2.0 NGL AND THEIR EXTRACTION ON THE INTEGRATED ALBERTA SYSTEM

2.1 Introduction

This section provides a description of NGL Components entrained in Gas[1] delivered to the Integrated Alberta System, the Extraction Plants connected to the System for the purpose of extracting NGL, and the value that is obtained through the extraction and sale of NGL Components.

2.2 NGL

Gas received onto the Alberta System is predominantly comprised of methane. However, Gas also normally contains varying quantities of other hydrocarbons, including ethane, propane, butane and pentanes plus; the last of which is also referred to as condensate. These components are often referred to by names related to their chemical formulae reflecting the number of carbon molecules in each component: C2 (ethane; formally C_2H_6), C3 (propane; C_3H_8), C4 (butane; C_4H_{10}) and C5+ (pentanes plus or condensate). Pentanes plus refers to a mix of heavier NGL hydrocarbons including C5, C6, C7 and heavier components.

Because these compounds may be extracted from Gas by condensation processes and are subsequently stored and transported in liquid state, as a group they are often referred to as NGL.

Common uses of NGL are as follows:

- Ethane is consumed almost entirely by the Alberta petrochemical industry to produce ethylene, polyethylene and other derivatives.
- Propane is most commonly used for space heating in rural/remote locations and for agricultural crop drying and other industrial purposes. Propane is transported across Canada and into the Northern United States (US).

[1] The definition of Gas is as per NGTL Tariff amendments included in Appendix 1 of this Application.

- Butane is used as a refinery feedstock in local and export markets or as a diluent (within the WCSB) when blended with heavy crude to reduce viscosity for transportation in pipelines.
- Condensate is used almost exclusively within the WCSB as a diluent.

Some of these components may be partially recovered or extracted at facilities located in or near the producing gas fields. This may be done to achieve the hydrocarbon dew point standard of the NGTL Tariff which is imposed to ensure that these components of the Gas stream (especially butane and pentane plus) do not condense in transit, potentially causing damage to pipelines and compressors.

NGTL measures the quantity of each NGL Component received on the Alberta System at each Receipt Point[2] in order to determine the heating value of the Gas and the quantity of energy received. The Common Stream Operator (CSO) at each Receipt Point allocates the total measured quantity of energy and volume received among Receipt Customers.[3] The measured and allocated volume of Gas received is used by NGTL to determine a Customer's charges for receipt service while the quantity of energy measured and allocated is credited to the Customer Account.

The type of measurement facility at a Receipt Point is dependent on the volume of Gas and the variability of the Gas composition. At Receipt Points with large volumes and significant composition variability, the composition is determined with on-site gas chromatographs. At locations with smaller volumes and with low compositional variability, proportionate samples are collected and sent off-site for component analysis.

2.3 Extraction Plants Connected to the Alberta System

Extraction Plants connected to the Alberta System are also referred to as "straddle plants" since they receive Gas from transmission lines (i.e. notionally, the plants

[2] A Receipt Point is a location on the Alberta System where gas is received under an NGTL Service Agreement.
[3] "Receipt Customers" are Customers that have executed Service Agreements with NGTL for receipt service such as FT-R and IT-R.

straddle the transmission lines). These plants extract NGL from the Common Stream and then return the remaining Gas to the pipeline. In this Application, NGTL refers to these facilities as "Extraction Plants" and to those locations with one or more plants as an "Extraction Location" according to the table below.

A list of Extraction Plants currently connected to the Integrated Alberta System is provided in Table 2-1.

Table 2-1 Extraction Plants Connected to the Integrated Alberta System

	Extraction Plant	Operator	Ownership	Estimated Capacity (MMcf/d)	Pipeline Inter-connect	Extraction Location
1	Edmonton Ethane Extraction Plant	AltaGas	ATCO Midstream (51%) AltaGas (49%)	390	ATCO Pipelines	Edmonton
2	Fort Saskatchewan Ethane Extraction Plant	ATCO Midstream	ATCO Midstream (100%)	37	ATCO Pipelines	Fort Saskatchewan
3	Golden Spike Ethane Extraction Plant	ATCO Midstream	ATCO Midstream (100%)	65	ATCO Pipelines	Golden Spike
4	Paddle River Gas Plant	Keyera Energy	Keyera Energy (87%) Pennwest (12%) Canadian Natural Resources Limited (1%)	100	ATCO Pipelines	Paddle River
5	Villeneuve Ethane Extraction Plant	ATCO Midstream	ATCO Midstream (100%)	40	ATCO Pipelines	Villeneuve
6	Cochrane	IPF	Inter Pipeline Fund (IPF) (100%)	2,500	NGTL	West Gate
7	Joffre Ethane Extraction Plant	AltaGas	AltaGas (100%)	250	NGTL	Joffre
8	BP Empress 1	BP	BP (67%) Provident (33%)	1,200	NGTL	East Gate

