3.6.1 PURPOSE

The Storm Hills pigging facility will:

- receive pigs launched from the Taglu or Parsons Lake pig launchers
- send pigs from Storm Hills pig launcher to the Inuvik area facility

3.6.2 FACILITY DESCRIPTION

Pig receivers will be provided for the Taglu and Parsons Lake laterals and a pig launcher will be installed for the Storm Hills lateral. A plot plan of this facility, including a list of major structures, is shown in Figure 3-38. Liquids and gas being pushed by the pigs will pass through the Storm Hills pigging facility. Any residual liquids in the receiver barrels after the pig arrives at the site will be transferred into the Storm Hills lateral. Figure 3-39 shows the preliminary process flow for the Storm Hills pigging facility. For the material balances, see:

- Figure 3-40 for summer
- Figure 3-41 for winter

The Storm Hills pigging facility will contain:

- an NPS 22 pig receiver from the Parsons Lake lateral
- an NPS 30 pig receiver from the Taglu lateral
- an NPS 34 pig launcher from the Storm Hills lateral

Other equipment located on this site will include:

- an electrical power generator fuelled by pipeline gas
- fuel gas conditioning equipment
- a standby diesel-powered generator for emergencies
- controls and communications equipment

The main piping within the facility will be:

- NPS 18 piping, Grade 414 with a minimum wall thickness of 11.3 mm
- NPS 26 piping, Grade 483 with a minimum wall thickness of 13.9 mm
- NPS 30 piping, Grade 483 with a minimum wall thickness of 16.1 mm

3.6.2 FACILITY DESCRIPTION (cont'd)

The facility will have a design pressure of 12.2 MPa with a design factor of 0.8 and a location factor of 0.75. These piping configurations will be optimized as engineering progresses.

The facilities will use qualified commercially available launcher and receiver vessels. The closure types might vary by manufacturer but they are expected to be a swing closure design with protection systems to ensure that the door cannot be opened while the barrel is pressurized.

Piping within the pigging facility will have external coatings where required. Buried piping will be protected by the pipeline's cathodic protection system.

As engineering progresses, the conceptual flow schematic will be upgraded and process and instrumentation diagrams (P&IDs) and detailed equipment and line lists will be developed.

Equipment and structures will be modularized to facilitate construction in remote areas.

The facility will be designed for remote, unstaffed operation and will be accessible by helicopter. Living quarters will be provided for operations and maintenance staff when on site. A workshop will accommodate maintenance activities.

3.6.3 SAFETY AND CONTROL SYSTEMS

The main control centre will remotely operate, monitor, control and diagnose pigging facility functions. The facility control logic will be designed for safe operation. Safety systems will include:

- gas detection
- smoke detection

The pigging facility will be designed to remotely receive one pig from each of the Taglu and Parsons Lake laterals and to remotely send one pig down the Storm Hills lateral. Additional pigging will require maintenance personnel intervention.

