Schedule 18

Minimum System Study

May 31, 2012

Classification of Enbridge Gas New Brunswick Mains by Customer and Demand
prepared by
Black and Veatch

Study Methodology

There are two widely accepted methods for the classification of mains between customer related costs and demand related costs. The two methods are the Minimum System Method and the Zero Intercept Method. This report describes the theoretical underpinnings of each method as it relates to Enbridge Gas New Brunswick ("EGNB"). Both of these methods require data to support the analysis from the books and records of the utility.

The analysis begins with the cost of pipe by size and type. In this case, there are two pipe types- steel and plastic. For each type of pipe, there are multiple sizes typically measured in nominal inches that indicate the approximate inside diameter. Thus a 2 inch pipe will have an inside diameter of slightly more than 2 inches. The cost of the pipe is based on the booked cost for the pipe, installation and capital loaders. The unit cost for pipe in any year is determined by dividing the booked costs by the amount of pipe installed in a standard unit of measurement, in this case meters of pipe. Thus for each size and type of pipe the data consists of the average cost of pipe in each year. To perform an analysis of the minimum system or the zero intercept requires a single cost for each size and type of pipe.

It is important to understand that a variety of factors cause the annual unit cost of pipe by size and type to vary significantly. Factors that affect the average cost include the amount of pipe installed, where the pipe is installed such as urban, suburban and rural areas, conditions incident to the installation such as soil conditions and other factors. Thus, a simple average of the yearly costs is not adequate for a determination of the cost for each size of pipe as it will not reflect a consistent set of data. Therefore, it is common to convert the annual dollars of cost to a single year using an index. By applying the index, differences in materials costs, installation and so forth are normalized to a base year. The cost per year are added together in constant dollars and divided by the total length of pipe by size and type to produce an inflation adjusted price per meter for each size and type of pipe. This value is then used in both the minimum system and zero intercept analysis.

For this study, we have chosen to use the Handy Whitman Index of Public Utility Construction Costs. It is widely accepted as a reliable method for adjusting historic costs to a comparable basis relating to construction cost analysis. Regulators in the US use the Handy Whitman Index in zero intercept and minimum system studies when the methodology for minimum system uses historic rather than current data. This Index presents the level of costs (stated as cost index numbers) for different types of utility construction for each year since 1912. In this case we have an index value for both steel and plastic mains. The index is also provided by region of the United States. For EGNB, we have used the index North Central United States based on our judgment that this region is more likely to be representative of the cost conditions for EGNB. We made this choice as an alternative to the Northeast Region because we were concerned that the heavily urban Northeast might not fairly represent the costs of the EGNB service territory. That judgment included our understanding of the added cost associated urban main construction and the added complications associated with working in a more heavily developed area.

Study Data

The study was conducted using mains data for EGNB from the start of utility operations, which was in 2001. The data requested to perform the study was for total investment in mains by material type by size and by year installed. (E.g. steel, plastic, 2 inch, 4 inch) The investment included the original cost of pipe and capitalized trenching and other construction/installation costs.

This data was provided by EGNB and shown in Appendix A. The data provided by EGNB was then adjusted and summarized to perform both the minimum system and zero intercept studies.

The length in meters were summed and arranged by size and by type (e.g. steel, plastic, 1¼ inch, 2 inch, 4 inch). The original cost of the pipe was arranged by the same sizes and the same types as the pipe lengths and also escalated into 2010 real dollars by using the Handy-Whitman index as described above.

The cost of pipe in real 2010 dollars was then divided by length in meters to calculate a per meter cost of each type and size of main. This resulting data is presented in Appendix A.

This summarized and adjusted data was then used to perform three studies, one zero intercept study and two versions of a minimum system study.

Zero Intercept Study:

The zero intercept study performed regression on the cost per meter by pipe size, against pipe size. The regressions were done in various forms using linear and non-linear forms of pipe size and pipe type. A "what if' test was also performed, combining both steel and plastic pipe types. However, in all cases the regression failed to produce valid results. This invalid result was not calculated. Essentially, the regressions had too few degrees of freedom and the intercept term (the term of interest) had a t-statitistic that did not permit us to reject the hypothesis that the intercept was statistically different than zero. The following table provides the intercept term and the associated t-statistic that shows the intercept and the t-statistic that is well below the value needed to reject the hypothesis that the coefficient is different from zero.

