NATURAL GAS SYSTEM

INTRODUCTION

New Mexico State University currently uses natural gas, provided by the City of Las Cruces, for the steam-producing boilers and the gas-fired cogeneration turbine at the central utility plant and for water heaters, individual building boilers, laboratories and kitchens on the medium pressure campus distribution system. Approximately 615,000 decatherms of natural gas fuel is delivered to the campus annually at a cost of roughly $4,966,000.

DISTRIBUTION SYSTEM

Natural gas is provided to the campus via a single 6" city-owned steel line running north up Espina St. from I-10. This line is capable of providing the campus with 14,137 cfh at a velocity of 20 ft/s and a pressure of 125 psi or 4072 decatherms per hour (Dth/hr). The main city line has a single tie-in to the NMSU-owned campus distribution system on Espina St. south of University Ave. From here it is regulated down to 45 psi for preliminary campus distribution. The 45 psi line is HDPE and at 4" will maintain the capacity to run 6283 cfh at 20 ft/s or 651 Dth/hr. The 45 psi line runs north-south along Espina St. intersecting a total of five regulating stations, including the main station mentioned above. At each of these stations the 45 psi natural gas is regulated down to 18 psi for final campus distribution to the buildings, which for the most part are individually metered and regulated. Table 1 below shows a complete list of campus regulating stations and locations:

Table 1 - Natural Gas Regulating Stations

#	Location	Input	Output
1	Espina between University and N. Horseshoe	125 psi, 6", steel	45 psi, 4", HDPE / 18 psi, 4", steel
2	Espina between S. Horseshoe and Stewart	45 psi, 4", HDPE	18 psi, 4", steel
3	Stewart and Sweet	45 psi, 2", steel	18 psi, 2", steel
4	Espina between Stewart and Gregg	45 psi, 4" HDPE	18 psi, 4", steel
5	Wells and Espina	45 psi, 4", HDPE	18 psi, 4" steel

The campus distribution system consists of a combination of direct buried, above ground, and utility tunnel located gas lines.

The cogeneration turbine is fed from a 4" dedicated city-owned line running up from the southeast end of campus. The cogeneration line is pressurized at 340 lbs and is tapped off of an 8" west-east city line spanning I-10 and I-25.

Currently the natural gas distribution system is capable of providing an adequate volume of gas for the needs of the campus.

NATURAL GAS DEMAND/CONSUMPTION

From observation of 2007 and 2008 gas meter data, the entire campus, including the gas turbine, peaks at approximately 130 Dth/hr. Table 2 below shows comprehensive consumption and cost data by year, based on billing records. The numbers below are representative of the entire gas distribution to campus, including that feeding the cogeneration turbine.