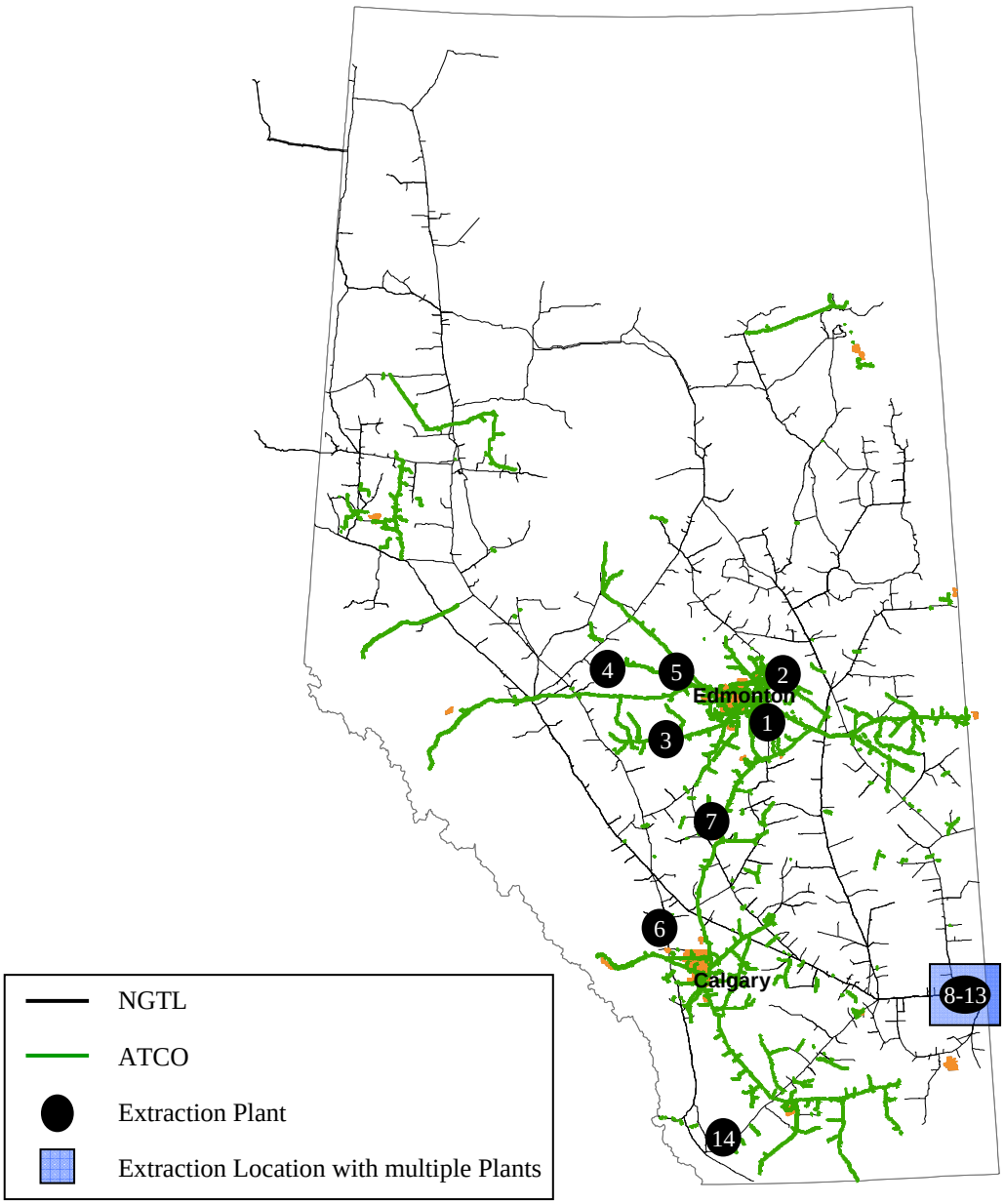
Table 2-1 Extraction Plants Connected to the Integrated Alberta System

