

STATE OF MINNESOTA  
BEFORE THE  
MINNESOTA PUBLIC UTILITIES COMMISSION

IN THE MATTER OF XCEL ENERGY'S  
2020-2034 UPPER MIDWEST INTEGRATED RESOURCE PLAN

DOCKET NO. E002-19-368

**COMMENTS OF NORTHERN NATURAL GAS**

**I. INTRODUCTION**

A central issue in this integrated resource plan is whether Xcel Energy's proposed 835 MW combined cycle natural gas-fired power plant in Becker, Minnesota should be included in its least-cost portfolio of future resources. To that question, Xcel has demonstrated that a new natural gas plant to replace the retiring Sherco coal units is an important bridge to Xcel's plan to reach 100% carbon-free electricity by 2050. By previously authorizing the plant's construction and exempting it from the certificate of need and facility siting review processes, the legislature seemingly agrees.<sup>1</sup>

Northern Natural Gas takes this opportunity to focus the Commission's attention not on the plant but instead on a related issue of great importance to Xcel's customers: natural gas transportation service to the proposed plant. In its resource plan modeling, Xcel has assumed that its least cost option to serve the plant is a 135-mile, greenfield pipeline interconnecting with the Northern Border Pipeline Company's interstate pipeline in south central Minnesota near Trimont. The preliminary cost assumptions Xcel included in the modeling<sup>2</sup> significantly underestimate that

---

<sup>1</sup> HF No. 113, Laws of Minnesota 2017; <http://wdoc.house.leg.state.mn.us/leg/LS90/HF0113.2.pdf>.

<sup>2</sup> See, September 11, 2019 Xcel Energy Response to Information Request No. 72 of Clean Energy Organizations.

pipeline's true cost and appear to overlook entirely the greenfield pipeline's substantial environmental impacts, particularly when Northern can offer – and has offered – Xcel more prudent and feasible alternatives. As demonstrated in these comments, the most cost-effective and environmentally responsible natural gas pipeline service to the plant is to expand Northern's existing pipeline facilities already in the area. These facilities are interconnected to Northern's vast pipeline system already serving Xcel's Becker service territory under existing contracts, the terms of which extend beyond the expected in-service date for the new plant. The purpose of these comments is to make sure the Commission understands that the greenfield pipeline being modeled by Xcel is not, by any objective standard, Xcel's most feasible and prudent alternative. Instead, the transportation options Northern has presented to Xcel over the course of the last two years and most recently in response to its solicitation for transportation service proposals are far less expensive than Xcel's assumed pipeline, are more reliable, and require just a fraction of the amount of new, greenfield right-of-way construction. Indeed, Northern has informed Xcel that it would guarantee to be Xcel's least cost transportation service option.

## **II. NORTHERN NATURAL GAS**

### **A. The Northern System.**

Northern is a subsidiary of Berkshire Hathaway Energy, which in turn is owned by Berkshire Hathaway, Inc. Operating since the early 1930s, Northern owns and operates approximately 14,600 miles of pipeline stretching across 11 states, from the Permian Basin in Texas to Michigan's Upper Peninsula, making it the largest interstate natural gas pipeline system in the United States by miles. Exhibit 1. Northern provides natural gas transportation and storage services to 82 utilities and energy marketing companies, independent power producers, industrial end users and producers. It provides critical grid transportation between other interstate and

intrastate pipelines and access to the major North American gas supply basins in Canada, and the Rocky Mountain, Bakken, Mid-Continent and Permian basins.

Northern has been reliably serving Minnesota, including Xcel and its predecessor utilities, since the 1930s. Xcel is currently Northern's second largest customer. Northern currently owns and operates 3,388 miles of pipeline in Minnesota, has 109 current employees in the state and maintains field offices in Carlton, Farmington, Foley, Harris, Mendota Heights, North Branch, Owatonna, St. Cloud, Welcome, Willmar and Wrenshall. In 2019, Northern paid approximately \$14 million in Minnesota property taxes.

Northern offers unparalleled financial strength. It is the only A-rated interstate natural gas pipeline in the U.S., with a senior unsecured rating of A2/A and has ready access to capital and cash. Its weighted-average debt rate is 4.4%, with a weighted average life of 21.2 years. Northern's parent company, Berkshire Hathaway Energy, is also an A-rated entity, with over \$125 billion in assets. Northern is currently amid a \$1.6 billion, decade-long system modernization program. By replacing Northern's legacy pipelines with new high-pressure equivalents and existing compressor units with superior modern technology, the program will safeguard Northern's reliable service far into the future. Northern's commitment to the maintenance, safety and reliability of its interstate pipeline system is unparalleled.

**B. The Existing Northern/Xcel Service Agreements.**

Through its tariff and a series of long-term agreements on file with and approved by the Federal Energy Regulatory Commission, Northern provides Xcel (through its operating subsidiary Northern States Power Company) and much of its Minnesota retail natural gas service territories with firm, "full requirements" interstate natural gas transportation service, including all of Xcel's

load growth served by existing or new delivery points within these service territories.<sup>3</sup> The term of the service agreements began in 2007 and extend through October 31, 2027. Under the agreements, Northern delivers gas to Xcel at various points connecting Northern's interstate pipeline system with Xcel's local distribution systems. Xcel then delivers that gas to its retail natural gas customers and to many of its gas-fired power plants, including Mankato, Black Dog, High Bridge, and Riverside.

The service agreements are the result of a compromise between the parties. Beginning in 2003, Xcel, CenterPoint Energy and a large industrial customer began considering bypassing Northern's service to the Twin Cities through construction of their own 100+ mile pipeline connecting to Northern Border's pipeline near Trimont, Minnesota. To counter the bypass, Northern made major concessions to Xcel including, among other things, significant rate discounts, pressure guarantees, and the right for Xcel to increase its firm entitlement levels at the discounted rates. In exchange, Northern received the right to serve Xcel with its full requirements, including the exclusive right to provide service to Xcel's load growth – i.e., the right to serve both expanded and new load. FERC approved the compromises in May 2006, as reflected in the package of service agreements which now form a part of Northern's tariff, which provides in part:

Under [the full requirements] option, a Shipper [i.e., Xcel] *will agree to take its full requirements from Northern for the service territory currently served, by the existing entitlement and the growth associated with such service territory and agree not to physically bypass Northern for such territory for the term of the agreement.*<sup>4</sup>

---

<sup>3</sup> See, *Northern Natural Gas*, F.E.R.C. Docket No. RP06-302, *Northern States Power Company – Minnesota – Non-conforming Service Agreements*.

<sup>4</sup> Northern FERC Gas Tariff, First Revised Sheet No. 101. Emphasis supplied. Northern reached similar compromise agreements with CenterPoint, which agreements and tariffs were also approved by FERC.

In short, the service Northern provides under the existing contracts complement and are key components of Xcel's least cost resource plan. It is also important, however, that the Commission and others be aware of the full requirements nature of these existing contracts: they do not terminate until October 31, 2027, or approximately one year after Xcel's expected in-service date for the proposed new plant, and they do not allow bypass of the Northern system for service to Sherco by any competing pipeline. Service by anyone other than Northern is prohibited and, Northern submits, would constitute interference with Northern's existing contractual rights.

### **III. DISCUSSION**

#### **A. Type, Timing and Size; the Sherco Legislation.**

According to the resource planning statute, Minn. Stat. § 216B.2422, a "resource plan" is "a set of resource options that a utility could use to meet the service needs of its customers over a forecast period, including an explanation of the supply and demand circumstances under which, and the extent to which, each resource option would be used to meet those service needs." The Commission's responsibility with respect to a resource plan is broad: "[t]he commission shall approve, reject, or modify the plan of a public utility . . . consistent with the public interest." Historically, the Commission has used resource planning as a tool to assess and determine the appropriate "size, type, and timing" of generation (and transmission) resources but does not typically use the process to select any specific resource or set of resources. Instead, the selection of a specific resource is typically determined in subsequent proceedings, including, most commonly, a certificate of need proceeding.

The situation presented with the Sherco plant, however, is unique. Here, the legislature has already authorized Xcel "at its sole discretion, [to] construct, own, and operate a natural gas combined cycle electric generation plant" at the Sherco site, provided the plant is consistent with

the plant as proposed by Xcel in this (and its previous) resource plan and the Commission approves the plan. The legislation exempts the plant from both the state certificate of need and facility siting processes.<sup>5</sup> Thus, assuming the Commission approves Xcel’s preferred plan, it is reasonable to assume Xcel will move forward with construction of the new plant.<sup>6</sup>

The legislation does not exempt or otherwise address any pipeline facilities necessary to serve the new gas plant, however. With respect to the pipeline facilities necessary to serve the new plant, Xcel’s assumption – at least for modeling purposes – is the construction of a pipeline that would emanate from a point of interconnection on Northern Border’s interstate pipeline near Trimont, Minnesota, and would require approximately 135+ miles of new greenfield construction and right-of-way.<sup>7</sup> Exhibit 2. Unlike the Sherco plant, any new intrastate pipeline would be subject to the ordinary regulatory review process, including both a certificate of need and route permit processes, which for pipelines in particular have experienced significant protraction

---

<sup>5</sup> H.F. No. 113, Laws of Minnesota 2017, Section 1: “Notwithstanding [Minn. Stat. §] 216B.243 and [Minn. Stat.] chapter 216E, a public utility may, at its sole discretion, construct, own, and operate a natural gas combined cycle electric generation plant as the utility proposed to the Public Utilities Commission in docket number E-002/RP-15-21, or as revised by the utility and approved by the Public Utilities Commission in the latest resource plan filed after the effective date of this section, provided that the plant is located on property in Sherburne County, Minnesota, already owned by the public utility, and will be constructed after January 1, 2018.”

<sup>6</sup> H.F. No. 113 also states that Xcel may recover its “[r]easonable and prudently incurred costs and investments” pursuant to Minn. Stat. § 216B.16. Ordinarily, the receipt by a regulated utility of a certificate of need constitutes prima facie evidence that construction of the facility at issue is both reasonable and prudent. In other words, to the extent the Commission deems the Sherco plant as part of a preferred set of future resource options, it would be hard to understand how costs incurred by Xcel to construct the plant were not reasonably and prudently incurred, provided the final costs to construct were reasonably commensurate with the cost assumptions put forth by Xcel in this docket.

<sup>7</sup> “The Sherco site does not currently have sufficient natural gas infrastructure to serve the planned Sherco CC; we are exploring several options to secure the necessary delivery infrastructure. For Resource Plan modeling purposes, we assumed firm natural gas supply to fuel the Sherco CC would be delivered by a new pipeline facility that connects the plant to the interstate natural gas market in southern Minnesota. . . . As we are still in preliminary stages of project development, the cost estimates and assumptions regarding the method of natural gas delivery to the Sherco CC included in our Resource Plan modeling should be considered preliminary and subject to change as we continue to develop our plans.” Xcel’s July 29, 2019 response to the Information Request No. 1 of the Minnesota Public Utilities Commission.

recently in Minnesota and elsewhere.<sup>8</sup> It would also be subject to the state's environmental policy laws, including that it undergo a full environmental impact statement.<sup>9</sup> Under state law, no certificate of need or route permit may be issued so long as there is a feasible and prudent alternative consistent with the state's need to protect the public's health, safety, and welfare and its paramount concern for the protection of its water, land and other natural resources, where economic considerations alone cannot justify any such conduct.<sup>10</sup>

For the reasons set forth below, Northern respectfully submits that any pipeline emanating from Trimont, Minnesota, or from any other non-Northern point for that matter, would be a far less feasible and prudent alternative than a Northern alternative, service that could originate just a handful of miles from the Sherco site and utilize the full advantage of Northern's existing pipeline system. Instead, any alternative to Northern would be more expensive, less reliable, and more destructive to Minnesota's environment and natural resources.

## **B. Northern's Proposal to Xcel.**

### **1. Northern's options are less expensive.**

Because of the existing service agreements between Xcel and Northern and Northern's more than 80 years of providing service to Xcel and other Minnesota utilities, it should be no surprise that Xcel and Northern have discussed several scenarios under which Northern would

---

<sup>8</sup> See, e.g., Xcel's July 29, 2019 response to Information Request No. 20 of the Clean Energy Organizations: "As noted in our responses to DOC Information Request Nos. 18 and 19, the natural gas supply pipeline envisioned to serve the Sherco combined cycle (CC) is in the preliminary development stage. Responsibility for obtaining any required regulatory approvals and permits would fall to the entity that ultimately constructs and operates the pipeline. Additionally, the particular regulatory approvals and permits needed for the project will be a function of the facilities that entity determines are ultimately needed to provide gas transportation services. Given these uncertainties, we cannot definitively identify all of the necessary approvals and permits at this time. That said, the pipeline will either be subject to federal jurisdiction, in which case the pipeline developer would seek regulatory approval from the Federal Energy Regulatory Commission (FERC), or the pipeline will fall within the State of Minnesota's jurisdiction."

<sup>9</sup> Minn. Rules, Pt. 4410.4400, subp. 24.

<sup>10</sup> Minn. Stat. § 116D.04, subd. 6.

provide service to the Sherco plant throughout its useful life. In those discussions, Northern has consistently committed to be Xcel's lowest cost (and highest quality) alternative for firm natural gas transportation service to Sherco. To date, however, the parties have not reached an agreement on service to Sherco. Indeed, as the Commission is likely aware, Xcel recently issued a solicitation of interest seeking proposals from natural gas pipelines to provide the Sherco plant with natural gas transportation service. Northern responded to the solicitation by proposing no less than six separate service options, in each case providing fixed-price annual firm demand costs and assuming no upfront costs to Xcel, thereby eliminating substantial pricing risk for Xcel and its customers. As discussed further below in Northern's summary of its Competitive Bypass Analysis, an analysis undertaken to test Xcel's assumptions with respect to its modeled pipeline alternatives, the average cost associated with Xcel's assumed pipeline alternatives is approximately \$300 million<sup>11</sup> more than the options Northern has presented to Xcel for service to Sherco.

## **2. Northern's options have less environmental impacts.**

In addition to cost, one other obvious advantage of Northern's options over a 135+ mile greenfield pipeline is that Northern's options will cause far less environmental impacts. The options Northern presented to Xcel for service to Sherco would require construction of a new 16.6-mile greenfield lateral pipeline originating from Northern's existing facilities near Buffalo, Minnesota, with other necessary system enhancements to be installed parallel to existing facilities, largely in existing right-of-way and previously disturbed areas. This represents eight times *less* new greenfield right-of-way than that required for the Xcel assumed pipeline.

---

<sup>11</sup> In 2026 dollars.



As part of its Competitive Bypass Analysis (described further below), Northern thoroughly compared the impacts associated with the different routes required of Xcel’s assumed option versus Northern’s option, including a review of more than thirty different environmental factors. In all categories, Northern’s greenfield lateral resulted in substantially less impact to Minnesota’s natural resources, in most instances by an order of magnitude. For instance, to get from Trimont to the Sherco campus would require Xcel’s assumed pipeline to cross 87 different waterbodies, including 21 considered “perennial” and 17 considered “impaired,” versus just nine waterbodies for the Northern option, only three of which are considered perennial and just one impaired. And while both pipelines would likely attempt in most instances to use less intrusive horizontal directional or conventional drilling techniques with respect to these waterbodies to minimize impacts, it is simply not reasonable to assume a pipeline crossing 87 different waterbodies would use these less intrusive methods in every instance. Instead, given the high number of waterbodies, it is essentially assured that the “southern Minnesota” pipeline being assumed by Xcel will require the far more intrusive and environmentally impactful – and therefore much more difficult to permit – “open-cut” crossings, likely to a significant degree.

Similarly, Xcel’s assumed pipeline would need to cross more than 260 wetland complexes totaling 6.7 miles, compared to Northern’s greenfield lateral that would need to cross just 33 wetland complexes for a total of 1.4 miles. In addition, the Xcel assumed pipeline would undoubtedly encounter considerable permitting challenges with respect to wetlands, including the Pollution Control Agency’s restriction that no more than 5,280 feet of trench may be open at any one time.<sup>12</sup> For Xcel’s assumed pipeline, that would mean no more than one mile of trench could

---

<sup>12</sup> See, Minn. Rule Pt. 7050.0270 and MPCA’s 2018, Section 401 Certification under the Clean Water Act for the USACE, St. Paul District Utility Regional General Permit.

be open at any one time, which for a 135-mile project, raises substantial questions with respect to its constructability.

In addition, Northern’s analysis showed that Xcel’s assumed pipeline would be required to cross a large number of sensitive areas as designated by the Department of Natural Resources, including 17 conservation easements, 12 sites of biodiversity significance, eight wildlife management areas, eight native plant communities, six snowmobile/hiking trails, four forest stand inventories, three DNR-owned properties, two native prairies, one state park, one wellhead protection area, and a scenic river. This is compared to just nine similar areas in Northern’s option.

In short, the 135-mile greenfield pipeline modeled by Xcel will unquestionably cause more impacts to the state’s environment and natural resources, not to mention private property, than any of the options proposed by Northern. The table below highlights some of the major differences in impacts between the two options.<sup>13</sup>

<b>Environmental Feature of Greenfield Pipeline</b>	<b>Unit</b>	<b>Northern Greenfield Lateral</b>	<b>Xcel Assumed Pipeline</b>
<b>Greenfield pipeline</b>	Miles	16.6	134.5
<b>Total Construction ROW<sup>14</sup></b>	Acres	201.3	1629.8
<b>Wetlands Crossed<sup>15</sup></b>	Miles	1.4	6.7
<b>Waterbodies Crossed<sup>16</sup></b>	Number	9	87
<b>Minnesota Department of Natural Resources sites impacted</b>	Number	9	63
<b>Regionally Significant Ecological Areas (1 and 2)</b>	Number	5	13
<b>FEMA Floodplains crossed (Zones A and AE)</b>	Number	3	9

<sup>13</sup> The analysis is based on desktop surveys. As a result, Northern anticipates that actual impacts would increase based on actual conditions encountered in the field.

<sup>14</sup> Based on 100-foot wide construction corridor.

<sup>15</sup> Based on National Wetland Inventory Data.

<sup>16</sup> Based on National Hydrograph Data.

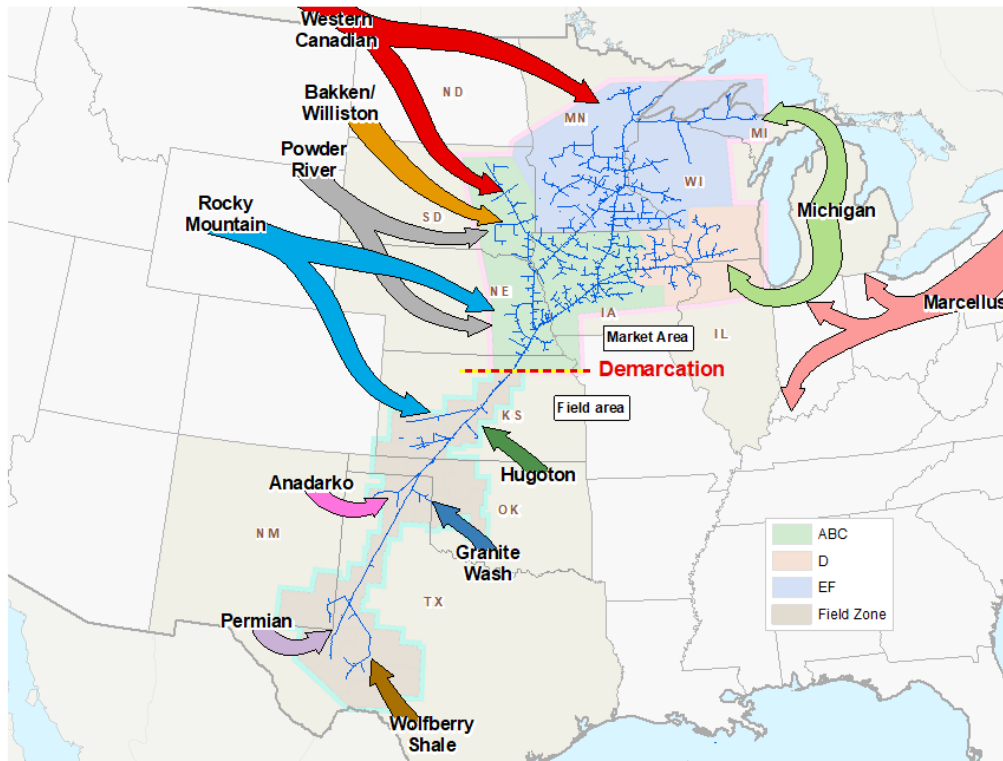
### **3. Other Northern advantages.**

In addition to costing significantly less and minimizing adverse environmental and natural resource impacts, Northern's proposal offers numerous other advantages that make it the more feasible and prudent alternative. Given Northern's robust system throughout Xcel's service territory, including in and around Becker, Northern has significant flexibility to develop a tailored solution to meet Sherco's needs, including providing Xcel access to multiple diverse gas supply options that other pipelines cannot provide, and far superior system resiliency and redundancy.

