

July 18, 2011

**Filed on RESS  
Sent by Courier**

Kirsten Walli  
Board Secretary  
Ontario Energy Board  
Suite 2700  
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Toronto, ON M4P 1E4

Your reference  
EB-2010-0018

Our reference  
01012724



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Dear Ms. Walli:

**Natural Resource Gas Limited ("NRG")  
Fiscal 2011 Rates Application (EB-2010-0018)**

In Phase 1 of NRG's 2011 rate case, the Board directed NRG to have an independent engineering study prepared to identify alternatives to maintaining system pressure in NRG's southern service area. As promised in our correspondence dated June 29, 2011, the system integrity study is now complete. Please find attached the final report.

In addition to filing this on RESS, hard copies are being couriered to the Board today.

Please contact me if you have any questions.

Yours very truly,

A handwritten signature in black ink, appearing to read 'John Beauchamp', with a stylized flourish at the end.

John Beauchamp

JB/mnm

Cop(y/ies) to: Laurie O'Meara  
Jack Howley  
All Intervenors and Observers

DOCSTOR: 2220680\1



# **Natural Resource Gas Limited**

## **System Integrity Study**

**Prepared For: Natural Resource Gas Limited**

**Attention: Mr. Jack Howley**

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Date: July 15, 2011

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# **1 SCOPE OF STUDY**

## **1.1 General**

Natural Resource Gas Limited (NRG) is a privately-owned local distribution company (LDC) that distributes natural gas in Southern Ontario to approximately seven thousand customers in the Town of Aylmer and surrounding regions.

The service territory extends south from Highway 401 to the shores of Lake Erie. In addition to the Town of Aylmer, NRG also serves the Municipalities of Thames Centre and Central Elgin, the Townships of Bayham, Malahide and South West Oxford.

The purpose of this study is to assess the existing NRG distribution system and identify viable alternatives to maintaining adequate system pressures with all existing well supplies removed from the system.

## **1.2 Understanding of the NRG Distribution System**

The NRG distribution system consists of over 639,000 metres of distribution mains being fed by, 20 NRG regulator stations, 7 NRG/Union Gas interconnection (UGL) stations, and a number of NRG Corp gas wells. See Appendix 1 for the NRG System Map.

NRG Corp has a total of 40 producing gas wells in the area capable of feeding into the NRG distribution system. Depending on the time of year and system requirements, the number of gas wells feeding the distribution system may vary.

During the frost-free periods of the year, the distribution system runs almost entirely on well gas. Operating conditions as a result of winter residential, commercial, light industrial demands, and grain drying operations dictate the introduction of gas from the UGL interconnection stations.

A simulation model of the distribution network had been put together by NRG using the SynerGEE Gas program. This simulation model should be a tool for NRG to analyze existing system operation, anticipate possible system pressure issues, and therefore, able to take proactive measures to mitigate and/or eliminate potential system issues.

## **1.3 NRG Supplied Information**

The following information and documents were made available for use and examination by Aecon Utility Engineering (AUE):

- a) NRG system map showing high-level pipe routing
- b) Pipe sizes
- c) Gas supply points including NRG/UGL interconnection stations
- d) Daily volumes and corresponding pressures at NRG/UGL interconnection meter locations
- e) Gas well audit trail reports showing hourly volumes and pressures.

## **1.4 Scope of Work**

This system integrity study consists of the following general steps:

- a) Review of the existing NRG distribution system.
- b) Review and validate the simulation model of the NRG distribution system.
- c) Run the existing simulation model using different system loading scenarios.
- d) Determine alternatives for maintaining adequate system capacity and pressures to mitigate the impact of the removal of well supplies from the distribution network.
- e) Prepare high-level total installed cost estimates for each alternative.
- f) Summarize results of the evaluation and provide recommendations

## **2 DISTRIBUTION SYSTEM REVIEW**

### **2.1 Distribution Pipeline Network**

The distribution network consists of high density polyethylene (HDPE) pipes of various nominal pipe sizes (NPS) from NPS-6 to NPS-1 diameter pipes.

A NPS-6 HDPE feeder main extends from the Putnam (NRG/UGL) Station south along Lewis Road, Helder Road, Newell Road, Hacienda Road, and then west along Glencolin Road to feed the Aylmer NW Regulator Station.

There are NPS-4 mains extending from various NRG/UGL interconnection stations feeding smaller gas mains throughout the distribution system.

Gas mains are looped at strategic locations to ensure adequate system pressures and capacities are achieved. Isolation valves are present to allow isolation of the distribution mains, if required.

### **2.2 NRG / UGL Interconnection Stations**

The interconnection stations are as follows:

- a) Belmont Station (Outlet set @ 80 psig / 550 kPag)
- b) Harrietsville Station (Outlet set @ 90 psig / 620 kPag)
- c) Putnam Station (Outlet set @ 90 psig / 620 kPag)
- d) Brownsville Station (Outlet set @ 35 psig / 240 kPag)
- e) Bayham Station (Outlet set @ 90 psig / 620 kPag)
- f) Eden Station (Outlet set @ 90 psig / 620 kPag)
- g) North Walsingham Station (Outlet set @ 90 psig / 620 kPag)

These interconnection stations are fed into the NRG regulator stations which further step down the line pressure to the desired values.

### **2.3 NRG Regulator Stations**

The NRG regulator systems are summarized as follows:

- a) Belmont South (Outlet set @ 35 psig / 240 kPag)
- b) Belmont North (Outlet set @ 31 psig / 210 kPag)
- c) Nilestown South (Outlet set @ 75 psig / 520 kPag)
- d) Nilestown North (Outlet set @ 15 psig / 100 kPag)
- e) Brownsville (Outlet set @ 30 psig / 210 kPag)
- f) Eden Ridge (Outlet = 80 psig / 550 kPag)
- g) Bayham New Eng (Outlet set @ 78 psig / 540 kPag)
- h) Browns South (Outlet set @ 30 psig / 210 kPag)
- i) Port Bruce (Outlet set @ 20 psig / 140 kPag)
- j) Aylmer West (Outlet set @ 30 psig / 210 kPag)
- k) Aylmer South (Outlet set @ 30 psig / 210 kPag)

- l) Aylmer Southeast (Outlet set @ 30 psig / 210 kPag)
- m) Aylmer North (Outlet set @ 30 psig / 210 kPag)
- n) Aylmer Northwest (Outlet set @ 30 psig / 210 kPag)
- o) Burwell Northwest (Outlet set @ 28 psig / 190 kPag)
- p) Burwell Northeast (Outlet set @ 28 psig / 190 kPag)
- q) Harrietsville (Outlet = 79 psig / 540 kPag)
- r) North Walsingham (Outlet = 80 psig / 550 kPag)
- s) Putnam (Outlet set = 73 psig / 500 kPag)
- t) Ostrander Road (Outlet set @ 30 psig / 210 kPag)

These regulator stations rely on the NRG/UGL stations to supply sufficient line pressures to allow the regulators to feed downstream customers. The capacities for these regulators are dependent on the inlet pressures from the NRG/UGL station outlets. Typically, the higher the inlet pressure values, the higher the overall capacity for these regulators. However, the inlet pressures to these regulators drop considerably, the regulator outlet pressures may start to droop, at which time, the capacities of the regulator stations will start to decrease and may eventually dropped off from the distribution network.

## **2.4 NRG Corp Gas Wells**

NRG Corp has 40 gas wells in the area which can feed sales quality gas into the NRG distribution system.

For the purpose of this study, the cold-day simulation model uses actual recorded flow data from the following active gas wells which were feeding gas into the NRG distribution network in January 23 and 24 of 2011:

- a) 02-02 Well (Outlet = 71 psig / 490 kPag)
- b) 06-04 Well (Outlet = 61 psig / 420 kPag)
- c) 06-09 Well (Outlet = 61 psig / 420 kPag)
- d) 06-10 Well (Outlet = 61 psig / 420 kPag)
- e) 07-01 Well (Outlet = 61 psig / 420 kPag)

### **3 VALIDATION SYSTEM SIMULATION MODEL**

#### **3.1 General**

The simulation model of the NRG distribution system is constructed from on-linear mathematical equations based on available network information: pipe sizes and lengths, pressure regulator coefficients and outlet set-points, and customer gas flow rates, etc.

The equation solutions provide predictions of pressures, flows, valve positions, and pipe diameters necessary to achieve desired results.

The simulation software (SynerGee Gas) solves all equations in terms of nodal pressures, and then computes the resultant facility flows. This iterative process ideally results in a solution where all unknown facilities, unknown pressures, and unknown flows are solved to within the set tolerances which are required to limit the number of iterations.

As a tool, the simulation model must reflect reasonably closely to the characteristics of the distribution system in the field under various loading conditions, especially during peak demand during the coldest day of the year.

#### **3.2 NRG Distribution System Simulation Model**

The NRG distribution system model has the following characteristics:

- a) 1107 segment of simulated pipe lengths totaling approximately 639,000 metres
- b) 20 pressure regulating facilities (including the 7 NRG/UGL interconnections)
- c) 12 supply sources (including the 7 NRG/UGL interconnections (fixed pressures) and 5 active gas wells (fixed flows))
- d) 31 fixed demand (flow) locations or nodes (including large users like grain dryers)
- e) 24 fixed pressure locations (including the 7 NRG/UGL interconnections)

#### **3.3 Model Data Review**

Flow data for all NRG/UGL interconnection stations (Appendix 2) and NRG Corp gas well flow charts (Appendix 3) were reviewed against the data contained in the model data base. The supplied data are found to be faithfully reflected in the model data base and, as such, are deemed to reflect reasonably accurately the amount of gas flowing into the NRG distribution network.