	Extraction Plant	Operator	Ownership	Estimated Capacity (MMcf/d)	Pipeline Inter-connect	Extraction Location
9	Provident Empress	Provident	Provident (67.5%) Devon (10%) AltaGas (11.25%) Husky (11.25%)	1,200	NGTL	East Gate
10	BP Empress 2	BP	IPF (100%)	2,700	NGTL	East Gate
11	BP Empress 5	BP	BP (50%) IPF (50%)	1,100	NGTL	East Gate
12	Empress Gas Liquids Joint Venture	ATCO Midstream	BP (35.5%) Provident (12.4%) ATCO Midstream (12.2%) Devon (10.8%) AltaGas (7.2%) Nexen (6.3%) and ExxonMobil Oil Canada, Shell Canada and Talisman Energy (15.6%)	1,100	NGTL	East Gate
13	Spectra Empress	Spectra Energy Empress Manage-ment	Spectra Energy Empress Management (92%) Provident (8%)	2,400	NGTL	East Gate
14	Waterton Gas Complex	Shell Canada	Shell Canada (100%)	300	NGTL	Waterton
Total Estimated Current Capacity (MMcf/d)				**13,382**		

During 2010, Extraction Plants located on what is now the Integrated Alberta System processed approximately 2 691 Bcf of Gas and extracted the heating equivalent of approximately 317 PJ. During that calendar year, the capacity at Waterton Gas Plant was not in service. In aggregate, these plants operated at an annual average load factor of 56% in 2010.

Figure 2-1 shows the location of the various Extraction Plants on the Integrated Alberta System. The numbers assigned to each plant in Table 2-1 above correspond to the numbered locations on the map below.

Figure 2-1: The Integrated Alberta System, Extraction Locations and Plants



2.4 The Incremental Value of NGL

In the WCSB, prices for spec NGL products[4] are generally derived from the largest North American market situated in the US Gulf Coast. In this market, which is

[4] Spec NGL product refers to NGL in its components that are of a quality and at conditions to be sold at market.

underpinned by petrochemical and refinery demand, NGL products often compete with oil-sourced alternatives. As a result, they tend to follow price trends established by crude oil and refined products rather than natural gas. Within Alberta, ethane pricing is the exception. Almost all ethane produced in the WCSB is sold to local petrochemical facilities; much of it under long-term cost of service agreements.

The incremental value of spec product over the value of the NGL Components if consumed within natural gas is what the industry refers to as the "fractionation spread" (Frac Spread). One estimate of the gross Frac Spread is determined by calculating the market value of the extracted NGL Components, and deducting the cost of the gas required to replace the energy associated with the extracted NGL. Extraction Plant operating costs and costs to separate the NGL into marketable components (Fractionation Costs) are considered in the net Frac Spread. In the WCSB, the value of ethane is generally not considered in the Frac Spread; only the 'heavier' components (C3, C4, and C5+) are included in these calculations.

Table 2-2 provides a calculation of the Frac Spread on both a per barrel and per GJ basis, using 2010 data for natural gas and NGL prices as published by the Government of Alberta in the Gas Royalty Operations Information Bulletin.[5] For the calculations, a split of 70% propane, 20% butane and 10% pentanes plus was assumed for the NGL composition. The Fractionation Cost was assumed to be equal to that used by the Government of Alberta for 2010 NGL Transportation Allowance and Deductions (per the bulletin above), while operating costs and the NGL composition referenced above were assumed using information provided by the Straddle Plant Group (SPG) in the NGL Inquiry.[6]

When the Government of Alberta 2010 NGL Reference Price data is used, weighted for the proportion of propane, butane and pentanes plus as noted above, the result is an NGL value of $53.94/bbl. Applying the energy content of each NGL Component in the table results in the aggregate NGL energy per volume conversion factor of

[5] See Appendix 4, the February 2011 Bulletin Attachment 1A
[6] Information Response from the Straddle Plant Group (SPG) to NGTL Question 3; Page 4; Response (b)

4.24 GJ/bbl for C3+ (which includes C3, C4, and C5+). The equivalent natural gas value on an energy basis would be 12.72 $/GJ. After the cost to replace energy content (Shrinkage) is deducted, assuming the average 2010 natural gas price of 3.57 $/GJ, the gross Frac Spread is 9.15 $/GJ (or $38.80/bbl). When operating costs and fractionation costs are also factored in, the net Frac Spread is 7.71 $/GJ (or 32.67 $/bbl) over and above the energy value of natural gas liquids extracted. On a per GJ basis, this represents substantial additional value.