Figure 3.38 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

Figure 3.39 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

Stream #	Units	1		2		3		4	
Description		Production from Taglu Lateral		Production from Parsons Lake Lateral		Production from Other Metered Production		Combined Production to Storm Hills Lateral	
Vapour Fraction	-	0.98039		0.95981		0.97413		0.97350	
Temperature	C	-5.5		-4.9		-1.0		-10.6	
Pressure	kPa (a)	9227		9227		9227		7100	
Molar Flow	kgmole/h	35193		18389		2615		56197	
Mass Flow	10^3 kg/h	642.0		372.6		49.0		1063.5	
Phase		Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid
Std. Gas Flow	10^3 Std m^3/day	19579	0	10016	0	1446	0	31045	0
Liq. Vol. Flow @ std. cond.	m^3/h	0	77.05	0	74.95	0	7.51	0	164.53
Compressibility	-	0.71847	-	0.69328	-	0.72805	-	0.74680	-
Mass Density	kg/m^3	99.13	678.01	110.66	637.48	97.17	669.94	76.37	679.07
Molecular Weight	-	17.178	71.389	18.547	61.214	17.350	70.614	17.534	70.010
Viscosity	cP	0.014202	0.478334	0.014610	0.346249	0.014117	0.440389	0.012784	0.466930
Mass Heat Capacity	kJ/kg-C	3.4350	2.0130	3.4145	2.1028	3.3624	2.0394	3.1012	1.9997
Components Molar Flow	kgmole/h								
Nitrogen		40.3709	0.1283	225.8051	1.7236	2.9609	0.0125	270.0718	0.9295
CO2		141.6474	3.0973	467.6591	21.1485	6.7735	0.1872	622.6871	17.8258
Methane		32759.7844	273.4446	15732.9576	295.4119	2397.6390	26.1436	50973.6123	511.7688
Ethane		1050.0196	33.9881	731.2546	49.6534	93.6912	3.8604	1874.5908	87.8766
Propane		297.7728	25.2440	298.3953	50.7530	27.6077	2.9290	615.4324	87.2694
i-Butane		57.8667	9.8989	47.4447	15.5445	5.1436	1.0882	104.0319	32.9548
n-Butane		63.2722	14.5924	76.1642	33.0753	5.7202	1.6204	134.8279	59.6168
i-Pentane		21.2350	9.4424	20.8570	16.8956	1.8956	1.0255	36.6631	34.6880
n-Pentane		13.8563	7.9776	17.4878	18.0618	1.2264	0.8526	26.2618	33.2008
n-Hexane		14.8886	20.6773	9.3693	22.2989	1.2779	2.1086	15.7595	54.8612
n-Heptane		10.5375	33.7621	3.8946	20.4302	0.8886	3.3295	7.1918	65.6509
n-Octane		5.0105	36.9075	2.1477	24.7740	0.4057	3.4385	2.9224	69.7616
n-Nonane		0.7455	12.1705	0.6094	14.8920	0.0555	1.0271	0.4854	29.0146
n-Decane		0.6653	22.7380	0.3474	17.0735	0.0549	2.0999	0.3022	42.6769
