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Gela - Malta Project

April 2009

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- Basis and Criteria of the Study
 - Results
 - Budgetary Estimate Summary



SUMMARY OF THE STUDY

- The study represents an updating of a previous evaluation performed in 2002 and is based on the following requirements:
 - Malta shore approach at Delimara,
 - Export pressure = 54 barg
 - Minimum delivery pressure = 39 barg,
 - Flowrate scenario:
 - Max Peak = 106570 Sm³/h
- The hydraulic study performed according to the same approach adopted in 2002 leads to the definition of the following pipeline diameter
 - OD = 18"
- The expected accuracy of the estimate is $\pm 20\%$



- **Basic Data**



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Gas Composition and Characteristics

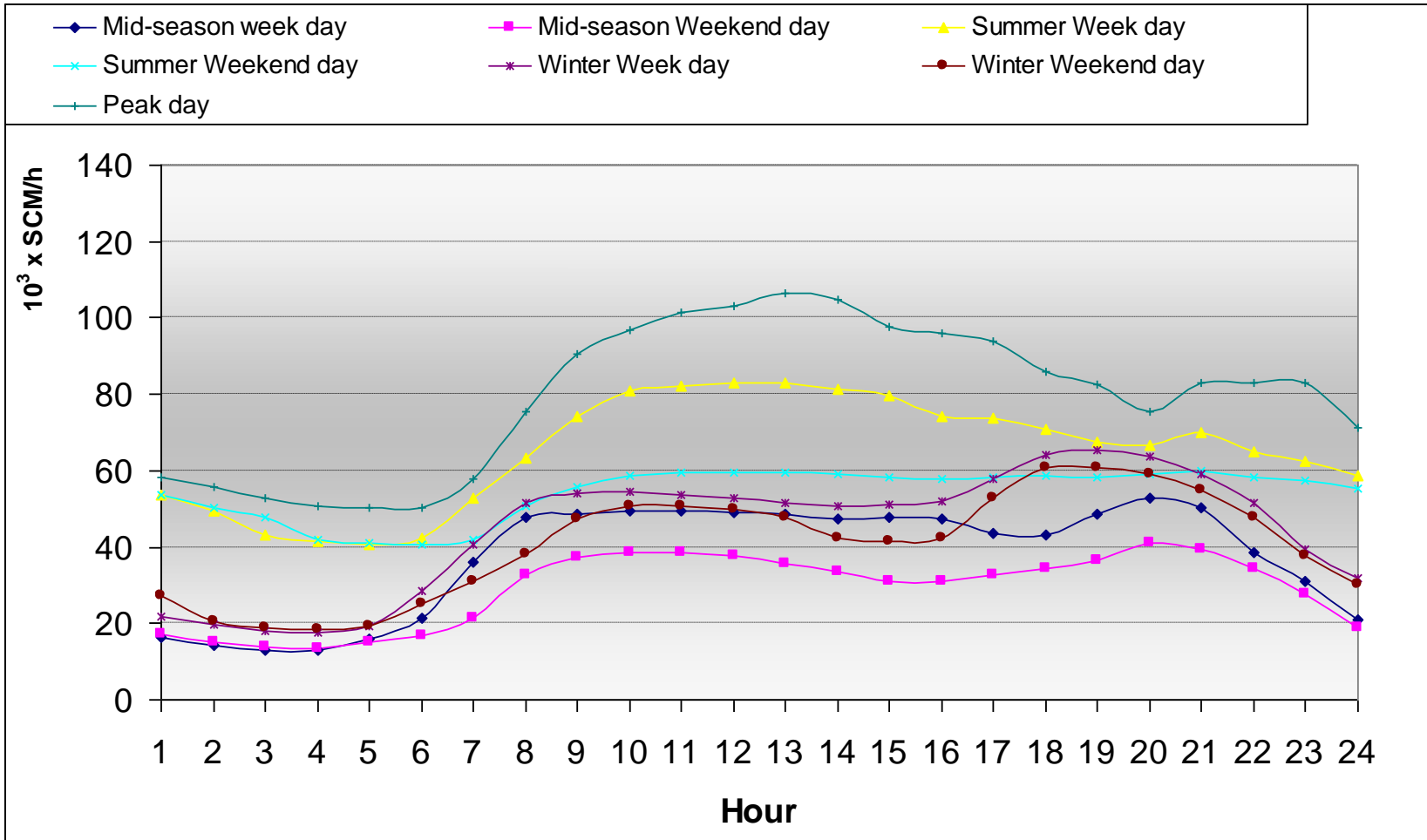
Gas Composition	
Component	Mol%
Methane	86.7854
Ethane	6.2315
Propane	1.4872
i-Butane	0.2707
n-Butane	0.4140
i-Pentane	0.1305
n-Pentane	0.1080
Exane	0.0375
Eptane	0.0053
Nitrogen	4.1520
Carbon Dioxide	0.3711
Water	0.0068
Total	100.0000