#### **3.4 Model Runs of Existing Distribution System**

A simulation run of the current NRG distribution system for a -28 degree day (January 23/24, 2011) with grain dryers operating was performed and the resultant flows and pressures were examined for accuracy and consistency for the purpose of predicting system behavior. The system pressure profile for this simulation run can be found in Appendix 4.



The result of this simulation run indicates that the distribution system would be working properly with no pressure issue on a -28 degree day even with the grain dryers in operation.

The grain dryers were turned on in the simulation run to account for the scenario of late fall harvest and the occurrence of a cold snap in late fall or early part of winter.

#### **4 REMOVAL OF WELL GAS FROM THE NRG DISTRIBUTION SYSTEM**

A simulation run was performed for a cold (-28 deg. C) day with all the gas wells shut in and the resultant system pressure map was shown in Appendix 5.

The simulation results show the lowest line pressure is 5 psig located at the inlet of Aylmer South Regulator Station. Aylmer West Regulator Station sees 12 psig of inlet pressure. With such low inlet pressures, the regulator at the Aylmer town regulator stations will seize to operate and wide-spread outage will occur.

To maintain adequate system pressures without the benefits of well supplies, alternatives must be looked into in bringing fresh gas supply to affected areas, i.e.: the Town of Aylmer and the area just south of Aylmer.

## **5 PROPOSED ALTERNATIVES**

There are different ways to bring in additional capacities to the existing distribution system to make up for the lack of well supplies.

Alternatives considered are described in the following sections:

### **5.1 New Gas Supply from UGL HP Facility East of the NRG Franchise Area (Alternative #1)**

This alternative entails running approximately 23 kilometers of NPS-4 high pressure steel pipeline from a UGL facility located south of the Town of Tillsonburg just east of the NRG franchise area. The new pipeline will end at a new NRG pressure regulating facility located at the corner of Talbot Line and Springfield Road (Summers Corner).

The pipeline is be designed to have an inlet pressure of 400 psig and an end pressure of no less than 150 psig at the new NRG pressure regulating station with outlet pressure set at 70 psig. The capacity of this pipeline is 200,000 scfh (4.80 mmcf/d).

The high-level estimated costs are as follows:

- NPS-4 steel pipeline = \$6.7 million
- UGL & NRG pressure regulator facilities = \$0.9 million
- Total estimated cost = \$7.6 million

### **5.2 New Gas Supply from UGL HP Facility near Highway 401 (Alternative #2)**

This alternative involves the installation of approximately 28 kilometers of NPS-4 HP steel pipeline from a UGL gas source to a new NRG pressure regulating facility located at the corner of Talbot Line and Springfield Road (Summers Corner).

The pipeline is be designed to have an inlet pressure of 450 psig and an end pressure of no less than 150 psig at the new NRG pressure regulating station with outlet pressure set at 70 psig. The capacity of this pipeline is 207,000 scfh (4.97 mmcf/d).

The high-level estimated costs are as follows:

- NPS-4 steel pipeline = \$7.2 million
- NGL & NRG pressure regulator facilities = \$0.9 million
- Total estimated cost = \$8.1 million

### **5.3 New Gas Feed from UGL Interconnection Station near Highway 401 (Alternative #3)**

This alternative involves the installation of approximately 28 kilometers of NPS-10 distribution pressure pipeline from a UGL interconnection station to a new NRG pressure regulating station located at the corner of Talbot Line and Springfield Road (Summers

Corner). This proposed pipeline is also met to be a "Bullet" line with no connection with other distribution mains along the way.

The pipeline is be designed to have an inlet pressure of 100 psig and an end pressure of no less than 90 psig at the new NRG pressure regulating station with outlet pressure set at 80 psig. The capacity of this pipeline is 207,000 scfh (4.97 mmcf/d).

The high-level estimated costs are as follows:

- NPS-10 steel pipeline = \$22.0 million
- NGL & NRG pressure regulator facilities = \$0.9 million
- Total estimated cost = \$22.9 million

## 6 CONCLUSION AND RECOMMENDATIONS

The estimated total costs for the various alternatives are for pipeline materials and installation, and pressure regulating facility costs only. Costs associated with surveying, land costs, and rights-of-way are not included. Additionally, the operating and maintenance costs associated with a high pressure pipeline are also not accounted for in the estimated costs.

At \$22.9 million, alternative #3 is an expensive way of getting additional capacity to the existing distribution system. There is no real advantage in picking this option over the other two alternatives.

As the estimated costs alternatives #1 and #2 are fairly close to each other, either alternative could be viable for bringing in new gas supply to ensure that the NRG distribution system has adequate capacity to ensure safe and reliable service to existing customers without any well supplies from the current NRG Corp gas wells.

To properly select the most feasible alternative, it is recommended that the following be conducted:

- a) Consult Union Gas Limited regarding a suitable gas supply location in their system in the vicinity of the NRG franchise territory. The inlet pressure to the new pipeline will dictate its capacity. The availability of higher line pressures may result in a smaller pipeline.
- b) Walk the entire pipeline routing prior to select the final pipeline alignment.
- c) Perform detailed design exercises to ensure all possible operating scenarios are accounted prior to arriving at the final size for the pipeline and pressure regulating facilities.
- d) Prepare detailed cost estimates.
- e) Perform cost benefit analyses

## **7 APPENDICES**

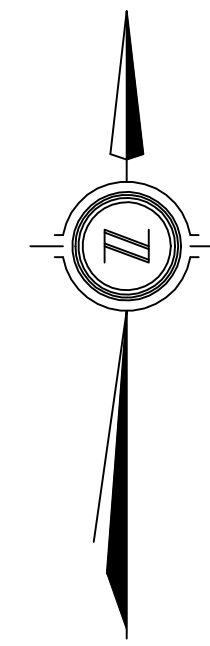
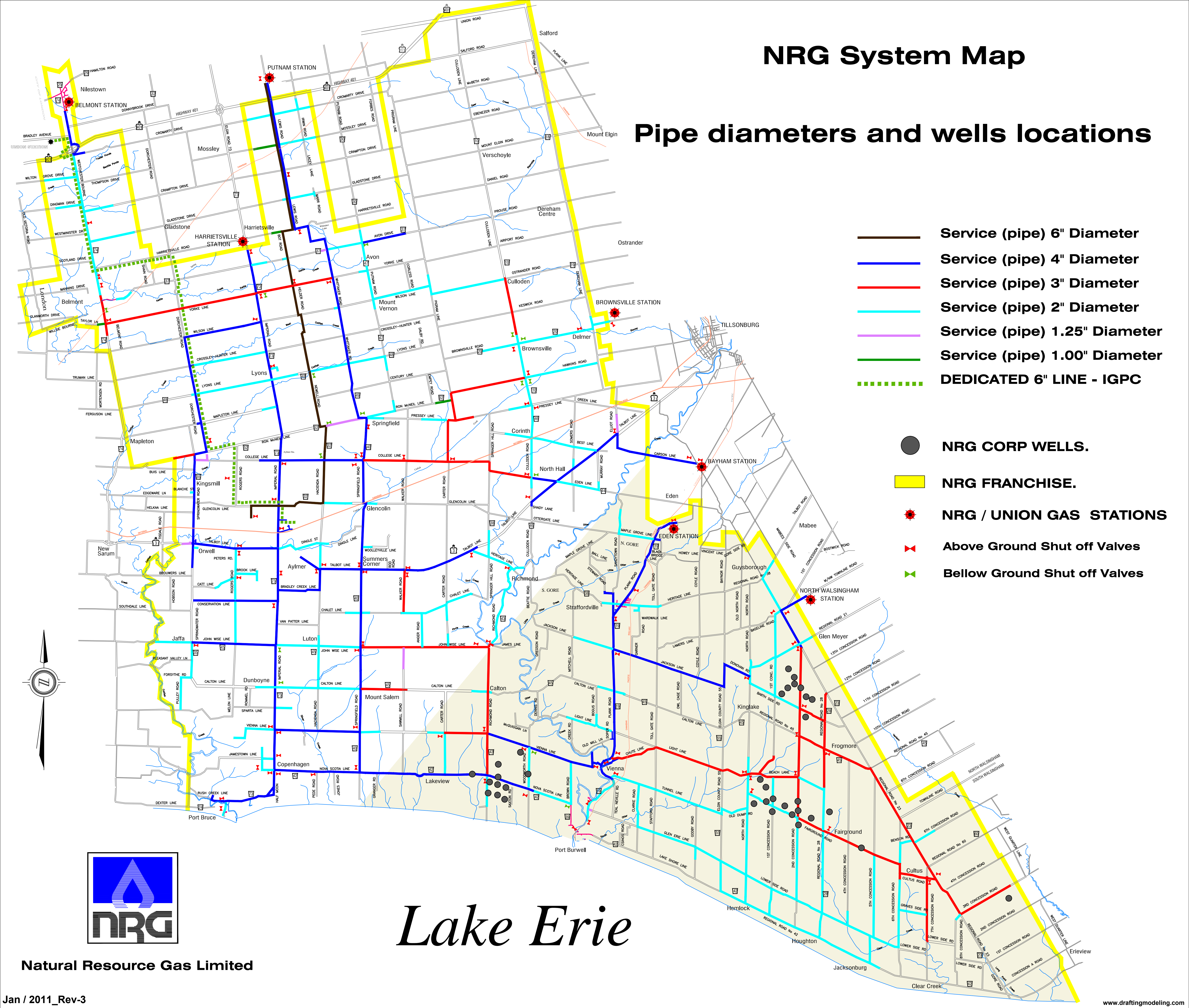
- Appendix 1 – NRG System Map
- Appendix 2 – NRG / Union Gas Limited Interconnection Station Flow Data
- Appendix 3 – NRG Corp Gas Well Flow Charts
- Appendix 4 – Simulated System Pressure Map – Current System Conditions
- Appendix 5 – System Pressure Map – Well Supplies Turned Off
- Appendix 6 – System Pressure Map – Alternative #1
- Appendix 7 – System Pressure Map – Alternative #2
- Appendix 8 – System Map - Alternative #3