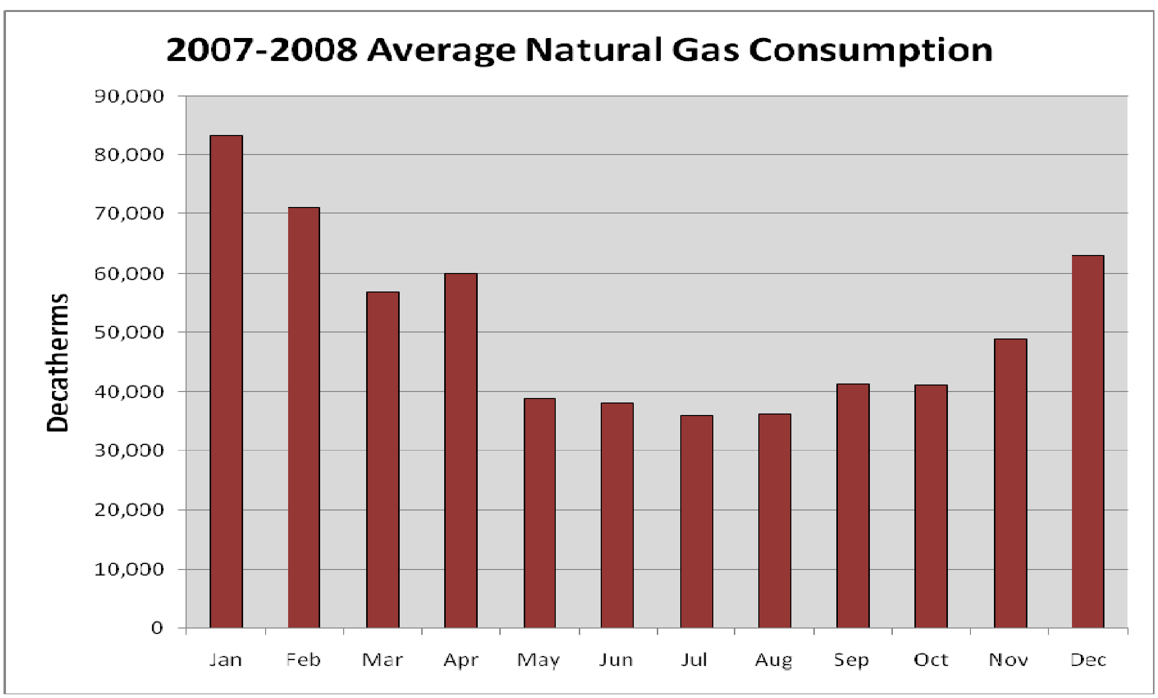
Table 2 – Annual Natural Gas Usage and Costs

Year	Total Decatherms	Average Cost/Decatherm	Total Cost
2007	648,562	$7.70	$5,066,168
2008	580,927	$8.65	$4,866,164

The slight shift downward in usage from 2007 to 2008 can be attributed to the unusually high gas prices during the summer of 2008, resulting in lowered usage of the gas-fired turbine. The cogeneration turbine, when running full out, consumes roughly 55.8 Dth/hr or 55,800 Mbh.

Figure 1 below is a graphical representation of the annual natural gas usage by month for the entire campus. These numbers were taken from actual billing information and are an average of 2007 and 2008 data.

