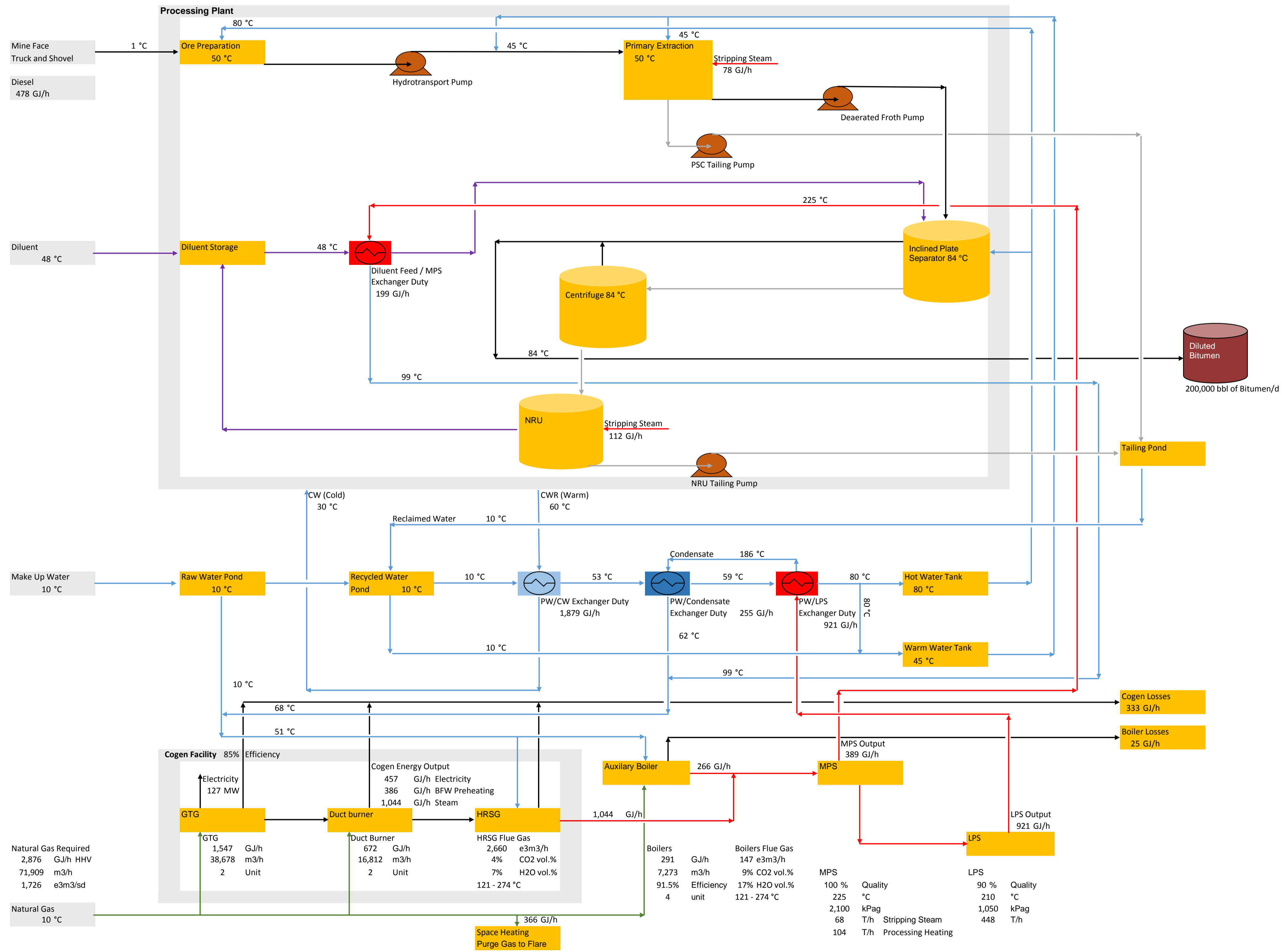


COSIA Mining & Extraction: High Grade - Naphthenic Froth Treatment - Energy Flow

Ore Grade 12 wt%
 Fine Contents 11.7 wt%
 Waste to Ore 4.3 wt%



Legend	
Bitumen	
Water	
Steam	
Fuel gas	
Diluent	
Tailing	

Abbreviations	
BFW	Boiler Feed Water
CW	Cooling Water
CWR	Cooling Water Return
GTG	Gas Turbine Generator
HHV	High Heating Value
HRSG	Heat Recovery Steam Generator
LPS	Low Pressure Steam
MPS	Medium Pressure Steam
NRU	Naphtha Recovery Unit
PSC	Primary Separation Cell
PW	Process Water

Energy Output Summary		
	Input (GJ/h)	Output (GJ/h)
Cogen	1,547	457
	672	386
		1,044
		333
Subtotal - Cogen	2,220	2,220
Boilers	291	266
		25
Subtotal - Boilers	291	291
Total	2,511	2,511

