.3297E-03	384.0	0.5263
21	62	20	20.00	10.55	10.54	3.0174E-03	3.0174E-03	343.4	0.4706
22	15	61	12.00	10.54	10.54	3.1948E-04	3.1948E-04	82.35	0.3135
23	56	14	12.00	10.54	10.54	2.8305E-03	2.8305E-03	82.35	0.3135
24	71	25	20.00	10.55	10.54	2.9325E-03	2.9325E-03	338.6	0.4640
25	59	46	14.00	10.55	10.54	1.3676E-03	1.3676E-03	110.1	0.3078
26	46	56	12.00	10.54	10.54	1.0023E-03	1.0023E-03	82.35	0.3135
27	9	8	20.00	10.54	10.54	0.000	0.000	1.520	2.0836E-03
28	41	58	20.00	10.55	10.55	2.5349E-03	2.5349E-03	390.6	0.5353
29	21	22	14.00	10.55	10.55	1.8797E-03	1.8797E-03	70.87	0.1982
31	23	19	14.00	10.55	10.55	6.0749E-04	6.0749E-04	81.62	0.2283
33	20	10	20.00	10.54	10.54	4.9343E-03	4.9343E-03	325.7	0.4463
34	14	15	12.00	10.54	10.54	4.9496E-04	4.9496E-04	82.35	0.3135
35	29	28	12.00	10.54	10.54	1.1349E-03	1.1349E-03	74.69	0.2843
36	7	73	24.00	10.56	10.56	1.0071E-03	1.0071E-03	365.6	0.3479
37	26	22	20.00	10.55	10.55	1.7948E-03	1.7948E-03	248.9	0.3411
38	17	1	18.00	10.54	10.54	4.7493E-04	4.7493E-04	150.2	0.2541
39	32	16	18.00	10.54	10.53	4.0245E-04	4.0245E-04	150.2	0.2541
40	49	26	20.00	10.55	10.55	2.9049E-03	2.9049E-03	211.4	0.2898
41	49	30	12.00	10.55	10.55	1.1425E-03	1.1425E-03	37.45	0.1426
42	31	26	12.00	10.55	10.55	8.2016E-04	8.2016E-04	37.45	0.1426
43	1	32	18.00	10.54	10.54	2.8992E-04	2.8992E-04	150.2	0.2541

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.53	10.53	5.1308E-04	5.1308E-04	150.2	0.2541
45	30	35	12.00	10.55	10.55	3.5954E-04	3.5954E-04	37.45	0.1426
46	33	53	18.00	10.53	10.53	8.6689E-04	8.6689E-04	150.2	0.2541
47	35	31	12.00	10.55	10.55	5.8270E-04	5.8270E-04	37.45	0.1426
48	42	34	20.00	10.53	10.53	3.7823E-03	3.7823E-03	519.0	0.7113
53	24	23	14.00	10.55	10.55	1.8978E-04	1.8978E-04	81.62	0.2283
54	43	6	14.00	10.53	10.53	2.5749E-04	2.5749E-04	37.53	0.1050
55	55	44	24.00	10.56	10.56	1.7672E-03	1.7672E-03	426.4	0.4058
56	55	7	24.00	10.56	10.56	1.4019E-04	1.4019E-04	365.6	0.3479
57	45	21	20.00	10.55	10.55	3.1624E-03	3.1624E-03	543.1	0.7443
58	63	47	20.00	10.54	10.54	1.6022E-04	1.6022E-04	75.51	0.1035
59	46	25	14.00	10.54	10.54	3.9768E-04	3.9768E-04	27.70	7.7486E-02
60	73	40	24.00	10.56	10.56	4.6539E-04	4.6539E-04	365.6	0.3479
61	20	25	14.00	10.54	10.54	1.2970E-04	1.2970E-04	17.71	4.9529E-02
62	51	50	20.00	10.54	10.54	9.5367E-05	9.5367E-05	54.18	7.4255E-02
64	48	3	16.00	10.54	10.54	1.0719E-03	1.0719E-03	99.67	0.2134
66	57	54	20.00	10.53	10.53	1.7681E-03	1.7681E-03	273.0	0.3741
67	40	45	20.00	10.56	10.55	4.5147E-03	4.5147E-03	365.6	0.5010
68	19	59	14.00	10.55	10.55	7.5245E-04	7.5245E-04	110.1	0.3078
69	61	60	12.00	10.54	10.54	8.0109E-05	8.0109E-05	7.659	2.9158E-02
70	53	66	18.00	10.53	10.53	4.1485E-04	4.1485E-04	150.2	0.2541
71	58	71	20.00	10.55	10.55	4.5967E-04	4.5967E-04	367.0	0.5030
72	60	9	20.00	10.54	10.54	4.7493E-04	4.7493E-04	391.7	0.5368
73	22	62	20.00	10.55	10.55	1.7557E-03	1.7557E-03	319.8	0.4382
74	58	62	14.00	10.55	10.55	2.4509E-04	2.4509E-04	23.60	6.6012E-02
75	68	49	20.00	10.55	10.55	3.7289E-04	3.7289E-04	248.9	0.3411
76	63	64	20.00	10.54	10.54	1.4305E-04	1.4305E-04	314.6	0.4312
77	66	67	18.00	10.53	10.53	3.4046E-04	3.4046E-04	150.2	0.2541
78	44	68	20.00	10.56	10.55	4.3297E-03	4.3297E-03	426.4	0.5844
79	41	24	14.00	10.55	10.55	2.6121E-03	2.6121E-03	81.62	0.2283
80	68	45	20.00	10.55	10.55	3.0518E-05	3.0518E-05	177.5	0.2433
81	21	41	20.00	10.55	10.55	8.5545E-04	8.5545E-04	472.2	0.6472
82	71	19	14.00	10.55	10.55	4.1485E-04	4.1485E-04	28.43	7.9523E-02
83	54	72	14.00	10.53	10.53	2.9469E-04	2.9469E-04	37.53	0.1050
84	54	6	20.00	10.53	10.53	9.4414E-04	9.4414E-04	235.5	0.3227
86	11	57	20.00	10.53	10.53	1.9073E-03	1.9073E-03	273.0	0.3741
89	65	77	20.00	10.54	10.53	1.7748E-03	1.7748E-03	273.0	0.3741
91	51	79	20.00	10.54	10.54	7.8583E-04	7.8583E-04	173.3	0.2375
94	64	82	20.00	10.54	10.53	2.5101E-03	2.5101E-03	368.8	0.5055
96	34	84	20.00	10.53	10.53	5.8079E-04	5.8079E-04	519.0	0.7113
97	84	85	20.00	10.53	10.52	1.0432E-02	1.0432E-02	792.0	1.085

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	792.0	0.000	10.56	10.56	10.17	9.4283E-02	2.3231E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	792.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
85	10.52	792.0	*	244.23

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

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RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 20 Pool fire scenario in flare area – Case A
20.A PIPENET schematic layout with piping and nodes label
20.B PIPENET schematic layout with flow rate and pressure results
20.C PIPENET schematic layout with velocity results
20.D PIPENET input/output printout report

Attachment 20.A contains 1 page
Attachment 20.B contains 1 page
Attachment 20.C contains 1 page
Attachment 20.D contains 22 pages

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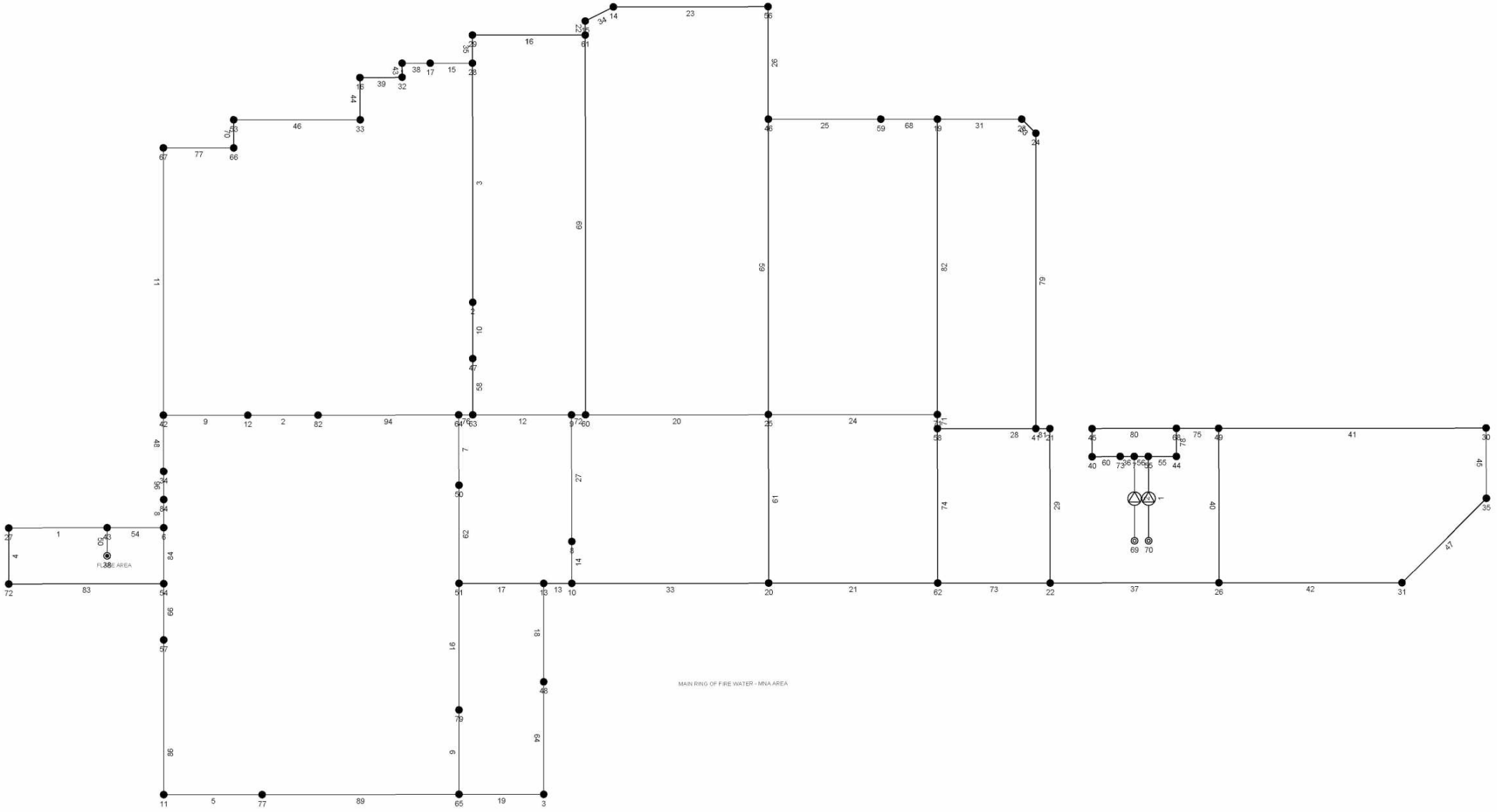
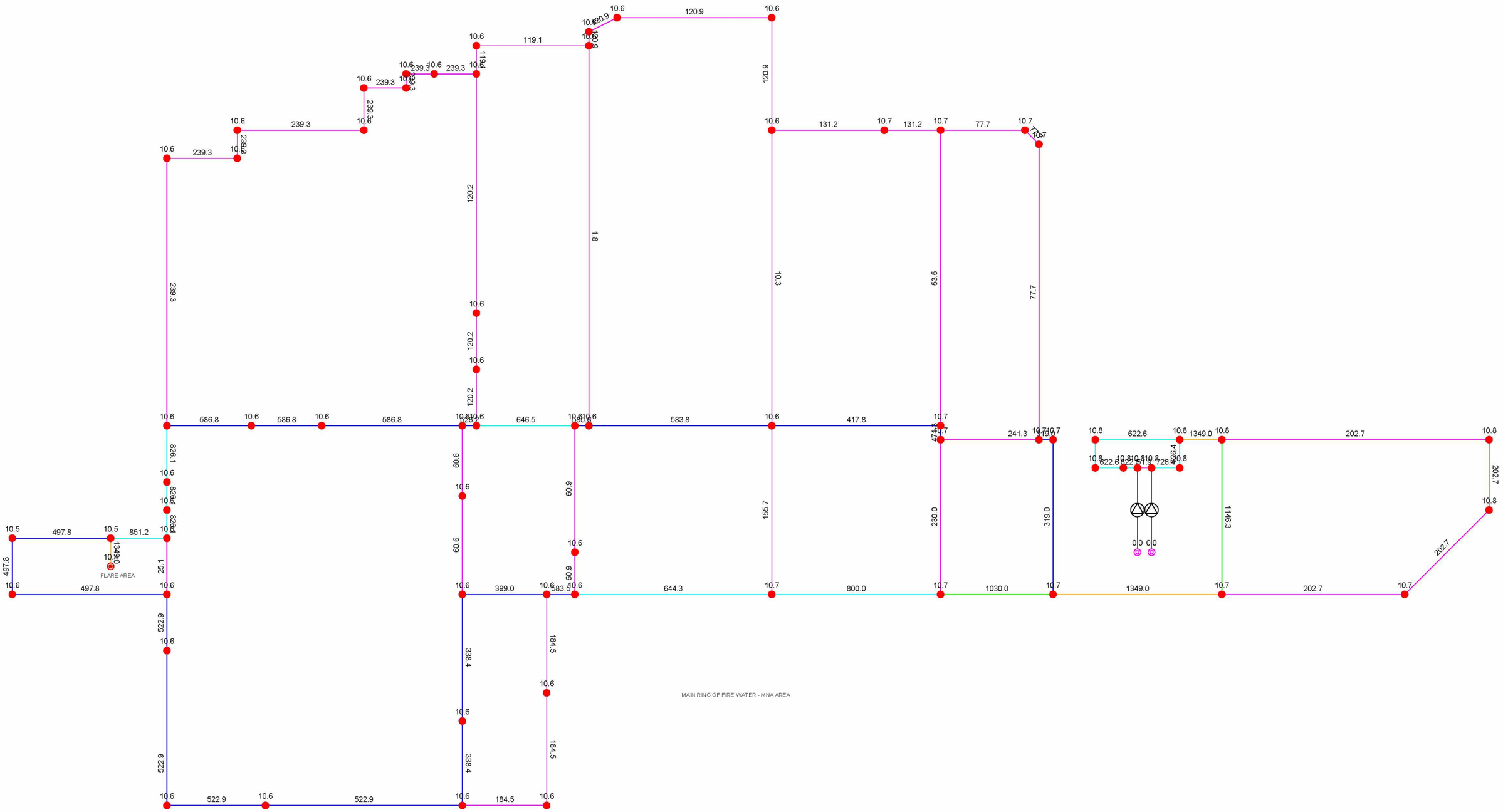
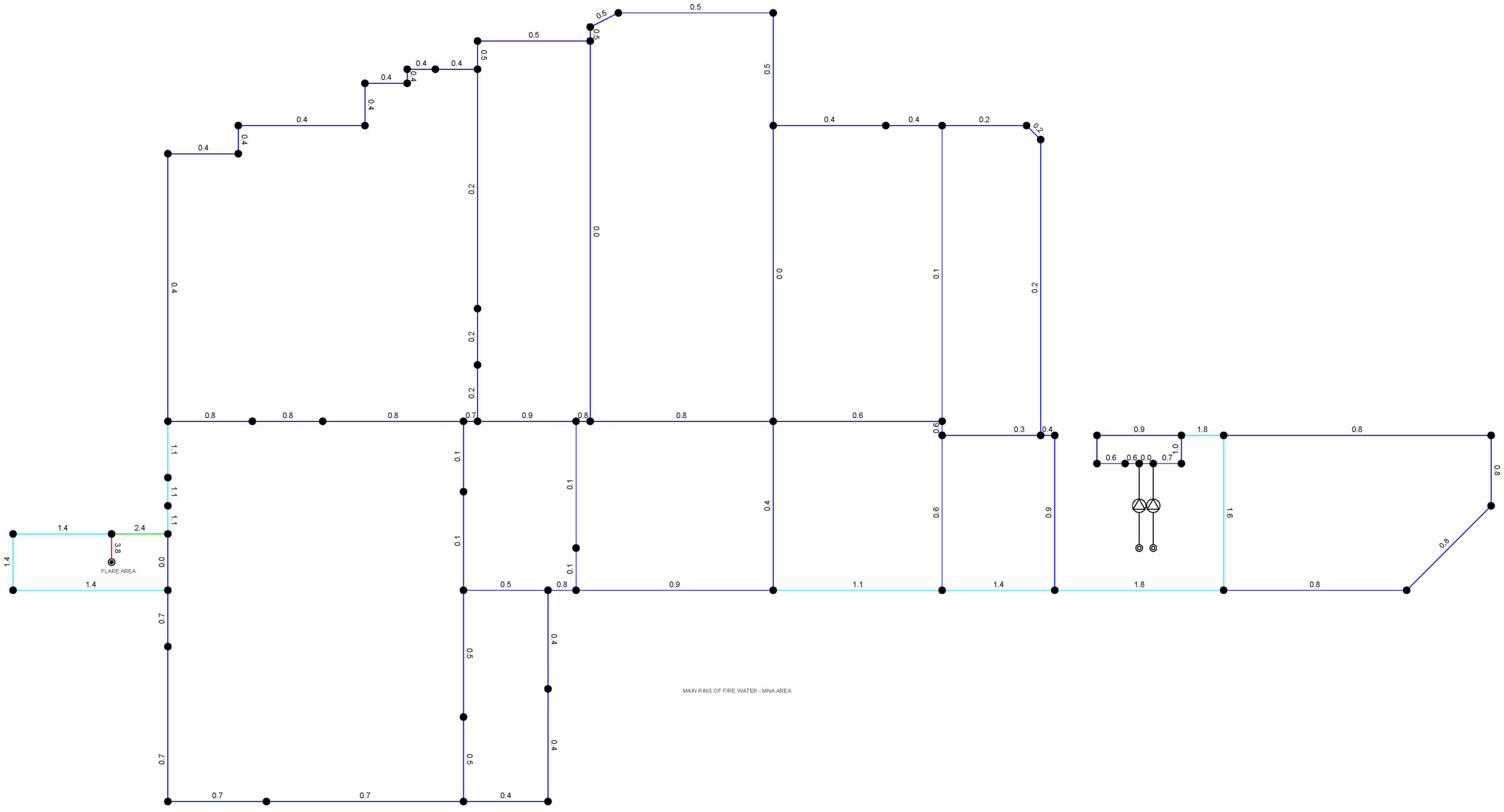


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

23:06 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18
Warnings	19

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
50	43	38	14.00	20.00	0.000	150.0	30.86
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
50	1 x 4	30.86		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	497.7649	9	14.0000	14.0000	*
2	82	12	586.8181	9	20.0000	20.0000	*
3	2	28	120.2144	9	20.0000	20.0000	*
4	72	27	497.7649	9	14.0000	14.0000	*
5	77	11	522.9041	9	20.0000	20.0000	*
6	79	65	338.4352	9	20.0000	20.0000	*
7	50	64	60.5680	9	20.0000	20.0000	*
8	84	6	826.0991	9	20.0000	20.0000	*
9	12	42	586.8181	9	20.0000	20.0000	*
10	47	2	120.2144	9	20.0000	20.0000	*
11	67	42	239.2810	9	18.0000	18.0000	*
12	9	63	646.4645	9	20.0000	20.0000	*
13	10	13	583.4720	9	20.0000	20.0000	*
14	10	8	60.8595	9	20.0000	20.0000	*
15	28	17	239.2810	9	18.0000	18.0000	*
16	61	29	119.0665	9	12.0000	12.0000	*
17	13	51	399.0032	9	20.0000	20.0000	*
18	13	48	184.4689	9	16.0000	16.0000	*
19	3	65	184.4689	9	16.0000	16.0000	*
20	25	60	583.7579	9	20.0000	20.0000	*
21	62	20	800.0121	9	20.0000	20.0000	*
22	15	61	120.9136	9	12.0000	12.0000	*
23	56	14	120.9136	9	12.0000	12.0000	*
24	71	25	417.7885	9	20.0000	20.0000	*
25	59	46	131.2026	9	14.0000	14.0000	*
26	46	56	120.9136	9	12.0000	12.0000	*
27	8	9	60.8595	9	20.0000	20.0000	*
28	41	58	241.2976	9	20.0000	20.0000	*
29	22	21	318.9572	9	14.0000	14.0000	*
31	23	19	77.6596	9	14.0000	14.0000	*
33	20	10	644.3316	9	20.0000	20.0000	*
34	14	15	120.9136	9	12.0000	12.0000	*
35	29	28	119.0665	9	12.0000	12.0000	*
36	7	73	622.6361	9	24.0000	24.0000	*
37	26	22	1349.0032	9	20.0000	20.0000	*
38	17	1	239.2810	9	18.0000	18.0000	*
39	32	16	239.2810	9	18.0000	18.0000	*
40	49	26	1146.2676	9	20.0000	20.0000	*
41	49	30	202.7355	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	202.7355	9	12.0000	12.0000	*
43	1	32	239.2810	9	18.0000	18.0000	*
44	16	33	239.2810	9	18.0000	18.0000	*
45	30	35	202.7355	9	12.0000	12.0000	*
46	33	53	239.2810	9	18.0000	18.0000	*
47	35	31	202.7355	9	12.0000	12.0000	*
48	42	34	826.0991	9	20.0000	20.0000	*
50	43	38	1349.0032	9	14.0000	14.0000	*
53	24	23	77.6596	9	14.0000	14.0000	*
54	6	43	851.2381	9	14.0000	14.0000	*
55	55	44	726.3670	9	24.0000	24.0000	*
56	7	55	51.8647	9	24.0000	24.0000	*
58	63	47	120.2144	9	20.0000	20.0000	*
59	46	25	10.2890	9	14.0000	14.0000	*
60	73	40	622.6361	9	24.0000	24.0000	*
61	20	25	155.6804	9	14.0000	14.0000	*
62	51	50	60.5680	9	20.0000	20.0000	*
64	48	3	184.4689	9	16.0000	16.0000	*
66	57	54	522.9041	9	20.0000	20.0000	*
67	40	45	622.6360	9	20.0000	20.0000	*
68	19	59	131.2026	9	14.0000	14.0000	*
69	61	60	1.8470	9	12.0000	12.0000	*
70	53	66	239.2810	9	18.0000	18.0000	*
71	58	71	471.3316	9	20.0000	20.0000	*
72	60	9	585.6050	9	20.0000	20.0000	*
73	22	62	1030.0460	9	20.0000	20.0000	*
74	62	58	230.0340	9	14.0000	14.0000	*
75	68	49	1349.0032	9	20.0000	20.0000	*
76	63	64	526.2501	9	20.0000	20.0000	*
77	66	67	239.2810	9	18.0000	18.0000	*
78	44	68	726.3670	9	20.0000	20.0000	*
79	41	24	77.6596	9	14.0000	14.0000	*
80	45	68	622.6360	9	20.0000	20.0000	*
81	21	41	318.9572	9	20.0000	20.0000	*
82	71	19	53.5430	9	14.0000	14.0000	*
83	54	72	497.7649	9	14.0000	14.0000	*
84	54	6	25.1391	9	20.0000	20.0000	*
86	11	57	522.9041	9	20.0000	20.0000	*
89	65	77	522.9041	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	338.4352	9	20.0000	20.0000	*
94	64	82	586.8181	9	20.0000	20.0000	*
96	34	84	826.0991	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.54	10.52	1.6478E-02	1.6478E-02	497.8	1.392
2	82	12	20.00	10.63	10.62	2.7351E-03	2.7351E-03	586.8	0.8042
3	2	28	20.00	10.63	10.63	3.9959E-04	3.9959E-04	120.2	0.1648
4	72	27	14.00	10.57	10.54	3.0637E-02	3.0637E-02	497.8	1.392
5	77	11	20.00	10.62	10.62	5.7201E-03	5.7201E-03	522.9	0.7166
6	79	65	20.00	10.63	10.63	1.6470E-03	1.6470E-03	338.4	0.4638
7	50	64	20.00	10.63	10.63	1.1730E-04	1.1730E-04	60.57	8.3008E-02
8	84	6	20.00	10.61	10.61	4.8151E-03	4.8151E-03	826.1	1.132
9	12	42	20.00	10.62	10.62	4.1952E-03	4.1952E-03	586.8	0.8042
10	47	2	20.00	10.63	10.63	1.5068E-04	1.5068E-04	120.2	0.1648
11	67	42	18.00	10.62	10.62	3.8128E-03	3.8128E-03	239.3	0.4049
12	9	63	20.00	10.64	10.63	4.4746E-03	4.4746E-03	646.5	0.8860
13	10	13	20.00	10.64	10.64	9.0313E-04	9.0313E-04	583.5	0.7996
14	10	8	20.00	10.64	10.64	6.0081E-05	6.0081E-05	60.86	8.3408E-02
15	28	17	18.00	10.63	10.63	6.7043E-04	6.7043E-04	239.3	0.4049
16	61	29	12.00	10.64	10.64	3.7203E-03	3.7203E-03	119.1	0.4533
17	13	51	20.00	10.64	10.63	3.9568E-03	3.9568E-03	399.0	0.5468
18	13	48	16.00	10.64	10.64	2.4519E-03	2.4519E-03	184.5	0.3950
19	3	65	16.00	10.63	10.63	2.5148E-03	2.5148E-03	184.5	0.3950
20	25	60	20.00	10.65	10.64	9.4070E-03	9.4070E-03	583.8	0.8000
21	62	20	20.00	10.67	10.66	1.4407E-02	1.4407E-02	800.0	1.096
22	15	61	12.00	10.64	10.64	6.5231E-04	6.5231E-04	120.9	0.4603
23	56	14	12.00	10.65	10.64	5.7592E-03	5.7592E-03	120.9	0.4603
24	71	25	20.00	10.65	10.65	4.3354E-03	4.3354E-03	417.8	0.5726
25	59	46	14.00	10.65	10.65	1.8902E-03	1.8902E-03	131.2	0.3670
26	46	56	12.00	10.65	10.65	2.0456E-03	2.0456E-03	120.9	0.4603
27	8	9	20.00	10.64	10.64	1.8311E-04	1.8311E-04	60.86	8.3408E-02
28	41	58	20.00	10.65	10.65	1.0395E-03	1.0395E-03	241.3	0.3307
29	22	21	14.00	10.69	10.66	3.0388E-02	3.0388E-02	319.0	0.8921
31	23	19	14.00	10.65	10.65	5.5504E-04	5.5504E-04	77.66	0.2172
33	20	10	20.00	10.66	10.64	1.7420E-02	1.7420E-02	644.3	0.8831
34	14	15	12.00	10.64	10.64	1.0080E-03	1.0080E-03	120.9	0.4603
35	29	28	12.00	10.64	10.63	2.6922E-03	2.6922E-03	119.1	0.4533
36	7	73	24.00	10.82	10.82	2.6979E-03	2.6979E-03	622.6	0.5926
37	26	22	20.00	10.73	10.69	4.0893E-02	4.0893E-02	1349.	1.849
38	17	1	18.00	10.63	10.63	1.1244E-03	1.1244E-03	239.3	0.4049
39	32	16	18.00	10.63	10.63	9.4986E-04	9.4986E-04	239.3	0.4049
40	49	26	20.00	10.79	10.73	6.6193E-02	6.6193E-02	1146.	1.571
41	49	30	12.00	10.79	10.77	2.6025E-02	2.6025E-02	202.7	0.7718
42	31	26	12.00	10.75	10.73	1.8695E-02	1.8695E-02	202.7	0.7718
43	1	32	18.00	10.63	10.63	6.8760E-04	6.8760E-04	239.3	0.4049

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.63	10.63	1.2131E-03	1.2131E-03	239.3	0.4049
45	30	35	12.00	10.77	10.76	8.1882E-03	8.1882E-03	202.7	0.7718
46	33	53	18.00	10.63	10.63	2.0571E-03	2.0571E-03	239.3	0.4049
47	35	31	12.00	10.76	10.75	1.3285E-02	1.3285E-02	202.7	0.7718
48	42	34	20.00	10.62	10.61	8.9369E-03	8.9369E-03	826.1	1.132
50	43	38	14.00	10.52	10.40	0.1231	0.1231	1349.	3.773
53	24	23	14.00	10.65	10.65	1.6975E-04	1.6975E-04	77.66	0.2172
54	6	43	14.00	10.61	10.52	8.2355E-02	8.2355E-02	851.2	2.381
55	55	44	24.00	10.82	10.81	4.7379E-03	4.7379E-03	726.4	0.6913
56	7	55	24.00	10.82	10.82	4.7684E-06	0.000	51.86	4.9362E-02
58	63	47	20.00	10.63	10.63	3.7956E-04	3.7956E-04	120.2	0.1648
59	46	25	14.00	10.65	10.65	6.2943E-05	6.2943E-05	10.29	2.8778E-02
60	73	40	24.00	10.82	10.81	1.2445E-03	1.2445E-03	622.6	0.5926
61	20	25	14.00	10.66	10.65	7.2527E-03	7.2527E-03	155.7	0.4354
62	51	50	20.00	10.63	10.63	1.1539E-04	1.1539E-04	60.57	8.3008E-02
64	48	3	16.00	10.64	10.63	3.3426E-03	3.3426E-03	184.5	0.3950
66	57	54	20.00	10.61	10.61	5.8746E-03	5.8746E-03	522.9	0.7166
67	40	45	20.00	10.81	10.80	1.2090E-02	1.2090E-02	622.6	0.8533
68	19	59	14.00	10.65	10.65	1.0443E-03	1.0443E-03	131.2	0.3670
69	61	60	12.00	10.64	10.64	4.7684E-06	0.000	1.847	7.0316E-03
70	53	66	18.00	10.63	10.63	9.8038E-04	9.8038E-04	239.3	0.4049
71	58	71	20.00	10.65	10.65	7.3242E-04	7.3242E-04	471.3	0.6460
72	60	9	20.00	10.64	10.64	1.0033E-03	1.0033E-03	585.6	0.8026
73	22	62	20.00	10.69	10.67	1.5250E-02	1.5250E-02	1030.	1.412
74	62	58	14.00	10.67	10.65	1.6592E-02	1.6592E-02	230.0	0.6434
75	68	49	20.00	10.80	10.79	8.5201E-03	8.5201E-03	1349.	1.849
76	63	64	20.00	10.63	10.63	3.7479E-04	3.7479E-04	526.2	0.7212
77	66	67	18.00	10.63	10.62	8.0490E-04	8.0490E-04	239.3	0.4049
78	44	68	20.00	10.81	10.80	1.1595E-02	1.1595E-02	726.4	0.9955
79	41	24	14.00	10.65	10.65	2.3851E-03	2.3851E-03	77.66	0.2172
80	45	68	20.00	10.80	10.80	3.0518E-04	3.0518E-04	622.6	0.8533
81	21	41	20.00	10.66	10.65	4.1485E-04	4.1485E-04	319.0	0.4371
82	71	19	14.00	10.65	10.65	1.3380E-03	1.3380E-03	53.54	0.1498
83	54	72	14.00	10.61	10.57	3.5255E-02	3.5255E-02	497.8	1.392
84	54	6	20.00	10.61	10.61	1.5259E-05	1.5259E-05	25.14	3.4453E-02
86	11	57	20.00	10.62	10.61	6.3477E-03	6.3477E-03	522.9	0.7166
89	65	77	20.00	10.63	10.62	5.9052E-03	5.9052E-03	522.9	0.7166
91	51	79	20.00	10.63	10.63	2.7056E-03	2.7056E-03	338.4	0.4638
94	64	82	20.00	10.63	10.63	5.9252E-03	5.9252E-03	586.8	0.8042
96	34	84	20.00	10.61	10.61	1.3752E-03	1.3752E-03	826.1	1.132

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	674.5	0.000	10.82	10.82	10.17	9.2032E-02	2.0268E+05	100.0
2	674.5	0.000	10.82	10.82	10.17	9.2032E-02	2.0268E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	674.5	0.0000
69	0.000	*	674.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
38	10.40	1349.	*	418.30

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

WARNINGS

*** WARNING - Velocity in pipe   50   exceeds specified maximum

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 21 Pool Fire scenario in flare area – Case B
21.A PIPENET schematic layout with piping and nodes label
21.B PIPENET schematic layout with flow rate and pressure results
21.C PIPENET schematic layout with velocity results
21.D PIPENET input/output printout report

Attachment 21.A contains 1 page
Attachment 21.B contains 1 page
Attachment 21.C contains 1 page
Attachment 21.D contains 22 pages

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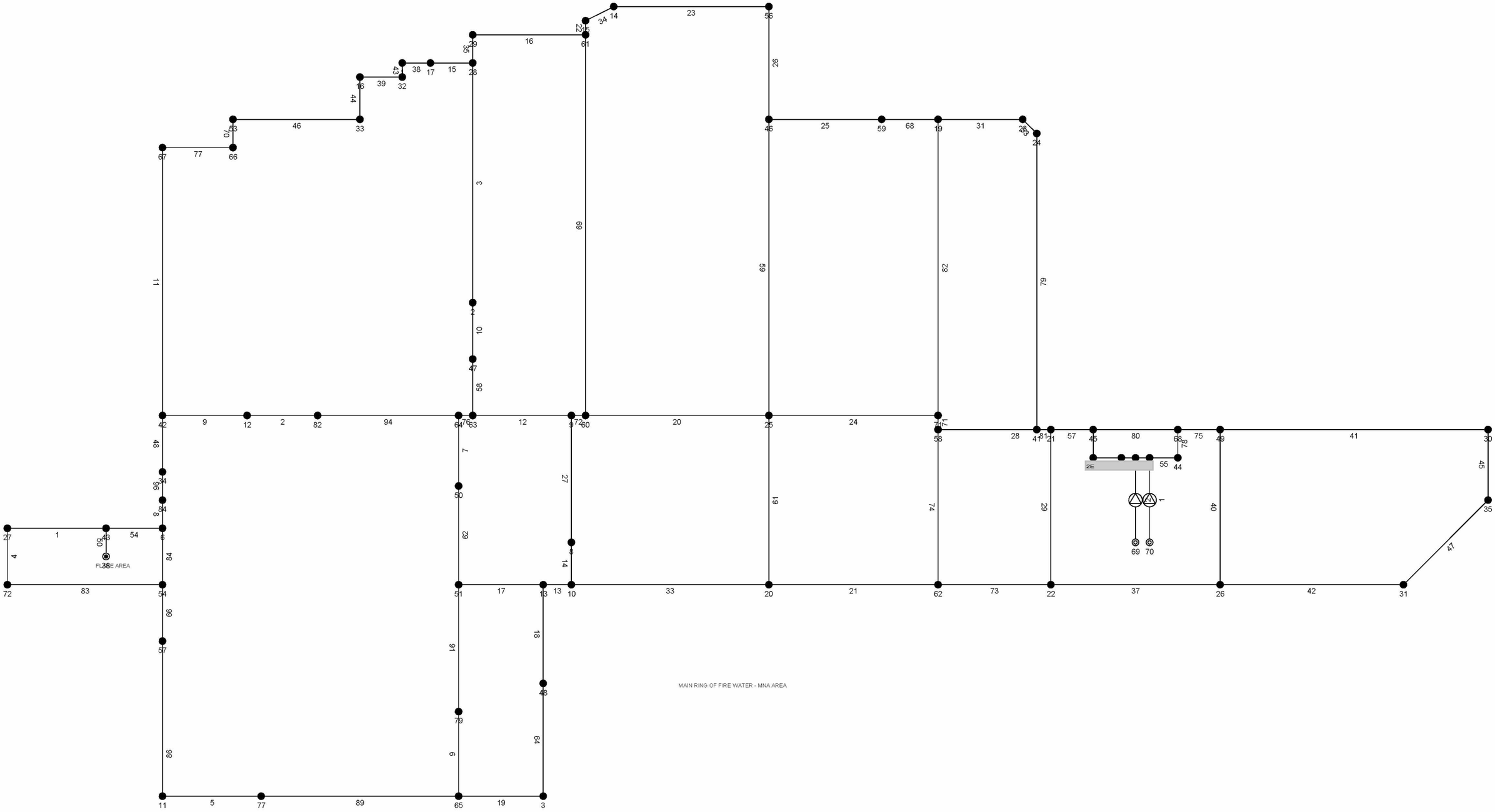
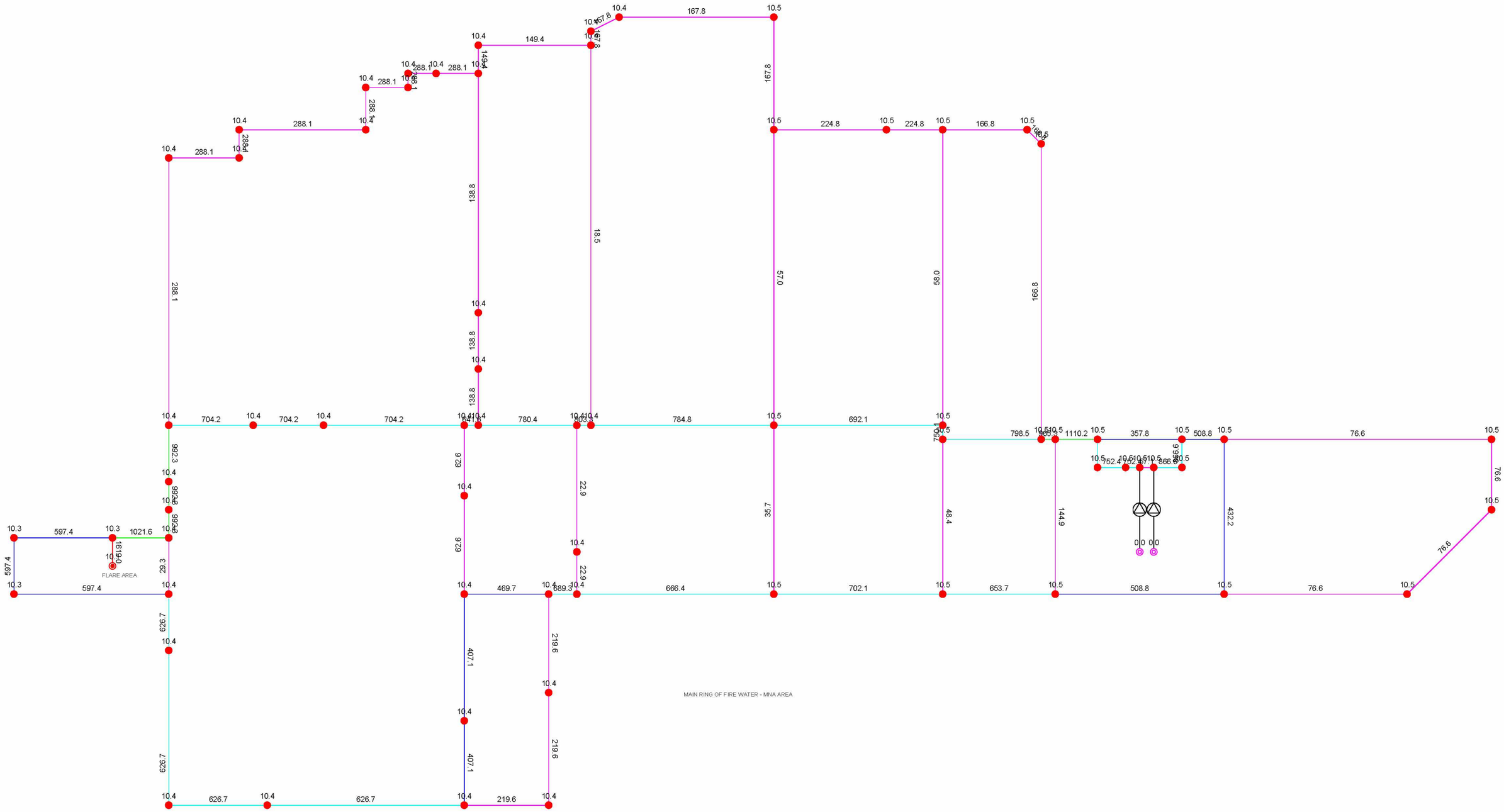
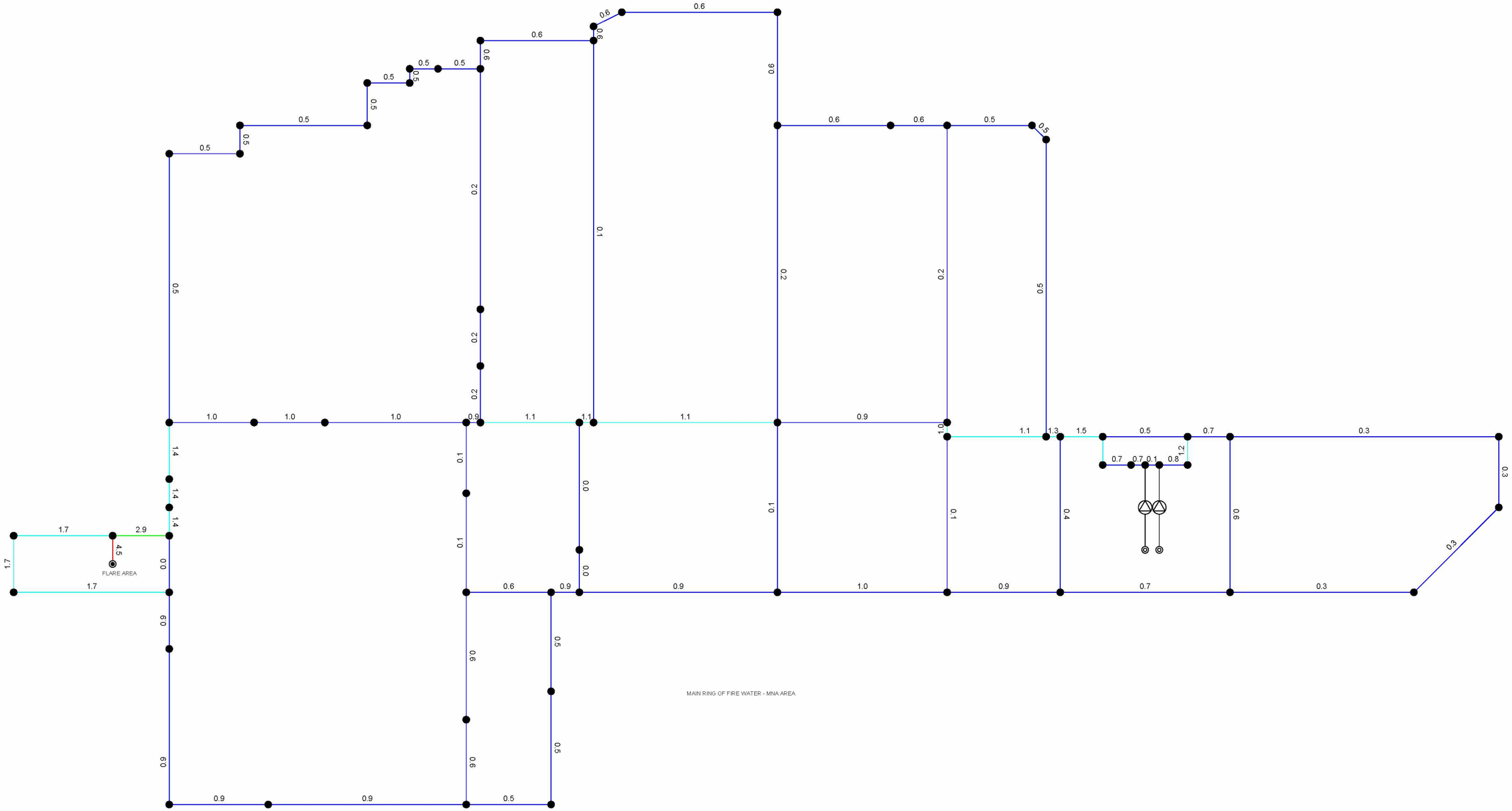


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

23:14 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18
Warnings	19

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	84	6	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	8	10	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	9	8	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	42	34	20.00	52.00	0.000	150.0	0.000
50	43	38	14.00	20.00	0.000	150.0	30.86
53	24	23	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	34	84	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
50	1 x 4	30.86		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	597.3804	9	14.0000	14.0000	*
2	82	12	704.1884	9	20.0000	20.0000	*
3	2	28	138.7702	9	20.0000	20.0000	*
4	72	27	597.3804	9	14.0000	14.0000	*
5	77	11	626.6938	9	20.0000	20.0000	*
6	79	65	407.0924	9	20.0000	20.0000	*
7	50	64	62.5620	9	20.0000	20.0000	*
8	84	6	992.3099	9	20.0000	20.0000	*
9	12	42	704.1884	9	20.0000	20.0000	*
10	47	2	138.7702	9	20.0000	20.0000	*
11	67	42	288.1215	9	18.0000	18.0000	*
12	9	63	780.3966	9	20.0000	20.0000	*
13	10	13	689.2557	9	20.0000	20.0000	*
14	8	10	22.8826	9	20.0000	20.0000	*
15	28	17	288.1215	9	18.0000	18.0000	*
16	61	29	149.3513	9	12.0000	12.0000	*
17	13	51	469.6545	9	20.0000	20.0000	*
18	13	48	219.6013	9	16.0000	16.0000	*
19	3	65	219.6013	9	16.0000	16.0000	*
20	25	60	784.7944	9	20.0000	20.0000	*
21	62	20	702.1228	9	20.0000	20.0000	*
22	15	61	167.8362	9	12.0000	12.0000	*
23	56	14	167.8362	9	12.0000	12.0000	*
24	71	25	692.0809	9	20.0000	20.0000	*
25	59	46	224.8000	9	14.0000	14.0000	*
26	46	56	167.8362	9	12.0000	12.0000	*
27	9	8	22.8826	9	20.0000	20.0000	*
28	41	58	798.4850	9	20.0000	20.0000	*
29	21	22	144.9260	9	14.0000	14.0000	*
31	23	19	166.8009	9	14.0000	14.0000	*
33	20	10	666.3732	9	20.0000	20.0000	*
34	14	15	167.8362	9	12.0000	12.0000	*
35	29	28	149.3513	9	12.0000	12.0000	*
36	7	73	752.4318	9	24.0000	24.0000	*
37	26	22	508.7918	9	20.0000	20.0000	*
38	17	1	288.1215	9	18.0000	18.0000	*
39	32	16	288.1215	9	18.0000	18.0000	*
40	49	26	432.2362	9	20.0000	20.0000	*
41	49	30	76.5557	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	76.5557	9	12.0000	12.0000	*
43	1	32	288.1215	9	18.0000	18.0000	*
44	16	33	288.1215	9	18.0000	18.0000	*
45	30	35	76.5557	9	12.0000	12.0000	*
46	33	53	288.1215	9	18.0000	18.0000	*
47	35	31	76.5557	9	12.0000	12.0000	*
48	42	34	992.3099	9	20.0000	20.0000	*
50	43	38	1619.0034	9	14.0000	14.0000	*
53	24	23	166.8009	9	14.0000	14.0000	*
54	6	43	1021.6231	9	14.0000	14.0000	*
55	55	44	866.5719	9	24.0000	24.0000	*
56	7	55	57.0690	9	24.0000	24.0000	*
57	45	21	1110.2119	9	20.0000	20.0000	*
58	63	47	138.7702	9	20.0000	20.0000	*
59	46	25	56.9638	9	14.0000	14.0000	*
60	73	40	752.4318	9	24.0000	24.0000	*
61	20	25	35.7496	9	14.0000	14.0000	*
62	51	50	62.5620	9	20.0000	20.0000	*
64	48	3	219.6013	9	16.0000	16.0000	*
66	57	54	626.6938	9	20.0000	20.0000	*
67	40	45	752.4318	9	20.0000	20.0000	*
68	19	59	224.8000	9	14.0000	14.0000	*
69	61	60	18.4849	9	12.0000	12.0000	*
70	53	66	288.1215	9	18.0000	18.0000	*
71	58	71	750.0800	9	20.0000	20.0000	*
72	60	9	803.2792	9	20.0000	20.0000	*
73	22	62	653.7178	9	20.0000	20.0000	*
74	58	62	48.4050	9	14.0000	14.0000	*
75	68	49	508.7918	9	20.0000	20.0000	*
76	63	64	641.6265	9	20.0000	20.0000	*
77	66	67	288.1215	9	18.0000	18.0000	*
78	44	68	866.5719	9	20.0000	20.0000	*
79	41	24	166.8009	9	14.0000	14.0000	*
80	68	45	357.7801	9	20.0000	20.0000	*
81	21	41	965.2859	9	20.0000	20.0000	*
82	71	19	57.9990	9	14.0000	14.0000	*
83	54	72	597.3804	9	14.0000	14.0000	*
84	54	6	29.3133	9	20.0000	20.0000	*
86	11	57	626.6938	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	626.6938	9	20.0000	20.0000	*
91	51	79	407.0924	9	20.0000	20.0000	*
94	64	82	704.1884	9	20.0000	20.0000	*
96	34	84	992.3099	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.30	10.28	2.3092E-02	2.3092E-02	597.4	1.671
2	82	12	20.00	10.43	10.42	3.8328E-03	3.8328E-03	704.2	0.9651
3	2	28	20.00	10.43	10.43	5.1975E-04	5.1975E-04	138.8	0.1902
4	72	27	14.00	10.35	10.30	4.2940E-02	4.2940E-02	597.4	1.671
5	77	11	20.00	10.42	10.41	7.9994E-03	7.9994E-03	626.7	0.8589
6	79	65	20.00	10.43	10.43	2.3203E-03	2.3203E-03	407.1	0.5579
7	50	64	20.00	10.43	10.43	1.2493E-04	1.2493E-04	62.56	8.5741E-02
8	84	6	20.00	10.40	10.39	6.7549E-03	6.7549E-03	992.3	1.360
9	12	42	20.00	10.42	10.42	5.8746E-03	5.8746E-03	704.2	0.9651
10	47	2	20.00	10.43	10.43	1.9836E-04	1.9836E-04	138.8	0.1902
11	67	42	18.00	10.42	10.42	5.3720E-03	5.3720E-03	288.1	0.4875
12	9	63	20.00	10.44	10.43	6.3372E-03	6.3372E-03	780.4	1.070
13	10	13	20.00	10.44	10.44	1.2293E-03	1.2293E-03	689.3	0.9446
14	8	10	20.00	10.44	10.44	1.0490E-05	1.0490E-05	22.88	3.1361E-02
15	28	17	18.00	10.43	10.43	9.4223E-04	9.4223E-04	288.1	0.4875
16	61	29	12.00	10.44	10.44	5.6524E-03	5.6524E-03	149.4	0.5686
17	13	51	20.00	10.44	10.43	5.3577E-03	5.3577E-03	469.7	0.6437
18	13	48	16.00	10.44	10.44	3.3903E-03	3.3903E-03	219.6	0.4703
19	3	65	16.00	10.43	10.43	3.4781E-03	3.4781E-03	219.6	0.4703
20	25	60	20.00	10.46	10.44	1.6245E-02	1.6245E-02	784.8	1.076
21	62	20	20.00	10.47	10.46	1.1330E-02	1.1330E-02	702.1	0.9623
22	15	61	12.00	10.44	10.44	1.1978E-03	1.1978E-03	167.8	0.6389
23	56	14	12.00	10.46	10.45	1.0560E-02	1.0560E-02	167.8	0.6389
24	71	25	20.00	10.47	10.46	1.1009E-02	1.1009E-02	692.1	0.9485
25	59	46	14.00	10.47	10.46	5.1203E-03	5.1203E-03	224.8	0.6288
26	46	56	12.00	10.46	10.46	3.7479E-03	3.7479E-03	167.8	0.6389
27	9	8	20.00	10.44	10.44	2.9564E-05	2.9564E-05	22.88	3.1361E-02
28	41	58	20.00	10.48	10.47	9.5119E-03	9.5119E-03	798.5	1.094
29	21	22	14.00	10.48	10.48	7.0581E-03	7.0581E-03	144.9	0.4053
31	23	19	14.00	10.47	10.47	2.2821E-03	2.2821E-03	166.8	0.4665
33	20	10	20.00	10.46	10.44	1.8560E-02	1.8560E-02	666.4	0.9133
34	14	15	12.00	10.45	10.44	1.8492E-03	1.8492E-03	167.8	0.6389
35	29	28	12.00	10.44	10.43	4.0903E-03	4.0903E-03	149.4	0.5686
36	7	73	24.00	10.52	10.52	3.8252E-03	3.8252E-03	752.4	0.7161
37	26	22	20.00	10.48	10.48	6.7377E-03	6.7377E-03	508.8	0.6973
38	17	1	18.00	10.43	10.43	1.5879E-03	1.5879E-03	288.1	0.4875
39	32	16	18.00	10.43	10.43	1.3399E-03	1.3399E-03	288.1	0.4875
40	49	26	20.00	10.50	10.48	1.0905E-02	1.0905E-02	432.2	0.5924
41	49	30	12.00	10.50	10.49	4.2877E-03	4.2877E-03	76.56	0.2914
42	31	26	12.00	10.49	10.48	3.0804E-03	3.0804E-03	76.56	0.2914
43	1	32	18.00	10.43	10.43	9.6989E-04	9.6989E-04	288.1	0.4875