Gas Characteristic @ STD Conditions: 1.013bar, 15°C	Value
Gas Molecular Weight (kg/kmol)	18.39
Gas Density (kg/m ³)	0.779

Equation of State = PR Peneloux



Malta Required Flowrate



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Pipeline Data

Pipeline characteristics	
Pipe Material	Steel Grade API 5L-X65
SMYS	450 MPa
SMTS	535 MPa
Steel Density	7850 kg/m ³
Young Modulus	207000 MPa
Poisson Ratio	0.3
Coefficient Of thermal Expansion	1.16 x 10 ⁻⁵ °C ⁻¹
Sea Water Density	1026 kg/m ³
Concrete Density	3040 kg/m ³
Corrosion Coating Density	1300 kg/m ³
Corrosion Coating Thickness	2.5 mm
Corrosion Allowance	0 mm
Out of roundness	1.5% OD but maximum 15 mm
Thickness tolerance	±0.75 mm for t ≤ 15 mm ±1.00 mm for t > 15 mm



Soil Data

KP	KP	SOIL GELA-MALTA	γ	ϕ	Dr	Su	D₅₀
From	To		kN/m³	Deg.	%	kN/m²	mm
0	4.4	Fine SAND with occasion Shell becoming medium toward coast	9	44	85-100	--	0.09-0.16 0.7 (max.)
4.4	7.9	Silty Fine SAND with Occasional Shell. Possible Presence of clayey SAND.	9	32	35-65	--	0.07-0.1
7.9	10.2	Very Soft Silty CLAY with Occasional Shell	7.5	--	--	2	0.009-0.013
10.2	21.2	Very Soft Silty CLAY	4.5-5.5	--	--	2-4	<0.002
21.2	36	Very Soft Silty/Sandy CLAY. Occasional presence of Shell Fragments.	7	--	--	8-10	0.01-0.03
36	51	Very Soft Silty CLAY. Occasionally some intrusions of sandy CLAY,	5.5*	--	--	6*	0.003
51	95	Very Soft Sandy CLAY, containing some shell fragments	8.0*	--	--	8-15*	0.01-0.04
95	115	Very Soft Silty/Sandy CLAY at top, changing in fine SAND in depth.	4.0*			1-2*	<0.002
			8.5*	40*	50-65*		<0.074
115	136	Fine to Medium SAND with Occasional Shells. Possible intercalation of Clay and Silt.	8.5*	36-44*	60-100*	--	0.06-0.2*
136	145	Fine SAND with high content of Shells, concretions and corals.	9.0*	40-44*	80-100*	--	0.09-0.16 0.7 (max.)*
145	148	Fine to Medium SAND with high content of shells/corals fragment.	8.5*	36-44*	60-100*	--	0.06-0.2*
148	LTE	Gravelly SAND. High Probability of Rock Outcrops.	7.0-8.5*	30-36*	35-65*	--	gas & power



Hydraulic Analysis - Inlet and Delivery Gas Conditions

Gas Condition	Value
Inlet Gas Pressure (barg)	54
Inlet Gas Temperature (°C)	18
Delivery Gas Pressure (barg)	≥39
Delivery Gas Temperature (°C)	As per result of the hydraulic simulations, in peak day conditions



Hydraulic Analysis – Data Input

Pipe and Soil data:

Steel grade: X65

Pipe internal roughness: 25 microns

Corrosion Coating Thickness: 2.5 mm.