In 2010, the average daily volume of Gas processed by Extraction Plants connected to what has become the Integrated Alberta System was approximately 7.4 Bcf/d. Assuming 10 bbl of C3+ product is extracted from every 1 MMcf of gas, the gross Frac Spread value represents approximately $1.04 billion on an annual basis. On a net Frac Spread basis, the corresponding value is approximately $880 million. The net value of extracted ethane has not been included in this calculation. The quantity of ethane produced by Extraction Plants in 2010 is estimated to have been in excess of 50 million barrels.[7]

[7] Energy Resources Conservation Board (ERCB) ST13 and NGTL internal analysis.

Table 2-2: Illustrative 2010 Frac Spreads

NGL Price Per Barrel (bbl)	a	b	c = a × b	d	e = c / d
	2010 Average ADOE Reference Price *$/m³*	**Assumed NGL Proportion**	**Weighted NGL Price** *$/m³*	**m³ to bbl Conversion Factor**	**NGL Price per BBL** *$/bbl*
Propane	$285.52	70%	$199.87		$31.77
Butane	$433.14	20%	$86.63	6.292	$13.77
Pentanes Plus	$528.72	10%	$52.87		$8.40
			$339.37		$53.94

Weighted Energy per Barrel C3+	f	g	h = f × g		e / h
	Standard Energy per Volume Factors *GJ/bbl*	**Assumed NGL Proportion**	**Weighted Energy Content** *GJ/bbl*		**Equivalent NGL Price Per GJ**
Propane	4.03	70%	2.82		
Butane	4.47	20%	0.89		
Pentanes Plus	5.26	10%	0.53		
			4.24		$12.72

Frac Spread	i	per (h) above			
	2010 Average ADOE Gas Price *$/GJ*	**Weighted Energy Content** *GJ/bbl*		*$/bbl*	*$/GJ*
				j = i × h	j / h
Cost to replace Heat Content (Shrinkage)	$3.57	4.24		$15.14	$3.57
				k = e - j	m = k / h
GROSS Frac Spread				$38.80	$9.15
				n	n / h
Operating Cost				$3.39	$0.80
				p	p / h
Fractionation Cost				$2.74	$0.65
				q = k - n - p	q / h
NET Frac Spread				$32.67	$7.71
GROSS Frac Spread ($/GJ)					**$9.15**
NET Frac Spread ($/GJ)					**$7.71**

Total value of C3+ processed by Extraction Plants (2010)				
Inlet gas volume received by Extraction Plants	7,373	MMcf/d	r	
C3+ Extraction rate	10	bbl/MMcf	s	
Average Daily C3+ Extraction	73,730	bpd	r × s	
				($ millions)
Total Annual Value assuming Gross Frac Spread	73,730	bpd @	$38.80	**$1,044**
Total Annual Value assuming Net Frac Spread	73,730	bpd @	$32.67	**$880**

Input Value

b Information Response from the Straddle Plant Group (SPG) to NGTL Question 3; Page 4; Response (b); EUB 2009-009

d NEB conversion factor (bbl/m3) posted at http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/sttstc/nrgycnvrsntbl/nrgycnvrsntbl-eng.html#s4

f Energy per volume conversion factors for NGL at spec product temperature and pressure conditions. Propane and butane factors are posted by the Gas Processors Association (GPA Standard 2145). The C5+ conversion factor considers a product mix of C5, C6, C7, and so which is representative of the product extracted at East Gate.

g Information Response from the Straddle Plant Group (SPG) to NGTL Question 3; Page 4; Response (b); EUB 2009-009

n Information Response from the Straddle Plant Group (SPG) to NGTL Question 3; Page 4; Response (b); EUB 2009-009

p Government of Alberta for 2010 NGL Transportation Allowance and Deductions. See Appendix 4, the February 2011 Bulletin Attachment 1A

r NGTL internal analysis of the 2010 average daily Gas volumes received at the inlet of Extraction Plants.

s Industry standard.