Figure 1 – Natural Gas Usage by Month

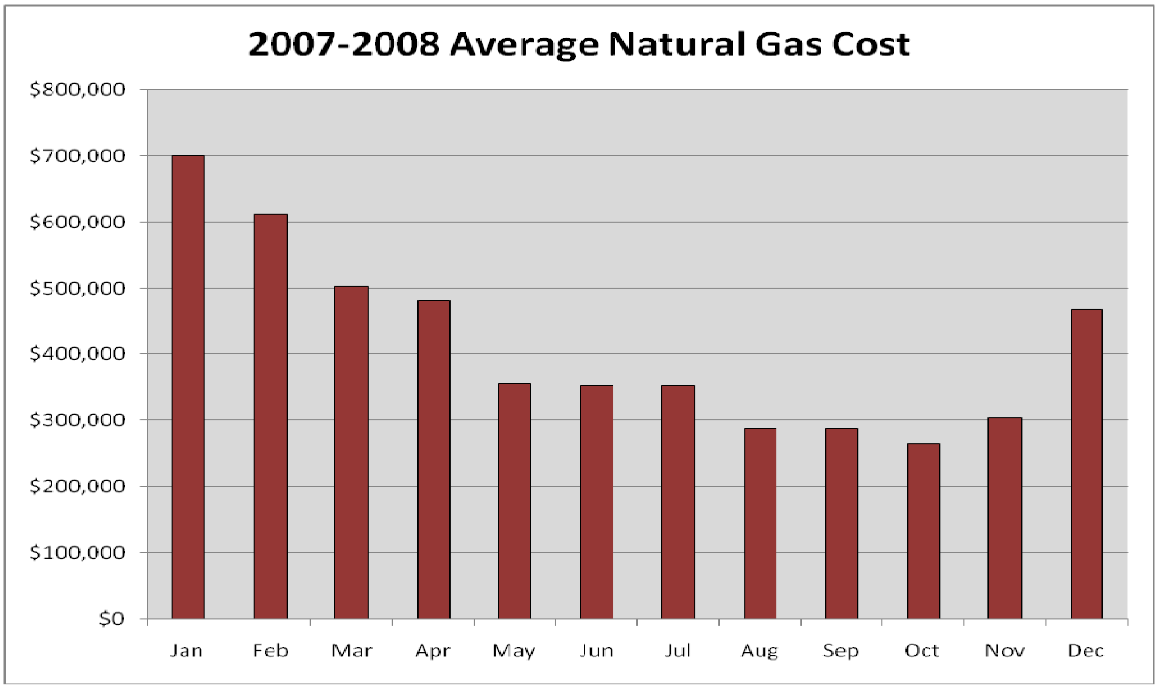


As seen in Figure 1, natural gas consumption peaks in the winter and bottoms out in the summer, as expected, due to the campus demand for space heating.

Figure 2 below is a graphical representation of the annual natural gas costs by month for the entire campus. These numbers were taken from actual billing information and are an average of 2007 and 2008 data with the price of natural gas fluctuating between $4/Dth to nearly 13$/Dth.

.

Figure 2 – Natural Gas Usage by Month



In order to best prepare for the future it is beneficial to be aware of both near term and long term natural gas price projections. Figure 3, below, represents monthly projections for the next year and shows prices in terms of NMSU burner tip rates. The prices have been taken from Henry Hub projections and adjusted to account for the discount to the San Juan Basin Hub, transportation to the Las Cruces Gate and City of Las Cruces delivery costs.