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.43	10.43	1.7099E-03	1.7099E-03	288.1	0.4875
45	30	35	12.00	10.49	10.49	1.3504E-03	1.3504E-03	76.56	0.2914
46	33	53	18.00	10.43	10.42	2.8973E-03	2.8973E-03	288.1	0.4875
47	35	31	12.00	10.49	10.49	2.1868E-03	2.1868E-03	76.56	0.2914
48	42	34	20.00	10.42	10.40	1.2546E-02	1.2546E-02	992.3	1.360
50	43	38	14.00	10.28	10.11	0.1725	0.1725	1619.	4.528
53	24	23	14.00	10.47	10.47	7.0763E-04	7.0763E-04	166.8	0.4665
54	6	43	14.00	10.39	10.28	0.1154	0.1154	1022.	2.857
55	55	44	24.00	10.52	10.51	6.5699E-03	6.5699E-03	866.6	0.8247
56	7	55	24.00	10.52	10.52	2.8610E-06	0.000	57.07	5.4315E-02
57	45	21	20.00	10.50	10.48	1.1880E-02	1.1880E-02	1110.	1.522
58	63	47	20.00	10.43	10.43	4.9210E-04	4.9210E-04	138.8	0.1902
59	46	25	14.00	10.46	10.46	1.5097E-03	1.5097E-03	56.96	0.1593
60	73	40	24.00	10.52	10.51	1.7700E-03	1.7700E-03	752.4	0.7161
61	20	25	14.00	10.46	10.46	4.7970E-04	4.7970E-04	35.75	0.1000
62	51	50	20.00	10.43	10.43	1.2302E-04	1.2302E-04	62.56	8.5741E-02
64	48	3	16.00	10.44	10.43	4.6148E-03	4.6148E-03	219.6	0.4703
66	57	54	20.00	10.40	10.39	8.2150E-03	8.2150E-03	626.7	0.8589
67	40	45	20.00	10.51	10.50	1.7159E-02	1.7159E-02	752.4	1.031
68	19	59	14.00	10.47	10.47	2.8248E-03	2.8248E-03	224.8	0.6288
69	61	60	12.00	10.44	10.44	3.9959E-04	3.9959E-04	18.48	7.0371E-02
70	53	66	18.00	10.42	10.42	1.3828E-03	1.3828E-03	288.1	0.4875
71	58	71	20.00	10.47	10.47	1.7233E-03	1.7233E-03	750.1	1.028
72	60	9	20.00	10.44	10.44	1.7958E-03	1.7958E-03	803.3	1.101
73	22	62	20.00	10.48	10.47	6.5851E-03	6.5851E-03	653.7	0.8959
74	58	62	14.00	10.47	10.47	9.2316E-04	9.2316E-04	48.40	0.1354
75	68	49	20.00	10.50	10.50	1.4048E-03	1.4048E-03	508.8	0.6973
76	63	64	20.00	10.43	10.43	5.3787E-04	5.3787E-04	641.6	0.8793
77	66	67	18.00	10.42	10.42	1.1349E-03	1.1349E-03	288.1	0.4875
78	44	68	20.00	10.51	10.50	1.6072E-02	1.6072E-02	866.6	1.188
79	41	24	14.00	10.48	10.47	9.8000E-03	9.8000E-03	166.8	0.4665
80	68	45	20.00	10.50	10.50	1.0967E-04	1.0967E-04	357.8	0.4903
81	21	41	20.00	10.48	10.48	3.2082E-03	3.2082E-03	965.3	1.323
82	71	19	14.00	10.47	10.47	1.5545E-03	1.5545E-03	58.00	0.1622
83	54	72	14.00	10.39	10.35	4.9408E-02	4.9408E-02	597.4	1.671
84	54	6	20.00	10.39	10.39	1.8120E-05	1.8120E-05	29.31	4.0174E-02
86	11	57	20.00	10.41	10.40	8.8749E-03	8.8749E-03	626.7	0.8589
89	65	77	20.00	10.43	10.42	8.2550E-03	8.2550E-03	626.7	0.8589
91	51	79	20.00	10.43	10.43	3.8052E-03	3.8052E-03	407.1	0.5579
94	64	82	20.00	10.43	10.43	8.3017E-03	8.3017E-03	704.2	0.9651
96	34	84	20.00	10.40	10.40	1.9302E-03	1.9302E-03	992.3	1.360

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	809.5	0.000	10.52	10.52	10.17	9.4644E-02	2.3654E+05	100.0
2	809.5	0.000	10.52	10.52	10.17	9.4644E-02	2.3653E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	809.5	0.0000
69	0.000	*	809.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
38	10.11	1619.	*	509.25

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

WARNINGS

*** WARNING - Velocity in pipe   50   exceeds specified maximum

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 22 Pool Fire scenario in Hot Oil Fire Scenario Area – Case A
22.A PIPENET schematic layout with piping and nodes label
22.B PIPENET schematic layout with flow rate and pressure results
22.C PIPENET schematic layout with velocity results
22.D PIPENET input/output printout report

Attachment 22.A contains 1 page
Attachment 22.B contains 1 page
Attachment 22.C contains 1 page
Attachment 22.D contains 21 pages

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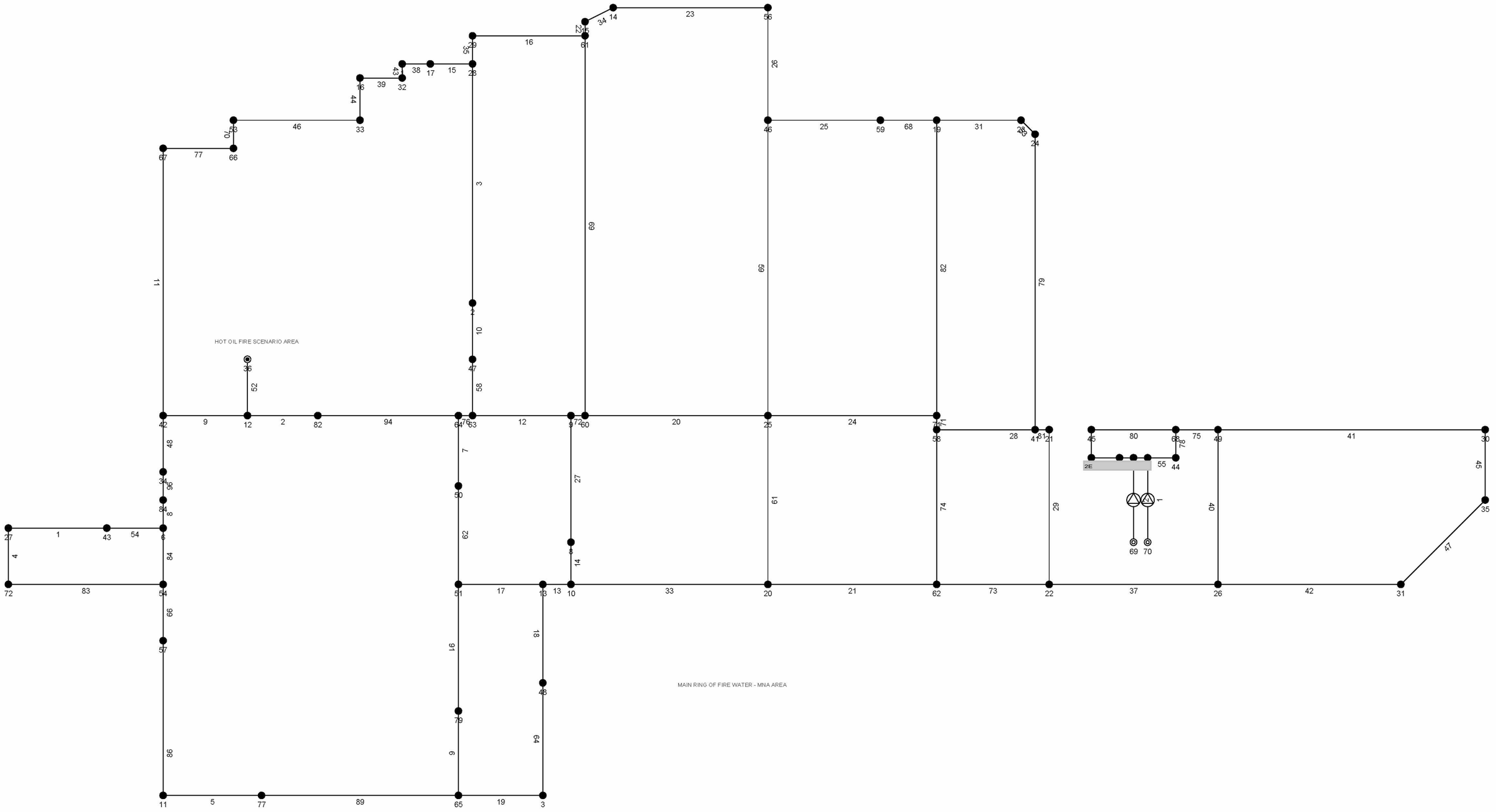
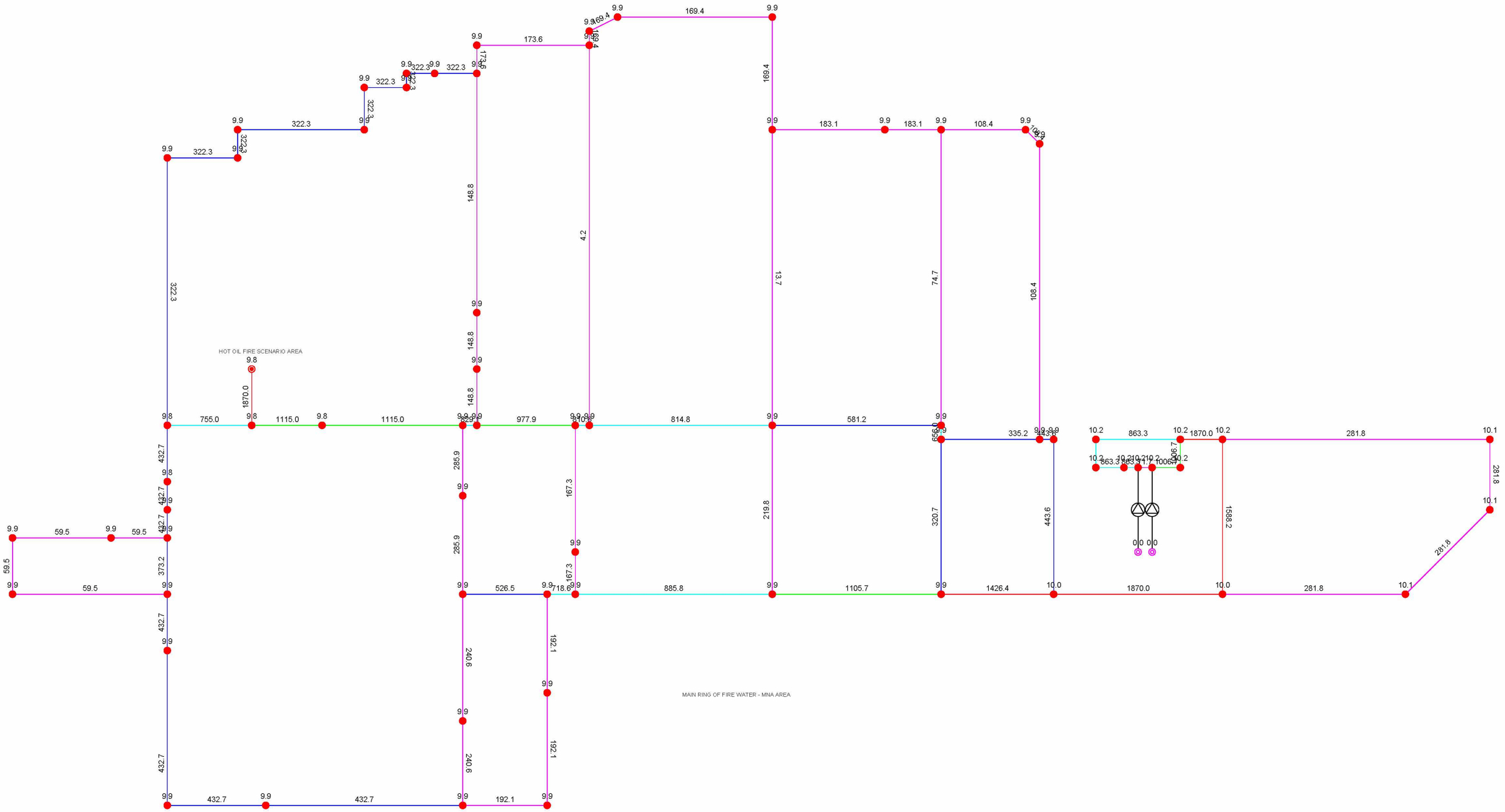
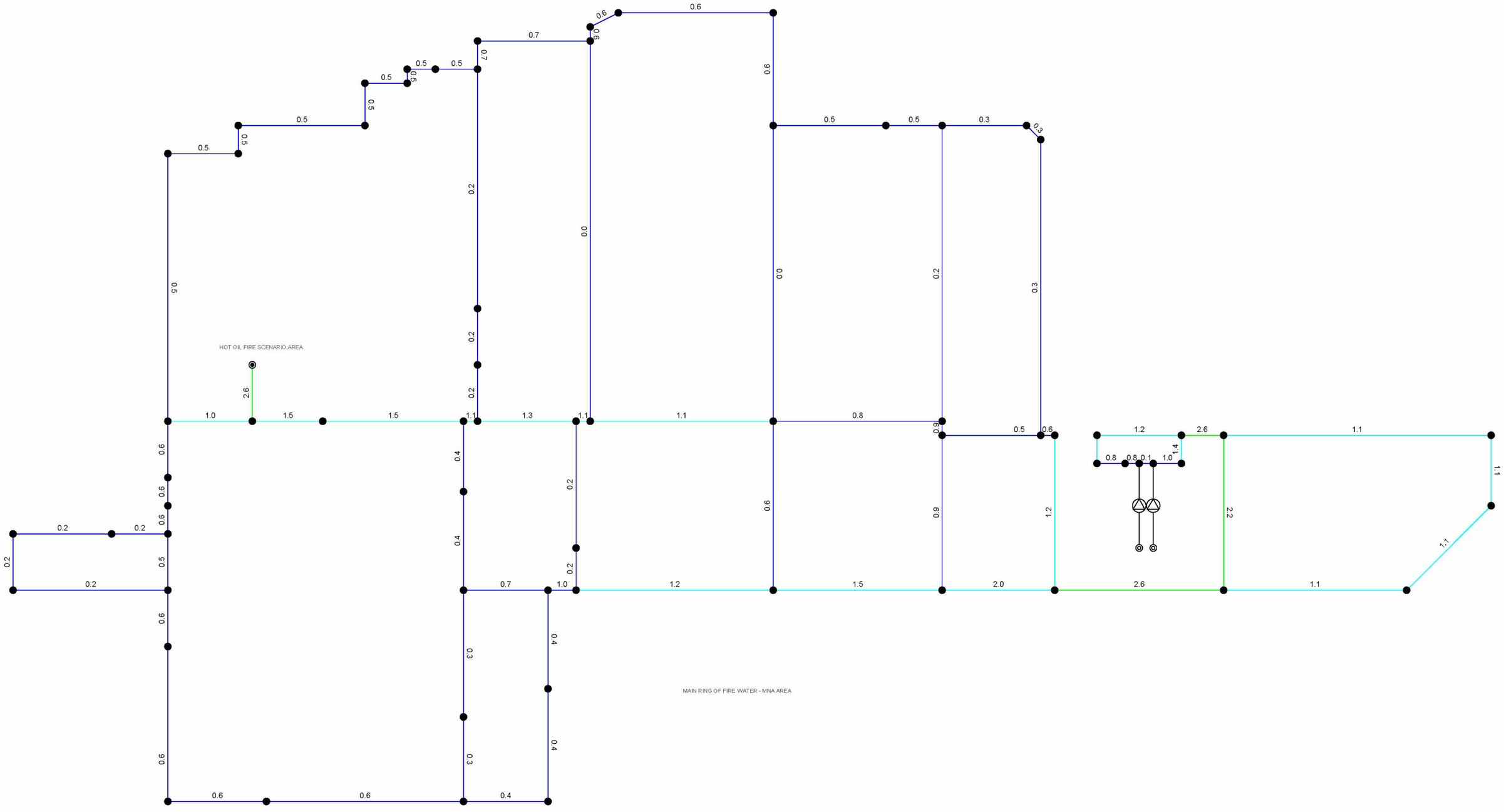


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Wednesday, July 07, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Wednesday, July 07, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

23:25 on 7-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
52	12	36	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
52	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	59.4615	9	14.0000	14.0000	*
2	82	12	1115.0071	9	20.0000	20.0000	*
3	2	28	148.7664	9	20.0000	20.0000	*
4	72	27	59.4615	9	14.0000	14.0000	*
5	77	11	432.6744	9	20.0000	20.0000	*
6	79	65	240.5604	9	20.0000	20.0000	*
7	50	64	285.9030	9	20.0000	20.0000	*
8	6	84	432.6744	9	20.0000	20.0000	*
9	42	12	754.9972	9	20.0000	20.0000	*
10	47	2	148.7664	9	20.0000	20.0000	*
11	67	42	322.3228	9	18.0000	18.0000	*
12	9	63	977.8705	9	20.0000	20.0000	*
13	10	13	718.5773	9	20.0000	20.0000	*
14	10	8	167.2648	9	20.0000	20.0000	*
15	28	17	322.3228	9	18.0000	18.0000	*
16	61	29	173.5564	9	12.0000	12.0000	*
17	13	51	526.4634	9	20.0000	20.0000	*
18	13	48	192.1139	9	16.0000	16.0000	*
19	3	65	192.1139	9	16.0000	16.0000	*
20	25	60	814.8023	9	20.0000	20.0000	*
21	62	20	1105.6910	9	20.0000	20.0000	*
22	15	61	169.3600	9	12.0000	12.0000	*
23	56	14	169.3600	9	12.0000	12.0000	*
24	71	25	581.2260	9	20.0000	20.0000	*
25	59	46	183.0873	9	14.0000	14.0000	*
26	46	56	169.3600	9	12.0000	12.0000	*
27	8	9	167.2648	9	20.0000	20.0000	*
28	41	58	335.2309	9	20.0000	20.0000	*
29	22	21	443.5871	9	14.0000	14.0000	*
31	23	19	108.3562	9	14.0000	14.0000	*
33	20	10	885.8422	9	20.0000	20.0000	*
34	14	15	169.3600	9	12.0000	12.0000	*
35	29	28	173.5564	9	12.0000	12.0000	*
36	7	73	863.3098	9	24.0000	24.0000	*
37	26	22	1870.0043	9	20.0000	20.0000	*
38	17	1	322.3228	9	18.0000	18.0000	*
39	32	16	322.3228	9	18.0000	18.0000	*
40	49	26	1588.1566	9	20.0000	20.0000	*
41	49	30	281.8477	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	281.8477	9	12.0000	12.0000	*
43	1	32	322.3228	9	18.0000	18.0000	*
44	16	33	322.3228	9	18.0000	18.0000	*
45	30	35	281.8477	9	12.0000	12.0000	*
46	33	53	322.3228	9	18.0000	18.0000	*
47	35	31	281.8477	9	12.0000	12.0000	*
48	34	42	432.6744	9	20.0000	20.0000	*
52	12	36	1870.0043	9	20.0000	20.0000	*
53	24	23	108.3562	9	14.0000	14.0000	*
54	43	6	59.4615	9	14.0000	14.0000	*
55	55	44	1006.6946	9	24.0000	24.0000	*
56	7	55	71.6913	9	24.0000	24.0000	*
58	63	47	148.7664	9	20.0000	20.0000	*
59	46	25	13.7274	9	14.0000	14.0000	*
60	73	40	863.3098	9	24.0000	24.0000	*
61	20	25	219.8490	9	14.0000	14.0000	*
62	51	50	285.9030	9	20.0000	20.0000	*
64	48	3	192.1139	9	16.0000	16.0000	*
66	57	54	432.6744	9	20.0000	20.0000	*
67	40	45	863.3099	9	20.0000	20.0000	*
68	19	59	183.0873	9	14.0000	14.0000	*
69	60	61	4.1964	9	12.0000	12.0000	*
70	53	66	322.3228	9	18.0000	18.0000	*
71	58	71	655.9570	9	20.0000	20.0000	*
72	60	9	810.6058	9	20.0000	20.0000	*
73	22	62	1426.4171	9	20.0000	20.0000	*
74	62	58	320.7261	9	14.0000	14.0000	*
75	68	49	1870.0043	9	20.0000	20.0000	*
76	63	64	829.1041	9	20.0000	20.0000	*
77	66	67	322.3228	9	18.0000	18.0000	*
78	44	68	1006.6945	9	20.0000	20.0000	*
79	41	24	108.3562	9	14.0000	14.0000	*
80	45	68	863.3099	9	20.0000	20.0000	*
81	21	41	443.5872	9	20.0000	20.0000	*
82	71	19	74.7310	9	14.0000	14.0000	*
83	54	72	59.4615	9	14.0000	14.0000	*
84	54	6	373.2129	9	20.0000	20.0000	*
86	11	57	432.6744	9	20.0000	20.0000	*
89	65	77	432.6744	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	240.5604	9	20.0000	20.0000	*
94	64	82	1115.0071	9	20.0000	20.0000	*
96	84	34	432.6744	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.852	9.852	3.2234E-04	3.2234E-04	59.46	0.1663
2	82	12	20.00	9.849	9.840	8.9874E-03	8.9874E-03	1115.	1.528
3	2	28	20.00	9.869	9.868	5.9223E-04	5.9223E-04	148.8	0.2039
4	72	27	14.00	9.853	9.852	5.9986E-04	5.9986E-04	59.46	0.1663
5	77	11	20.00	9.866	9.862	4.0274E-03	4.0274E-03	432.7	0.5930
6	79	65	20.00	9.871	9.871	8.7547E-04	8.7547E-04	240.6	0.3297
7	50	64	20.00	9.871	9.869	2.0676E-03	2.0676E-03	285.9	0.3918
8	6	84	20.00	9.852	9.850	1.4544E-03	1.4544E-03	432.7	0.5930
9	42	12	20.00	9.847	9.840	6.6929E-03	6.6929E-03	755.0	1.035
10	47	2	20.00	9.869	9.869	2.2316E-04	2.2316E-04	148.8	0.2039
11	67	42	18.00	9.854	9.847	6.5899E-03	6.5899E-03	322.3	0.5454
12	9	63	20.00	9.879	9.870	9.6302E-03	9.6302E-03	977.9	1.340
13	10	13	20.00	9.881	9.880	1.3304E-03	1.3304E-03	718.6	0.9848
14	10	8	20.00	9.881	9.880	3.9482E-04	3.9482E-04	167.3	0.2292
15	28	17	18.00	9.868	9.867	1.1549E-03	1.1549E-03	322.3	0.5454
16	61	29	12.00	9.881	9.874	7.4272E-03	7.4272E-03	173.6	0.6607
17	13	51	20.00	9.880	9.873	6.6195E-03	6.6195E-03	526.5	0.7215
18	13	48	16.00	9.880	9.877	2.6369E-03	2.6369E-03	192.1	0.4114
19	3	65	16.00	9.873	9.871	2.7056E-03	2.7056E-03	192.1	0.4114
20	25	60	20.00	9.899	9.881	1.7430E-02	1.7430E-02	814.8	1.117
21	62	20	20.00	9.939	9.912	2.6242E-02	2.6242E-02	1106.	1.515
22	15	61	12.00	9.882	9.881	1.2121E-03	1.2121E-03	169.4	0.6447
23	56	14	12.00	9.895	9.884	1.0691E-02	1.0691E-02	169.4	0.6447
24	71	25	20.00	9.907	9.899	7.9842E-03	7.9842E-03	581.2	0.7966
25	59	46	14.00	9.902	9.899	3.4857E-03	3.4857E-03	183.1	0.5121
26	46	56	12.00	9.899	9.895	3.7918E-03	3.7918E-03	169.4	0.6447
27	8	9	20.00	9.880	9.879	1.1797E-03	1.1797E-03	167.3	0.2292
28	41	58	20.00	9.910	9.908	1.9131E-03	1.9131E-03	335.2	0.4594
29	22	21	14.00	9.966	9.911	5.5847E-02	5.5847E-02	443.6	1.241
31	23	19	14.00	9.905	9.904	1.0233E-03	1.0233E-03	108.4	0.3031
33	20	10	20.00	9.912	9.881	3.1425E-02	3.1425E-02	885.8	1.214
34	14	15	12.00	9.884	9.882	1.8702E-03	1.8702E-03	169.4	0.6447
35	29	28	12.00	9.874	9.868	5.3778E-03	5.3778E-03	173.6	0.6607
36	7	73	24.00	10.21	10.20	4.9324E-03	4.9324E-03	863.3	0.8216
37	26	22	20.00	10.04	9.966	7.4822E-02	7.4822E-02	1870.	2.563
38	17	1	18.00	9.867	9.865	1.9455E-03	1.9455E-03	322.3	0.5454
39	32	16	18.00	9.864	9.862	1.6451E-03	1.6451E-03	322.3	0.5454
40	49	26	20.00	10.16	10.04	0.1211	0.1211	1588.	2.177
41	49	30	12.00	10.16	10.11	4.7618E-02	4.7618E-02	281.8	1.073
42	31	26	12.00	10.08	10.04	3.4207E-02	3.4207E-02	281.8	1.073
43	1	32	18.00	9.865	9.864	1.1892E-03	1.1892E-03	322.3	0.5454

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	9.862	9.860	2.0952E-03	2.0952E-03	322.3	0.5454
45	30	35	12.00	10.11	10.10	1.4979E-02	1.4979E-02	281.8	1.073
46	33	53	18.00	9.860	9.857	3.5553E-03	3.5553E-03	322.3	0.5454
47	35	31	12.00	10.10	10.08	2.4308E-02	2.4308E-02	281.8	1.073
48	34	42	20.00	9.850	9.847	2.7027E-03	2.7027E-03	432.7	0.5930
52	12	36	20.00	9.840	9.789	5.1125E-02	5.1125E-02	1870.	2.563
53	24	23	14.00	9.905	9.905	3.1662E-04	3.1662E-04	108.4	0.3031
54	43	6	14.00	9.852	9.852	6.0081E-04	6.0081E-04	59.46	0.1663
55	55	44	24.00	10.21	10.20	8.6699E-03	8.6699E-03	1007.	0.9581
56	7	55	24.00	10.21	10.21	7.6294E-06	0.000	71.69	6.8231E-02
58	63	47	20.00	9.870	9.869	5.5981E-04	5.5981E-04	148.8	0.2039
59	46	25	14.00	9.899	9.899	1.0681E-04	1.0681E-04	13.73	3.8395E-02
60	73	40	24.00	10.20	10.20	2.2831E-03	2.2831E-03	863.3	0.8216
61	20	25	14.00	9.912	9.899	1.3742E-02	1.3742E-02	219.8	0.6149
62	51	50	20.00	9.873	9.871	2.0552E-03	2.0552E-03	285.9	0.3918
64	48	3	16.00	9.877	9.873	3.5925E-03	3.5925E-03	192.1	0.4114
66	57	54	20.00	9.858	9.854	4.1351E-03	4.1351E-03	432.7	0.5930
67	40	45	20.00	10.20	10.18	2.2120E-02	2.2120E-02	863.3	1.183
68	19	59	14.00	9.904	9.902	1.9217E-03	1.9217E-03	183.1	0.5121
69	60	61	12.00	9.881	9.881	2.7657E-05	2.7657E-05	4.196	1.5976E-02
70	53	66	18.00	9.857	9.855	1.6918E-03	1.6918E-03	322.3	0.5454
71	58	71	20.00	9.908	9.907	1.3475E-03	1.3475E-03	656.0	0.8990
72	60	9	20.00	9.881	9.879	1.8272E-03	1.8272E-03	810.6	1.111
73	22	62	20.00	9.966	9.939	2.7867E-02	2.7867E-02	1426.	1.955
74	62	58	14.00	9.939	9.908	3.0653E-02	3.0653E-02	320.7	0.8971
75	68	49	20.00	10.18	10.16	1.5587E-02	1.5587E-02	1870.	2.563
76	63	64	20.00	9.870	9.869	8.6784E-04	8.6784E-04	829.1	1.136
77	66	67	18.00	9.855	9.854	1.3905E-03	1.3905E-03	322.3	0.5454
78	44	68	20.00	10.20	10.18	2.1218E-02	2.1218E-02	1007.	1.380
79	41	24	14.00	9.910	9.905	4.3907E-03	4.3907E-03	108.4	0.3031
80	45	68	20.00	10.18	10.18	5.6076E-04	5.6076E-04	863.3	1.183
81	21	41	20.00	9.911	9.910	7.6008E-04	7.6008E-04	443.6	0.6079
82	71	19	14.00	9.907	9.904	2.4700E-03	2.4700E-03	74.73	0.2090
83	54	72	14.00	9.854	9.853	6.8951E-04	6.8951E-04	59.46	0.1663
84	54	6	20.00	9.854	9.852	2.2125E-03	2.2125E-03	373.2	0.5115
86	11	57	20.00	9.862	9.858	4.4680E-03	4.4680E-03	432.7	0.5930
89	65	77	20.00	9.871	9.866	4.1571E-03	4.1571E-03	432.7	0.5930
91	51	79	20.00	9.873	9.871	1.4400E-03	1.4400E-03	240.6	0.3297
94	64	82	20.00	9.869	9.849	1.9470E-02	1.9470E-02	1115.	1.528
96	84	34	20.00	9.850	9.850	4.1485E-04	4.1485E-04	432.7	0.5930

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	935.0	0.000	10.21	10.21	10.17	9.7531E-02	2.6512E+05	100.0
2	935.0	0.000	10.21	10.21	10.17	9.7531E-02	2.6512E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	935.0	0.0000
69	0.000	*	935.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
36	9.789	1870.	*	597.68

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 23 Pool Fire scenario in Hot Oil Fire Scenario Area – Case B

23.A PIPENET schematic layout with piping and nodes label

23.B PIPENET schematic layout with flow rate and pressure results

23.C PIPENET schematic layout with velocity results

23.D PIPENET input/output printout report

Attachment 23.A contains 1 page
Attachment 23.B contains 1 page
Attachment 23.C contains 1 page
Attachment 23.D contains 21 pages

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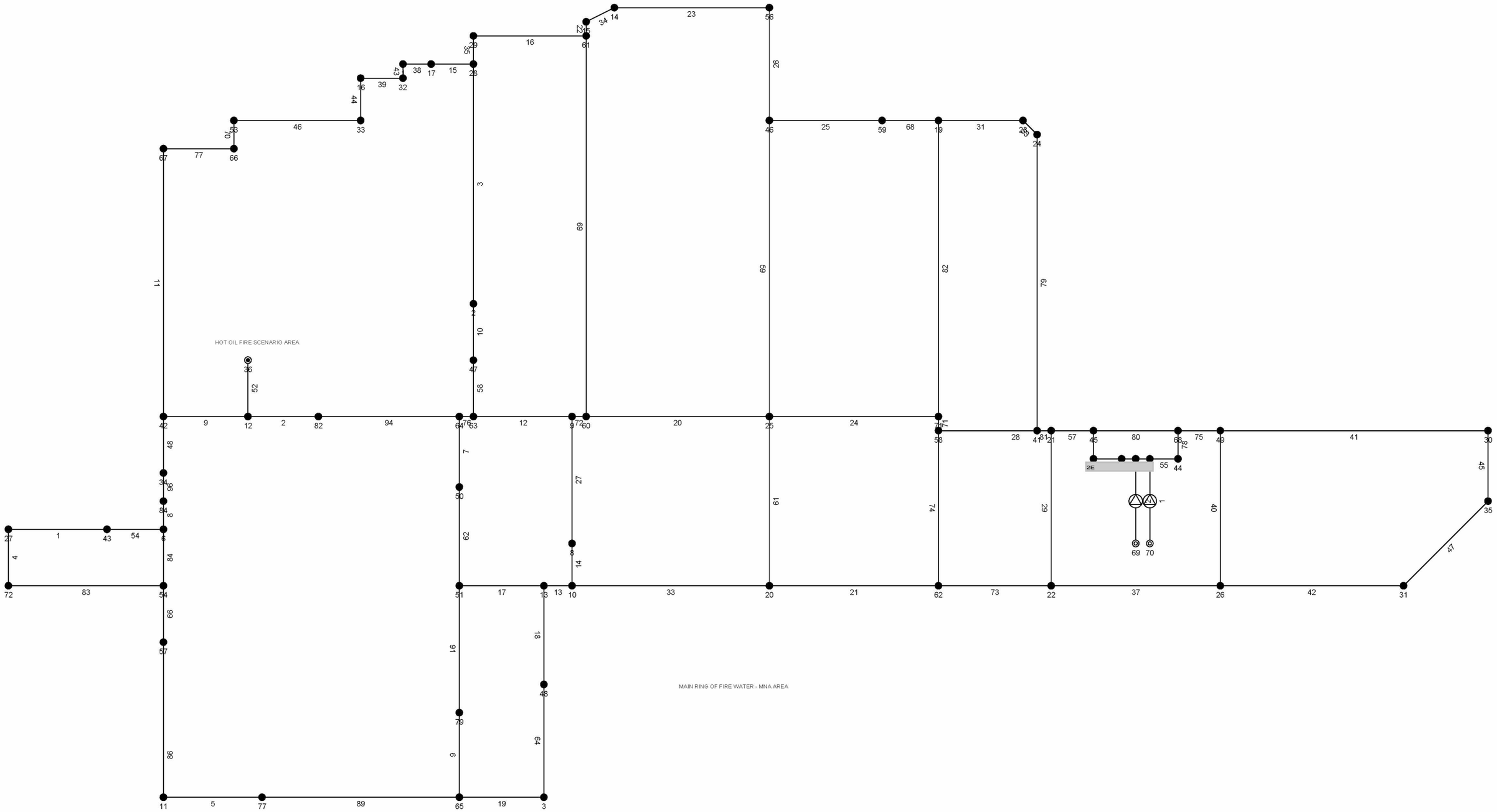
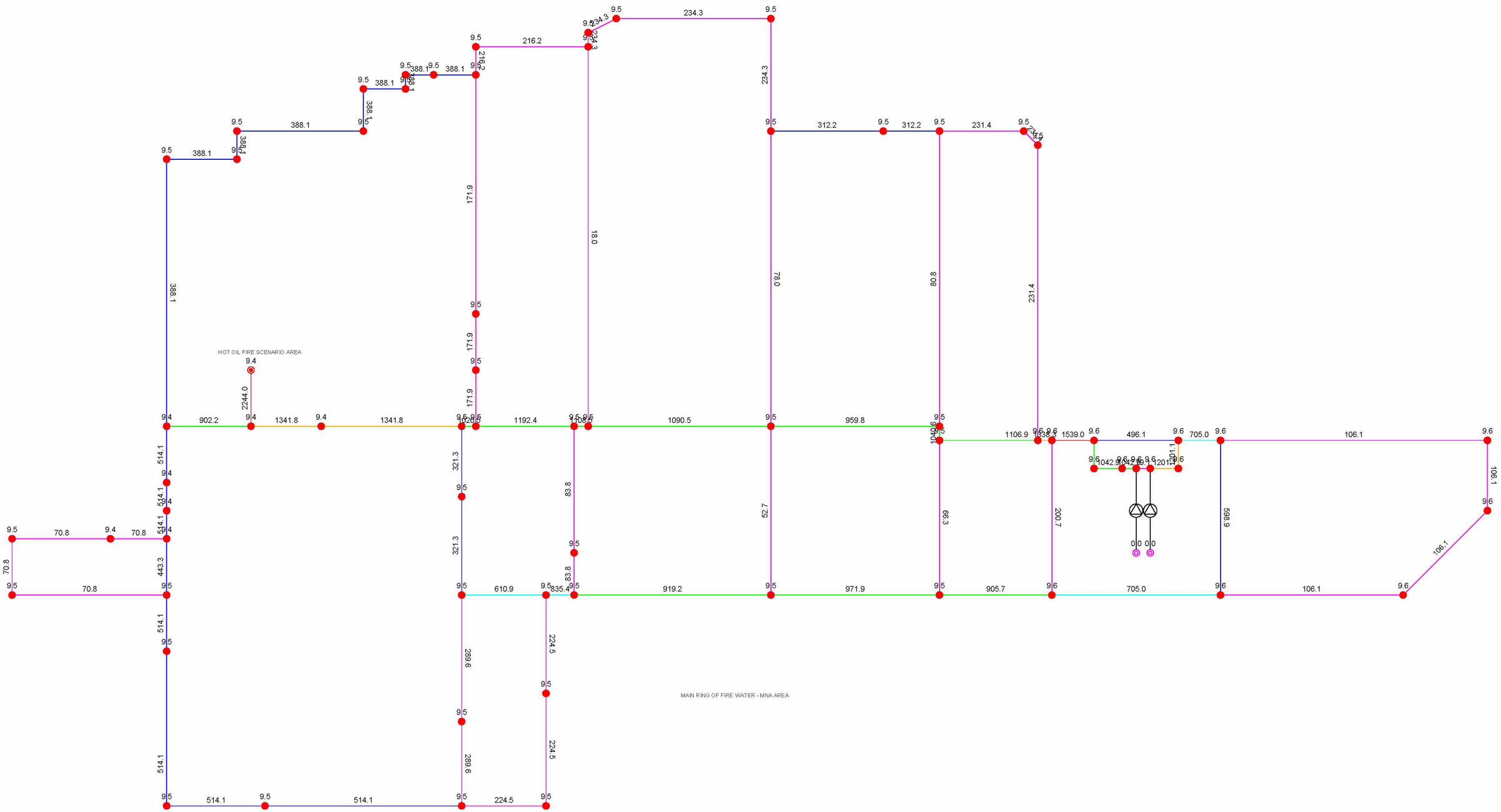
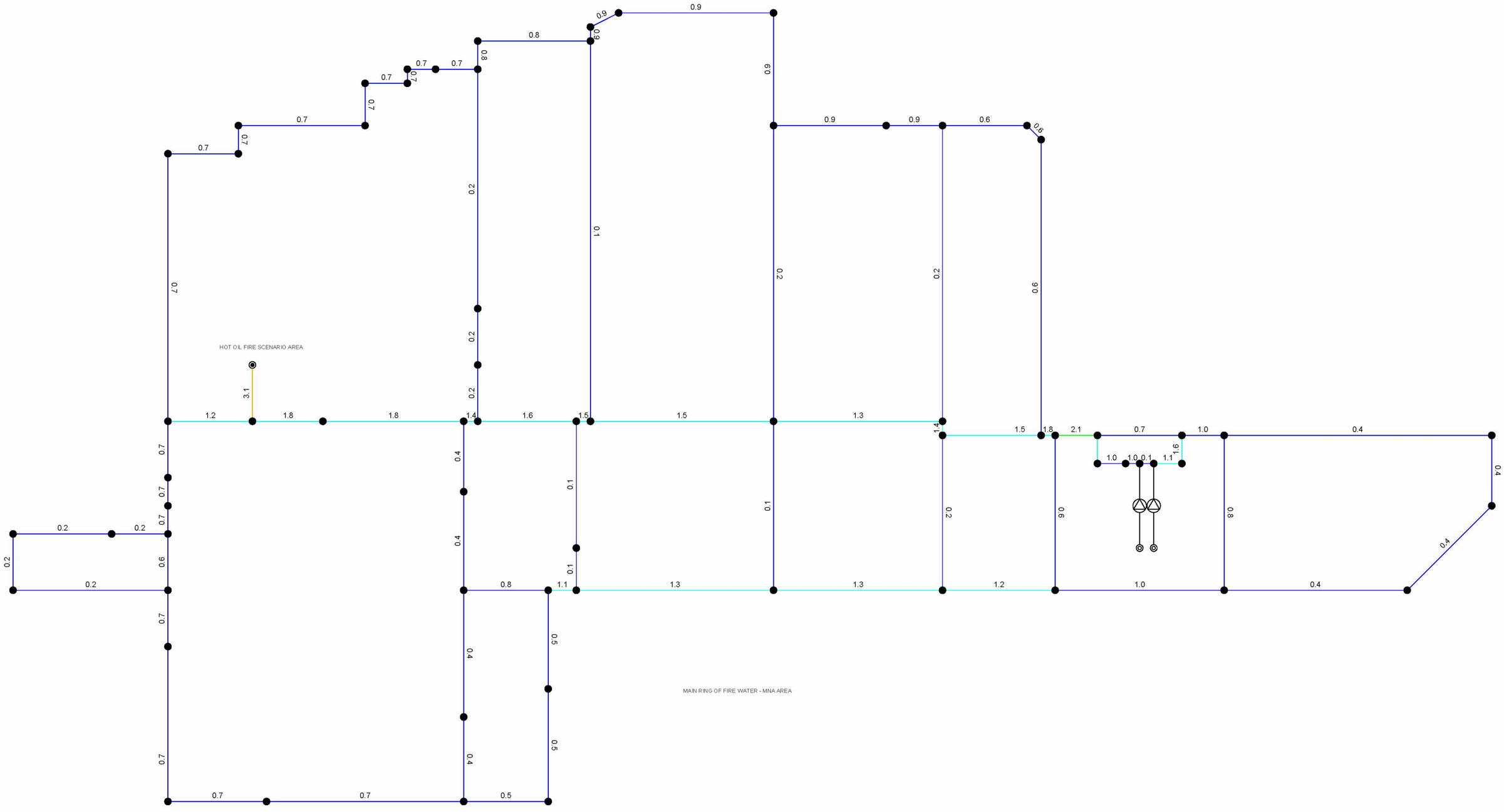


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

08:44 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
52	12	36	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
52	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	70.8221	9	14.0000	14.0000	*
2	82	12	1341.7856	9	20.0000	20.0000	*
3	2	28	171.8764	9	20.0000	20.0000	*
4	72	27	70.8221	9	14.0000	14.0000	*
5	77	11	514.1068	9	20.0000	20.0000	*
6	79	65	289.5646	9	20.0000	20.0000	*
7	50	64	321.2925	9	20.0000	20.0000	*
8	6	84	514.1068	9	20.0000	20.0000	*
9	42	12	902.2195	9	20.0000	20.0000	*
10	47	2	171.8764	9	20.0000	20.0000	*
11	67	42	388.1127	9	18.0000	18.0000	*
12	9	63	1192.3696	9	20.0000	20.0000	*
13	10	13	835.3993	9	20.0000	20.0000	*
14	10	8	83.8177	9	20.0000	20.0000	*
15	28	17	388.1127	9	18.0000	18.0000	*
16	61	29	216.2362	9	12.0000	12.0000	*
17	13	51	610.8571	9	20.0000	20.0000	*
18	13	48	224.5422	9	16.0000	16.0000	*
19	3	65	224.5422	9	16.0000	16.0000	*
20	25	60	1090.5040	9	20.0000	20.0000	*
21	62	20	971.9512	9	20.0000	20.0000	*
22	15	61	234.2840	9	12.0000	12.0000	*
23	56	14	234.2840	9	12.0000	12.0000	*
24	71	25	959.8148	9	20.0000	20.0000	*
25	59	46	312.2391	9	14.0000	14.0000	*
26	46	56	234.2840	9	12.0000	12.0000	*
27	8	9	83.8177	9	20.0000	20.0000	*
28	41	58	1106.9309	9	20.0000	20.0000	*
29	21	22	200.6665	9	14.0000	14.0000	*
31	23	19	231.4102	9	14.0000	14.0000	*
33	20	10	919.2169	9	20.0000	20.0000	*
34	14	15	234.2840	9	12.0000	12.0000	*
35	29	28	216.2362	9	12.0000	12.0000	*
36	7	73	1042.9026	9	24.0000	24.0000	*
37	26	22	704.9973	9	20.0000	20.0000	*
38	17	1	388.1127	9	18.0000	18.0000	*
39	32	16	388.1127	9	18.0000	18.0000	*
40	49	26	598.9016	9	20.0000	20.0000	*
41	49	30	106.0958	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	106.0958	9	12.0000	12.0000	*
43	1	32	388.1127	9	18.0000	18.0000	*
44	16	33	388.1127	9	18.0000	18.0000	*
45	30	35	106.0958	9	12.0000	12.0000	*
46	33	53	388.1127	9	18.0000	18.0000	*
47	35	31	106.0958	9	12.0000	12.0000	*
48	34	42	514.1068	9	20.0000	20.0000	*
52	12	36	2244.0049	9	20.0000	20.0000	*
53	24	23	231.4102	9	14.0000	14.0000	*
54	43	6	70.8221	9	14.0000	14.0000	*
55	55	44	1201.1025	9	24.0000	24.0000	*
56	7	55	79.0989	9	24.0000	24.0000	*
57	45	21	1539.0079	9	20.0000	20.0000	*
58	63	47	171.8764	9	20.0000	20.0000	*
59	46	25	77.9551	9	14.0000	14.0000	*
60	73	40	1042.9026	9	24.0000	24.0000	*
61	20	25	52.7343	9	14.0000	14.0000	*
62	51	50	321.2925	9	20.0000	20.0000	*
64	48	3	224.5422	9	16.0000	16.0000	*
66	57	54	514.1068	9	20.0000	20.0000	*
67	40	45	1042.9026	9	20.0000	20.0000	*
68	19	59	312.2391	9	14.0000	14.0000	*
69	61	60	18.0478	9	12.0000	12.0000	*
70	53	66	388.1127	9	18.0000	18.0000	*
71	58	71	1040.6437	9	20.0000	20.0000	*
72	60	9	1108.5519	9	20.0000	20.0000	*
73	22	62	905.6638	9	20.0000	20.0000	*
74	58	62	66.2873	9	14.0000	14.0000	*
75	68	49	704.9973	9	20.0000	20.0000	*
76	63	64	1020.4933	9	20.0000	20.0000	*
77	66	67	388.1127	9	18.0000	18.0000	*
78	44	68	1201.1027	9	20.0000	20.0000	*
79	41	24	231.4102	9	14.0000	14.0000	*
80	68	45	496.1052	9	20.0000	20.0000	*
81	21	41	1338.3413	9	20.0000	20.0000	*
82	71	19	80.8289	9	14.0000	14.0000	*
83	54	72	70.8221	9	14.0000	14.0000	*
84	54	6	443.2846	9	20.0000	20.0000	*
86	11	57	514.1068	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	514.1068	9	20.0000	20.0000	*
91	51	79	289.5646	9	20.0000	20.0000	*
94	64	82	1341.7856	9	20.0000	20.0000	*
96	84	34	514.1068	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.450	9.450	4.4537E-04	4.4537E-04	70.82	0.1981
2	82	12	20.00	9.446	9.433	1.2630E-02	1.2630E-02	1342.	1.839
3	2	28	20.00	9.473	9.473	7.7534E-04	7.7534E-04	171.9	0.2356
4	72	27	14.00	9.451	9.450	8.2684E-04	8.2684E-04	70.82	0.1981
5	77	11	20.00	9.469	9.464	5.5523E-03	5.5523E-03	514.1	0.7046
6	79	65	20.00	9.476	9.475	1.2369E-03	1.2369E-03	289.6	0.3968
7	50	64	20.00	9.476	9.473	2.5625E-03	2.5625E-03	321.3	0.4403
8	6	84	20.00	9.449	9.447	2.0046E-03	2.0046E-03	514.1	0.7046
9	42	12	20.00	9.442	9.433	9.3374E-03	9.3374E-03	902.2	1.236
10	47	2	20.00	9.474	9.473	2.9182E-04	2.9182E-04	171.9	0.2356
11	67	42	18.00	9.452	9.442	9.3346E-03	9.3346E-03	388.1	0.6567
12	9	63	20.00	9.488	9.474	1.3880E-02	1.3880E-02	1192.	1.634
13	10	13	20.00	9.489	9.487	1.7576E-03	1.7576E-03	835.4	1.145
14	10	8	20.00	9.489	9.489	1.0967E-04	1.0967E-04	83.82	0.1149
15	28	17	18.00	9.473	9.471	1.6403E-03	1.6403E-03	388.1	0.6567
16	61	29	12.00	9.492	9.481	1.1210E-02	1.1210E-02	216.2	0.8232
17	13	51	20.00	9.487	9.478	8.7147E-03	8.7147E-03	610.9	0.8372
18	13	48	16.00	9.487	9.483	3.5343E-03	3.5343E-03	224.5	0.4808
19	3	65	16.00	9.479	9.475	3.6268E-03	3.6268E-03	224.5	0.4808
20	25	60	20.00	9.521	9.492	2.9853E-02	2.9853E-02	1091.	1.495
21	62	20	20.00	9.543	9.522	2.0682E-02	2.0682E-02	971.9	1.332
22	15	61	12.00	9.494	9.492	2.2154E-03	2.2154E-03	234.3	0.8919
23	56	14	12.00	9.517	9.498	1.9572E-02	1.9572E-02	234.3	0.8919
24	71	25	20.00	9.542	9.521	2.0160E-02	2.0160E-02	959.8	1.315
25	59	46	14.00	9.533	9.524	9.4004E-03	9.4004E-03	312.2	0.8733
26	46	56	12.00	9.524	9.517	6.9504E-03	6.9504E-03	234.3	0.8919
27	8	9	20.00	9.489	9.488	3.2520E-04	3.2520E-04	83.82	0.1149
28	41	58	20.00	9.562	9.545	1.7403E-02	1.7403E-02	1107.	1.517
29	21	22	14.00	9.568	9.555	1.2895E-02	1.2895E-02	200.7	0.5613
31	23	19	14.00	9.543	9.539	4.1828E-03	4.1828E-03	231.4	0.6472
33	20	10	20.00	9.522	9.489	3.3655E-02	3.3655E-02	919.2	1.260
34	14	15	12.00	9.498	9.494	3.4294E-03	3.4294E-03	234.3	0.8919
35	29	28	12.00	9.481	9.473	8.1120E-03	8.1120E-03	216.2	0.8232
36	7	73	24.00	9.631	9.624	7.0000E-03	7.0000E-03	1043.	0.9926
37	26	22	20.00	9.567	9.555	1.2320E-02	1.2320E-02	705.0	0.9662
38	17	1	18.00	9.471	9.468	2.7552E-03	2.7552E-03	388.1	0.6567
39	32	16	18.00	9.467	9.464	2.3308E-03	2.3308E-03	388.1	0.6567
40	49	26	20.00	9.587	9.567	1.9943E-02	1.9943E-02	598.9	0.8208
41	49	30	12.00	9.587	9.580	7.8402E-03	7.8402E-03	106.1	0.4039
42	31	26	12.00	9.573	9.567	5.6334E-03	5.6334E-03	106.1	0.4039
43	1	32	18.00	9.468	9.467	1.6842E-03	1.6842E-03	388.1	0.6567