	Pipeline Material Thermal Conductivity
	W/m K
Steel	50
Corrosion Coating (PE)	0.3
Overweight Concrete	2.33

	Soil Thermal Conductivity
	W/m K
Wet Sand	2
Dry Sand at Gela	1
Dry Sand at Malta	1.5



Hydraulic Analysis – Data Input

Pipeline Burial Configuration:

The pipeline is assumed buried in the onshore sections and in the coastal areas (i.e. for $WD < 30\text{m}$ at Gela side and for $WD < 35\text{-}40\text{m}$ at Malta side). The pipeline is considered unburied in the deep water.

	Pipeline Burial Depth (from the pipeline top)
	m
Onshore Sections	1.5
Offshore Sections	1



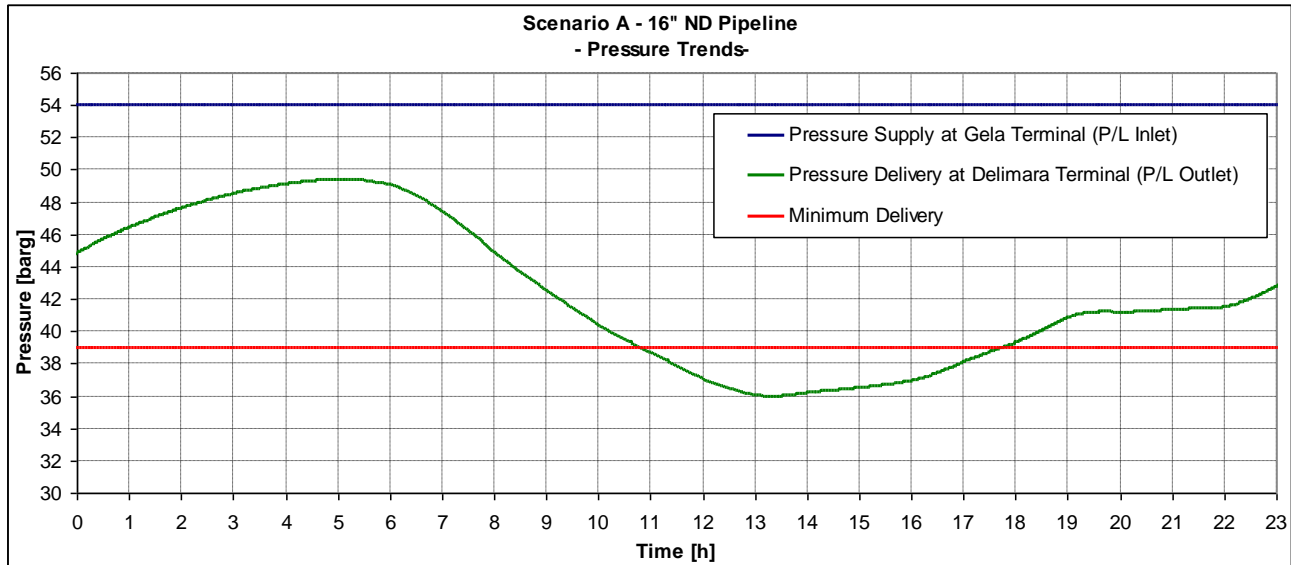
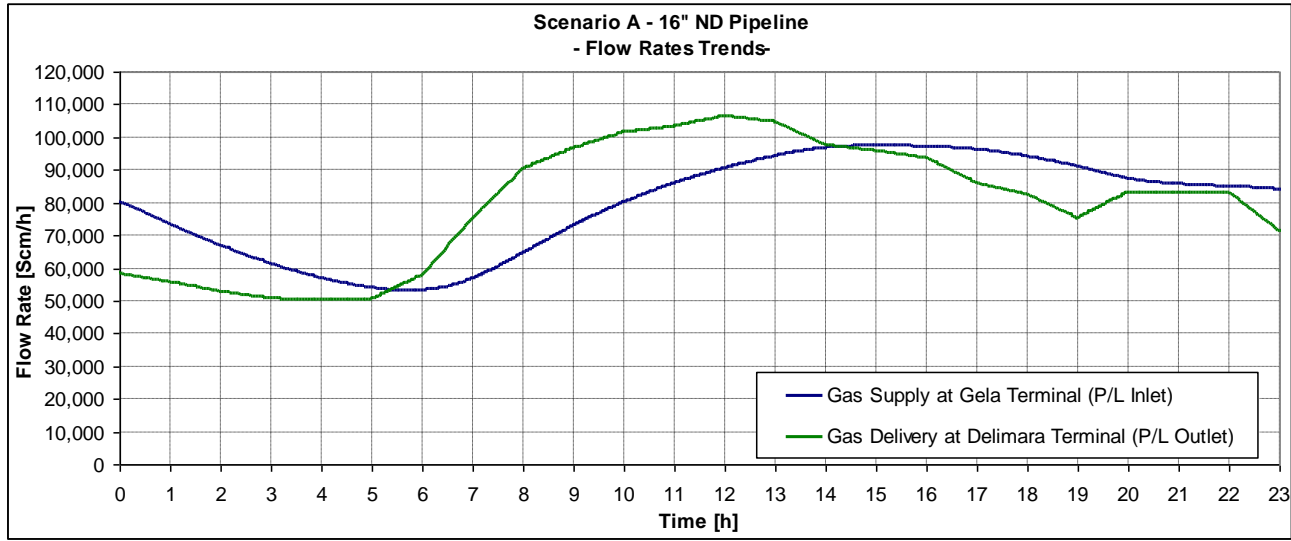
■ Results