Zero Intercept Summary Table

Type of Pipe	Intercept Term	t-statistic
Plastic	23.30	1.130
Steel	21.89	0.160
Combined	-21.56	-0.283

Minimum System Studies:

Black and Veatch recognizes that the Board ordered EGNB to undertaken the minimum system study using 1.25 inch pipe as the minimum system and has completed the study as directed. However, after reviewing the data on both the length and the investment dollars of the EGNB

system it was noted that there has been a decline in the relative portion of 1.25 inch pipe over time and the minimum system study using 2 inch pipe was also completed.

Minimum System Study using (1.25 Inch) Pipe Size as Minimum:

The minimum system study based on a minimum pipe size of 1.25 inches was performed by taking the resulting cost per meter of the plastic 1.25 inch pipe equaling $74.8 dollars and effectively multiplying that by the sum of all meters installed for steel and plastic pipe. This equals 58.2 million dollars. The steel pipe is considered the backbone of EGNB's distribution system and therefore is classified directly to demand. The total cost of steel pipe minus the calculated minimum cost of steel pipe equals 48.2 million dollars and is classified directly to demand. The total cost of the plastic pipe plus the calculated minimum cost of steel pipe equals 83 million dollars. The minimum system percentage is calculated by taking the 58.2 million dollars calculated as the minimum system costs over the total cost of pipe, minus the cost of steel pipe directly assigned to demand. This equals 70 percent as presented in Table 1 below.

The resulting customer component is calculated by taking the 58.2 million dollars, which is the 2010 real cost of the install minimum system over the total 2010 real cost of install pipe. The resulting percentages are 56 percent demand and 44 percent customer.

Table 1 – Minimum System Study (1.25 inch)

Minimum System Study
Enbridge Gas New Brunswick

Pipe Type	Pipe Size	Real 2010 ($)	Total Length in Meter	$/Meter
PE	1.25	$ 12,278,334	164,163	$ 74.79
PE	2.0	$ 28,850,509	287,625	$ 100.31
PE	4.0	$ 20,778,244	145,038	$ 143.26
PE	6.0	$ 10,904,145	44,268	$ 246.32
	Total	$ 72,811,233	641,095	

Pipe Type	Pipe Size	Real 2010 ($)	Total Length in Meter	$/Meter
ST	2.00	$ 2,038,196	14,303	$ 142.50
ST	4.0	$ 6,796,595	28,192	$ 241.08
ST	6.0	$ 31,728,159	58,226	$ 544.91
ST	8.0	$ 17,850,649	36,040	$ 495.30
	Total	$ 58,413,599	136,761	

Minimum System Calculation	
Total Number of Meters for System	777,856
Total Minmum System Costs	$58,178,513
Total System Mains Costs based on PE	$83,040,069
Minimum System Percentage	70%

Steel pipe is considered distribution back-bone and classified directly to demand

Mains Costs Classification

	Demand	Energy	Customer	Total
Direct to Demand	$ 48,184,763			$ 48,184,763
Subject to Minsys	$ 24,861,555		$58,178,513	$ 83,040,069
Total Mains Allocation	$ 73,046,318		$58,178,513	$131,224,831
Total Main Percentage	56%		44%	

Minimum System Study using (2 Inch) Pipe Size as Minimum:

The minimum system study based on a minimum pipe size of 2 inches was performed by taking the resulting cost per meter of the plastic 2 inch pipe equaling $100.3 dollars and effectively multiplying that by the sum of all meters installed for steel and plastic pipe. This equals 78 million dollars. The steel pipe is considered the backbone of EGNB's distribution system and therefore is classified directly to demand. The total cost of steel pipe minus the calculated minimum cost of steel pipe equals 44.7 million dollars and is classified directly to demand. The total cost of the plastic pipe plus the calculated minimum cost of steel pipe equals 86.5 million dollars. The minimum system percentage is calculated by taking the 78 million dollars calculated as the minimum system costs over the total cost of pipe, minus the cost of steel pipe directly assigned to demand. This equals 90 percent as presented in Table 2.

The resulting customer component is calculated by taking the 78 million dollars, which is the 2010 real cost of the install minimum system over the total 2010 real cost of install pipe. The resulting percentages are 41 percent demand and 59 percent customer.