n-C11		0.2219	16.9980	0.1140	12.0079	0.0192	1.6204	0.0861	30.8955
n-C12		0.0896	12.8734	0.0482	9.2079	0.0078	1.2265	0.0312	23.4223
n-C13		0.0365	12.8991	0.0204	9.1126	0.0033	1.2285	0.0110	23.2893
n-C14		0.0131	11.6042	0.0066	6.9713	0.0012	1.1050	0.0032	19.6982
n-C15		0.0053	7.6297	0.0036	6.1142	0.0005	0.7265	0.0013	14.4785
n-C16		0.0017	5.1066	0.0012	4.1742	0.0002	0.4863	0.0004	9.7698
n-C17		0.0010	4.1460	0.0007	2.9175	0.0001	0.3948	0.0002	7.4599
n-C18		0.0004	2.1144	0.0003	2.0911	0.0000	0.2013	0.0001	4.4074
n-C19		0.0002	1.2357	0.0002	1.7454	0.0000	0.1177	0.0000	3.0991
n-C20		0.0000	0.9887	0.0000	1.1378	0.0000	0.0941	0.0000	2.2207
n-C21		0.0000	0.6042	0.0000	0.9601	0.0000	0.0575	0.0000	1.6219
n-C22		0.0000	0.1099	0.0000	0.5571	0.0000	0.0105	0.0000	0.6774
n-C23		0.0000	0.2472	0.0000	0.5248	0.0000	0.0235	0.0000	0.7955
n-C24		0.0000	0.1648	0.0000	0.4364	0.0000	0.0157	0.0000	0.6168
n-C25		0.0000	0.1099	0.0000	0.4050	0.0000	0.0105	0.0000	0.5254
n-C26		0.0000	0.0824	0.0000	0.0884	0.0000	0.0078	0.0000	0.1787
n-C27		0.0000	0.0549	0.0000	0.0590	0.0000	0.0052	0.0000	0.1191
n-C28		0.0000	0.0275	0.0000	0.0433	0.0000	0.0026	0.0000	0.0734
n-C29		0.0000	0.0275	0.0000	0.0433	0.0000	0.0026	0.0000	0.0734
n-C30		0.0000	0.1648	0.0000	0.1769	0.0000	0.0157	0.0000	0.3573
Benzene		3.3942	6.5517	1.5475	4.8677	0.2678	0.6056	3.1268	14.1078
Toluene		4.1818	20.4810	2.0760	15.7417	0.3542	1.9942	3.2205	41.6084
E-Benzene		0.8568	8.9479	0.5991	9.4773	0.0723	0.8613	0.6239	20.1908
o-Xylene		0.7465	10.2118	0.1547	3.0936	0.0635	0.9799	0.3549	14.8951
124-MBenzene		0.2398	8.1643	0.0686	3.3133	0.0206	0.7797	0.1002	12.4860
Cyclopentane		0.0752	0.0621	0.9836	1.4194	0.0066	0.0065	0.9078	1.6456
Mcyclopentane		3.2030	5.1187	2.5783	6.9575	0.2739	0.5185	3.8037	14.8461
Cyclohexane		2.6736	5.3460	3.0272	9.9698	0.2277	0.5360	3.7174	18.0628
m-Xylene		0.7157	9.0890	0.1165	2.1777	0.0609	0.8727	0.3248	12.7077
p-Xylene		0.7269	9.0779	0.1040	1.9169	0.0618	0.8718	0.3232	12.4360
Mcyclohexane		8.2803	25.8303	3.8357	19.5485	0.6954	2.5526	6.3782	54.3647
H2O		0.0793	0.0019	0.0000	0.0000	0.0000	0.0000	0.0788	0.0024
Methanol		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Figure 3-40: Storm Hills Pigging Facility Material Balance – Summer