## Appendix 1 – NRG System Map



# NRG System Map

## Pipe diameters and wells locations



Natural Resource Gas Limited

Lake Erie



## **Appendix 2 – NRG / Union Gas Limited Interconnection Station Flow Data**

## Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: Harrietsville Station

Site Id: 8-8

Site Location: Union/NRG Station

Date	Time	Incremental Cor Vol	Incremental Unc Vol	Average Pressure	Average Temperature	Previous Day Corvol	Corrected Volume	Uncorrected Volume	Gas Pressure	Gas Temperature	Daily Cor Vol	Log Trigger
		CCF	CCF	PSIG	F	CCF	CCF	CCF	PSIG	F	CCF	
1/23/2011	23:00:00	1043	147	82.57	31.43	18188	11110906	1841192	82.77	31.21	9989	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	00:00:00	1038	146	82.63	30.96	18188	11111944	1841338	82.41	30.75	11027	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	01:00:00	1046	148	82.05	30.99	18188	11112990	1841486	81.80	30.96	12073	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	02:00:00	1045	149	81.42	30.96	18188	11114035	1841635	81.05	30.66	13118	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	03:00:00	1053	151	80.78	30.99	18188	11115088	1841786	80.57	31.44	14171	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	04:00:00	1057	153	79.99	31.25	18188	11116145	1841939	79.81	30.71	15228	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	05:00:00	1057	154	79.33	30.83	18188	11117202	1842093	78.54	30.00	16285	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	06:00:00	1070	158	77.83	29.38	18188	11118272	1842251	77.19	29.26	17355	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	07:00:00	696	102	78.66	30.36	18188	11118968	1842353	84.79	29.16	18051	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	08:00:00	656	92	83.11	32.29	18188	11119624	1842445	83.01	34.25	18707	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	09:00:00	759	107	82.91	33.64	18188	11120383	1842552	82.92	33.69	19466	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												
1/24/2011	10:00:00	765	108	82.95	33.87	18188	11121148	1842660	82.91	33.43	20231	Time
(Batt Low Volt) (Batt Cycles) (SW #1 Fault) (Pulser A Limit)												

\* - Records have been modified

5/16/2011 10:20:34 AM

# Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: North Walsingham Station

Site Id: 10-10

Site Location: Union/NRG Station

Date	Time	Incremental Cor Vol	Incremental Unc Vol	Average Pressure	Average Temperature	Previous Day Corvol	Corrected Volume	Uncorrected Volume	Gas Pressure	Gas Temperature	Daily Cor Vol	Log Trigger
		CCF	CCF	PSIG	F	CCF	CCF	CCF	PSIG	F	CCF	
1/23/2011	23:00:00	287	41	86.62	29.27	6080	6724184	1043392	86.67	29.61	3247	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	00:00:00	274	39	86.89	28.71	6080	6724458	1043431	87.08	28.94	3521	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	01:00:00	280	40	86.74	29.14	6080	6724738	1043471	86.41	29.35	3801	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	02:00:00	285	41	85.98	29.53	6080	6725023	1043512	85.75	29.38	4086	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	03:00:00	290	42	85.25	28.35	6080	6725313	1043554	84.80	28.38	4376	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	04:00:00	287	42	84.52	28.90	6080	6725600	1043596	84.19	28.73	4663	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	05:00:00	293	43	83.86	28.99	6080	6725893	1043639	83.42	29.20	4956	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	06:00:00	296	44	82.86	28.51	6080	6726189	1043683	82.52	28.39	5252	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	07:00:00	337	48	86.97	30.09	6080	6726526	1043731	93.49	33.32	5589	Time
(Batt Cycles) (Tamper Detect)												
1/24/2011	08:00:00	384	51	94.27	33.35	6080	6726910	1043782	95.00	33.35	5973	Time
(Batt Cycles) (Press Out Range) (Tamper Detect) (Press High)												
1/24/2011	09:00:00	366	48	95.46	33.51	6080	6727276	1043830	96.69	33.84	6339	Time
(Batt Cycles) (Press Out Range) (Tamper Detect) (Press High)												
1/24/2011	10:00:00	349	45	97.57	35.00	6080	6727625	1043875	98.45	35.46	6688	Time
(Batt Cycles) (Press Out Range) (Tamper Detect) (Press High)												

\* - Records have been modified

5/16/2011 10:20:34 AM

# Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: New England

Site Id: 78-78

Site Location: Carson Ln

Date	Time	Incremental Cor Vol	Incremental Unc Vol	PCor Average Pressure	Average Temperature	Battery Voltage Reading	Corrected Volume	Uncorrected Volume	PCor Gas Pressure	Gas Temperature	Daily Cor Vol	Log Trigger
		MCF	CCF	PSIG	F	Volts	MCF	CCF	PSIG	F	MCF	
1/23/2011	21:00:00	23	33	78.89	15.14	8.09	72531	00109767	79.47	15.57	233	Time
1/23/2011	21:00:00	23	33	78.89	15.14	8.09	72531	109767	79.47	15.57	233	Time
1/23/2011	22:00:00	23	33	79.10	15.01	8.08	72554	109800	79.05	15.44	256	Time
1/23/2011	22:00:00	23	33	79.10	15.01	8.08	72554	00109800	79.05	15.44	256	Time
1/23/2011	23:00:00	24	34	79.75	15.45	8.08	72578	109834	79.32	14.73	280	Time
1/23/2011	23:00:00	24	34	79.75	15.45	8.08	72578	00109834	79.32	14.73	280	Time
1/24/2011	00:00:00	24	33	80.18	14.34	8.07	72602	00109867	80.25	14.23	304	Time
1/24/2011	00:00:00	24	33	80.18	14.34	8.07	72602	109867	80.25	14.23	304	Time
1/24/2011	01:00:00	24	34	79.91	14.22	8.07	72626	109901	79.02	15.15	328	Time
1/24/2011	01:00:00	24	34	79.91	14.22	8.07	72626	00109901	79.02	15.15	328	Time
1/24/2011	02:00:00	25	35	79.16	13.84	8.07	72651	109936	78.88	12.93	353	Time
1/24/2011	02:00:00	25	35	79.16	13.84	8.07	72651	00109936	78.88	12.93	353	Time
1/24/2011	03:00:00	26	36	78.85	12.95	8.07	72677	00109972	79.16	12.14	379	Time
1/24/2011	03:00:00	26	36	78.85	12.95	8.07	72677	109972	79.16	12.14	379	Time
1/24/2011	04:00:00	26	37	78.89	13.22	8.05	72703	110009	78.60	14.89	405	Time
1/24/2011	04:00:00	26	37	78.89	13.22	8.05	72703	00110009	78.60	14.89	405	Time
1/24/2011	05:00:00	27	39	78.48	13.20	8.06	72730	110048	78.51	11.97	432	Time
1/24/2011	05:00:00	27	39	78.48	13.20	8.06	72730	00110048	78.51	11.97	432	Time
1/24/2011	06:00:00	29	40	78.36	12.48	8.05	72759	110088	78.09	12.96	461	Time
1/24/2011	06:00:00	29	40	78.36	12.48	8.05	72759	00110088	78.09	12.96	461	Time
1/24/2011	07:00:00	31	43	78.15	14.47	8.05	72790	110131	77.94	17.86	492	Time
1/24/2011	07:00:00	31	43	78.15	14.47	8.05	72790	00110131	77.94	17.86	492	Time