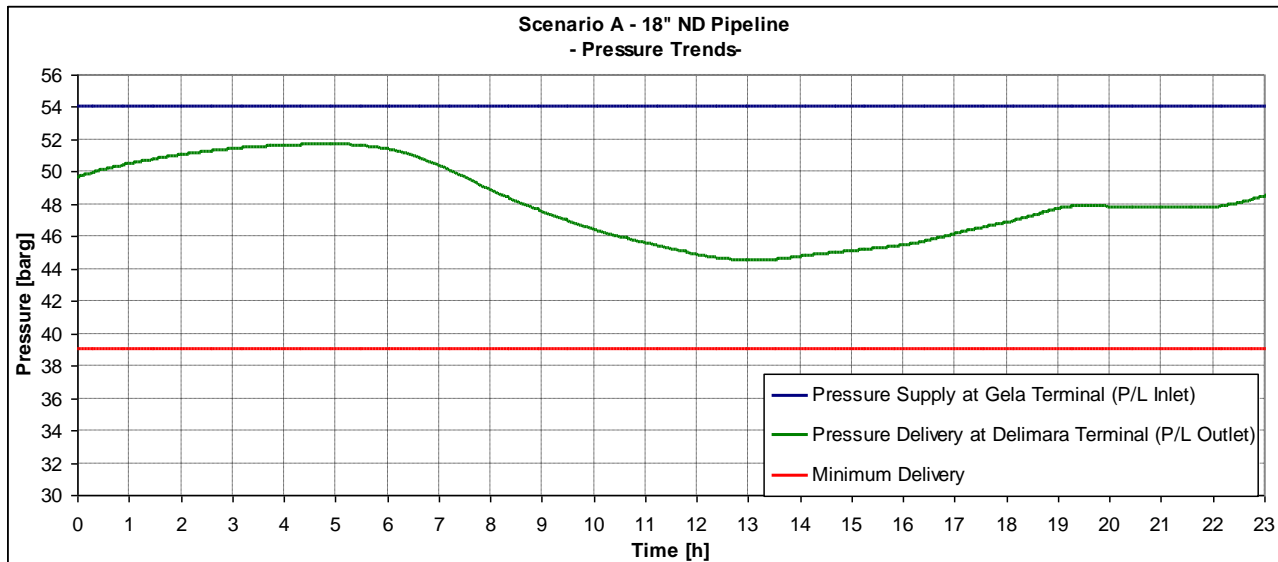
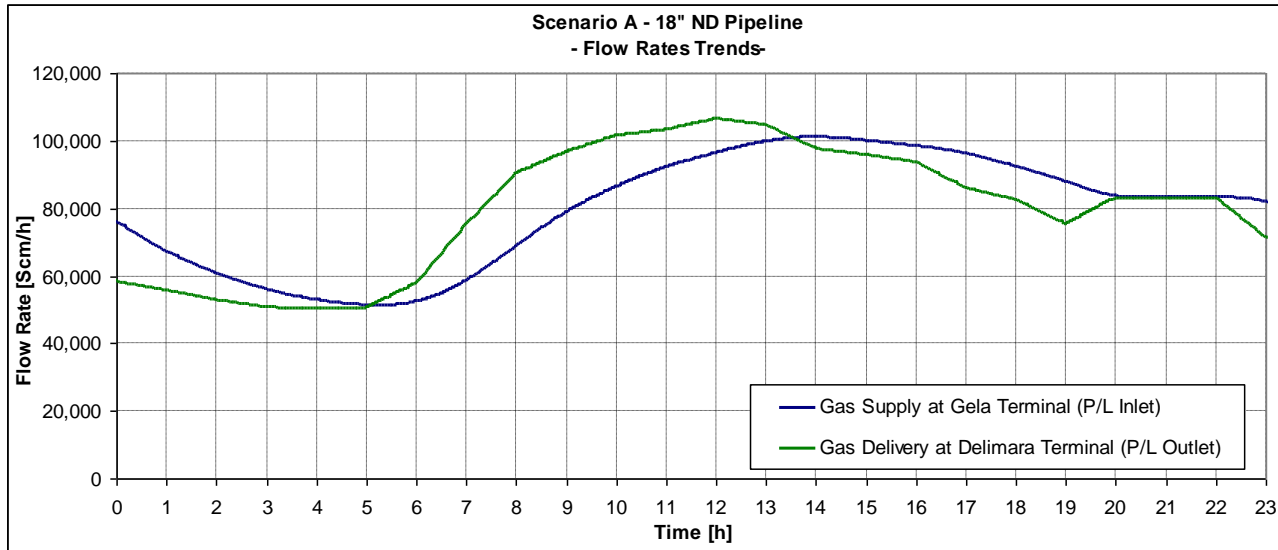
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