Table 1 – Minimum System Study (2 inch)

Minimum System Study
Enbridge Gas New Brunswick

Pipe Type	Pipe Size	Real 2010 ($)	Total Length in Meter	$/Meter
PE	1.25	$ 12,278,334	164,163	$ 74.79
PE	2.0	$ 28,850,509	287,625	$ 100.31
PE	4.0	$ 20,778,244	145,038	$ 143.26
PE	6.0	$ 10,904,145	44,268	$ 246.32
	Total	$ 72,811,233	641,095	

Pipe Type	Pipe Size	Real 2010 ($)	Total Length in Meter	$/Meter
ST	2.00	$ 2,038,196	14,303	$ 142.50
ST	4.0	$ 6,796,595	28,192	$ 241.08
ST	6.0	$ 31,728,159	58,226	$ 544.91
ST	8.0	$ 17,850,649	36,040	$ 495.30
	Total	$ 58,413,599	136,761	

Minimum System Calculation	
Total Number of Meters for System	777,856
Total Minmum System Costs	$ 78,023,573
Total System Mains Costs based on PE	$ 86,529,190
Minimum System Percentage	90%

Steel pipe is considered distribution back-bone and classified directly to demand

Mains Costs Classification

	Demand	Energy	Customer	Total
Direct to Demand	$ 44,695,642			$ 44,695,642
Subject to Minsys	$ 8,505,617		$ 78,023,573	$ 86,529,190
Total Mains Allocation	$ 53,201,258		$ 78,023,573	$131,224,831
Total Main Percentage	41%		59%	

Results Allocation of Mains

The minimum system study is the basis for the allocation of mains investment. The mains investment is functionalized to distribution, classified based on the minimum system study to demand and customer. The demand component of mains investment is allocated based on each class' allocation of design day. The customer component of mains investment is allocated based on each class' number of customers.

In the EGNB cost of service study presented to the Board, Black and Veatch proposed the use of 2" pipe as the Minimum system. Based on the data for annual footage, it is more reasonable to conclude that 2 inch pipe is the minimum system. In the case of a minimum system using 2 inch pipe there is no allocation for the demand component of mains investment to the residential rate class. This is due to the fact that a 2 inch pipe system can serve the demands of the residential class on a design day. This conclusion permits the cost study to more accurately and consistently allocate costs based on the way costs are incurred. If the minimum system using a 1.25 inch pipe is used, there must be an allocation of demand component of mains investment to the residential class along with the customer component, since a 1.25 inch pipe system cannot serve the demands of the residential class on a design day. This process makes the allocation of mains both more complex and less reliable that the use of the actual pipe size that represents the minimum system.

The resulting allocation of the mains investment using the 1.25 inch minimum and the 2 inch minimum is presented on the Table 3.

Table 3 – Allocation of the mains investment (1.25 inch and 2 inch minimum)

Minsys Type	Allocator Name	TOTAL	Small General	Mid General	Large General	Contract General	Industrial Contract General	OPS	CLVOP
2" Min	MainsDemand	37,071	0	7,675	8,615	7,589	13,193	0.00	0.00
2" Min	MainsCustomer	11,277	9,211	1,518	432	94	8	14.00	0.00
1.25" Min	MainsDemand	44,010	6,938	7,675	8,615	7,589	13,193	0.00	0.00
1.25" Min	MainsCustomer	11,277	9,211	1,518	432	94	8	14.00	0.00
2" Min	Mains Demand	$ 53,201,258	$ -	$11,014,400	$12,363,497	$10,890,564	$18,932,798	$ -	$ -
2" Min	Mains Customer	$ 78,023,573	$ 63,729,283	$10,502,774	$ 2,988,932	$ 650,369	$ 55,351	$ 96,864	$ -
2" Min	Mains Allocation	$ 131,224,831	$ 107,183,819	$17,664,210	$ 5,026,969	$ 1,093,831	$ 93,092	$ 162,911	$ -
	% Allocation		81.7%	13.5%	3.8%	0.8%	0.1%	0.1%	0.0%
1.25" Min	Mains Demand	$ 73,046,318	$ 11,515,773	$12,738,834	$14,299,148	$12,595,611	$21,896,952	$ -	$ -
1.25" Min	Mains Customer	$ 58,178,513	$ 47,519,933	$ 7,831,425	$ 2,228,706	$ 484,950	$ 41,272	$ 72,227	$ -
1.25" Min	Mains Allocation	$ 131,224,831	$ 107,183,819	$17,664,210	$ 5,026,969	$ 1,093,831	$ 93,092	$ 162,911	$ -
	% Allocation		81.7%	13.5%	3.8%	0.8%	0.1%	0.1%	0.0%

Conclusions:

Based on this study, we conclude the following:

1. The data to support a zero intercept analysis does not render a useable result and therefore is not an appropriate basis for classification of a customer component of mains.