\* - Records have been modified

5/16/2011 10:20:34 AM

# Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: Ridge Rd

Site Id: 79-79

Site Location: Ridge Ln

Date	Time	Incremental Cor Vol	Incremental Unc Vol	PCor Average Pressure	Average Temperature	Battery Voltage Reading	Corrected Volume	Uncorrected Volume	PCor Gas Pressure	Gas Temperature	Daily Cor Vol	Log Trigger
		MCF	CCF	PSIG	F	Volts	MCF	CCF	PSIG	F	MCF	
1/23/2011	10:00:00	32	43	83.90	16.54	8.24	92918	00136158	84.75	17.05	660	Time
1/23/2011	11:00:00	30	40	84.90	18.32	8.24	92948	00136198	84.83	18.96	30	Time
1/23/2011	12:00:00	27	36	84.83	20.90	8.25	92975	00136234	84.67	24.53	57	Time
1/23/2011	13:00:00	25	34	84.89	25.85	8.26	93000	00136268	84.85	27.02	82	Time
1/23/2011	14:00:00	23	32	84.84	28.11	8.27	93023	00136300	84.75	28.13	105	Time
1/23/2011	15:00:00	23	31	84.90	27.85	8.27	93046	00136331	84.80	27.83	128	Time
1/23/2011	16:00:00	22	30	84.81	27.29	8.27	93068	00136361	84.82	25.55	150	Time
1/23/2011	17:00:00	21	29	84.33	24.25	8.27	93089	00136390	83.84	22.16	171	Time
1/23/2011	18:00:00	23	31	83.25	20.65	8.26	93112	00136421	83.19	19.94	194	Time
1/23/2011	19:00:00	25	34	83.08	19.56	8.25	93137	00136455	83.19	19.36	219	Time
1/23/2011	20:00:00	27	37	83.02	18.95	8.24	93164	00136492	83.00	18.00	246	Time
1/23/2011	21:00:00	29	39	83.15	18.21	8.23	93193	00136531	83.22	18.04	275	Time
1/23/2011	22:00:00	28	39	83.41	18.09	8.23	93221	00136570	83.37	18.09	303	Time
1/23/2011	23:00:00	30	40	83.68	17.36	8.22	93251	00136610	83.93	17.47	333	Time
1/24/2011	00:00:00	29	39	84.28	17.92	8.22	93280	00136649	84.15	17.56	362	Time
1/24/2011	01:00:00	29	39	84.39	17.36	8.22	93309	00136688	84.23	17.76	391	Time
1/24/2011	02:00:00	30	40	83.67	17.47	8.22	93339	00136728	83.07	17.10	421	Time
1/24/2011	03:00:00	30	41	83.06	16.76	8.22	93369	00136769	83.01	16.49	451	Time
1/24/2011	04:00:00	32	43	83.06	16.85	8.21	93401	00136812	82.95	17.42	483	Time
1/24/2011	05:00:00	33	45	82.99	17.37	8.21	93434	00136857	83.04	16.86	516	Time
1/24/2011	06:00:00	35	48	82.96	16.91	8.21	93469	00136905	82.78	17.05	551	Time
1/24/2011	07:00:00	37	50	82.93	17.16	8.21	93506	00136955	83.23	18.19	588	Time

\* - Records have been modified

5/16/2011 10:20:34 AM

# Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: Nilestown Station

Site Id: 45-45

Site Location:

Date	Time	Incremental Cor Vol	Incremental Unc Vol	PCor Average Pressure	Average Temperature	Daily Cor Vol	Corrected Volume	Uncorrected Volume	PCor Gas Pressure	Gas Temperature	Battery Wakeup Cycles	Log Trigger
		MCF	CCF	PSIG	F	MCF	MCF	CCF	PSIG	F	----	
1/23/2011	23:00:00	20	27	83.44	14.13	226	217782	355587	84.34	14.35	2906001	Time
(SW #1 Fault)												
1/24/2011	00:00:00	20	26	84.75	13.70	246	217802	355613	84.78	13.66	2912475	Time
(SW #1 Fault)												
1/24/2011	01:00:00	20	27	84.72	13.38	266	217822	355640	84.54	12.56	2912756	Time
(SW #1 Fault)												
1/24/2011	02:00:00	21	27	84.76	11.72	287	217843	355667	84.50	11.01	2913038	Time
(SW #1 Fault)												
1/24/2011	03:00:00	20	27	84.71	10.57	307	217863	355694	84.35	12.26	2913324	Time
(SW #1 Fault)												
1/24/2011	04:00:00	22	28	84.64	11.88	329	217885	355722	84.73	11.15	2913618	Time
(SW #1 Fault)												
1/24/2011	05:00:00	21	29	84.62	11.11	350	217906	355751	84.52	11.63	2913918	Time
(SW #1 Fault)												
1/24/2011	06:00:00	23	30	84.50	11.52	373	217929	355781	84.63	10.82	2914232	Time
(SW #1 Fault)												
1/24/2011	07:00:00	24	31	84.40	12.45	397	217953	355812	84.42	13.82	2914558	Time
(SW #1 Fault)												
1/24/2011	08:00:00	21	29	83.84	14.13	418	217974	355841	72.16	11.88	2914864	Time
(SW #1 Fault)												
1/24/2011	09:00:00	21	30	76.61	13.35	439	217995	355871	71.86	15.57	2915171	Time
(SW #1 Fault)												
1/24/2011	10:00:00	19	29	71.92	17.29	458	218014	355900	71.97	17.69	2915479	Time
(SW #1 Fault)												

\* - Records have been modified

5/16/2011 10:20:34 AM

## Audit Trail Report (Without Summary)

Report Name: MasterLink32 Audit Trail Report (Without Summary)

Report Date: 5/16/2011

Report Selections: 6 Sites, From 1/23/2011 10:00:00 AM To 1/24/2011 10:00:00 AM

Site Name: Putnam Station

Site Id: 11-11

Site Location: Union/NRG Station

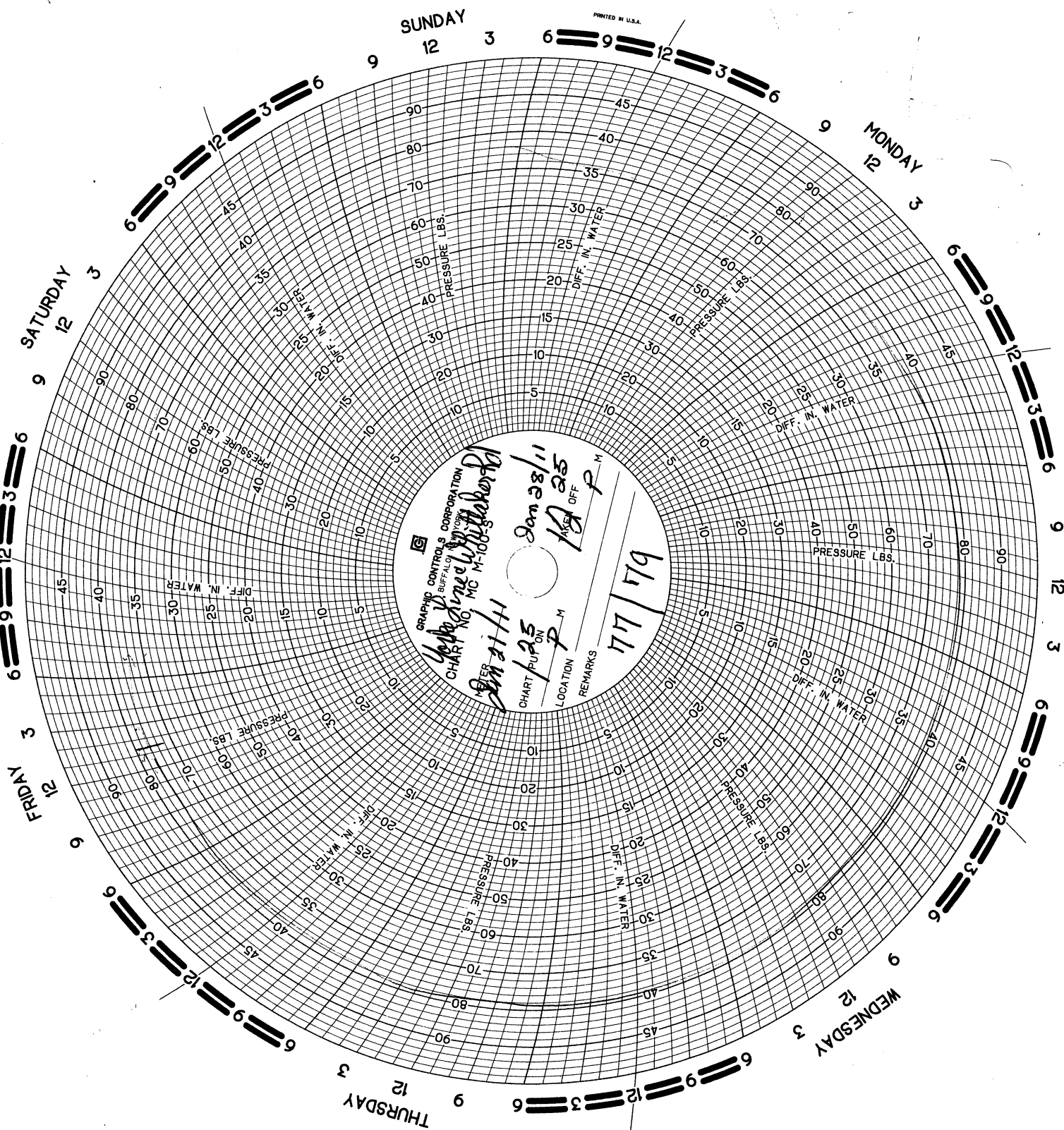
Date	Time	Incremental Cor Vol	Incremental Unc Vol	Average Pressure	Average Temperature	Previous Day Corvol	Corrected Volume	Uncorrected Volume	Gas Pressure	Gas Temperature	Daily Cor Vol	Log Trigger
		CCF	CCF	PSIG	F	CCF	CCF	CCF	PSIG	F	CCF	
1/23/2011	10:00:00	559	82	78.35	29.08	10430	23561455	3911603	78.78	28.68	11483	Time
1/23/2011	11:00:00	509	74	79.05	28.20	11483	23561964	3911677	79.15	27.83	509	Time
1/23/2011	12:00:00	450	65	79.55	28.16	11483	23562414	3911742	79.93	28.57	959	Time
1/23/2011	13:00:00	448	64	80.79	29.81	11483	23562862	3911806	81.90	31.24	1407	Time
1/23/2011	14:00:00	474	67	82.49	32.16	11483	23563336	3911873	83.12	32.91	1881	Time
1/23/2011	15:00:00	471	66	83.28	33.12	11483	23563807	3911939	83.88	33.68	2352	Time
1/23/2011	16:00:00	496	69	84.17	33.19	11483	23564303	3912008	84.18	32.45	2848	Time
1/23/2011	17:00:00	467	65	83.84	32.25	11483	23564770	3912073	83.23	32.49	3315	Time
1/23/2011	18:00:00	425	60	82.52	31.55	11483	23565195	3912133	81.63	30.26	3740	Time
1/23/2011	19:00:00	417	60	80.08	29.49	11483	23565612	3912193	78.74	29.02	4157	Time
1/23/2011	20:00:00	394	58	78.02	28.54	11483	23566006	3912251	77.24	28.30	4551	Time
1/23/2011	21:00:00	377	56	76.91	28.27	11483	23566383	3912307	76.53	27.78	4928	Time
1/23/2011	22:00:00	320	48	76.07	27.21	11483	23566703	3912355	75.70	26.86	5248	Time
1/23/2011	23:00:00	318	48	75.35	26.83	11483	23567021	3912403	75.24	26.59	5566	Time
1/24/2011	00:00:00	265	40	75.02	25.84	11483	23567286	3912443	75.09	25.43	5831	Time
1/24/2011	01:00:00	232	35	74.82	24.60	11483	23567518	3912478	75.00	24.58	6063	Time
1/24/2011	02:00:00	250	38	74.46	24.63	11483	23567768	3912516	74.38	24.96	6313	Time
1/24/2011	03:00:00	296	45	74.41	25.23	11483	23568064	3912561	74.44	25.63	6609	Time
1/24/2011	04:00:00	348	53	74.36	26.08	11483	23568412	3912614	74.13	26.34	6957	Time
1/24/2011	05:00:00	385	59	73.96	26.67	11483	23568797	3912673	74.37	27.15	7342	Time
1/24/2011	06:00:00	445	68	74.36	27.65	11483	23569242	3912741	74.19	27.67	7787	Time
1/24/2011	07:00:00	493	76	73.72	28.16	11483	23569735	3912817	73.71	28.66	8280	Time
1/24/2011	08:00:00	614	94	74.59	29.74	11483	23570349	3912911	75.69	30.51	8894	Time