Other advantages include:

*Alternative gas supply access* – unlike any other pipeline company that may want to provide service to Sherco, Northern offers its customers the ability to supply natural gas from nearly every major supply basin in North America. In Northern's Market Area, which includes Minnesota, customers can access gas from the Rocky Mountains through its interconnections with the Trailblazer and Rockies' Express pipelines, the Permian and Midcontinent gas supplies through the Northern "Demarc" trading hub in Clifton, Kansas (a point that separates Northern's field (southern) and market (northern) areas), Michigan and Canadian supplies through Northern interconnections with the Northern Border, Viking, and Great Lakes Gas Transmission pipelines, and also gas storage volumes from interconnects with Great Lakes Gas Transmission. This supply diversity has historically allowed Xcel and other Northern customers to take advantage of price differentials between the various gas producing basins. No other pipeline operating in Minnesota can match this supply flexibility.

## Northern Accessible Natural Gas Supply Basins



Northern's unparalleled diversity also acts to help ensure Xcel has access to the high-quality gas even in the event of upstream pipeline gas quality issues. Unlike the single point of interconnection Xcel is assuming, Northern's supply diversity significantly reduces the chances of adverse impacts caused by disruptions on any single point of receipt. In addition, Northern's liquefied natural gas assets – capable of providing up to 600,000 dekatherms/day of emergency gas into its Market Area – provides even further mitigation in the event of upstream supply disruptions.

*System resiliency* – Northern's system consists of up to five large-diameter, high-pressure mainlines that can provide continuous levels of required service even in the event of a single line failure. In addition, many of the Northern branch line pipelines supplying the Twin Cities area are looped and tied together, effectively creating a large diameter, high pressure web-like system used

to maintain continuous, reliable service in the event of an operational problem elsewhere on the system. Northern's 14 Minnesota compressor stations include 28 compressor units that collectively have more than 152,000 horsepower. No other pipeline can come close to matching this operational resiliency. Indeed, the 135+ mile single source greenfield option Xcel is modeling subjects Sherco to a complete loss of gas supply from a single upstream interruption event.

*Flexible service, tariff certainty* – primarily because of Northern's expansive system, it is uniquely positioned to provide Xcel the flexible service needed for power generation. Northern currently has more than 6.2 billion cubic feet of system-wide line pack and 14 billion cubic feet of operational storage gas. These assets, in addition to its multiple main and branch lines, further provides Northern customers with unparalleled service flexibility, including "no-notice" service, daily scheduling tolerances, monthly imbalances, and hourly delivery flexibility that allows Xcel to schedule and receive gas into Northern's system uniformly over the 24-hour gas day while taking delivery of this same gas over a shorter period of time, and thus allowing for significant swings in load as demand varies throughout the day. Unlike other interstate pipelines operating in Minnesota, Northern has guaranteed the 16-hour delivery flexibility in its FERC tariff, offering Xcel and Northern's other customers tariff certainty. This feature, one that only Northern can provide, is particularly valuable given Xcel's ever-increasing reliance on variable wind and solar resources and the resulting hourly changes in natural gas generation demand that accompanies such variability.

*Existing system benefits* – Northern's proposed service options also include planned system expansion projects, including looping Northern's existing mainline. These expansions are intended to provide even further reinforcement and resiliency to Northern's system, and thereby provide additional benefit to Xcel and Northern's other customers in the state.

Northern's proposed service options, which Northern included in its response to Xcel's solicitation of interest and also presented in meetings between the companies spanning more than a year, provides multiple advantages over alternative pipelines, including with respect to reduced capital requirements, alternate supply access, reliability, operational flexibility, and significantly reduced impacts to Minnesota's environment and natural resources. As further shown below, Northern's proposals represent a far more feasible and prudent approach than the greenfield alternative Xcel is modeling in its resource plan.

### **C. Northern's Competitive Bypass Analysis.**

In its Information Request No. 1, the Commission sought information regarding Xcel's assumptions with respect to natural gas transportation service to the new Sherco plant. Xcel responded by stating that for "modeling purposes" it was assuming that firm natural gas supply to fuel Sherco "would be delivered by a new pipeline facility that connects the plant to the interstate natural gas market in southern Minnesota."<sup>17</sup> To test the competitiveness and feasibility of this "southern Minnesota" transportation service option, Northern undertook a comprehensive analysis of the option. A copy of the Sherco Competitive Bypass Analysis is included as Exhibit 3.<sup>18</sup> Completed in October 2020, the analysis examined two different scenarios with respect to Xcel's assumed transportation service options, options that were also outlined in Xcel's solicitation of interest for proposals: installation of either a new 20-inch or 24-inch greenfield pipeline connecting the Sherco plant to Northern Border Pipeline Company's interstate pipeline near Trimont,

---

<sup>17</sup> In Xcel Energy's February 1, 2021 Response to Information Request No. 187 of Sierra Club, Xcel confirmed "We do not have further updated [sic] to our response provided in MPUC's Information Request No. 1."

<sup>18</sup> The analysis includes detailed color maps of a 135+ mile route proxy of Xcel's assumed pipeline and detailed cost information, which can be difficult to print. Northern will provide a paper copy of the analysis to any party upon request.

Minnesota, a distance of some 135 miles. Northern provided Xcel with the analysis on October 23, 2020.

### **1. Northern's analysis of pipeline design and cost risks.**

Prior to adjusting for known risks, discussed below, Northern's analysis shows that Xcel's assumed pipeline, depending on ultimate design parameters, will cost between \$450 million and \$550 million in 2026 dollars.<sup>19</sup> Northern's analysis, however, is extremely conservative. The capital costs estimated in the analysis do not incorporate, for instance, the likely and significant increased costs caused by permitting opposition and the often-associated cost overruns. And while the analysis examines the risks a new pipeline would likely encounter in market variability, increased costs tied to rock installation and related pipe design factors, complications associated with the large amount of horizontal directional drilling required, increased pipeline length, and the significant right-of-way acquisition cost risks, it is important to note that Northern's cost analysis purposely excluded much of the impact of these risks.<sup>20</sup> If realized, however, these risks would undoubtedly increase the cost of the Xcel assumed pipeline option by another \$98 million to \$136 million.<sup>21</sup> On average, the alternatives identified by Xcel are approximately \$300 million more than the Northern options.<sup>22</sup>

### **2. Greenfield pipeline permitting risk.**

It is also important to highlight one additional key factor that further underscores the conservative nature of Northern's analysis: it assumed no increased costs caused by delays in the permitting process. While permitting delays are not the only reason for project cost overruns, they

---

<sup>19</sup> Analysis at 1.

<sup>20</sup> Each of these common risks are explained and analyzed in Northern's Competitive Bypass Analysis, Exhibit 3. *See also*, Analysis at 17 for a summary of the increased costs caused by risk factors *not* priced into the direct cost comparison.

<sup>21</sup> Analysis at 17, in 2026 dollars.

<sup>22</sup> In 2026 dollars.

undoubtedly have played a significant role in overruns experienced by recent pipeline projects throughout the country.<sup>23</sup> This Commission needs no reminder of the controversies that can surround greenfield pipeline permitting matters. As pointed out above and as recognized by Xcel in its July 29, 2020 information request response, the Sherco legislation does not exempt any pipeline necessary to serve the plant from the certificate of need or route permit process, or from environmental review under the Minnesota Environmental Policy Act (assuming an intrastate line). It goes without saying that a 135+ mile greenfield pipeline proposed to provide natural gas to a large natural gas plant specifically exempted by special legislation from the state's otherwise applicable regulatory review process would – and *should* – attract heightened regulatory scrutiny. This is particularly true when Xcel's assumed option would require approximately eight times the greenfield construction than would a Northern alternative, cost approximately \$300 million more to build, and be significantly less reliable. And while Northern's interstate alternative would be subject to review by FERC, there are many reasons why Northern would be much more likely to obtain all necessary permits, not the least of which is because its alternative is the most economical and reliable option, and the one that minimizes the potential for any significant effects on Minnesota's environment and natural resources. In short, there is no reasonable scenario where Northern would fail to obtain permits for a 16.6-mile greenfield option while the proponent of a 135-mile greenfield pipeline would succeed.

#### IV. CONCLUSION

A key issue in this resource plan is whether Xcel's proposed Sherco plant should be included in its least-cost portfolio of generation resources. The legislature has authorized

---

<sup>23</sup> The Atlantic Coast Pipeline, Constitution Pipeline Company, Mountain Valley Pipeline, Keystone Pipeline, and Dakota Access Pipeline are all recent pipeline projects that have either been cancelled or substantially delayed, but in each instance have experienced significant cost overruns.



construction of the plant, subject to the Commission's confirmation of Xcel's proposed plan. A critical component of the plant's overall cost is the cost of natural gas transportation service. For modeling purposes, Xcel has assumed the cost of a 135+ mile greenfield pipeline originating from a single point of interconnection near Trimont, Minnesota. The modeled pipeline is hundreds of millions of dollars more expensive to build than alternatives Northern has presented to Xcel and given the substantial risks discussed above, its true cost would likely be much more. It would also be less reliable and cause more damage to Minnesota's environment and finite natural resources. Because Northern's options cost less, are more reliable, have significantly less environmental impact, and avoid the risk of protracted litigation with Xcel and others concerning interference with Northern's existing contractual rights, they represent the most feasible and prudent alternative for Xcel and its customers.

Date: February 8, 2021

Respectfully submitted,

/s/ Todd J. Guerrero

Todd J. Guerrero

Andrew R. Shedlock

KUTAK ROCK LLP

60 South Sixth Street, Suite 3400

Minneapolis, MN 55402

(612) 334-5007

[todd.guerrero@kutakrock.com](mailto:todd.guerrero@kutakrock.com)

(612) 334-5022

[andrew.shedlock@kutakrock.com](mailto:andrew.shedlock@kutakrock.com)

/s/ J. Gregory Porter

J. Gregory Porter

Assistant General Counsel

NORTHERN NATURAL GAS

1111 South 103<sup>rd</sup> Street

Omaha, NE 68124

(402) 398-7406

[greg.porter@nngco.com](mailto:greg.porter@nngco.com)

# Northern Natural Gas System Map



★

Sherco Power Plant

■

Compressor Station

★

Liquefied Natural Gas Plant

—

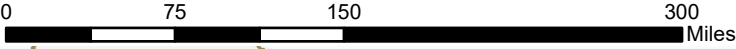
Pipeline

Underground Storage

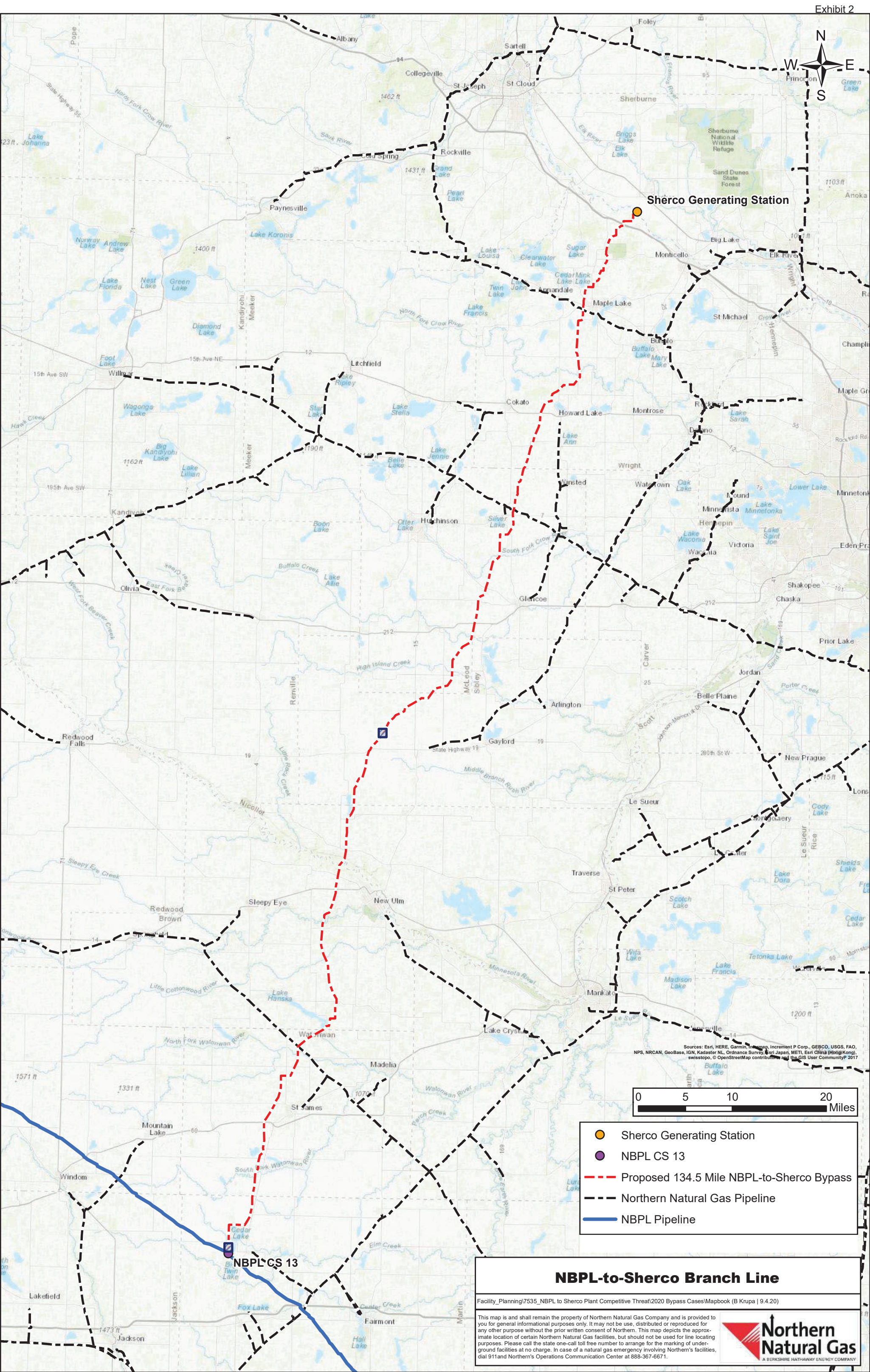
This map is and shall remain the property of Northern Natural Gas Company and is provided to you for general informational purposes only. It may not be used, distributed or reproduced for any other purpose without the prior written consent of Northern. This map depicts the approximate location of certain Northern Natural Gas facilities, but should not be used for line locating purposes. Please call the state one-call toll free number to arrange for the marking of underground facilities at no charge. In case of a natural gas emergency involving Northern's facilities, dial 911 and Northern's Operations Communication Center at 888-367-6671.








Engineering\_Construction\0273\_2020\_ShercoExpansion\Overall System Map\NNG System Map.mxd 2/1/2021








Sources: Esri, HERE, Garmin, InMap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community P 2017

-  Sherco Generating Station
-  NBPL CS 13
-  Proposed 134.5 Mile NBPL-to-Sherco Bypass
-  Northern Natural Gas Pipeline
-  NBPL Pipeline

### NBPL-to-Sherco Branch Line

Facility\_Planning\7535\_NBPL to Sherco Plant Competitive Threat\2020 Bypass Cases\Mapbook (B Krupa | 9.4.20)

This map is and shall remain the property of Northern Natural Gas Company and is provided to you for general informational purposes only. It may not be used, distributed or reproduced for any other purpose without the prior written consent of Northern. This map depicts the approximate location of certain Northern Natural Gas facilities, but should not be used for line locating purposes. Please call the state one-call toll free number to arrange for the marking of underground facilities at no charge. In case of a natural gas emergency involving Northern's facilities, dial 911 and Northern's Operations Communication Center at 888-367-6671.





# Sherco Competitive Bypass Analysis

---

*Engineering Transient Model Analysis and Competitive Estimate*

*October 23, 2020*

---

## **EXECUTIVE SUMMARY**

Northern Natural Gas Company (“Northern”) engineering personnel completed an analysis of an alternative service option for Xcel Energy Inc. (“Xcel”) to supply the Sherburne County Generating Station (“Sherco”) near Becker, Minnesota. The analysis studied the installation of a 135-mile greenfield pipeline from Northern Border Pipeline Company’s (“Border”) pipeline near Trimont, Minnesota, to Sherco. Table 1 summarizes the total costs for the two scenarios analyzed.

**Table 1 – Scope and Total Cost Summary**

<b>Scenario</b>	<b>Flow (Dth/hour)</b>	<b>Delivery Pressure (psig)</b>	<b>Component</b>	<b>2020 Cost</b>	<b>2026 Cost</b>	<b>2020 Total Cost</b>	<b>2026 Total Cost</b>
1	6,500	560	20-inch-diameter Pipeline	\$387.64m	\$443.69m	\$392.55m	\$449.30m
			Delivery Facility	\$1.92m	\$2.19m		
			Interconnect Facility	\$2.99m	\$3.42m		
2	7,500	765	24-inch-diameter Pipeline	\$458.55m	\$524.85m	\$482.96m	\$552.16m
			Delivery Facility	\$1.92m	\$2.19m		
			Interconnect Facility	\$2.99m	\$3.42m		
			1,775 hp Compressor Station	\$19.50m	\$21.70m		

This estimate reflects the lowest possible construction cost outcome. It is based on the assumption that the large greenfield lateral could be constructed without significant opposition. As discussed throughout this document, this would not be the case.

This paper memorializes the due diligence performed for the competitive bypass analysis and the risks associated with the project. It also highlights considerable pricing and operational risks associated with the large greenfield lateral. Operational risks include Border pressure profile and gas quality associated with a single point of service. Quantifiable cost risks include market variability over the next five years and pipeline installation costs tied to rock installation, pipe design factor, horizontal directional drilling complication, and right of way condemnation. If realized, these risks would increase the scenario 1 and scenario 2 2020 cost estimates to \$478.71m and \$602.32m, respectively.

The paper also discusses less quantifiable risks, most notably increasing pipeline opposition that would lead to project delays and increases in project costs above those outlined in Table 1 above.

## **HYDRAULIC ANALYSIS**

### **Xcel Gas Requirements**

Northern evaluated scenarios 1 and 2 for Xcel's lowest cost alternatives to Northern's transportation service to minimize capital requirements. The evaluation concluded that a 135-mile, 1,440 psig maximum allowable operating pressure ("MAOP") bypass lateral from Border near Trimont, Minnesota, to Sherco would be required. For scenario 1, compression would not be required, and the pipeline diameter would be 20 inches. For scenario 2, compression (1,775 hp) would be required at a midpoint location and the pipeline diameter would be 24 inches. For scenario 1, Northern assumed Border could maintain a pressure of 1,010 psig or higher and the greenfield pipeline developer would design for a 660 psig inlet pressure upstream of the Sherco regulating station. For scenario 2, Northern assumed the greenfield pipeline developer would design for an 865 psig inlet pressure upstream of the Sherco regulating station to accommodate operational fluctuations and anomalies. The proposed route and compression are shown in Figure 1.