Flue Gas		
Natural Gas HHV	40	MJ/m ³
Excess air @ 13% O ₂ in Cogen	179%	%
Excess O ₂	13%	%
Cogen Flue Gas	2,660	e3m ³ /h
CO ₂ in Flue Gas from Cogen	4%	vol.%
H ₂ O in Flue Gas from Cogen	7%	vol.%
Boiler Flue Gas	147	e3m ³ /h
CO ₂ in Flue Gas from Boilers	9%	vol.%
H ₂ O in Flue Gas from Boilers	17%	vol.%
Flue Gas Temperature - Acid Dew Point Limit	121	°C
Flue Gas - Max. without Economizer	274	°C

Exchanger	
	Duty (GJ/h)
Process Water / Cooling Water	1,879
Process Water / Condensate	255
Process Water / LPS	921
Diluent Feed / MPS	199

Energy Consumption Summary		
	GJ/h	e3m ³ /d
Natural Gas	1,547	928
	672	403
	366	220
	291	175
Diesel	478	0.3
Energy Intensity (GJ / bbl bitumen produced)	0.40	GJ/bbl
Electricity Generated	3,044	MWH/d
Electricity Consumed	3,600	MWH/d

GHG Emissions Summary		
Stationary Combustion & Flaring	3,329	t CO ₂ e/d
Mobile Equipment	827	t CO ₂ e/d
Fugitive Mine	0.0001 - 0.0150	kg CO ₂ e/m ² /d
Fugitive Pond	0.0119 - 0.8054	kg CO ₂ e/m ² /d
Total Cogen Emissions (Gt)	2,569	t CO₂e/d
Deemed emissions from Heat by Cogen (D _h)	2,069	t CO ₂ e/d
Deemed emissions from electricity by Cogen (D _e)	500	t CO ₂ e/d

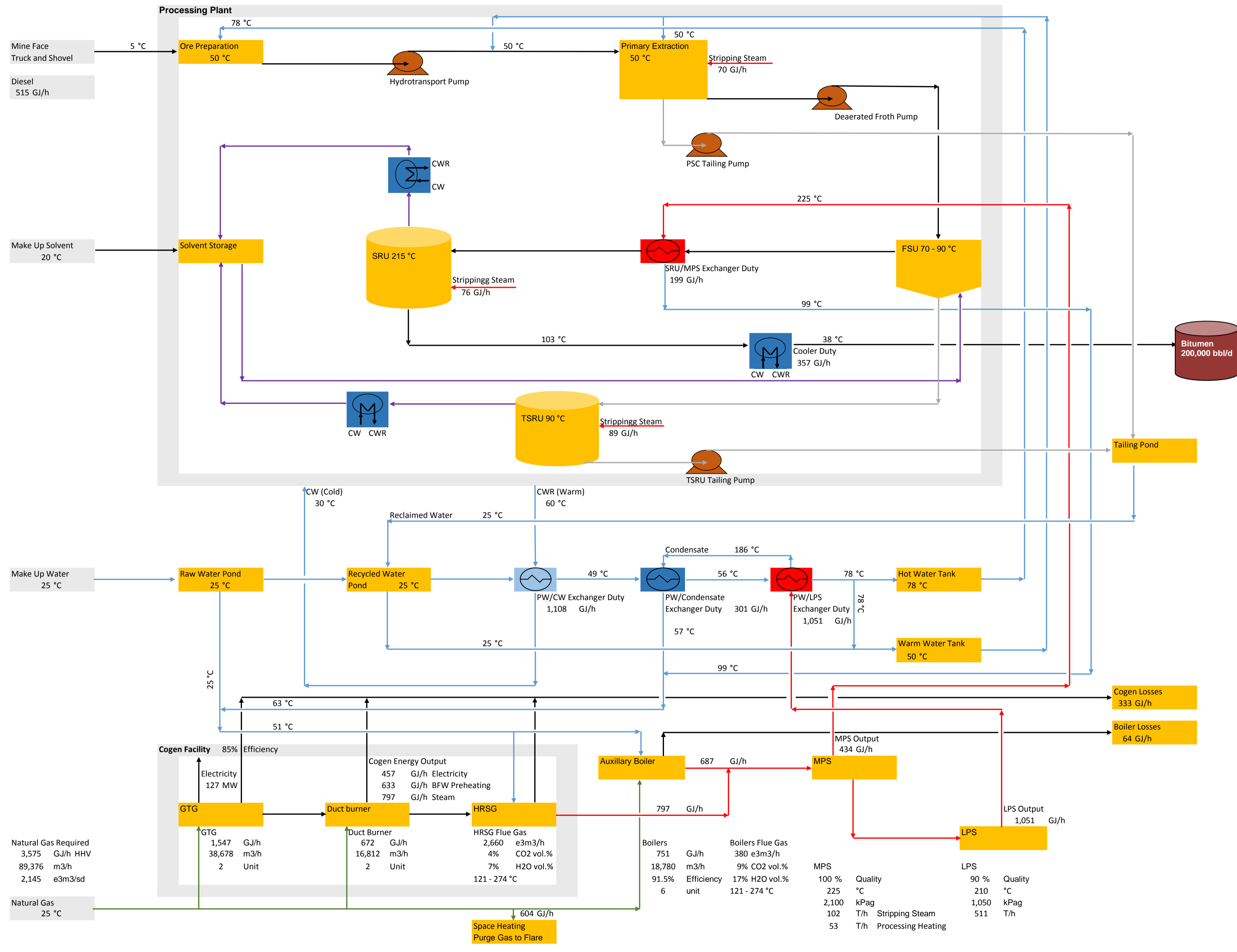
Project:	Static Reference Oil Sands Mine and Extraction Reference Facility	
Case:	Naphthenic - High Grade	Revision: v 1.6
Owner:	COSIA	
Date:	04-Oct-15	
Energy / Heat Flow	High Temperature Extraction, High Grade, Average Condition	