Figure 3 – Natural Gas Projections - Monthly

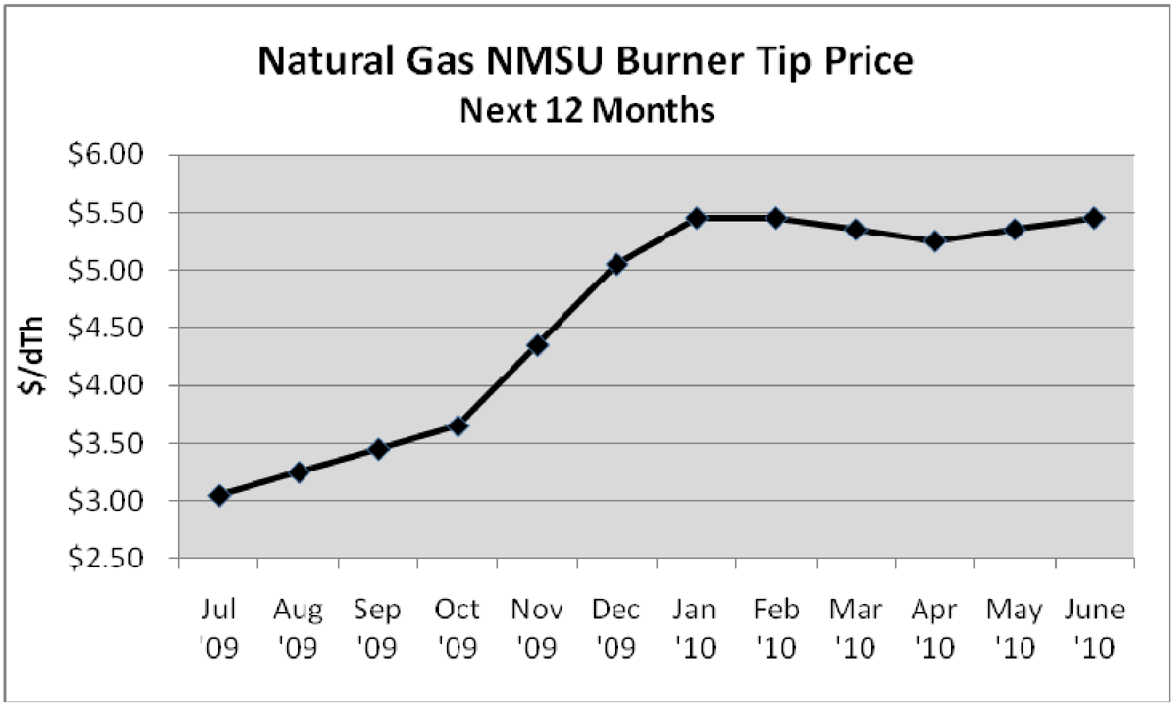
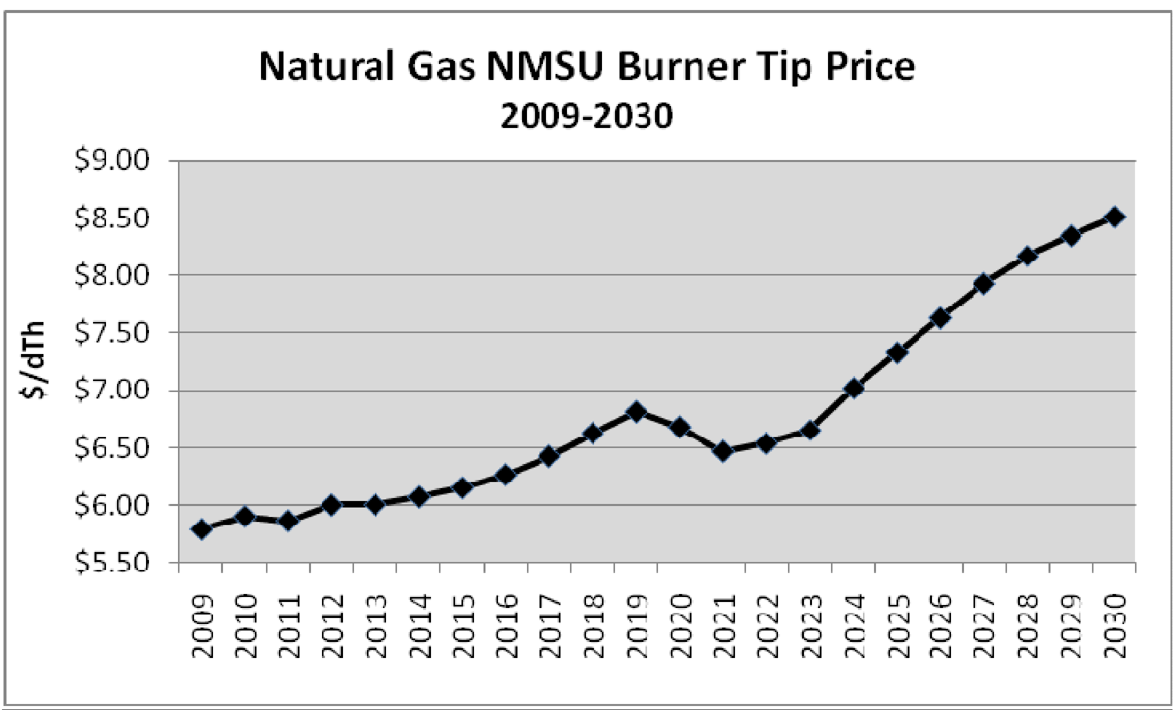


Figure 4, below, represents the DOE-EIA Henry Hub projections up until 2030. The values have been adjusted, as above, to reflect NMSU burner tip prices.

Figure 4 – Natural Gas Projections – Annual



NATURAL GAS STRATEGIES FOR CAMPUS EXPANSION

New Mexico State University has developed an architectural master plan to aid in facilitating structured campus growth in five year phases out through the year 2034. A natural gas development plan is a crucial counterpart of this equation. Not only are there some significant deficiencies with the existing system, but it will need to change in configuration as well to match the progressing architectural build out of the main campus.

The strategy for natural gas expansion/reconfiguration has been somewhat contingent on the strategy for steam expansion. In instances where future buildings are within reasonable vicinity of the steam system, it is assumed that all heating needs for the building are being met with the delivered steam load and henceforth, natural gas is not required. On occasions where future buildings are too far from the steam system and have significant heating loads or where there are planned laboratories, which may require the use of natural gas, it is assumed that provisions shall be made to have a natural gas resource brought to the building.