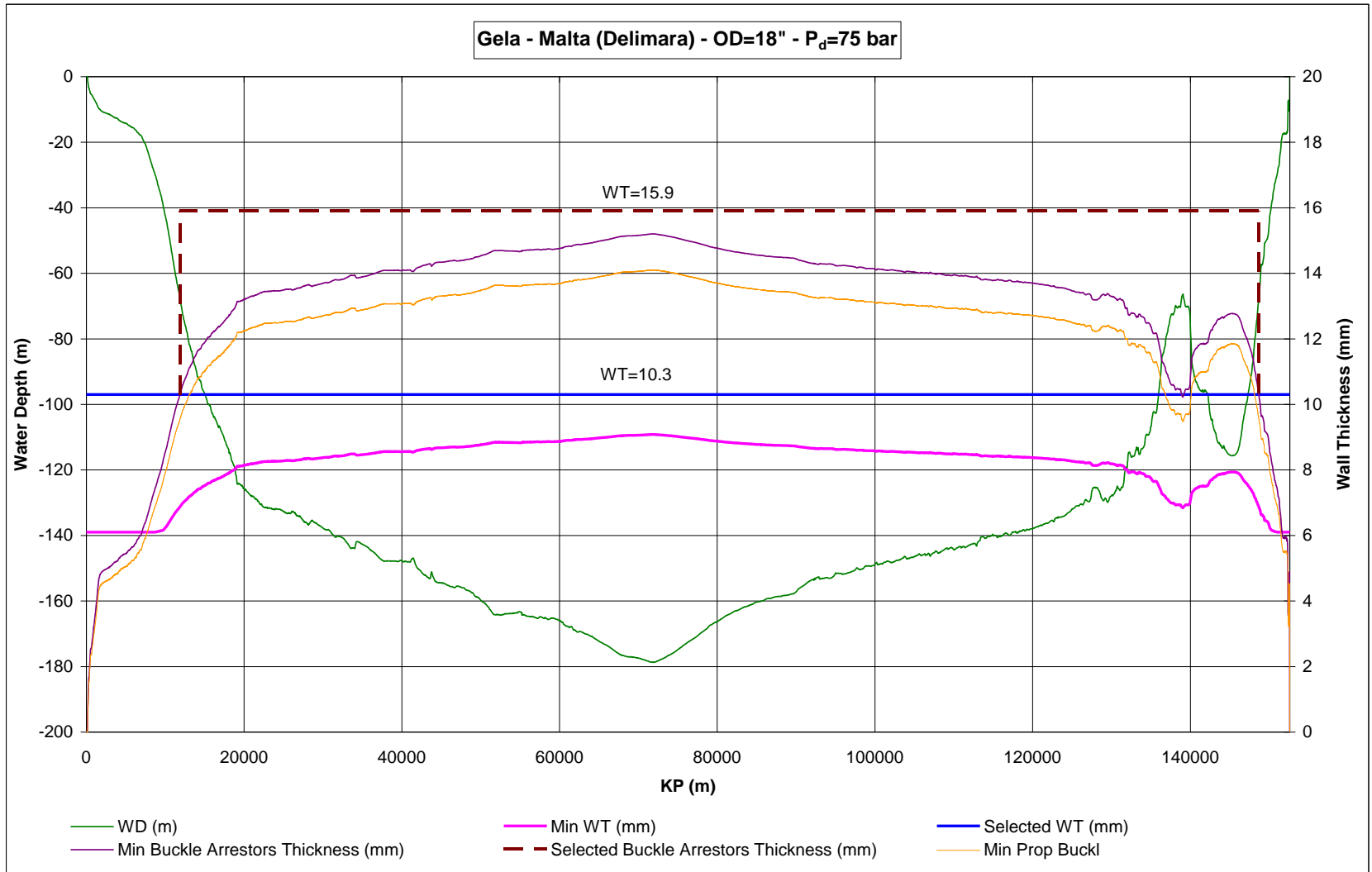
Scenario 16" OD Pipeline Gela – Malta (Delimara): Process Analyses Results