This is a generic and hypothetical mine and extraction facility developed by COSIA. While representative, it is not based on any one facility. Recovery and solvent loss is based on Alberta Energy Regulator requirements.



COSIA Mining & Extraction: High Grade - Paraffinic Froth Treatment - Energy Flow

Ore Grade 12 wt%
 Fine Contents 11.9 wt%
 Waste to Ore 4.3 wt%



Legend	
Bitumen	
Water	
Steam	
Fuel gas	
Solvent	
Tailing	

Abbreviations	
BFW	Boiler Feed Water
CW	Cooling Water
CWR	Cooling Water Return
FSU	Froth Settling Unit
GTG	Gas Turbine Generator
HHV	High Heating Value
HRSG	Heat Recovery Steam Generator
LPS	Low Pressure Steam
MPS	Medium Pressure Steam
PSC	Primary Separation Cell
PW	Process Water
SRU	Solvent Recovery Unit
TSRU	Tailing Solvent Recovery Unit

Energy Output Summary				
	Input (GJ/h)	Output (GJ/h)		
Cogen	GTG	1,547	Electricity	457
	HRSG	672	BFW Preheating	633
			Steam	797
			Cogen Losses	333
Subtotal - Cogen	2,220		2,220	
Boilers			Steam	687
			Boiler Losses	64
Subtotal - Boilers	751		751	
Total	2,971		2,971	

Flue Gas - Based on Stoichiometric Combustion			
Natural Gas HHV	40	MJ/m ³	
Excess air @ 13% O ₂	179	%	
Excess O ₂	13	%	
Cogen Flue Gas	2,660	e3m ³ /h	
CO ₂ in Flue Gas from Cogen	4%	vol.%	
H ₂ O in Flue Gas from Cogen	7%	vol.%	
Boiler Flue Gas	380	e3m ³ /h	
CO ₂ in Flue Gas from Boilers	9%	vol.%	
H ₂ O in Flue Gas from Boilers	17%	vol.%	
Flue Gas Temperature - Acid Dew Point Limit	121	°C	
Flue Gas - Max. without Economizer	274	°C	

Exchanger & Cooler		Duty (GJ/h)
Process Water / Cooling Water		1,108
Process Water / Condensate		301
Process Water / LPS		1,051
SRU Feed / MPS		199
Cooler		357

Energy Consumption Summary			
	GJ/h	e3m ³ /d	
Natural Gas	GTG	1,547	928
	HRSG	672	403
	Building Heating and Flare	704	363
	Boilers	651	451
Diesel	515	0.3	
Energy Intensity (GJ per bbl of bitumen produced)	0.49	GJ/bbl	
Electricity Generated	3,044	MWH/d	
Electricity Consumed	3,142	MWH/d	

GHG Emissions Summary			
Stationary Combustion & Flaring	4,137	t CO ₂ e/d	
Mobile Equipment	892	t CO ₂ e/d	
Fugitive Mine	0.0001 - 0.0150	kg CO ₂ e/m ² /d	
Fugitive Pond	0.0007 - 0.0201	kg CO ₂ e/m ² /d	
Total Cogen Emissions (Gt)	2,569	t CO₂e/d	
Deemed emissions from Heat by Cogen (D ₁)	2,069	t CO ₂ e/d	
Deemed emissions from electricity by Cogen (D ₂)	500	t CO ₂ e/d	

Project:	Static Oil Sands Mine and Extraction Reference Facility		
Case:	Paraffinic - High Grade	Revision:	v 2.3.9
Owner:	COSIA		
Date:	04-Oct-15		
Energy / Heat Flow	High Temperature Extraction, High Grade, Summer Condition		

This is a generic and hypothetical mine and extraction facility developed by COSIA. While representative, it is not based on any one facility. Recovery and solvent loss is based on Alberta Energy Regulator requirements.