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	9.464	9.461	2.9669E-03	2.9669E-03	388.1	0.6567
45	30	35	12.00	9.580	9.577	2.4681E-03	2.4681E-03	106.1	0.4039
46	33	53	18.00	9.461	9.456	5.0373E-03	5.0373E-03	388.1	0.6567
47	35	31	12.00	9.577	9.573	4.0016E-03	4.0016E-03	106.1	0.4039
48	34	42	20.00	9.446	9.442	3.7251E-03	3.7251E-03	514.1	0.7046
52	12	36	20.00	9.433	9.361	7.1632E-02	7.1632E-02	2244.	3.075
53	24	23	14.00	9.544	9.543	1.2951E-03	1.2951E-03	231.4	0.6472
54	43	6	14.00	9.450	9.449	8.2779E-04	8.2779E-04	70.82	0.1981
55	55	44	24.00	9.631	9.619	1.2017E-02	1.2017E-02	1201.	1.143
56	7	55	24.00	9.631	9.631	7.6294E-06	0.000	79.10	7.5281E-02
57	45	21	20.00	9.590	9.568	2.1733E-02	2.1733E-02	1539.	2.109
58	63	47	20.00	9.474	9.474	7.3528E-04	7.3528E-04	171.9	0.2356
59	46	25	14.00	9.524	9.521	2.6999E-03	2.6999E-03	77.95	0.2180
60	73	40	24.00	9.624	9.621	3.2377E-03	3.2377E-03	1043.	0.9926
61	20	25	14.00	9.522	9.521	9.8228E-04	9.8228E-04	52.73	0.1475
62	51	50	20.00	9.478	9.476	2.5473E-03	2.5473E-03	321.3	0.4403
64	48	3	16.00	9.483	9.479	4.8180E-03	4.8180E-03	224.5	0.4808
66	57	54	20.00	9.458	9.452	5.7030E-03	5.7030E-03	514.1	0.7046
67	40	45	20.00	9.621	9.590	3.1392E-02	3.1392E-02	1043.	1.429
68	19	59	14.00	9.539	9.533	5.1870E-03	5.1870E-03	312.2	0.8733
69	61	60	12.00	9.492	9.492	3.8528E-04	3.8528E-04	18.05	6.8707E-02
70	53	66	18.00	9.456	9.454	2.3975E-03	2.3975E-03	388.1	0.6567
71	58	71	20.00	9.545	9.542	3.1576E-03	3.1576E-03	1041.	1.426
72	60	9	20.00	9.492	9.488	3.2549E-03	3.2549E-03	1109.	1.519
73	22	62	20.00	9.555	9.543	1.2035E-02	1.2035E-02	905.7	1.241
74	58	62	14.00	9.545	9.543	1.6527E-03	1.6527E-03	66.29	0.1854
75	68	49	20.00	9.590	9.587	2.5673E-03	2.5673E-03	705.0	0.9662
76	63	64	20.00	9.474	9.473	1.2674E-03	1.2674E-03	1020.	1.399
77	66	67	18.00	9.454	9.452	1.9732E-03	1.9732E-03	388.1	0.6567
78	44	68	20.00	9.619	9.590	2.9403E-02	2.9403E-02	1201.	1.646
79	41	24	14.00	9.562	9.544	1.7955E-02	1.7955E-02	231.4	0.6472
80	68	45	20.00	9.590	9.590	2.0218E-04	2.0218E-04	496.1	0.6799
81	21	41	20.00	9.568	9.562	5.8746E-03	5.8746E-03	1338.	1.834
82	71	19	14.00	9.542	9.539	2.8725E-03	2.8725E-03	80.83	0.2261
83	54	72	14.00	9.452	9.451	9.5272E-04	9.5272E-04	70.82	0.1981
84	54	6	20.00	9.452	9.449	3.0527E-03	3.0527E-03	443.3	0.6075
86	11	57	20.00	9.464	9.458	6.1598E-03	6.1598E-03	514.1	0.7046
89	65	77	20.00	9.475	9.469	5.7306E-03	5.7306E-03	514.1	0.7046
91	51	79	20.00	9.478	9.476	2.0275E-03	2.0275E-03	289.6	0.3968
94	64	82	20.00	9.473	9.446	2.7363E-02	2.7363E-02	1342.	1.839
96	84	34	20.00	9.447	9.446	5.7220E-04	5.7220E-04	514.1	0.7046

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	1122.	0.000	9.631	9.631	10.17	0.1034	3.0018E+05	100.0
2	1122.	0.000	9.631	9.631	10.17	0.1034	3.0018E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	1122.	0.0000
69	0.000	*	1122.	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
36	9.361	2244.	*	733.42

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 24 Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area – Case A

24.A PIPENET schematic layout with piping and nodes label

24.B PIPENET schematic layout with flow rate and pressure results

24.C PIPENET schematic layout with velocity results

24.D PIPENET input/output printout report

Attachment 24.A contains 1 page
Attachment 24.B contains 1 page
Attachment 24.C contains 1 page
Attachment 24.D contains 21 pages

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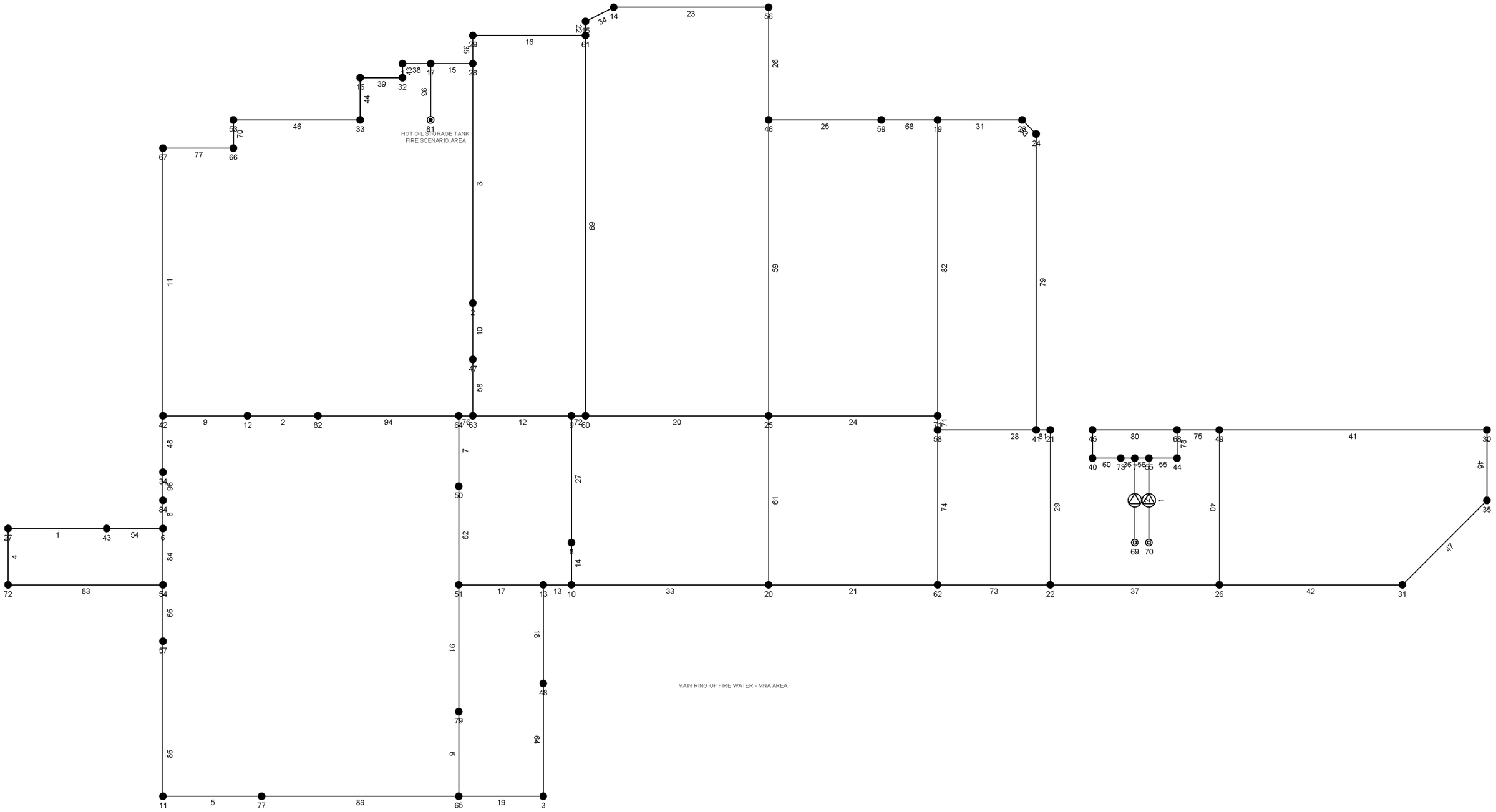
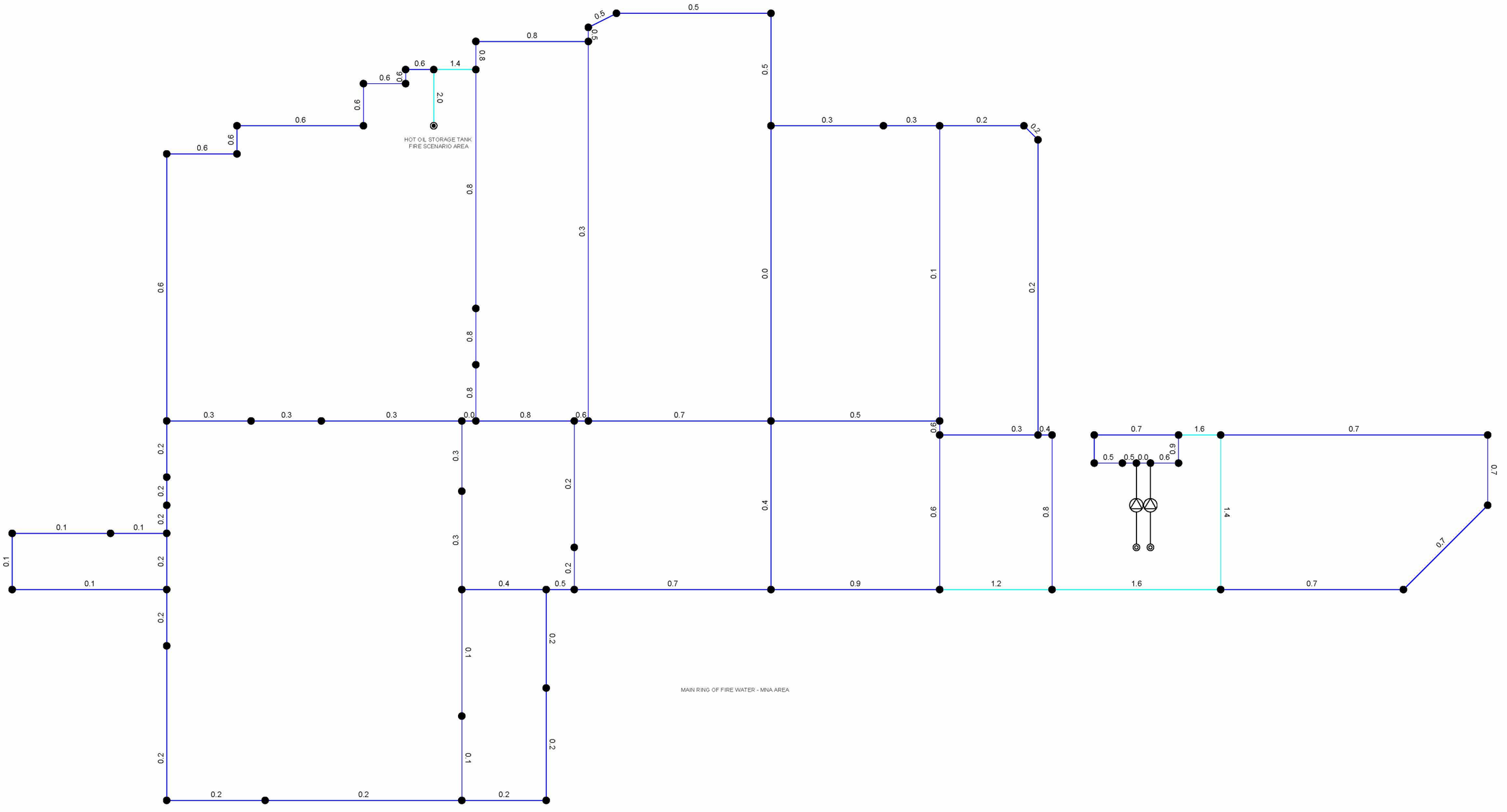


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

HOT OIL STORAGE TANK
FIRE SCENARIO AREA

MAIN RING OF FIRE WATER - MNA AREA

Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

08:53 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
93	17	81	18.00	20.00	0.000	150.0	40.99
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
93	1 x 4	40.99

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	22.2989	9	14.0000	14.0000	*
2	82	12	188.0682	9	20.0000	20.0000	*
3	2	28	608.6944	9	20.0000	20.0000	*
4	72	27	22.2989	9	14.0000	14.0000	*
5	77	11	162.0305	9	20.0000	20.0000	*
6	79	65	68.4398	9	20.0000	20.0000	*
7	50	64	218.0856	9	20.0000	20.0000	*
8	6	84	162.0305	9	20.0000	20.0000	*
9	12	42	188.0682	9	20.0000	20.0000	*
10	47	2	608.6944	9	20.0000	20.0000	*
11	42	67	350.0987	9	18.0000	18.0000	*
12	9	63	578.6770	9	20.0000	20.0000	*
13	10	13	380.1161	9	20.0000	20.0000	*
14	10	8	157.4011	9	20.0000	20.0000	*
15	28	17	815.9041	9	18.0000	18.0000	*
16	61	29	207.2096	9	12.0000	12.0000	*
17	13	51	286.5253	9	20.0000	20.0000	*
18	13	48	93.5907	9	16.0000	16.0000	*
19	3	65	93.5907	9	16.0000	16.0000	*
20	25	60	493.0947	9	20.0000	20.0000	*
21	62	20	683.4100	9	20.0000	20.0000	*
22	15	61	135.3908	9	12.0000	12.0000	*
23	56	14	135.3908	9	12.0000	12.0000	*
24	71	25	364.6440	9	20.0000	20.0000	*
25	59	46	117.9486	9	14.0000	14.0000	*
26	46	56	135.3908	9	12.0000	12.0000	*
27	8	9	157.4011	9	20.0000	20.0000	*
28	41	58	209.7328	9	20.0000	20.0000	*
29	22	21	278.8563	9	14.0000	14.0000	*
31	23	19	69.1236	9	14.0000	14.0000	*
33	20	10	537.5172	9	20.0000	20.0000	*
34	14	15	135.3908	9	12.0000	12.0000	*
35	29	28	207.2096	9	12.0000	12.0000	*
36	7	73	538.1718	9	24.0000	24.0000	*
37	26	22	1166.0028	9	20.0000	20.0000	*
38	1	17	350.0987	9	18.0000	18.0000	*
39	16	32	350.0987	9	18.0000	18.0000	*
40	49	26	990.7696	9	20.0000	20.0000	*
41	49	30	175.2332	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	175.2332	9	12.0000	12.0000	*
43	32	1	350.0987	9	18.0000	18.0000	*
44	33	16	350.0987	9	18.0000	18.0000	*
45	30	35	175.2332	9	12.0000	12.0000	*
46	53	33	350.0987	9	18.0000	18.0000	*
47	35	31	175.2332	9	12.0000	12.0000	*
48	34	42	162.0305	9	20.0000	20.0000	*
53	24	23	69.1236	9	14.0000	14.0000	*
54	43	6	22.2989	9	14.0000	14.0000	*
55	55	44	627.8310	9	24.0000	24.0000	*
56	7	55	44.8288	9	24.0000	24.0000	*
58	63	47	608.6944	9	20.0000	20.0000	*
59	25	46	17.4421	9	14.0000	14.0000	*
60	73	40	538.1718	9	24.0000	24.0000	*
61	20	25	145.8929	9	14.0000	14.0000	*
62	51	50	218.0856	9	20.0000	20.0000	*
64	48	3	93.5907	9	16.0000	16.0000	*
66	57	54	162.0305	9	20.0000	20.0000	*
67	40	45	538.1717	9	20.0000	20.0000	*
68	19	59	117.9486	9	14.0000	14.0000	*
69	60	61	71.8188	9	12.0000	12.0000	*
70	66	53	350.0987	9	18.0000	18.0000	*
71	58	71	413.4691	9	20.0000	20.0000	*
72	60	9	421.2759	9	20.0000	20.0000	*
73	22	62	887.1464	9	20.0000	20.0000	*
74	62	58	203.7363	9	14.0000	14.0000	*
75	68	49	1166.0028	9	20.0000	20.0000	*
76	64	63	30.0174	9	20.0000	20.0000	*
77	67	66	350.0987	9	18.0000	18.0000	*
78	44	68	627.8309	9	20.0000	20.0000	*
79	41	24	69.1236	9	14.0000	14.0000	*
80	45	68	538.1717	9	20.0000	20.0000	*
81	21	41	278.8563	9	20.0000	20.0000	*
82	71	19	48.8251	9	14.0000	14.0000	*
83	54	72	22.2989	9	14.0000	14.0000	*
84	54	6	139.7316	9	20.0000	20.0000	*
86	11	57	162.0305	9	20.0000	20.0000	*
89	65	77	162.0305	9	20.0000	20.0000	*
91	51	79	68.4398	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
93	17	81	1166.0028	9	18.0000	18.0000	*
94	64	82	188.0682	9	20.0000	20.0000	*
96	84	34	162.0305	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.87	10.87	5.2452E-05	5.2452E-05	22.30	6.2369E-02
2	82	12	20.00	10.87	10.87	3.3474E-04	3.3474E-04	188.1	0.2577
3	2	28	20.00	10.86	10.85	7.9975E-03	7.9975E-03	608.7	0.8342
4	72	27	14.00	10.87	10.87	9.7275E-05	9.7275E-05	22.30	6.2369E-02
5	77	11	20.00	10.87	10.87	6.5517E-04	6.5517E-04	162.0	0.2221
6	79	65	20.00	10.87	10.87	8.4877E-05	8.4877E-05	68.44	9.3797E-02
7	50	64	20.00	10.87	10.87	1.2522E-03	1.2522E-03	218.1	0.2989
8	6	84	20.00	10.87	10.87	2.3746E-04	2.3746E-04	162.0	0.2221
9	12	42	20.00	10.87	10.87	5.1212E-04	5.1212E-04	188.1	0.2577
10	47	2	20.00	10.86	10.86	3.0251E-03	3.0251E-03	608.7	0.8342
11	42	67	18.00	10.87	10.86	7.6952E-03	7.6952E-03	350.1	0.5924
12	9	63	20.00	10.88	10.87	3.6449E-03	3.6449E-03	578.7	0.7931
13	10	13	20.00	10.88	10.88	4.1008E-04	4.1008E-04	380.1	0.5209
14	10	8	20.00	10.88	10.88	3.5286E-04	3.5286E-04	157.4	0.2157
15	28	17	18.00	10.85	10.85	6.4526E-03	6.4526E-03	815.9	1.380
16	61	29	12.00	10.87	10.86	1.0350E-02	1.0350E-02	207.2	0.7888
17	13	51	20.00	10.88	10.87	2.1448E-03	2.1448E-03	286.5	0.3927
18	13	48	16.00	10.88	10.88	7.0000E-04	7.0000E-04	93.59	0.2004
19	3	65	16.00	10.88	10.87	7.1716E-04	7.1716E-04	93.59	0.2004
20	25	60	20.00	10.88	10.88	6.8846E-03	6.8846E-03	493.1	0.6758
21	62	20	20.00	10.90	10.89	1.0765E-02	1.0765E-02	683.4	0.9366
22	15	61	12.00	10.87	10.87	8.0490E-04	8.0490E-04	135.4	0.5154
23	56	14	12.00	10.88	10.87	7.0925E-03	7.0925E-03	135.4	0.5154
24	71	25	20.00	10.89	10.88	3.3703E-03	3.3703E-03	364.6	0.4997
25	59	46	14.00	10.88	10.88	1.5526E-03	1.5526E-03	117.9	0.3299
26	46	56	12.00	10.88	10.88	2.5177E-03	2.5177E-03	135.4	0.5154
27	8	9	20.00	10.88	10.88	1.0500E-03	1.0500E-03	157.4	0.2157
28	41	58	20.00	10.89	10.89	8.0204E-04	8.0204E-04	209.7	0.2874
29	22	21	14.00	10.91	10.89	2.3697E-02	2.3697E-02	278.9	0.7799
31	23	19	14.00	10.89	10.89	4.4727E-04	4.4727E-04	69.12	0.1933
33	20	10	20.00	10.89	10.88	1.2457E-02	1.2457E-02	537.5	0.7367
34	14	15	12.00	10.87	10.87	1.2398E-03	1.2398E-03	135.4	0.5154
35	29	28	12.00	10.86	10.85	7.4930E-03	7.4930E-03	207.2	0.7888
36	7	73	24.00	11.01	11.01	2.0599E-03	2.0599E-03	538.2	0.5122
37	26	22	20.00	10.94	10.91	3.1228E-02	3.1228E-02	1166.	1.598
38	1	17	18.00	10.85	10.85	2.2707E-03	2.2707E-03	350.1	0.5924
39	16	32	18.00	10.85	10.85	1.9197E-03	1.9197E-03	350.1	0.5924
40	49	26	20.00	10.99	10.94	5.0542E-02	5.0542E-02	990.8	1.358
41	49	30	12.00	10.99	10.97	1.9873E-02	1.9873E-02	175.2	0.6671
42	31	26	12.00	10.96	10.94	1.4275E-02	1.4275E-02	175.2	0.6671
43	32	1	18.00	10.85	10.85	1.3895E-03	1.3895E-03	350.1	0.5924

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	10.86	10.85	2.4481E-03	2.4481E-03	350.1	0.5924
45	30	35	12.00	10.97	10.97	6.2494E-03	6.2494E-03	175.2	0.6671
46	53	33	18.00	10.86	10.86	4.1494E-03	4.1494E-03	350.1	0.5924
47	35	31	12.00	10.97	10.96	1.0145E-02	1.0145E-02	175.2	0.6671
48	34	42	20.00	10.87	10.87	4.3964E-04	4.3964E-04	162.0	0.2221
53	24	23	14.00	10.89	10.89	1.3733E-04	1.3733E-04	69.12	0.1933
54	43	6	14.00	10.87	10.87	9.7275E-05	9.7275E-05	22.30	6.2369E-02
55	55	44	24.00	11.01	11.01	3.6201E-03	3.6201E-03	627.8	0.5975
56	7	55	24.00	11.01	11.01	2.8610E-06	0.000	44.83	4.2665E-02
58	63	47	20.00	10.87	10.86	7.5703E-03	7.5703E-03	608.7	0.8342
59	25	46	14.00	10.88	10.88	1.6689E-04	1.6689E-04	17.44	4.8785E-02
60	73	40	24.00	11.01	11.01	9.4986E-04	9.4986E-04	538.2	0.5122
61	20	25	14.00	10.89	10.88	6.4325E-03	6.4325E-03	145.9	0.4081
62	51	50	20.00	10.87	10.87	1.2407E-03	1.2407E-03	218.1	0.2989
64	48	3	16.00	10.88	10.88	9.5272E-04	9.5272E-04	93.59	0.2004
66	57	54	20.00	10.87	10.87	6.7329E-04	6.7329E-04	162.0	0.2221
67	40	45	20.00	11.01	11.00	9.2325E-03	9.2325E-03	538.2	0.7376
68	19	59	14.00	10.89	10.88	8.5735E-04	8.5735E-04	117.9	0.3299
69	60	61	12.00	10.88	10.87	4.9372E-03	4.9372E-03	71.82	0.2734
70	66	53	18.00	10.86	10.86	1.9779E-03	1.9779E-03	350.1	0.5924
71	58	71	20.00	10.89	10.89	5.7507E-04	5.7507E-04	413.5	0.5667
72	60	9	20.00	10.88	10.88	5.4264E-04	5.4264E-04	421.3	0.5774
73	22	62	20.00	10.91	10.90	1.1570E-02	1.1570E-02	887.1	1.216
74	62	58	14.00	10.90	10.89	1.3252E-02	1.3252E-02	203.7	0.5698
75	68	49	20.00	11.00	10.99	6.5079E-03	6.5079E-03	1166.	1.598
76	64	63	20.00	10.87	10.87	0.000	0.000	30.02	4.1139E-02
77	67	66	18.00	10.86	10.86	1.6251E-03	1.6251E-03	350.1	0.5924
78	44	68	20.00	11.01	11.00	8.8520E-03	8.8520E-03	627.8	0.8604
79	41	24	14.00	10.89	10.89	1.9197E-03	1.9197E-03	69.12	0.1933
80	45	68	20.00	11.00	11.00	2.3270E-04	2.3270E-04	538.2	0.7376
81	21	41	20.00	10.89	10.89	3.2330E-04	3.2330E-04	278.9	0.3822
82	71	19	14.00	10.89	10.89	1.1272E-03	1.1272E-03	48.82	0.1366
83	54	72	14.00	10.87	10.87	1.1253E-04	1.1253E-04	22.30	6.2369E-02
84	54	6	20.00	10.87	10.87	3.5954E-04	3.5954E-04	139.7	0.1915
86	11	57	20.00	10.87	10.87	7.2670E-04	7.2670E-04	162.0	0.2221
89	65	77	20.00	10.87	10.87	6.7806E-04	6.7806E-04	162.0	0.2221
91	51	79	20.00	10.87	10.87	1.4019E-04	1.4019E-04	68.44	9.3797E-02
93	17	81	18.00	10.85	10.81	3.3139E-02	3.3139E-02	1166.	1.973
94	64	82	20.00	10.87	10.87	7.2289E-04	7.2289E-04	188.1	0.2577
96	84	34	20.00	10.87	10.87	6.7711E-05	6.7711E-05	162.0	0.2221

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	583.0	0.000	11.01	11.01	10.17	9.0399E-02	1.7835E+05	100.0
2	583.0	0.000	11.01	11.01	10.17	9.0399E-02	1.7835E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	583.0	0.0000
69	0.000	*	583.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
81	10.81	1166.	*	354.57

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

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RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 25 Pool Fire scenario in Hot Oil Storage Tank Fire Scenario Area – Case B

25.A PIPENET schematic layout with piping and nodes label

25.B PIPENET schematic layout with flow rate and pressure results

25.C PIPENET schematic layout with velocity results

25.D PIPENET input/output printout report

Attachment 25.A contains 1 page
Attachment 25.B contains 1 page
Attachment 25.C contains 1 page
Attachment 25.D contains 21 pages

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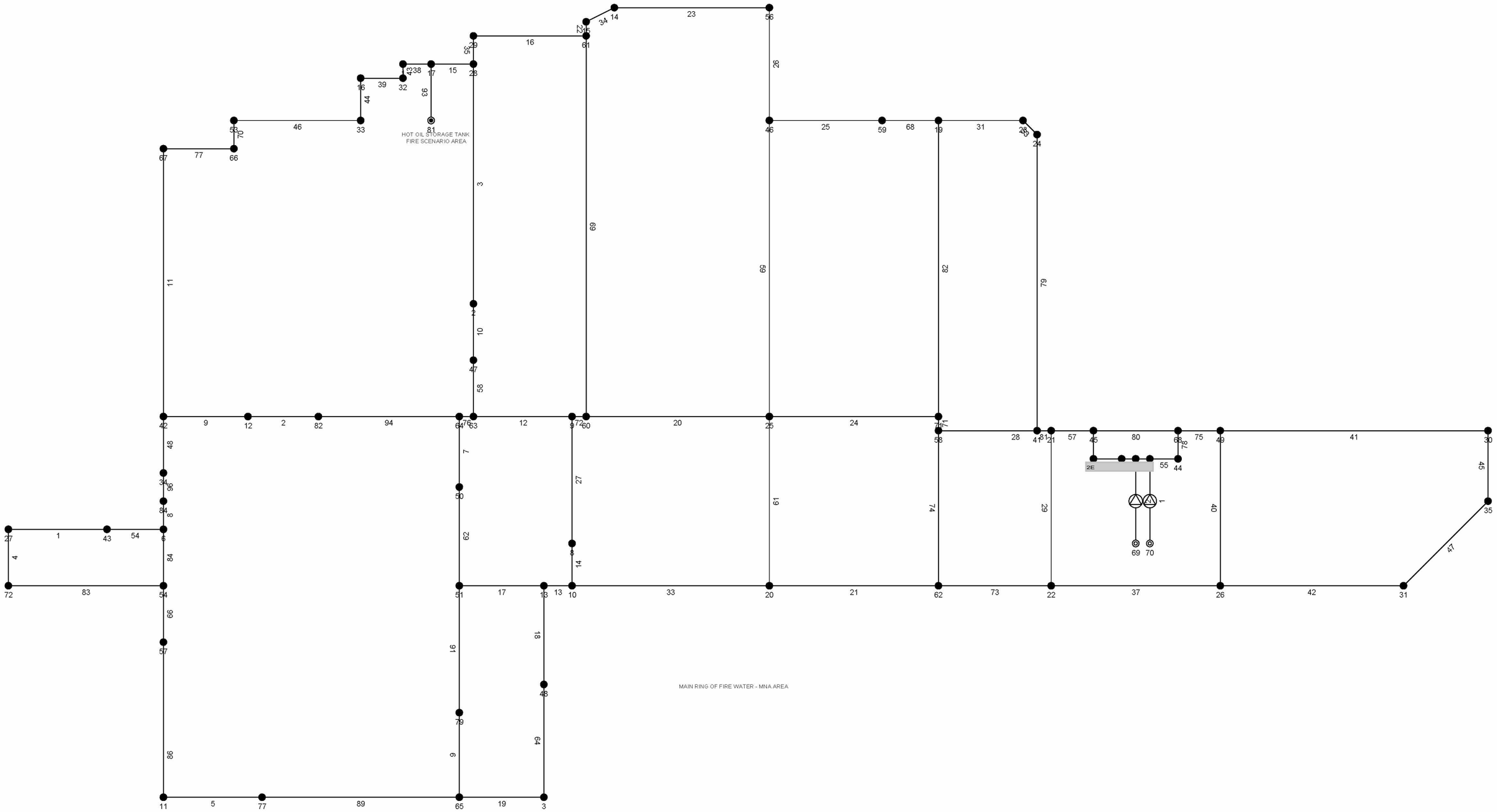
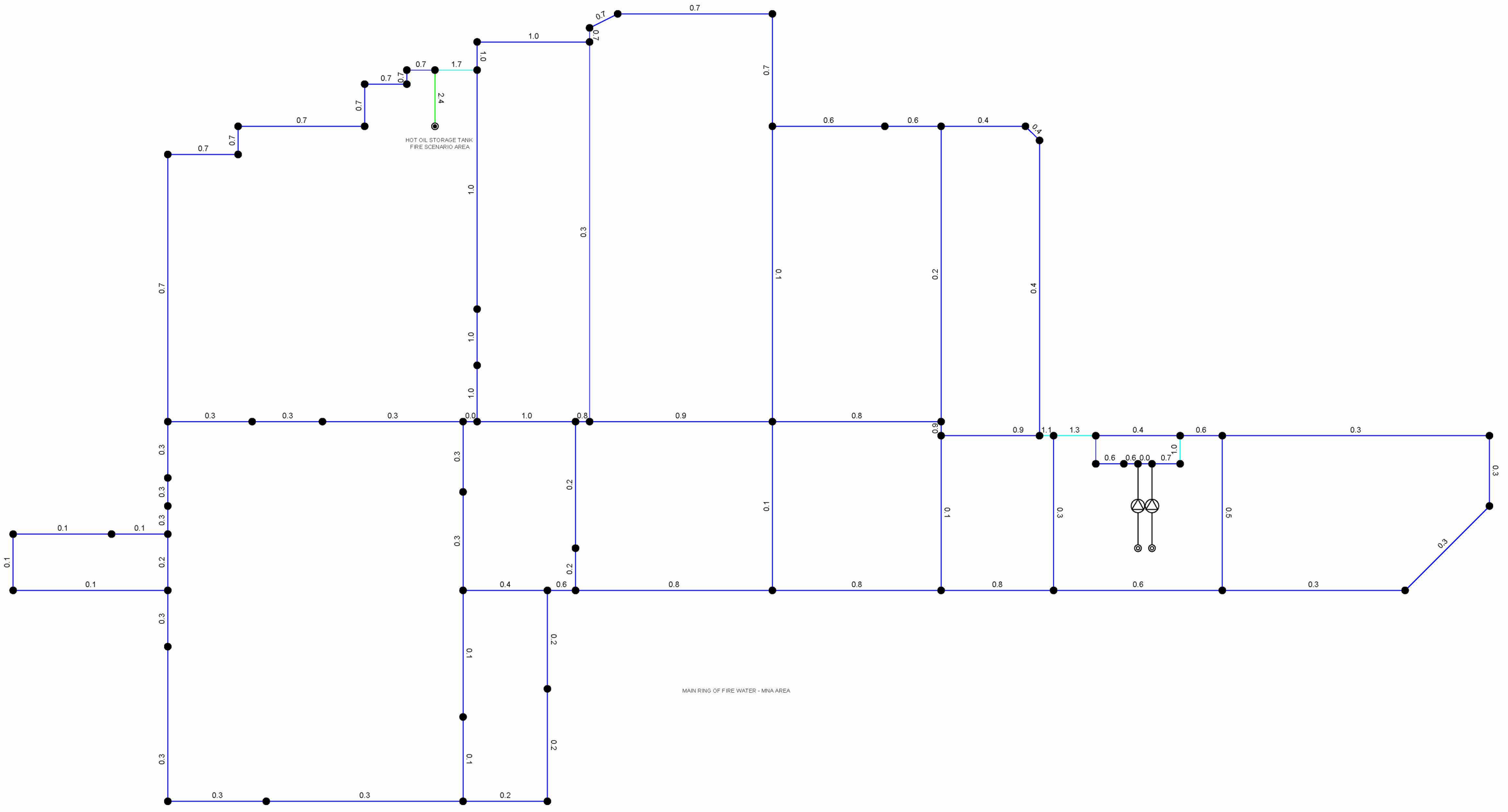


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

HOT OIL STORAGE TANK
FIRE SCENARIO AREA

MAIN RING OF FIRE WATER - MNA AREA

Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

08:58 on 8-Jul-2021

LIST OF CONTENTS
==========

	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
93	17	81	18.00	20.00	0.000	150.0	40.99
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
93	1 x 4	40.99

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	25.8562	9	14.0000	14.0000	*
2	82	12	230.5546	9	20.0000	20.0000	*
3	2	28	726.3718	9	20.0000	20.0000	*
4	72	27	25.8562	9	14.0000	14.0000	*
5	77	11	187.2992	9	20.0000	20.0000	*
6	79	65	81.0240	9	20.0000	20.0000	*
7	50	64	242.7729	9	20.0000	20.0000	*
8	6	84	187.2992	9	20.0000	20.0000	*
9	12	42	230.5546	9	20.0000	20.0000	*
10	47	2	726.3718	9	20.0000	20.0000	*
11	42	67	417.8538	9	18.0000	18.0000	*
12	9	63	714.1535	9	20.0000	20.0000	*
13	10	13	430.0721	9	20.0000	20.0000	*
14	10	8	122.0925	9	20.0000	20.0000	*
15	28	17	981.1494	9	18.0000	18.0000	*
16	61	29	254.7776	9	12.0000	12.0000	*
17	13	51	323.7969	9	20.0000	20.0000	*
18	13	48	106.2752	9	16.0000	16.0000	*
19	3	65	106.2752	9	16.0000	16.0000	*
20	25	60	672.1738	9	20.0000	20.0000	*
21	62	20	598.3473	9	20.0000	20.0000	*
22	15	61	174.6646	9	12.0000	12.0000	*
23	56	14	174.6646	9	12.0000	12.0000	*
24	71	25	598.0823	9	20.0000	20.0000	*
25	59	46	202.5736	9	14.0000	14.0000	*
26	46	56	174.6646	9	12.0000	12.0000	*
27	8	9	122.0925	9	20.0000	20.0000	*
28	41	58	690.2659	9	20.0000	20.0000	*
29	21	22	123.8844	9	14.0000	14.0000	*
31	23	19	146.5478	9	14.0000	14.0000	*
33	20	10	552.1647	9	20.0000	20.0000	*
34	14	15	174.6646	9	12.0000	12.0000	*
35	29	28	254.7776	9	12.0000	12.0000	*
36	7	73	650.1943	9	24.0000	24.0000	*
37	26	22	438.3051	9	20.0000	20.0000	*
38	1	17	417.8538	9	18.0000	18.0000	*
39	16	32	417.8538	9	18.0000	18.0000	*
40	49	26	372.3258	9	20.0000	20.0000	*
41	49	30	65.9792	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	65.9792	9	12.0000	12.0000	*
43	32	1	417.8538	9	18.0000	18.0000	*
44	33	16	417.8538	9	18.0000	18.0000	*
45	30	35	65.9792	9	12.0000	12.0000	*
46	53	33	417.8538	9	18.0000	18.0000	*
47	35	31	65.9792	9	12.0000	12.0000	*
48	34	42	187.2992	9	20.0000	20.0000	*
53	24	23	146.5478	9	14.0000	14.0000	*
54	43	6	25.8562	9	14.0000	14.0000	*
55	55	44	748.8088	9	24.0000	24.0000	*
56	7	55	49.3063	9	24.0000	24.0000	*
57	45	21	960.6982	9	20.0000	20.0000	*
58	63	47	726.3718	9	20.0000	20.0000	*
59	46	25	27.9090	9	14.0000	14.0000	*
60	73	40	650.1943	9	24.0000	24.0000	*
61	20	25	46.1826	9	14.0000	14.0000	*
62	51	50	242.7729	9	20.0000	20.0000	*
64	48	3	106.2752	9	16.0000	16.0000	*
66	57	54	187.2992	9	20.0000	20.0000	*
67	40	45	650.1944	9	20.0000	20.0000	*
68	19	59	202.5736	9	14.0000	14.0000	*
69	60	61	80.1129	9	12.0000	12.0000	*
70	66	53	417.8538	9	18.0000	18.0000	*
71	58	71	654.1081	9	20.0000	20.0000	*
72	60	9	592.0609	9	20.0000	20.0000	*
73	22	62	562.1895	9	20.0000	20.0000	*
74	58	62	36.1578	9	14.0000	14.0000	*
75	68	49	438.3051	9	20.0000	20.0000	*
76	64	63	12.2183	9	20.0000	20.0000	*
77	67	66	417.8538	9	18.0000	18.0000	*
78	44	68	748.8087	9	20.0000	20.0000	*
79	41	24	146.5478	9	14.0000	14.0000	*
80	68	45	310.5037	9	20.0000	20.0000	*
81	21	41	836.8137	9	20.0000	20.0000	*
82	71	19	56.0258	9	14.0000	14.0000	*
83	54	72	25.8562	9	14.0000	14.0000	*
84	54	6	161.4431	9	20.0000	20.0000	*
86	11	57	187.2992	9	20.0000	20.0000	*
89	65	77	187.2992	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	81.0240	9	20.0000	20.0000	*
93	17	81	1399.0033	9	18.0000	18.0000	*
94	64	82	230.5546	9	20.0000	20.0000	*
96	84	34	187.2992	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.70	10.70	6.7711E-05	6.7711E-05	25.86	7.2318E-02
2	82	12	20.00	10.70	10.70	4.8447E-04	4.8447E-04	230.6	0.3160
3	2	28	20.00	10.68	10.67	1.1092E-02	1.1092E-02	726.4	0.9955
4	72	27	14.00	10.70	10.70	1.2970E-04	1.2970E-04	25.86	7.2318E-02
5	77	11	20.00	10.70	10.70	8.5735E-04	8.5735E-04	187.3	0.2567
6	79	65	20.00	10.70	10.70	1.1730E-04	1.1730E-04	81.02	0.1110
7	50	64	20.00	10.70	10.70	1.5278E-03	1.5278E-03	242.8	0.3327
8	6	84	20.00	10.70	10.70	3.0994E-04	3.0994E-04	187.3	0.2567
9	12	42	20.00	10.70	10.70	7.4768E-04	7.4768E-04	230.6	0.3160
10	47	2	20.00	10.69	10.68	4.1952E-03	4.1952E-03	726.4	0.9955
11	42	67	18.00	10.70	10.69	1.0677E-02	1.0677E-02	417.9	0.7070
12	9	63	20.00	10.70	10.70	5.3778E-03	5.3778E-03	714.2	0.9787
13	10	13	20.00	10.71	10.71	5.1498E-04	5.1498E-04	430.1	0.5894
14	10	8	20.00	10.71	10.71	2.2030E-04	2.2030E-04	122.1	0.1673
15	28	17	18.00	10.67	10.66	9.0752E-03	9.0752E-03	981.1	1.660
16	61	29	12.00	10.70	10.68	1.5162E-02	1.5162E-02	254.8	0.9699
17	13	51	20.00	10.71	10.70	2.6932E-03	2.6932E-03	323.8	0.4438
18	13	48	16.00	10.71	10.70	8.8501E-04	8.8501E-04	106.3	0.2276
19	3	65	16.00	10.70	10.70	9.0981E-04	9.0981E-04	106.3	0.2276
20	25	60	20.00	10.72	10.71	1.2200E-02	1.2200E-02	672.2	0.9212
21	62	20	20.00	10.73	10.72	8.4324E-03	8.4324E-03	598.3	0.8200
22	15	61	12.00	10.70	10.70	1.2856E-03	1.2856E-03	174.7	0.6649
23	56	14	12.00	10.71	10.70	1.1348E-02	1.1348E-02	174.7	0.6649
24	71	25	20.00	10.73	10.72	8.4019E-03	8.4019E-03	598.1	0.8197
25	59	46	14.00	10.72	10.72	4.2181E-03	4.2181E-03	202.6	0.5666
26	46	56	12.00	10.72	10.71	4.0293E-03	4.0293E-03	174.7	0.6649
27	8	9	20.00	10.71	10.70	6.5517E-04	6.5517E-04	122.1	0.1673
28	41	58	20.00	10.74	10.73	7.2651E-03	7.2651E-03	690.3	0.9460
29	21	22	14.00	10.74	10.73	5.2843E-03	5.2843E-03	123.9	0.3465
31	23	19	14.00	10.73	10.73	1.7929E-03	1.7929E-03	146.5	0.4099
33	20	10	20.00	10.72	10.71	1.3112E-02	1.3112E-02	552.2	0.7567
34	14	15	12.00	10.70	10.70	1.9875E-03	1.9875E-03	174.7	0.6649
35	29	28	12.00	10.68	10.67	1.0972E-02	1.0972E-02	254.8	0.9699
36	7	73	24.00	10.76	10.76	2.9221E-03	2.9221E-03	650.2	0.6188
37	26	22	20.00	10.74	10.73	5.1126E-03	5.1126E-03	438.3	0.6007
38	1	17	18.00	10.67	10.66	3.1500E-03	3.1500E-03	417.9	0.7070
39	16	32	18.00	10.67	10.67	2.6627E-03	2.6627E-03	417.9	0.7070
40	49	26	20.00	10.75	10.74	8.2798E-03	8.2798E-03	372.3	0.5103
41	49	30	12.00	10.75	10.74	3.2549E-03	3.2549E-03	65.98	0.2512
42	31	26	12.00	10.74	10.74	2.3394E-03	2.3394E-03	65.98	0.2512
43	32	1	18.00	10.67	10.67	1.9302E-03	1.9302E-03	417.9	0.7070

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	10.68	10.67	3.3951E-03	3.3951E-03	417.9	0.7070
45	30	35	12.00	10.74	10.74	1.0252E-03	1.0252E-03	65.98	0.2512
46	53	33	18.00	10.68	10.68	5.7592E-03	5.7592E-03	417.9	0.7070
47	35	31	12.00	10.74	10.74	1.6603E-03	1.6603E-03	65.98	0.2512
48	34	42	20.00	10.70	10.70	5.7507E-04	5.7507E-04	187.3	0.2567
53	24	23	14.00	10.73	10.73	5.5695E-04	5.5695E-04	146.5	0.4099
54	43	6	14.00	10.70	10.70	1.2779E-04	1.2779E-04	25.86	7.2318E-02
55	55	44	24.00	10.76	10.76	5.0125E-03	5.0125E-03	748.8	0.7127
56	7	55	24.00	10.76	10.76	4.7684E-06	0.000	49.31	4.6927E-02
57	45	21	20.00	10.75	10.74	9.0876E-03	9.0876E-03	960.7	1.317
58	63	47	20.00	10.70	10.69	1.0497E-02	1.0497E-02	726.4	0.9955
59	46	25	14.00	10.72	10.72	4.0436E-04	4.0436E-04	27.91	7.8060E-02
60	73	40	24.00	10.76	10.76	1.3504E-03	1.3504E-03	650.2	0.6188
61	20	25	14.00	10.72	10.72	7.6962E-04	7.6962E-04	46.18	0.1292
62	51	50	20.00	10.70	10.70	1.5173E-03	1.5173E-03	242.8	0.3327
64	48	3	16.00	10.70	10.70	1.2083E-03	1.2083E-03	106.3	0.2276
66	57	54	20.00	10.70	10.70	8.8215E-04	8.8215E-04	187.3	0.2567
67	40	45	20.00	10.76	10.75	1.3098E-02	1.3098E-02	650.2	0.8911
68	19	59	14.00	10.73	10.72	2.3270E-03	2.3270E-03	202.6	0.5666
69	60	61	12.00	10.71	10.70	6.0453E-03	6.0453E-03	80.11	0.3050
70	66	53	18.00	10.68	10.68	2.7428E-03	2.7428E-03	417.9	0.7070
71	58	71	20.00	10.73	10.73	1.3380E-03	1.3380E-03	654.1	0.8965
72	60	9	20.00	10.71	10.70	1.0176E-03	1.0176E-03	592.1	0.8114
73	22	62	20.00	10.73	10.73	4.9829E-03	4.9829E-03	562.2	0.7705
74	58	62	14.00	10.73	10.73	5.3787E-04	5.3787E-04	36.16	0.1011
75	68	49	20.00	10.75	10.75	1.0643E-03	1.0643E-03	438.3	0.6007
76	64	63	20.00	10.70	10.70	0.000	0.000	12.22	1.6745E-02
77	67	66	18.00	10.69	10.68	2.2554E-03	2.2554E-03	417.9	0.7070
78	44	68	20.00	10.76	10.75	1.2268E-02	1.2268E-02	748.8	1.026
79	41	24	14.00	10.74	10.73	7.7057E-03	7.7057E-03	146.5	0.4099
80	68	45	20.00	10.75	10.75	8.4877E-05	8.4877E-05	310.5	0.4255
81	21	41	20.00	10.74	10.74	2.4643E-03	2.4643E-03	836.8	1.147
82	71	19	14.00	10.73	10.73	1.4524E-03	1.4524E-03	56.03	0.1567
83	54	72	14.00	10.70	10.70	1.4496E-04	1.4496E-04	25.86	7.2318E-02
84	54	6	20.00	10.70	10.70	4.7016E-04	4.7016E-04	161.4	0.2213
86	11	57	20.00	10.70	10.70	9.5272E-04	9.5272E-04	187.3	0.2567
89	65	77	20.00	10.70	10.70	8.8501E-04	8.8501E-04	187.3	0.2567
91	51	79	20.00	10.70	10.70	1.9264E-04	1.9264E-04	81.02	0.1110
93	17	81	18.00	10.66	10.62	4.6420E-02	4.6420E-02	1399.	2.367
94	64	82	20.00	10.70	10.70	1.0548E-03	1.0548E-03	230.6	0.3160
96	84	34	20.00	10.70	10.70	8.9645E-05	8.9645E-05	187.3	0.2567

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	699.5	0.000	10.76	10.76	10.17	9.2491E-02	2.0915E+05	100.0
2	699.5	0.000	10.76	10.76	10.17	9.2491E-02	2.0915E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	699.5	0.0000
69	0.000	*	699.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
81	10.62	1399.	*	429.33

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 26 Pool Fire scenario in HTU Fire Scenario Area 1 – Case A
26.A PIPENET schematic layout with piping and nodes label
26.B PIPENET schematic layout with flow rate and pressure results
26.C PIPENET schematic layout with velocity results
26.D PIPENET input/output printout report

Attachment 26.A contains 1 page
Attachment 26.B contains 1 page
Attachment 26.C contains 1 page
Attachment 26.D contains 21 pages