SYSTEM EXPANSION FOR GROWTH OF CAMPUS

Following are brief descriptions of changes to the distribution system through the set phases of campus development. Cost estimates are also provided with inflation factored in.

Phase 1 – 2014
The first phase of development fosters only one candidate for natural gas, building 05-11 (Football Offices). It is nearby an existing gas main and would take minimal effort to connect to the system. Estimates for this phase total roughly $10,000.

Phase 2 – 2019
Once again, this phase of development poses few future buildings with the need for natural gas out on the west end of campus by existing gas mains, making for a simple update to the system. Estimates for this phase total roughly $50,000.

Phase 3 – 2024
Phase 3 of expansion encompasses a good amount of laboratory square footage as well as some housing facilities not proposed for the steam system. System upgrades for the phase include about 3000 linear feet of pipe and total roughly $316,000.

Phase 4 – 2029
This phase of development has only one laboratory building warranting 60 feet of new pipe, but also includes the Athletic Program Expansion building just southwest of the stadium that is proposed to be constructed over an existing gas main. The costs relocation of this line alone total roughly $116,000. An alternative would be slight relocation of the proposed location. Total estimates for this phase include some significant demolition of existing lines and come out to roughly $196,000.

Phase 5 – 2034

Phase 5 includes no additions to the natural gas system, but like the last phase, includes some significant demolition in order to construct the new academic/research building complexes. As the drawings are shown, there are no gas connections to these new facilities due to the fact that they have not been called out as laboratories. Should this change it should not be an issue to pick up a connection to the 4" lines running across campus in this location. Total costs for this phase come to roughly $230,000.

There is more than enough line capacity in the existing system and overall, it is not foreseen that the campus demand will have any significant increase due to the removal of such a large amount of current natural gas square footage.

STEEL PIPE REPLACEMENT PLAN

As presented in the Stage 1 materials, roughly 85% of the gas piping on campus is steel and most of the steel piping on campus is direct buried. This poses a cathodic corrosion problem in the long term due to electric potential variations in the ground which can lead to gas leaks and possibly safety issues. Discussion with facilities personnel revealed that most, if not all, of the direct buried steel gas lines are original which would put them in the 50 plus years age range. This would indicate that replacements of these gas lines are far overdue and can be realized in the number of gas leaks the NMSU campus is currently suffering from. It was reported that in 2008 alone there were 32 leaks throughout the system, in which the facilities team replaced small lengths of steel pipe or fittings with HDPE pipe with inherent cathodic protection due to the nature of the material. The average useful life of direct buried steel pipe for pressurized natural gas is roughly 30 years. This knowledge along with the number of gas leaks the campus currently suffers would indicate an immediate need to replace all original direct buried steel pipe with HDPE pipe. Failure to do so will only result in an increase in the current number of gas leaks and perhaps something much worse. The costs for steel pipe replacement are included in the 2009 estimate form and, broken out, sum to roughly $5,863,000.

SECONDARY CITY LINE TIE-IN

The second notable deficiency is as the distribution system currently stands, aside from the cogeneration turbine operation, there remains only one tie-in to the City of Las Cruces natural gas system. Not only does this configuration leave no redundancy in the source supply, it forces a unidirectional distribution through campus without leaving any contingency for outages, be they on the 125 psi, 45 psi or 18 psi level. This existing distribution configuration could lead to unattractive situations should the unexpected occur. Included in this report is a separate cost estimate for an addition to the campus distribution system to make a secondary tie-in to the city system, should the nearby city lines have the appropriate capacity. The estimate comes out to roughly $2,040,000. This option should not be considered a requirement, but should be considered as an alternative for redundancy in case of an outage, especially in one of the city lines.

STAGE 1 DEFICIENCIES

Steel Pipe Replacement Plan
See natural gas strategies for campus expansion.

Secondary City Line Tie-In
See natural gas strategies for campus expansion.

Natural Gas Lines in Utility Tunnel System
See Utility Tunnel System section of report.