Stream #	Units	1		2		3		4	
Description		Production from Taglu Lateral		Production from Parsons Lake Lateral		Production from Other Metered Production		Combined Production to Storm Hills Lateral	
Vapour Fraction	-	0.97841		0.95699		0.97405		0.96842	
Temperature	C	-13.1		-8.8		-1.0		-21.2	
Pressure	kPa (a)	9563		9563		9563		7100	
Molar Flow	kgmole/h	40087		20946		2980		64013	
Mass Flow	10^3 kg/h	731.2		424.4		55.8		1211.4	
Phase		Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid
Std. Gas Flow	10^3 Std m^3/day	22257	0	11375	0	1647	0	35178	0
Liq. Vol. Flow @ std. cond.	m^3/h	0	91.29	0	88.51	0	8.35	0	207.14
Compressibility	-	0.67893	-	0.66832	-	0.72119	-	0.70596	-
Mass Density	kg/m^3	111.79	671.66	120.65	630.48	101.76	667.41	83.82	668.51
Molecular Weight	-	17.160	67.214	18.536	58.663	17.364	69.892	17.459	63.878
Viscosity	cP	0.014661	0.471332	0.015034	0.334706	0.014372	0.434588	0.012743	0.443517
Mass Heat Capacity	kJ/kg-C	3.7360	2.0041	3.6124	2.1077	3.4194	2.0444	3.3630	1.9934
Components Molar Flow	kgmole/h								
Nitrogen		45.9556	0.1750	256.8928	2.2605	3.3732	0.0149	307.3141	1.3579
CO2		160.6450	4.2278	529.8044	26.9521	7.7151	0.2165	701.8917	27.6692
Methane		37256.0045	370.4679	17876.5446	380.5675	2731.2316	30.6393	57878.2146	767.2407
Ethane		1189.4878	45.2431	827.5411	61.9949	106.7522	4.4067	2099.4468	135.9789
Propane		335.0715	32.8577	336.0919	61.6298	31.5143	3.2819	666.2590	134.1882
i-Butane		64.6052	12.5828	53.2920	18.4600	5.8956	1.2054	107.1767	48.8643
n-Butane		70.2372	18.4537	85.3848	39.0531	6.5737	1.7908	134.6773	86.8160
i-Pentane		23.3367	11.6061	23.4220	19.5828	2.2009	1.1276	33.9576	47.3185
n-Pentane		15.1124	9.7573	19.6244	20.8714	1.4309	0.9382	23.4448	44.2897
n-Hexane		15.9990	24.5121	10.6218	25.4530	1.5273	2.3317	12.7345	67.7104
n-Heptane		11.2716	39.1873	4.4939	23.2166	1.0916	3.7150	5.4460	77.5301
n-Octane		5.3849	42.3615	2.5315	28.1356	0.5119	3.8686	2.1211	80.6729
n-Nonane		0.8108	13.9011	0.7345	16.9239	0.0717	1.1620	0.3430	33.2610
n-Decane		0.7364	25.9209	0.4286	19.4150	0.0724	2.3830	0.2098	48.7466
n-C11		0.2492	19.3650	0.1438	13.6645	0.0259	1.8425	0.0584	35.2325
n-C12		0.1028	14.6626	0.0621	10.4819	0.0107	1.3958	0.0210	26.6950
n-C13		0.0424	14.6917	0.0269	10.3768	0.0045	1.3990	0.0072	26.5342
n-C14		0.0154	13.2171	0.0088	7.9401	0.0017	1.2588	0.0021	22.4399
n-C15		0.0064	8.6902	0.0050	6.9642	0.0007	0.8277	0.0008	16.4933
n-C16		0.0021	5.8165	0.0017	4.7548	0.0002	0.5540	0.0002	11.1292
n-C17		0.0013	4.7224	0.0009	3.3232	0.0001	0.4498	0.0001	8.4977
n-C18		0.0005	2.4083	0.0005	2.3820	0.0001	0.2294	0.0000	5.0207
n-C19		0.0002	1.4075	0.0003	1.9882	0.0000	0.1341	0.0000	3.5303
n-C20		0.0000	1.1261	0.0000	1.2962	0.0000	0.1073	0.0000	2.5297
n-C21		0.0000	0.6882	0.0000	1.0938	0.0000	0.0656	0.0000	1.8476
n-C22		0.0000	0.1251	0.0000	0.6346	0.0000	0.0119	0.0000	0.7717
n-C23		0.0000	0.2815	0.0000	0.5978	0.0000	0.0268	0.0000	0.9062
n-C24		0.0000	0.1877	0.0000	0.4971	0.0000	0.0179	0.0000	0.7027
n-C25		0.0000	0.1251	0.0000	0.4614	0.0000	0.0119	0.0000	0.5985
n-C26		0.0000	0.0938	0.0000	0.1007	0.0000	0.0089	0.0000	0.2035
n-C27		0.0000	0.0626	0.0000	0.0672	0.0000	0.0060	0.0000	0.1357
n-C28		0.0000	0.0313	0.0000	0.0493	0.0000	0.0030	0.0000	0.0836
n-C29		0.0000	0.0313	0.0000	0.0493	0.0000	0.0030	0.0000	0.0836
n-C30		0.0000	0.1877	0.0000	0.2015	0.0000	0.0179	0.0000	0.4070
Benzene		3.5493	7.7796	1.7335	5.5749	0.3203	0.6750	2.4582	17.1743
Toluene		4.3293	23.7625	2.3635	17.9342	0.4346	2.2413	2.3893	48.6762
E-Benzene		0.9005	10.2675	0.6991	10.7784	0.0911	0.9727	0.4439	23.2653
o-Xylene		0.7781	11.7038	0.1805	3.5199	0.0802	1.1088	0.2518	17.1194
124-MBenzene		0.2541	9.3185	0.0822	3.7703	0.0267	0.8851	0.0681	14.2689
Cyclopentane		0.0809	0.0755	1.1001	1.6377	0.0077	0.0072	0.7778	2.1314
Mcyclopentane		3.4098	6.0689	2.9111	7.9520	0.3276	0.5753	3.0395	18.2053
Cyclohexane		2.8255	6.3092	3.4190	11.3869	0.2734	0.5968	2.9374	21.8732
m-Xylene		0.7464	10.4216	0.1358	2.4780	0.0769	0.9870	0.2302	14.6154
p-Xylene		0.7588	10.4092	0.1213	2.1811	0.0780	0.9858	0.2295	14.3048
Mcyclohexane		8.8639	29.9895	4.4153	22.2231	0.8513	2.8497	4.8984	64.2944
H2O		0.0899	0.0026	0.0000	0.0000	0.0000	0.0000	0.0888	0.0038
Methanol		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Figure 3-41: Storm Hills Pigging Facility Material Balance – Winter