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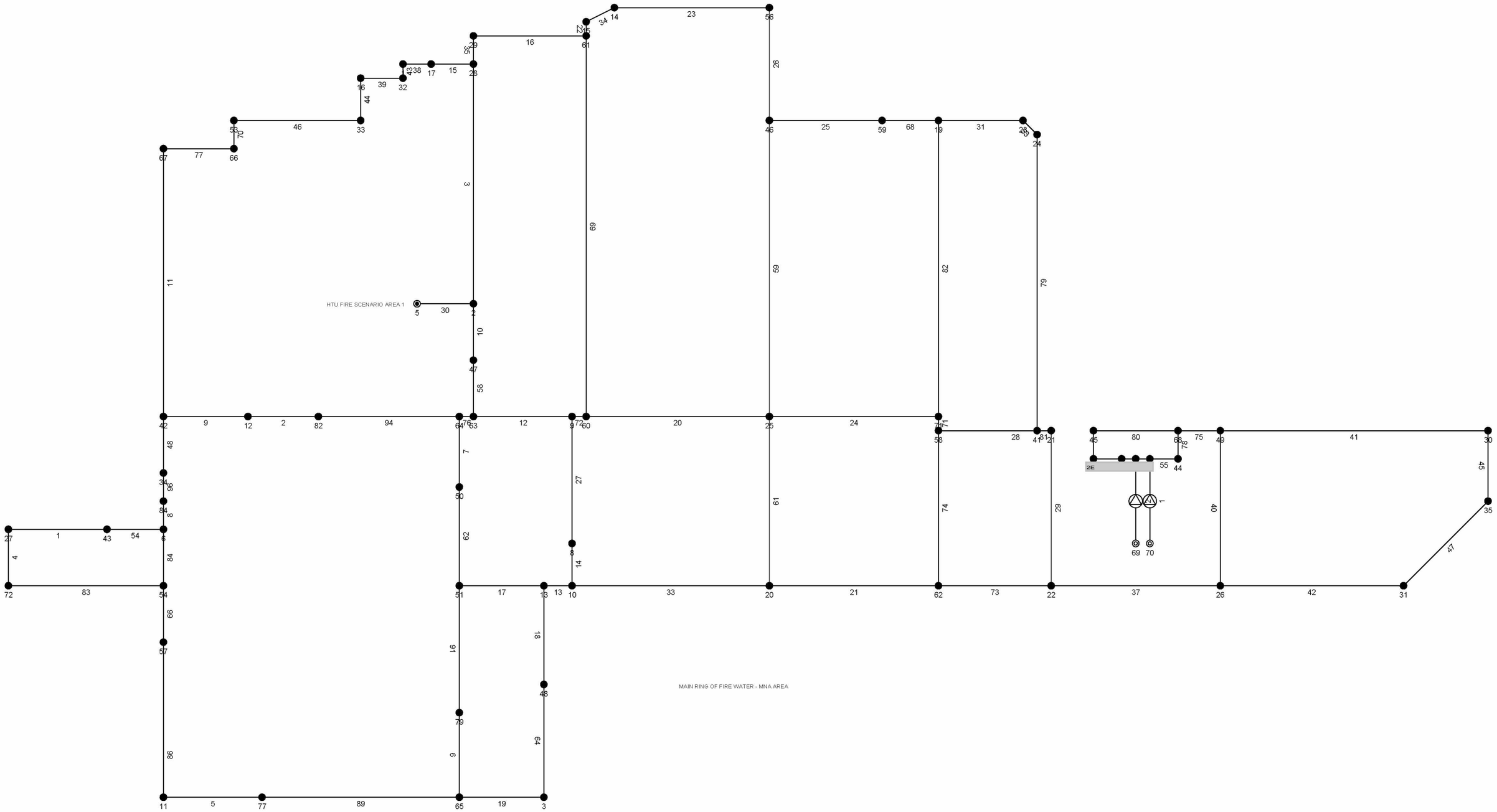
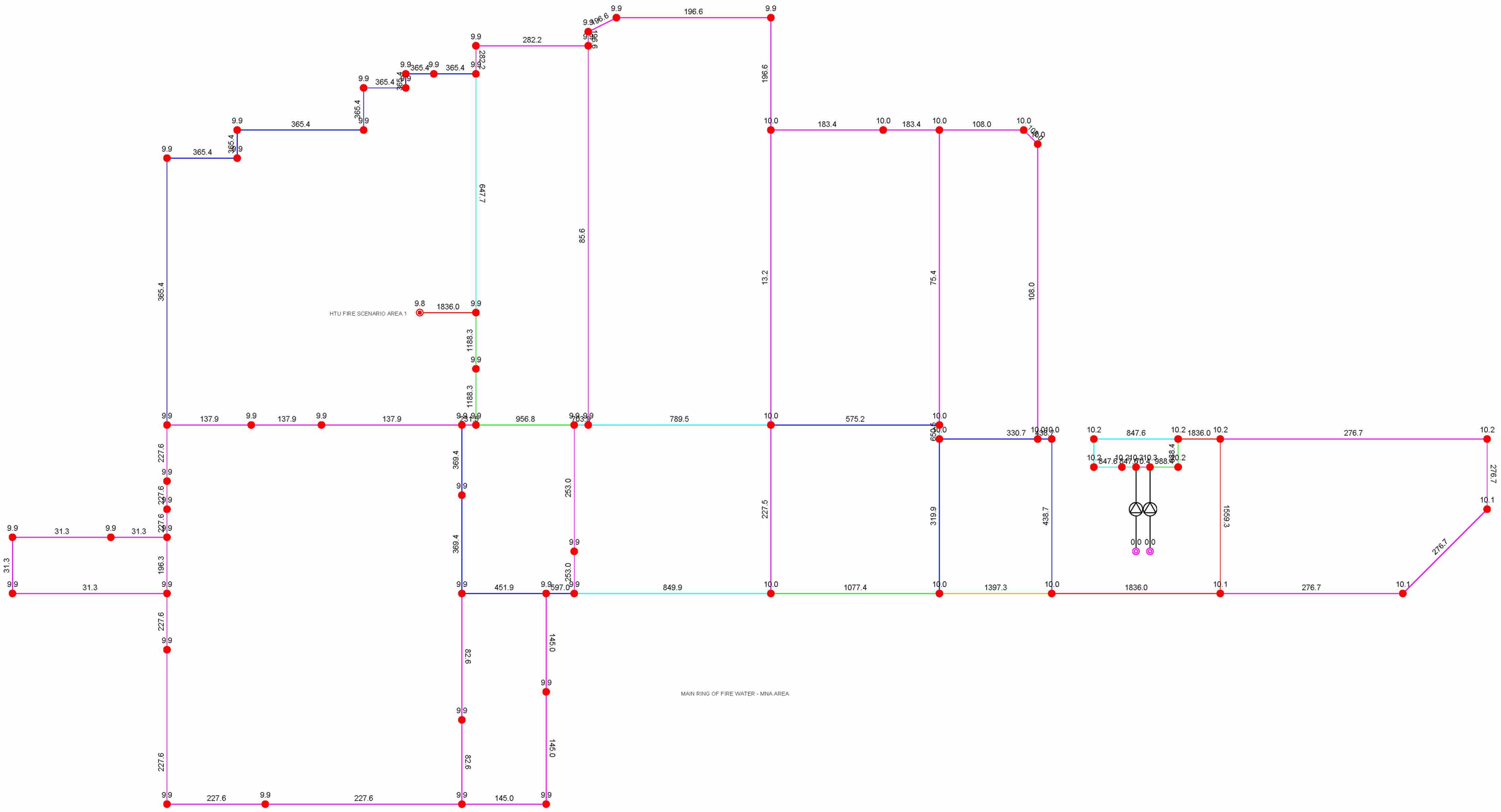
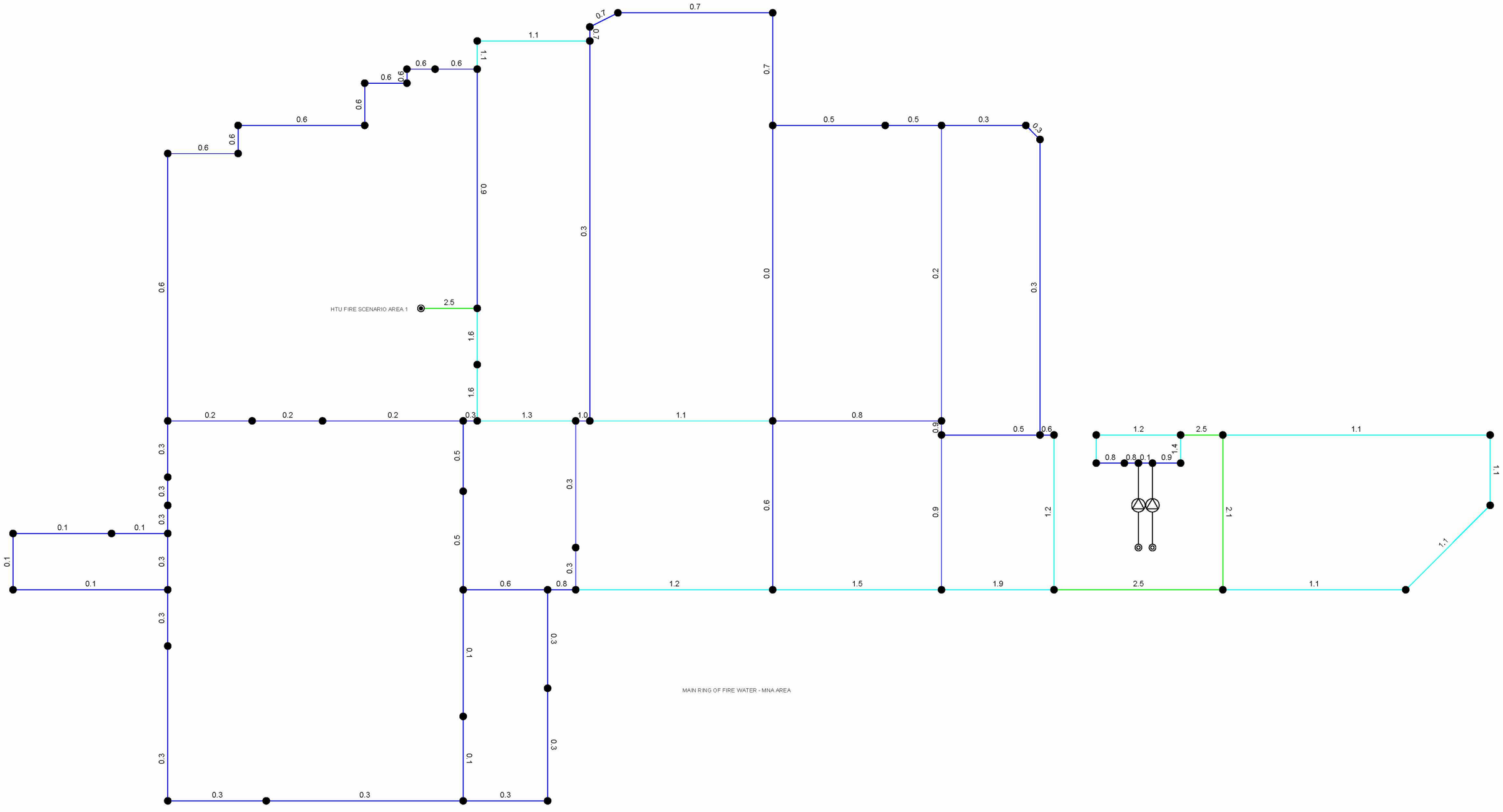


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:05 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
30	2	5	20.00	20.00	0.000	150.0	45.60
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
30	1 x 4	45.60		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	31.2627	9	14.0000	14.0000	*
2	82	12	137.8586	9	20.0000	20.0000	*
3	28	2	647.6556	9	20.0000	20.0000	*
4	72	27	31.2627	9	14.0000	14.0000	*
5	77	11	227.5909	9	20.0000	20.0000	*
6	79	65	82.5534	9	20.0000	20.0000	*
7	50	64	369.3681	9	20.0000	20.0000	*
8	6	84	227.5909	9	20.0000	20.0000	*
9	12	42	137.8586	9	20.0000	20.0000	*
10	47	2	1188.3485	9	20.0000	20.0000	*
11	42	67	365.4496	9	18.0000	18.0000	*
12	9	63	956.8391	9	20.0000	20.0000	*
13	10	13	596.9590	9	20.0000	20.0000	*
14	10	8	252.9562	9	20.0000	20.0000	*
15	17	28	365.4496	9	18.0000	18.0000	*
16	61	29	282.2061	9	12.0000	12.0000	*
17	13	51	451.9215	9	20.0000	20.0000	*
18	13	48	145.0375	9	16.0000	16.0000	*
19	3	65	145.0375	9	16.0000	16.0000	*
20	25	60	789.4876	9	20.0000	20.0000	*
21	62	20	1077.4418	9	20.0000	20.0000	*
22	15	61	196.6013	9	12.0000	12.0000	*
23	56	14	196.6013	9	12.0000	12.0000	*
24	71	25	575.1560	9	20.0000	20.0000	*
25	59	46	183.4063	9	14.0000	14.0000	*
26	46	56	196.6013	9	12.0000	12.0000	*
27	8	9	252.9562	9	20.0000	20.0000	*
28	41	58	330.6582	9	20.0000	20.0000	*
29	22	21	438.7001	9	14.0000	14.0000	*
30	2	5	1836.0043	9	20.0000	20.0000	*
31	23	19	108.0419	9	14.0000	14.0000	*
33	20	10	849.9152	9	20.0000	20.0000	*
34	14	15	196.6013	9	12.0000	12.0000	*
35	29	28	282.2061	9	12.0000	12.0000	*
36	7	73	847.6133	9	24.0000	24.0000	*
37	26	22	1836.0043	9	20.0000	20.0000	*
38	1	17	365.4496	9	18.0000	18.0000	*
39	16	32	365.4496	9	18.0000	18.0000	*
40	49	26	1559.2810	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	276.7232	9	12.0000	12.0000	*
42	31	26	276.7232	9	12.0000	12.0000	*
43	32	1	365.4496	9	18.0000	18.0000	*
44	33	16	365.4496	9	18.0000	18.0000	*
45	30	35	276.7232	9	12.0000	12.0000	*
46	53	33	365.4496	9	18.0000	18.0000	*
47	35	31	276.7232	9	12.0000	12.0000	*
48	34	42	227.5909	9	20.0000	20.0000	*
53	24	23	108.0419	9	14.0000	14.0000	*
54	43	6	31.2627	9	14.0000	14.0000	*
55	55	44	988.3910	9	24.0000	24.0000	*
56	7	55	70.3877	9	24.0000	24.0000	*
58	63	47	1188.3485	9	20.0000	20.0000	*
59	25	46	13.1950	9	14.0000	14.0000	*
60	73	40	847.6133	9	24.0000	24.0000	*
61	20	25	227.5266	9	14.0000	14.0000	*
62	51	50	369.3681	9	20.0000	20.0000	*
64	48	3	145.0375	9	16.0000	16.0000	*
66	57	54	227.5909	9	20.0000	20.0000	*
67	40	45	847.6133	9	20.0000	20.0000	*
68	19	59	183.4063	9	14.0000	14.0000	*
69	60	61	85.6048	9	12.0000	12.0000	*
70	66	53	365.4496	9	18.0000	18.0000	*
71	58	71	650.5204	9	20.0000	20.0000	*
72	60	9	703.8827	9	20.0000	20.0000	*
73	22	62	1397.3040	9	20.0000	20.0000	*
74	62	58	319.8621	9	14.0000	14.0000	*
75	68	49	1836.0043	9	20.0000	20.0000	*
76	64	63	231.5094	9	20.0000	20.0000	*
77	67	66	365.4496	9	18.0000	18.0000	*
78	44	68	988.3910	9	20.0000	20.0000	*
79	41	24	108.0419	9	14.0000	14.0000	*
80	45	68	847.6133	9	20.0000	20.0000	*
81	21	41	438.7002	9	20.0000	20.0000	*
82	71	19	75.3644	9	14.0000	14.0000	*
83	54	72	31.2627	9	14.0000	14.0000	*
84	54	6	196.3282	9	20.0000	20.0000	*
86	11	57	227.5909	9	20.0000	20.0000	*
89	65	77	227.5909	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	82.5534	9	20.0000	20.0000	*
94	64	82	137.8586	9	20.0000	20.0000	*
96	84	34	227.5909	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.927	9.927	9.7275E-05	9.7275E-05	31.26	8.7440E-02
2	82	12	20.00	9.926	9.925	1.9073E-04	1.9073E-04	137.9	0.1889
3	28	2	20.00	9.898	9.889	8.9808E-03	8.9808E-03	647.7	0.8876
4	72	27	14.00	9.927	9.927	1.8311E-04	1.8311E-04	31.26	8.7440E-02
5	77	11	20.00	9.931	9.930	1.2274E-03	1.2274E-03	227.6	0.3119
6	79	65	20.00	9.932	9.932	1.2016E-04	1.2016E-04	82.55	0.1131
7	50	64	20.00	9.929	9.926	3.3226E-03	3.3226E-03	369.4	0.5062
8	6	84	20.00	9.926	9.926	4.4250E-04	4.4250E-04	227.6	0.3119
9	12	42	20.00	9.925	9.925	2.8706E-04	2.8706E-04	137.9	0.1889
10	47	2	20.00	9.900	9.889	1.0450E-02	1.0450E-02	1188.	1.629
11	42	67	18.00	9.925	9.917	8.3122E-03	8.3122E-03	365.4	0.6183
12	9	63	20.00	9.935	9.926	9.2545E-03	9.2545E-03	956.8	1.311
13	10	13	20.00	9.938	9.938	9.4509E-04	9.4509E-04	597.0	0.8181
14	10	8	20.00	9.938	9.938	8.4686E-04	8.4686E-04	253.0	0.3467
15	17	28	18.00	9.900	9.898	1.4601E-03	1.4601E-03	365.4	0.6183
16	61	29	12.00	9.930	9.911	1.8260E-02	1.8260E-02	282.2	1.074
17	13	51	20.00	9.938	9.933	4.9896E-03	4.9896E-03	451.9	0.6194
18	13	48	16.00	9.938	9.936	1.5669E-03	1.5669E-03	145.0	0.3106
19	3	65	16.00	9.934	9.932	1.6079E-03	1.6079E-03	145.0	0.3106
20	25	60	20.00	9.953	9.936	1.6442E-02	1.6442E-02	789.5	1.082
21	62	20	20.00	9.993	9.968	2.5017E-02	2.5017E-02	1077.	1.477
22	15	61	12.00	9.931	9.930	1.5955E-03	1.5955E-03	196.6	0.7485
23	56	14	12.00	9.948	9.934	1.4085E-02	1.4085E-02	196.6	0.7485
24	71	25	20.00	9.961	9.953	7.8325E-03	7.8325E-03	575.2	0.7883
25	59	46	14.00	9.956	9.953	3.4952E-03	3.4952E-03	183.4	0.5130
26	46	56	12.00	9.953	9.948	5.0001E-03	5.0001E-03	196.6	0.7485
27	8	9	20.00	9.938	9.935	2.5358E-03	2.5358E-03	253.0	0.3467
28	41	58	20.00	9.964	9.962	1.8654E-03	1.8654E-03	330.7	0.4532
29	22	21	14.00	10.02	9.965	5.4715E-02	5.4715E-02	438.7	1.227
30	2	5	20.00	9.889	9.840	4.9417E-02	4.9417E-02	1836.	2.516
31	23	19	14.00	9.959	9.958	1.0147E-03	1.0147E-03	108.0	0.3022
33	20	10	20.00	9.968	9.938	2.9108E-02	2.9108E-02	849.9	1.165
34	14	15	12.00	9.934	9.931	2.4672E-03	2.4672E-03	196.6	0.7485
35	29	28	12.00	9.911	9.898	1.3217E-02	1.3217E-02	282.2	1.074
36	7	73	24.00	10.25	10.25	4.7684E-03	4.7684E-03	847.6	0.8067
37	26	22	20.00	10.09	10.02	7.2325E-02	7.2325E-02	1836.	2.516
38	1	17	18.00	9.902	9.900	2.4548E-03	2.4548E-03	365.4	0.6183
39	16	32	18.00	9.906	9.904	2.0742E-03	2.0742E-03	365.4	0.6183
40	49	26	20.00	10.21	10.09	0.1171	0.1171	1559.	2.137
41	49	30	12.00	10.21	10.16	4.6030E-02	4.6030E-02	276.7	1.053
42	31	26	12.00	10.12	10.09	3.3065E-02	3.3065E-02	276.7	1.053

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	32	1	18.00	9.904	9.902	1.5001E-03	1.5001E-03	365.4	0.6183
44	33	16	18.00	9.908	9.906	2.6426E-03	2.6426E-03	365.4	0.6183
45	30	35	12.00	10.16	10.15	1.4481E-02	1.4481E-02	276.7	1.053
46	53	33	18.00	9.913	9.908	4.4851E-03	4.4851E-03	365.4	0.6183
47	35	31	12.00	10.15	10.12	2.3498E-02	2.3498E-02	276.7	1.053
48	34	42	20.00	9.926	9.925	8.2493E-04	8.2493E-04	227.6	0.3119
53	24	23	14.00	9.960	9.959	3.1471E-04	3.1471E-04	108.0	0.3022
54	43	6	14.00	9.927	9.926	1.8501E-04	1.8501E-04	31.26	8.7440E-02
55	55	44	24.00	10.25	10.24	8.3818E-03	8.3818E-03	988.4	0.9407
56	7	55	24.00	10.25	10.25	5.7220E-06	0.000	70.39	6.6991E-02
58	63	47	20.00	9.926	9.900	2.6153E-02	2.6153E-02	1188.	1.629
59	25	46	14.00	9.953	9.953	1.0014E-04	1.0014E-04	13.19	3.6905E-02
60	73	40	24.00	10.25	10.25	2.2049E-03	2.2049E-03	847.6	0.8067
61	20	25	14.00	9.968	9.953	1.4643E-02	1.4643E-02	227.5	0.6364
62	51	50	20.00	9.933	9.929	3.2978E-03	3.2978E-03	369.4	0.5062
64	48	3	16.00	9.936	9.934	2.1353E-03	2.1353E-03	145.0	0.3106
66	57	54	20.00	9.928	9.927	1.2598E-03	1.2598E-03	227.6	0.3119
67	40	45	20.00	10.25	10.22	2.1382E-02	2.1382E-02	847.6	1.162
68	19	59	14.00	9.958	9.956	1.9302E-03	1.9302E-03	183.4	0.5130
69	60	61	12.00	9.936	9.930	6.8054E-03	6.8054E-03	85.60	0.3259
70	66	53	18.00	9.915	9.913	2.1372E-03	2.1372E-03	365.4	0.6183
71	58	71	20.00	9.962	9.961	1.3247E-03	1.3247E-03	650.5	0.8915
72	60	9	20.00	9.936	9.935	1.4057E-03	1.4057E-03	703.9	0.9647
73	22	62	20.00	10.02	9.993	2.6823E-02	2.6823E-02	1397.	1.915
74	62	58	14.00	9.993	9.962	3.0502E-02	3.0502E-02	319.9	0.8946
75	68	49	20.00	10.22	10.21	1.5067E-02	1.5067E-02	1836.	2.516
76	64	63	20.00	9.926	9.926	8.2016E-05	8.2016E-05	231.5	0.3173
77	67	66	18.00	9.917	9.915	1.7557E-03	1.7557E-03	365.4	0.6183
78	44	68	20.00	10.24	10.22	2.0508E-02	2.0508E-02	988.4	1.355
79	41	24	14.00	9.964	9.960	4.3678E-03	4.3678E-03	108.0	0.3022
80	45	68	20.00	10.22	10.22	5.3978E-04	5.3978E-04	847.6	1.162
81	21	41	20.00	9.965	9.964	7.4482E-04	7.4482E-04	438.7	0.6012
82	71	19	14.00	9.961	9.958	2.5072E-03	2.5072E-03	75.36	0.2108
83	54	72	14.00	9.927	9.927	2.0981E-04	2.0981E-04	31.26	8.7440E-02
84	54	6	20.00	9.927	9.926	6.7520E-04	6.7520E-04	196.3	0.2691
86	11	57	20.00	9.930	9.928	1.3599E-03	1.3599E-03	227.6	0.3119
89	65	77	20.00	9.932	9.931	1.2674E-03	1.2674E-03	227.6	0.3119
91	51	79	20.00	9.933	9.932	2.0027E-04	2.0027E-04	82.55	0.1131
94	64	82	20.00	9.926	9.926	4.0436E-04	4.0436E-04	137.9	0.1889
96	84	34	20.00	9.926	9.926	1.2493E-04	1.2493E-04	227.6	0.3119

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	918.0	0.000	10.25	10.25	10.17	9.7103E-02	2.6145E+05	100.0
2	918.0	0.000	10.25	10.25	10.17	9.7103E-02	2.6145E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	918.0	0.0000
69	0.000	*	918.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
5	9.840	1836.	*	585.30

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 27 Pool Fire scenario in HTU Fire Scenario Area 1 – Case B
27.A PIPENET schematic layout with piping and nodes label
27.B PIPENET schematic layout with flow rate and pressure results
27.C PIPENET schematic layout with velocity results
27.D PIPENET input/output printout report

Attachment 27.A contains 1 page
Attachment 27.B contains 1 page
Attachment 27.C contains 1 page
Attachment 27.D contains 21 pages

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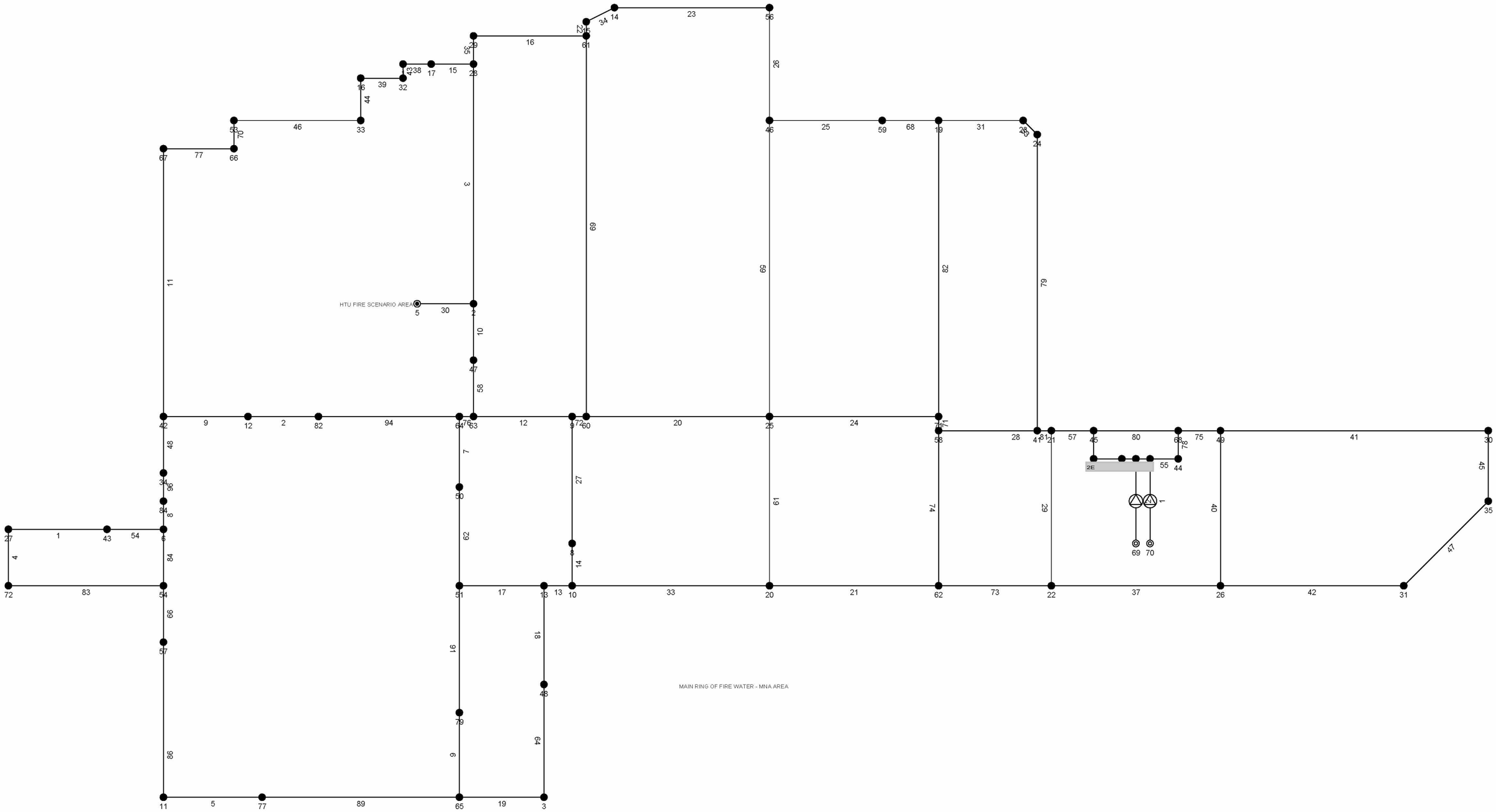
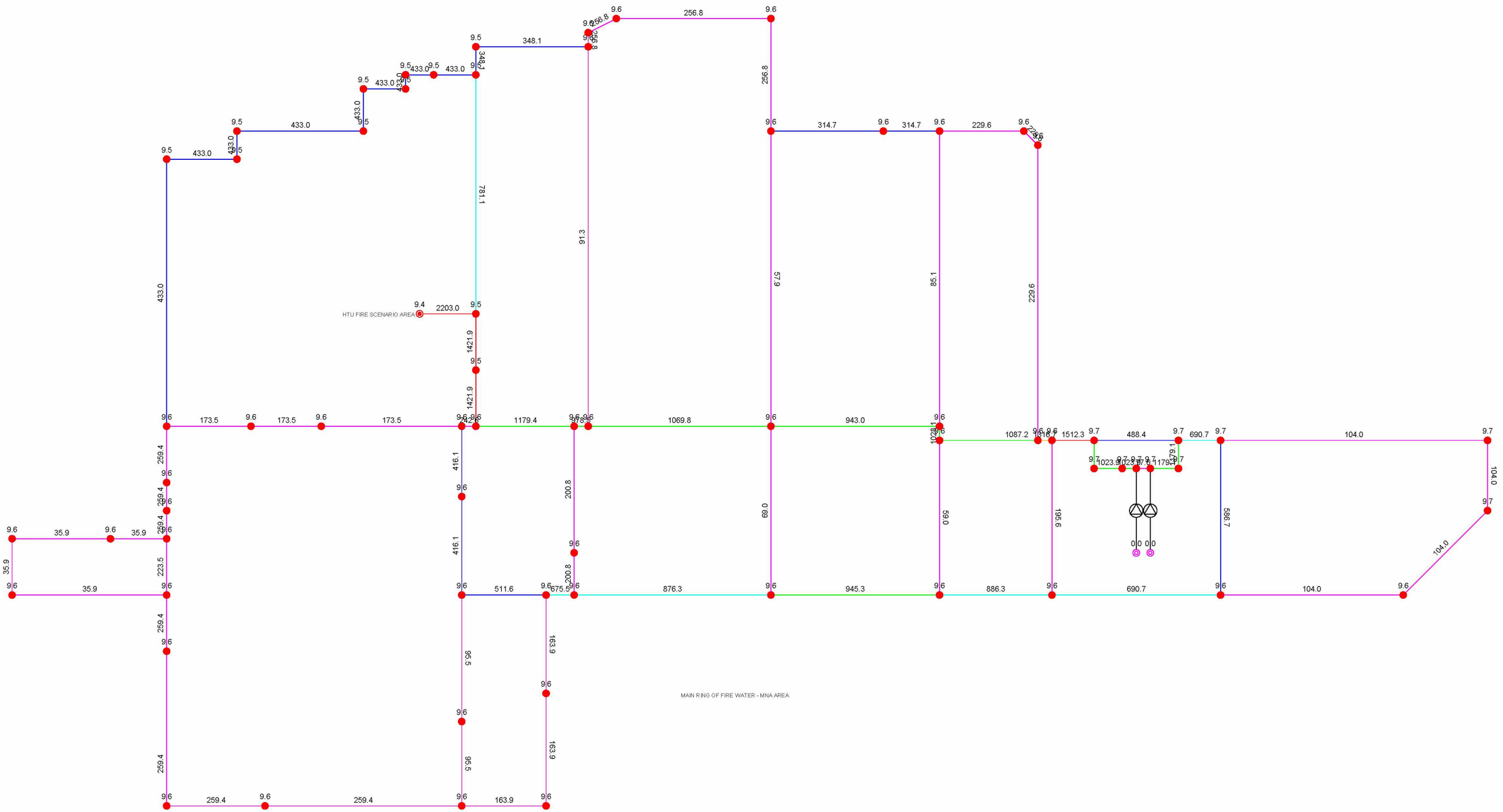
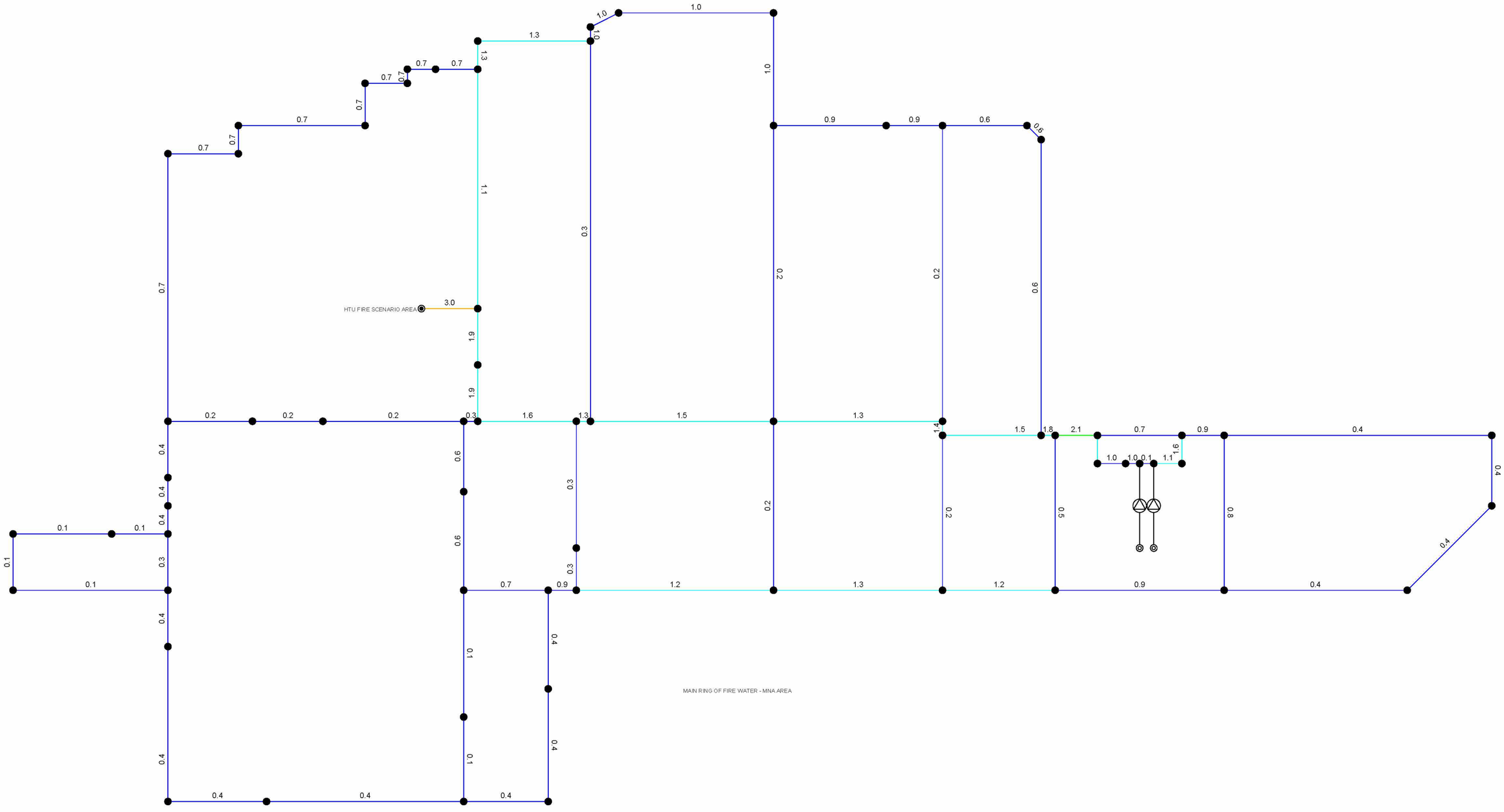


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:11 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
30	2	5	20.00	20.00	0.000	150.0	45.60
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
45	30	35	12.00	47.00	0.000	150.0	5.987
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
30	1 x 4	45.60		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	35.8900	9	14.0000	14.0000	*
2	82	12	173.5275	9	20.0000	20.0000	*
3	28	2	781.0717	9	20.0000	20.0000	*
4	72	27	35.8900	9	14.0000	14.0000	*
5	77	11	259.4282	9	20.0000	20.0000	*
6	79	65	95.4899	9	20.0000	20.0000	*
7	50	64	416.0826	9	20.0000	20.0000	*
8	6	84	259.4282	9	20.0000	20.0000	*
9	12	42	173.5275	9	20.0000	20.0000	*
10	47	2	1421.9333	9	20.0000	20.0000	*
11	42	67	432.9557	9	18.0000	18.0000	*
12	9	63	1179.3782	9	20.0000	20.0000	*
13	10	13	675.5109	9	20.0000	20.0000	*
14	10	8	200.8372	9	20.0000	20.0000	*
15	17	28	432.9557	9	18.0000	18.0000	*
16	61	29	348.1160	9	12.0000	12.0000	*
17	13	51	511.5725	9	20.0000	20.0000	*
18	13	48	163.9383	9	16.0000	16.0000	*
19	3	65	163.9383	9	16.0000	16.0000	*
20	25	60	1069.8258	9	20.0000	20.0000	*
21	62	20	945.3158	9	20.0000	20.0000	*
22	15	61	256.8312	9	12.0000	12.0000	*
23	56	14	256.8312	9	12.0000	12.0000	*
24	71	25	942.9755	9	20.0000	20.0000	*
25	59	46	314.7137	9	14.0000	14.0000	*
26	46	56	256.8312	9	12.0000	12.0000	*
27	8	9	200.8372	9	20.0000	20.0000	*
28	41	58	1087.1532	9	20.0000	20.0000	*
29	21	22	195.5864	9	14.0000	14.0000	*
30	2	5	2203.0049	9	20.0000	20.0000	*
31	23	19	229.5660	9	14.0000	14.0000	*
33	20	10	876.3480	9	20.0000	20.0000	*
34	14	15	256.8312	9	12.0000	12.0000	*
35	29	28	348.1160	9	12.0000	12.0000	*
36	7	73	1023.8559	9	24.0000	24.0000	*
37	26	22	690.6993	9	20.0000	20.0000	*
38	1	17	432.9557	9	18.0000	18.0000	*
39	16	32	432.9557	9	18.0000	18.0000	*
40	49	26	586.7344	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
41	49	30	103.9650	9	12.0000	12.0000	*
42	31	26	103.9650	9	12.0000	12.0000	*
43	32	1	432.9557	9	18.0000	18.0000	*
44	33	16	432.9557	9	18.0000	18.0000	*
45	30	35	103.9650	9	12.0000	12.0000	*
46	53	33	432.9557	9	18.0000	18.0000	*
47	35	31	103.9650	9	12.0000	12.0000	*
48	34	42	259.4282	9	20.0000	20.0000	*
53	24	23	229.5660	9	14.0000	14.0000	*
54	43	6	35.8900	9	14.0000	14.0000	*
55	55	44	1179.1493	9	24.0000	24.0000	*
56	7	55	77.6456	9	24.0000	24.0000	*
57	45	21	1512.3057	9	20.0000	20.0000	*
58	63	47	1421.9333	9	20.0000	20.0000	*
59	46	25	57.8825	9	14.0000	14.0000	*
60	73	40	1023.8559	9	24.0000	24.0000	*
61	20	25	68.9677	9	14.0000	14.0000	*
62	51	50	416.0826	9	20.0000	20.0000	*
64	48	3	163.9383	9	16.0000	16.0000	*
66	57	54	259.4282	9	20.0000	20.0000	*
67	40	45	1023.8559	9	20.0000	20.0000	*
68	19	59	314.7137	9	14.0000	14.0000	*
69	60	61	91.2847	9	12.0000	12.0000	*
70	66	53	432.9557	9	18.0000	18.0000	*
71	58	71	1028.1233	9	20.0000	20.0000	*
72	60	9	978.5411	9	20.0000	20.0000	*
73	22	62	886.2858	9	20.0000	20.0000	*
74	58	62	59.0299	9	14.0000	14.0000	*
75	68	49	690.6993	9	20.0000	20.0000	*
76	64	63	242.5551	9	20.0000	20.0000	*
77	67	66	432.9557	9	18.0000	18.0000	*
78	44	68	1179.1493	9	20.0000	20.0000	*
79	41	24	229.5660	9	14.0000	14.0000	*
80	68	45	488.4499	9	20.0000	20.0000	*
81	21	41	1316.7192	9	20.0000	20.0000	*
82	71	19	85.1477	9	14.0000	14.0000	*
83	54	72	35.8900	9	14.0000	14.0000	*
84	54	6	223.5382	9	20.0000	20.0000	*
86	11	57	259.4282	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	259.4282	9	20.0000	20.0000	*
91	51	79	95.4899	9	20.0000	20.0000	*
94	64	82	173.5275	9	20.0000	20.0000	*
96	84	34	259.4282	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	9.553	9.552	1.2493E-04	1.2493E-04	35.89	0.1004
2	82	12	20.00	9.551	9.551	2.8801E-04	2.8801E-04	173.5	0.2378
3	28	2	20.00	9.514	9.501	1.2755E-02	1.2755E-02	781.1	1.070
4	72	27	14.00	9.553	9.553	2.3270E-04	2.3270E-04	35.89	0.1004
5	77	11	20.00	9.558	9.556	1.5669E-03	1.5669E-03	259.4	0.3555
6	79	65	20.00	9.560	9.560	1.6022E-04	1.6022E-04	95.49	0.1309
7	50	64	20.00	9.556	9.552	4.1370E-03	4.1370E-03	416.1	0.5702
8	6	84	20.00	9.552	9.552	5.6744E-04	5.6744E-04	259.4	0.3555
9	12	42	20.00	9.551	9.550	4.4250E-04	4.4250E-04	173.5	0.2378
10	47	2	20.00	9.515	9.501	1.4528E-02	1.4528E-02	1422.	1.949
11	42	67	18.00	9.550	9.539	1.1427E-02	1.1427E-02	433.0	0.7326
12	9	63	20.00	9.565	9.552	1.3597E-02	1.3597E-02	1179.	1.616
13	10	13	20.00	9.567	9.566	1.1873E-03	1.1873E-03	675.5	0.9258
14	10	8	20.00	9.567	9.567	5.5218E-04	5.5218E-04	200.8	0.2752
15	17	28	18.00	9.516	9.514	2.0046E-03	2.0046E-03	433.0	0.7326
16	61	29	12.00	9.560	9.533	2.7038E-02	2.7038E-02	348.1	1.325
17	13	51	20.00	9.566	9.560	6.2780E-03	6.2780E-03	511.6	0.7011
18	13	48	16.00	9.566	9.564	1.9751E-03	1.9751E-03	163.9	0.3511
19	3	65	16.00	9.562	9.560	2.0275E-03	2.0275E-03	163.9	0.3511
20	25	60	20.00	9.597	9.568	2.8818E-02	2.8818E-02	1070.	1.466
21	62	20	20.00	9.618	9.598	1.9650E-02	1.9650E-02	945.3	1.296
22	15	61	12.00	9.563	9.560	2.6245E-03	2.6245E-03	256.8	0.9777
23	56	14	12.00	9.590	9.567	2.3174E-02	2.3174E-02	256.8	0.9777
24	71	25	20.00	9.616	9.597	1.9509E-02	1.9509E-02	943.0	1.292
25	59	46	14.00	9.608	9.598	9.5329E-03	9.5329E-03	314.7	0.8802
26	46	56	12.00	9.598	9.590	8.2273E-03	8.2273E-03	256.8	0.9777
27	8	9	20.00	9.567	9.565	1.6508E-03	1.6508E-03	200.8	0.2752
28	41	58	20.00	9.636	9.619	1.6832E-02	1.6832E-02	1087.	1.490
29	21	22	14.00	9.642	9.630	1.2300E-02	1.2300E-02	195.6	0.5470
30	2	5	20.00	9.501	9.432	6.9232E-02	6.9232E-02	2203.	3.019
31	23	19	14.00	9.617	9.613	4.1170E-03	4.1170E-03	229.6	0.6421
33	20	10	20.00	9.598	9.567	3.0812E-02	3.0812E-02	876.3	1.201
34	14	15	12.00	9.567	9.563	4.0607E-03	4.0607E-03	256.8	0.9777
35	29	28	12.00	9.533	9.514	1.9567E-02	1.9567E-02	348.1	1.325
36	7	73	24.00	9.703	9.696	6.7654E-03	6.7654E-03	1024.	0.9744
37	26	22	20.00	9.641	9.630	1.1863E-02	1.1863E-02	690.7	0.9466
38	1	17	18.00	9.519	9.516	3.3731E-03	3.3731E-03	433.0	0.7326
39	16	32	18.00	9.524	9.521	2.8496E-03	2.8496E-03	433.0	0.7326
40	49	26	20.00	9.661	9.641	1.9202E-02	1.9202E-02	586.7	0.8041
41	49	30	12.00	9.661	9.653	7.5493E-03	7.5493E-03	104.0	0.3958
42	31	26	12.00	9.647	9.641	5.4226E-03	5.4226E-03	104.0	0.3958

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
43	32	1	18.00	9.521	9.519	2.0647E-03	2.0647E-03	433.0	0.7326
44	33	16	18.00	9.527	9.524	3.6325E-03	3.6325E-03	433.0	0.7326
45	30	35	12.00	9.653	9.651	2.3756E-03	2.3756E-03	104.0	0.3958
46	53	33	18.00	9.534	9.527	6.1655E-03	6.1655E-03	433.0	0.7326
47	35	31	12.00	9.651	9.647	3.8548E-03	3.8548E-03	104.0	0.3958
48	34	42	20.00	9.551	9.550	1.0529E-03	1.0529E-03	259.4	0.3555
53	24	23	14.00	9.618	9.617	1.2751E-03	1.2751E-03	229.6	0.6421
54	43	6	14.00	9.552	9.552	2.3460E-04	2.3460E-04	35.89	0.1004
55	55	44	24.00	9.703	9.691	1.1613E-02	1.1613E-02	1179.	1.122
56	7	55	24.00	9.703	9.703	7.6294E-06	0.000	77.65	7.3898E-02
57	45	21	20.00	9.663	9.642	2.1040E-02	2.1040E-02	1512.	2.073
58	63	47	20.00	9.552	9.515	3.6362E-02	3.6362E-02	1422.	1.949
59	46	25	14.00	9.598	9.597	1.5593E-03	1.5593E-03	57.88	0.1619
60	73	40	24.00	9.696	9.693	3.1300E-03	3.1300E-03	1024.	0.9744
61	20	25	14.00	9.598	9.597	1.6146E-03	1.6146E-03	68.97	0.1929
62	51	50	20.00	9.560	9.556	4.1075E-03	4.1075E-03	416.1	0.5702
64	48	3	16.00	9.564	9.562	2.6951E-03	2.6951E-03	163.9	0.3511
66	57	54	20.00	9.555	9.553	1.6098E-03	1.6098E-03	259.4	0.3555
67	40	45	20.00	9.693	9.663	3.0337E-02	3.0337E-02	1024.	1.403
68	19	59	14.00	9.613	9.608	5.2605E-03	5.2605E-03	314.7	0.8802
69	60	61	12.00	9.568	9.560	7.7095E-03	7.7095E-03	91.28	0.3475
70	66	53	18.00	9.537	9.534	2.9373E-03	2.9373E-03	433.0	0.7326
71	58	71	20.00	9.619	9.616	3.0880E-03	3.0880E-03	1028.	1.409
72	60	9	20.00	9.568	9.565	2.5826E-03	2.5826E-03	978.5	1.341
73	22	62	20.00	9.630	9.618	1.1564E-02	1.1564E-02	886.3	1.215
74	58	62	14.00	9.619	9.618	1.3323E-03	1.3323E-03	59.03	0.1651
75	68	49	20.00	9.663	9.661	2.4700E-03	2.4700E-03	690.7	0.9466
76	64	63	20.00	9.552	9.552	9.0599E-05	9.0599E-05	242.6	0.3324
77	67	66	18.00	9.539	9.537	2.4128E-03	2.4128E-03	433.0	0.7326
78	44	68	20.00	9.691	9.663	2.8418E-02	2.8418E-02	1179.	1.616
79	41	24	14.00	9.636	9.618	1.7685E-02	1.7685E-02	229.6	0.6421
80	68	45	20.00	9.663	9.663	1.9455E-04	1.9455E-04	488.4	0.6694
81	21	41	20.00	9.642	9.636	5.7001E-03	5.7001E-03	1317.	1.805
82	71	19	14.00	9.616	9.613	3.1567E-03	3.1567E-03	85.15	0.2382
83	54	72	14.00	9.553	9.553	2.6989E-04	2.6989E-04	35.89	0.1004
84	54	6	20.00	9.553	9.552	8.6212E-04	8.6212E-04	223.5	0.3064
86	11	57	20.00	9.556	9.555	1.7433E-03	1.7433E-03	259.4	0.3555
89	65	77	20.00	9.560	9.558	1.6203E-03	1.6203E-03	259.4	0.3555
91	51	79	20.00	9.560	9.560	2.5940E-04	2.5940E-04	95.49	0.1309
94	64	82	20.00	9.552	9.551	6.2752E-04	6.2752E-04	173.5	0.2378
96	84	34	20.00	9.552	9.551	1.6022E-04	1.6022E-04	259.4	0.3555

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	1102.	0.000	9.703	9.703	10.17	0.1026	2.9689E+05	100.0
2	1101.	0.000	9.703	9.703	10.17	0.1026	2.9689E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	1102.	0.0000
69	0.000	*	1101.	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
5	9.432	2203.	*	717.34

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 28 Pool Fire scenario in HTU Fire Scenario Area 2 – Case A

28.A PIPENET schematic layout with piping and nodes label

28.B PIPENET schematic layout with flow rate and pressure results

28.C PIPENET schematic layout with velocity results

28.D PIPENET input/output printout report

Attachment 28.A contains 1 page
Attachment 28.B contains 1 page
Attachment 28.C contains 1 page
Attachment 28.D contains 21 pages