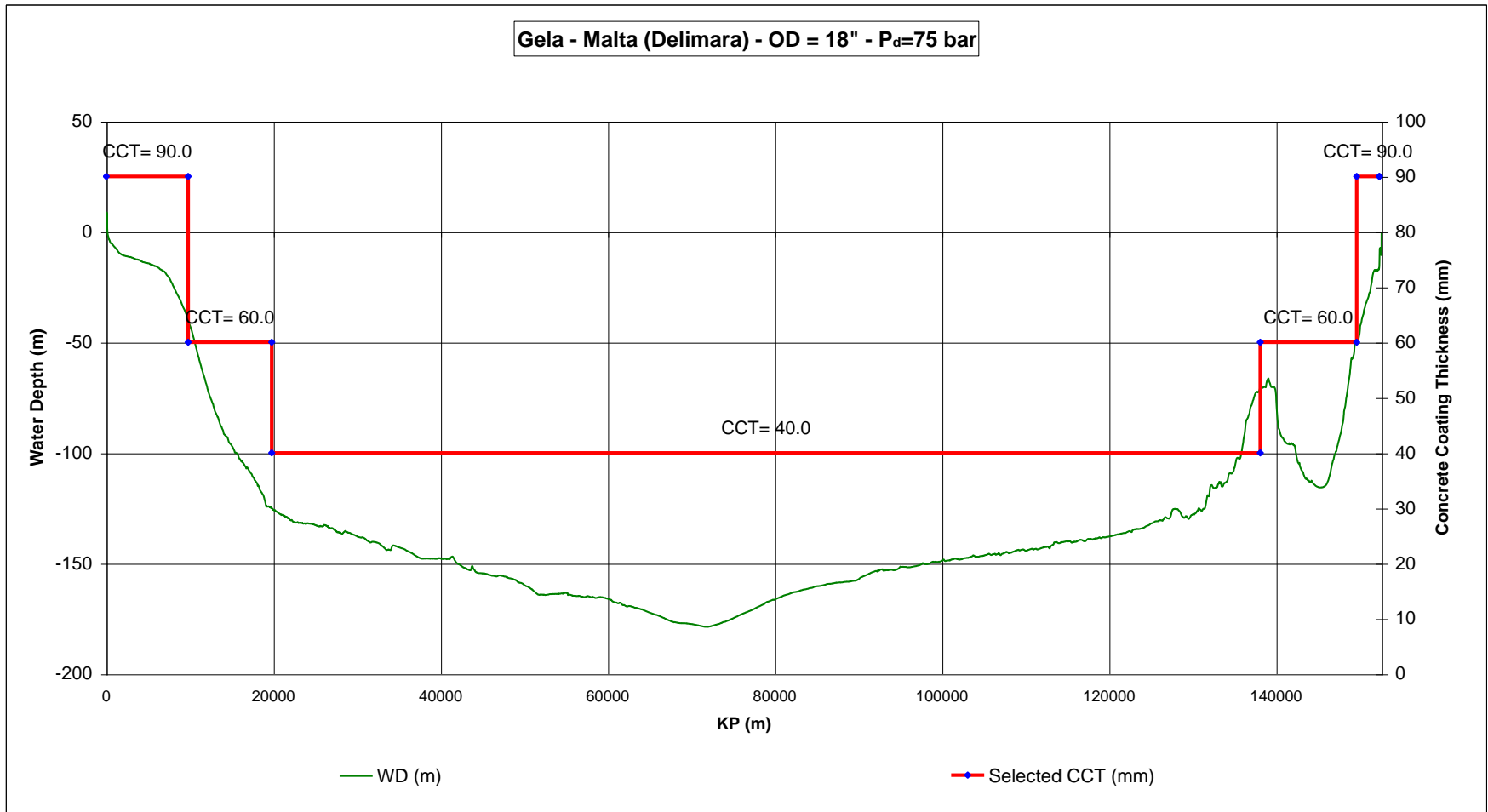
Scenario 18" OD Pipeline Gela – Malta (Delimara): Process Analyses Results