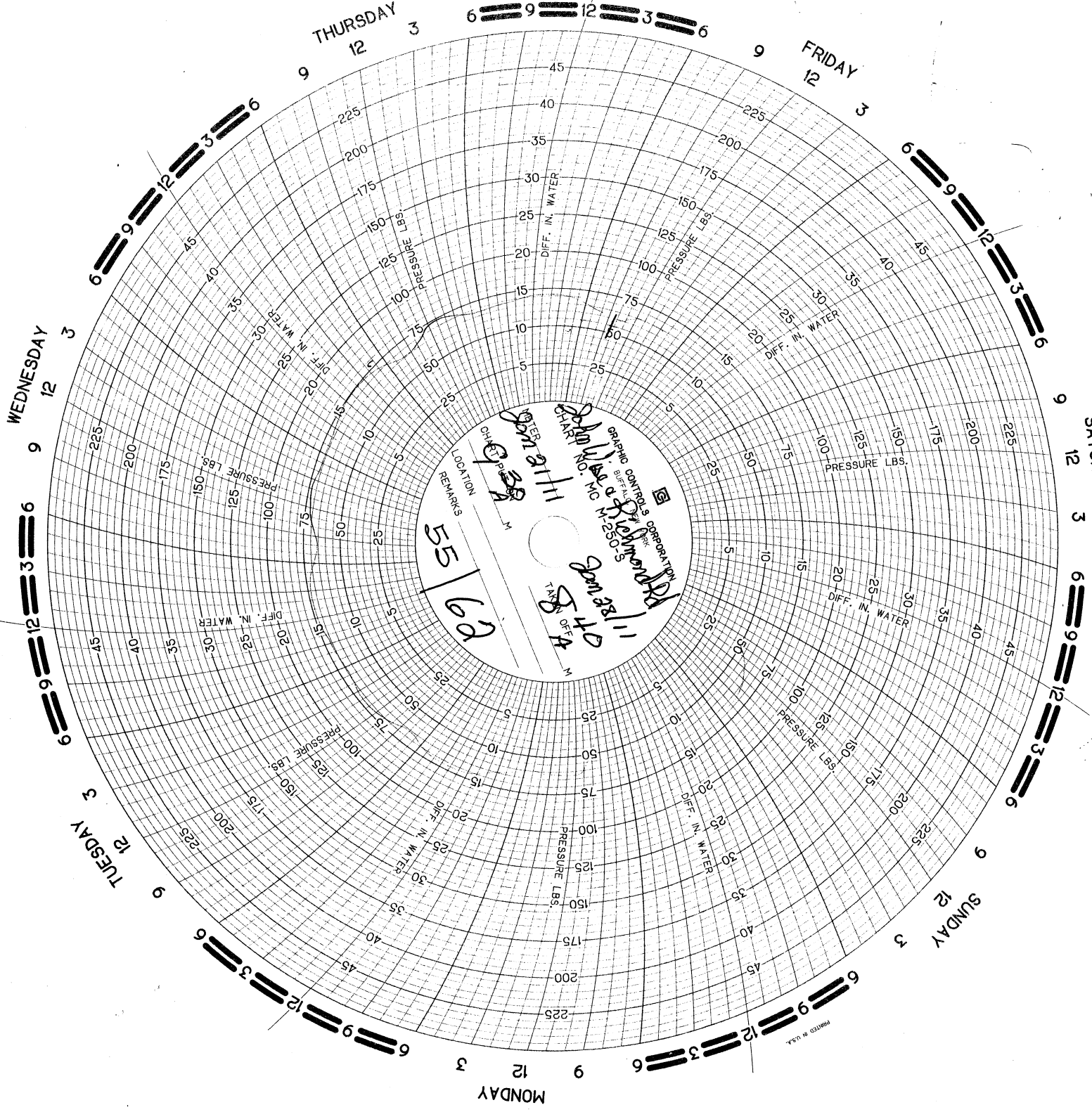
\* - Records have been modified

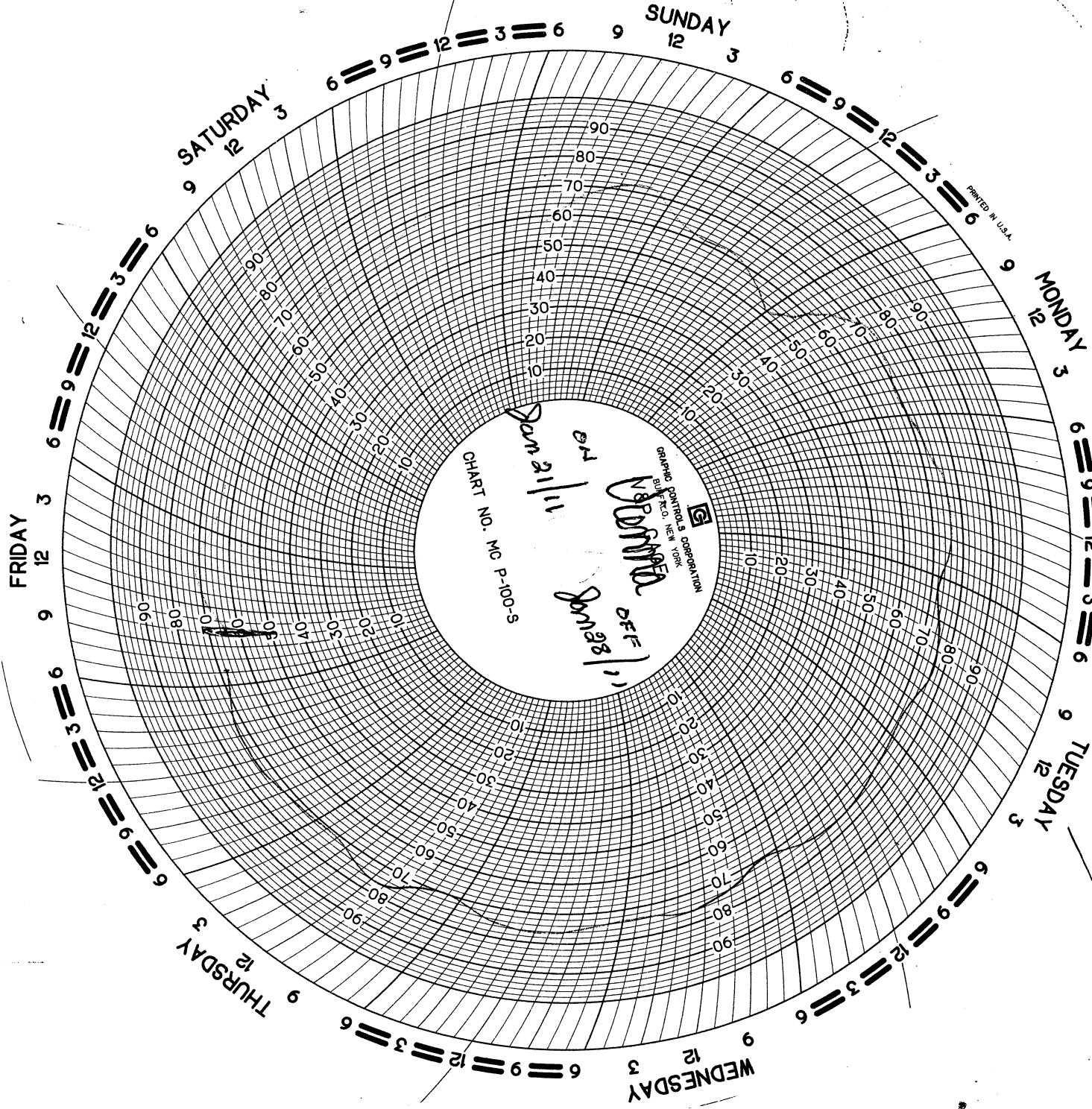
5/16/2011 10:20:34 AM

## Appendix 3 – NRG Corp Gas Well Flow