2. The minimum system analysis produces statistically acceptable results for the Board ordered 1.25 inch pipe size, however there must be an allocation of demand component of mains investment to the residential class along with the customer component.
3. Black and Veatch believe that the 1.25 inch pipe is demonstrably not the minimum system size of pipe based on a review of the EGNB pattern of installation and customer growth. Based on both length and investment dollars in the EGNB system there has been a decline in the relative portion of 1.25 inch pipe over time. This decline indicates that the 1.25 inch pipe is not the minimum system pipe and is used as part of relatively short stub installations. In fact, based on the net customer growth from 2005 through 2008, the average meters of 1.25 inch pipe per new customer is 10.75 meters. For all but one year in this period the actual installation is less than 10 meters per new customer. Given the average density of the system these values are not representative of the pipe required to meet the test of the minimum system installation. As a result, the most reasonable conclusion for the system is that the 2 inch pipe should be the basis for the minimum system because it is far more representative of the general main installed to serve customers and the 1.25 inch pipe is predominantly stub mains.

Appendix A – Study Data

Length in Metres

Pipe Size	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL (m)
1" ST Total	0	50	0	1	0	0	29	370	0	0	
1" PE Total	0	0	0	0	0	15	0	0	0	0	
1-1/4" PE Total	100	28977	47634	6975	7273	32128	24861.3	9389	3688	3138	164,163
1-1/2 " ST Total	0	0	0	0	0	0	0	0	0	0	-
2" PE Total	11265	33598	30181	31711	42301	38587	30337.8	32260	20418	16967	287,625
2" ST Total	1305	948	1311	1095	2478	117	1570.9	4570	295	614	14,303
4" PE Total	19306	14623	16578	22284	22931	12230	8536	16247	6863	5441	145,038
4" ST Total	13141	1616	620	41	328	0	7850	4216	0	380	28,192
6" PE Total	19866	40	1125	6382	189	11514	0	34	5118	0	44,268
6" ST Total	28184	2196	0	12853	1290	0	11750	1953	0	0	58,226
8" ST Total	33780	0	2256	0	0	0	0	4	0	0	36,040
12" ST Total	0	0	0	0	0	0	0	0	0	0	-
3" ST Total	0	0	0	0	0	0	0	0	0	0	-
Total Pipe	126,947.00	82,048.00	99,705.00	81,341.10	76789.70	94590.60	84935.00	69042.20	36381.30	26540.70	778,320.60

Capitalized Cost

Pipe Size	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ($)
1" ST Total	0	30,602	0	6,718	0	0	6,860	-339	0	0	$56,780
1" PE Total	0	0	0	0	0	0	0	0	0	0	$0
1-1/4" PE Total	108,658	1,348,827	1,675,524	667,875	237,987	1,799,447	2,370,912	1,347,398	533,239	470,310	$12,278,334
1-1/2 " ST Total	29,853	-37,343	2,621	0	0	0	0	0	9,358	14,940	$16,367
2" PE Total	747,184	2,473,657	1,353,351	1,910,996	1,518,289	2,881,303	3,814,409	5,129,911	2,727,342	3,092,371	$28,850,509
2" ST Total	183,140	75,581	198,766	63,999	214,830	4,087	97,932	167,750	392,418	262,016	$2,038,196
4" PE Total	1,933,313	2,261,120	1,195,241	1,824,492	1,299,089	1,847,801	1,218,545	2,876,864	1,660,813	1,615,129	$20,778,244
4" ST Total	1,866,925	346,320	48,049	13,411	14,170	77,375	68,114	1,872,301	611,444	114,282	$6,796,595
6" PE Total	3,553,703	619,715	63,349	1,053,565	108,233	1,214,601	28,495	350	2,171,604	122,695	$10,904,145
6" ST Total	10,672,227	614,024	62,666	1,827,076	165,260	2,993,489	599,973	3,824,033	625,821	776,435	$31,728,159
8" ST Total	10,109,544	-230,285	-185,442	0	441,283	0	0	153,378	541,009	0	$17,850,649
12" ST Total	0	0	0	709	0	0	0	0	0	0	$904
3" ST Total	651	34	0	0	0	0	0	0	0	0	$934
Total Cost	$29,204,547	$7,502,219	$4,414,125	$7,368,841	$3,999,141	$10,818,103	$8,205,241	$15,371,647	$9,273,047	$6,468,178	$122,596,462