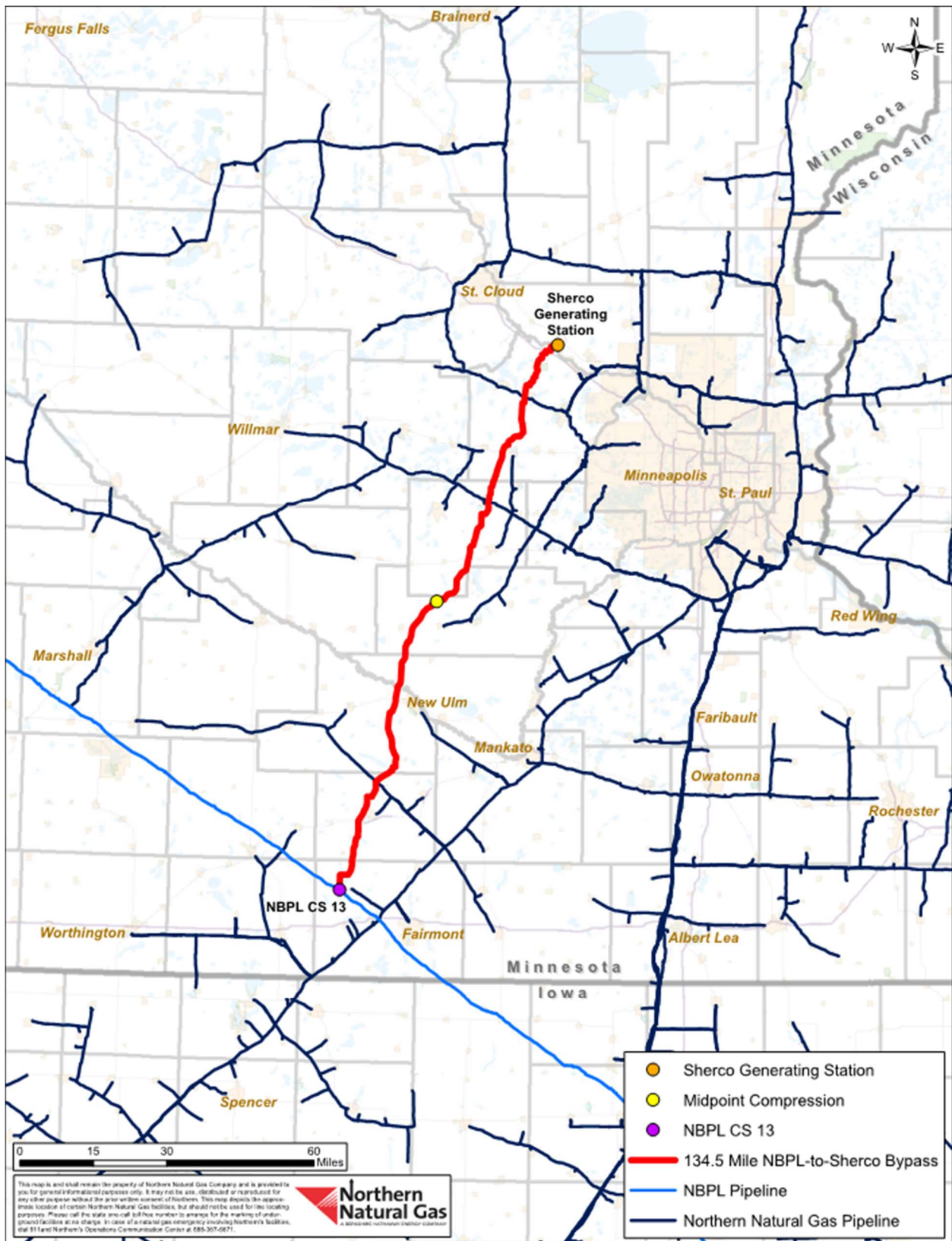
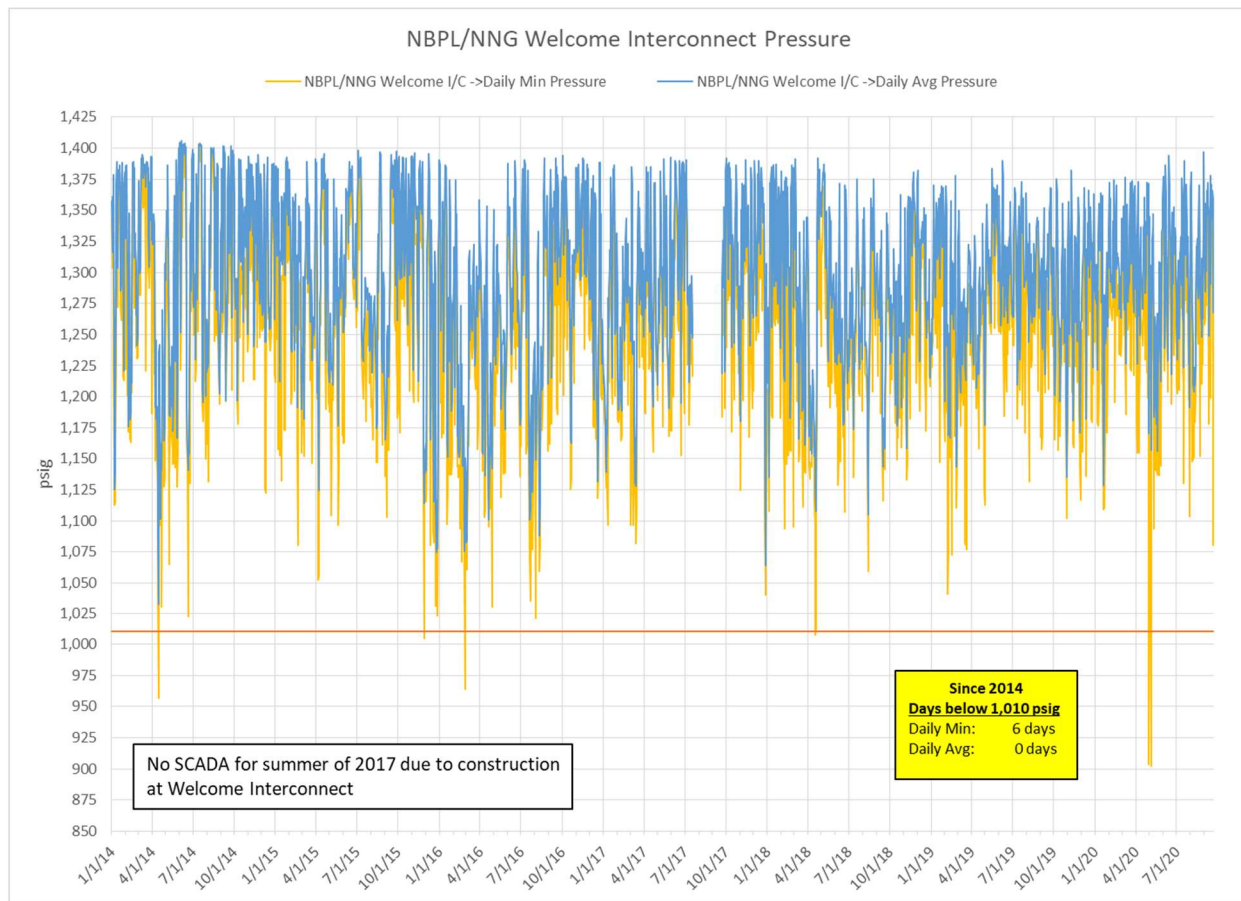


Figure 1 – Border to Sherco Bypass Lateral

## Border Pressure Assumptions

The first step in evaluating the bypass lateral was to determine an expected source pressure from Border. Northern’s interconnect with Border at Welcome, Minnesota, (“Welcome Interconnect”) was used as a basis for this analysis. The Welcome Interconnect is located approximately 10 miles downstream of Border’s CS13 near Trimont, Minnesota, and is assumed to have similar pressure profiles. While Border lists the minimum delivery pressure at Welcome, Minnesota, as 796 psig on its website, it is possible that Border would be willing to provide higher pressure commitments to Xcel. For the purpose of the analysis, Northern assumed a 1,010 psig source pressure available from Border. This source pressure assumption constitutes a risk to the viability of the bypass based on Northern’s operating experience with Border. Since 2014, Border has delivered pressures lower than 1,010 psig six times (excluding outliers that were likely the result of a system outage or poor data), reaching a minimum pressure of 902 psig May 5, 2020 (see Figure 2).



**Figure 2 – Northern Border Pressures**



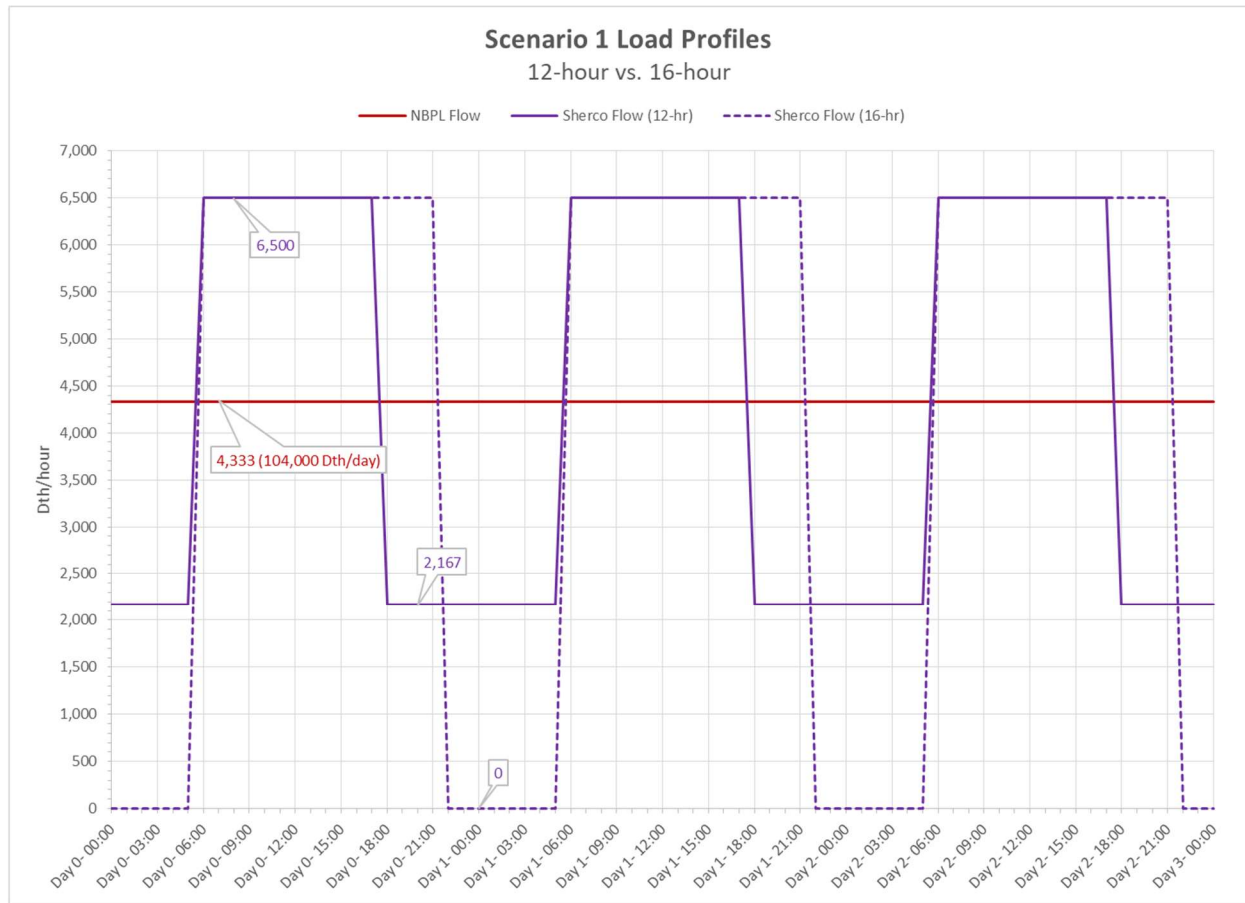
### **Lateral Transient Analysis**

Northern performed transient modeling to determine the minimum required diameter for the bypass lateral to meet the 6,500 and 7,500 Dth/hour peak load requirements. The transient analysis was conducted using both a 12-hour and a 16-hour peak burn period. The 12-hour peak burn period assumes peak flow rates of 6,500 or 7,500 Dth/hour for 12 consecutive hours followed by a reduced flow rate of 2,167 or 2,500 Dth/hour for the remainder of the day. The 16-hour peak burn period assumes peak flow rates of 6,500 or 7,500 Dth/hour for 16 consecutive hours followed by zero flow (see Figures 3 and 4).

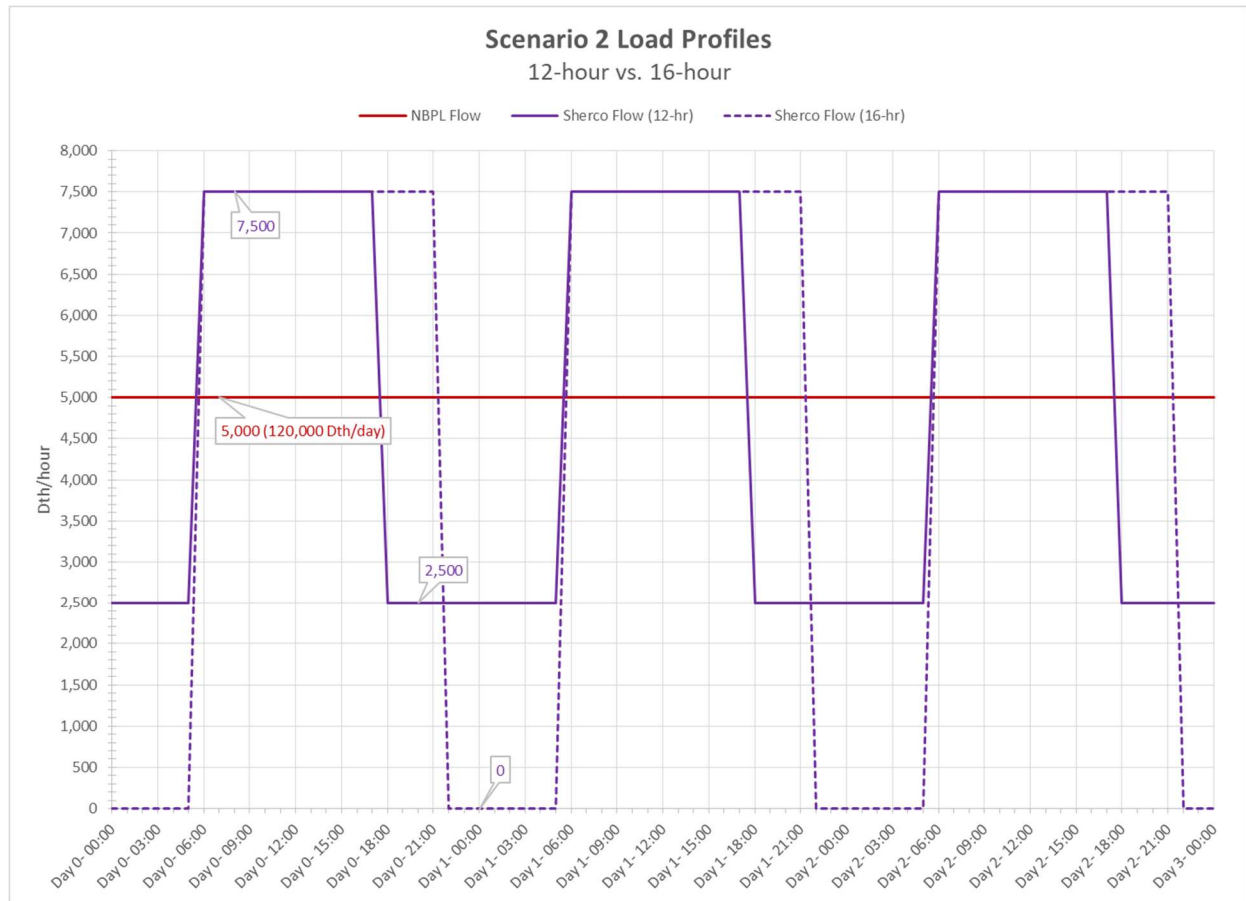
The 16-hour load profile represents service provided by Northern's tariff totaling 104,000 Dth of daily deliveries (6,500 Dth/hour multiplied by 16 hours/day) for scenario 1 and 120,000 Dth of daily deliveries (7,500 Dth/hour multiplied by 16 hours/day) for scenario 2. Northern's tariff allows flexible hourly usage, including the ability to use up to 1/16 of firm entitlement (regardless of scheduled quantities).

In contrast, the Border tariff is much more restrictive, limiting deliveries to 1/24 of the scheduled daily quantity. This is a significant limitation which must be accounted for in the design of a bypass lateral from Border. To reflect Border's hourly limitations, the analysis assumed the Border interconnect would maintain uniform hourly flows of 4,333 Dth/hour (104,000 Dth/day divided by 24 hours/day) for scenario 1 and 5,000 Dth/hour (120,000 Dth/day divided by 24 hours/day) for scenario 2 (see Figures 3 and 4).

The transient model study determined that a 20-inch lateral is the minimum acceptable pipeline size for scenario 1 and that a 24-inch lateral with compression are the minimum acceptable facilities for scenario 2.



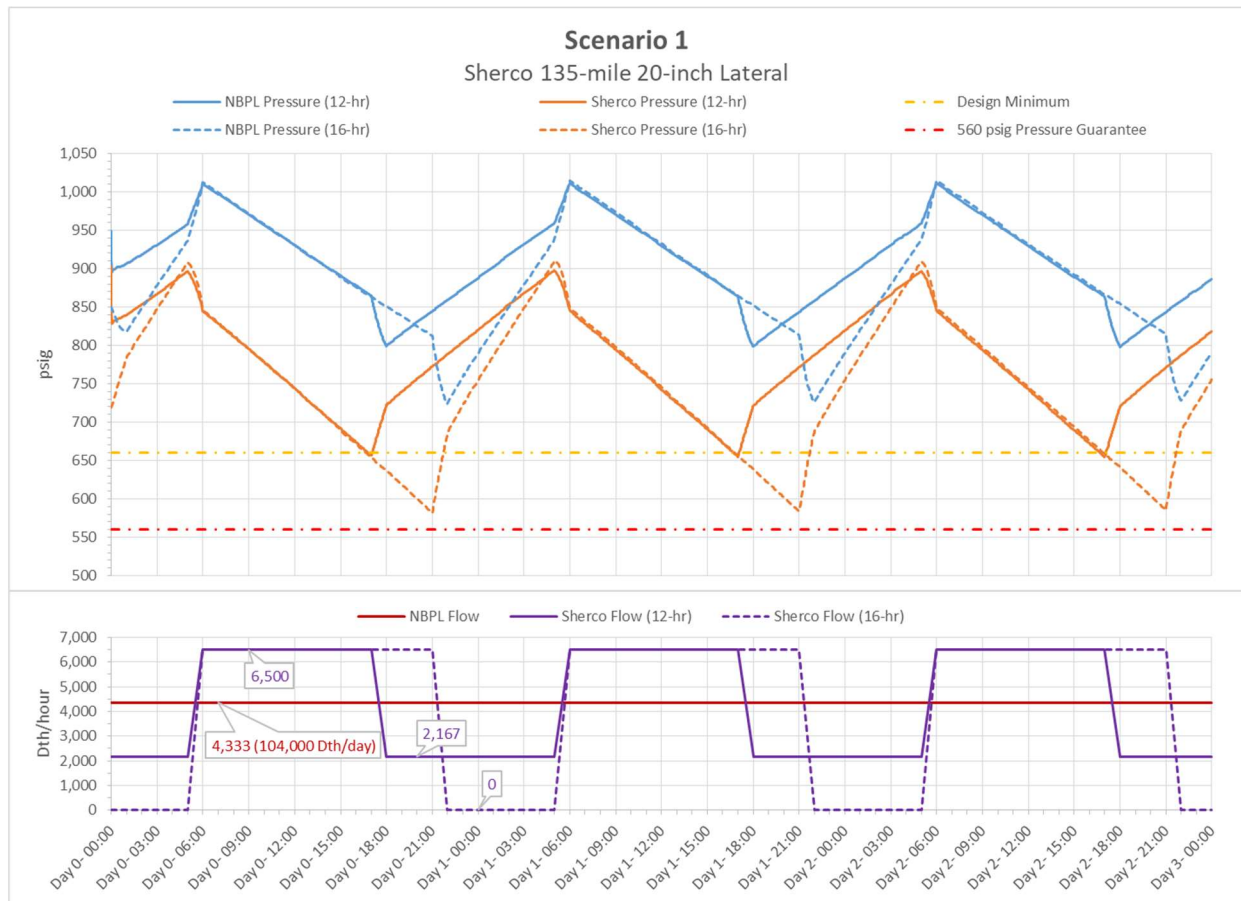
**Figure 3 – Scenario 1 Load Profiles**



**Figure 4 – Scenario 2 Load Profiles**

## Scenario 1 Analysis

Analysis of a 20-inch lateral shows the ability to maintain the minimum design inlet pressure of 660 psig under the 12-hour peak burn period; however, the design pressure is not maintained under the 16-hour peak burn period (see Figure 5). While this design fails to meet the minimum design inlet pressure in the 16-hour peak burn period (dropping to 581 psig), it does maintain the 560 psig delivery pressure. Northern considers this design inadequate, as it provides no allowance for error. This reduced design margin compounds risks associated with Border's takeoff pressure falling below 1,010 psig (see Figure 2), which would put the delivery at further risk. In order to meet the 660 psig minimum design inlet pressure on the 16-hour peak burn period, a takeoff pressure from Border of 1,064 psig would be required. As this pressure is not consistently available from Border (see Figure 2), compression would be required to reliably meet the minimum design inlet pressure. While proposing the system above without compression is a poor design, Northern understands that others may choose to accept this risk and has therefore not included the cost of compression in the Scenario 1 estimate.