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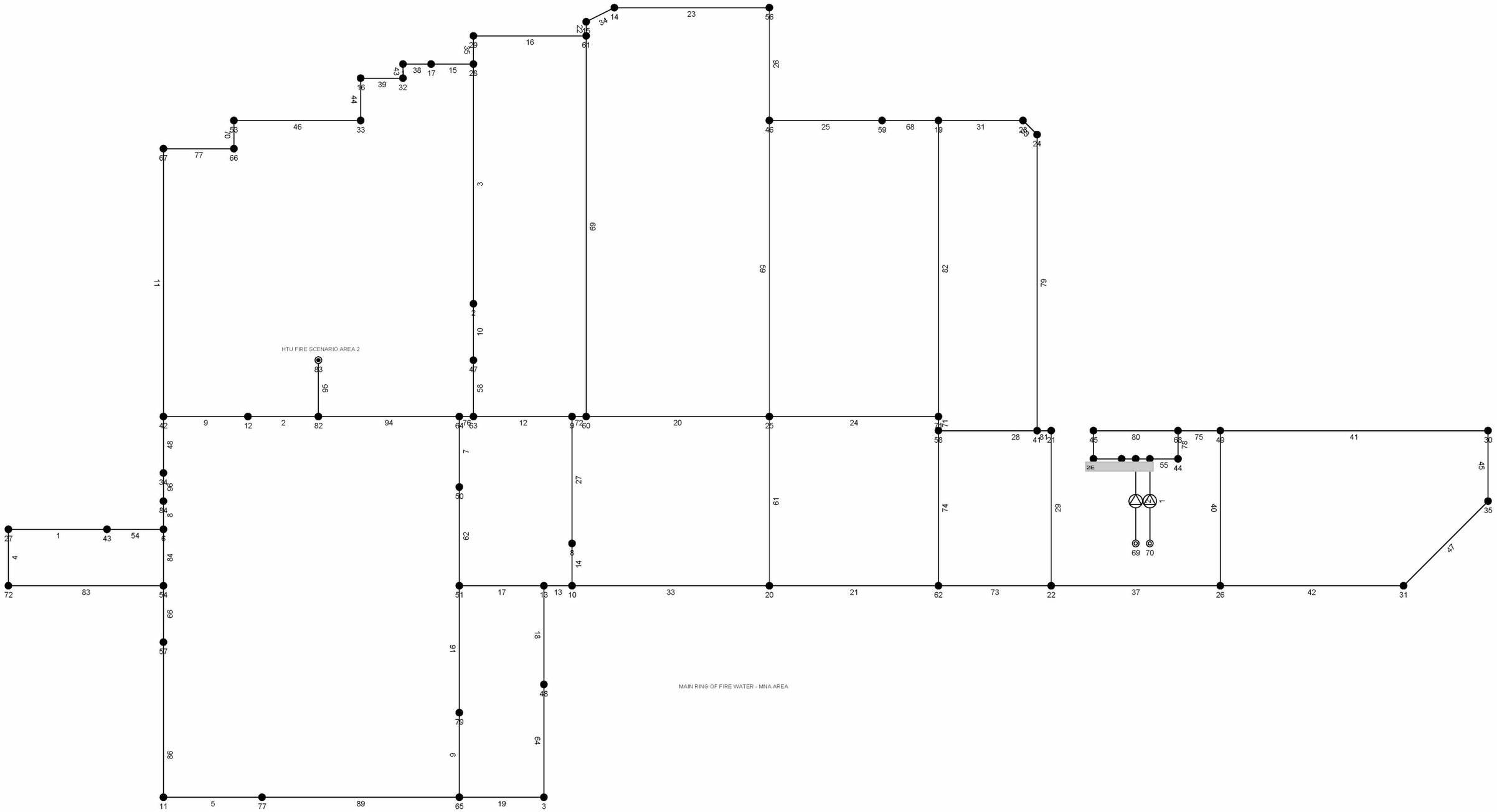
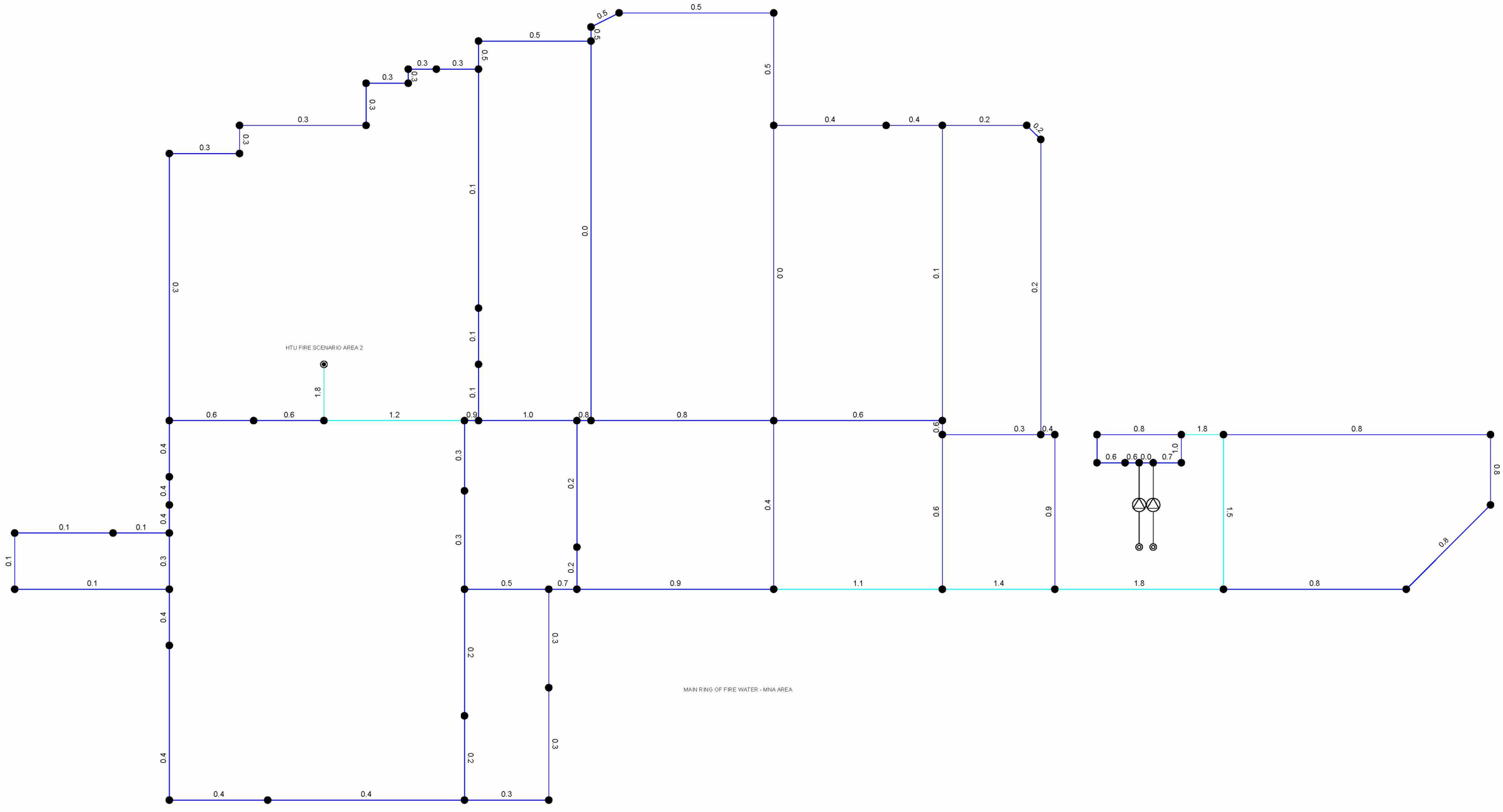


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

HTU FIRE SCENARIO AREA 2

MAIN RING OF FIRE WATER - MNA AREA

Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:18 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
95	82	83	20.00	20.00	0.000	150.0	45.60
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
95	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	36.8400	9	14.0000	14.0000	*
2	12	82	458.6685	9	20.0000	20.0000	*
3	2	28	69.2263	9	20.0000	20.0000	*
4	72	27	36.8400	9	14.0000	14.0000	*
5	77	11	268.1181	9	20.0000	20.0000	*
6	79	65	139.3844	9	20.0000	20.0000	*
7	50	64	228.8185	9	20.0000	20.0000	*
8	6	84	268.1181	9	20.0000	20.0000	*
9	42	12	458.6685	9	20.0000	20.0000	*
10	47	2	69.2263	9	20.0000	20.0000	*
11	67	42	190.5503	9	18.0000	18.0000	*
12	9	63	707.7424	9	20.0000	20.0000	*
13	10	13	496.9367	9	20.0000	20.0000	*
14	10	8	130.0613	9	20.0000	20.0000	*
15	28	17	190.5503	9	18.0000	18.0000	*
16	61	29	121.3240	9	12.0000	12.0000	*
17	13	51	368.2029	9	20.0000	20.0000	*
18	13	48	128.7337	9	16.0000	16.0000	*
19	3	65	128.7337	9	16.0000	16.0000	*
20	25	60	578.7858	9	20.0000	20.0000	*
21	62	20	783.5800	9	20.0000	20.0000	*
22	15	61	120.2192	9	12.0000	12.0000	*
23	56	14	120.2192	9	12.0000	12.0000	*
24	71	25	412.4872	9	20.0000	20.0000	*
25	59	46	129.9360	9	14.0000	14.0000	*
26	46	56	120.2192	9	12.0000	12.0000	*
27	8	9	130.0613	9	20.0000	20.0000	*
28	41	58	237.8257	9	20.0000	20.0000	*
29	22	21	314.7201	9	14.0000	14.0000	*
31	23	19	76.8944	9	14.0000	14.0000	*
33	20	10	626.9980	9	20.0000	20.0000	*
34	14	15	120.2192	9	12.0000	12.0000	*
35	29	28	121.3240	9	12.0000	12.0000	*
36	7	73	612.1651	9	24.0000	24.0000	*
37	26	22	1326.0031	9	20.0000	20.0000	*
38	17	1	190.5503	9	18.0000	18.0000	*
39	32	16	190.5503	9	18.0000	18.0000	*
40	49	26	1126.1475	9	20.0000	20.0000	*
41	49	30	199.8557	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	199.8557	9	12.0000	12.0000	*
43	1	32	190.5503	9	18.0000	18.0000	*
44	16	33	190.5503	9	18.0000	18.0000	*
45	30	35	199.8557	9	12.0000	12.0000	*
46	33	53	190.5503	9	18.0000	18.0000	*
47	35	31	199.8557	9	12.0000	12.0000	*
48	34	42	268.1181	9	20.0000	20.0000	*
53	24	23	76.8944	9	14.0000	14.0000	*
54	43	6	36.8400	9	14.0000	14.0000	*
55	55	44	713.8378	9	24.0000	24.0000	*
56	7	55	50.8353	9	24.0000	24.0000	*
58	63	47	69.2263	9	20.0000	20.0000	*
59	46	25	9.7167	9	14.0000	14.0000	*
60	73	40	612.1651	9	24.0000	24.0000	*
61	20	25	156.5819	9	14.0000	14.0000	*
62	51	50	228.8185	9	20.0000	20.0000	*
64	48	3	128.7337	9	16.0000	16.0000	*
66	57	54	268.1181	9	20.0000	20.0000	*
67	40	45	612.1651	9	20.0000	20.0000	*
68	19	59	129.9360	9	14.0000	14.0000	*
69	60	61	1.1048	9	12.0000	12.0000	*
70	53	66	190.5503	9	18.0000	18.0000	*
71	58	71	465.5287	9	20.0000	20.0000	*
72	60	9	577.6810	9	20.0000	20.0000	*
73	22	62	1011.2829	9	20.0000	20.0000	*
74	62	58	227.7030	9	14.0000	14.0000	*
75	68	49	1326.0031	9	20.0000	20.0000	*
76	63	64	638.5160	9	20.0000	20.0000	*
77	66	67	190.5503	9	18.0000	18.0000	*
78	44	68	713.8380	9	20.0000	20.0000	*
79	41	24	76.8944	9	14.0000	14.0000	*
80	45	68	612.1651	9	20.0000	20.0000	*
81	21	41	314.7201	9	20.0000	20.0000	*
82	71	19	53.0415	9	14.0000	14.0000	*
83	54	72	36.8400	9	14.0000	14.0000	*
84	54	6	231.2782	9	20.0000	20.0000	*
86	11	57	268.1181	9	20.0000	20.0000	*
89	65	77	268.1181	9	20.0000	20.0000	*
91	51	79	139.3844	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
94	64	82	867.3345	9	20.0000	20.0000	*
95	82	83	1326.0031	9	20.0000	20.0000	*
96	84	34	268.1181	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.66	10.66	1.3256E-04	1.3256E-04	36.84	0.1030
2	12	82	20.00	10.65	10.65	1.7347E-03	1.7347E-03	458.7	0.6286
3	2	28	20.00	10.66	10.66	1.4210E-04	1.4210E-04	69.23	9.4875E-02
4	72	27	14.00	10.66	10.66	2.4700E-04	2.4700E-04	36.84	0.1030
5	77	11	20.00	10.66	10.66	1.6594E-03	1.6594E-03	268.1	0.3675
6	79	65	20.00	10.66	10.66	3.2043E-04	3.2043E-04	139.4	0.1910
7	50	64	20.00	10.66	10.66	1.3695E-03	1.3695E-03	228.8	0.3136
8	6	84	20.00	10.66	10.66	5.9986E-04	5.9986E-04	268.1	0.3675
9	42	12	20.00	10.65	10.65	2.6627E-03	2.6627E-03	458.7	0.6286
10	47	2	20.00	10.66	10.66	5.5313E-05	5.5313E-05	69.23	9.4875E-02
11	67	42	18.00	10.66	10.65	2.4900E-03	2.4900E-03	190.5	0.3224
12	9	63	20.00	10.67	10.66	5.2977E-03	5.2977E-03	707.7	0.9700
13	10	13	20.00	10.67	10.67	6.7043E-04	6.7043E-04	496.9	0.6811
14	10	8	20.00	10.67	10.67	2.4796E-04	2.4796E-04	130.1	0.1782
15	28	17	18.00	10.66	10.66	4.3774E-04	4.3774E-04	190.5	0.3224
16	61	29	12.00	10.67	10.67	3.8300E-03	3.8300E-03	121.3	0.4619
17	13	51	20.00	10.67	10.67	3.4170E-03	3.4170E-03	368.2	0.5046
18	13	48	16.00	10.67	10.67	1.2579E-03	1.2579E-03	128.7	0.2757
19	3	65	16.00	10.67	10.66	1.2903E-03	1.2903E-03	128.7	0.2757
20	25	60	20.00	10.68	10.67	9.2602E-03	9.2602E-03	578.8	0.7932
21	62	20	20.00	10.70	10.69	1.3880E-02	1.3880E-02	783.6	1.074
22	15	61	12.00	10.67	10.67	6.4278E-04	6.4278E-04	120.2	0.4577
23	56	14	12.00	10.68	10.67	5.6705E-03	5.6705E-03	120.2	0.4577
24	71	25	20.00	10.68	10.68	4.2324E-03	4.2324E-03	412.5	0.5653
25	59	46	14.00	10.68	10.68	1.8473E-03	1.8473E-03	129.9	0.3634
26	46	56	12.00	10.68	10.68	2.0123E-03	2.0123E-03	120.2	0.4577
27	8	9	20.00	10.67	10.67	7.4005E-04	7.4005E-04	130.1	0.1782
28	41	58	20.00	10.68	10.68	1.0128E-03	1.0128E-03	237.8	0.3259
29	22	21	14.00	10.71	10.68	2.9595E-02	2.9595E-02	314.7	0.8803
31	23	19	14.00	10.68	10.68	5.4264E-04	5.4264E-04	76.89	0.2151
33	20	10	20.00	10.69	10.67	1.6580E-02	1.6580E-02	627.0	0.8593
34	14	15	12.00	10.67	10.67	9.9182E-04	9.9182E-04	120.2	0.4577
35	29	28	12.00	10.67	10.66	2.7723E-03	2.7723E-03	121.3	0.4619
36	7	73	24.00	10.84	10.84	2.6121E-03	2.6121E-03	612.2	0.5826
37	26	22	20.00	10.75	10.71	3.9613E-02	3.9613E-02	1326.	1.817
38	17	1	18.00	10.66	10.66	7.3528E-04	7.3528E-04	190.5	0.3224
39	32	16	18.00	10.66	10.66	6.1989E-04	6.1989E-04	190.5	0.3224
40	49	26	20.00	10.82	10.75	6.4119E-02	6.4119E-02	1126.	1.543
41	49	30	12.00	10.82	10.79	2.5209E-02	2.5209E-02	199.9	0.7608
42	31	26	12.00	10.77	10.75	1.8109E-02	1.8109E-02	199.9	0.7608
43	1	32	18.00	10.66	10.66	4.5013E-04	4.5013E-04	190.5	0.3224

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.66	10.66	7.9250E-04	7.9250E-04	190.5	0.3224
45	30	35	12.00	10.79	10.79	7.9298E-03	7.9298E-03	199.9	0.7608
46	33	53	18.00	10.66	10.66	1.3447E-03	1.3447E-03	190.5	0.3224
47	35	31	12.00	10.79	10.77	1.2871E-02	1.2871E-02	199.9	0.7608
48	34	42	20.00	10.66	10.65	1.1148E-03	1.1148E-03	268.1	0.3675
53	24	23	14.00	10.68	10.68	1.6689E-04	1.6689E-04	76.89	0.2151
54	43	6	14.00	10.66	10.66	2.4796E-04	2.4796E-04	36.84	0.1030
55	55	44	24.00	10.84	10.84	4.5900E-03	4.5900E-03	713.8	0.6794
56	7	55	24.00	10.84	10.84	4.7684E-06	0.000	50.84	4.8382E-02
58	63	47	20.00	10.66	10.66	1.3447E-04	1.3447E-04	69.23	9.4875E-02
59	46	25	14.00	10.68	10.68	5.5313E-05	5.5313E-05	9.717	2.7177E-02
60	73	40	24.00	10.84	10.84	1.2074E-03	1.2074E-03	612.2	0.5826
61	20	25	14.00	10.69	10.68	7.3328E-03	7.3328E-03	156.6	0.4380
62	51	50	20.00	10.67	10.66	1.3609E-03	1.3609E-03	228.8	0.3136
64	48	3	16.00	10.67	10.67	1.7147E-03	1.7147E-03	128.7	0.2757
66	57	54	20.00	10.66	10.66	1.7080E-03	1.7080E-03	268.1	0.3675
67	40	45	20.00	10.84	10.83	1.1710E-02	1.1710E-02	612.2	0.8390
68	19	59	14.00	10.68	10.68	1.0204E-03	1.0204E-03	129.9	0.3634
69	60	61	12.00	10.67	10.67	1.9073E-06	0.000	1.105	4.2059E-03
70	53	66	18.00	10.66	10.66	6.3992E-04	6.3992E-04	190.5	0.3224
71	58	71	20.00	10.68	10.68	7.1526E-04	7.1526E-04	465.5	0.6380
72	60	9	20.00	10.67	10.67	9.7466E-04	9.7466E-04	577.7	0.7917
73	22	62	20.00	10.71	10.70	1.4748E-02	1.4748E-02	1011.	1.386
74	62	58	14.00	10.70	10.68	1.6265E-02	1.6265E-02	227.7	0.6369
75	68	49	20.00	10.83	10.82	8.2531E-03	8.2531E-03	1326.	1.817
76	63	64	20.00	10.66	10.66	5.3215E-04	5.3215E-04	638.5	0.8751
77	66	67	18.00	10.66	10.66	5.2738E-04	5.2738E-04	190.5	0.3224
78	44	68	20.00	10.84	10.83	1.1232E-02	1.1232E-02	713.8	0.9783
79	41	24	14.00	10.68	10.68	2.3279E-03	2.3279E-03	76.89	0.2151
80	45	68	20.00	10.83	10.83	2.9755E-04	2.9755E-04	612.2	0.8390
81	21	41	20.00	10.68	10.68	4.0436E-04	4.0436E-04	314.7	0.4313
82	71	19	14.00	10.68	10.68	1.3094E-03	1.3094E-03	53.04	0.1484
83	54	72	14.00	10.66	10.66	2.8515E-04	2.8515E-04	36.84	0.1030
84	54	6	20.00	10.66	10.66	9.1267E-04	9.1267E-04	231.3	0.3170
86	11	57	20.00	10.66	10.66	1.8425E-03	1.8425E-03	268.1	0.3675
89	65	77	20.00	10.66	10.66	1.7147E-03	1.7147E-03	268.1	0.3675
91	51	79	20.00	10.67	10.66	5.2547E-04	5.2547E-04	139.4	0.1910
94	64	82	20.00	10.66	10.65	1.2235E-02	1.2235E-02	867.3	1.189
95	82	83	20.00	10.65	10.62	2.7065E-02	2.7065E-02	1326.	1.817
96	84	34	20.00	10.66	10.66	1.6975E-04	1.6975E-04	268.1	0.3675

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	663.0	0.000	10.84	10.84	10.17	9.1823E-02	1.9968E+05	100.0
2	663.0	0.000	10.84	10.84	10.17	9.1823E-02	1.9968E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	663.0	0.0000
69	0.000	*	663.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
83	10.62	1326.	*	406.83

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 29 Pool Fire scenario in HTU Fire Scenario Area 2 – Case B

29.A PIPENET schematic layout with piping and nodes label

29.B PIPENET schematic layout with flow rate and pressure results

29.C PIPENET schematic layout with velocity results

29.D PIPENET input/output printout report

Attachment 29.A contains 1 page
Attachment 29.B contains 1 page
Attachment 29.C contains 1 page
Attachment 29.D contains 21 pages

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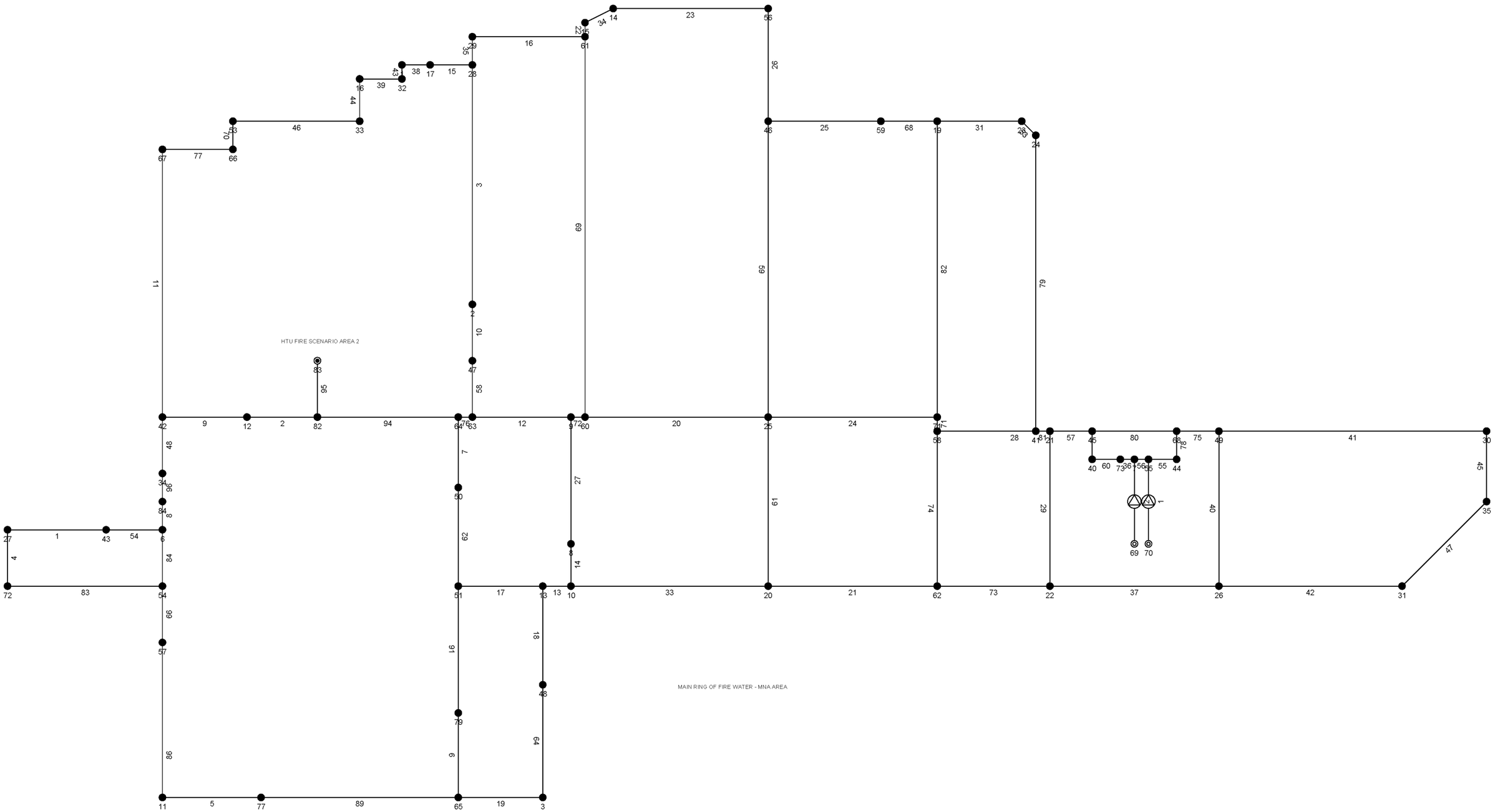
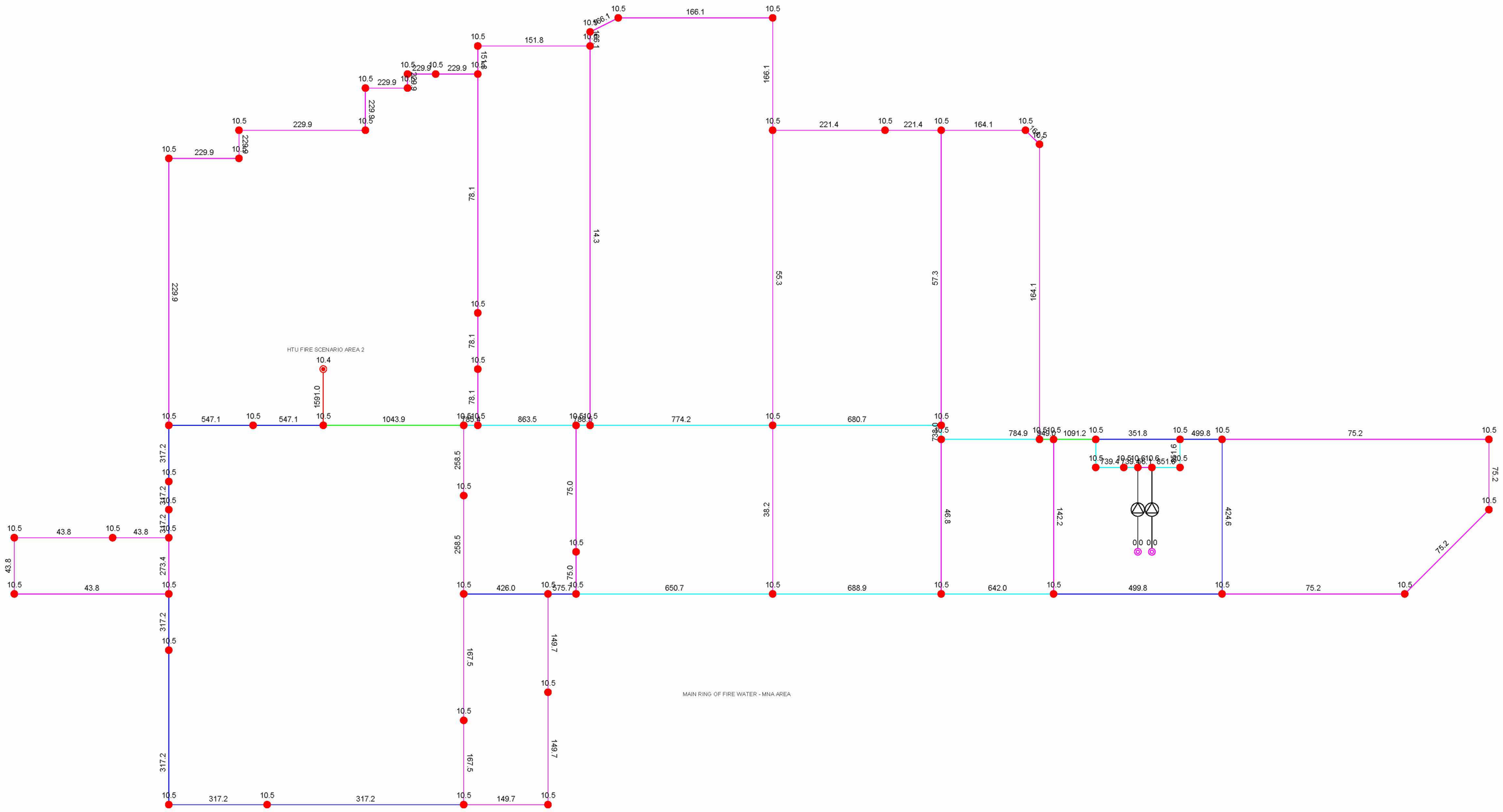
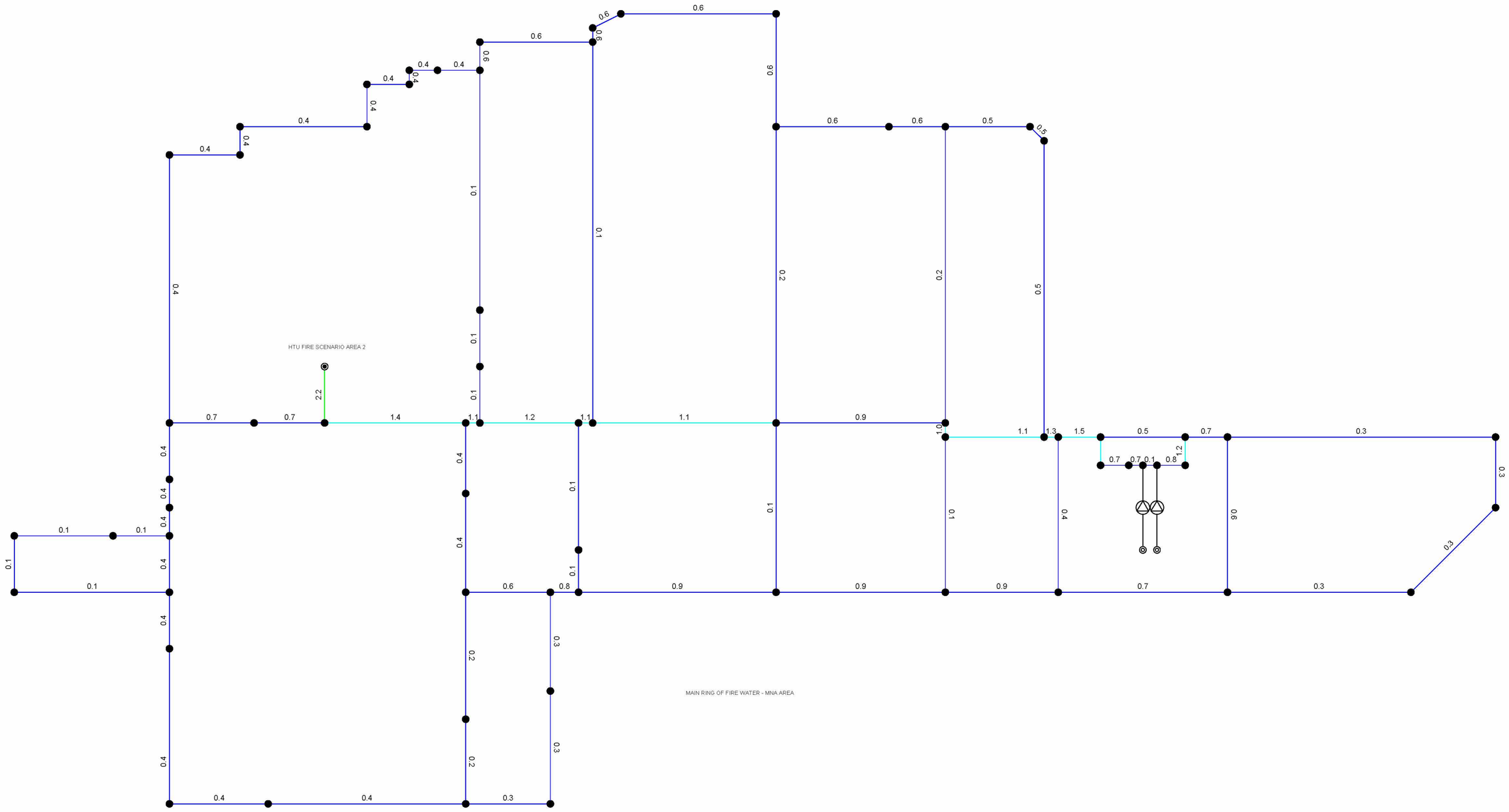


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:25 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	67	42	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	28	17	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	17	1	18.00	23.00	0.000	150.0	15.66
39	32	16	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	16	33	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	33	53	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	61	60	12.00	163.0	0.000	150.0	55.27
70	53	66	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	66	67	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
95	82	83	20.00	20.00	0.000	150.0	45.60
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
95	1 x 4	45.60

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	43.7598	9	14.0000	14.0000	*
2	12	82	547.0687	9	20.0000	20.0000	*
3	2	28	78.1055	9	20.0000	20.0000	*
4	72	27	43.7598	9	14.0000	14.0000	*
5	77	11	317.1678	9	20.0000	20.0000	*
6	79	65	167.4653	9	20.0000	20.0000	*
7	50	64	258.5439	9	20.0000	20.0000	*
8	6	84	317.1678	9	20.0000	20.0000	*
9	42	12	547.0687	9	20.0000	20.0000	*
10	47	2	78.1055	9	20.0000	20.0000	*
11	67	42	229.9009	9	18.0000	18.0000	*
12	9	63	863.4965	9	20.0000	20.0000	*
13	10	13	575.7117	9	20.0000	20.0000	*
14	10	8	74.9588	9	20.0000	20.0000	*
15	28	17	229.9009	9	18.0000	18.0000	*
16	61	29	151.7955	9	12.0000	12.0000	*
17	13	51	426.0091	9	20.0000	20.0000	*
18	13	48	149.7026	9	16.0000	16.0000	*
19	3	65	149.7026	9	16.0000	16.0000	*
20	25	60	774.2481	9	20.0000	20.0000	*
21	62	20	688.8651	9	20.0000	20.0000	*
22	15	61	166.0850	9	12.0000	12.0000	*
23	56	14	166.0850	9	12.0000	12.0000	*
24	71	25	680.7231	9	20.0000	20.0000	*
25	59	46	221.4155	9	14.0000	14.0000	*
26	46	56	166.0850	9	12.0000	12.0000	*
27	8	9	74.9588	9	20.0000	20.0000	*
28	41	58	784.8745	9	20.0000	20.0000	*
29	21	22	142.2339	9	14.0000	14.0000	*
31	23	19	164.0910	9	14.0000	14.0000	*
33	20	10	650.6705	9	20.0000	20.0000	*
34	14	15	166.0850	9	12.0000	12.0000	*
35	29	28	151.7955	9	12.0000	12.0000	*
36	7	73	739.4202	9	24.0000	24.0000	*
37	26	22	499.8042	9	20.0000	20.0000	*
38	17	1	229.9009	9	18.0000	18.0000	*
39	32	16	229.9009	9	18.0000	18.0000	*
40	49	26	424.5868	9	20.0000	20.0000	*
41	49	30	75.2175	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	75.2175	9	12.0000	12.0000	*
43	1	32	229.9009	9	18.0000	18.0000	*
44	16	33	229.9009	9	18.0000	18.0000	*
45	30	35	75.2175	9	12.0000	12.0000	*
46	33	53	229.9009	9	18.0000	18.0000	*
47	35	31	75.2175	9	12.0000	12.0000	*
48	34	42	317.1678	9	20.0000	20.0000	*
53	24	23	164.0910	9	14.0000	14.0000	*
54	43	6	43.7598	9	14.0000	14.0000	*
55	55	44	851.5836	9	24.0000	24.0000	*
56	7	55	56.0809	9	24.0000	24.0000	*
57	45	21	1091.1995	9	20.0000	20.0000	*
58	63	47	78.1055	9	20.0000	20.0000	*
59	46	25	55.3305	9	14.0000	14.0000	*
60	73	40	739.4202	9	24.0000	24.0000	*
61	20	25	38.1946	9	14.0000	14.0000	*
62	51	50	258.5439	9	20.0000	20.0000	*
64	48	3	149.7026	9	16.0000	16.0000	*
66	57	54	317.1678	9	20.0000	20.0000	*
67	40	45	739.4201	9	20.0000	20.0000	*
68	19	59	221.4155	9	14.0000	14.0000	*
69	61	60	14.2896	9	12.0000	12.0000	*
70	53	66	229.9009	9	18.0000	18.0000	*
71	58	71	738.0475	9	20.0000	20.0000	*
72	60	9	788.5377	9	20.0000	20.0000	*
73	22	62	642.0381	9	20.0000	20.0000	*
74	58	62	46.8270	9	14.0000	14.0000	*
75	68	49	499.8042	9	20.0000	20.0000	*
76	63	64	785.3910	9	20.0000	20.0000	*
77	66	67	229.9009	9	18.0000	18.0000	*
78	44	68	851.5836	9	20.0000	20.0000	*
79	41	24	164.0910	9	14.0000	14.0000	*
80	68	45	351.7793	9	20.0000	20.0000	*
81	21	41	948.9655	9	20.0000	20.0000	*
82	71	19	57.3245	9	14.0000	14.0000	*
83	54	72	43.7598	9	14.0000	14.0000	*
84	54	6	273.4080	9	20.0000	20.0000	*
86	11	57	317.1678	9	20.0000	20.0000	*
89	65	77	317.1678	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	167.4653	9	20.0000	20.0000	*
94	64	82	1043.9348	9	20.0000	20.0000	*
95	82	83	1591.0038	9	20.0000	20.0000	*
96	84	34	317.1678	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.46	10.46	1.8311E-04	1.8311E-04	43.76	0.1224
2	12	82	20.00	10.45	10.45	2.4147E-03	2.4147E-03	547.1	0.7498
3	2	28	20.00	10.47	10.47	1.8024E-04	1.8024E-04	78.11	0.1070
4	72	27	14.00	10.46	10.46	3.3665E-04	3.3665E-04	43.76	0.1224
5	77	11	20.00	10.47	10.46	2.2726E-03	2.2726E-03	317.2	0.4347
6	79	65	20.00	10.47	10.47	4.5013E-04	4.5013E-04	167.5	0.2295
7	50	64	20.00	10.47	10.47	1.7147E-03	1.7147E-03	258.5	0.3543
8	6	84	20.00	10.46	10.46	8.2016E-04	8.2016E-04	317.2	0.4347
9	42	12	20.00	10.46	10.45	3.7022E-03	3.7022E-03	547.1	0.7498
10	47	2	20.00	10.47	10.47	6.9618E-05	6.9618E-05	78.11	0.1070
11	67	42	18.00	10.46	10.46	3.5458E-03	3.5458E-03	229.9	0.3890
12	9	63	20.00	10.48	10.47	7.6408E-03	7.6408E-03	863.5	1.183
13	10	13	20.00	10.48	10.48	8.8215E-04	8.8215E-04	575.7	0.7890
14	10	8	20.00	10.48	10.48	8.7738E-05	8.7738E-05	74.96	0.1027
15	28	17	18.00	10.47	10.47	6.2275E-04	6.2275E-04	229.9	0.3890
16	61	29	12.00	10.48	10.47	5.8250E-03	5.8250E-03	151.8	0.5779
17	13	51	20.00	10.48	10.47	4.4727E-03	4.4727E-03	426.0	0.5838
18	13	48	16.00	10.48	10.47	1.6699E-03	1.6699E-03	149.7	0.3206
19	3	65	16.00	10.47	10.47	1.7147E-03	1.7147E-03	149.7	0.3206
20	25	60	20.00	10.49	10.48	1.5842E-02	1.5842E-02	774.2	1.061
21	62	20	20.00	10.50	10.49	1.0940E-02	1.0940E-02	688.9	0.9441
22	15	61	12.00	10.48	10.48	1.1730E-03	1.1730E-03	166.1	0.6323
23	56	14	12.00	10.49	10.48	1.0358E-02	1.0358E-02	166.1	0.6323
24	71	25	20.00	10.50	10.49	1.0675E-02	1.0675E-02	680.7	0.9329
25	59	46	14.00	10.50	10.49	4.9772E-03	4.9772E-03	221.4	0.6193
26	46	56	12.00	10.49	10.49	3.6774E-03	3.6774E-03	166.1	0.6323
27	8	9	20.00	10.48	10.48	2.6417E-04	2.6417E-04	74.96	0.1027
28	41	58	20.00	10.51	10.51	9.2125E-03	9.2125E-03	784.9	1.076
29	21	22	14.00	10.52	10.51	6.8207E-03	6.8207E-03	142.2	0.3978
31	23	19	14.00	10.50	10.50	2.2125E-03	2.2125E-03	164.1	0.4590
33	20	10	20.00	10.49	10.48	1.7763E-02	1.7763E-02	650.7	0.8917
34	14	15	12.00	10.48	10.48	1.8148E-03	1.8148E-03	166.1	0.6323
35	29	28	12.00	10.47	10.47	4.2171E-03	4.2171E-03	151.8	0.5779
36	7	73	24.00	10.55	10.55	3.7050E-03	3.7050E-03	739.4	0.7037
37	26	22	20.00	10.52	10.51	6.5174E-03	6.5174E-03	499.8	0.6850
38	17	1	18.00	10.47	10.47	1.0471E-03	1.0471E-03	229.9	0.3890
39	32	16	18.00	10.47	10.46	8.8310E-04	8.8310E-04	229.9	0.3890
40	49	26	20.00	10.53	10.52	1.0555E-02	1.0555E-02	424.6	0.5819
41	49	30	12.00	10.53	10.52	4.1494E-03	4.1494E-03	75.22	0.2863
42	31	26	12.00	10.52	10.52	2.9831E-03	2.9831E-03	75.22	0.2863
43	1	32	18.00	10.47	10.47	6.3992E-04	6.3992E-04	229.9	0.3890

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	16	33	18.00	10.46	10.46	1.1292E-03	1.1292E-03	229.9	0.3890
45	30	35	12.00	10.52	10.52	1.3056E-03	1.3056E-03	75.22	0.2863
46	33	53	18.00	10.46	10.46	1.9131E-03	1.9131E-03	229.9	0.3890
47	35	31	12.00	10.52	10.52	2.1172E-03	2.1172E-03	75.22	0.2863
48	34	42	20.00	10.46	10.46	1.5249E-03	1.5249E-03	317.2	0.4347
53	24	23	14.00	10.51	10.50	6.8760E-04	6.8760E-04	164.1	0.4590
54	43	6	14.00	10.46	10.46	3.3951E-04	3.3951E-04	43.76	0.1224
55	55	44	24.00	10.55	10.55	6.3601E-03	6.3601E-03	851.6	0.8105
56	7	55	24.00	10.55	10.55	1.9073E-06	0.000	56.08	5.3374E-02
57	45	21	20.00	10.53	10.52	1.1505E-02	1.1505E-02	1091.	1.495
58	63	47	20.00	10.47	10.47	1.6975E-04	1.6975E-04	78.11	0.1070
59	46	25	14.00	10.49	10.49	1.4305E-03	1.4305E-03	55.33	0.1548
60	73	40	24.00	10.55	10.55	1.7118E-03	1.7118E-03	739.4	0.7037
61	20	25	14.00	10.49	10.49	5.4073E-04	5.4073E-04	38.19	0.1068
62	51	50	20.00	10.47	10.47	1.7023E-03	1.7023E-03	258.5	0.3543
64	48	3	16.00	10.47	10.47	2.2755E-03	2.2755E-03	149.7	0.3206
66	57	54	20.00	10.46	10.46	2.3355E-03	2.3355E-03	317.2	0.4347
67	40	45	20.00	10.55	10.53	1.6615E-02	1.6615E-02	739.4	1.013
68	19	59	14.00	10.50	10.50	2.7475E-03	2.7475E-03	221.4	0.6193
69	61	60	12.00	10.48	10.48	2.4986E-04	2.4986E-04	14.29	5.4400E-02
70	53	66	18.00	10.46	10.46	9.0981E-04	9.0981E-04	229.9	0.3890
71	58	71	20.00	10.51	10.50	1.6727E-03	1.6727E-03	738.0	1.011
72	60	9	20.00	10.48	10.48	1.7319E-03	1.7319E-03	788.5	1.081
73	22	62	20.00	10.51	10.50	6.3696E-03	6.3696E-03	642.0	0.8799
74	58	62	14.00	10.51	10.50	8.6784E-04	8.6784E-04	46.83	0.1310
75	68	49	20.00	10.53	10.53	1.3580E-03	1.3580E-03	499.8	0.6850
76	63	64	20.00	10.47	10.47	7.7915E-04	7.7915E-04	785.4	1.076
77	66	67	18.00	10.46	10.46	7.4959E-04	7.4959E-04	229.9	0.3890
78	44	68	20.00	10.55	10.53	1.5565E-02	1.5565E-02	851.6	1.167
79	41	24	14.00	10.51	10.51	9.5053E-03	9.5053E-03	164.1	0.4590
80	68	45	20.00	10.53	10.53	1.0490E-04	1.0490E-04	351.8	0.4821
81	21	41	20.00	10.52	10.51	3.1099E-03	3.1099E-03	949.0	1.301
82	71	19	14.00	10.50	10.50	1.5202E-03	1.5202E-03	57.32	0.1603
83	54	72	14.00	10.46	10.46	3.9005E-04	3.9005E-04	43.76	0.1224
84	54	6	20.00	10.46	10.46	1.2493E-03	1.2493E-03	273.4	0.3747
86	11	57	20.00	10.46	10.46	2.5244E-03	2.5244E-03	317.2	0.4347
89	65	77	20.00	10.47	10.47	2.3479E-03	2.3479E-03	317.2	0.4347
91	51	79	20.00	10.47	10.47	7.3719E-04	7.3719E-04	167.5	0.2295
94	64	82	20.00	10.47	10.45	1.7198E-02	1.7198E-02	1044.	1.431
95	82	83	20.00	10.45	10.41	3.7918E-02	3.7918E-02	1591.	2.180
96	84	34	20.00	10.46	10.46	2.3556E-04	2.3556E-04	317.2	0.4347

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	795.5	0.000	10.55	10.55	10.17	9.4354E-02	2.3316E+05	100.0
2	795.5	0.000	10.55	10.55	10.17	9.4354E-02	2.3316E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	795.5	0.0000
69	0.000	*	795.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
83	10.41	1591.	*	493.06

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

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RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 30 Pool Fire scenario in rerun bullet Fire Scenario Area – Case A

30.A PIPENET schematic layout with piping and nodes label
30.B PIPENET schematic layout with flow rate and pressure results
30.C PIPENET schematic layout with velocity results
30.D PIPENET input/output printout report

Attachment 30.A contains 1 page
Attachment 30.B contains 1 page
Attachment 30.C contains 1 page
Attachment 30.D contains 21 pages

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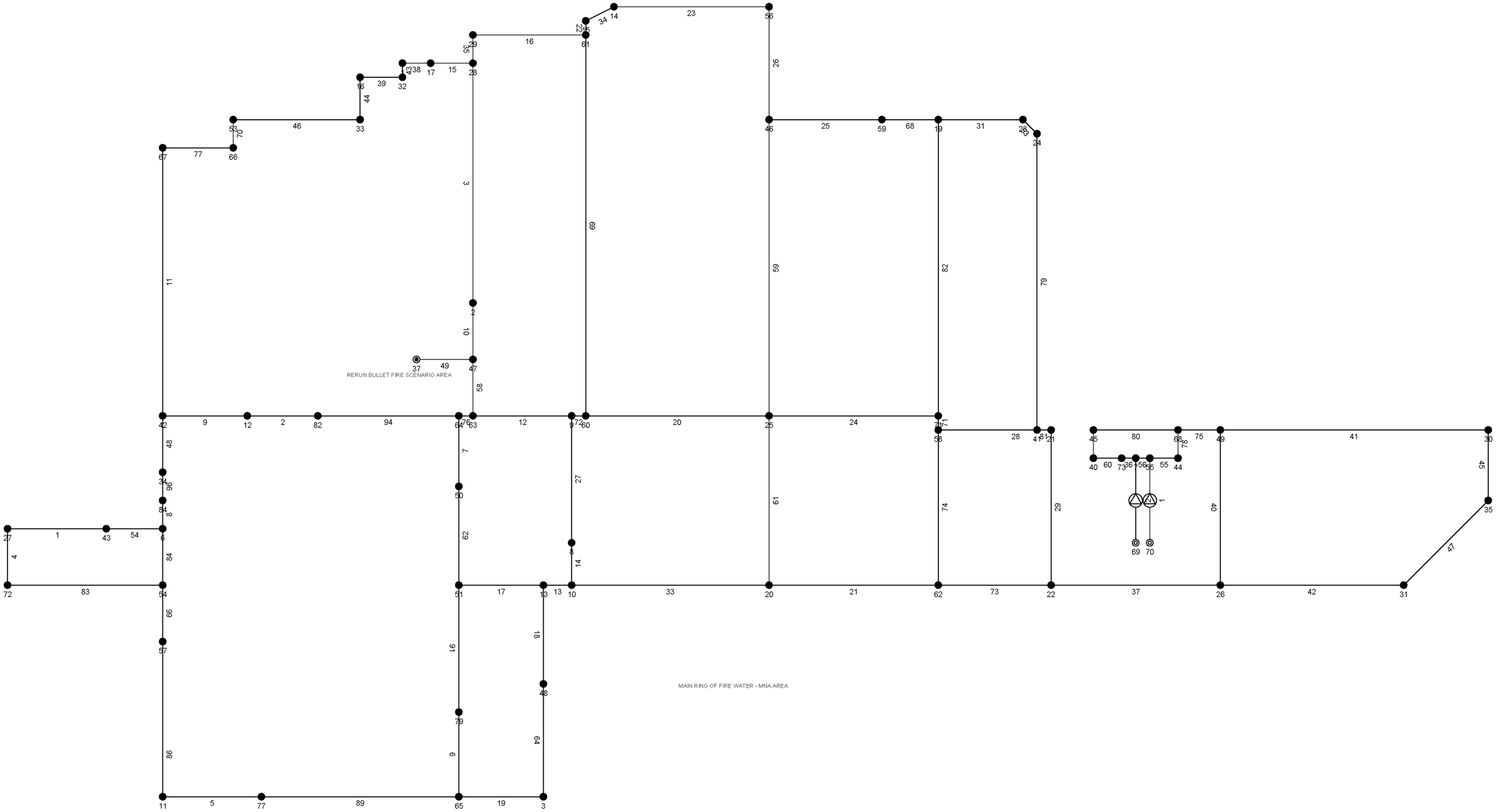
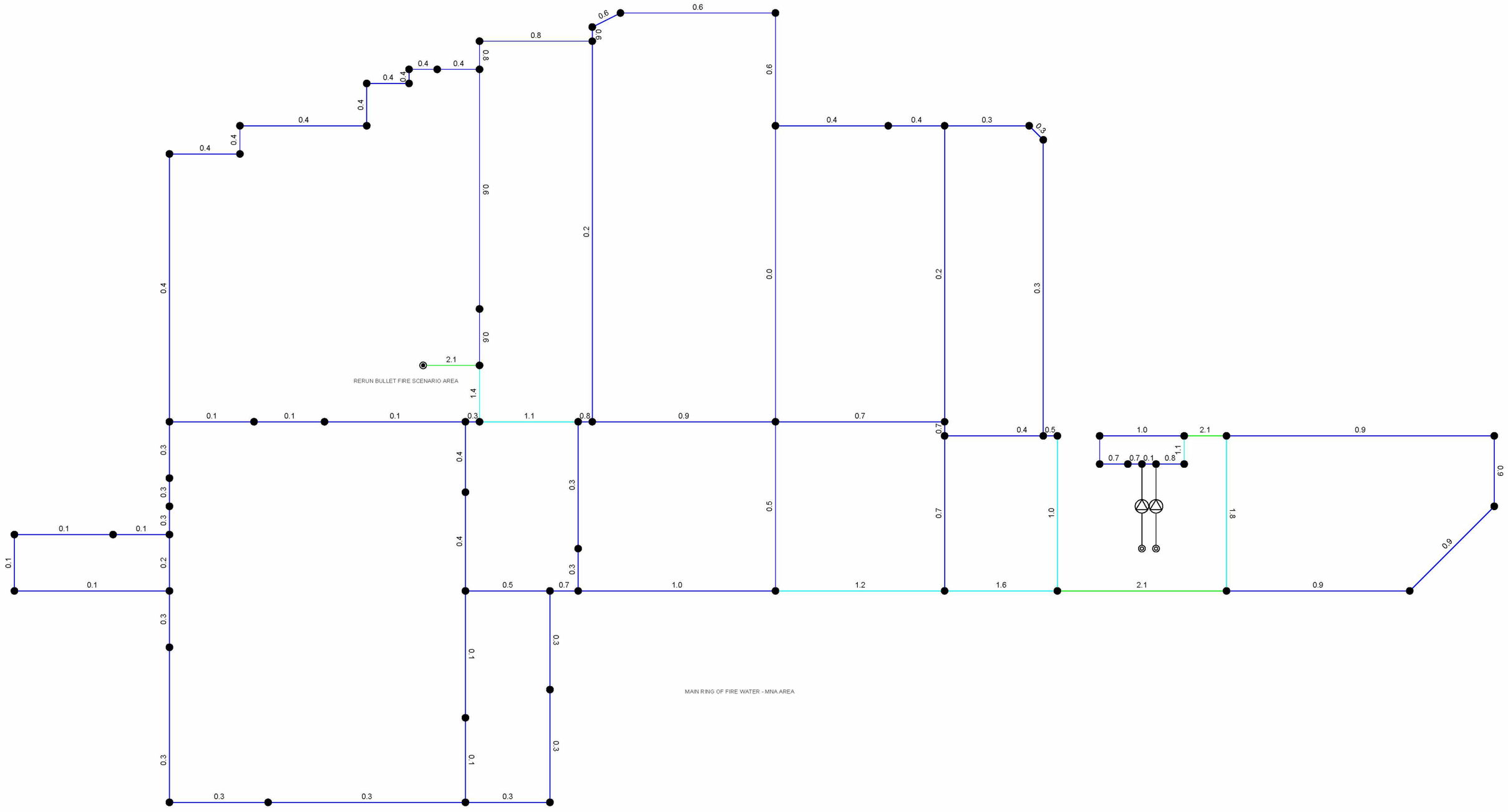