Charts







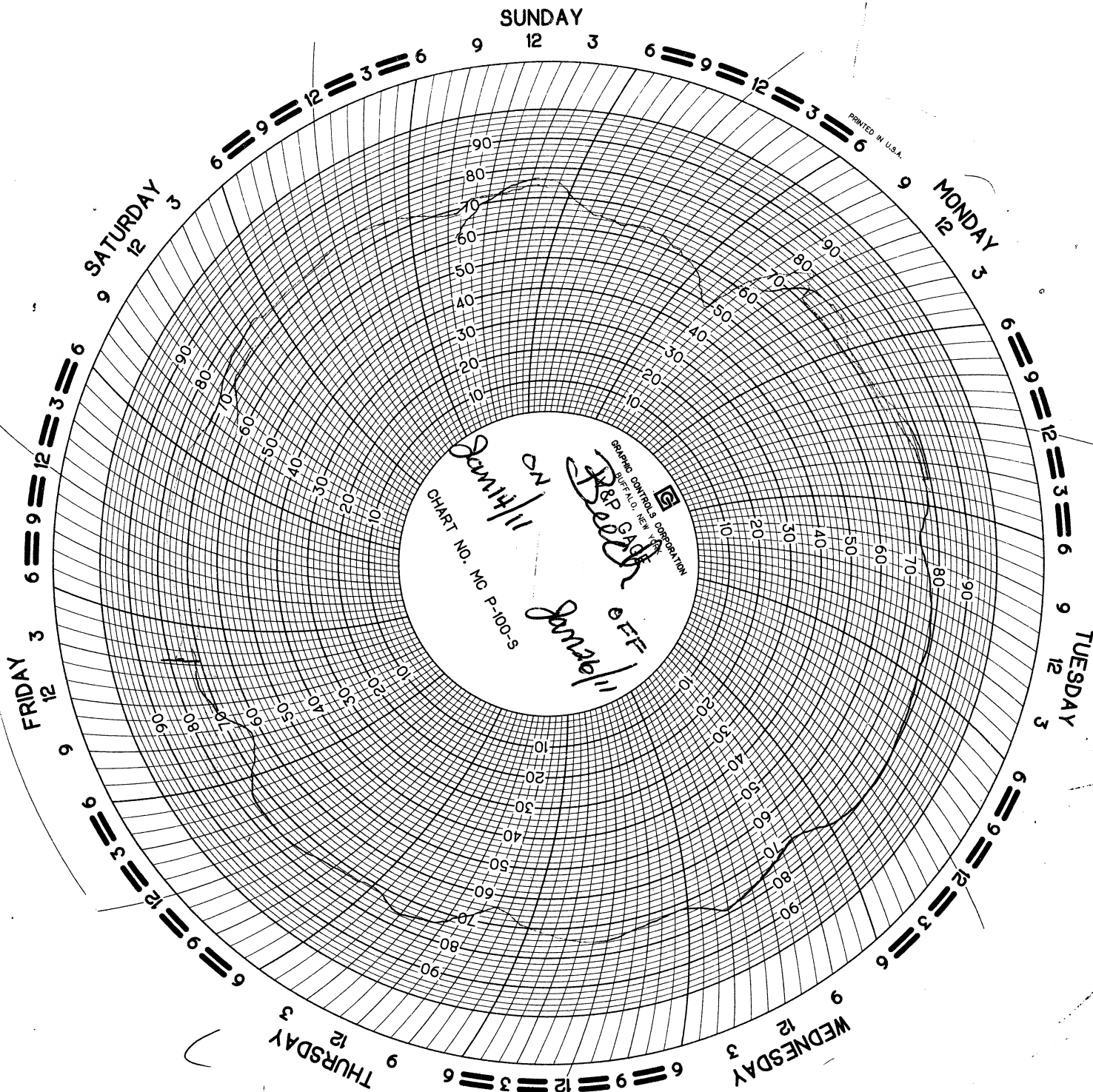


PRINTED IN U.S.A.

CHART NO. MC P-100-S

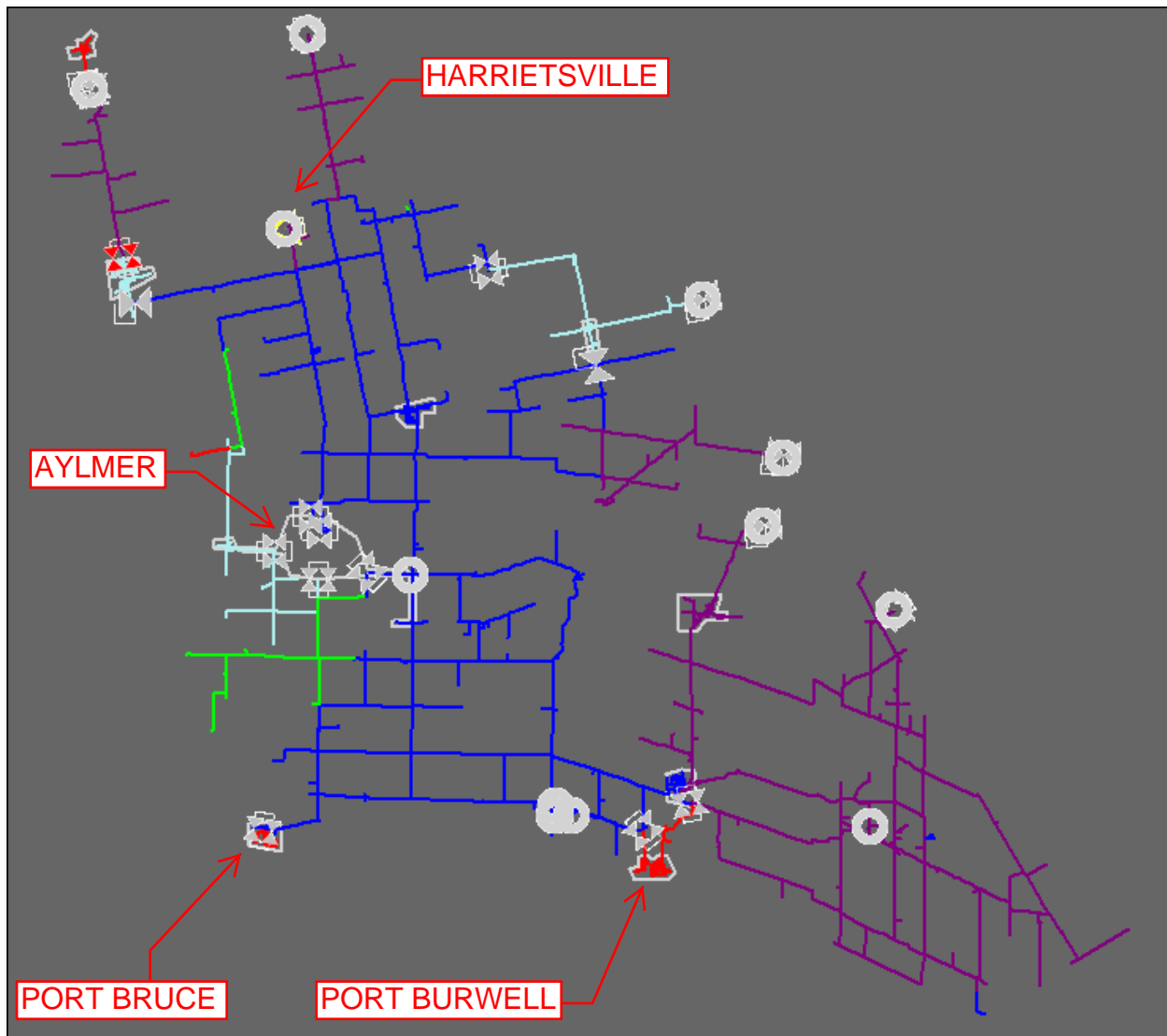
GRAPHIC CONTROLS CORPORATION  
BUREAU, NEW YORK