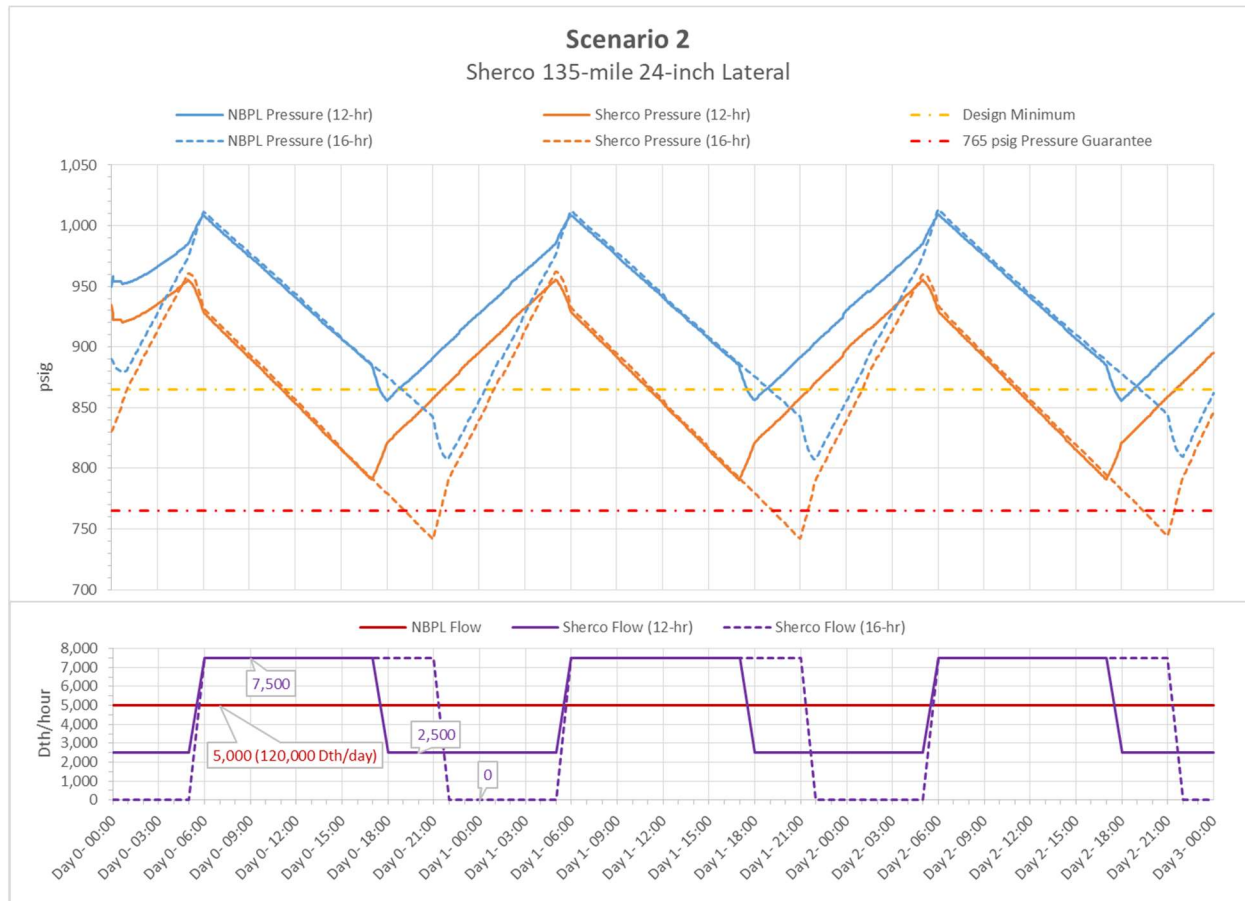
**Figure 5 – Transient Analysis of 20-inch Bypass Lateral for Scenario 1**

### *Scenario 2 Analysis*

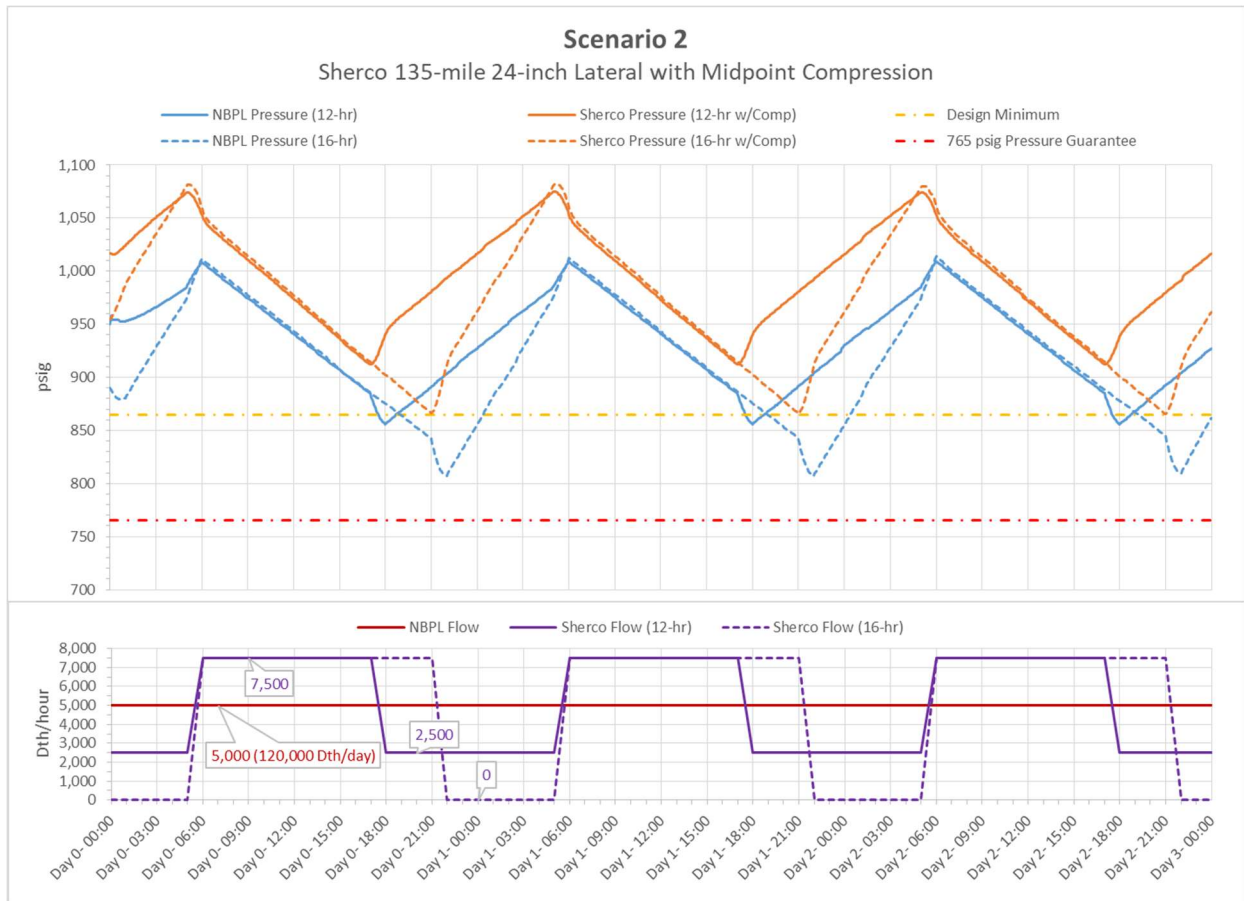
Analysis of a 24-inch lateral shows that neither the 12-hour or 16-hour peak burn periods can maintain the minimum design inlet pressure of 865 psig without compression (see Figure 6). To meet the 865 psig minimum design inlet pressure, a takeoff pressure of 1,074 psig would be required for a 12-hour peak burn period and 1,118 psig for the 16-hour peak burn period. While the 12-hour peak burn period fails to meet the minimum design inlet pressure (dropping to 790 psig), it does maintain the 765 psig delivery pressure. However, the 16-hour peak burn period fails to meet the 765 psig delivery pressure (dropping to 741 psig). In order to meet the 765 psig delivery pressure on the 16-hour peak burn period, a takeoff pressure from Border of at least 1,031 psig would be required. Based on historical Border pressures (see Figure 2), takeoff pressures are not consistently high enough to rely on a 24-inch lateral without compression.

With the installation of a midpoint compressor station, a 24-inch lateral shows the ability to maintain the minimum design inlet pressure of 865 psig for both a 12-hour and 16-hour peak burn period (see Figure 7).

The proposed compressor station is near the midway point of the lateral (see Figure 1). Assuming a takeoff pressure from Border of 1,010 psig, approximately 750 horsepower is required for the 12-hour peak burn period. For the 16-hour peak burn period, approximately 860 horsepower is required. Installation of a 1,775 horsepower reciprocating unit would allow for fluctuations in Border's pressure. A redundant unit would be required to perform maintenance on the single unit if Border's pressure could not be relied on and uninterrupted delivery is required, but is not included in the estimate. The redundant unit is estimated at \$7.0m.



**Figure 6 – Transient Analysis of 24-inch Bypass Lateral for Scenario 2**



**Figure 7 – Transient Analysis of 24-inch Bypass Lateral w/ Compression for Scenario 2**



## **COMPETITIVE BYPASS ESTIMATE ANALYSIS**

After completing the hydraulic analysis, Northern compiled estimates for the lateral facilities. Northern has an abundance of experience and an impressive record of accurately estimating pipeline and associated facilities. Since 2007, the Berkshire Hathaway Energy Pipeline Group has completed 195 expansion projects with total capital costs of \$1.5b executed 3% below the total estimated construction cost.

The following sections detail the process Northern used to develop the lateral estimate's various cost categories. Northern considers this estimate to be a competitive estimate backed by recent market data and comparable projects, while excluding the cost of significant risk factors that are likely to occur.

### **Engineering Estimates**

Engineers developed estimates following Northern standards and procedures. Northern engineers are adept at estimating pipeline construction especially in Minnesota, where a significant number of Northern's expansions occur. Northern utilized advanced aerial imagery to identify the optimal pipeline alignment between Border and Sherco. The selected route is detailed in Appendix A.

Northern used aerial maps and National Wetland Inventory data to determine base lay and horizontal directional drill footages. Engineers worked with representatives from Northern's construction, environmental services, right of way and operations departments to develop quantity takeoffs for estimated line items. The detailed estimates are included in Appendix B.

Northern compiled all line items and associated costs in its estimating database to develop a base estimate. The estimating database includes labor, equipment and material costs for specific line items based on historical pricing data. These estimates were then validated using a top down approach by comparing each cost category against comparable projects completed by Northern and third parties.

### **Comparable Projects**

In order to validate estimated costs, Northern collected historical data from projects of similar scope and scale filed with the Federal Energy Regulatory Commission ("FERC"). The data set included pipeline projects with pipe diameters ranging between 16 and 30 inches and with lengths of at least 10 miles completed between 2014 and 2019. The original data set included 10 projects; however, Northern eliminated three high-end outliers, resulting in a data set of 7 projects. Two additional projects not filed with the FERC were included in the data set for comparison: the Ft.



Lupton-to-Cherokee Project, constructed by Xcel, and the West Central Lateral Project, constructed by We Energies. Details of the project data set are tabulated in Appendix C.

In order to effectively compare projects from different years and of varying pipe diameters, the estimating team normalized the cost data.

1. Project costs were escalated into 2020 dollars using annual Global Insight rates.<sup>1</sup>
2. Project costs were scaled to 20- and 24-inch pipelines.

Northern engineers examined the distribution of total costs, and clear trends emerged. Normalized total project costs averaged \$2.89m per mile for 20-inch and \$3.47m per mile for 24-inch. Northern estimated the bypass lateral at \$2.88m per mile for 20-inch and \$3.41m per mile for 24-inch in 2020 costs.

The majority of the larger comparable projects either occurred prior to the increased frequency of pipeline opposition discussed in the risk section below or utilized existing easements. As such, those projects do not include costs increasingly necessary to address organized pipeline opposition.

### **Project Cost Breakdown**

#### ***Labor***

Contract installation labor is the single largest estimate component, comprising slightly over 50% of the estimate. Developing pipeline takeoff quantities is straightforward. Pricing is dependent on a number of variables, including construction industry dynamics, commodity markets and location factors. Determining accurate unit pricing is complicated, but critical to overall estimate accuracy.

Estimates completed by Northern's engineering department typically utilize a base lay unit cost in the range of the historical data for projects that are most comparable considering terrain, ground clearing requirements, geographic location, encroachment and pipeline length, among other factors. Northern's engineering department sought publicly available cost information on pipeline projects of comparable size, length and terrain to ensure estimate accuracy and to recognize possible adjustments due to economies of scale.

---

<sup>1</sup> In order to accurately compare projects occurring in different years, the analysis accounts for past and future market shifts using data provided by Global Insight, a division of Information Handling Services. The data offers historical changes in labor and material rates in a given year and forecasts future annual trends in industry costs. The data is regionalized and pipeline-industry specific. The adjustment rates for each year are included in Appendix D.

Historical data from external comparable projects filed with FERC show construction base lay costs range widely between \$1.17m and \$2.04m per mile. Northern comparable projects range between \$1.22m and \$2.72m. The labor cost for this estimate was \$1.55m per mile for 20-inch and \$1.92m per mile for 24-inch. These costs fall within the range of the external and Northern comparable projects.

### ***Materials***

Materials are another major contributor to total project costs. The entire 135-mile route was designed for Class 2 installation utilizing a 0.6 design factor for open cut sections and horizontal directional drill segments. Using these criteria for the 20-inch pipeline, the minimum allowable standard API 5L wall thickness is 0.375-inch, grade X-65 steel for open cut sections and horizontal directional drill segments. Using the same criteria for the 24-inch pipeline, the minimum allowable wall thickness is 0.412-inch, grade X-70 for open cut sections and horizontal directional drill segments. These minimum requirements were utilized for estimated material costs. Northern obtained September 2020 pipe pricing for the estimate from domestic pipe mills. This estimate was based upon current market conditions.

The estimate includes nine mainline valve settings to accommodate the current Department of Transportation Code of Federal Regulations 192 valve spacing requirements. The takeoff, midpoint and delivery locations include in-line inspection tool facilities.

### ***Environmental***

The 135-mile bypass pipeline will require several environmental permits/clearances on both the state and federal level. Northern's environmental services division is well-versed in Minnesota permitting requirements and processes and provided environmental consulting and permitting estimates, as well as an estimate for environmental unit-price items (e.g., wetland mats, silt fence, erosion control devices, etc.). The proposed pipeline crosses 6.7 miles of wetlands, 87 waterbodies and multiple Minnesota Department of Natural Resources ("MDNR") sites. The complete list of environmental impacts is summarized in Appendix G.

### ***Right of Way Acquisition***

Virtually the entire length of the identified route involves greenfield installation; therefore, the selection of easement width significantly impacts land acquisition estimates. The Interstate Natural Gas Association of America ("INGAA") recommends 50 feet of permanent easement for 20- and 24-inch pipelines, which is the assumed width in the estimate. Northern's right of way department provided an acquisition estimate based on current land values in the project area. This estimate includes condemnation on 10% of the parcels due to the nature of landowner negotiations on

greenfield pipelines. Actual condemnation requirements vary from project to project, but condemnation proceedings on up to and exceeding 20% of the parcels are not uncommon on greenfield laterals. This number can increase substantially in the event of organized opposition.

### ***Right of Way Damages***

Similar to land acquisition costs, construction damage costs vary proportionally with choice of easement width and size of extra temporary workspace outside of permanent easement for construction. INGAA recommends a 100-foot-wide construction corridor for 20- and 24-inch pipelines, and this estimate follows the recommendation. Northern's right of way department estimated damages based on the proposed route and current crop values.

It should be noted that utilizing smaller workspace widths to reduce right of way costs would result in offsetting construction cost increases, as the constrained workspace introduces construction inefficiencies. Therefore, narrowing of the construction corridor would result in an increased overall expense.

### ***Right of Way Labor***

The resources required to engage, negotiate and process agreements with affected landowners are not completely dependent on total affected area. While fewer affected acres may provide a more attractive negotiation position with impacted landowners, it does not necessarily provide a substantial reduction in total number of landowners encountered on the pipeline route. Therefore, agent time required to negotiate and execute contracts is not measurably reduced. The right of way department provided a labor estimate commensurate with Northern's comparable project costs. As with land acquisition, right of way labor and legal costs increase considerably when condemnation is required.

### ***Construction Support***

Nondestructive testing and survey costs are relatively minor and proportionate to the length of pipeline. Northern construction coordinators were consulted to obtain costs, and costs were validated with Northern's comparable projects.

### ***Engineering and Inspection***

Engineering and inspection costs were estimated by consulting Northern’s construction coordinators and by using Northern’s comparable project data. External comparable projects with lengths of 98 miles and greater were used to validate these costs, as seen in Table 2. Six projects were identified that met this length requirement. Two projects submitted engineering costs only, while the other four submitted engineering and inspection costs combined. These costs can be seen in Appendix E.

**Table 2 – Engineering and Inspection Percentages**

Category	Comparable Projects	Northern's Estimate	
		20-inch	24-inch
Engineering	4.19%	3.39%	3.15%
Inspection	4.67%	3.80%	3.60%
Total	8.86%	7.19%	6.76%

### ***Other Company Labor***

Other company labor (including field, procurement, regulatory, etc.) costs represent a minor portion of total capital project expenditure (less than 1%). Average Northern comparable costs were used for the estimate.

### **Facility Estimates**

In addition to the 135-mile lateral, scenario 1 would require a valve setting and interconnect facility at the takeoff of the Border pipeline and a delivery facility at the Sherco plant. In addition to scenario 1 requirements, scenario 2 would require compression at the midpoint location. Northern estimated the delivery facility using Northern’s comparable project costs. The interconnect cost is based on a 6-inch tap and interconnect constructed in 2015 by Border and operated by Northern. The compressor station estimate was based on comparable projects detailed in Appendix C. Table 3 summarizes these costs.