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

RERUN BULLET FIRE SCENARIO AREA

MAIN RING OF FIRE WATER - MNA AREA

Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:35 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
49	47	37	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
49	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	25.5244	9	14.0000	14.0000	*
2	82	12	71.1483	9	20.0000	20.0000	*
3	28	2	470.5614	9	20.0000	20.0000	*
4	72	27	25.5244	9	14.0000	14.0000	*
5	77	11	185.8310	9	20.0000	20.0000	*
6	79	65	64.8917	9	20.0000	20.0000	*
7	50	64	313.2831	9	20.0000	20.0000	*
8	6	84	185.8310	9	20.0000	20.0000	*
9	12	42	71.1483	9	20.0000	20.0000	*
10	2	47	470.5614	9	20.0000	20.0000	*
11	42	67	256.9793	9	18.0000	18.0000	*
12	9	63	813.3074	9	20.0000	20.0000	*
13	10	13	499.1141	9	20.0000	20.0000	*
14	10	8	209.4985	9	20.0000	20.0000	*
15	17	28	256.9793	9	18.0000	18.0000	*
16	61	29	213.5821	9	12.0000	12.0000	*
17	13	51	378.1748	9	20.0000	20.0000	*
18	13	48	120.9392	9	16.0000	16.0000	*
19	3	65	120.9392	9	16.0000	16.0000	*
20	25	60	661.3354	9	20.0000	20.0000	*
21	62	20	896.4714	9	20.0000	20.0000	*
22	15	61	156.0556	9	12.0000	12.0000	*
23	56	14	156.0556	9	12.0000	12.0000	*
24	71	25	477.8916	9	20.0000	20.0000	*
25	59	46	151.6404	9	14.0000	14.0000	*
26	46	56	156.0556	9	12.0000	12.0000	*
27	8	9	209.4985	9	20.0000	20.0000	*
28	41	58	274.7792	9	20.0000	20.0000	*
29	22	21	364.2529	9	14.0000	14.0000	*
31	23	19	89.4737	9	14.0000	14.0000	*
33	20	10	708.6125	9	20.0000	20.0000	*
34	14	15	156.0556	9	12.0000	12.0000	*
35	29	28	213.5821	9	12.0000	12.0000	*
36	7	73	704.4977	9	24.0000	24.0000	*
37	26	22	1526.0035	9	20.0000	20.0000	*
38	1	17	256.9793	9	18.0000	18.0000	*
39	16	32	256.9793	9	18.0000	18.0000	*
40	49	26	1296.0037	9	20.0000	20.0000	*
41	49	30	229.9998	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	229.9998	9	12.0000	12.0000	*
43	32	1	256.9793	9	18.0000	18.0000	*
44	33	16	256.9793	9	18.0000	18.0000	*
45	30	35	229.9998	9	12.0000	12.0000	*
46	53	33	256.9793	9	18.0000	18.0000	*
47	35	31	229.9998	9	12.0000	12.0000	*
48	34	42	185.8310	9	20.0000	20.0000	*
49	47	37	1526.0035	9	20.0000	20.0000	*
53	24	23	89.4737	9	14.0000	14.0000	*
54	43	6	25.5244	9	14.0000	14.0000	*
55	55	44	821.5059	9	24.0000	24.0000	*
56	7	55	58.5027	9	24.0000	24.0000	*
58	63	47	1055.4421	9	20.0000	20.0000	*
59	25	46	4.4152	9	14.0000	14.0000	*
60	73	40	704.4977	9	24.0000	24.0000	*
61	20	25	187.8589	9	14.0000	14.0000	*
62	51	50	313.2831	9	20.0000	20.0000	*
64	48	3	120.9392	9	16.0000	16.0000	*
66	57	54	185.8310	9	20.0000	20.0000	*
67	40	45	704.4977	9	20.0000	20.0000	*
68	19	59	151.6404	9	14.0000	14.0000	*
69	60	61	57.5265	9	12.0000	12.0000	*
70	66	53	256.9793	9	18.0000	18.0000	*
71	58	71	540.0583	9	20.0000	20.0000	*
72	60	9	603.8088	9	20.0000	20.0000	*
73	22	62	1161.7505	9	20.0000	20.0000	*
74	62	58	265.2791	9	14.0000	14.0000	*
75	68	49	1526.0035	9	20.0000	20.0000	*
76	64	63	242.1348	9	20.0000	20.0000	*
77	67	66	256.9793	9	18.0000	18.0000	*
78	44	68	821.5058	9	20.0000	20.0000	*
79	41	24	89.4737	9	14.0000	14.0000	*
80	45	68	704.4977	9	20.0000	20.0000	*
81	21	41	364.2530	9	20.0000	20.0000	*
82	71	19	62.1667	9	14.0000	14.0000	*
83	54	72	25.5244	9	14.0000	14.0000	*
84	54	6	160.3066	9	20.0000	20.0000	*
86	11	57	185.8310	9	20.0000	20.0000	*
89	65	77	185.8310	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	64.8917	9	20.0000	20.0000	*
94	64	82	71.1483	9	20.0000	20.0000	*
96	84	34	185.8310	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.39	10.39	6.7711E-05	6.7711E-05	25.52	7.1390E-02
2	82	12	20.00	10.39	10.39	5.5313E-05	5.5313E-05	71.15	9.7509E-02
3	28	2	20.00	10.38	10.37	4.9725E-03	4.9725E-03	470.6	0.6449
4	72	27	14.00	10.39	10.39	1.2493E-04	1.2493E-04	25.52	7.1390E-02
5	77	11	20.00	10.40	10.40	8.4496E-04	8.4496E-04	185.8	0.2547
6	79	65	20.00	10.40	10.40	7.8201E-05	7.8201E-05	64.89	8.8934E-02
7	50	64	20.00	10.39	10.39	2.4500E-03	2.4500E-03	313.3	0.4294
8	6	84	20.00	10.39	10.39	3.0518E-04	3.0518E-04	185.8	0.2547
9	12	42	20.00	10.39	10.39	8.4877E-05	8.4877E-05	71.15	9.7509E-02
10	2	47	20.00	10.37	10.37	1.8806E-03	1.8806E-03	470.6	0.6449
11	42	67	18.00	10.39	10.39	4.3325E-03	4.3325E-03	257.0	0.4348
12	9	63	20.00	10.40	10.39	6.8502E-03	6.8502E-03	813.3	1.115
13	10	13	20.00	10.40	10.40	6.7711E-04	6.7711E-04	499.1	0.6840
14	10	8	20.00	10.40	10.40	5.9986E-04	5.9986E-04	209.5	0.2871
15	17	28	18.00	10.38	10.38	7.6008E-04	7.6008E-04	257.0	0.4348
16	61	29	12.00	10.40	10.39	1.0904E-02	1.0904E-02	213.6	0.8131
17	13	51	20.00	10.40	10.40	3.5906E-03	3.5906E-03	378.2	0.5183
18	13	48	16.00	10.40	10.40	1.1206E-03	1.1206E-03	120.9	0.2590
19	3	65	16.00	10.40	10.40	1.1482E-03	1.1482E-03	120.9	0.2590
20	25	60	20.00	10.41	10.40	1.1847E-02	1.1847E-02	661.3	0.9064
21	62	20	20.00	10.44	10.42	1.7802E-02	1.7802E-02	896.5	1.229
22	15	61	12.00	10.40	10.40	1.0405E-03	1.0405E-03	156.1	0.5941
23	56	14	12.00	10.41	10.40	9.1848E-03	9.1848E-03	156.1	0.5941
24	71	25	20.00	10.42	10.41	5.5599E-03	5.5599E-03	477.9	0.6550
25	59	46	14.00	10.41	10.41	2.4576E-03	2.4576E-03	151.6	0.4241
26	46	56	12.00	10.41	10.41	3.2625E-03	3.2625E-03	156.1	0.5941
27	8	9	20.00	10.40	10.40	1.7872E-03	1.7872E-03	209.5	0.2871
28	41	58	20.00	10.42	10.42	1.3227E-03	1.3227E-03	274.8	0.3766
29	22	21	14.00	10.46	10.42	3.8785E-02	3.8785E-02	364.3	1.019
31	23	19	14.00	10.42	10.42	7.1812E-04	7.1812E-04	89.47	0.2503
33	20	10	20.00	10.42	10.40	2.0793E-02	2.0793E-02	708.6	0.9712
34	14	15	12.00	10.40	10.40	1.6098E-03	1.6098E-03	156.1	0.5941
35	29	28	12.00	10.39	10.38	7.8926E-03	7.8926E-03	213.6	0.8131
36	7	73	24.00	10.62	10.62	3.3875E-03	3.3875E-03	704.5	0.6705
37	26	22	20.00	10.51	10.46	5.1371E-02	5.1371E-02	1526.	2.091
38	1	17	18.00	10.38	10.38	1.2798E-03	1.2798E-03	257.0	0.4348
39	16	32	18.00	10.38	10.38	1.0805E-03	1.0805E-03	257.0	0.4348
40	49	26	20.00	10.59	10.51	8.3150E-02	8.3150E-02	1296.	1.776
41	49	30	12.00	10.59	10.56	3.2693E-02	3.2693E-02	230.0	0.8756
42	31	26	12.00	10.53	10.51	2.3485E-02	2.3485E-02	230.0	0.8756
43	32	1	18.00	10.38	10.38	7.8201E-04	7.8201E-04	257.0	0.4348

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	10.38	10.38	1.3771E-03	1.3771E-03	257.0	0.4348
45	30	35	12.00	10.56	10.55	1.0284E-02	1.0284E-02	230.0	0.8756
46	53	33	18.00	10.39	10.38	2.3375E-03	2.3375E-03	257.0	0.4348
47	35	31	12.00	10.55	10.53	1.6687E-02	1.6687E-02	230.0	0.8756
48	34	42	20.00	10.39	10.39	5.6458E-04	5.6458E-04	185.8	0.2547
49	47	37	20.00	10.37	10.34	3.5100E-02	3.5100E-02	1526.	2.091
53	24	23	14.00	10.42	10.42	2.2221E-04	2.2221E-04	89.47	0.2503
54	43	6	14.00	10.39	10.39	1.2493E-04	1.2493E-04	25.52	7.1390E-02
55	55	44	24.00	10.62	10.62	5.9519E-03	5.9519E-03	821.5	0.7819
56	7	55	24.00	10.62	10.62	5.7220E-06	0.000	58.50	5.5679E-02
58	63	47	20.00	10.39	10.37	2.1003E-02	2.1003E-02	1055.	1.446
59	25	46	14.00	10.41	10.41	1.2398E-05	1.2398E-05	4.415	1.2349E-02
60	73	40	24.00	10.62	10.62	1.5650E-03	1.5650E-03	704.5	0.6705
61	20	25	14.00	10.42	10.41	1.0273E-02	1.0273E-02	187.9	0.5254
62	51	50	20.00	10.40	10.39	2.4319E-03	2.4319E-03	313.3	0.4294
64	48	3	16.00	10.40	10.40	1.5268E-03	1.5268E-03	120.9	0.2590
66	57	54	20.00	10.39	10.39	8.6498E-04	8.6498E-04	185.8	0.2547
67	40	45	20.00	10.62	10.60	1.5188E-02	1.5188E-02	704.5	0.9655
68	19	59	14.00	10.42	10.41	1.3571E-03	1.3571E-03	151.6	0.4241
69	60	61	12.00	10.40	10.40	3.2625E-03	3.2625E-03	57.53	0.2190
70	66	53	18.00	10.39	10.39	1.1148E-03	1.1148E-03	257.0	0.4348
71	58	71	20.00	10.42	10.42	9.4032E-04	9.4032E-04	540.1	0.7402
72	60	9	20.00	10.40	10.40	1.0595E-03	1.0595E-03	603.8	0.8275
73	22	62	20.00	10.46	10.44	1.9062E-02	1.9062E-02	1162.	1.592
74	62	58	14.00	10.44	10.42	2.1575E-02	2.1575E-02	265.3	0.7420
75	68	49	20.00	10.60	10.59	1.0702E-02	1.0702E-02	1526.	2.091
76	64	63	20.00	10.39	10.39	8.7738E-05	8.7738E-05	242.1	0.3318
77	67	66	18.00	10.39	10.39	9.1553E-04	9.1553E-04	257.0	0.4348
78	44	68	20.00	10.62	10.60	1.4565E-02	1.4565E-02	821.5	1.126
79	41	24	14.00	10.42	10.42	3.0804E-03	3.0804E-03	89.47	0.2503
80	45	68	20.00	10.60	10.60	3.8242E-04	3.8242E-04	704.5	0.9655
81	21	41	20.00	10.42	10.42	5.2929E-04	5.2929E-04	364.3	0.4992
82	71	19	14.00	10.42	10.42	1.7576E-03	1.7576E-03	62.17	0.1739
83	54	72	14.00	10.39	10.39	1.4496E-04	1.4496E-04	25.52	7.1390E-02
84	54	6	20.00	10.39	10.39	4.6253E-04	4.6253E-04	160.3	0.2197
86	11	57	20.00	10.40	10.39	9.3460E-04	9.3460E-04	185.8	0.2547
89	65	77	20.00	10.40	10.40	8.6975E-04	8.6975E-04	185.8	0.2547
91	51	79	20.00	10.40	10.40	1.2684E-04	1.2684E-04	64.89	8.8934E-02
94	64	82	20.00	10.39	10.39	1.1730E-04	1.1730E-04	71.15	9.7509E-02
96	84	34	20.00	10.39	10.39	8.7738E-05	8.7738E-05	185.8	0.2547

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	763.0	0.000	10.62	10.62	10.17	9.3702E-02	2.2519E+05	100.0
2	763.0	0.000	10.62	10.62	10.17	9.3702E-02	2.2519E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	763.0	0.0000
69	0.000	*	763.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
37	10.34	1526.	*	474.65

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 31 Pool Fire scenario in rerun bullet Fire Scenario Area – Case B

31.A PIPENET schematic layout with piping and nodes label

31.B PIPENET schematic layout with flow rate and pressure results

31.C PIPENET schematic layout with velocity results

31.D PIPENET input/output printout report

Attachment 31.A contains 1 page
Attachment 31.B contains 1 page
Attachment 31.C contains 1 page
Attachment 31.D contains 21 pages

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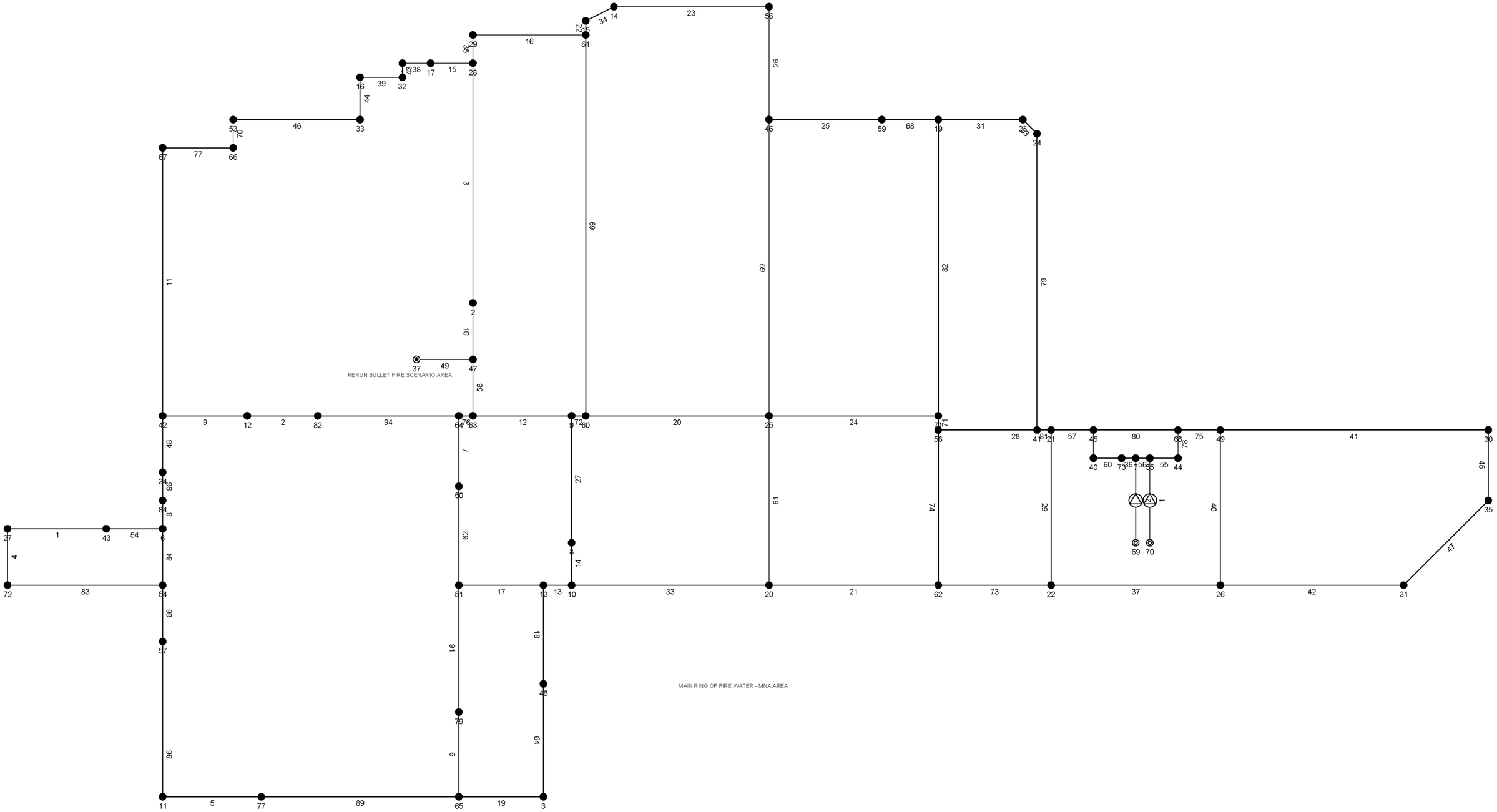
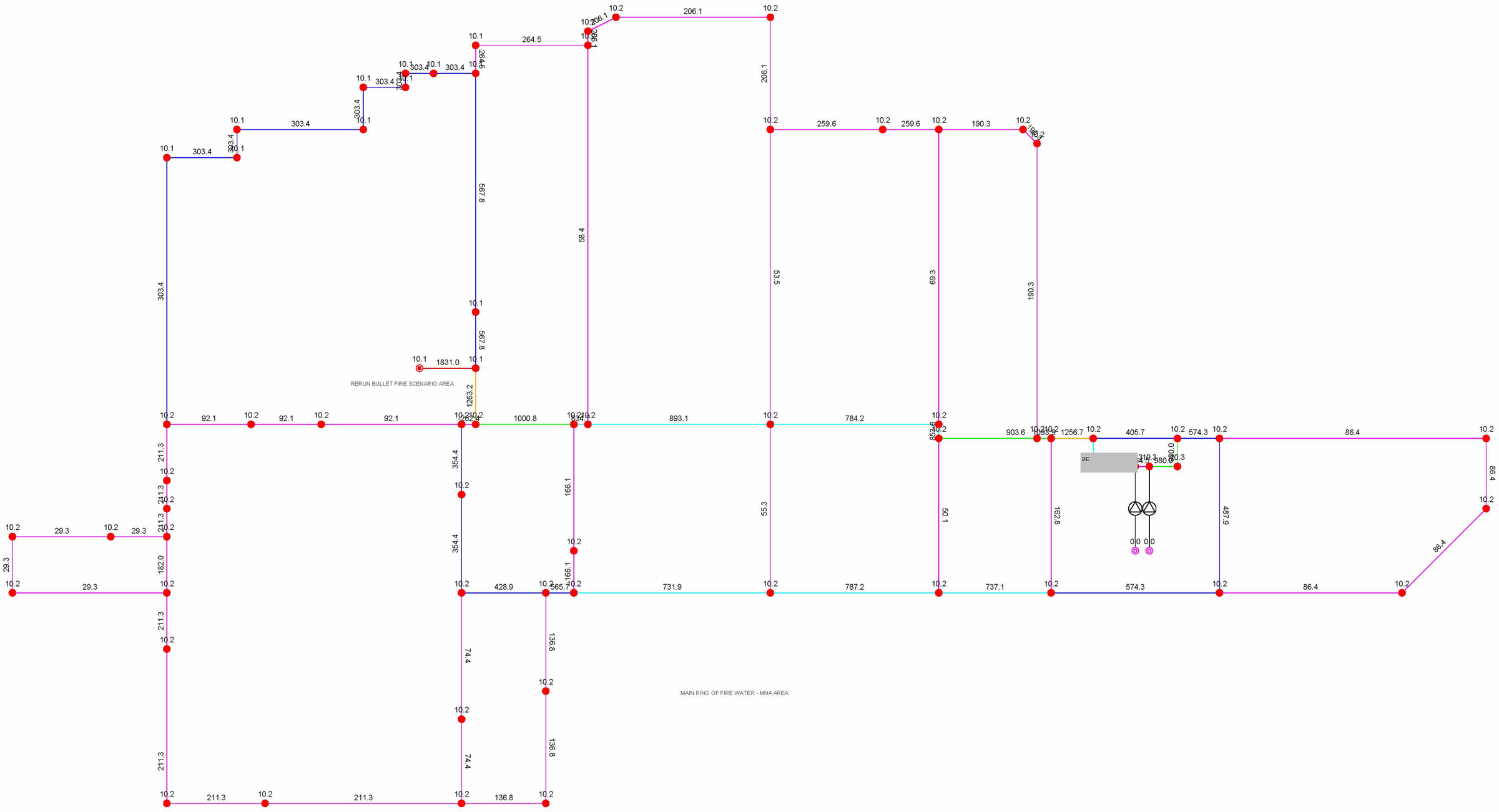
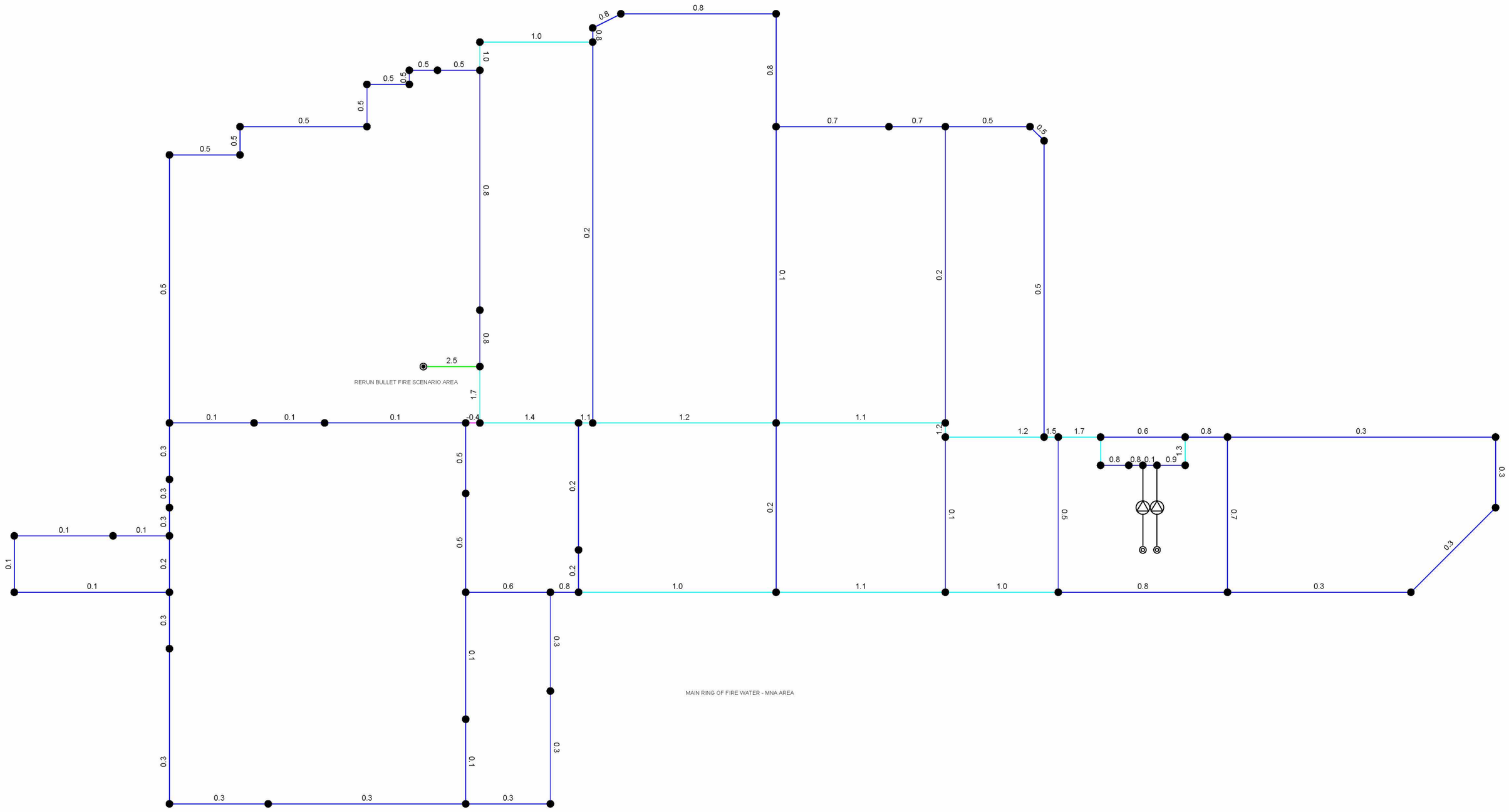


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

09:41 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	28	2	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	2	47	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	61	29	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	15	61	12.00	5.000	0.000	150.0	5.987
23	56	14	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	59	46	14.00	58.00	0.000	150.0	0.000
26	46	56	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	14	15	12.00	11.00	0.000	150.0	5.987
35	29	28	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
49	47	37	20.00	20.00	0.000	150.0	45.60
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	46	25	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	58	62	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
49	1 x 4	45.60		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
82	2 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	29.2564	9	14.0000	14.0000	*
2	82	12	92.0809	9	20.0000	20.0000	*
3	28	2	567.8363	9	20.0000	20.0000	*
4	72	27	29.2564	9	14.0000	14.0000	*
5	77	11	211.2937	9	20.0000	20.0000	*
6	79	65	74.4434	9	20.0000	20.0000	*
7	50	64	354.4323	9	20.0000	20.0000	*
8	6	84	211.2937	9	20.0000	20.0000	*
9	12	42	92.0809	9	20.0000	20.0000	*
10	2	47	567.8363	9	20.0000	20.0000	*
11	42	67	303.3747	9	18.0000	18.0000	*
12	9	63	1000.8166	9	20.0000	20.0000	*
13	10	13	565.7260	9	20.0000	20.0000	*
14	10	8	166.1465	9	20.0000	20.0000	*
15	17	28	303.3747	9	18.0000	18.0000	*
16	61	29	264.4617	9	12.0000	12.0000	*
17	13	51	428.8757	9	20.0000	20.0000	*
18	13	48	136.8503	9	16.0000	16.0000	*
19	3	65	136.8503	9	16.0000	16.0000	*
20	25	60	893.0534	9	20.0000	20.0000	*
21	62	20	787.1839	9	20.0000	20.0000	*
22	15	61	206.0783	9	12.0000	12.0000	*
23	56	14	206.0783	9	12.0000	12.0000	*
24	71	25	784.2173	9	20.0000	20.0000	*
25	59	46	259.6031	9	14.0000	14.0000	*
26	46	56	206.0783	9	12.0000	12.0000	*
27	8	9	166.1465	9	20.0000	20.0000	*
28	41	58	903.6347	9	20.0000	20.0000	*
29	21	22	162.8043	9	14.0000	14.0000	*
31	23	19	190.2534	9	14.0000	14.0000	*
33	20	10	731.8725	9	20.0000	20.0000	*
34	14	15	206.0783	9	12.0000	12.0000	*
35	29	28	264.4617	9	12.0000	12.0000	*
36	7	73	850.9656	9	24.0000	24.0000	*
37	26	22	574.3118	9	20.0000	20.0000	*
38	1	17	303.3747	9	18.0000	18.0000	*
39	16	32	303.3747	9	18.0000	18.0000	*
40	49	26	487.8681	9	20.0000	20.0000	*
41	49	30	86.4437	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	86.4437	9	12.0000	12.0000	*
43	32	1	303.3747	9	18.0000	18.0000	*
44	33	16	303.3747	9	18.0000	18.0000	*
45	30	35	86.4437	9	12.0000	12.0000	*
46	53	33	303.3747	9	18.0000	18.0000	*
47	35	31	86.4437	9	12.0000	12.0000	*
48	34	42	211.2937	9	20.0000	20.0000	*
49	47	37	1831.0044	9	20.0000	20.0000	*
53	24	23	190.2534	9	14.0000	14.0000	*
54	43	6	29.2564	9	14.0000	14.0000	*
55	55	44	980.0387	9	24.0000	24.0000	*
56	7	55	64.5355	9	24.0000	24.0000	*
57	45	21	1256.6926	9	20.0000	20.0000	*
58	63	47	1263.1680	9	20.0000	20.0000	*
59	46	25	53.5248	9	14.0000	14.0000	*
60	73	40	850.9656	9	24.0000	24.0000	*
61	20	25	55.3114	9	14.0000	14.0000	*
62	51	50	354.4323	9	20.0000	20.0000	*
64	48	3	136.8503	9	16.0000	16.0000	*
66	57	54	211.2937	9	20.0000	20.0000	*
67	40	45	850.9656	9	20.0000	20.0000	*
68	19	59	259.6031	9	14.0000	14.0000	*
69	60	61	58.3833	9	12.0000	12.0000	*
70	66	53	303.3747	9	18.0000	18.0000	*
71	58	71	853.5670	9	20.0000	20.0000	*
72	60	9	834.6701	9	20.0000	20.0000	*
73	22	62	737.1161	9	20.0000	20.0000	*
74	58	62	50.0678	9	14.0000	14.0000	*
75	68	49	574.3118	9	20.0000	20.0000	*
76	63	64	-262.3513	9	20.0000	20.0000	*
77	67	66	303.3747	9	18.0000	18.0000	*
78	44	68	980.0387	9	20.0000	20.0000	*
79	41	24	190.2534	9	14.0000	14.0000	*
80	68	45	405.7269	9	20.0000	20.0000	*
81	21	41	1093.8882	9	20.0000	20.0000	*
82	71	19	69.3496	9	14.0000	14.0000	*
83	54	72	29.2564	9	14.0000	14.0000	*
84	54	6	182.0373	9	20.0000	20.0000	*
86	11	57	211.2937	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	211.2937	9	20.0000	20.0000	*
91	51	79	74.4434	9	20.0000	20.0000	*
94	64	82	92.0809	9	20.0000	20.0000	*
96	84	34	211.2937	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.15	10.15	8.4877E-05	8.4877E-05	29.26	8.1828E-02
2	82	12	20.00	10.15	10.15	8.9645E-05	8.9645E-05	92.08	0.1262
3	28	2	20.00	10.13	10.12	7.0801E-03	7.0801E-03	567.8	0.7782
4	72	27	14.00	10.15	10.15	1.6022E-04	1.6022E-04	29.26	8.1828E-02
5	77	11	20.00	10.16	10.15	1.0729E-03	1.0729E-03	211.3	0.2896
6	79	65	20.00	10.16	10.16	1.0014E-04	1.0014E-04	74.44	0.1020
7	50	64	20.00	10.15	10.15	3.0699E-03	3.0699E-03	354.4	0.4857
8	6	84	20.00	10.15	10.15	3.8719E-04	3.8719E-04	211.3	0.2896
9	12	42	20.00	10.15	10.15	1.3733E-04	1.3733E-04	92.08	0.1262
10	2	47	20.00	10.12	10.12	2.6779E-03	2.6779E-03	567.8	0.7782
11	42	67	18.00	10.15	10.14	5.9309E-03	5.9309E-03	303.4	0.5133
12	9	63	20.00	10.16	10.15	1.0045E-02	1.0045E-02	1001.	1.372
13	10	13	20.00	10.16	10.16	8.5258E-04	8.5258E-04	565.7	0.7753
14	10	8	20.00	10.16	10.16	3.9005E-04	3.9005E-04	166.1	0.2277
15	17	28	18.00	10.13	10.13	1.0395E-03	1.0395E-03	303.4	0.5133
16	61	29	12.00	10.16	10.14	1.6268E-02	1.6268E-02	264.5	1.007
17	13	51	20.00	10.16	10.16	4.5252E-03	4.5252E-03	428.9	0.5878
18	13	48	16.00	10.16	10.16	1.4153E-03	1.4153E-03	136.8	0.2931
19	3	65	16.00	10.16	10.16	1.4496E-03	1.4496E-03	136.8	0.2931
20	25	60	20.00	10.18	10.16	2.0632E-02	2.0632E-02	893.1	1.224
21	62	20	20.00	10.20	10.18	1.4003E-02	1.4003E-02	787.2	1.079
22	15	61	12.00	10.16	10.16	1.7500E-03	1.7500E-03	206.1	0.7845
23	56	14	12.00	10.18	10.16	1.5430E-02	1.5430E-02	206.1	0.7845
24	71	25	20.00	10.20	10.18	1.3873E-02	1.3873E-02	784.2	1.075
25	59	46	14.00	10.19	10.19	6.6776E-03	6.6776E-03	259.6	0.7261
26	46	56	12.00	10.19	10.18	5.4770E-03	5.4770E-03	206.1	0.7845
27	8	9	20.00	10.16	10.16	1.1654E-03	1.1654E-03	166.1	0.2277
28	41	58	20.00	10.21	10.20	1.1958E-02	1.1958E-02	903.6	1.238
29	21	22	14.00	10.22	10.21	8.7576E-03	8.7576E-03	162.8	0.4554
31	23	19	14.00	10.20	10.20	2.9097E-03	2.9097E-03	190.3	0.5321
33	20	10	20.00	10.18	10.16	2.2077E-02	2.2077E-02	731.9	1.003
34	14	15	12.00	10.16	10.16	2.6999E-03	2.6999E-03	206.1	0.7845
35	29	28	12.00	10.14	10.13	1.1772E-02	1.1772E-02	264.5	1.007
36	7	73	24.00	10.26	10.25	4.8075E-03	4.8075E-03	851.0	0.8099
37	26	22	20.00	10.22	10.21	8.4295E-03	8.4295E-03	574.3	0.7871
38	1	17	18.00	10.13	10.13	1.7500E-03	1.7500E-03	303.4	0.5133
39	16	32	18.00	10.14	10.14	1.4801E-03	1.4801E-03	303.4	0.5133
40	49	26	20.00	10.23	10.22	1.3648E-02	1.3648E-02	487.9	0.6686
41	49	30	12.00	10.23	10.22	5.3654E-03	5.3654E-03	86.44	0.3291
42	31	26	12.00	10.22	10.22	3.8548E-03	3.8548E-03	86.44	0.3291
43	32	1	18.00	10.14	10.13	1.0700E-03	1.0700E-03	303.4	0.5133

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	10.14	10.14	1.8854E-03	1.8854E-03	303.4	0.5133
45	30	35	12.00	10.22	10.22	1.6870E-03	1.6870E-03	86.44	0.3291
46	53	33	18.00	10.14	10.14	3.1977E-03	3.1977E-03	303.4	0.5133
47	35	31	12.00	10.22	10.22	2.7409E-03	2.7409E-03	86.44	0.3291
48	34	42	20.00	10.15	10.15	7.1907E-04	7.1907E-04	211.3	0.2896
49	47	37	20.00	10.12	10.07	4.9170E-02	4.9170E-02	1831.	2.509
53	24	23	14.00	10.20	10.20	9.0313E-04	9.0313E-04	190.3	0.5321
54	43	6	14.00	10.15	10.15	1.6022E-04	1.6022E-04	29.26	8.1828E-02
55	55	44	24.00	10.26	10.25	8.2483E-03	8.2483E-03	980.0	0.9327
56	7	55	24.00	10.26	10.26	6.6757E-06	0.000	64.54	6.1421E-02
57	45	21	20.00	10.23	10.22	1.4939E-02	1.4939E-02	1257.	1.722
58	63	47	20.00	10.15	10.12	2.9205E-02	2.9205E-02	1263.	1.731
59	46	25	14.00	10.19	10.18	1.3475E-03	1.3475E-03	53.52	0.1497
60	73	40	24.00	10.25	10.25	2.2192E-03	2.2192E-03	851.0	0.8099
61	20	25	14.00	10.18	10.18	1.0748E-03	1.0748E-03	55.31	0.1547
62	51	50	20.00	10.16	10.15	3.0499E-03	3.0499E-03	354.4	0.4857
64	48	3	16.00	10.16	10.16	1.9255E-03	1.9255E-03	136.8	0.2931
66	57	54	20.00	10.15	10.15	1.0996E-03	1.0996E-03	211.3	0.2896
67	40	45	20.00	10.25	10.23	2.1548E-02	2.1548E-02	851.0	1.166
68	19	59	14.00	10.20	10.19	3.6850E-03	3.6850E-03	259.6	0.7261
69	60	61	12.00	10.16	10.16	3.3779E-03	3.3779E-03	58.38	0.2223
70	66	53	18.00	10.14	10.14	1.5249E-03	1.5249E-03	303.4	0.5133
71	58	71	20.00	10.20	10.20	2.1868E-03	2.1868E-03	853.6	1.170
72	60	9	20.00	10.16	10.16	1.9255E-03	1.9255E-03	834.7	1.144
73	22	62	20.00	10.21	10.20	8.2254E-03	8.2254E-03	737.1	1.010
74	58	62	14.00	10.20	10.20	9.8228E-04	9.8228E-04	50.07	0.1400
75	68	49	20.00	10.23	10.23	1.7567E-03	1.7567E-03	574.3	0.7871
76	63	64	20.00	10.15	10.15	-1.0300E-04	1.0300E-04	-262.4	-0.3596
77	67	66	18.00	10.14	10.14	1.2493E-03	1.2493E-03	303.4	0.5133
78	44	68	20.00	10.25	10.23	2.0183E-02	2.0183E-02	980.0	1.343
79	41	24	14.00	10.21	10.20	1.2495E-02	1.2495E-02	190.3	0.5321
80	68	45	20.00	10.23	10.23	1.3733E-04	1.3733E-04	405.7	0.5560
81	21	41	20.00	10.22	10.21	4.0426E-03	4.0426E-03	1094.	1.499
82	71	19	14.00	10.20	10.20	2.1629E-03	2.1629E-03	69.35	0.1940
83	54	72	14.00	10.15	10.15	1.8501E-04	1.8501E-04	29.26	8.1828E-02
84	54	6	20.00	10.15	10.15	5.9032E-04	5.9032E-04	182.0	0.2495
86	11	57	20.00	10.15	10.15	1.1902E-03	1.1902E-03	211.3	0.2896
89	65	77	20.00	10.16	10.16	1.1072E-03	1.1072E-03	211.3	0.2896
91	51	79	20.00	10.16	10.16	1.6499E-04	1.6499E-04	74.44	0.1020
94	64	82	20.00	10.15	10.15	1.9550E-04	1.9550E-04	92.08	0.1262
96	84	34	20.00	10.15	10.15	1.1063E-04	1.1063E-04	211.3	0.2896

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	915.5	0.000	10.26	10.26	10.17	9.7041E-02	2.6090E+05	100.0
2	915.5	0.000	10.26	10.26	10.17	9.7041E-02	2.6090E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	915.5	0.0000
69	0.000	*	915.5	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
37	10.07	1831.	*	576.92

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 32 Fire scenario for PTU building sprinkler design – Case A
32.A PIPENET schematic layout with piping and nodes label
32.B PIPENET schematic layout with flow rate and pressure results
32.C PIPENET schematic layout with velocity results
32.D PIPENET input/output printout report

Attachment 32.A contains 1 page
Attachment 32.B contains 1 page
Attachment 32.C contains 1 page
Attachment 32.D contains 21 pages

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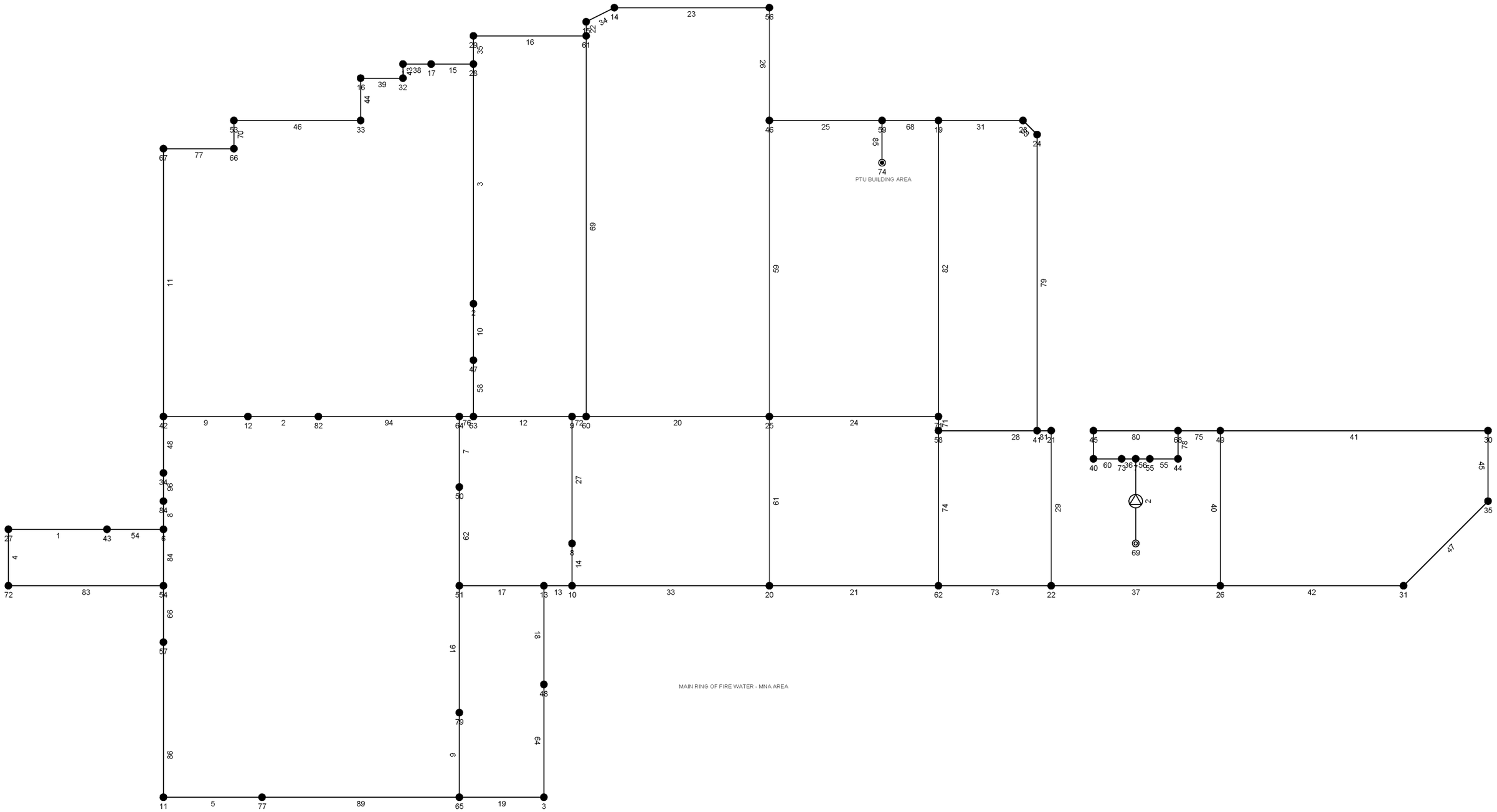
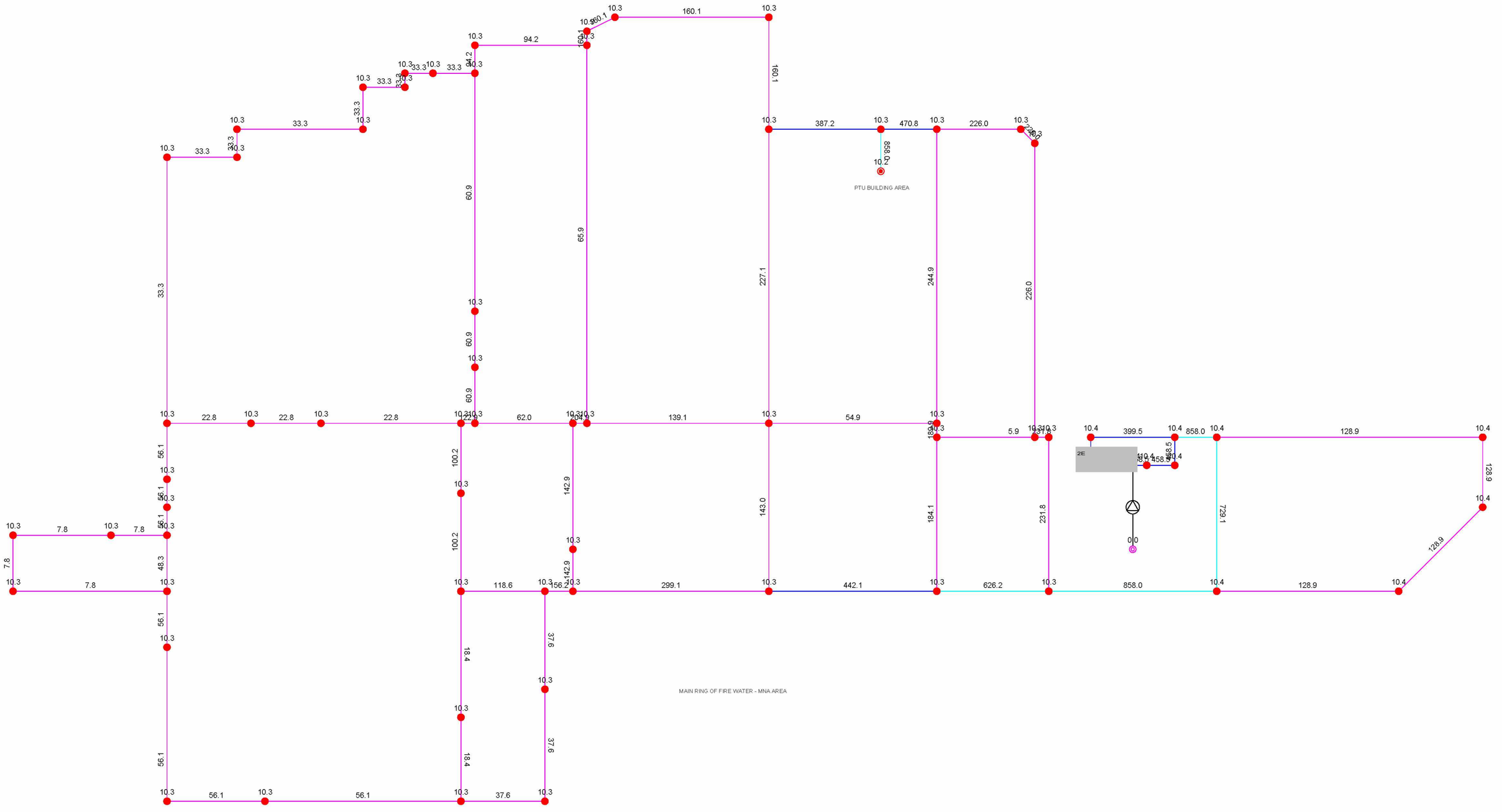
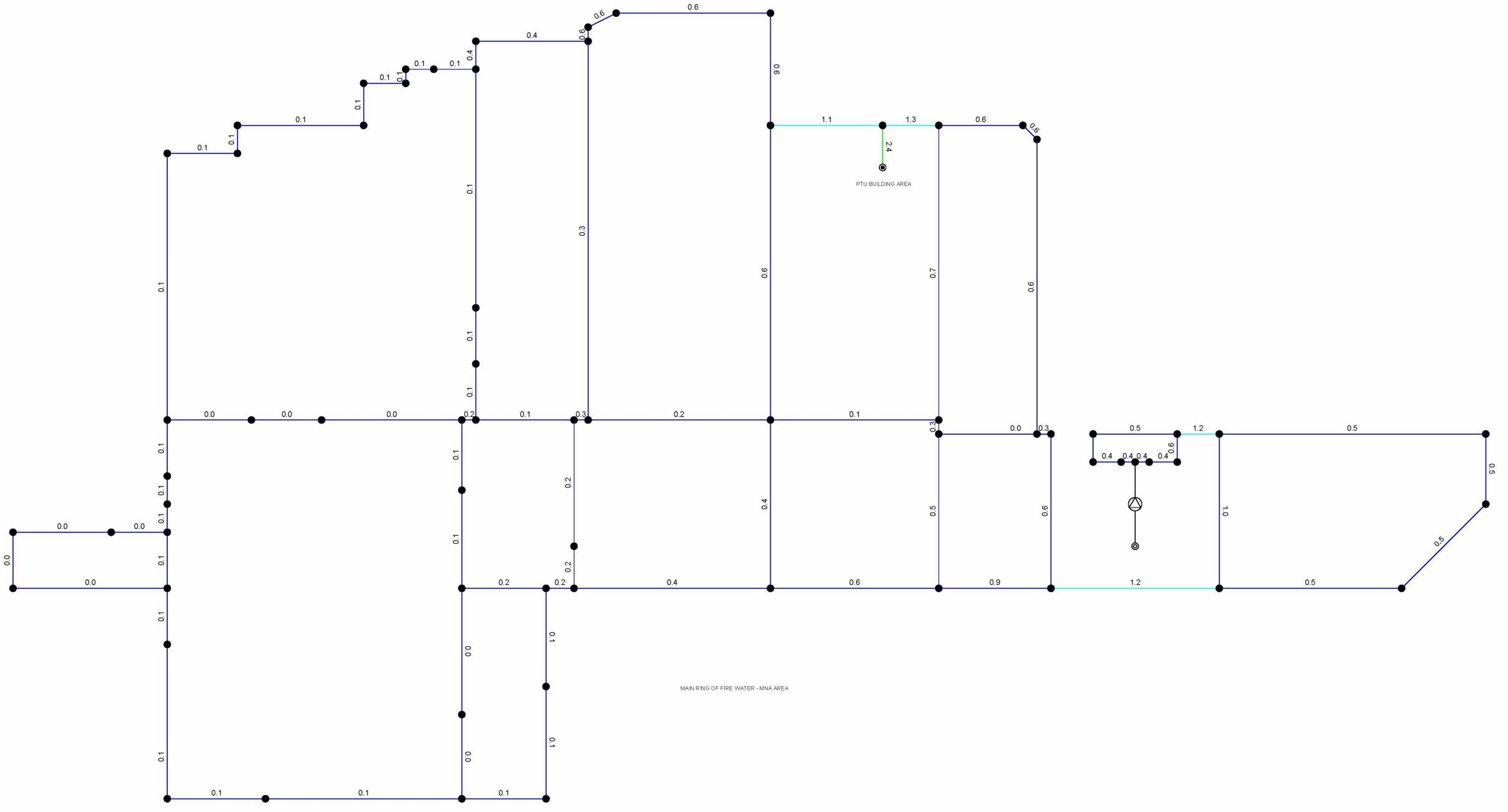