*Jan 21/11*  
*Jan 28/11*  
*DEF*

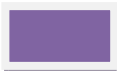






## Appendix 4 – Simulated System Pressure Map – Current System Conditions

## NRG SYSTEM PRESSURE MAP FOR EXISTING SIMULATION MODEL (-28C DAY)

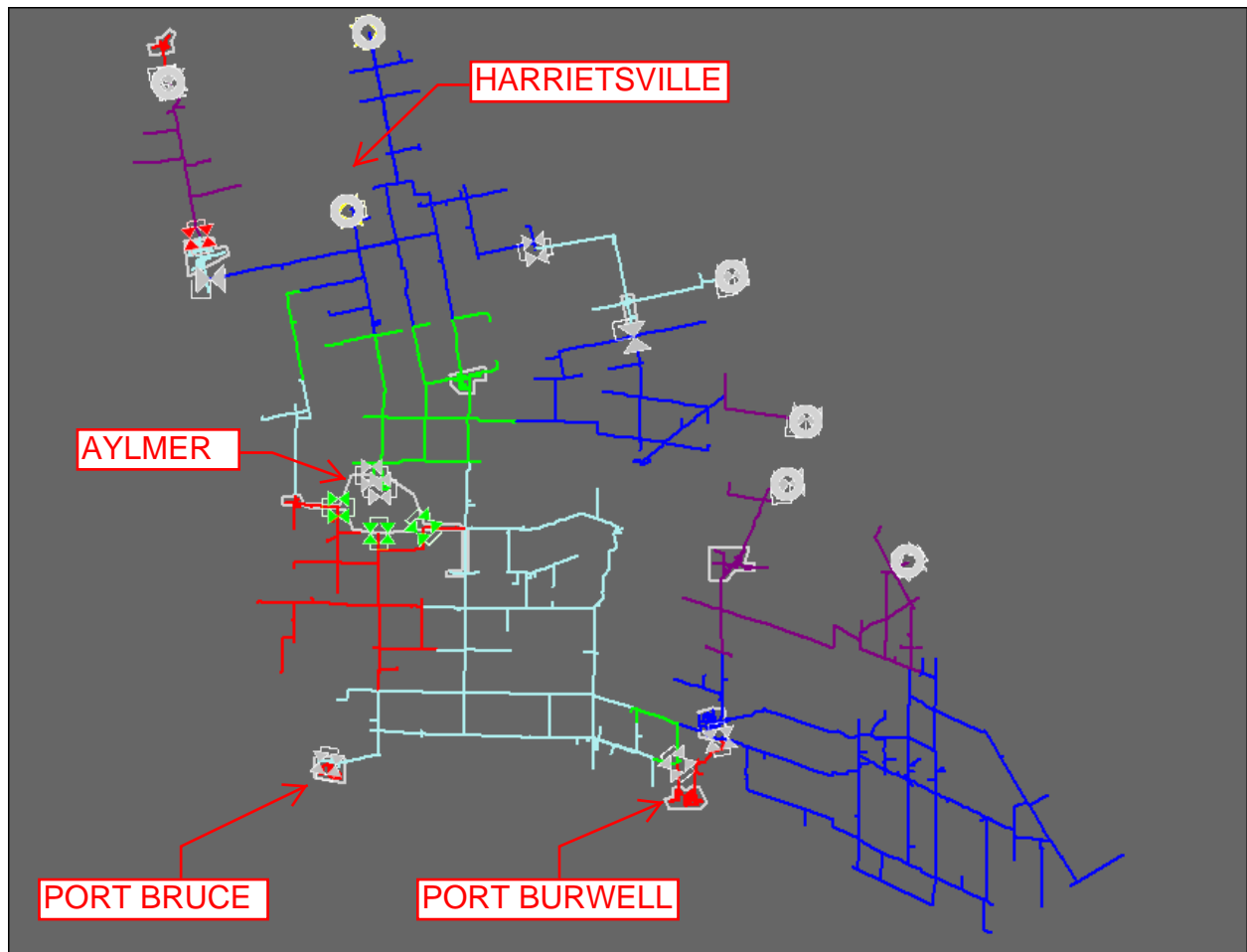


### SYSTEM PRESSURE LEGEND:

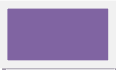
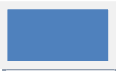


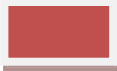
- > 60 PSIG 
- 45 TO 60 PSIG 
- 35 TO 45 PSIG 
- 25 TO 35 PSIG 
- < 25 PSIG 

## Appendix 5 – Simulated System Pressure Map – Well Supplies Turned Off

**NRG SYSTEM PRESSURE MAP FOR EXISTING SIMULATION MODEL**  
**WITH GAS WELL SUPPLIES TURNED OFF**



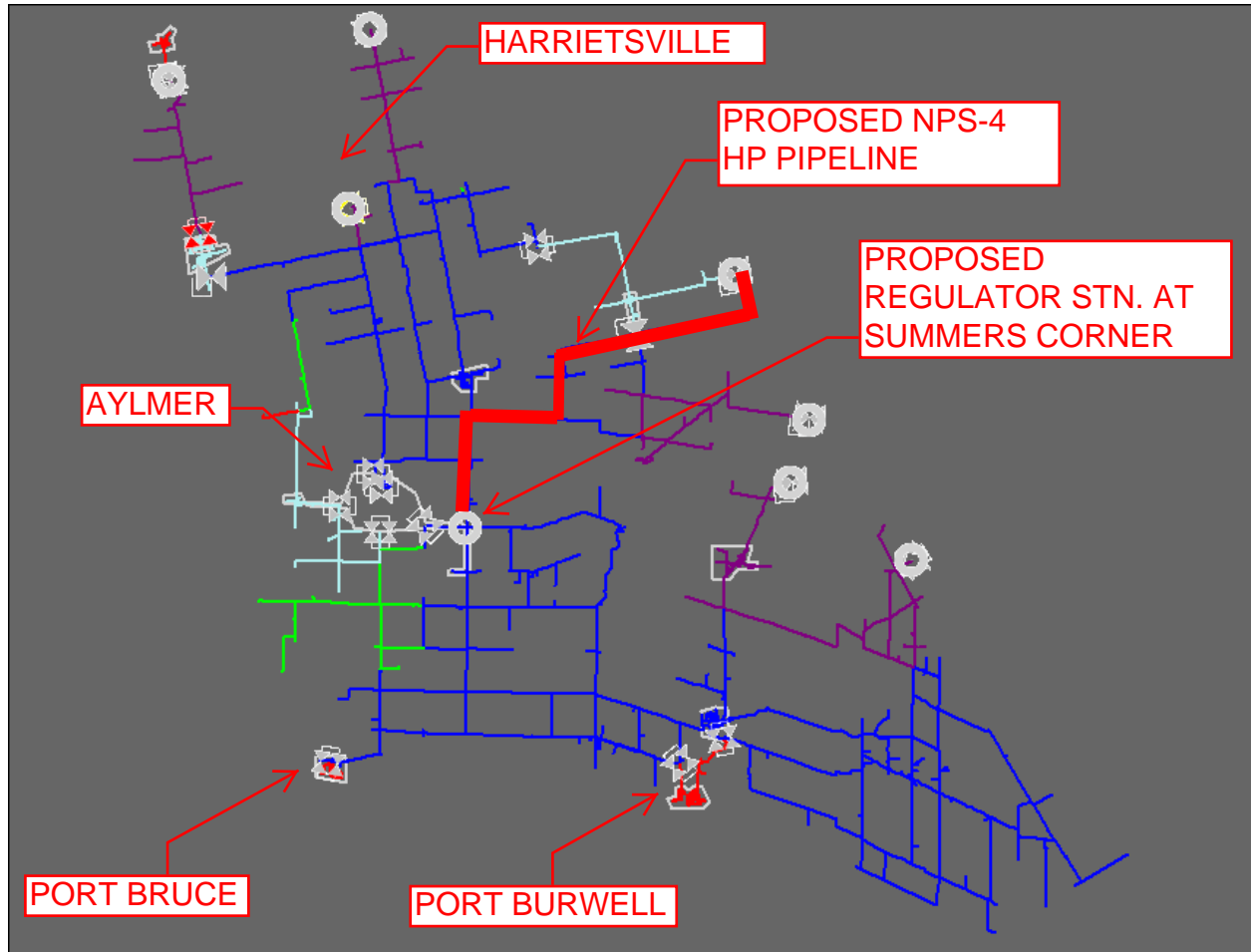
**SYSTEM PRESSURE LEGEND:**

- > 60 PSIG 
- 45 TO 60 PSIG 
- 35 TO 45 PSIG 
- 25 TO 35 PSIG 
- < 25 PSIG 



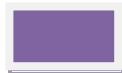
## Appendix 6 – System Pressure Map – Alternative #1

**NRG SYSTEM PRESSURE MAP WITH GAS WELL SUPPLIES TURNED OFF**  
**AND NEW REGULATOR STATION AT SUMMERS CORNER**  
**(ALTERNATIVE 1)**