**Table 3 – Facility Costs**

Facility	2020 Cost	2026 Cost
Delivery	\$1.92m	\$2.19m
Interconnect	\$2.99m	\$3.42m
Compressor Station	\$19.50m	\$21.70m
Total Costs	\$21.41m	\$27.31m

## **DESIGN AND COST ESTIMATE RISKS**

The evaluation of pipeline and facility requirements and subsequent estimation of costs considered multiple risks. Estimate contingency accounts for some of these risks; however, Northern assumed the majority of these design and estimate risks would be avoided. Proper financial mitigation of these risks would increase the estimated costs.

### **Design Requirements**

Northern made several assumptions about Xcel's requirements at the Sherco plant that represent design risks that could increase construction costs. Northern assumed that Xcel would need a takeoff pressure of 1,010 psig to maintain at least 660 psig for scenario 1 and 865 psig for scenario 2 at the plant site. Based on historic Border pressures, this minimum pressure could not be guaranteed without modifications to Border's system. As a result, reliance on the 1,010 psig takeoff pressure could result in operational issues and loss of delivery pressure.

The design assumes that the 135-mile lateral would only be located in Class 1 and 2 locations, permitting a 0.6 design factor for the entire route. The pipeline specifications were chosen to meet the 1,440 psig MAOP obligation. The pipe specifications would not support a 1,440 psig MAOP in Class 3 locations. Therefore, there is risk that if Class 3 locations develop in the future, pipe would need to be replaced.

### **Cost Estimates**

This 135-mile lateral and associated facilities comprise several construction risks that would impact project cost and duration. To ensure this project was competitively priced, the estimate includes some level risk, but considerable cost risk remains. Table 4 summarizes possible risks and potential increases in cost.

**Table 4 – Cost Estimate Risks Summary**

<b>Risk</b>	<b>Cost Increase</b>	
	<b>Scenario 1</b>	<b>Scenario 2</b>
Market Conditions	\$41.45m	\$55.73m
Installation in Rock	\$8.27m	\$10.72m
Pipe Design Factor	\$4.58m	\$11.27m
Drilling Complications	\$4.16m	\$4.81m
Drill Length Increases	\$14.20m	\$16.33m
ROW Condemnation	\$13.50m	\$13.50m
Compressor Stations	-	\$7.00m
Total Risks	\$86.16m	\$119.36m

### ***Market Conditions***

Recent bid events have shown that pipeline construction market conditions have a large impact on contract install pricing. Northern has recently experienced installation price increases of 25-30% due to market conditions. This estimate is not solely based on increased costs recently encountered, but on historical trends, which include recent Northern projects in the area. Northern has experienced unfavorable market trends for pipeline installation in this area, most recently on expansion projects near Rockford and Rochester, Minnesota. Depending on market conditions at the time of construction, the total project cost could increase by an estimated \$41.45m (20-inch) or \$55.73m (24-inch). This increase would result in new labor costs of \$1.86m/mile for 20-inch and \$2.33m for 24-inch. The 20-inch costs would still fall within the range of the external FERC comparables; however, the 24-inch costs would fall above the range of the external FERC comparables, but within the range of Northern comparables. Based on 2019 and 2020 pipeline installation bids received by Northern, such increases are likely.

### ***Installation in Rock***

Based on soil bores and experience constructing throughout the state of Minnesota, a 135-mile pipeline would inevitably experience various forms of rock and other unfavorable soil conditions. Contractor quotes suggest that installation in such conditions can as much as double the contract installation costs. No rock is included in the project estimate. If rock is encountered on as little as 5% of the 135-mile route, costs could increase by \$8.27m for 20-inch or \$10.72m for 24-inch.

### ***Pipe Design Factor***

The pipeline specifications were selected to facilitate a 1,440 psig MAOP in Class 2 locations. There is risk that if anything other than Class 2 location is encountered, a thicker-wall pipe or higher-grade steel would need to be installed. If the area is further developed prior to project execution, those areas would need to be installed with a 0.5 design factor, and the material and labor costs would increase accordingly. An analysis was completed on each scenario to provide a cost associated with this risk.

### ***20-inch***

The 20-inch pipeline would require 0.375-inch wall thickness and grade X-65 steel piping for Class 2 installation. The highest allowable MAOP this pipe specification could support in a Class 3 location would only be 1,218 psig. To meet Class 3 requirements, 0.412-inch wall thickness and grade X-70 steel is required. If the entire route was designed to these specifications this would result in an increased cost of \$4.58m for Class 3.

### *24-inch*

The 24-inch pipeline would require 0.412-inch wall thickness and grade X-70 steel piping for Class 2 installation. The highest allowable MAOP this pipe specification could support in a Class 3 location would only be 1,201 psig. To meet Class 3 requirements, 0.494-inch wall thickness and grade X-70 steel is required. If the entire route was designed to these specifications this would result in an increased cost of \$11.27m for Class 3.

### ***Drilling Complications***

The proposed pipeline route includes several horizontal directional drills crossing approximately 160 roads, 9 railroads, 87 waterbodies, and 6.7 miles of wetland. In aggregate, the lateral includes approximately 220 drills, averaging 450 feet per drill (including drills up to 4,500 feet in length), with a total drill length of approximately 19 miles. Included in these drills are crossings of Interstate 94, the Mississippi River and other smaller rivers. Horizontal directional drills present inherent risks, such as inadvertent releases, difficult soil conditions (resulting in slow drilling or collapsed holes), and damaged pipe coating due to debris in the drill hole. For the purpose of the estimate, Northern assumed favorable drilling conditions and no added costs for drilling through rock. Given the length of the pipeline and quantity of drills, this is highly unlikely. Any rock encountered would have an impact on the contract installation cost.

Northern completed a desktop review of soil conditions along the route using the National Resources Conservation Service web soil survey data on the United States Department of Agriculture website. Northern discovered approximately 11% of the soil along the route to contain a large amount of gravel and sand. Assuming the distribution is balanced throughout the entire route, 25 of the 220 drills will occur in these soil conditions. Drilling in gravel and sandy conditions introduces increased risks of inadvertent mud releases, sinkholes and collapsed drill holes. Assuming 50% of the drills in this soil type encounter issues, and a two-week increase in drill duration, the total project cost could increase up to \$1.54m to cover a partial inspection staff required to monitor the drills. If these drills were contracted on a time-and-material basis, an additional \$2.62m (20-inch) or \$3.27m (24-inch) could be incurred to cover the additional costs of the drilling contractor. The total cost impact could be in excess of \$4.16m (20-inch) or \$4.81m (24-inch). The quantity and length of directional drills are such that more significant drilling issues represent a conceivable risk. It is difficult to quantify the upper bounds of such risks. The project estimate excludes any additional costs for drilling complications.



### ***Drill Length Increases***

Horizontal directional drill footages often increase due to environmental survey findings (culturally significant findings, tribal findings, wetland delineations, organic farms, etc.), landowner requests and other obstructions not identified during preliminary route analysis. On nine pipelines Northern constructed in 2019 and 2020, the increased horizontal directional drill footage due to obstructions unseen at the time of estimate averaged 5% of the overall pipeline length, with individual values up to 23.6%. Assuming the 5% average Northern experienced over the last two years, this would result in an increased cost of \$14.20m for 20-inch or \$16.33m for 24-inch.

### ***ROW Condemnation***

The Northern right of way department provided an acquisition estimate based on current land values in the project area. This estimate assumed condemnation on 10% of the required easements. Due to nature of landowner negotiations on greenfield pipelines, it is reasonable to assume the project could require condemnation on an additional 10% of the required easements. In addition to an increase in project duration, this could increase right of way costs by an estimated \$13.5m.

### ***Compressor Stations***

The estimate for scenario 2 (7,500 Dth/hour) includes costs for a midpoint compressor station. The estimate included one unit at the midpoint location, which leaves the system at risk, as the station is not fully redundant. In order to have full redundancy, an additional unit would be required. The total incremental cost for the additional unit is \$7.0m.

### ***Contingency***

Northern utilizes between 5% and 15% of contingency in project estimates to mitigate various risk, depending on the perceived difficulty of the project. Despite the difficulties discussed above, Northern only included 6.5% contingency to ensure the project is competitively priced.

## **ROUTE ALTERNATIVES**

Northern's engineering department analyzed route alternatives in an effort to identify potential savings. The sections below detail the cost impact associated with each alternative for each pipeline diameter.



### ***Public ROW***

While it is sometimes possible to install a pipeline within public road right of way, the cross-country nature of the route is such that attempting to follow public road right of way would significantly extend the length, resulting in greater total cost. To be thorough, Northern's engineering department analyzed a route alternative that utilizes all existing public road right of way. This route increased the total pipeline length from 135 to 160 miles. This route may yield savings in right of way costs of up to \$16.0m, but they are offset by an incremental \$50.13m (20-inch) or \$61.18m (24-inch) incurred in labor and materials alone. This is not a feasible alternative, as this route results in a net increase of \$34.13m (20-inch) or \$45.18m (24-inch).

### ***Combined Public and Private Right of Way***

Northern's engineering department analyzed a second route alternative that makes use of public right of way wherever feasible without adding additional length to the route. This route uses 26.0 miles of public right of way. The use of public right of way could yield savings of approximately \$2.60m, assuming temporary workspaces would still be required outside of the public right of way. While this alternative offers an opportunity for initial savings, there is significant risk for future relocation and associated costs if roads are expanded.

### ***Power Line Corridor***

Northern's engineering department analyzed a third route alternative that could be adjusted to parallel high-voltage power lines near the Sherco generating station. This would result in the need for an alternating current induction mitigation system to reduce the levels of current induced on the pipeline. Northern has recently experienced costs of \$350.0k per mile for mitigation when paralleling high-voltage power lines. If the new pipeline alignment was adjusted to parallel the high-voltage power lines leading to the plant, up to 20 miles of high-voltage power lines could be paralleled. While right of way costs may be reduced, additional costs of up to \$7.0m may be incurred for installation of an alternating current induction mitigation system. In addition, this route would increase the total length by approximately 6 miles, which would increase material and labor costs by \$11.89m (20-inch) or \$14.51m (24-inch) for a total of \$18.89m (20-inch) or \$21.51m (24-inch) in additional costs. Using 20 miles of existing right of way could yield a reduction of \$3.42m in acquisition savings; however, this is not a feasible route alternative, as this route results in a net increase of \$15.47m (20-inch) or \$18.09m (24-inch).

## **OPERATIONS AND MAINTENANCE COSTS**

On top of the up-front costs to install the lateral, delivery station, and compressor station, annual costs for operations and maintenance (O&M), staffing additions, compressor fuel, and compressor overhauls need to be accounted for. Annual O&M costs are estimated at \$0.19m for the pipeline and delivery station in scenario 1. With the addition of the compressor station in scenario 2, annual O&M costs are estimated at \$0.62m.

Based on historic expenses, Northern assumes an annual O&M cost of \$1.3k per mile for pipelines located in Class 1 locations. For delivery stations sized to flow more than 50,000 Dth/day, Northern assumes an annual O&M cost of \$15.0k. For the 135-mile, 20- or 24-inch lateral and delivery station, total annual O&M costs are estimated at \$0.19m. It is assumed that existing operations employees in the area would absorb the day-to-day operation of the pipeline and delivery station so no additional staff additions are required. Annual O&M costs would increase if additional staff is deemed necessary.

After discussion with Northern operations personnel, a minimum of two staff additions would be required to operate the midpoint compressor station in scenario 2. The annual O&M cost for the compressor station, including staff additions and overhauls, is estimated at \$0.43m (see Appendix F). Without knowing how often the power plant will operate, it is difficult to estimate the run hours for the compressors. Therefore, compressor fuel costs are not included in the annual O&M estimate. Under full load, a single compressor unit would consume approximately 350 Dth/day of fuel. Assuming 100% run time for a single unit, the annual fuel usage is estimated at 127,800 Dth/year or approximately \$0.38m (assumes \$3 per Dth).

## **PIPELINE OPPOSITION RISK**

The alternative involves a 135-mile, 20- or 24-inch-diameter greenfield pipeline, with or without midpoint compression. The scale of the scope and nature of the greenfield pipeline would experience highly organized opposition from landowners, environmental permitting agencies, Native American tribes and non-governmental organizations that would without question exceed any such opposition experienced for the Northern cases that involve only 16.6 miles of greenfield pipeline.

In recent years, larger greenfield oil and gas pipelines have experienced increased opposition from landowners, state and federal permitting agencies, Native American tribes and non-governmental organizations including environmental activists. Successful opposition has resulted in extended permitting process, dramatic increases in costs, and – in some cases – failed projects.

Notably, in July 2020, Dominion Energy and Duke Energy announced that their joint venture to construct the Atlantic Coast Pipeline would be discontinued. The announcement ended efforts to construct the proposed 600-mile pipeline that would carry Marcellus Shale fields in West Virginia to markets in West Virginia, Virginia and North Carolina. The pipeline struggled against a wave of opposition that started with landowners and the neighboring Native American tribes.

Ultimately, this grassroots resistance attracted environmental non-governmental organizations, such as the Environmental Defense Fund and the Sierra Club. These organizations worked to organize all stakeholder opposition in an effort to shut the project down. The project was the target of heightened activism based on concerns about climate change, project need, and the extensive use of condemnation to acquire land rights. Legal battles and delays increased the costs of the project from \$5 billion to an estimated \$8 billion.

Similar to the Atlantic Coast Pipeline, the Dakota Access Pipeline saw a large increase in incurred costs compared to its originally estimated project cost. Delays and opposition to the pipeline increased overall project costs from \$3.78 billion to an estimated \$7.50 billion. From 2016 to 2018, Energy Transfer Partners stock also declined almost 20% while the S&P 500 increased by almost 35% over same time period. The pipeline primarily saw opposition from Native American tribes, which led to several protests over the course of construction. Pipeline construction was put on pause by the Obama administration to allow for additional review of environmental impacts imposed by the pipeline. The pipeline resumed construction in early 2017 after an executive order was signed by the Trump administration, allowing advancement of the Dakota Access and Keystone XL pipelines. Construction on the pipeline restarted in March 2016, and the pipeline was placed into service June 2017.

While the pipeline has been in operation for approximately three years, it continues to see opposition today. In June 2020, a federal judge ordered the pipeline to shut down until further environmental evaluation of the line had been completed. This was later overturned in August 2020. A shutdown would result in a loss of 570,000 barrels of oil per day in transportation and cause significant revenue loss for Energy Transfer Partners and other pipeline owners.

The increasing pipeline opposition has led to hearings in Congress and action in the courts. In April 2020, a panel in the U.S. House of Representatives found that FERC made it too easy for pipelines to use eminent domain. Further, court challenges have resulted in holdings that FERC's process for granting pipeline certificates over pending landowner objections failed to provide necessary landowner procedural rights to oppose pipeline projects.

Importantly, the construction of a long greenfield pipeline would be uniquely subject to these same vulnerabilities; namely, an incremental need to use eminent domain, and a significantly larger number of impacted landowners that would heighten the risk of organized landowner opposition.

This could attract the involvement of environmental non-governmental organizations and other interested parties, a result that would mean sophisticated permit battles and well-funded litigation. Opposition would focus on less-invasive alternatives, such as Northern is able to provide. Northern's alternative would impact far fewer landowners and largely limit impacts to landowners with whom Northern already maintains ongoing property rights. The greenfield project sponsor would need to demonstrate to regulators how its project comprises less environmental impact than the alternatives, which would be exceedingly challenging, if not impossible.

While impossible to predict the potential success of pipeline opposition, it is safe to say that the potential for such organized opposition is incrementally greater for the greenfield pipeline.

## **CONCLUSION**

Northern exercised extensive diligence in completing an in-depth and detailed analysis of a bypass lateral capable of meeting the needs of the Sherburne County Generating Station. The analysis was conducted in a manner to reflect appropriate and competitive facility requirements, estimated capital costs, and operations and maintenance requirements without factoring in the cost of organized opposition. As a result of these efforts, Northern has the utmost confidence that the estimated values represent the lowest likely capital requirements needed to facilitate alternative service to the Sherco facility.

## Appendix A

# Bypass Lateral Map Book

## Appendix B

### Detailed Estimates

**Pipeline to NBPL**  
**135 Miles**  
**20-inch-diameter 1440 MAOP**

<b>Project name</b>	Competitive Threat
<b>Estimator</b>	Pipeline Expansion
<b>Labor rate table</b>	IL,MI,MN,WI
<b>Project</b>	Sherco
<b>Estimate Level</b>	B
<b>Accuracy Level +/-</b>	15%
<b>Const. Duration</b>	28 weeks (4 crews)
<b>Revision</b>	1
<b>Revision Date</b>	9/11/2020
<b>Region</b>	North
<b>State</b>	Minnesota
<b>Notes</b>	<p>Scope:</p> <p>Install a new 20-inch branch line lateral from NBPL to the Sherco generating station.</p> <p>Details:</p> <ul style="list-style-type: none"><li>- 20" pipeline, 135 miles long</li><li>- Open Cut: 20-inch-diameter, 0.375" Wall Thickness, Grade X65, with FBE</li><li>- Quantity: 613,800 feet</li><li>- Drills: 20-inch-diameter, 0.375" Wall Thickness, Grade X65, with Powercrete</li><li>- Quantity: 99,000 feet</li></ul> <p>Outage:</p> <p>Assumed Tie-in will be completed by method of hot tapping. No outage is proposed for the NBPL line.</p> <p>Assumptions:</p> <ul style="list-style-type: none"><li>- 1.6 % AFUDC</li><li>- 9 block valve settings installed to meet current spacing requirements and future compressor tie-in. Assumed all class 1 excluding one class 2 location</li><li>- 2 launchers/receivers installed on the line. Pigging over 80 miles is uncommon (battery life)</li><li>- 4 spreads 196 days</li><li>- Construction not in winter</li><li>- Construction not accelerated</li><li>- Hot taps included in estimate</li></ul> <p>Risks:</p> <ul style="list-style-type: none"><li>- Route will require drilling under the Mississippi River</li><li>- Route currently includes 3 drills that span between 3000-5000 feet</li><li>- Route crosses numerous wetlands, potential for amount of drilling to increase once delineated wetlands are identified</li><li>- See paper for detailed risk analysis</li></ul>
<b>Report format</b>	Sorted by 'Group phase/Phase'