3.7.1 PURPOSE

The Inuvik NGL meter station will measure the NGLs received by the NGL pipeline at the Inuvik area facility.

3.7.2 FACILITY DESCRIPTION

The Inuvik NGL meter station (see Figure 3-42) will be located within the Inuvik area facility site and will use the infrastructure and utility services available at the site. The meter station will have a design pressure of 9.93 MPa. The piping within the site will be externally coated and will be integrated with the Inuvik area facility's cathodic protection system. Further studies will be undertaken to optimize the quantity and size of buildings and equipment. A detailed equipment list and line list will be developed as engineering progresses.

The Inuvik NGL meter station will use Coriolis mass flow meters or equivalent. The nominal range of these meters will be 10 to 110% of the design volume. The size and number of meters will be determined as engineering progresses.

These meters and their associated instruments are expected to be accurate about ±1% over the operating range. A primary flow meter and a check meter will be installed in series. This configuration will be used to monitor measurement performance. A chromatograph will be used to measure liquid composition.

Operational control as well as safety monitoring and response at the Inuvik NGL meter station will be integrated into the control system of the Inuvik area facility, which will provide local operational control.

Safety systems include:

- fire and vapour detection
- smoke detection

Figure 3.42 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

ENBRIDGE INTERCONNECT FACILITY

3.8.1 FACILITY DESCRIPTION

The NGL pipeline will terminate at a pig receiver and block valve located adjacent to the existing Enbridge pump station at Norman Wells (see Figure 3-43).

The existing Enbridge pipeline is capable of shipping up to 5,400 m^3/d of crude oil to Zama, Alberta. The original design included the potential for expansion to about 8,000 m^3/d.

This system is expected to be capable of accommodating NGL volumes from the Mackenzie gathering system. Each NGL pipeline shipper will be responsible for its shipping arrangements on the Enbridge pipeline.

Joint studies with Enbridge are planned to define the interconnection requirements, including those required for metering and potential batching.

Facilities downstream of the NGL pipeline block valve, such as custody transfer metering, are expected to be owned, constructed and managed by Enbridge.

Figure 3.43 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

3.9.1 SCOPE

Environmental design considerations for the pipeline right-of-way, the Inuvik area facility and the Storm Hills pigging facility include:

- right-of-way design
- site development
- air emissions
- noise levels
- waste management

3.9.2 RIGHT-OF-WAY DESIGN

3.9.2.1 Right-of-Way Construction Modes

Right-of-way construction modes suitable for several combinations of slope and soil conditions have been developed to reduce impact and mitigate potential erosion or stability concerns related to permafrost conditions and disturbance of surface organic cover.

Typical right-of-way layouts for different pipe sizes are shown in:

- Figure 3-44 for NPS 10, 16 or 18 pipe
- Figure 3-45 for NPS 26 or 30 pipe
- Figure 3-46 for NPS 30 and 10 pipe

3.9.2.2 Buoyancy Control

Buoyancy control used in wet areas will be designed using a minimum 5% negative buoyancy. Buoyancy control used at watercourses will be designed using negative buoyancy of up to 20%. Values greater than 20% might be used depending on water flow, velocity, watercourse bed soil type, and water depth. A buoyancy control method for each area will be established as engineering progresses. These methods will likely include a combination of concrete weights, screw anchors and deeper burial. Continuous concrete coating might be used on large river crossings.

The final selection of the buoyancy control method will be confirmed when the detailed soils investigation program is complete, prior to construction.