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

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10:02 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	63	9	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	29	61	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	60	25	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	61	15	12.00	5.000	0.000	150.0	5.987
23	14	56	12.00	97.00	0.000	150.0	0.000
24	25	71	20.00	89.00	0.000	150.0	0.000
25	46	59	14.00	58.00	0.000	150.0	0.000
26	56	46	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	15	14	12.00	11.00	0.000	150.0	5.987
35	28	29	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	9	60	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	45	68	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
85	59	74	14.00	20.00	0.000	150.0	30.86
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	82	64	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
85	1 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	7.7657	9	14.0000	14.0000	*
2	12	82	22.7558	9	20.0000	20.0000	*
3	2	28	60.9100	9	20.0000	20.0000	*
4	72	27	7.7657	9	14.0000	14.0000	*
5	77	11	56.0595	9	20.0000	20.0000	*
6	79	65	18.4262	9	20.0000	20.0000	*
7	50	64	100.1555	9	20.0000	20.0000	*
8	6	84	56.0595	9	20.0000	20.0000	*
9	42	12	22.7558	9	20.0000	20.0000	*
10	47	2	60.9100	9	20.0000	20.0000	*
11	42	67	33.3037	9	18.0000	18.0000	*
12	63	9	62.0013	9	20.0000	20.0000	*
13	10	13	156.2150	9	20.0000	20.0000	*
14	10	8	142.9231	9	20.0000	20.0000	*
15	17	28	33.3037	9	18.0000	18.0000	*
16	29	61	94.2137	9	12.0000	12.0000	*
17	13	51	118.5816	9	20.0000	20.0000	*
18	13	48	37.6333	9	16.0000	16.0000	*
19	3	65	37.6333	9	16.0000	16.0000	*
20	60	25	139.0698	9	20.0000	20.0000	*
21	62	20	442.0918	9	20.0000	20.0000	*
22	61	15	160.0682	9	12.0000	12.0000	*
23	14	56	160.0682	9	12.0000	12.0000	*
24	25	71	54.9341	9	20.0000	20.0000	*
25	46	59	387.1577	9	14.0000	14.0000	*
26	56	46	160.0682	9	12.0000	12.0000	*
27	8	9	142.9231	9	20.0000	20.0000	*
28	41	58	5.8501	9	20.0000	20.0000	*
29	22	21	231.8391	9	14.0000	14.0000	*
31	23	19	225.9890	9	14.0000	14.0000	*
33	20	10	299.1381	9	20.0000	20.0000	*
34	15	14	160.0682	9	12.0000	12.0000	*
35	28	29	94.2137	9	12.0000	12.0000	*
36	7	73	399.4843	9	24.0000	24.0000	*
37	26	22	858.0021	9	20.0000	20.0000	*
38	1	17	33.3037	9	18.0000	18.0000	*
39	16	32	33.3037	9	18.0000	18.0000	*
40	49	26	729.0568	9	20.0000	20.0000	*
41	49	30	128.9452	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	128.9452	9	12.0000	12.0000	*
43	32	1	33.3037	9	18.0000	18.0000	*
44	33	16	33.3037	9	18.0000	18.0000	*
45	30	35	128.9452	9	12.0000	12.0000	*
46	53	33	33.3037	9	18.0000	18.0000	*
47	35	31	128.9452	9	12.0000	12.0000	*
48	34	42	56.0595	9	20.0000	20.0000	*
53	24	23	225.9890	9	14.0000	14.0000	*
54	43	6	7.7657	9	14.0000	14.0000	*
55	55	44	458.5178	9	24.0000	24.0000	*
56	7	55	458.5178	9	24.0000	24.0000	*
58	63	47	60.9100	9	20.0000	20.0000	*
59	25	46	227.0894	9	14.0000	14.0000	*
60	73	40	399.4843	9	24.0000	24.0000	*
61	20	25	142.9538	9	14.0000	14.0000	*
62	51	50	100.1555	9	20.0000	20.0000	*
64	48	3	37.6333	9	16.0000	16.0000	*
66	57	54	56.0595	9	20.0000	20.0000	*
67	40	45	399.4843	9	20.0000	20.0000	*
68	19	59	470.8442	9	14.0000	14.0000	*
69	60	61	65.8546	9	12.0000	12.0000	*
70	66	53	33.3037	9	18.0000	18.0000	*
71	58	71	189.9212	9	20.0000	20.0000	*
72	9	60	204.9244	9	20.0000	20.0000	*
73	22	62	626.1629	9	20.0000	20.0000	*
74	62	58	184.0711	9	14.0000	14.0000	*
75	68	49	858.0021	9	20.0000	20.0000	*
76	64	63	122.9113	9	20.0000	20.0000	*
77	67	66	33.3037	9	18.0000	18.0000	*
78	44	68	458.5178	9	20.0000	20.0000	*
79	41	24	225.9890	9	14.0000	14.0000	*
80	45	68	399.4843	9	20.0000	20.0000	*
81	21	41	231.8391	9	20.0000	20.0000	*
82	71	19	244.8553	9	14.0000	14.0000	*
83	54	72	7.7657	9	14.0000	14.0000	*
84	54	6	48.2938	9	20.0000	20.0000	*
85	59	74	858.0020	9	14.0000	14.0000	*
86	11	57	56.0595	9	20.0000	20.0000	*
89	65	77	56.0595	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
91	51	79	18.4262	9	20.0000	20.0000	*
94	82	64	22.7558	9	20.0000	20.0000	*
96	84	34	56.0595	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	10.33	10.33	7.6294E-06	0.000	7.766	2.1720E-02
2	12	82	20.00	10.33	10.33	4.7684E-06	0.000	22.76	3.1187E-02
3	2	28	20.00	10.33	10.33	1.1539E-04	1.1539E-04	60.91	8.3477E-02
4	72	27	14.00	10.33	10.33	1.2398E-05	1.2398E-05	7.766	2.1720E-02
5	77	11	20.00	10.33	10.33	8.9645E-05	8.9645E-05	56.06	7.6830E-02
6	79	65	20.00	10.33	10.33	7.6294E-06	0.000	18.43	2.5253E-02
7	50	64	20.00	10.33	10.33	2.9755E-04	2.9755E-04	100.2	0.1373
8	6	84	20.00	10.33	10.33	3.2425E-05	3.2425E-05	56.06	7.6830E-02
9	42	12	20.00	10.33	10.33	1.2398E-05	1.2398E-05	22.76	3.1187E-02
10	47	2	20.00	10.33	10.33	4.1962E-05	4.1962E-05	60.91	8.3477E-02
11	42	67	18.00	10.33	10.33	1.0014E-04	1.0014E-04	33.30	5.6349E-02
12	63	9	20.00	10.33	10.33	6.0081E-05	6.0081E-05	62.00	8.4973E-02
13	10	13	20.00	10.33	10.33	8.0109E-05	8.0109E-05	156.2	0.2141
14	10	8	20.00	10.33	10.33	2.9469E-04	2.9469E-04	142.9	0.1959
15	17	28	18.00	10.33	10.33	1.7166E-05	1.7166E-05	33.30	5.6349E-02
16	29	61	12.00	10.33	10.33	2.4052E-03	2.4052E-03	94.21	0.3587
17	13	51	20.00	10.33	10.33	4.1962E-04	4.1962E-04	118.6	0.1625
18	13	48	16.00	10.33	10.33	1.2779E-04	1.2779E-04	37.63	8.0588E-02
19	3	65	16.00	10.33	10.33	1.3447E-04	1.3447E-04	37.63	8.0588E-02
20	60	25	20.00	10.33	10.33	6.6280E-04	6.6280E-04	139.1	0.1906
21	62	20	20.00	10.34	10.34	4.8132E-03	4.8132E-03	442.1	0.6059
22	61	15	12.00	10.33	10.33	1.0920E-03	1.0920E-03	160.1	0.6094
23	14	56	12.00	10.32	10.31	9.6502E-03	9.6502E-03	160.1	0.6094
24	25	71	20.00	10.33	10.33	1.0014E-04	1.0014E-04	54.93	7.5287E-02
25	46	59	14.00	10.31	10.30	1.3943E-02	1.3943E-02	387.2	1.083
26	56	46	12.00	10.31	10.31	3.4275E-03	3.4275E-03	160.1	0.6094
27	8	9	20.00	10.33	10.33	8.8024E-04	8.8024E-04	142.9	0.1959
28	41	58	20.00	10.33	10.33	1.9073E-06	0.000	5.850	8.0176E-03
29	22	21	14.00	10.35	10.33	1.6820E-02	1.6820E-02	231.8	0.6484
31	23	19	14.00	10.31	10.31	3.9854E-03	3.9854E-03	226.0	0.6321
33	20	10	20.00	10.34	10.33	4.2171E-03	4.2171E-03	299.1	0.4100
34	15	14	12.00	10.33	10.32	1.6899E-03	1.6899E-03	160.1	0.6094
35	28	29	12.00	10.33	10.33	1.7376E-03	1.7376E-03	94.21	0.3587
36	7	73	24.00	10.40	10.40	1.1854E-03	1.1854E-03	399.5	0.3802
37	26	22	20.00	10.36	10.35	1.7705E-02	1.7705E-02	858.0	1.176
38	1	17	18.00	10.33	10.33	3.0518E-05	3.0518E-05	33.30	5.6349E-02
39	16	32	18.00	10.33	10.33	2.4796E-05	2.4796E-05	33.30	5.6349E-02
40	49	26	20.00	10.39	10.36	2.8657E-02	2.8657E-02	729.1	0.9992
41	49	30	12.00	10.39	10.38	1.1267E-02	1.1267E-02	128.9	0.4909
42	31	26	12.00	10.37	10.36	8.0919E-03	8.0919E-03	128.9	0.4909
43	32	1	18.00	10.33	10.33	1.7166E-05	1.7166E-05	33.30	5.6349E-02

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	10.33	10.33	3.2425E-05	3.2425E-05	33.30	5.6349E-02
45	30	35	12.00	10.38	10.38	3.5458E-03	3.5458E-03	128.9	0.4909
46	53	33	18.00	10.33	10.33	5.2452E-05	5.2452E-05	33.30	5.6349E-02
47	35	31	12.00	10.38	10.37	5.7526E-03	5.7526E-03	128.9	0.4909
48	34	42	20.00	10.33	10.33	6.0081E-05	6.0081E-05	56.06	7.6830E-02
53	24	23	14.00	10.31	10.31	1.2350E-03	1.2350E-03	226.0	0.6321
54	43	6	14.00	10.33	10.33	1.4305E-05	1.4305E-05	7.766	2.1720E-02
55	55	44	24.00	10.40	10.40	2.0256E-03	2.0256E-03	458.5	0.4364
56	7	55	24.00	10.40	10.40	2.1267E-04	2.1267E-04	458.5	0.4364
58	63	47	20.00	10.33	10.33	1.0777E-04	1.0777E-04	60.91	8.3477E-02
59	25	46	14.00	10.33	10.31	1.9403E-02	1.9403E-02	227.1	0.6352
60	73	40	24.00	10.40	10.40	5.5027E-04	5.5027E-04	399.5	0.3802
61	20	25	14.00	10.34	10.33	6.1970E-03	6.1970E-03	143.0	0.3998
62	51	50	20.00	10.33	10.33	2.9278E-04	2.9278E-04	100.2	0.1373
64	48	3	16.00	10.33	10.33	1.7738E-04	1.7738E-04	37.63	8.0588E-02
66	57	54	20.00	10.33	10.33	9.4414E-05	9.4414E-05	56.06	7.6830E-02
67	40	45	20.00	10.40	10.40	5.3167E-03	5.3167E-03	399.5	0.5475
68	19	59	14.00	10.31	10.30	1.1043E-02	1.1043E-02	470.8	1.317
69	60	61	12.00	10.33	10.33	4.2057E-03	4.2057E-03	65.85	0.2507
70	66	53	18.00	10.33	10.33	2.5749E-05	2.5749E-05	33.30	5.6349E-02
71	58	71	20.00	10.33	10.33	1.3542E-04	1.3542E-04	189.9	0.2603
72	9	60	20.00	10.33	10.33	1.4210E-04	1.4210E-04	204.9	0.2808
73	22	62	20.00	10.35	10.34	6.0749E-03	6.0749E-03	626.2	0.8582
74	62	58	14.00	10.34	10.33	1.0975E-02	1.0975E-02	184.1	0.5148
75	68	49	20.00	10.40	10.39	3.6879E-03	3.6879E-03	858.0	1.176
76	64	63	20.00	10.33	10.33	2.4796E-05	2.4796E-05	122.9	0.1685
77	67	66	18.00	10.33	10.33	2.1935E-05	2.1935E-05	33.30	5.6349E-02
78	44	68	20.00	10.40	10.40	4.9496E-03	4.9496E-03	458.5	0.6284
79	41	24	14.00	10.33	10.31	1.7119E-02	1.7119E-02	226.0	0.6321
80	45	68	20.00	10.40	10.40	1.3542E-04	1.3542E-04	399.5	0.5475
81	21	41	20.00	10.33	10.33	2.2793E-04	2.2793E-04	231.8	0.3177
82	71	19	14.00	10.33	10.31	2.2202E-02	2.2202E-02	244.9	0.6848
83	54	72	14.00	10.33	10.33	1.8120E-05	1.8120E-05	7.766	2.1720E-02
84	54	6	20.00	10.33	10.33	5.2452E-05	5.2452E-05	48.29	6.6187E-02
85	59	74	14.00	10.30	10.24	5.3277E-02	5.3277E-02	858.0	2.400
86	11	57	20.00	10.33	10.33	1.0300E-04	1.0300E-04	56.06	7.6830E-02
89	65	77	20.00	10.33	10.33	9.5367E-05	9.5367E-05	56.06	7.6830E-02
91	51	79	20.00	10.33	10.33	1.2398E-05	1.2398E-05	18.43	2.5253E-02
94	82	64	20.00	10.33	10.33	1.5259E-05	1.5259E-05	22.76	3.1187E-02
96	84	34	20.00	10.33	10.33	1.0490E-05	1.0490E-05	56.06	7.6830E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
2	858.0	0.000	10.40	10.40	10.17	9.5691E-02	2.4796E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
69	0.000	*	858.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
74	10.24	858.0	*	268.08

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 33 Fire scenario for PTU building sprinkler design – Case B
33.A PIPENET schematic layout with piping and nodes label
33.B PIPENET schematic layout with flow rate and pressure results
33.C PIPENET schematic layout with velocity results
33.D PIPENET input/output printout report

Attachment 33.A contains 1 page
Attachment 33.B contains 1 page
Attachment 33.C contains 1 page
Attachment 33.D contains 21 pages

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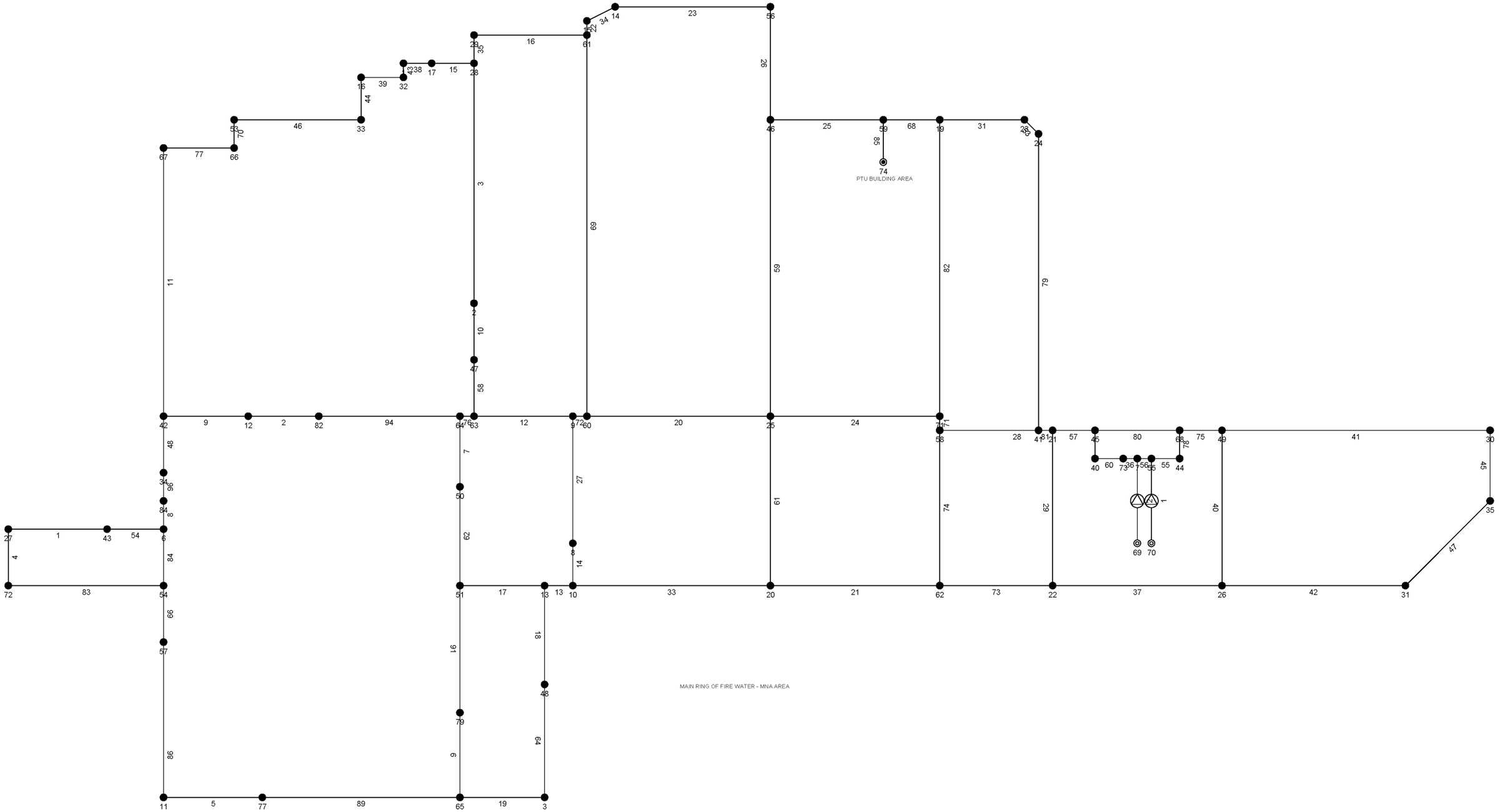
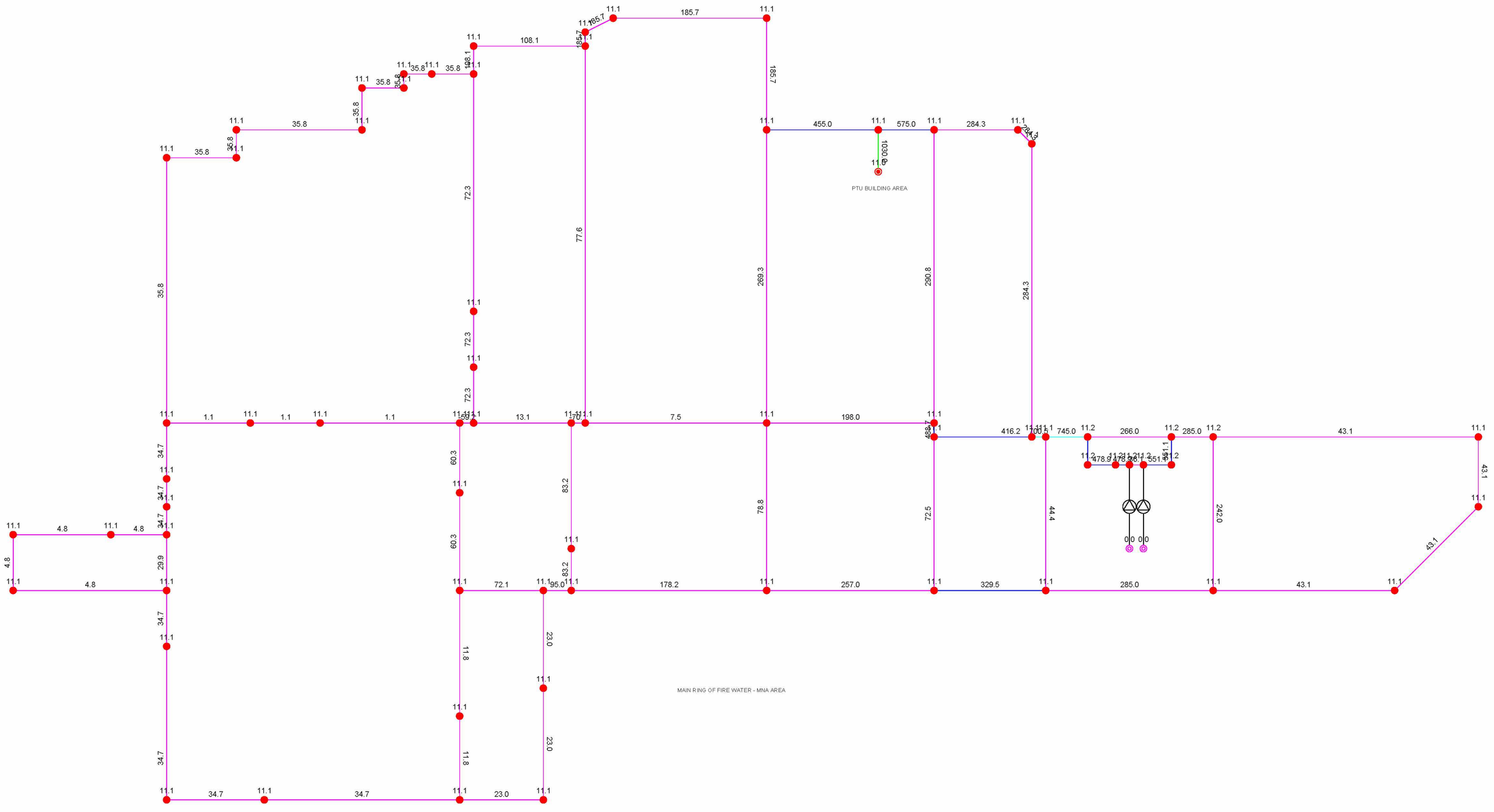
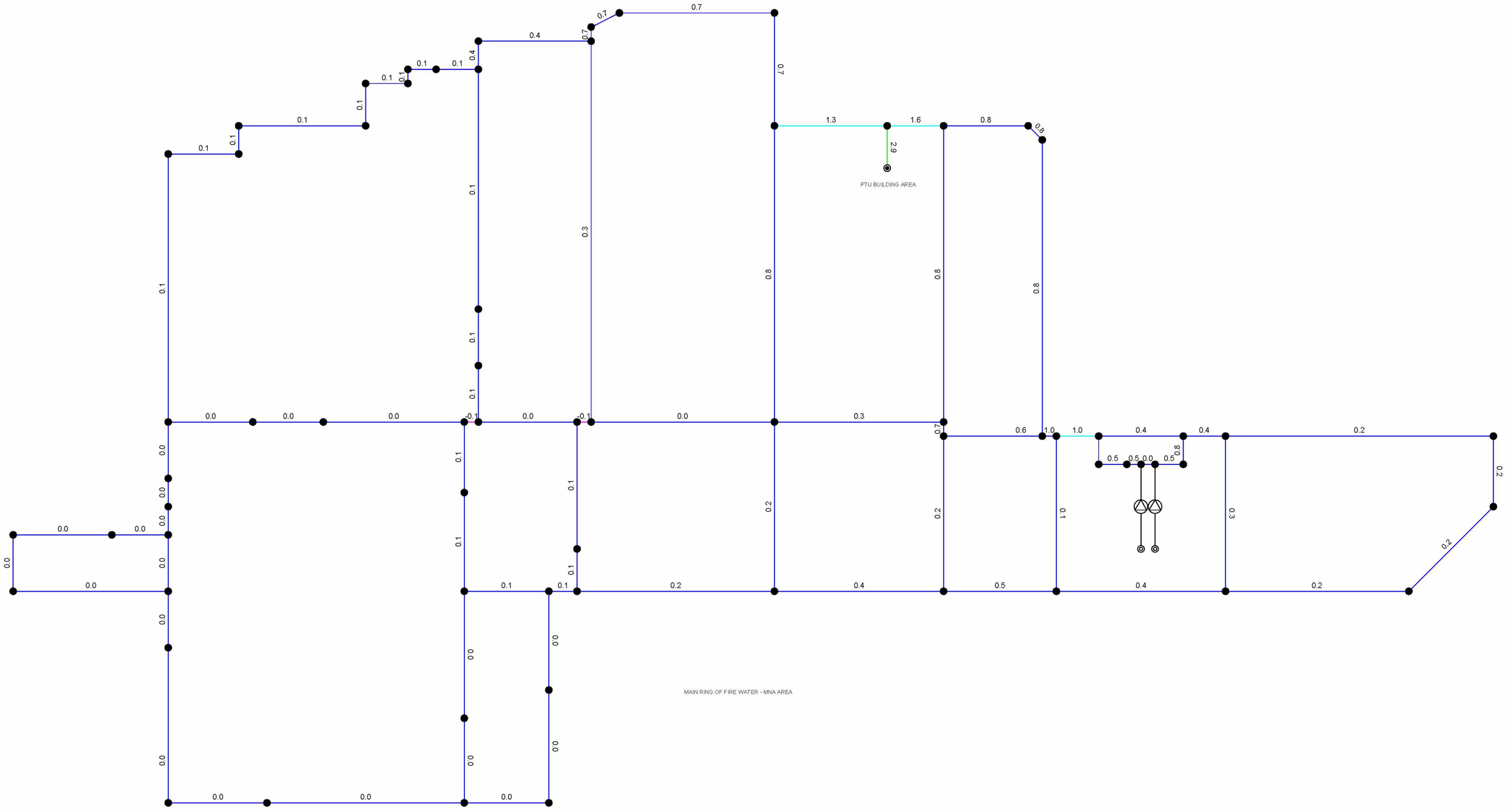


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

10:11 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	82	12	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	12	42	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	9	63	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	29	61	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	25	60	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	61	15	12.00	5.000	0.000	150.0	5.987
23	14	56	12.00	97.00	0.000	150.0	0.000
24	71	25	20.00	89.00	0.000	150.0	0.000
25	46	59	14.00	58.00	0.000	150.0	0.000
26	56	46	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	41	58	20.00	59.00	0.000	150.0	0.000
29	21	22	14.00	119.0	0.000	150.0	61.72
31	23	19	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	15	14	12.00	11.00	0.000	150.0	5.987
35	28	29	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	24	23	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	7	55	24.00	9.000	0.000	150.0	0.000
57	45	21	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	73	40	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	40	45	20.00	73.00	0.000	150.0	45.60
68	19	59	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	58	71	20.00	12.00	0.000	150.0	0.000
72	60	9	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	63	64	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	41	24	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	21	41	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
85	59	74	14.00	20.00	0.000	150.0	30.86
86	11	57	20.00	86.00	0.000	150.0	0.000
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	64	82	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
85	1 x 4	30.86

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None
2	69	7	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	4.8247	9	14.0000	14.0000	*
2	82	12	1.0517	9	20.0000	20.0000	*
3	2	28	72.3027	9	20.0000	20.0000	*
4	72	27	4.8247	9	14.0000	14.0000	*
5	77	11	34.7497	9	20.0000	20.0000	*
6	79	65	11.7964	9	20.0000	20.0000	*
7	50	64	60.2873	9	20.0000	20.0000	*
8	6	84	34.7497	9	20.0000	20.0000	*
9	12	42	1.0517	9	20.0000	20.0000	*
10	47	2	72.3027	9	20.0000	20.0000	*
11	42	67	35.8014	9	18.0000	18.0000	*
12	9	63	13.0672	9	20.0000	20.0000	*
13	10	13	95.0369	9	20.0000	20.0000	*
14	10	8	83.1833	9	20.0000	20.0000	*
15	17	28	35.8014	9	18.0000	18.0000	*
16	29	61	108.1041	9	12.0000	12.0000	*
17	13	51	72.0836	9	20.0000	20.0000	*
18	13	48	22.9533	9	16.0000	16.0000	*
19	3	65	22.9533	9	16.0000	16.0000	*
20	25	60	7.4835	9	20.0000	20.0000	*
21	62	20	256.9900	9	20.0000	20.0000	*
22	61	15	185.7038	9	12.0000	12.0000	*
23	14	56	185.7038	9	12.0000	12.0000	*
24	71	25	197.9827	9	20.0000	20.0000	*
25	46	59	454.9727	9	14.0000	14.0000	*
26	56	46	185.7038	9	12.0000	12.0000	*
27	8	9	83.1833	9	20.0000	20.0000	*
28	41	58	416.2417	9	20.0000	20.0000	*
29	21	22	44.4443	9	14.0000	14.0000	*
31	23	19	284.2736	9	14.0000	14.0000	*
33	20	10	178.2203	9	20.0000	20.0000	*
34	15	14	185.7038	9	12.0000	12.0000	*
35	28	29	108.1041	9	12.0000	12.0000	*
36	7	73	478.9195	9	24.0000	24.0000	*
37	26	22	285.0428	9	20.0000	20.0000	*
38	1	17	35.8014	9	18.0000	18.0000	*
39	16	32	35.8014	9	18.0000	18.0000	*
40	49	26	241.9616	9	20.0000	20.0000	*
41	49	30	43.0811	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	43.0811	9	12.0000	12.0000	*
43	32	1	35.8014	9	18.0000	18.0000	*
44	33	16	35.8014	9	18.0000	18.0000	*
45	30	35	43.0811	9	12.0000	12.0000	*
46	53	33	35.8014	9	18.0000	18.0000	*
47	35	31	43.0811	9	12.0000	12.0000	*
48	34	42	34.7497	9	20.0000	20.0000	*
53	24	23	284.2736	9	14.0000	14.0000	*
54	43	6	4.8247	9	14.0000	14.0000	*
55	55	44	551.0828	9	24.0000	24.0000	*
56	7	55	36.0814	9	24.0000	24.0000	*
57	45	21	744.9596	9	20.0000	20.0000	*
58	63	47	72.3027	9	20.0000	20.0000	*
59	25	46	269.2689	9	14.0000	14.0000	*
60	73	40	478.9195	9	24.0000	24.0000	*
61	20	25	78.7697	9	14.0000	14.0000	*
62	51	50	60.2873	9	20.0000	20.0000	*
64	48	3	22.9533	9	16.0000	16.0000	*
66	57	54	34.7497	9	20.0000	20.0000	*
67	40	45	478.9195	9	20.0000	20.0000	*
68	19	59	575.0295	9	14.0000	14.0000	*
69	60	61	77.5997	9	12.0000	12.0000	*
70	66	53	35.8014	9	18.0000	18.0000	*
71	58	71	488.7387	9	20.0000	20.0000	*
72	60	9	-70.1161	9	20.0000	20.0000	*
73	22	62	329.4870	9	20.0000	20.0000	*
74	62	58	72.4970	9	14.0000	14.0000	*
75	68	49	285.0428	9	20.0000	20.0000	*
76	63	64	-59.2356	9	20.0000	20.0000	*
77	67	66	35.8014	9	18.0000	18.0000	*
78	44	68	551.0829	9	20.0000	20.0000	*
79	41	24	284.2736	9	14.0000	14.0000	*
80	68	45	266.0401	9	20.0000	20.0000	*
81	21	41	700.5153	9	20.0000	20.0000	*
82	71	19	290.7559	9	14.0000	14.0000	*
83	54	72	4.8247	9	14.0000	14.0000	*
84	54	6	29.9250	9	20.0000	20.0000	*
85	59	74	1030.0022	9	14.0000	14.0000	*
86	11	57	34.7497	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	34.7497	9	20.0000	20.0000	*
91	51	79	11.7964	9	20.0000	20.0000	*
94	64	82	1.0517	9	20.0000	20.0000	*
96	84	34	34.7497	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	11.14	11.14	1.9073E-06	0.000	4.825	1.3494E-02
2	82	12	20.00	11.14	11.14	0.000	0.000	1.052	1.4413E-03
3	2	28	20.00	11.14	11.14	1.5736E-04	1.5736E-04	72.30	9.9091E-02
4	72	27	14.00	11.14	11.14	7.6294E-06	0.000	4.825	1.3494E-02
5	77	11	20.00	11.14	11.14	3.7193E-05	3.7193E-05	34.75	4.7624E-02
6	79	65	20.00	11.14	11.14	2.8610E-06	0.000	11.80	1.6167E-02
7	50	64	20.00	11.14	11.14	1.1444E-04	1.1444E-04	60.29	8.2624E-02
8	6	84	20.00	11.14	11.14	1.4305E-05	1.4305E-05	34.75	4.7624E-02
9	12	42	20.00	11.14	11.14	0.000	0.000	1.052	1.4413E-03
10	47	2	20.00	11.14	11.14	5.7220E-05	5.7220E-05	72.30	9.9091E-02
11	42	67	18.00	11.14	11.14	1.1539E-04	1.1539E-04	35.80	6.0575E-02
12	9	63	20.00	11.14	11.14	2.8610E-06	0.000	13.07	1.7909E-02
13	10	13	20.00	11.14	11.14	2.9564E-05	2.9564E-05	95.04	0.1302
14	10	8	20.00	11.14	11.14	1.0777E-04	1.0777E-04	83.18	0.1140
15	17	28	18.00	11.14	11.14	2.0027E-05	2.0027E-05	35.80	6.0575E-02
16	29	61	12.00	11.14	11.13	3.1052E-03	3.1052E-03	108.1	0.4115
17	13	51	20.00	11.14	11.14	1.6785E-04	1.6785E-04	72.08	9.8791E-02
18	13	48	16.00	11.14	11.14	5.2452E-05	5.2452E-05	22.95	4.9152E-02
19	3	65	16.00	11.14	11.14	5.2452E-05	5.2452E-05	22.95	4.9152E-02
20	25	60	20.00	11.14	11.14	2.8610E-06	0.000	7.484	1.0256E-02
21	62	20	20.00	11.14	11.14	1.7672E-03	1.7672E-03	257.0	0.3522
22	61	15	12.00	11.13	11.13	1.4400E-03	1.4400E-03	185.7	0.7070
23	14	56	12.00	11.13	11.12	1.2714E-02	1.2714E-02	185.7	0.7070
24	71	25	20.00	11.14	11.14	1.0872E-03	1.0872E-03	198.0	0.2713
25	46	59	14.00	11.11	11.09	1.8803E-02	1.8803E-02	455.0	1.273
26	56	46	12.00	11.12	11.11	4.5128E-03	4.5128E-03	185.7	0.7070
27	8	9	20.00	11.14	11.14	3.2425E-04	3.2425E-04	83.18	0.1140
28	41	58	20.00	11.14	11.14	2.8505E-03	2.8505E-03	416.2	0.5705
29	21	22	14.00	11.15	11.14	7.9441E-04	7.9441E-04	44.44	0.1243
31	23	19	14.00	11.12	11.11	6.0921E-03	6.0921E-03	284.3	0.7951
33	20	10	20.00	11.14	11.14	1.6203E-03	1.6203E-03	178.2	0.2443
34	15	14	12.00	11.13	11.13	2.2278E-03	2.2278E-03	185.7	0.7070
35	28	29	12.00	11.14	11.14	2.2449E-03	2.2449E-03	108.1	0.4115
36	7	73	24.00	11.16	11.16	1.6575E-03	1.6575E-03	478.9	0.4558
37	26	22	20.00	11.15	11.14	2.3127E-03	2.3127E-03	285.0	0.3907
38	1	17	18.00	11.14	11.14	3.5286E-05	3.5286E-05	35.80	6.0575E-02
39	16	32	18.00	11.14	11.14	3.0518E-05	3.0518E-05	35.80	6.0575E-02
40	49	26	20.00	11.15	11.15	3.7394E-03	3.7394E-03	242.0	0.3316
41	49	30	12.00	11.15	11.15	1.4696E-03	1.4696E-03	43.08	0.1640
42	31	26	12.00	11.15	11.15	1.0548E-03	1.0548E-03	43.08	0.1640
43	32	1	18.00	11.14	11.14	1.9073E-05	1.9073E-05	35.80	6.0575E-02

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	11.14	11.14	3.5286E-05	3.5286E-05	35.80	6.0575E-02
45	30	35	12.00	11.15	11.15	4.6539E-04	4.6539E-04	43.08	0.1640
46	53	33	18.00	11.14	11.14	6.1989E-05	6.1989E-05	35.80	6.0575E-02
47	35	31	12.00	11.15	11.15	7.4959E-04	7.4959E-04	43.08	0.1640
48	34	42	20.00	11.14	11.14	2.4796E-05	2.4796E-05	34.75	4.7624E-02
53	24	23	14.00	11.12	11.12	1.8854E-03	1.8854E-03	284.3	0.7951
54	43	6	14.00	11.14	11.14	5.7220E-06	0.000	4.825	1.3494E-02
55	55	44	24.00	11.16	11.16	2.8448E-03	2.8448E-03	551.1	0.5245
56	7	55	24.00	11.16	11.16	0.000	0.000	36.08	3.4340E-02
57	45	21	20.00	11.15	11.15	5.6753E-03	5.6753E-03	745.0	1.021
58	63	47	20.00	11.14	11.14	1.4782E-04	1.4782E-04	72.30	9.9091E-02
59	25	46	14.00	11.14	11.11	2.6595E-02	2.6595E-02	269.3	0.7531
60	73	40	24.00	11.16	11.16	7.6675E-04	7.6675E-04	478.9	0.4558
61	20	25	14.00	11.14	11.14	2.0676E-03	2.0676E-03	78.77	0.2203
62	51	50	20.00	11.14	11.14	1.1539E-04	1.1539E-04	60.29	8.2624E-02
64	48	3	16.00	11.14	11.14	7.0572E-05	7.0572E-05	22.95	4.9152E-02
66	57	54	20.00	11.14	11.14	4.0054E-05	4.0054E-05	34.75	4.7624E-02
67	40	45	20.00	11.16	11.15	7.4406E-03	7.4406E-03	478.9	0.6564
68	19	59	14.00	11.11	11.09	1.5978E-02	1.5978E-02	575.0	1.608
69	60	61	12.00	11.14	11.13	5.6973E-03	5.6973E-03	77.60	0.2954
70	66	53	18.00	11.14	11.14	2.7657E-05	2.7657E-05	35.80	6.0575E-02
71	58	71	20.00	11.14	11.14	7.8011E-04	7.8011E-04	488.7	0.6698
72	60	9	20.00	11.14	11.14	-1.8120E-05	1.8120E-05	-70.12	-9.6094E-02
73	22	62	20.00	11.14	11.14	1.8578E-03	1.8578E-03	329.5	0.4516
74	62	58	14.00	11.14	11.14	1.9674E-03	1.9674E-03	72.50	0.2028
75	68	49	20.00	11.15	11.15	4.8065E-04	4.8065E-04	285.0	0.3907
76	63	64	20.00	11.14	11.14	-7.6294E-06	0.000	-59.24	-8.1182E-02
77	67	66	18.00	11.14	11.14	2.4796E-05	2.4796E-05	35.80	6.0575E-02
78	44	68	20.00	11.16	11.15	6.9571E-03	6.9571E-03	551.1	0.7553
79	41	24	14.00	11.14	11.12	2.6160E-02	2.6160E-02	284.3	0.7951
80	68	45	20.00	11.15	11.15	6.2943E-05	6.2943E-05	266.0	0.3646
81	21	41	20.00	11.15	11.14	1.7691E-03	1.7691E-03	700.5	0.9601
82	71	19	14.00	11.14	11.11	3.0507E-02	3.0507E-02	290.8	0.8132
83	54	72	14.00	11.14	11.14	4.7684E-06	0.000	4.825	1.3494E-02
84	54	6	20.00	11.14	11.14	2.0027E-05	2.0027E-05	29.92	4.1012E-02
85	59	74	14.00	11.09	11.02	7.4702E-02	7.4702E-02	1030.	2.881
86	11	57	20.00	11.14	11.14	4.2915E-05	4.2915E-05	34.75	4.7624E-02
89	65	77	20.00	11.14	11.14	4.0054E-05	4.0054E-05	34.75	4.7624E-02
91	51	79	20.00	11.14	11.14	4.7684E-06	0.000	11.80	1.6167E-02
94	64	82	20.00	11.14	11.14	0.000	0.000	1.052	1.4413E-03
96	84	34	20.00	11.14	11.14	2.8610E-06	0.000	34.75	4.7624E-02

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	515.0	0.000	11.16	11.16	10.17	8.9201E-02	1.5966E+05	100.0
2	515.0	0.000	11.16	11.16	10.17	8.9201E-02	1.5966E+05	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	515.0	0.0000
69	0.000	*	515.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
74	11.02	1030.	*	310.29

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 34 Fire scenario for FW pump building sprinkler design – Case A

34.A PIPENET schematic layout with piping and nodes label

34.B PIPENET schematic layout with flow rate and pressure results

34.C PIPENET schematic layout with velocity results

34.D PIPENET input/output printout report

Attachment 34.A contains 1 page
Attachment 34.B contains 1 page
Attachment 34.C contains 1 page
Attachment 34.D contains 22 pages

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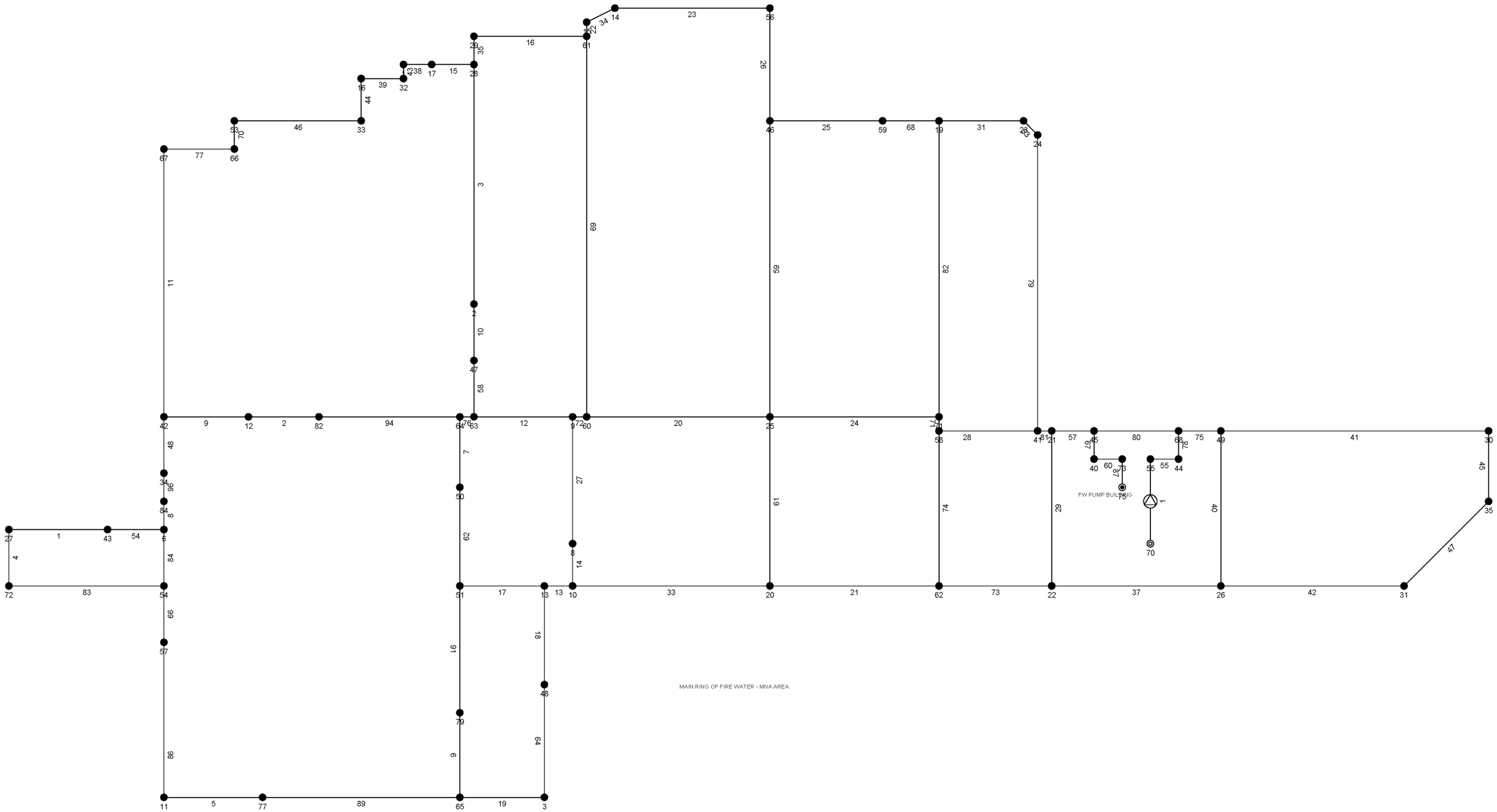
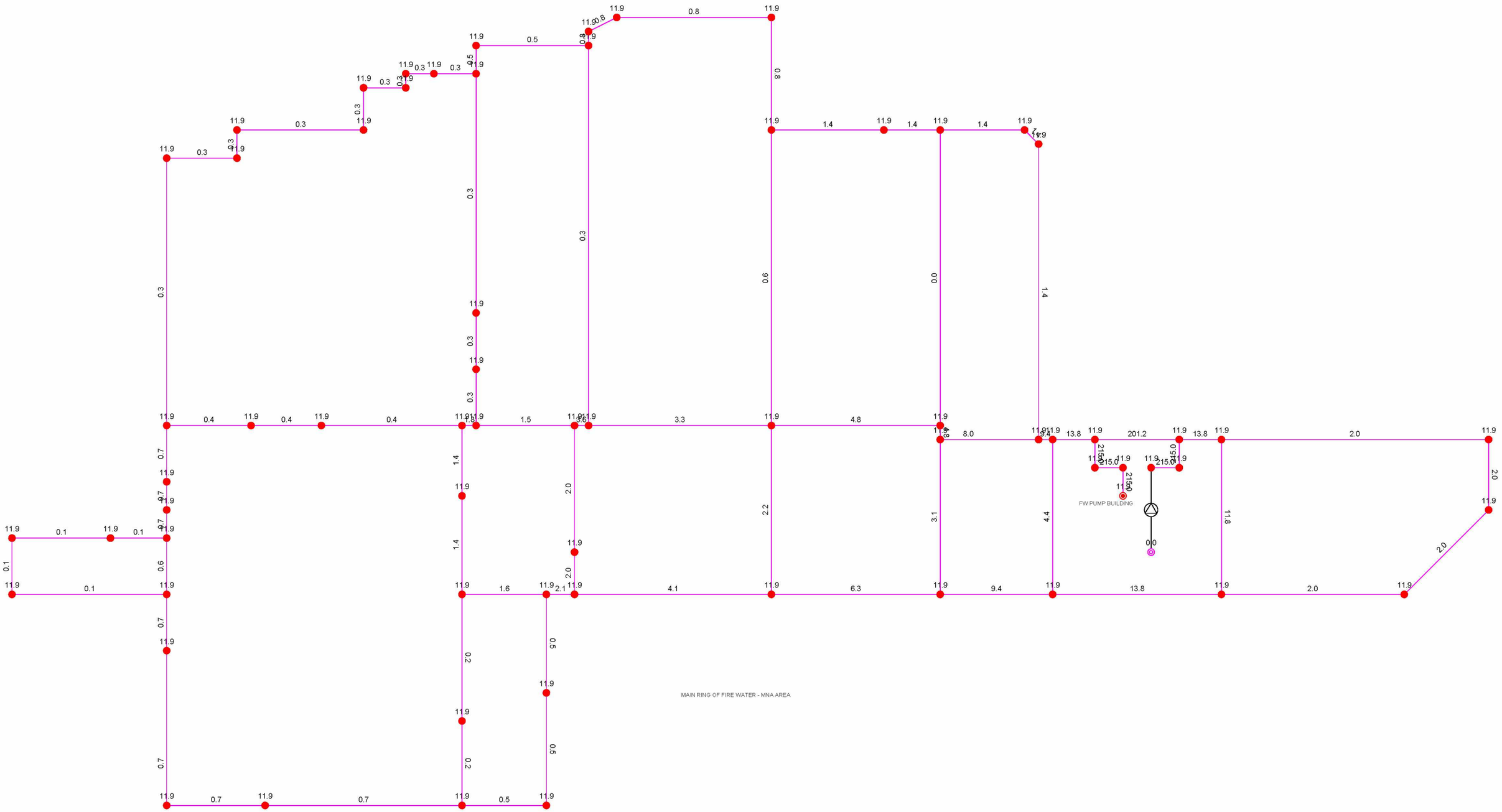
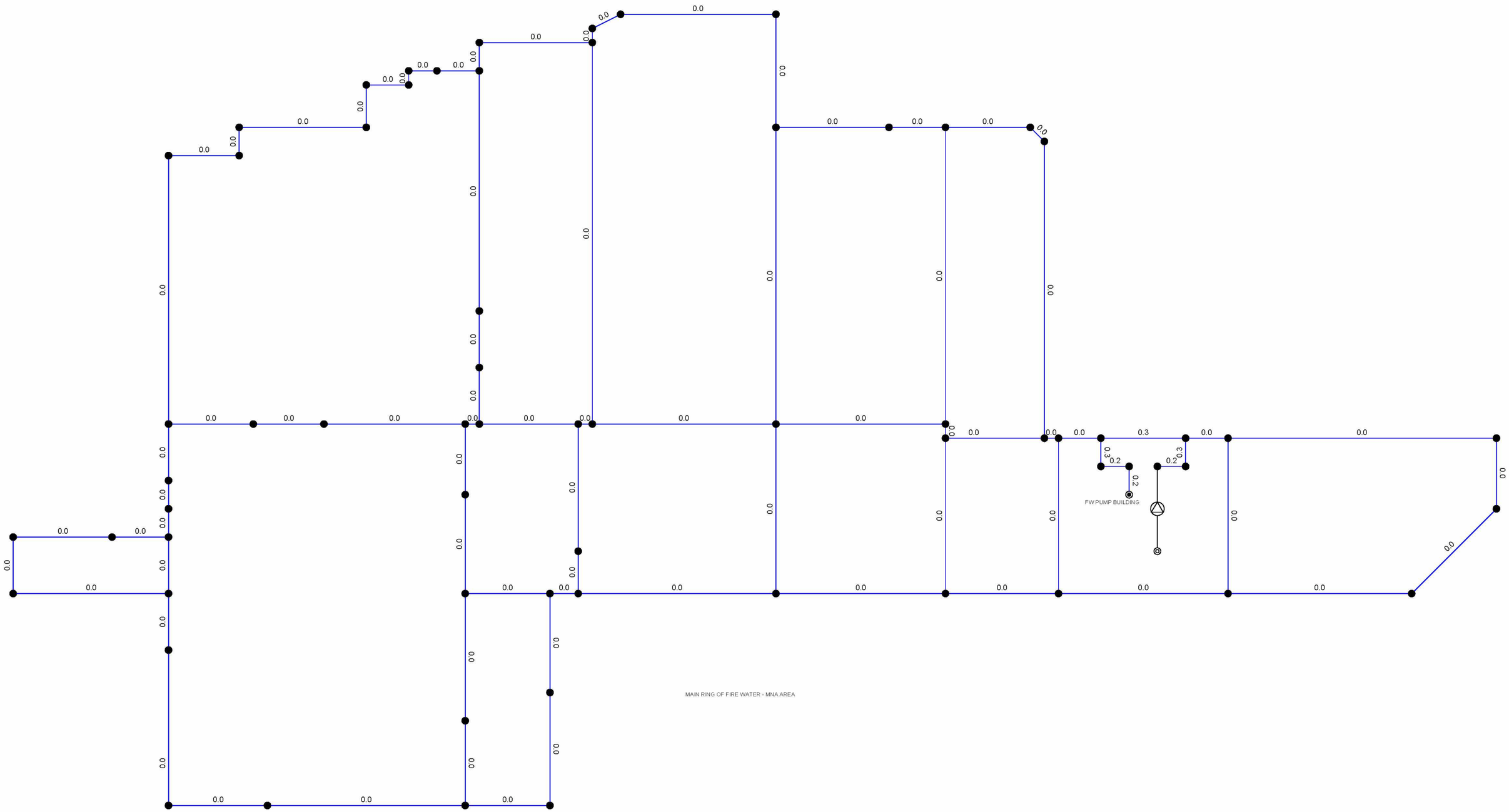