'Detail' summary





Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>1.100</b>	<b>P/L Material</b>									
<b>1.103</b>	<b>CS, X Gr, Thin Wall</b>									
	20 20" 0.375" ERW X65 Gr Pipe (Drill)	99,000.00	FEET	-	-	84.844 /FEET	8,399,516	-	-	8,399,516
	20 20" 0.375" ERW X65 Gr Pipe (Open Cut)	613,800.00	FEET	-	-	67.27 /FEET	41,289,712	-	-	41,289,712
	<b>CS, X Gr, Thin Wall</b>						<b>49,689,229</b>			<b>49,689,229</b>
<b>1.119</b>	<b>Cathodic Protection</b>									
cp02	AC Current Mitigation Study	1.00	LS	149,999.920 /LS	150,000			-	-	150,000
cp02	Cathodic Protection Ground Bed	3.00	LS	23,190.00 /LS	69,570	50,000.00 /LS	150,000	-	-	219,570
cp04	Cathodic System Rectifier	12.00	EACH	6,000.00 /EACH	72,000	18,000.00 /EACH	216,000	-	-	288,000
cp05	Cathodic System Anode	12.00	EACH	1,000.00 /EACH	12,000	5,000.00 /EACH	60,000	-	-	72,000
	<b>Cathodic Protection</b>				<b>303,570</b>		<b>426,000</b>			<b>729,570</b>
	1,372.904 Labor hours									
<b>1.120</b>	<b>Markers &amp; Signs</b>									
01	Aerial Marker	136.00	EACH	176.27 /EACH	23,972	95.00 /EACH	12,920	-	-	36,892
02	Pipeline Marker	675.00	EACH	176.27 /EACH	118,979	100.00 /EACH	67,500	-	-	186,479
03	Pipeline Crossing Sign	260.00	EACH	176.27 /EACH	45,829	210.00 /EACH	54,600	-	-	100,429
	<b>Markers &amp; Signs</b>				<b>188,780</b>		<b>135,020</b>			<b>323,800</b>
	1,606.500 Labor hours									
	<b>P/L Material</b>				<b>492,350</b>		<b>50,250,249</b>	<b>0</b>	<b>0</b>	<b>50,742,598</b>
	2,979.404 Labor hours									
<b>1.300</b>	<b>P/L Install II,Mi,Mn &amp; Wi</b>									
<b>1.310</b>	<b>Base Lay Costs</b>									
	20 20" Base Lay	613,800.00	FEET	205.00 /FEET	125,829,000	-	-	-	-	125,829,000
	<b>Base Lay Costs</b>				<b>125,829,000</b>					<b>125,829,000</b>
<b>1.318</b>	<b>Erosion Control</b>									
n	01 Silt Fence	3,218,400.00	LF	6.50 /LF	20,919,600	-	-	-	-	20,919,600
n	01 Safety Fence for Env. Exclusion	1,350.00	LF	3.00 /LF	4,050	-	-	-	-	4,050
n	02 Hay or Straw Bales	2,700.00	EACH	24.00 /EACH	64,800	-	-	-	-	64,800
n	05 Ditch Line Breakers (Snd bgs)	460.00	EA	5.00 /EA	2,300	-	-	-	-	2,300
n	08 Slope Breakers (mounded soil)	460.00	FT	75.00 /FT	34,500	-	-	-	-	34,500
n	09 Filter Bags (10ft x 15ft)	405.00	EACH	100.00 /EACH	40,500	0.00	0	-	-	40,500
	10 Seed & Mulch	346.27	ACRE	3,760.00 /ACRE	1,301,975	-	-	-	-	1,301,975
	12 Blanket	729,000.00	SQFT	7.50 /SQFT	5,467,500	-	-	-	-	5,467,500
	14 Access Ramp	270.00	EACH	3,695.00 /EACH	997,650	-	-	-	-	997,650
	15 Wetland Mat	100.00	EACH	445.00 /EACH	44,500	-	-	-	-	44,500
01a	Silt Fence removal (per foot)	3,218,400.00	LF	3.33 /LF	10,717,272	-	-	-	-	10,717,272
01a	Safety Fence for Env. Exclusion removal	1,350.00	LF	1.75 /LF	2,363	-	-	-	-	2,363
02a	Straw Bales removal (each)	2,700.00	EACH	5.44 /EACH	14,688	-	-	-	-	14,688
10a	Wetland Seed	148.40	ACRE	2,152.00 /ACRE	319,357	-	-	-	-	319,357
	<b>Erosion Control</b>				<b>39,931,055</b>					<b>39,931,055</b>
<b>1.325</b>	<b>Horiz Direct'l Drilling</b>									
	20 20" Horizontal Direct'l Drill	99,000.00	FEET	400.00 /FEET	39,600,000	-	-	-	-	39,600,000

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	Horiz Direct'l Drilling				39,600,000					39,600,000
1.326	Gas Blowdown									
	03 Line Pack	172,287.00	MCF	-	-	3.00 /MCF	516,861	-	-	516,861
	Gas Blowdown						516,861			516,861
1.355	Pipe Storage & Handling									
	01 Large job - Storage & Handling	794,000.00	LF	1.00 /LF	794,000	-	-	-	-	794,000
	Pipe Storage & Handling				794,000					794,000
	P/L Install II,Mi,Mn & Wi				206,154,055		516,861	0	0	206,670,916

## 2.000 Compressor Stn Major Itms

2.050	Pig Launchers & Receivers									
	1 Above Ground Pig Detector	4.00	EACH	227.933 /EACH	912	2,250.00 /EACH	9,000	-	-	9,912
	20 24" Pig Launcher for 20" Line	2.00	EACH	1,997.67 /EACH	3,995	21,747.00 /EACH	43,494	-	-	47,489
20R	24" Pig Receiver for 20" Line	2.00	EACH	1,997.67 /EACH	3,995	22,500.00 /EACH	45,000	-	-	48,995
	Pig Launchers & Receivers				8,902		97,494			106,396
	75.76 Labor hours									
	Compressor Stn Major Itms				8,902		97,494	0	0	106,396
	75.76 Labor hours									

## 2.700 Process Piping

2.702	Pipe Std, Gr B									
n	02 2" Station Pipe .218wt Gr B	40.00	FEET	23.502 /FEET	940	4.77 /FEET	191	-	-	1,131
n	04 4" Station Pipe .237wt Gr B	20.00	FEET	47.004 /FEET	940	6.61 /FEET	132	-	-	1,072
	06 6" Station Pipe .280wt Gr B	200.00	FEET	72.974 /FEET	14,595	13.78 /FEET	2,756	-	-	17,351
	08 8" Station Pipe .322wt Gr B	100.00	FEET	94.01 /FEET	9,401	19.76 /FEET	1,976	-	-	11,377
	Pipe Std, Gr B				25,876		5,055			30,931
	220.20 Labor hours									
2.706	Pipe Std, X Gr									
	16 16" Station Pipe .375wt X Gr	180.00	FEET	76.713 /FEET	13,808	35.42 /FEET	6,376	-	-	20,184
	20 20" Station Pipe .375wt X Gr	460.00	FEET	97.35 /FEET	44,779	47.25 /FEET	21,735	-	-	66,514
	Pipe Std, X Gr				58,587		28,111			86,698
	498.572 Labor hours									
	Process Piping				84,463		33,166	0	0	117,628
	718.772 Labor hours									

## 3.300 600# ANSI Class

3.320	Ball Valves - Flange End									
	20 20" 600# Ball Valve FE	1.00	EACH	2,647.89 /EACH	2,648	26,175.00 /EACH	26,175	-	-	28,823
	Ball Valves - Flange End				2,648		26,175			28,823
	26.00 Labor hours									
3.322	Ball Valves - Weld End									
	20 20" 600# Ball Valve WE	13.00	EACH	4,112.850 /EACH	53,467	27,110.00 /EACH	352,430	-	-	405,897

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Ball Valves - Weld End</b>			<b>53,467</b>		<b>352,430</b>			<b>405,897</b>
	455.00 Labor hours								
<b>3.323</b>	<b>Ball Valves - Flg x WE</b>								
	02 2" 600# Ball Valve Flg x WE	2.00 EACH	458.29 /EACH	917	1,600.00 /EACH	3,200	-	-	4,117
	06 6" 600# Ball Valve Flg x WE	18.00 EACH	893.08 /EACH	16,075	4,893.00 /EACH	88,074	-	-	104,149
	20 20" 600# Ball Valve Flg x WE	6.00 EACH	2,820.24 /EACH	16,921	27,110.00 /EACH	162,660	-	-	179,581
	<b>Ball Valves - Flg x WE</b>			<b>33,913</b>		<b>253,934</b>			<b>287,847</b>
	288.600 Labor hours								
<b>3.324</b>	<b>Plug Valves - Flange End</b>								
	02 2" 600# Plug Valve FE	4.00 EACH	199.77 /EACH	799	868.00 /EACH	3,472	-	-	4,271
	04 4" 600# Plug Valve FE	6.00 EACH	411.29 /EACH	2,468	1,959.00 /EACH	11,754	-	-	14,222
	<b>Plug Valves - Flange End</b>			<b>3,267</b>		<b>15,226</b>			<b>18,493</b>
	27.80 Labor hours								
<b>3.326</b>	<b>Plug Valves - Weld End</b>								
	20 20" 600# Plug Valve WE	2.00 EACH	4,112.850 /EACH	8,226	29,989.00 /EACH	59,978	-	-	68,204
	<b>Plug Valves - Weld End</b>			<b>8,226</b>		<b>59,978</b>			<b>68,204</b>
	70.00 Labor hours								
<b>3.327</b>	<b>Plug Valves - Flg x WE</b>								
	06 6" 600# Plug Valve Flg x WE	4.00 EACH	799.07 /EACH	3,196	4,312.00 /EACH	17,248	-	-	20,444
	08 8" 600# Plug Valve Flg x WE	4.00 EACH	1,527.63 /EACH	6,111	6,072.00 /EACH	24,288	-	-	30,399
	<b>Plug Valves - Flg x WE</b>			<b>9,307</b>		<b>41,536</b>			<b>50,843</b>
	79.200 Labor hours								
<b>3.350</b>	<b>Stopple Fittings</b>								
s 20	20" 600# Stopple Fitting	1.00 EACH	1,731.31 /EACH	1,731	14,751.00 /EACH	14,751	-	-	16,482
	<b>Stopple Fittings</b>			<b>1,731</b>		<b>14,751</b>			<b>16,482</b>
	17.00 Labor hours								
<b>3.360</b>	<b>Flanges - Standard</b>								
n	02 2" 600# Flange	14.00 EACH	728.562 /EACH	10,200	15.11 /EACH	212	-	-	10,411
n	04 4" 600# Flange	8.00 EACH	1,292.61 /EACH	10,341	39.29 /EACH	314	-	-	10,655
n	06 6" 600# Flange	14.00 EACH	1,633.39 /EACH	22,867	76.58 /EACH	1,072	-	-	23,940
n	20 20" 600# Flange	4.00 EACH	5,088.183 /EACH	20,353	1,750.67 /EACH	7,003	-	-	27,355
	<b>Flanges - Standard</b>			<b>63,761</b>		<b>8,601</b>			<b>72,362</b>
	542.600 Labor hours								
<b>3.362</b>	<b>Blind Flanges</b>								
	02 2" 600# Blind Flange	4.00 EACH	123.39 /EACH	494	14.94 /EACH	60	-	-	553
	04 4" 600# Blind Flange	6.00 EACH	246.772 /EACH	1,481	37.41 /EACH	224	-	-	1,705
	06 6" 600# Blind Flange	22.00 EACH	387.783 /EACH	8,531	92.47 /EACH	2,034	-	-	10,566
	08 8" 600# Blind Flange	4.00 EACH	517.05 /EACH	2,068	144.00 /EACH	576	-	-	2,644
	20 20" 600# Blind Flange	4.00 EACH	1,639.31 /EACH	6,557	1,133.33 /EACH	4,533	-	-	11,091
	<b>Blind Flanges</b>			<b>19,131</b>		<b>7,428</b>			<b>26,559</b>
	149.40 Labor hours								
<b>3.370</b>	<b>Bolts &amp; Gaskets</b>								
	02 2" 600# Bolt Up	16.00 EACH	85.783 /EACH	1,373	8.23 /EACH	132	-	-	1,504
	04 4" 600# Bolt Up	16.00 EACH	170.39 /EACH	2,726	17.00 /EACH	272	-	-	2,998
	06 6" 600# Bolt Up	46.00 EACH	256.172 /EACH	11,784	36.76 /EACH	1,691	-	-	13,475
	08 8" 600# Bolt Up	4.00 EACH	512.343 /EACH	2,049	43.70 /EACH	175	-	-	2,224
	20 20" 600# Bolt Up	14.00 EACH	1,237.380 /EACH	17,323	296.07 /EACH	4,145	-	-	21,468

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Bolts &amp; Gaskets</b>			35,255		6,414			41,670
	300.020 Labor hours								
	<b>600# ANSI Class</b>			230,706		786,473	0	0	1,017,179
	1,955.62 Labor hours								
3.500	<b>Fittings, B-GR, STD</b>								
3.502	<b>90 Elbows</b>								
	02 2" 90 Elbow Std Gr B	2.00	EACH	411.29 /EACH	823	8.70 /EACH	17	-	840
	06 6" 90 Elbow Std Gr B	22.00	EACH	881.33 /EACH	19,389	29.46 /EACH	648	-	20,037
	08 8" 90 Elbow Std Gr B	2.00	EACH	1,292.61 /EACH	2,585	67.00 /EACH	134	-	2,719
	<b>90 Elbows</b>			22,797		800			23,596
	194.000 Labor hours								
3.508	<b>Tees</b>								
	06 6" Tee Std Gr B	18.00	EACH	1,280.86 /EACH	23,055	69.00 /EACH	1,242	-	24,297
	08 8" Tee Std Gr B	2.00	EACH	1,692.15 /EACH	3,384	145.00 /EACH	290	-	3,674
	<b>Tees</b>			26,440		1,532			27,972
	225.000 Labor hours								
3.510	<b>Reducing Tees</b>								
	0602 6" x 2" Red Tee Std Gr B	2.00	EACH	1,045.84 /EACH	2,092	100.00 /EACH	200	-	2,292
	<b>Reducing Tees</b>			2,092		200			2,292
	17.80 Labor hours								
3.518	<b>Reinforced Saddles</b>								
	02 Saddle Std Gr B - 2" Nozzle	2.00	EACH	470.04 /EACH	940	300.00 /EACH	600	-	1,540
	<b>Reinforced Saddles</b>			940		600			1,540
	8.00 Labor hours								
	<b>Fittings, B-GR, STD</b>			52,268		3,132	0	0	55,400
	444.800 Labor hours								
3.650	<b>Fittings, Y-60, STD</b>								
3.652	<b>90 Elbows</b>								
	20 20" 90 Elbow Std Y-60	16.00	EACH	3,055.26 /EACH	48,884	1,294.00 /EACH	20,704	-	69,588
	<b>90 Elbows</b>			48,884		20,704			69,588
	416.000 Labor hours								
3.654	<b>45 Elbows</b>								
	20 20" 45 Elbow Std Y-60	16.00	EACH	3,055.26 /EACH	48,884	1,007.00 /EACH	16,112	-	64,996
	<b>45 Elbows</b>			48,884		16,112			64,996
	416.000 Labor hours								
3.658	<b>Tees</b>								
	20 20" Tee Std Y-60	10.00	EACH	3,995.34 /EACH	39,953	1,674.00 /EACH	16,740	-	56,693
	<b>Tees</b>			39,953		16,740			56,693
	340.00 Labor hours								
3.660	<b>Reducing Tees</b>								
	2006 20" x 6" Red Tee Std Y-60	2.00	EACH	3,172.77 /EACH	6,346	1,563.00 /EACH	3,126	-	9,472
	2008 20" x 8" Red Tee Std Y-60	2.00	EACH	3,172.77 /EACH	6,346	1,876.00 /EACH	3,752	-	10,098

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
3.660	<b>Reducing Tees</b>									
	2016 20" x 16" Red Tee Std Y-60	18.00	EACH	3,642.81 /EACH	65,571	1,628.00 /EACH	29,304	-	-	94,875
	<b>Reducing Tees</b>				<b>78,262</b>		<b>36,182</b>			<b>114,444</b>
	666.000 Labor hours									
3.662	<b>Concentric Reducers</b>									
	1608 16" x 8" Conc Red Std Y-60	18.00	EACH	1,880.16 /EACH	33,843	470.00 /EACH	8,460	-	-	42,303
	2006 20" x 6" Conc Red Std Y-60	2.00	EACH	2,232.69 /EACH	4,465	1,400.00 /EACH	2,800	-	-	7,265
	<b>Concentric Reducers</b>				<b>38,308</b>		<b>11,260</b>			<b>49,568</b>
	326.00 Labor hours									
	<b>Fittings, Y-60, STD</b>				<b>254,292</b>		<b>100,998</b>	<b>0</b>	<b>0</b>	<b>355,290</b>
	2,164.000 Labor hours									
4.200	<b>Small Valves &amp; Fittings</b>									
4.204	<b>Ball Valves, NPT</b>									
	04 1/2" Ball Valve NPT - 4500#	12.00	EACH	101.06 /EACH	1,213	22.64 /EACH	272	-	-	1,484
	<b>Ball Valves, NPT</b>				<b>1,213</b>		<b>272</b>			<b>1,484</b>
	10.32 Labor hours									
4.220	<b>Plugs, NPT</b>									
	04 1/2" Plug NPT	2.00	EACH	21.15 /EACH	42	3.56 /EACH	7	-	-	49
	08 1" Plug NPT	9.00	EACH	25.852 /EACH	233	2.81 /EACH	25	-	-	258
	<b>Plugs, NPT</b>				<b>275</b>		<b>32</b>			<b>307</b>
	2.34 Labor hours									
4.224	<b>Couplings, NPT</b>									
	08 1" Coupling NPT	9.00	EACH	21.152 /EACH	190	1.48 /EACH	13	-	-	204
	<b>Couplings, NPT</b>				<b>190</b>		<b>13</b>			<b>204</b>
	1.62 Labor hours									
	<b>Small Valves &amp; Fittings</b>				<b>1,678</b>		<b>317</b>	<b>0</b>	<b>0</b>	<b>1,995</b>
	14.28 Labor hours									
4.300	<b>Miscellaneous Mechanical</b>									
4.306	<b>Adjustable Pipe Supports</b>									
	20 20" Adjustable Pipe Support	10.00	EACH	1,022.34 /EACH	10,223	425.00 /EACH	4,250	-	-	14,473
	<b>Adjustable Pipe Supports</b>				<b>10,223</b>		<b>4,250</b>			<b>14,473</b>
	87.00 Labor hours									
4.312	<b>Painting</b>									
	01 Prep & Paint (LS)	1.00	LS	41,345.95 /LS	41,346	-	-	-	-	41,346
	<b>Painting</b>				<b>41,346</b>					<b>41,346</b>
	383.472 Labor hours									
4.314	<b>Contractor Mobilization</b>									
	02 Contractor Move in / out	1.00	LS	863,000.04 /LS	863,000	-	-	-	-	863,000

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	Contractor Mobilization			863,000					863,000
	7,576.16 Labor hours								
	Miscellaneous Mechanical			914,569		4,250	0	0	918,819
	8,046.63 Labor hours								
5.000	Civil								
5.100	Dirt & Gravel Work								
n	29 Excavate & Backfill-Large Dia.	125.00	cuyd	120.003 /cuyd	15,000	-	-	-	15,000
	Dirt & Gravel Work				15,000				15,000
	184.33 Labor hours								
5.210	Piers/Piling & Anch. Blk.								
	03 Underground Pipe Support Block	10.00	CY	739.61 /CY	7,396	-	-	-	7,396
	04 Concrete - Pipe Piers	20.00	CY	697.70 /CY	13,954	-	-	-	13,954
	Piers/Piling & Anch. Blk.				21,350				21,350
	212.00 Labor hours								
5.310	Fencing & Guardrails								
b06f	6' Barb Wire Fence	800.00	FEET	6.75 /FEET	5,400	-	-	-	5,400
	Fencing & Guardrails				5,400				5,400
	Civil				41,750		0	0	41,750
	396.32 Labor hours								
6.000	Cut, Bevel, and Weld								
6.002	Cut & Bevel - STD								
	20 20" Cut & Bevel-Std	16.00	EACH	540.55 /EACH	8,649	-	-	-	8,649
	Cut & Bevel - STD				8,649				8,649
	73.60 Labor hours								
6.004	Butt Weld - STD								
	20 20" Butt Weld - Std	8.00	EACH	1,198.603 /EACH	9,589	-	-	-	9,589
	Butt Weld - STD				9,589				9,589
	81.60 Labor hours								
	Cut, Bevel, and Weld				18,238		0	0	18,238
	155.200 Labor hours								