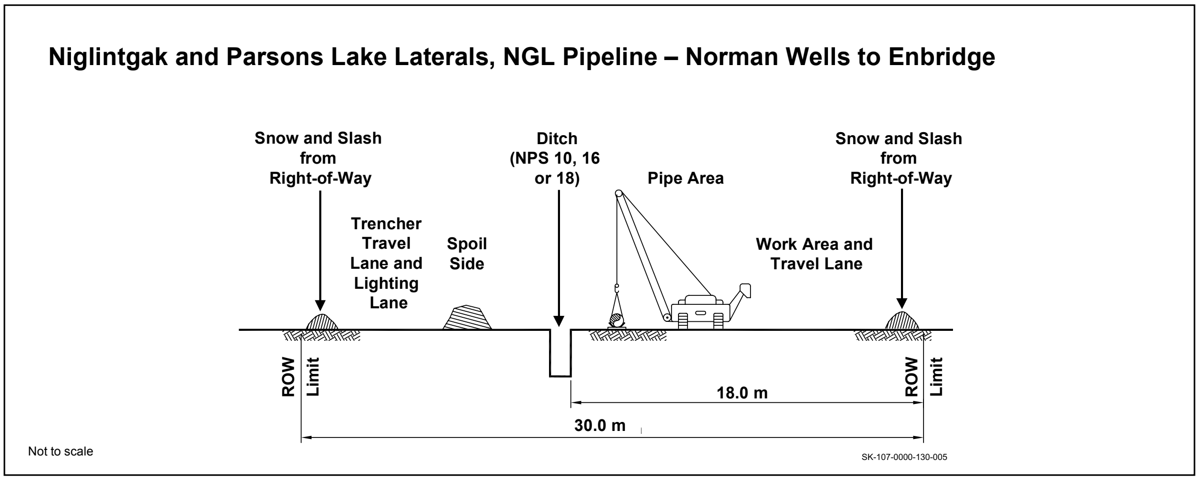

Figure 3-44: Typical Right-of-Way Layout for NPS 10, 16 or 18 Pipe

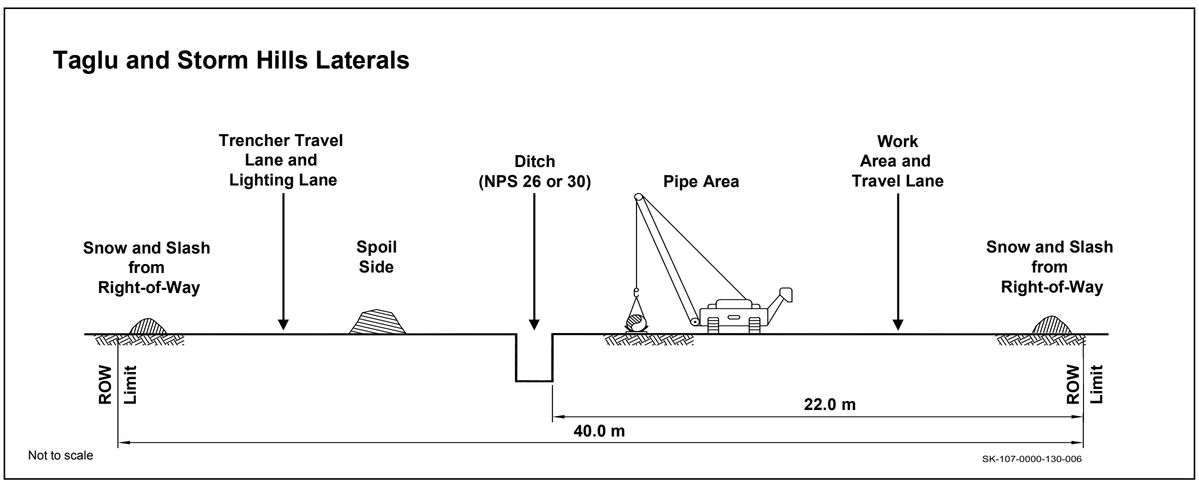

Figure 3-45: Typical Right-of-Way Layout for NPS 26 or 30 Pipe

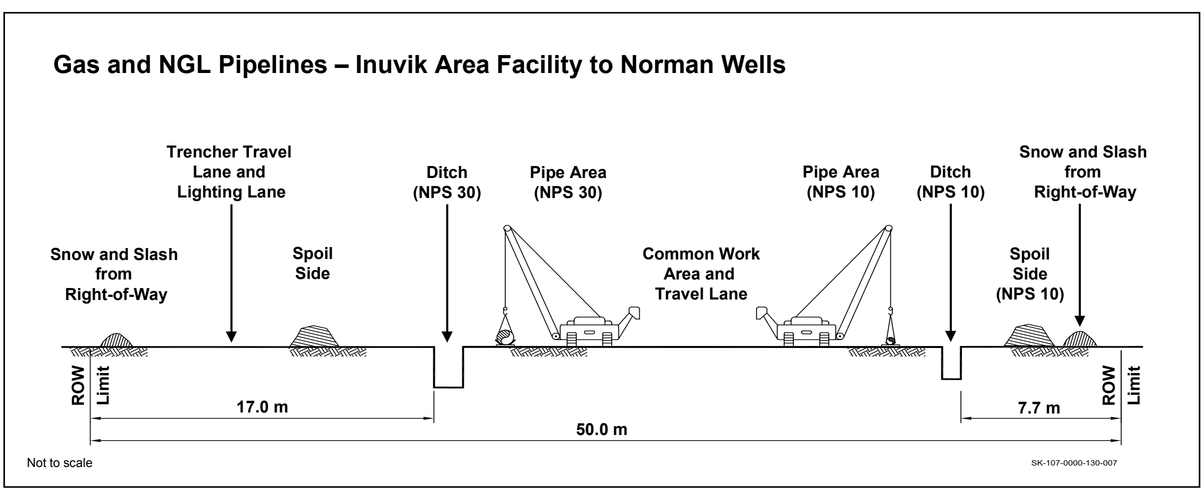

Figure 3-46: Typical Right-of-Way Layout for NPS 30 and 10 Pipe

3.9.3 SITE DEVELOPMENT

Site development will be influenced by terrain, soil type and the extent of permafrost. Site-specific geotechnical studies conducted as engineering progresses will be used to complete the design.