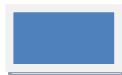


**SYSTEM PRESSURE LEGEND:**

➤ > 60 PSIG



➤ 45 TO 60 PSIG



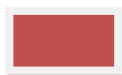
➤ 35 TO 45 PSIG



➤ 25 TO 35 PSIG

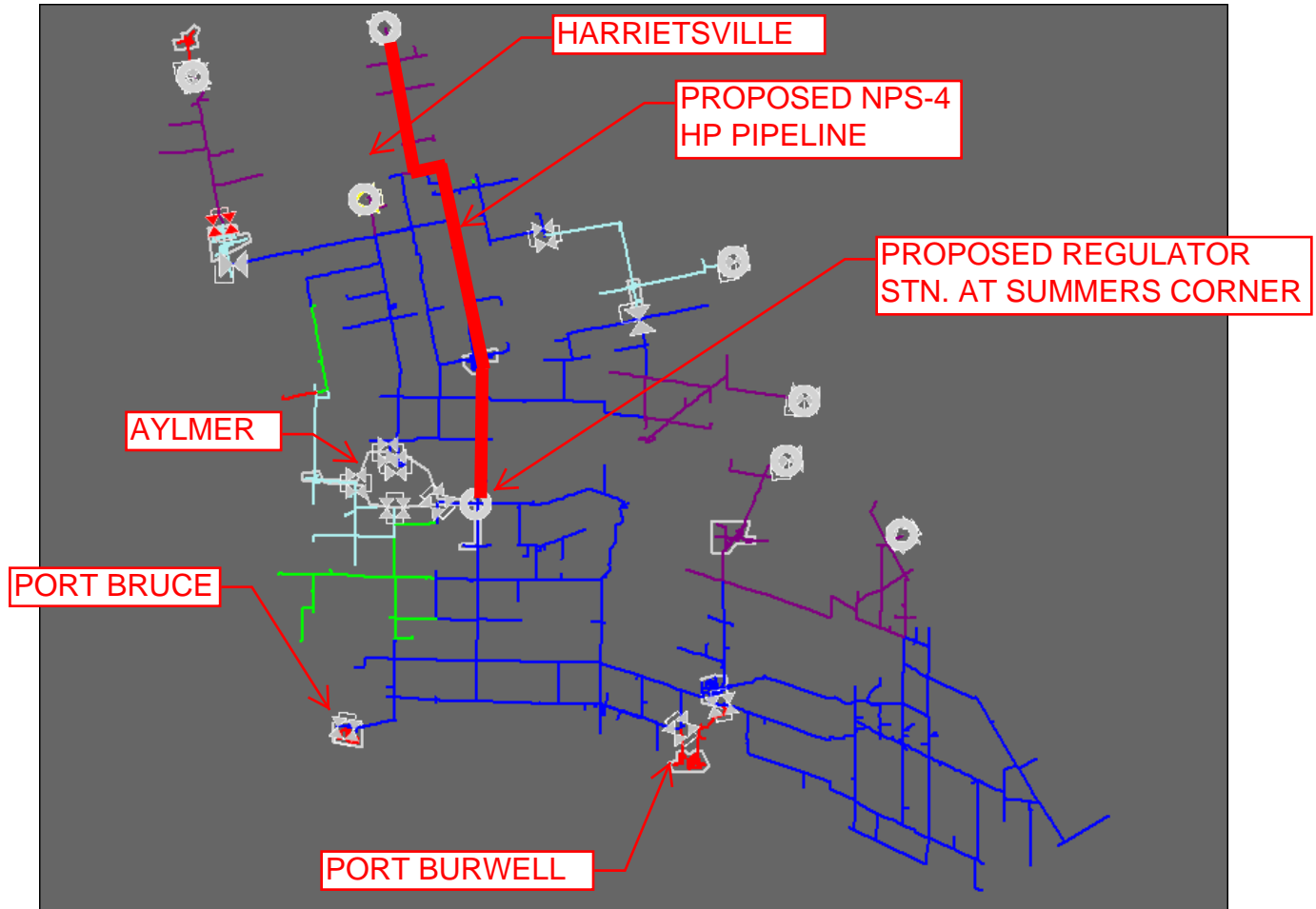


➤ < 25 PSIG



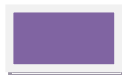
## Appendix 7 – System Pressure Map – Alternative #2

**NRG SYSTEM PRESSURE MAP WITH GAS WELL SUPPLIES TURNED OFF**  
**HP PIPELINE FROM THE NORTH AND NEW REGULATOR STATION AT**  
**SUMMERS CORNER (ALTERNATIVE 2)**

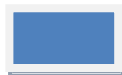


**SYSTEM PRESSURE LEGEND:**

➤ > 60 PSIG



➤ 45 TO 60 PSIG



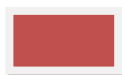
➤ 35 TO 45 PSIG



➤ 25 TO 35 PSIG

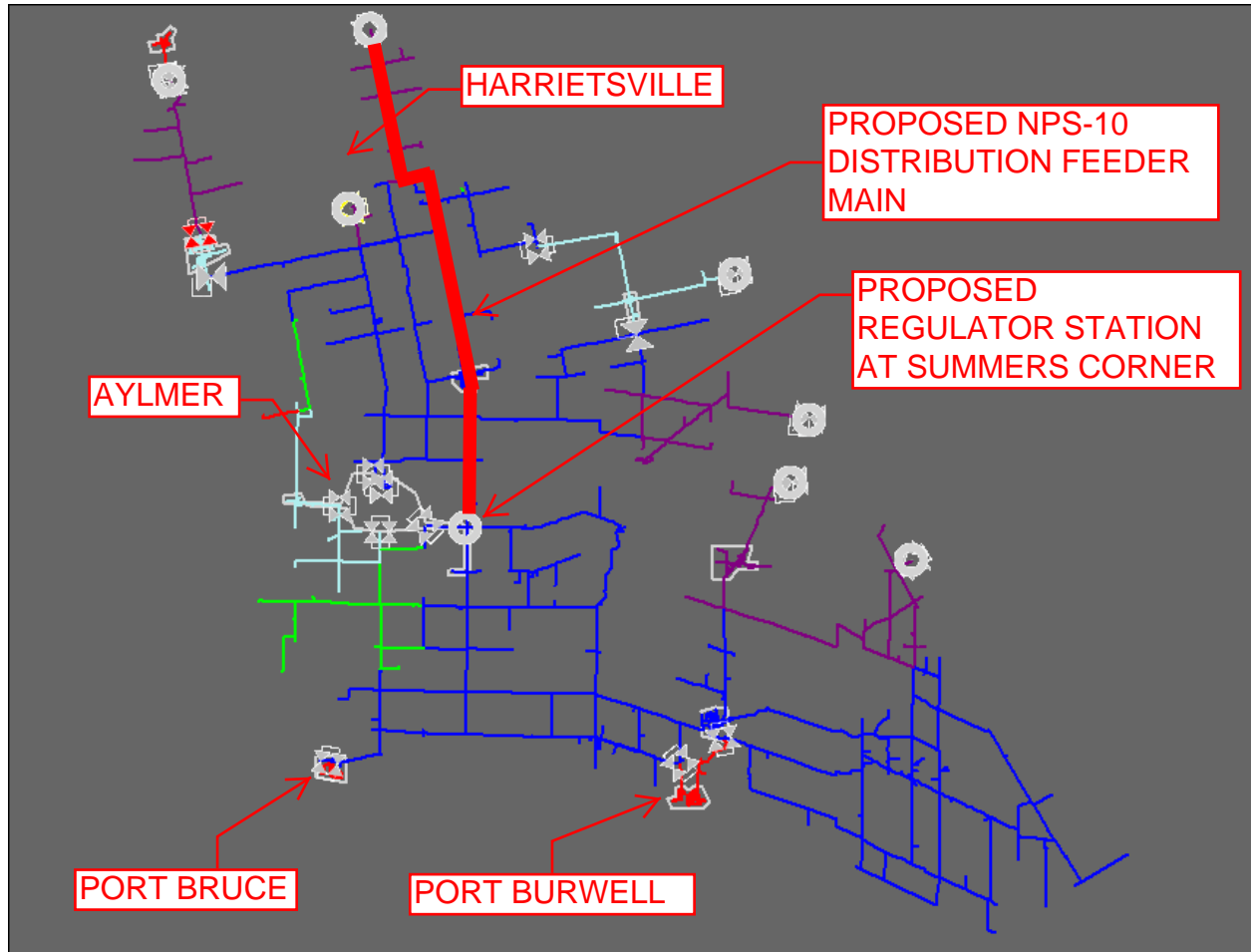


➤ < 25 PSIG

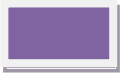





## Appendix 8 -- System Pressure Map - Alternative #3

**NRG SYSTEM PRESSURE MAP WITH GAS WELL SUPPLIES TURNED OFF**  
**AND NEW DISTRIBUTION PIPELINE TO SUMMERS CORNER**  
**(ALTERNATIVE 3)**



**SYSTEM PRESSURE LEGEND:**

- > 60 PSIG 
- 45 TO 60 PSIG 
- 35 TO 45 PSIG 
- 25 TO 35 PSIG 
- < 25 PSIG 