## Estimate Totals

Description	Amount	Totals	Rate
Labor	208,253,271		
Material	51,792,939		
Subcontract			
Equipment			
Removal			
	<u>260,046,210</u>	<b>260,046,210</b>	
LABOR			
Labor - See Above			
Labor Tax			
MATERIALS			
Materials - See Above			
Freight	2,330,682		4.500 %
Sales Tax	4,143,435		8.000 %
ENVIRONMENTAL			
General Expense			
Permits/Auth.	2,750,000		
Construction Monitoring	2,412,000		
CONSTRUCTION SUPPORT			
Company Labor	27,400		
Contract Labor			
X-Ray (NDT)	1,488,000		
Survey	3,296,000		
Third Party Inspection	14,730,356		
Test			
DISTRICT LABOR AND EQUIPMENT			
Company Labor	300,000		
ENGINEERING			
Company Labor (Engr)	7,500,000		
Contract Labor (Design)	5,641,028		
As-Builts			
CONTRACT INSTALLATION			
Contract Labor - See Above			
ROW			
Pipeline Property Purchase	17,736,474		
Right of Way Labor	18,386,000		
Damages, Services, & Other	5,347,796		
OTHER			
Other General			
Gas Loss			
Quality Inspection			
	<u>86,089,171</u>	<b>346,135,381</b>	
CONTINGENCY	<u>22,498,800</u>		6.500 %
	<b>22,498,800</b>	<b>368,634,181</b>	
OVERHEAD	<u>12,902,196</u>		3.500 %
	<b>12,902,196</b>	<b>381,536,377</b>	
AFUDC	<u>6,104,582</u>		1.600 %
	<b>6,104,582</b>	<b>387,640,959</b>	
<b>Total</b>		<b>387,640,959</b>	

**Pipeline to NBPL**  
**135 Miles**  
**24-inch-diameter 1440 MAOP**

<b>Project name</b>	Competitive Threat
<b>Estimator</b>	Pipeline Expansion
<b>Labor rate table</b>	IL,MI,MN,WI
<b>Project</b>	Sherco
<b>Estimate Level</b>	B
<b>Accuracy Level +/-</b>	15%
<b>Const. Duration</b>	28 weeks (4 crews)
<b>Revision</b>	0
<b>Revision Date</b>	9/15/2020
<b>Region</b>	North
<b>State</b>	Minnesota
<b>Notes</b>	<p>Scope:</p> <p>Install a new 24-inch branch line lateral from NBPL to the Sherco generating station.</p> <p>Details:</p> <ul style="list-style-type: none"><li>- 24" pipeline, 135 miles long</li><li>- Open Cut:24-inch-diameter, 0.412" Wall Thickness, Grade X70, with FBE</li><li>- Quantity: 613,800 feet</li><li>- Drills: - 24-inch-diameter, 0.412" Wall Thickness, Grade X70, with Powercrete</li><li>- Quantity: 99,000 feet</li></ul> <p>Outage:</p> <p>Assumed Tie-in will be completed by method of hot tapping. No outage is proposed for the NBPL line.</p> <p>Assumptions:</p> <ul style="list-style-type: none"><li>-1.6 % AFUDC</li><li>- 9 block valve settings installed to meet current spacing requirments and future compressor tie-in. Assumed all class 1 excluding one class 2 location</li><li>- 2 launchers/receivers installed on the line. Pigging over 80 miles is uncommon (battery life)</li><li>- 4 spreads 196 days</li><li>- Construction not in winter</li><li>- Construction not accelerated</li><li>- Hot taps included in estimate</li></ul> <p>Risks:</p> <ul style="list-style-type: none"><li>- Route will require drilling under the Mississippi River</li><li>- Route currently includes 3 drills that span between 3000-5000 feet</li><li>- Route crosses numerous wetlands, potential for amount of drilling to increase once dilineated wetlands are identified</li><li>- See paper for detailed risk analysis</li></ul>
<b>Report format</b>	Sorted by 'Group phase/Phase'





'Detail' summary



Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>1.100</b>	<b>P/L Material</b>									
<b>1.103</b>	<b>CS, X Gr, Thin Wall</b>									
	20 24" 0.412" HFW X70 Gr Pipe (Drill)	99,000.00	FEET	-	-	121.82 /FEET	12,060,041	-	-	12,060,041
	20 24" 0.412" HFW X70 Gr Pipe (Open Cut)	613,800.00	FEET	-	-	74.491 /FEET	45,722,330	-	-	45,722,330
	<b>CS, X Gr, Thin Wall</b>						<b>57,782,372</b>			<b>57,782,372</b>
<b>1.119</b>	<b>Cathodic Protection</b>									
cp02	AC Current Mitigation Study	1.00	LS	149,999.920 /LS	150,000			-	-	150,000
cp02	Cathodic Protection Ground Bed	3.00	LS	23,190.00 /LS	69,570	50,000.00 /LS	150,000	-	-	219,570
cp04	Cathodic System Rectifier	12.00	EACH	6,000.00 /EACH	72,000	18,000.00 /EACH	216,000	-	-	288,000
cp05	Cathodic System Anode	12.00	EACH	1,000.00 /EACH	12,000	5,000.00 /EACH	60,000	-	-	72,000
	<b>Cathodic Protection</b>				<b>303,570</b>		<b>426,000</b>			<b>729,570</b>
	1,372.904 Labor hours									
<b>1.120</b>	<b>Markers &amp; Signs</b>									
01	Aerial Marker	136.00	EACH	176.27 /EACH	23,972	95.00 /EACH	12,920	-	-	36,892
02	Pipeline Marker	675.00	EACH	176.27 /EACH	118,979	100.00 /EACH	67,500	-	-	186,479
03	Pipeline Crossing Sign	260.00	EACH	176.27 /EACH	45,829	210.00 /EACH	54,600	-	-	100,429
	<b>Markers &amp; Signs</b>				<b>188,780</b>		<b>135,020</b>			<b>323,800</b>
	1,606.500 Labor hours									
	<b>P/L Material</b>				<b>492,350</b>		<b>58,343,392</b>	<b>0</b>	<b>0</b>	<b>58,835,741</b>
	2,979.404 Labor hours									
<b>1.300</b>	<b>P/L Install II,Mi,Mn &amp; Wi</b>									
<b>1.310</b>	<b>Base Lay Costs</b>									
	20 24" Base Lay	613,800.00	FEET	275.00 /FEET	168,795,000	-	-	-	-	168,795,000
	<b>Base Lay Costs</b>				<b>168,795,000</b>					<b>168,795,000</b>
<b>1.318</b>	<b>Erosion Control</b>									
n	01 Silt Fence	3,218,400.00	LF	6.50 /LF	20,919,600	-	-	-	-	20,919,600
n	01 Safety Fence for Env. Exclusion	1,350.00	LF	3.00 /LF	4,050	-	-	-	-	4,050
n	02 Hay or Straw Bales	2,700.00	EACH	24.00 /EACH	64,800	-	-	-	-	64,800
n	05 Ditch Line Breakers (Snd bgs)	460.00	EA	5.00 /EA	2,300	-	-	-	-	2,300
n	08 Slope Breakers (mounded soil)	460.00	FT	75.00 /FT	34,500	-	-	-	-	34,500
n	09 Filter Bags (10ft x 15ft)	405.00	EACH	100.00 /EACH	40,500	0.00	0	-	-	40,500
	10 Seed & Mulch	346.27	ACRE	3,760.00 /ACRE	1,301,975	-	-	-	-	1,301,975
	12 Blanket	729,000.00	SQFT	7.50 /SQFT	5,467,500	-	-	-	-	5,467,500
	14 Access Ramp	270.00	EACH	3,695.00 /EACH	997,650	-	-	-	-	997,650
	15 Wetland Mat	100.00	EACH	445.00 /EACH	44,500	-	-	-	-	44,500
01a	Silt Fence removal (per foot)	3,218,400.00	LF	3.33 /LF	10,717,272	-	-	-	-	10,717,272
01a	Safety Fence for Env. Exclusion removal	1,350.00	LF	1.75 /LF	2,363	-	-	-	-	2,363
02a	Straw Bales removal (each)	2,700.00	EACH	5.44 /EACH	14,688	-	-	-	-	14,688
10a	Wetland Seed	148.40	ACRE	2,152.00 /ACRE	319,357	-	-	-	-	319,357
	<b>Erosion Control</b>				<b>39,931,055</b>					<b>39,931,055</b>
<b>1.325</b>	<b>Horiz Direct'l Drilling</b>									
	20 24" Horizontal Direct'l Drill	99,000.00	FEET	460.00 /FEET	45,540,000	-	-	-	-	45,540,000

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	Horiz Direct'l Drilling				45,540,000					45,540,000
1.326	Gas Blowdown									
	03 Line Pack	172,287.00	MCF	-	-	3.00 /MCF	516,861	-	-	516,861
	Gas Blowdown						516,861			516,861
1.355	Pipe Storage & Handling									
	01 Large job - Storage & Handling	794,000.00	LF	1.00 /LF	794,000	-	-	-	-	794,000
	Pipe Storage & Handling				794,000					794,000
	P/L Install II,Mi,Mn & Wi				255,060,055		516,861	0	0	255,576,916
2.000	Compressor Stn Major Itms									
2.050	Pig Launchers & Receivers									
	1 Above Ground Pig Detector	4.00	EACH	227.933 /EACH	912	1,250.00 /EACH	5,000	-	-	5,912
	20 30" Pig Launcher for 24" Line	2.00	EACH	1,997.67 /EACH	3,995	21,747.00 /EACH	43,494	-	-	47,489
20R	24" Pig Receiver for 20" Line	2.00	EACH	1,997.67 /EACH	3,995	22,500.00 /EACH	45,000	-	-	48,995
	Pig Launchers & Receivers				8,902		93,494			102,396
	75.76 Labor hours									
	Compressor Stn Major Itms				8,902		93,494	0	0	102,396
	75.76 Labor hours									
2.700	Process Piping									
2.702	Pipe Std, Gr B									
n	02 2" Station Pipe .218wt Gr B	40.00	FEET	23.502 /FEET	940	4.77 /FEET	191	-	-	1,131
n	04 4" Station Pipe .237wt Gr B	20.00	FEET	47.004 /FEET	940	6.61 /FEET	132	-	-	1,072
	06 6" Station Pipe .280wt Gr B	200.00	FEET	72.974 /FEET	14,595	13.78 /FEET	2,756	-	-	17,351
	08 8" Station Pipe .322wt Gr B	100.00	FEET	94.01 /FEET	9,401	19.76 /FEET	1,976	-	-	11,377
	Pipe Std, Gr B				25,876		5,055			30,931
	220.20 Labor hours									
2.706	Pipe Std, X Gr									
	16 16" Station Pipe .375wt X Gr	180.00	FEET	76.713 /FEET	13,808	35.42 /FEET	6,376	-	-	20,184
	20 20" Station Pipe .375wt X Gr	460.00	FEET	97.35 /FEET	44,779	47.25 /FEET	21,735	-	-	66,514
	Pipe Std, X Gr				58,587		28,111			86,698
	498.572 Labor hours									
	Process Piping				84,463		33,166	0	0	117,628
	718.772 Labor hours									
3.300	600# ANSI Class									
3.320	Ball Valves - Flange End									
	20 20" 600# Ball Valve FE	1.00	EACH	2,647.89 /EACH	2,648	25,820.00 /EACH	25,820	-	-	28,468
	Ball Valves - Flange End				2,648		25,820			28,468
	26.00 Labor hours									
3.322	Ball Valves - Weld End									
	20 20" 600# Ball Valve WE	13.00	EACH	4,112.850 /EACH	53,467	27,110.00 /EACH	352,430	-	-	405,897

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Ball Valves - Weld End</b>			<u>53,467</u>		<u>352,430</u>			<u>405,897</u>
	455.00 Labor hours								
<b>3.323</b>	<b>Ball Valves - Flg x WE</b>								
	02 2" 600# Ball Valve Flg x WE	2.00	EACH	458.29 /EACH	917	1,600.00 /EACH	3,200	-	4,117
	06 6" 600# Ball Valve Flg x WE	18.00	EACH	893.08 /EACH	16,075	4,893.00 /EACH	88,074	-	104,149
	20 20" 600# Ball Valve Flg x WE	6.00	EACH	2,820.24 /EACH	16,921	27,110.00 /EACH	162,660	-	179,581
	<b>Ball Valves - Flg x WE</b>			<u>33,913</u>		<u>253,934</u>			<u>287,847</u>
	288.600 Labor hours								
<b>3.324</b>	<b>Plug Valves - Flange End</b>								
	02 2" 600# Plug Valve FE	4.00	EACH	199.77 /EACH	799	868.00 /EACH	3,472	-	4,271
	04 4" 600# Plug Valve FE	6.00	EACH	411.29 /EACH	2,468	1,959.00 /EACH	11,754	-	14,222
	<b>Plug Valves - Flange End</b>			<u>3,267</u>		<u>15,226</u>			<u>18,493</u>
	27.80 Labor hours								
<b>3.326</b>	<b>Plug Valves - Weld End</b>								
	20 20" 600# Plug Valve WE	2.00	EACH	4,112.850 /EACH	8,226	29,989.00 /EACH	59,978	-	68,204
	<b>Plug Valves - Weld End</b>			<u>8,226</u>		<u>59,978</u>			<u>68,204</u>
	70.00 Labor hours								
<b>3.327</b>	<b>Plug Valves - Flg x WE</b>								
	06 6" 600# Plug Valve Flg x WE	4.00	EACH	799.07 /EACH	3,196	4,312.00 /EACH	17,248	-	20,444
	08 8" 600# Plug Valve Flg x WE	4.00	EACH	1,527.63 /EACH	6,111	6,072.00 /EACH	24,288	-	30,399
	<b>Plug Valves - Flg x WE</b>			<u>9,307</u>		<u>41,536</u>			<u>50,843</u>
	79.200 Labor hours								
<b>3.350</b>	<b>Stopple Fittings</b>								
s 20	20" 600# Stopple Fitting	1.00	EACH	1,731.31 /EACH	1,731	14,751.00 /EACH	14,751	-	16,482
	<b>Stopple Fittings</b>			<u>1,731</u>		<u>14,751</u>			<u>16,482</u>
	17.00 Labor hours								
<b>3.360</b>	<b>Flanges - Standard</b>								
n	02 2" 600# Flange	14.00	EACH	728.562 /EACH	10,200	15.11 /EACH	212	-	10,411
n	04 4" 600# Flange	8.00	EACH	1,292.61 /EACH	10,341	39.29 /EACH	314	-	10,655
n	06 6" 600# Flange	14.00	EACH	1,633.39 /EACH	22,867	76.58 /EACH	1,072	-	23,940
n	20 20" 600# Flange	4.00	EACH	5,088.183 /EACH	20,353	1,750.67 /EACH	7,003	-	27,355
	<b>Flanges - Standard</b>			<u>63,761</u>		<u>8,601</u>			<u>72,362</u>
	542.600 Labor hours								
<b>3.362</b>	<b>Blind Flanges</b>								
	02 2" 600# Blind Flange	4.00	EACH	123.39 /EACH	494	14.94 /EACH	60	-	553
	04 4" 600# Blind Flange	6.00	EACH	246.772 /EACH	1,481	37.41 /EACH	224	-	1,705
	06 6" 600# Blind Flange	22.00	EACH	387.783 /EACH	8,531	92.47 /EACH	2,034	-	10,566
	08 8" 600# Blind Flange	4.00	EACH	517.05 /EACH	2,068	144.00 /EACH	576	-	2,644
	20 20" 600# Blind Flange	4.00	EACH	1,639.31 /EACH	6,557	1,133.33 /EACH	4,533	-	11,091
	<b>Blind Flanges</b>			<u>19,131</u>		<u>7,428</u>			<u>26,559</u>
	149.40 Labor hours								
<b>3.370</b>	<b>Bolts &amp; Gaskets</b>								
	02 2" 600# Bolt Up	16.00	EACH	85.783 /EACH	1,373	8.23 /EACH	132	-	1,504
	04 4" 600# Bolt Up	16.00	EACH	170.39 /EACH	2,726	17.00 /EACH	272	-	2,998
	06 6" 600# Bolt Up	46.00	EACH	256.172 /EACH	11,784	36.76 /EACH	1,691	-	13,475
	08 8" 600# Bolt Up	4.00	EACH	512.343 /EACH	2,049	43.70 /EACH	175	-	2,224
	20 20" 600# Bolt Up	14.00	EACH	1,237.380 /EACH	17,323	296.07 /EACH	4,145	-	21,468

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Bolts &amp; Gaskets</b>			35,255		6,414			41,670
	300.020 Labor hours								
	<b>600# ANSI Class</b>			230,706		786,118	0	0	1,016,824
	1,955.62 Labor hours								
<b>3.500</b>	<b>Fittings, B-GR, STD</b>								
<b>3.502</b>	<b>90 Elbows</b>								
	02 2" 90 Elbow Std Gr B	2.00	EACH	411.29 /EACH	823	8.70 /EACH	17	-	840
	06 6" 90 Elbow Std Gr B	22.00	EACH	881.33 /EACH	19,389	29.46 /EACH	648	-	20,037
	08 8" 90 Elbow Std Gr B	2.00	EACH	1,292.61 /EACH	2,585	67.00 /EACH	134	-	2,719
	<b>90 Elbows</b>			22,797		800			23,596
	194.000 Labor hours								
<b>3.508</b>	<b>Tees</b>								
	06 6" Tee Std Gr B	18.00	EACH	1,280.86 /EACH	23,055	69.00 /EACH	1,242	-	24,297
	08 8" Tee Std Gr B	2.00	EACH	1,692.15 /EACH	3,384	145.00 /EACH	290	-	3,674
	<b>Tees</b>			26,440		1,532			27,972
	225.000 Labor hours								
<b>3.510</b>	<b>Reducing Tees</b>								
	0602 6" x 2" Red Tee Std Gr B	2.00	EACH	1,045.84 /EACH	2,092	100.00 /EACH	200	-	2,292
	<b>Reducing Tees</b>			2,092		200			2,292
	17.80 Labor hours								
<b>3.518</b>	<b>Reinforced Saddles</b>								
	02 Saddle Std Gr B - 2" Nozzle	2.00	EACH	470.04 /EACH	940	300.00 /EACH	600	-	1,540
	<b>Reinforced Saddles</b>			940		600			1,540
	8.00 Labor hours								
	<b>Fittings, B-GR, STD</b>			52,268		3,132	0	0	55,400
	444.800 Labor hours								
<b>3.650</b>	<b>Fittings, Y-60, STD</b>								
<b>3.652</b>	<b>90 Elbows</b>								
	20 20" 90 Elbow Std Y-60	16.00	EACH	3,055.26 /EACH	48,884	1,294.00 /EACH	20,704	-	69,588
	<b>90 Elbows</b>			48,884		20,704			69,588
	416.000 Labor hours								
<b>3.654</b>	<b>45 Elbows</b>								
	20 20" 45 Elbow Std Y-60	16.00	EACH	3,055.26 /EACH	48,884	1,007.00 /EACH	16,112	-	64,996
	<b>45 Elbows</b>			48,884		16,112			64,996
	416.000 Labor hours								
<b>3.658</b>	<b>Tees</b>								
	20 20" Tee Std Y-60	10.00	EACH	3,995.34 /EACH	39,953	1,674.00 /EACH	16,740	-	56,693
	<b>Tees</b>			39,953		16,740			56,693
	340.00 Labor hours								
<b>3.660</b>	<b>Reducing Tees</b>								
	2006 20" x 6" Red Tee Std Y-60	2.00	EACH	3,172.77 /EACH	6,346	1,563.00 /EACH	3,126	-	9,472
	2008 20" x 8" Red Tee Std Y-60	2.00	EACH	3,172.77 /EACH	6,346	1,876.00 /EACH	3,752	-	10,098