Scenario 18" OD Pipeline Gela – Malta (Delimara): Wall Thickness Analyses Results



Scenario 18" OD Pipeline Gela – Malta (Delimara): On Bottom Stability and Layability Analyses Results



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- **Budgetary
Estimates**



Budgetary Estimates - CAPEX

CAPITAL COSTS		Scenario
		OD = 18"
Lenght (km)		154.0
Steel Weight (Kton)		17.763
Inch		18
Management and Design	Meuro	15
Materials	Meuro	53
Construction	Meuro	138
TOTAL	Meuro	206



Budgetary Estimates - OPEX

OPERATING COST		Scenario
		OD = 18"
Periodical cost for Pipelines and Shore approaches Surveys (Every two year operations)	Meuro	2.2
Periodical cost for Internal Line Inspection (Every seven years operations)	Meuro	1.4
TOTAL per year	Meuro/year	1.3



Budgetary Estimates Notes

The budgetary cost estimate has been evaluated in Euro on the basis of in house data bank. Particularly, the following cost for procurement of steel pipeline have been considered:

2,000 Euro/ton



Budgetary Estimates Exclusions

Main exclusions from the budgetary estimate:

- Capital taxes, import duties and levies
- Owner costs, taxes, etc.
- Paid interests and/or financial charges
- Financial arrangements, bonds, guarantees, cash flow burning and similar
- Taxes, duties, fees, VAT, etc. of any nature
- Costs associated with the Builder All Risk (BAR), Third Party Liability (TPL) or other related Project Insurances including Insurances during the operation period
- Land acquisition and Right of Way
- All permits and licences including special Project environmental protection arrangements
- Certification
- Any extraordinary intervention on pipelines and plants.
- Weather Down-Time or Weather Stand-By