ARCHITECTS & ENGINEERS, INC.

OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

- ☒ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	2009 Natural Gas Capital Costs	Sheet No.	

SUMMARY	QUANTITY		MATERIAL		LABOR		EQUIP	TOTAL COST
	No. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	
New Lines								
1 1/4" pipe, HDPE	120	lf	$41.37	$4,964.40				$4,964
Replaced Lines								
1 1/4" pipe, HDPE	3895	lf	$41.37	$161,136.15				$161,136
2" pipe, HDPE	32360	lf	$44.32	$1,434,195.20				$1,434,195
4" pipe, HDPE	18903	lf	$59.10	$1,117,167.30				$1,117,167
Demo								
1 1/4" pipe, Stl	3895	lf	$1.87	$7,283.65				$7,284
2" pipe, Stl	32360	lf	$2.49	$80,576.40				$80,576
4" pipe, Stl	18903	lf	$7.45	$140,827.35				$140,827
Subtotal								**$2,946,150**
Subcontractor Overhead, 10%								$294,615
Subcontractor Profit, 10%								$324,077
Subtotal								**$3,564,842**
General Contractor Overhead, 10%								$356,484
General Contractor Profit, 5%								$196,066
Subtotal								**$4,117,393**
General Contractor Liability, 1.5%								$61,761
General Contractor Bond, 2.5%								$102,935
General Contractor Tax, 5.5%								$235,515
General Contractor Total								**$4,517,603**
Soft Costs, 30%								$1,355,281
Escalation, 3% per year		yrs						
Total								**$5,872,884**

GLHN ARCHITECTS & ENGINEERS, INC.

OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

- ☒ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	2014 Natural Gas Capital Costs	Sheet No.	

SUMMARY	QUANTITY		MATERIAL		LABOR		EQUIP	TOTAL COST
	No. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	
1 1/4" pipe, HDPE	200	lf	$41.37	$8,274.00				$8,274
2" pipe, HDPE	300	lf	$44.32	$13,296.00				$13,296
Subtotal								**$21,570**
Subcontractor Overhead, 10%								$2,157
Subcontractor Profit, 10%								$2,373
Subtotal								**$26,100**
General Contractor Overhead, 10%								$2,610
General Contractor Profit, 5%								$1,435
Subtotal								**$30,145**
General Contractor Liability, 1.5%								$452
General Contractor Bond, 2.5%								$754
General Contractor Tax, 5.5%								$1,724
General Contractor Total								**$33,075**
Soft Costs, 30%								$9,923
Escalation, 3% per year	5	yrs						$6,848
Total								**$49,846**

GLHN ARCHITECTS & ENGINEERS, INC.

OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

☒ CODE A (No design completed)
☐ CODE B (Preliminary design)
☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	2019 Natural Gas Capital Costs	Sheet No.	

SUMMARY	QUANTITY No. UNITS	QUANTITY UNIT MEAS.	MATERIAL PER UNIT	MATERIAL TOTAL	LABOR PER UNIT	LABOR TOTAL	EQUIP PER UNIT	TOTAL COST
1 1/4" pipe, HDPE	2470	lf	$41.37	$102,183.90				$102,184
4" pipe, HDPE	270	lf	$59.10	$15,957.00				$15,957
Subtotal								**$118,141**
Subcontractor Overhead, 10%								$11,814
Subcontractor Profit, 10%								$12,995
Subtotal								**$142,950**
General Contractor Overhead, 10%								$14,295
General Contractor Profit, 5%								$7,862
Subtotal								**$165,108**
General Contractor Liability, 1.5%								$2,477
General Contractor Bond, 2.5%								$4,128
General Contractor Tax, 5.5%								$9,444
General Contractor Total								**$181,156**
Soft Costs, 30%								$54,347
Escalation, 3% per year	10	yrs						$80,993
Total								**$316,497**

GLHN ARCHITECTS & ENGINEERS, INC.

OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

☒ CODE A (No design completed)
☐ CODE B (Preliminary design)
☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	2024 Natural Gas Capital Costs	Sheet No.	

SUMMARY	QUANTITY		MATERIAL		LABOR		EQUIP	TOTAL COST
	No. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	
New Lines								
1 1/4" pipe, HDPE	60	lf	$41.37	$2,482.20				$2,482
3" pipe, HDPE	700	lf	$53.19	$37,233.00				$37,233
Demo								
2" pipe, Stl	5500	lf	$2.49	$13,695.00				$13,695
4" pipe, Stl	1300	lf	$7.45	$9,685.00				$9,685
Subtotal								**$63,095**
Subcontractor Overhead, 10%								$6,310
Subcontractor Profit, 10%								$6,940
Subtotal								**$76,345**
General Contractor Overhead, 10%								$7,635
General Contractor Profit, 5%								$4,199
Subtotal								**$88,179**
General Contractor Liability, 1.5%								$1,323
General Contractor Bond, 2.5%								$2,204
General Contractor Tax, 5.5%								$5,044
General Contractor Total								**$96,750**
Soft Costs, 30%								$29,025
Escalation, 3% per year	15	yrs						$70,178
Total								**$195,953**

GLHN ARCHITECTS & ENGINEERS, INC.

OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

- ☒ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	2029 Natural Gas Capital Costs	Sheet No.	

SUMMARY	QUANTITY		MATERIAL		LABOR		EQUIP	TOTAL COST
	No. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	
Demo								
2" pipe, Stl	10700	lf	$2.49	$26,643.00				$26,643
4" pipe, Stl	5000	lf	$7.45	$37,250.00				$37,250
Subtotal								**$63,893**
Subcontractor Overhead, 10%								$6,389
Subcontractor Profit, 10%								$7,028
Subtotal								**$77,311**
General Contractor Overhead, 10%								$7,731
General Contractor Profit, 5%								$4,252
Subtotal								**$89,294**
General Contractor Liability, 1.5%								$1,339
General Contractor Bond, 2.5%								$2,232
General Contractor Tax, 5.5%								$5,108
General Contractor Total								**$97,973**
Soft Costs, 30%								$29,392
Escalation, 3% per year	20	yrs						$102,670
Total								**$230,035**

ARCHITECTS & ENGINEERS, INC.