All sites will be cleared and graded where required. The degree of grading will depend on the amount of permafrost at the site and on the soil conditions. All sites will have borrow material placed in varying thickness around the site. The thickness depends on the soil conditions and soil temperatures and the intended use of the area within the site. The surface will be sloped to allow positive runoff away from the site.

Piles will generally be used to support equipment and buildings. The type of pile selected will depend on the soil conditions and the amount of permafrost at the site. Permafrost will be protected by creating an air space between the ground surface and the heat generating structures.

3.9.4 AIR EMISSIONS

Air emission sources will include the:

- residue gas compressor drivers
- propane refrigerant compressor drivers
- electrical generator drivers
- stabilizer reboiler
- heat medium boilers

Gas turbines will use commercially available dry, low-emission (DLE) combustors to reduce oxides of nitrogen (NO_x) emissions. The Inuvik area facility will have multiple gas turbines. As engineering progresses, consideration will be given to using aero-derivative gas turbines or heavy duty industrial gas-turbine drivers for the residual gas compressors. As the industrial gas turbines have the most air emissions, they have been assumed for emission calculations. All other turbines are assumed to be light industrial turbines. Estimated continuous air emissions are shown in Table 3-12.

3.9.5 NOISE LEVELS

Installing facilities and equipment will increase the existing noise levels. Noise control measures will be adopted, consistent with recognized industry practices and guidelines. Facility site designs will be consistent with the Alberta Energy and Utilities Board (EUB) Guideline 38, *Noise Control Directive User Guide,* November 1999.

As engineering progresses and equipment is selected, additional noise modelling will be completed to identify expected noise levels and mitigation measures. Mitigation might include:

- installing gas turbine air intake and exhaust ducting silencers
- acoustically insulating above-ground piping
- acoustically treating the compressor building walls, roof and floor
- installing low-noise fans on the aerial coolers

Infrequent flaring and venting will produce higher levels of noise for short durations.

Table 3-12: Estimated Facility Air Emissions

Facility	Equipment Type and System	Nominal Power (MW)	Emissions (t/d)			
			NO_x	CO_2*	CO	Particulate Matter
Inuvik area facility	Gas turbine (residue gas compressor)	36.46	0.44	528.31	0.40	0.03
	Gas turbine (residue gas compressor)	36.46	0.44	528.31	0.40	0.03
	Gas turbine (refrigerant compressor)	3.85	0.08	61.13	0.05	0.00
	Gas turbine (refrigerant compressor)	3.85	0.08	61.13	0.05	0.00
	Gas turbine (power generator)	3.85	0.08	61.13	0.05	0.00
	Gas turbine (power generator)	3.85	0.08	61.13	0.05	0.00
	Heater (heat medium)	5.72	0.02	41.09	0.03	0.00
	Heater (heat medium)	5.72	0.02	41.09	0.03	0.00
	Heater (stabilization)	8.59	0.03	61.72	0.04	0.00
	Heater (stabilization)	8.59	0.03	61.72	0.04	0.00
	Total	116.92	1.31	1,506.75	1.15	0.09
Storm Hills pigging facility	Gas engine (power generation)	0.10	0.06	2.27	0.01	0.00
	Heater (heat medium)	0.07	0.00	0.52	0.00	0.00
	Total	0.17	0.06	2.80	0.01	0.00
Note: * CO_2 emissions based on Canadian Association of Petroleum Producers (CAPP) method						

3.9.6 WASTE MANAGEMENT

The NGL pipeline shares a right-of-way with the gas pipeline from Inuvik to Norman Wells. Up to one third of the waste generated is estimated to be attributable to the NGL pipeline.

Waste will be disposed of in compliance with the waste management plan (see EIS Volume 7: Environmental Management).