Capitalized Cost in 2010 Dollars

Pipe Size	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total 2010 Dollars
1" ST Total	$0	$51,739	$0	$9,881	$0	$0	$7,589	-$368	$0	$0	$68,842
1" PE Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1-1/4" PE Total	$148,367	$1,816,018	$2,188,625	$851,629	$286,774	$2,050,434	$2,545,166	$1,399,668	$521,342	$470,310	$12,278,334
1-1/2 " ST Total	$51,265	-$63,137	$4,298	$0	$0	$0	$0	$0	$9,001	$14,940	$16,367
2" PE Total	$1,020,234	$3,330,455	$1,767,791	$2,436,773	$1,829,538	$3,283,187	$4,094,755	$5,328,917	$2,666,489	$3,092,371	$28,850,509
2" ST Total	$314,503	$127,786	$325,976	$94,133	$241,730	$4,366	$108,337	$181,891	$377,458	$262,016	$2,038,196
4" PE Total	$2,639,821	$3,044,302	$1,561,263	$2,326,469	$1,565,402	$2,105,532	$1,308,104	$2,988,466	$1,623,756	$1,615,129	$20,778,244
4" ST Total	$3,206,029	$585,531	$78,800	$19,725	$15,944	$82,668	$75,350	$2,030,132	$588,133	$114,282	$6,796,595
6" PE Total	$4,852,364	$834,366	$82,749	$1,343,435	$130,420	$1,384,013	$30,589	$364	$2,123,151	$122,695	$10,904,145
6" ST Total	$18,327,176	$1,038,143	$102,772	$2,687,359	$185,953	$3,198,255	$663,714	$4,146,389	$601,962	$776,435	$31,728,159
8" ST Total	$17,360,892	-$389,347	-$304,125	$0	$496,538	$0	$0	$166,307	$520,384	$0	$17,850,649
12" ST Total	$0	$0	$0	$1,043	$0	$0	$0	$0	$0	$0	$1,043
3" ST Total	$1,118	$57	$0	$0	$0	$0	$0	$0	$0	$0	$1,175
Total Cost	$47,921,769	$10,375,913	$5,808,150	$9,770,446	$4,752,300	$12,108,456	$8,833,605	$16,241,766	$9,031,675	$6,468,178	$184,556,607

Cost per Metre

Pipe Size	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ($/m)
1" ST Total		612		6,718			237	-1			
1" PE Total						0					
1-1/4" PE Total	1,087	47	35	96	33	56	95	144	145	150	$74.79
1-1/2 " ST Total											
2" PE Total	66	74	45	60	36	75	126	159	134	182	$100.31
2" ST Total	140	80	152	58	87	35	62	37	1,330	427	$142.50
4" PE Total	100	155	72	82	57	151	143	177	242	297	$143.26
4" ST Total	142	214	77	327	43		9	444		301	$241.08
6" PE Total	179	15,493	56	165	573	105		10	424		$246.32
6" ST Total	379	280		142	128		51	1,958			$544.91
8" ST Total	299		-82					38,345			$495.30
12" ST Total				709							
3" ST Total	651	34									

Handy-Whitman Values

Handy-Whitman Mains (NorthCentral)-ST	382	388	400	446	583	614	593	605	682	656
Handy-Whitman Mains (NorthCentral)-PL	353	358	369	378	400	423	449	464	493	482

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Handy-Whitman Mains (NorthCentral)-ST	1.72	1.69	1.64	1.47	1.13	1.07	1.11	1.08	0.96	1.00
Handy-Whitman Mains (NorthCentral)-PL	1.37	1.35	1.31	1.28	1.21	1.14	1.07	1.04	0.98	1.00