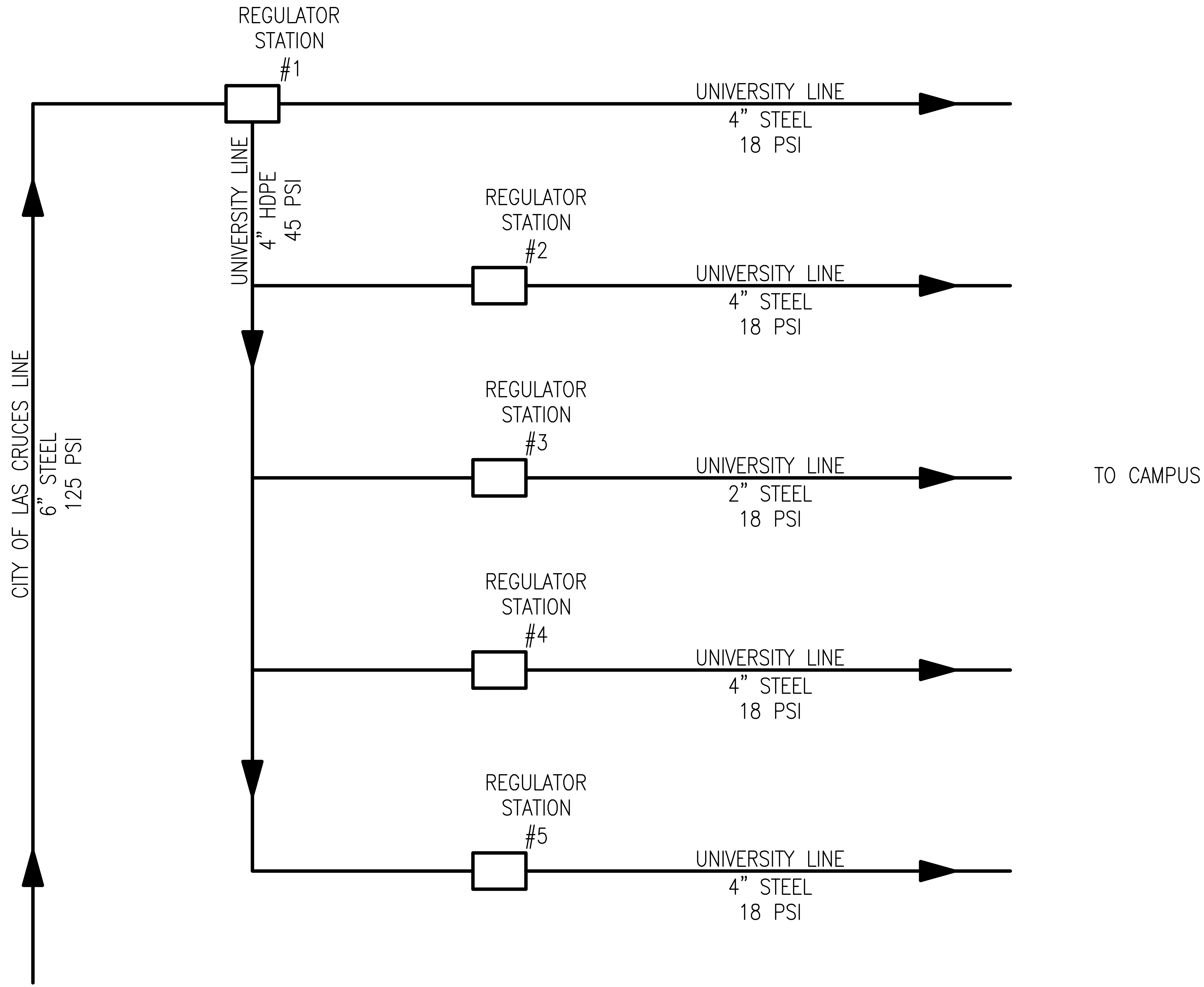
OPINION OF PROBABLE CONSTRUCTION COST

BASIS FOR ESTIMATE

- ☒ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Finished design)

COMPUTED BY: DHW	New Mexico State University	Proj. No.	0874.00
CHECKED BY:	Utility Development Plan	Dept.	Mechanical
6/16/09	Natural Gas - Secondary Tie-In	Sheet No.	

SUMMARY	QUANTITY		MATERIAL		LABOR		EQUIP	TOTAL COST
	No. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	
4" pipe, HDPE	20000	lf	$59.10	$1,182,000.00				$1,182,000
Subtotal								**$1,182,000**
Subcontractor Overhead, 10%								$118,200
Subcontractor Profit, 10%								$130,020
Subtotal								**$1,430,220**
General Contractor Overhead, 0%								
General Contractor Profit, 0%								
Subtotal								**$1,430,220**
General Contractor Liability, 1.5%								$21,453
General Contractor Bond, 2.5%								$35,756
General Contractor Tax, 5.5%								$81,809
General Contractor Total								**$1,569,237**
Soft Costs, 30%								$470,771
Escalation, 3% per year		yrs						
Total								**$2,040,009**



NATURAL GAS - SINGLE LINE DIAGRAM

NEW MEXICO STATE UNIVERSITY
UTILITY DEVELOPMENT PLAN
STAGE 2
NATURAL_GAS_SINGLE_LINE_DIAGRAM

GLHN
ARCHITECTS & ENGINEERS, INC.
2939 E. BROADWAY, TUCSON, ARIZONA 85716
www.glhn.com
PHONE: 520.881.4546
FAX: 520.795.1822

PROJ. NO.	0874.00
DESIGNED BY:	DHW
DRAWN BY:	DHW
CHECKED BY:	—
DATE:	JUNE 16, 2009
REVISIONS	

NGSL1