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

10:24 on 8-Jul-2021

LIST OF CONTENTS
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	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18
Warnings	19

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	27	43	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	72	27	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	63	9	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	29	61	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	60	25	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	61	15	12.00	5.000	0.000	150.0	5.987
23	14	56	12.00	97.00	0.000	150.0	0.000
24	25	71	20.00	89.00	0.000	150.0	0.000
25	46	59	14.00	58.00	0.000	150.0	0.000
26	56	46	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	58	41	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	19	23	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	15	14	12.00	11.00	0.000	150.0	5.987
35	28	29	12.00	19.00	0.000	150.0	27.63
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	32	1	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987
46	53	33	18.00	55.00	0.000	150.0	15.66

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	23	24	14.00	7.000	0.000	150.0	6.909
54	43	6	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
57	21	45	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	40	73	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	45	40	20.00	73.00	0.000	150.0	45.60
68	59	19	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	71	58	20.00	12.00	0.000	150.0	0.000
72	9	60	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	24	41	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	41	21	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	54	72	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
87	73	75	24.00	20.00	0.000	150.0	55.27
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	82	64	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		
87	1 x 4	55.27		

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	27	43	0.1137	9	14.0000	14.0000	*
2	12	82	0.4371	9	20.0000	20.0000	*
3	2	28	0.2567	9	20.0000	20.0000	*
4	72	27	0.1137	9	14.0000	14.0000	*
5	77	11	0.6988	9	20.0000	20.0000	*
6	79	65	0.2172	9	20.0000	20.0000	*
7	50	64	1.3546	9	20.0000	20.0000	*
8	6	84	0.6988	9	20.0000	20.0000	*
9	42	12	0.4371	9	20.0000	20.0000	*
10	47	2	0.2567	9	20.0000	20.0000	*
11	42	67	0.2617	9	18.0000	18.0000	*
12	63	9	1.5351	9	20.0000	20.0000	*
13	10	13	2.0534	9	20.0000	20.0000	*
14	10	8	2.0305	9	20.0000	20.0000	*
15	17	28	0.2617	9	18.0000	18.0000	*
16	29	61	0.5183	9	12.0000	12.0000	*
17	13	51	1.5718	9	20.0000	20.0000	*
18	13	48	0.4816	9	16.0000	16.0000	*
19	3	65	0.4816	9	16.0000	16.0000	*
20	60	25	3.3062	9	20.0000	20.0000	*
21	62	20	6.2538	9	20.0000	20.0000	*
22	61	15	0.7777	9	12.0000	12.0000	*
23	14	56	0.7777	9	12.0000	12.0000	*
24	25	71	4.8394	9	20.0000	20.0000	*
25	46	59	1.4144	9	14.0000	14.0000	*
26	56	46	0.7777	9	12.0000	12.0000	*
27	8	9	2.0305	9	20.0000	20.0000	*
28	58	41	7.9560	9	20.0000	20.0000	*
29	22	21	4.3831	9	14.0000	14.0000	*
31	19	23	1.4148	9	14.0000	14.0000	*
33	20	10	4.0839	9	20.0000	20.0000	*
34	15	14	0.7777	9	12.0000	12.0000	*
35	28	29	0.5183	9	12.0000	12.0000	*
37	26	22	13.7540	9	20.0000	20.0000	*
38	1	17	0.2617	9	18.0000	18.0000	*
39	16	32	0.2617	9	18.0000	18.0000	*
40	49	26	11.7597	9	20.0000	20.0000	*
41	49	30	1.9942	9	12.0000	12.0000	*
42	31	26	1.9942	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
43	32	1	0.2617	9	18.0000	18.0000	*
44	33	16	0.2617	9	18.0000	18.0000	*
45	30	35	1.9942	9	12.0000	12.0000	*
46	53	33	0.2617	9	18.0000	18.0000	*
47	35	31	1.9942	9	12.0000	12.0000	*
48	34	42	0.6988	9	20.0000	20.0000	*
53	23	24	1.4148	9	14.0000	14.0000	*
54	43	6	0.1137	9	14.0000	14.0000	*
55	55	44	215.0005	9	24.0000	24.0000	*
57	21	45	13.7540	9	20.0000	20.0000	*
58	63	47	0.2567	9	20.0000	20.0000	*
59	25	46	0.6367	9	14.0000	14.0000	*
60	40	73	215.0005	9	24.0000	24.0000	*
61	20	25	2.1698	9	14.0000	14.0000	*
62	51	50	1.3546	9	20.0000	20.0000	*
64	48	3	0.4816	9	16.0000	16.0000	*
66	57	54	0.6988	9	20.0000	20.0000	*
67	45	40	215.0005	9	20.0000	20.0000	*
68	59	19	1.4144	9	14.0000	14.0000	*
69	60	61	0.2593	9	12.0000	12.0000	*
70	66	53	0.2617	9	18.0000	18.0000	*
71	71	58	4.8389	9	20.0000	20.0000	*
72	9	60	3.5656	9	20.0000	20.0000	*
73	22	62	9.3709	9	20.0000	20.0000	*
74	62	58	3.1171	9	14.0000	14.0000	*
75	68	49	13.7540	9	20.0000	20.0000	*
76	64	63	1.7918	9	20.0000	20.0000	*
77	67	66	0.2617	9	18.0000	18.0000	*
78	44	68	215.0005	9	20.0000	20.0000	*
79	24	41	1.4148	9	14.0000	14.0000	*
80	68	45	201.2465	9	20.0000	20.0000	*
81	41	21	9.3709	9	20.0000	20.0000	*
82	71	19	0.0004	9	14.0000	14.0000	*
83	54	72	0.1137	9	14.0000	14.0000	*
84	54	6	0.5851	9	20.0000	20.0000	*
86	11	57	0.6988	9	20.0000	20.0000	*
87	73	75	215.0005	9	24.0000	24.0000	*
89	65	77	0.6988	9	20.0000	20.0000	*
91	51	79	0.2172	9	20.0000	20.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
94	82	64	0.4371	9	20.0000	20.0000	*
96	84	34	0.6988	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	27	43	14.00	11.94	11.94	0.000	0.000	0.1137	3.1795E-04
2	12	82	20.00	11.94	11.94	0.000	0.000	0.4371	5.9911E-04
3	2	28	20.00	11.94	11.94	0.000	0.000	0.2567	3.5179E-04
4	72	27	14.00	11.94	11.94	0.000	0.000	0.1137	3.1795E-04
5	77	11	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
6	79	65	20.00	11.94	11.94	0.000	0.000	0.2172	2.9772E-04
7	50	64	20.00	11.94	11.94	0.000	0.000	1.355	1.8565E-03
8	6	84	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
9	42	12	20.00	11.94	11.94	0.000	0.000	0.4371	5.9911E-04
10	47	2	20.00	11.94	11.94	0.000	0.000	0.2567	3.5179E-04
11	42	67	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
12	63	9	20.00	11.94	11.94	0.000	0.000	1.535	2.1038E-03
13	10	13	20.00	11.94	11.94	0.000	0.000	2.053	2.8142E-03
14	10	8	20.00	11.94	11.94	0.000	0.000	2.030	2.7828E-03
15	17	28	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
16	29	61	12.00	11.94	11.94	0.000	0.000	0.5183	1.9733E-03
17	13	51	20.00	11.94	11.94	0.000	0.000	1.572	2.1542E-03
18	13	48	16.00	11.94	11.94	0.000	0.000	0.4816	1.0312E-03
19	3	65	16.00	11.94	11.94	0.000	0.000	0.4816	1.0312E-03
20	60	25	20.00	11.94	11.94	0.000	0.000	3.306	4.5312E-03
21	62	20	20.00	11.94	11.94	0.000	0.000	6.254	8.5708E-03
22	61	15	12.00	11.94	11.94	0.000	0.000	0.7777	2.9606E-03
23	14	56	12.00	11.94	11.94	0.000	0.000	0.7777	2.9606E-03
24	25	71	20.00	11.94	11.94	1.9073E-06	0.000	4.839	6.6324E-03
25	46	59	14.00	11.94	11.94	1.9073E-06	0.000	1.414	3.9559E-03
26	56	46	12.00	11.94	11.94	0.000	0.000	0.7777	2.9606E-03
27	8	9	20.00	11.94	11.94	0.000	0.000	2.030	2.7828E-03
28	58	41	20.00	11.94	11.94	2.8610E-06	0.000	7.956	1.0904E-02
29	22	21	14.00	11.94	11.94	1.2398E-05	1.2398E-05	4.383	1.2259E-02
31	19	23	14.00	11.94	11.94	0.000	0.000	1.415	3.9572E-03
33	20	10	20.00	11.94	11.94	2.8610E-06	0.000	4.084	5.5970E-03
34	15	14	12.00	11.94	11.94	0.000	0.000	0.7777	2.9606E-03
35	28	29	12.00	11.94	11.94	0.000	0.000	0.5183	1.9733E-03
37	26	22	20.00	11.94	11.94	7.6294E-06	0.000	13.75	1.8850E-02
38	1	17	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
39	16	32	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
40	49	26	20.00	11.94	11.94	1.2398E-05	1.2398E-05	11.76	1.6117E-02
41	49	30	12.00	11.94	11.94	4.7684E-06	0.000	1.994	7.5919E-03
42	31	26	12.00	11.94	11.94	2.8610E-06	0.000	1.994	7.5919E-03
43	32	1	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
44	33	16	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
45	30	35	12.00	11.94	11.94	2.8610E-06	0.000	1.994	7.5919E-03
46	53	33	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
47	35	31	12.00	11.94	11.94	1.9073E-06	0.000	1.994	7.5919E-03
48	34	42	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
53	23	24	14.00	11.94	11.94	0.000	0.000	1.415	3.9572E-03
54	43	6	14.00	11.94	11.94	0.000	0.000	0.1137	3.1795E-04
55	55	44	24.00	11.94	11.94	4.9782E-04	4.9782E-04	215.0	0.2046
57	21	45	20.00	11.94	11.94	1.9073E-06	0.000	13.75	1.8850E-02
58	63	47	20.00	11.94	11.94	0.000	0.000	0.2567	3.5179E-04
59	25	46	14.00	11.94	11.94	0.000	0.000	0.6367	1.7808E-03
60	40	73	24.00	11.94	11.94	1.7548E-04	1.7548E-04	215.0	0.2046
61	20	25	14.00	11.94	11.94	2.8610E-06	0.000	2.170	6.0689E-03
62	51	50	20.00	11.94	11.94	0.000	0.000	1.355	1.8565E-03
64	48	3	16.00	11.94	11.94	0.000	0.000	0.4816	1.0312E-03
66	57	54	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
67	45	40	20.00	11.94	11.94	1.6899E-03	1.6899E-03	215.0	0.2947
68	59	19	14.00	11.94	11.94	0.000	0.000	1.414	3.9559E-03
69	60	61	12.00	11.94	11.94	0.000	0.000	0.2593	9.8725E-04
70	66	53	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
71	71	58	20.00	11.94	11.94	0.000	0.000	4.839	6.6318E-03
72	9	60	20.00	11.94	11.94	0.000	0.000	3.566	4.8866E-03
73	22	62	20.00	11.94	11.94	4.7684E-06	0.000	9.371	1.2843E-02
74	62	58	14.00	11.94	11.94	4.7684E-06	0.000	3.117	8.7183E-03
75	68	49	20.00	11.94	11.94	2.8610E-06	0.000	13.75	1.8850E-02
76	64	63	20.00	11.94	11.94	0.000	0.000	1.792	2.4556E-03
77	67	66	18.00	11.94	11.94	0.000	0.000	0.2617	4.4272E-04
78	44	68	20.00	11.94	11.94	1.2197E-03	1.2197E-03	215.0	0.2947
79	24	41	14.00	11.94	11.94	2.8610E-06	0.000	1.415	3.9572E-03
80	68	45	20.00	11.94	11.94	3.7193E-05	3.7193E-05	201.2	0.2758
81	41	21	20.00	11.94	11.94	0.000	0.000	9.371	1.2843E-02
82	71	19	14.00	11.94	11.94	0.000	0.000	4.4206E-04	1.2364E-06
83	54	72	14.00	11.94	11.94	0.000	0.000	0.1137	3.1795E-04
84	54	6	20.00	11.94	11.94	0.000	0.000	0.5851	8.0192E-04
86	11	57	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
87	73	75	24.00	11.94	11.94	4.4250E-04	4.4250E-04	215.0	0.2046
89	65	77	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04
91	51	79	20.00	11.94	11.94	0.000	0.000	0.2172	2.9772E-04
94	82	64	20.00	11.94	11.94	0.000	0.000	0.4371	5.9911E-04
96	84	34	20.00	11.94	11.94	0.000	0.000	0.6988	9.5771E-04

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	215.0	0.000	11.94	11.94	10.17	8.3367E-02	7.1320E+04	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	215.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
75	11.94	215.0	*	62.226

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

WARNINGS

*** WARNING - Pump 1 running below minimum flowrate

==========

Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

==========

RDCG (Rotterdam Capacity Growth) – DEFINITION PHASE
NESTE

Attachment 35 Fire scenario for FW pump building sprinkler design – Case B

35.A PIPENET schematic layout with piping and nodes label
35.B PIPENET schematic layout with flow rate and pressure results
35.C PIPENET schematic layout with velocity results
35.D PIPENET input/output printout report

Attachment 35.A contains 1 page
Attachment 35.B contains 1 page
Attachment 35.C contains 1 page
Attachment 35.D contains 21 pages

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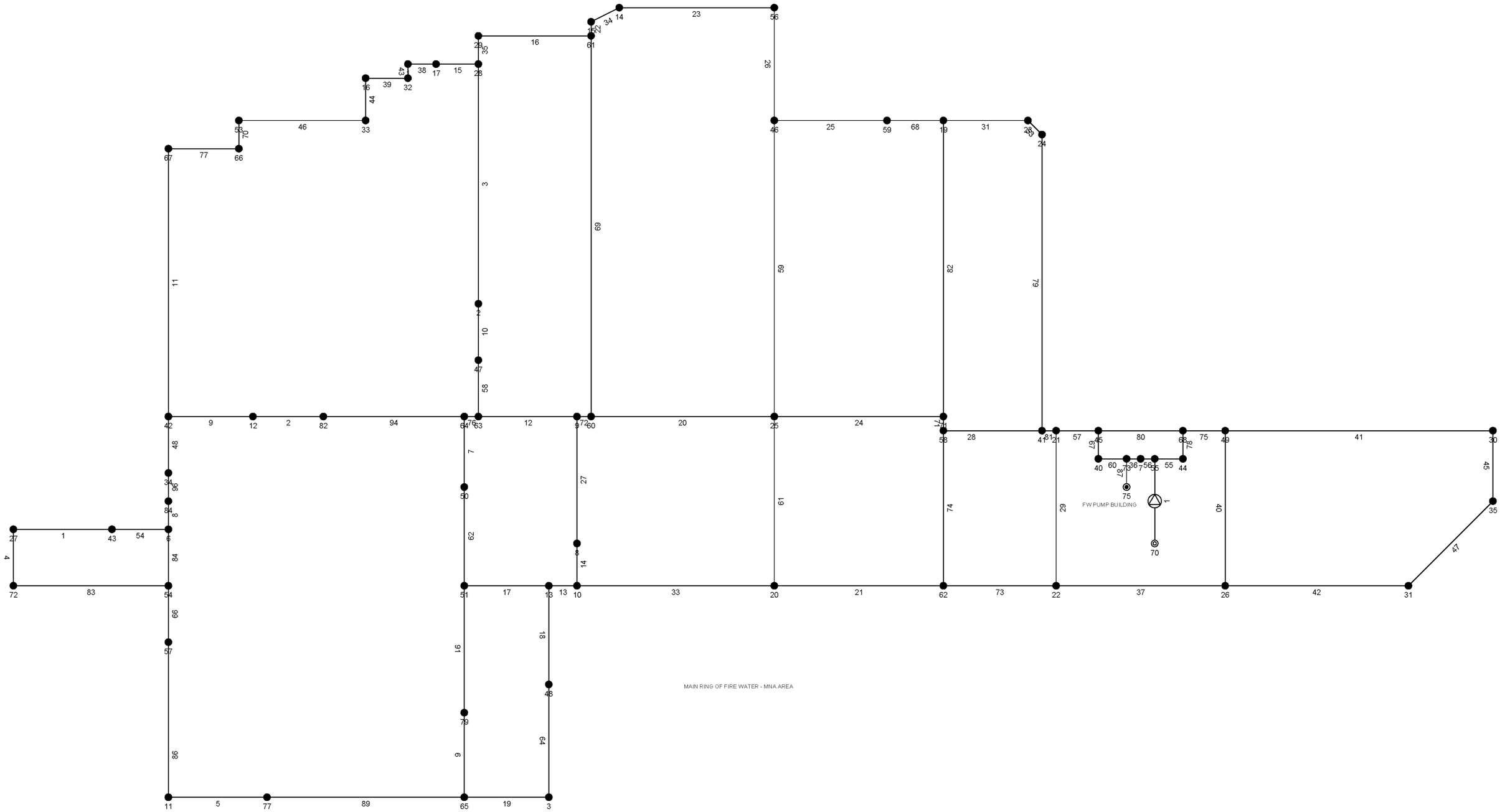
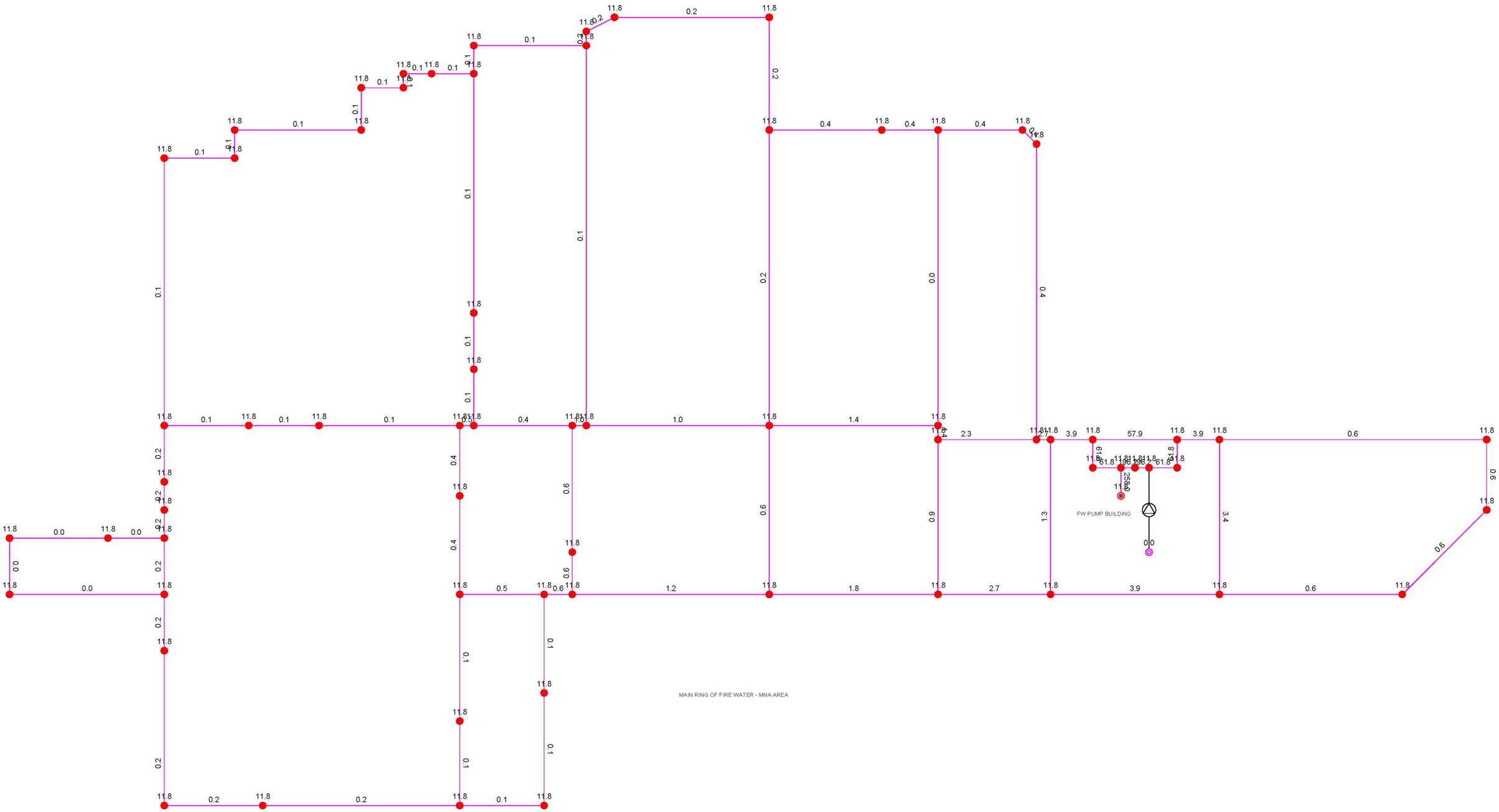
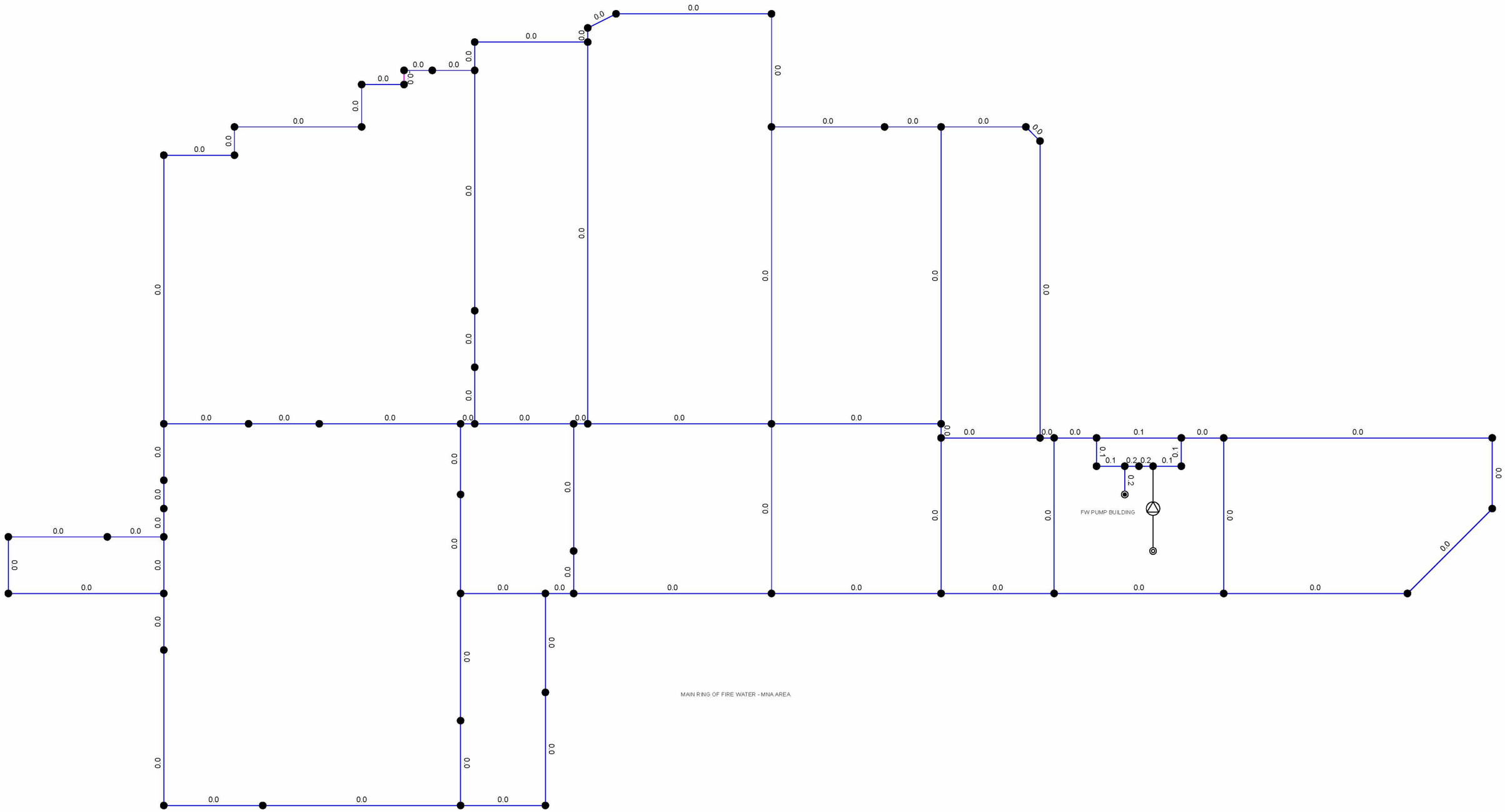


Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

082755C-000-CN-1901-0002-ATT-35_C



Proj.082755C - RDCG - MNA AREA			
PIPENET Schematic	Thursday, July 08, 2021		Page 1 of 1
Pressure (Bar G)	< 7.000000	< 7.500000	< 8.000000
	< 8.500000	< 9.000000	> 9.000000
Pipe vol. flow (m^3/h)	< 300.000000	< 600.000000	< 900.000000
	< 1200.000000	< 1400.000000	> 1400.000000



Proj.082755C - RDCG - MNA AREA		
PIPENET Schematic	Thursday, July 08, 2021	Page 1 of 1

Pipe velocity (m/sec)	< 0.000000	< 1.000000	< 2.000000
	< 3.000000	< 3.500000	> 3.500000

==========

PIPENET SPRAY/SPRINKLER MODULE

==========

VERSION 1.9.0

==========

Results for : Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

Licence Owner from key: Technip Italy spa

Licence Type: Network

Key number: Unavailable

MUS Date: 10/02/2022

==========

11:02 on 8-Jul-2021

LIST OF CONTENTS
==========

	Page
Control Information	1
Fluid System	1
Design Information	2
Pipe Configuration	4
Pump Configuration	8
Designed Diameters & Flowrates	9
Flow in Pipes	12
Flow through Pumps	14
Flow at Inlets	15
Flow at Outlets	16
Important Notice	17
Comments	18

CONTROL INFORMATION

```
   Convergence accuracy      = 0.20
   Maximum no. of iterations =   800
   Elevation Check Tolerance =     0.50 m
   Warnings Control Option   =     2
   ****** Diagnostic level   =     2
```

FLUID SYSTEM

```
   Fluid Class          =  1 (Liquid             )
   Density              =   998.2     kg/cu.m
   Viscosity            =  1.0000E-09 Pa.s
```

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

Design to NFPA Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at exit: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

Reinforced Fiber Gla
Not lined

Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)	Nom.Bore (in)	Act.Diam (in)	Max.Vel. (m/s)
0.7500	0.7500	3.5000						
1.0000	1.0000	3.5000						
1.2500	1.2500	3.5000						
1.5000	1.5000	3.5000						
2.0000	2.0000	3.5000						
2.5000	2.5000	3.5000						
3.0000	3.0000	3.5000						
3.5000	3.5000	3.5000						
4.0000	4.0000	3.5000						
5.0000	5.0000	3.5000						
6.0000	6.0000	3.5000						
8.0000	8.0000	3.5000						
10.0000	10.0000	3.5000						
12.0000	12.0000	3.5000						
14.0000	14.0000	3.5000						
16.0000	16.0000	3.5000						
18.0000	18.0000	3.5000						
20.0000	20.0000	3.5000						
24.0000	24.0000	3.5000						
28.0000	28.0000	3.5000						
30.0000	30.0000	3.5000						

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
1	43	27	14.00	43.00	0.000	150.0	0.000
2	12	82	20.00	30.00	0.000	150.0	0.000
3	2	28	20.00	82.00	0.000	150.0	0.000
4	27	72	14.00	56.00	0.000	150.0	23.95
5	77	11	20.00	60.00	0.000	150.0	17.50
6	79	65	20.00	50.00	0.000	150.0	0.000
7	50	64	20.00	40.00	0.000	150.0	45.60
8	6	84	20.00	28.00	0.000	150.0	0.000
9	42	12	20.00	46.00	0.000	150.0	0.000
10	47	2	20.00	31.00	0.000	150.0	0.000
11	42	67	18.00	90.00	0.000	150.0	40.99
12	63	9	20.00	41.00	0.000	150.0	0.000
13	10	13	20.00	10.00	0.000	150.0	0.000
14	10	8	20.00	44.00	0.000	150.0	0.000
15	17	28	18.00	23.00	0.000	150.0	0.000
16	29	61	12.00	52.00	0.000	150.0	12.44
17	13	51	20.00	43.00	0.000	150.0	45.60
18	13	48	16.00	41.00	0.000	150.0	35.92
19	3	65	16.00	43.00	0.000	150.0	35.92
20	60	25	20.00	104.0	0.000	150.0	0.000
21	62	20	20.00	89.00	0.000	150.0	0.000
22	61	15	12.00	5.000	0.000	150.0	5.987
23	14	56	12.00	97.00	0.000	150.0	0.000
24	25	71	20.00	89.00	0.000	150.0	0.000
25	46	59	14.00	58.00	0.000	150.0	0.000
26	56	46	12.00	22.00	0.000	150.0	12.44
27	8	9	20.00	86.00	0.000	150.0	45.60
28	58	41	20.00	59.00	0.000	150.0	0.000
29	22	21	14.00	119.0	0.000	150.0	61.72
31	19	23	14.00	38.00	0.000	150.0	6.909
33	20	10	20.00	115.0	0.000	150.0	45.60
34	15	14	12.00	11.00	0.000	150.0	5.987
35	28	29	12.00	19.00	0.000	150.0	27.63
36	7	73	24.00	9.000	0.000	150.0	55.27
37	26	22	20.00	96.00	0.000	150.0	0.000
38	1	17	18.00	23.00	0.000	150.0	15.66
39	16	32	18.00	17.00	0.000	150.0	15.66
40	49	26	20.00	119.0	0.000	150.0	91.19
41	49	30	12.00	156.0	0.000	150.0	12.44
42	31	26	12.00	121.0	0.000	150.0	0.000
43	1	32	18.00	8.000	0.000	150.0	15.66
44	33	16	18.00	26.00	0.000	150.0	15.66
45	30	35	12.00	47.00	0.000	150.0	5.987

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Length (m)	Elevation (m)	C Factor	Fitt.eq.lnth (m)
46	53	33	18.00	55.00	0.000	150.0	15.66
47	35	31	12.00	80.00	0.000	150.0	5.987
48	34	42	20.00	52.00	0.000	150.0	0.000
53	23	24	14.00	7.000	0.000	150.0	6.909
54	6	43	14.00	49.00	0.000	150.0	30.86
55	55	44	24.00	9.000	0.000	150.0	75.99
56	55	7	24.00	9.000	0.000	150.0	0.000
57	21	45	20.00	40.00	0.000	150.0	0.000
58	63	47	20.00	32.00	0.000	150.0	45.60
59	25	46	14.00	155.0	0.000	150.0	61.72
60	40	73	24.00	9.000	0.000	150.0	20.73
61	20	25	14.00	132.0	0.000	150.0	30.86
62	51	50	20.00	85.00	0.000	150.0	0.000
64	48	3	16.00	91.00	0.000	150.0	13.82
66	57	54	20.00	34.00	0.000	150.0	45.60
67	45	40	20.00	73.00	0.000	150.0	45.60
68	59	19	14.00	32.00	0.000	150.0	0.000
69	60	61	12.00	163.0	0.000	150.0	55.27
70	66	53	18.00	18.00	0.000	150.0	15.66
71	71	58	20.00	12.00	0.000	150.0	0.000
72	9	60	20.00	11.00	0.000	150.0	0.000
73	22	62	20.00	59.00	0.000	150.0	0.000
74	62	58	14.00	119.0	0.000	150.0	61.72
75	68	49	20.00	20.00	0.000	150.0	0.000
76	64	63	20.00	5.000	0.000	150.0	0.000
77	67	66	18.00	12.00	0.000	150.0	15.66
78	44	68	20.00	40.00	0.000	150.0	45.60
79	24	41	14.00	162.0	0.000	150.0	30.86
80	68	45	20.00	3.000	0.000	150.0	0.000
81	41	21	20.00	14.00	0.000	150.0	0.000
82	71	19	14.00	154.0	0.000	150.0	61.72
83	72	54	14.00	92.00	0.000	150.0	0.000
84	54	6	20.00	56.00	0.000	150.0	0.000
86	11	57	20.00	86.00	0.000	150.0	0.000
87	73	75	24.00	20.00	0.000	150.0	55.27
89	65	77	20.00	80.00	0.000	150.0	0.000
91	51	79	20.00	82.00	0.000	150.0	0.000
94	82	64	20.00	65.00	0.000	150.0	0.000
96	84	34	20.00	8.000	0.000	150.0	0.000

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)	Number x Type	Equivalent Length (m)
4	2 x 2	11.97		
5	1 x 2	17.50		
7	1 x 4	45.60		
11	1 x 4	40.99		
16	1 x 2	12.44		
17	1 x 4	45.60		
18	1 x 4	35.92		
19	1 x 4	35.92		
22	1 x 1	5.987		
26	1 x 2	12.44		
27	1 x 4	45.60		
29	2 x 4	30.86		
31	1 x 1	6.909		
33	1 x 4	45.60		
34	1 x 1	5.987		
35	1 x 4	27.63		
36	1 x 4	55.27		
38	1 x 2	15.66		
39	1 x 2	15.66		
40	2 x 4	45.60		
41	1 x 2	12.44		
43	1 x 2	15.66		
44	1 x 2	15.66		
45	1 x 1	5.987		
46	1 x 2	15.66		
47	1 x 1	5.987		
53	1 x 1	6.909		
54	1 x 4	30.86		
55	1 x 2	20.73	1 x 4	55.27
58	1 x 4	45.60		
59	2 x 4	30.86		
60	1 x 2	20.73		
61	1 x 4	30.86		
64	1 x 2	13.82		
66	1 x 4	45.60		
67	1 x 4	45.60		
69	2 x 4	27.63		
70	1 x 2	15.66		
74	2 x 4	30.86		
77	1 x 2	15.66		
78	1 x 4	45.60		
79	1 x 4	30.86		
82	2 x 4	30.86		

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (m)
87	1 x 4	55.27

Fitting types are :
1 -- 45 Deg Elbow
2 -- 90 Deg Standard Elbow
3 -- 90 Deg Long Radius Elbow
4 -- Tee or Cross (Flow Turned Thro 90 Deg)
5 -- Gate Valve
6 -- Swing Check Valve
7 -- Non-Return Valve
8 -- Ball Valve
9 -- Butterfly Valve

PUMP CONFIGURATION

Pump Label	Input Node	Output Node	Pump Descriptor	Coeffs. of Press Drop (bar) Cubic	Quadratic	Linear	Constant	Min flow (cu.m/hr)	Max flow (cu.m/hr)	ON	Sensor Type
1	70	55	86GA-01 A/B	-1.988E-09	3.773E-06	-4.519E-03	12.8	250.	1.600E+03	YES	None

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
1	43	27	0.0017	9	14.0000	14.0000	*
2	12	82	0.1254	9	20.0000	20.0000	*
3	2	28	0.0726	9	20.0000	20.0000	*
4	27	72	0.0017	9	14.0000	14.0000	*
5	77	11	0.2012	9	20.0000	20.0000	*
6	79	65	0.0630	9	20.0000	20.0000	*
7	50	64	0.3924	9	20.0000	20.0000	*
8	6	84	0.2012	9	20.0000	20.0000	*
9	42	12	0.1254	9	20.0000	20.0000	*
10	47	2	0.0726	9	20.0000	20.0000	*
11	42	67	0.0758	9	18.0000	18.0000	*
12	63	9	0.4452	9	20.0000	20.0000	*
13	10	13	0.5935	9	20.0000	20.0000	*
14	10	8	0.5900	9	20.0000	20.0000	*
15	17	28	0.0758	9	18.0000	18.0000	*
16	29	61	0.1483	9	12.0000	12.0000	*
17	13	51	0.4553	9	20.0000	20.0000	*
18	13	48	0.1382	9	16.0000	16.0000	*
19	3	65	0.1382	9	16.0000	16.0000	*
20	60	25	0.9616	9	20.0000	20.0000	*
21	62	20	1.8131	9	20.0000	20.0000	*
22	61	15	0.2219	9	12.0000	12.0000	*
23	14	56	0.2219	9	12.0000	12.0000	*
24	25	71	1.4112	9	20.0000	20.0000	*
25	46	59	0.4019	9	14.0000	14.0000	*
26	56	46	0.2219	9	12.0000	12.0000	*
27	8	9	0.5900	9	20.0000	20.0000	*
28	58	41	2.2725	9	20.0000	20.0000	*
29	22	21	1.2666	9	14.0000	14.0000	*
31	19	23	0.4082	9	14.0000	14.0000	*
33	20	10	1.1835	9	20.0000	20.0000	*
34	15	14	0.2219	9	12.0000	12.0000	*
35	28	29	0.1483	9	12.0000	12.0000	*
36	7	73	196.1945	9	24.0000	24.0000	*
37	26	22	3.9472	9	20.0000	20.0000	*
38	1	17	0.0758	9	18.0000	18.0000	*
39	16	32	0.0758	9	18.0000	18.0000	*
40	49	26	3.3749	9	20.0000	20.0000	*
41	49	30	0.5723	9	12.0000	12.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
42	31	26	0.5723	9	12.0000	12.0000	*
43	1	32	-0.0758	9	18.0000	18.0000	*
44	33	16	0.0758	9	18.0000	18.0000	*
45	30	35	0.5723	9	12.0000	12.0000	*
46	53	33	0.0758	9	18.0000	18.0000	*
47	35	31	0.5723	9	12.0000	12.0000	*
48	34	42	0.2012	9	20.0000	20.0000	*
53	23	24	0.4082	9	14.0000	14.0000	*
54	6	43	0.0017	9	14.0000	14.0000	*
55	55	44	61.8061	9	24.0000	24.0000	*
56	55	7	196.1945	9	24.0000	24.0000	*
57	21	45	3.9472	9	20.0000	20.0000	*
58	63	47	0.0726	9	20.0000	20.0000	*
59	25	46	0.1799	9	14.0000	14.0000	*
60	40	73	61.8061	9	24.0000	24.0000	*
61	20	25	0.6295	9	14.0000	14.0000	*
62	51	50	0.3924	9	20.0000	20.0000	*
64	48	3	0.1382	9	16.0000	16.0000	*
66	57	54	0.2012	9	20.0000	20.0000	*
67	45	40	61.8061	9	20.0000	20.0000	*
68	59	19	0.4019	9	14.0000	14.0000	*
69	60	61	0.0736	9	12.0000	12.0000	*
70	66	53	0.0758	9	18.0000	18.0000	*
71	71	58	1.4049	9	20.0000	20.0000	*
72	9	60	1.0352	9	20.0000	20.0000	*
73	22	62	2.6807	9	20.0000	20.0000	*
74	62	58	0.8676	9	14.0000	14.0000	*
75	68	49	3.9472	9	20.0000	20.0000	*
76	64	63	0.5178	9	20.0000	20.0000	*
77	67	66	0.0758	9	18.0000	18.0000	*
78	44	68	61.8061	9	20.0000	20.0000	*
79	24	41	0.4082	9	14.0000	14.0000	*
80	68	45	57.8589	9	20.0000	20.0000	*
81	41	21	2.6807	9	20.0000	20.0000	*
82	71	19	0.0063	9	14.0000	14.0000	*
83	72	54	0.0017	9	14.0000	14.0000	*
84	54	6	0.2029	9	20.0000	20.0000	*
86	11	57	0.2012	9	20.0000	20.0000	*
87	73	75	258.0006	9	24.0000	24.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (cu.m/hr)	Pipe Type	Act. Bore (in)	Nom. Size (in)	Pipe Group
89	65	77	0.2012	9	20.0000	20.0000	*
91	51	79	0.0630	9	20.0000	20.0000	*
94	82	64	0.1254	9	20.0000	20.0000	*
96	84	34	0.2012	9	20.0000	20.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(in)
9 -- Reinforced Fiber Gla	Not Lined	

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
1	43	27	14.00	11.81	11.81	0.000	0.000	1.7331E-03	4.8473E-06
2	12	82	20.00	11.81	11.81	0.000	0.000	0.1254	1.7191E-04
3	2	28	20.00	11.81	11.81	0.000	0.000	7.2567E-02	9.9453E-05
4	27	72	14.00	11.81	11.81	0.000	0.000	1.7331E-03	4.8473E-06
5	77	11	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
6	79	65	20.00	11.81	11.81	0.000	0.000	6.2996E-02	8.6337E-05
7	50	64	20.00	11.81	11.81	0.000	0.000	0.3924	5.3772E-04
8	6	84	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
9	42	12	20.00	11.81	11.81	0.000	0.000	0.1254	1.7191E-04
10	47	2	20.00	11.81	11.81	0.000	0.000	7.2567E-02	9.9453E-05
11	42	67	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
12	63	9	20.00	11.81	11.81	0.000	0.000	0.4452	6.1017E-04
13	10	13	20.00	11.81	11.81	0.000	0.000	0.5935	8.1346E-04
14	10	8	20.00	11.81	11.81	0.000	0.000	0.5900	8.0856E-04
15	17	28	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
16	29	61	12.00	11.81	11.81	0.000	0.000	0.1483	5.6469E-04
17	13	51	20.00	11.81	11.81	0.000	0.000	0.4553	6.2405E-04
18	13	48	16.00	11.81	11.81	0.000	0.000	0.1382	2.9595E-04
19	3	65	16.00	11.81	11.81	0.000	0.000	0.1382	2.9595E-04
20	60	25	20.00	11.81	11.81	0.000	0.000	0.9616	1.3178E-03
21	62	20	20.00	11.81	11.81	0.000	0.000	1.813	2.4848E-03
22	61	15	12.00	11.81	11.81	0.000	0.000	0.2219	8.4493E-04
23	14	56	12.00	11.81	11.81	0.000	0.000	0.2219	8.4493E-04
24	25	71	20.00	11.81	11.81	0.000	0.000	1.411	1.9340E-03
25	46	59	14.00	11.81	11.81	0.000	0.000	0.4019	1.1240E-03
26	56	46	12.00	11.81	11.81	0.000	0.000	0.2219	8.4493E-04
27	8	9	20.00	11.81	11.81	0.000	0.000	0.5900	8.0856E-04
28	58	41	20.00	11.81	11.81	0.000	0.000	2.272	3.1144E-03
29	22	21	14.00	11.81	11.81	0.000	0.000	1.267	3.5425E-03
31	19	23	14.00	11.81	11.81	0.000	0.000	0.4082	1.1417E-03
33	20	10	20.00	11.81	11.81	0.000	0.000	1.184	1.6220E-03
34	15	14	12.00	11.81	11.81	0.000	0.000	0.2219	8.4493E-04
35	28	29	12.00	11.81	11.81	0.000	0.000	0.1483	5.6469E-04
36	7	73	24.00	11.81	11.81	3.1662E-04	3.1662E-04	196.2	0.1867
37	26	22	20.00	11.81	11.81	0.000	0.000	3.947	5.4097E-03
38	1	17	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
39	16	32	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
40	49	26	20.00	11.81	11.81	2.8610E-06	0.000	3.375	4.6253E-03
41	49	30	12.00	11.81	11.81	0.000	0.000	0.5723	2.1788E-03
42	31	26	12.00	11.81	11.81	2.8610E-06	0.000	0.5723	2.1788E-03
43	1	32	18.00	11.81	11.81	0.000	0.000	-7.5764E-02	-1.2819E-04

FLOW IN PIPES

Pipe Label	Input Node	Output Node	Nom.Bore (in)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (cu.m/hr)	Velocity (m/s)
44	33	16	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
45	30	35	12.00	11.81	11.81	0.000	0.000	0.5723	2.1788E-03
46	53	33	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
47	35	31	12.00	11.81	11.81	0.000	0.000	0.5723	2.1788E-03
48	34	42	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
53	23	24	14.00	11.81	11.81	0.000	0.000	0.4082	1.1417E-03
54	6	43	14.00	11.81	11.81	0.000	0.000	1.7331E-03	4.8473E-06
55	55	44	24.00	11.81	11.81	5.0545E-05	5.0545E-05	61.81	5.8823E-02
56	55	7	24.00	11.81	11.81	4.5776E-05	4.5776E-05	196.2	0.1867
57	21	45	20.00	11.81	11.81	0.000	0.000	3.947	5.4097E-03
58	63	47	20.00	11.81	11.81	0.000	0.000	7.2567E-02	9.9453E-05
59	25	46	14.00	11.81	11.81	0.000	0.000	0.1799	5.0325E-04
60	40	73	24.00	11.81	11.81	1.7166E-05	1.7166E-05	61.81	5.8823E-02
61	20	25	14.00	11.81	11.81	0.000	0.000	0.6295	1.7608E-03
62	51	50	20.00	11.81	11.81	0.000	0.000	0.3924	5.3772E-04
64	48	3	16.00	11.81	11.81	0.000	0.000	0.1382	2.9595E-04
66	57	54	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
67	45	40	20.00	11.81	11.81	1.6975E-04	1.6975E-04	61.81	8.4705E-02
68	59	19	14.00	11.81	11.81	0.000	0.000	0.4019	1.1240E-03
69	60	61	12.00	11.81	11.81	0.000	0.000	7.3613E-02	2.8024E-04
70	66	53	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
71	71	58	20.00	11.81	11.81	0.000	0.000	1.405	1.9254E-03
72	9	60	20.00	11.81	11.81	0.000	0.000	1.035	1.4187E-03
73	22	62	20.00	11.81	11.81	0.000	0.000	2.681	3.6739E-03
74	62	58	14.00	11.81	11.81	0.000	0.000	0.8676	2.4266E-03
75	68	49	20.00	11.81	11.81	0.000	0.000	3.947	5.4097E-03
76	64	63	20.00	11.81	11.81	0.000	0.000	0.5178	7.0963E-04
77	67	66	18.00	11.81	11.81	0.000	0.000	7.5764E-02	1.2819E-04
78	44	68	20.00	11.81	11.81	1.2207E-04	1.2207E-04	61.81	8.4705E-02
79	24	41	14.00	11.81	11.81	0.000	0.000	0.4082	1.1417E-03
80	68	45	20.00	11.81	11.81	2.8610E-06	0.000	57.86	7.9296E-02
81	41	21	20.00	11.81	11.81	0.000	0.000	2.681	3.6739E-03
82	71	19	14.00	11.81	11.81	0.000	0.000	6.3173E-03	1.7669E-05
83	72	54	14.00	11.81	11.81	0.000	0.000	1.7331E-03	4.8473E-06
84	54	6	20.00	11.81	11.81	0.000	0.000	0.2029	2.7812E-04
86	11	57	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
87	73	75	24.00	11.81	11.81	6.2084E-04	6.2084E-04	258.0	0.2455
89	65	77	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04
91	51	79	20.00	11.81	11.81	0.000	0.000	6.2996E-02	8.6337E-05
94	82	64	20.00	11.81	11.81	0.000	0.000	0.1254	1.7191E-04
96	84	34	20.00	11.81	11.81	0.000	0.000	0.2012	2.7574E-04

FLOW THROUGH PUMPS

Pump	Flowrate (cu.m/hr)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (m)	Cavitation Parameter	Power Req. (W)	Setting (%)
1	258.0	0.000	11.81	11.81	10.17	8.4299E-02	8.4639E+04	100.0

Note: The calculation of NPSHA and cavitation parameter is based on
the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)		Flowrate (cu.m/hr)	Equivalent K-factor (cu.m/hr , bar G)
70	0.000	*	258.0	0.0000

Note: A * after a value indicates that this is a specification

FLOW AT OUTLETS

Outlet Node	Pressure (bar G)	Flowrate (cu.m/hr)		Equivalent K-factor (cu.m/hr , bar G)
75	11.81	258.0	*	75.078

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

COMMENTS

Analysis Converged in 2 Iterations

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Proj.082755C - RDCG - MNA AREA
GENERAL FIRE WATER MAIN NETWORK
HYDRAULIC CALCULATION REPORT
CALCULATION NUMBER:

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