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
3.660	<b>Reducing Tees</b>									
	2016 20" x 16" Red Tee Std Y-60	18.00	EACH	3,642.81 /EACH	65,571	1,628.00 /EACH	29,304	-	-	94,875
	<b>Reducing Tees</b>				<b>78,262</b>		<b>36,182</b>			<b>114,444</b>
	666.000 Labor hours									
3.662	<b>Concentric Reducers</b>									
	1608 16" x 8" Conc Red Std Y-60	18.00	EACH	1,880.16 /EACH	33,843	470.00 /EACH	8,460	-	-	42,303
	2006 20" x 6" Conc Red Std Y-60	2.00	EACH	2,232.69 /EACH	4,465	1,400.00 /EACH	2,800	-	-	7,265
	<b>Concentric Reducers</b>				<b>38,308</b>		<b>11,260</b>			<b>49,568</b>
	326.00 Labor hours									
	<b>Fittings, Y-60, STD</b>				<b>254,292</b>		<b>100,998</b>	<b>0</b>	<b>0</b>	<b>355,290</b>
	2,164.000 Labor hours									
4.200	<b>Small Valves &amp; Fittings</b>									
4.204	<b>Ball Valves, NPT</b>									
	04 1/2" Ball Valve NPT - 4500#	12.00	EACH	101.06 /EACH	1,213	22.64 /EACH	272	-	-	1,484
	<b>Ball Valves, NPT</b>				<b>1,213</b>		<b>272</b>			<b>1,484</b>
	10.32 Labor hours									
4.220	<b>Plugs, NPT</b>									
	04 1/2" Plug NPT	2.00	EACH	21.15 /EACH	42	3.56 /EACH	7	-	-	49
	08 1" Plug NPT	9.00	EACH	25.852 /EACH	233	2.81 /EACH	25	-	-	258
	<b>Plugs, NPT</b>				<b>275</b>		<b>32</b>			<b>307</b>
	2.34 Labor hours									
4.224	<b>Couplings, NPT</b>									
	08 1" Coupling NPT	9.00	EACH	21.152 /EACH	190	1.48 /EACH	13	-	-	204
	<b>Couplings, NPT</b>				<b>190</b>		<b>13</b>			<b>204</b>
	1.62 Labor hours									
	<b>Small Valves &amp; Fittings</b>				<b>1,678</b>		<b>317</b>	<b>0</b>	<b>0</b>	<b>1,995</b>
	14.28 Labor hours									
4.300	<b>Miscellaneous Mechanical</b>									
4.306	<b>Adjustable Pipe Supports</b>									
	20 20" Adjustable Pipe Support	10.00	EACH	1,022.34 /EACH	10,223	425.00 /EACH	4,250	-	-	14,473
	<b>Adjustable Pipe Supports</b>				<b>10,223</b>		<b>4,250</b>			<b>14,473</b>
	87.00 Labor hours									
4.312	<b>Painting</b>									
	01 Prep & Paint (LS)	1.00	LS	33,293.95 /LS	33,294	-	-	-	-	33,294
	<b>Painting</b>				<b>33,294</b>					<b>33,294</b>
	308.792 Labor hours									
4.314	<b>Contractor Mobilization</b>									
	02 Contractor Move in / out	1.00	LS	1,570,002.96 /LS	1,570,003	-	-	-	-	1,570,003

Item	Description	Takeoff Qty		Unit Cost	Labor	Unit Cost	Material	Amount	Equipment	Other	Total		
					Amount		Amount		Amount	Amount			
5.000	Contractor Mobilization												
		13,782.84	Labor hours					1,570,003			1,570,003		
	Miscellaneous Mechanical												
		14,178.63	Labor hours					1,613,520	4,250	0	0	1,617,770	
	Civil												
	5.100 n	Dirt & Gravel Work											
		29	Excavate & Backfill-Large Dia.	45.00	cuyd	110.00 /cuyd			4,950	-	-	-	4,950
		Dirt & Gravel Work											
			60.83	Labor hours					4,950				4,950
	5.210	Piers/Piling & Anch. Blk.											
03		Underground Pipe Support Block	10.00	CY	739.61 /CY			7,396	-	-	-	7,396	
04		Concrete - Pipe Piers	20.00	CY	697.70 /CY			13,954	-	-	-	13,954	
Piers/Piling & Anch. Blk.													
		212.00	Labor hours					21,350				21,350	
5.310 b06f	Fencing & Guardrails												
	6'	Barb Wire Fence	800.00	FEET	25.88 /FEET			20,704	-	-	-	20,704	
	Fencing & Guardrails												
								20,704				20,704	
	Civil												
		272.821	Labor hours					47,004	0	0	0	47,004	
6.000 Cut, Bevel, and Weld													
6.002	Cut & Bevel - STD												
	20	20" Cut & Bevel-Std	16.00	EACH	542.003 /EACH			8,672	-	-	-	8,672	
	Cut & Bevel - STD												
		73.80	Labor hours					8,672				8,672	
6.004	Butt Weld - STD												
	20	20" Butt Weld - Std	8.00	EACH	1,198.603 /EACH			9,589	-	-	-	9,589	
	Butt Weld - STD												
		81.60	Labor hours					9,589				9,589	
Cut, Bevel, and Weld													
		155.40	Labor hours					18,261	0	0	0	18,261	

## Estimate Totals

Description	Amount	Totals	Rate
Labor	257,863,499		
Material	59,881,727		
Subcontract			
Equipment			
Removal			
	<u>317,745,226</u>	<u>317,745,226</u>	
LABOR			
Labor - See Above			
Labor Tax			
MATERIALS			
Materials - See Above			
Freight	2,694,678		4.500 %
Sales Tax	4,790,538		8.000 %
ENVIRONMENTAL			
General Expense			
Permits/Auth.	2,750,000		
Construction Monitoring	2,894,400		
CONSTRUCTION SUPPORT			
Company Labor	27,400		
Contract Labor			
X-Ray (NDT)	1,785,600		
Survey	3,955,200		
Third Party Inspection	16,520,400		
Test			
DISTRICT LABOR AND EQUIPMENT			
Company Labor	360,000		
ENGINEERING			
Company Labor (Engr)	7,500,000		
Contract Labor (Design)	6,955,350		
As-Builts			
CONTRACT INSTALLATION			
Contract Labor - See Above			
ROW			
Pipeline Property Purchase	17,736,474		
Right of Way Labor	18,386,000		
Damages, Services, & Other	5,347,796		
OTHER			
Other General			
Gas Loss			
Quality Inspection			
	<u>91,703,836</u>	<u>409,449,062</u>	
CONTINGENCY	<u>26,614,189</u>	<u>436,063,251</u>	6.500 %
	<u>26,614,189</u>		
OVERHEAD	<u>15,262,214</u>	<u>451,325,465</u>	3.500 %
	<u>15,262,214</u>		
AFUDC	<u>7,221,207</u>	<u>458,546,672</u>	1.600 %
	<u>7,221,207</u>		
<b>Total</b>		<b>458,546,672</b>	



Sherco Xcel  
Midpoint Compressor

Project name	Sherco Xcel Midpoint Comp
Labor rate table	IL,MI,MN,WI
Equipment rate table	DOMESTIC
Project	Sherco
Est Level	Level B
Estimate Rev. No.	00
Est. Rev. Date	9/18/2020
Est Tol	+/-15%
Notes	Scope: Install a new compressor at the midpoint of the lateral. Station will consist of one Cat 3606 compressors in order to meet the delivery requirements of scenario 2.  Risk: An additional \$7.0m would be required in order to make the station fully redundant.
Report format	Sorted by 'Group phase/Phase' 'Detail' summary

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total	
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount	
2.000 Compressor Stn Major Itms											
2.005	Compressor Packages										
n	30	CAT 3606 Package	1.00	EACH	377,476.00 /EACH	377,476	2,500,000.00 /EACH	2,500,000	-	-	2,877,476
	321	Spare Parts - Start-up	1.00	LS			50,000.00 /LS	50,000	-	-	50,000
	351	Start-up Fluid Allowance	1.00	LOT	-	-	50,000.00 /LOT	50,000	-	-	50,000
	361	Vendor Commissioning	1.00	EACH	0.00	0	-	-	-	-	100,000
	390	Erect Intake	150.00	MH	692.37 /MH	103,856	-	-	-	-	103,856
	400	Erect Exhaust	150.00	MH	692.37 /MH	103,856	-	-	-	-	103,856
	Compressor Packages					585,187		2,600,000			3,285,187
		3,719.17 Labor hours									
2.010	HP Gas Filters & Seps										
n	102	Scrubber	1.00	EACH	36,447.95 /EACH	36,448	63,000.00 /EACH	63,000	-	-	99,448
	HP Gas Filters & Seps					36,448		63,000			99,448
		250.86 Labor hours									
Compressor Stn Major Itms					621,635		2,663,000	0	0	3,384,635	
		3,970.03 Labor hours									
2.600 Compressor Stn Eq & Fab											
2.602	Venting Equipment										
	38	Unit Blowdown Silencer	2.00	EACH	5,538.97 /EACH	11,078	25,000.00 /EACH	50,000	-	-	61,078
	Venting Equipment					11,078		50,000			61,078
2.610	Aux Filters & Scrubbers										
	90	Fuel Gas Scrubber	1.00	EACH	845.33 /EACH	845	9,500.00 /EACH	9,500	-	-	10,345
	Aux Filters & Scrubbers					845		9,500			10,345
		7.66 Labor hours									
2.615	Air Comps & Equip										
	4	25 H.P. Air Compressor	2.00	EACH	8,313.26 /EACH	16,627	32,000.00 /EACH	64,000	-	-	80,627
	10	Dryer for Instrument Air	1.00	EACH	8,313.25 /EACH	8,313	12,000.00 /EACH	12,000	-	-	20,313
	Air Comps & Equip					24,940		76,000			100,940
		225.904 Labor hours									
Compressor Stn Eq & Fab					36,863		135,500	0	0	172,363	
		233.561 Labor hours									
2.700 Process Piping											
2.702	Pipe Std, Gr B										
n	01	1" Station Pipe .179wt Gr B	1,200.00	FEET	30.38 /FEET	36,451	14.35 /FEET	17,220	-	-	53,671
n	02	2" Station Pipe .218wt Gr B	400.00	FEET	60.751 /FEET	24,300	14.03 /FEET	5,612	-	-	29,912
n	03	3" Station Pipe .216wt Gr B	600.00	FEET	91.13 /FEET	54,677	16.07 /FEET	9,642	-	-	64,319
n	04	4" Station Pipe .237wt Gr B	150.00	FEET	121.504 /FEET	18,226	18.51 /FEET	2,777	-	-	21,002
	06	6" Station Pipe .280wt Gr B	100.00	FEET	182.254 /FEET	18,225	24.96 /FEET	2,496	-	-	20,721

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Pipe Std, Gr B</b>				<b>151,879</b>		<b>37,747</b>			<b>189,625</b>
	1,384.75 Labor hours									
<b>2.706</b>	<b>Pipe Std, X Gr</b>									
	08 8" Station Pipe .322wt X Gr	100.00	FEET	243.01 /FEET	24,301	22.51 /FEET	2,251	-	-	26,552
	12 12" Station Pipe .375wt X Gr	200.00	FEET	364.51 /FEET	72,902	38.45 /FEET	7,690	-	-	80,592
	<b>Pipe Std, X Gr</b>				<b>97,202</b>		<b>9,941</b>			<b>107,143</b>
	886.24 Labor hours									
<b>2.708</b>	<b>Pipe XS, X Gr</b>									
	16 16" Station Pipe .500wt X GR	200.00	FEET	486.012 /FEET	97,202	136.70 /FEET	27,340	-	-	124,542
	20 20" Station Pipe .500wt X GR	500.00	FEET	607.514 /FEET	303,757	192.82 /FEET	96,410	-	-	400,167
	24 24" Station Pipe .500wt X GR	300.00	FEET	729.02 /FEET	218,705	232.37 /FEET	69,711	-	-	288,416
	<b>Pipe XS, X Gr</b>				<b>619,665</b>		<b>193,461</b>			<b>813,126</b>
	5,649.752 Labor hours									
	<b>Process Piping</b>				<b>868,746</b>		<b>241,149</b>	<b>0</b>	<b>0</b>	<b>1,109,895</b>
	7,920.734 Labor hours									
<b>3.300</b>	<b>600# ANSI Class</b>									
<b>3.318</b>	<b>Control Valves</b>									
602S	2" 600# Mooney Large Single Port Control Valve	2.00	EACH	759.37 /EACH	1,519	2,097.00 /EACH	4,194	-	-	5,713
few4	4" Fisher ED&ET Whisper	1.00	EACH	1,366.94 /EACH	1,367	8,905.00 /EACH	8,905	-	-	10,272
v060	8" 600# V-250 Control Valve	1.00	EACH	2,126.37 /EACH	2,126	80,000.00 /EACH	80,000	-	-	82,126
	<b>Control Valves</b>				<b>5,012</b>		<b>93,099</b>			<b>98,111</b>
	45.70 Labor hours									
<b>3.320</b>	<b>Ball Valves - Flange End</b>									
	1 1" 600# Ball Valve FE	5.00	EACH	267.312 /EACH	1,337	1,000.00 /EACH	5,000	-	-	6,337
n	2 2" 600# Ball Valve FE	5.00	EACH	729.022 /EACH	3,645	1,000.00 /EACH	5,000	-	-	8,645
n	3 3" 600# Ball Valve FE	2.00	EACH	789.76 /EACH	1,580	3,000.00 /EACH	6,000	-	-	7,580
n	6 6" 600# Ball Valve FE	1.00	EACH	1,609.88 /EACH	1,610	2,427.00 /EACH	2,427	-	-	4,037
n	8 8" 600# Ball Valve FE	1.00	EACH	3,341.35 /EACH	3,341	3,661.00 /EACH	3,661	-	-	7,002
n	8 8" 600# Ball Valve FE	1.00	EACH	3,341.32 /EACH	3,341	3,661.00 /EACH	3,661	-	-	7,002
n	12 12" 600# Ball Valve FE	1.00	EACH	4,860.140 /EACH	4,860	7,040.00 /EACH	7,040	-	-	11,900
n	16 16" 600# Ball Valve FE	2.00	EACH	6,378.90 /EACH	12,758	11,966.00 /EACH	23,932	-	-	36,690
n	20 20" 600# Ball Valve FE	2.00	EACH	7,897.65 /EACH	15,795	14,519.00 /EACH	29,038	-	-	44,833
	<b>Ball Valves - Flange End</b>				<b>48,267</b>		<b>85,759</b>			<b>134,026</b>
	440.071 Labor hours									
<b>3.322</b>	<b>Ball Valves - Weld End</b>									
n	20 20" 600# Ball Valve WE	2.00	EACH	10,631.50 /EACH	21,263	19,923.00 /EACH	39,846	-	-	61,109
n	24 24" 600# Ball Valve WE	1.00	EACH	12,757.70 /EACH	12,758	30,447.00 /EACH	30,447	-	-	43,205
	<b>Ball Valves - Weld End</b>				<b>34,021</b>		<b>70,293</b>			<b>104,314</b>
	310.182 Labor hours									
<b>3.324</b>	<b>Plug Valves - Flange End</b>									
	01 1" 600# Plug Valve FE	5.00	EACH	273.39 /EACH	1,367	374.49 /EACH	1,872	-	-	3,239
	02 2" 600# Plug Valve FE	8.00	EACH	516.39 /EACH	4,131	385.22 /EACH	3,082	-	-	7,213
	03 3" 600# Plug Valve FE	4.00	EACH	789.75 /EACH	3,159	1,020.99 /EACH	4,084	-	-	7,243
n	04 4" 600# Plug Valve FE	4.00	EACH	1,063.183 /EACH	4,253	1,453.53 /EACH	5,814	-	-	10,067
	06 6" 600# Plug Valve FE	2.00	EACH	1,609.89 /EACH	3,220	3,452.38 /EACH	6,905	-	-	10,125

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Plug Valves - Flange End</b>			<b>16,130</b>		<b>21,757</b>			<b>37,887</b>
	147.06 Labor hours								
<b>3.327</b>	<b>Plug Valves - Flg x WE</b>								
	06 6" 600# Plug Valve Flg x WE	1.00	EACH	2,065.60 /EACH	2,066	3,591.95 /EACH	3,592	-	5,658
	08 8" 600# Plug Valve Flg x WE	4.00	EACH	3,948.843 /EACH	15,795	5,861.00 /EACH	23,444	-	39,239
	12 12" 600# Plug Valve Flg x WE	1.00	EACH	5,984.03 /EACH	5,984	11,360.52 /EACH	11,361	-	17,345
	<b>Plug Valves - Flg x WE</b>			<b>23,845</b>		<b>38,396</b>			<b>62,241</b>
	217.41 Labor hours								
<b>3.328</b>	<b>Check Valves - Swing</b>								
	03 3" 600# Check Valve Swing FE	2.00	EACH	789.75 /EACH	1,580	716.00 /EACH	1,432	-	3,012
	12 12" 600# Check Valve Swing FE	1.00	EACH	5,072.810 /EACH	5,073	7,415.00 /EACH	7,415	-	12,488
	16 16" 600# Check Valve Swing FE	4.00	EACH	6,378.90 /EACH	25,516	27,500.00 /EACH	110,000	-	135,516
	<b>Check Valves - Swing</b>			<b>32,168</b>		<b>118,847</b>			<b>151,015</b>
	293.29 Labor hours								
<b>3.336</b>	<b>Relief Valves</b>								
	6030 3" 600# Mooney Single Port Relief Valve	1.00	EACH	1,041.85 /EACH	1,042	2,859.00 /EACH	2,859	-	3,901
	<b>Relief Valves</b>			<b>1,042</b>		<b>2,859</b>			<b>3,901</b>
	9.50 Labor hours								
<b>3.338</b>	<b>Operators - Hydraulic</b>								
	02 2" Valve Act/Operatr Hydraulic	2.00	EACH	1,306.18 /EACH	2,612	20,000.00 /EACH	40,000	-	42,612
	03 3" Valve Act/Operatr Hydraulic	2.00	EACH	1,640.30 /EACH	3,281	20,000.00 /EACH	40,000	-	43,281
	06 6" Valve Act/Operatr Hydraulic	2.00	EACH	2,278.17 /EACH	4,556	5,501.00 /EACH	11,002	-	15,558
	08 8" Valve Act/Operatr Hydraulic	2.00	EACH	2,612.280 /EACH	5,225	8,237.00 /EACH	16,474	-	21,699
	16 16" Vlive Act/Operatr Hydraulic	4.00	EACH	3,948.843 /EACH	15,795	9,239.00 /EACH	36,956	-	52,751
	20 20" Vlive Act/Operatr Hydraulic	4.00	EACH	4,556.35 /EACH	18,225	10,877.00 /EACH	43,508	-	61,733
	24 24" Vlive Act/Operatr Hydraulic	2.00	EACH	4,860.09 /EACH	9,720	11,800.00 /EACH	23,600	-	33,320
	<b>Operators - Hydraulic</b>			<b>59,415</b>		<b>211,540</b>			<b>270,955</b>
	541.710 Labor hours								
<b>3.340</b>	<b>Operators - Pneumatic</b>								
	01 1" Valve Act/Operatr Pneumatic	2.00	EACH	911.28 /EACH	1,823	1,783.00 /EACH	3,566	-	5,389
	02 2" Valve Act/Operatr Pneumatic	2.00	EACH	1,306.13 /EACH	2,612	2,275.00 /EACH	4,550	-	7,162
	<b>Operators - Pneumatic</b>			<b>4,435</b>		<b>8,116</b>			<b>12,551</b>
	40.434 Labor hours								
<b>3.342</b>	<b>Valve Extensions</b>								
n	0620 6' Extended Stem for 20" Valve	3.00	EACH	-	-	3,023.00 /EACH	9,069	-	9,069
n	0624 6' Extended Stem for 24" Valve	2.00	EACH	-	-	3,619.00 /EACH	7,238	-	7,238
	<b>Valve Extensions</b>					<b>16,307</b>			<b>16,307</b>
<b>3.360</b>	<b>Flanges - Standard</b>								
	01 1" 600# Flange	20.00	EACH	1,518.79 /EACH	30,376	15.47 /EACH	309	-	30,685
n	02 2" 600# Flange	25.00	EACH	1,883.291 /EACH	47,082	15.11 /EACH	378	-	47,460
n	03 3" 600# Flange	10.00	EACH	2,460.424 /EACH	24,604	22.00 /EACH	220	-	24,824
n	04 4" 600# Flange	5.00	EACH	3,341.34 /EACH	16,707	39.29 /EACH	196	-	16,903
n	06 6" 600# Flange	2.00	EACH	4,222.22 /EACH	8,444	76.58 /EACH	153	-	8,598
n	08 8" 600# Flange	2.00	EACH	5,771.36 /EACH	11,543	147.34 /EACH	295	-	11,837
n	12 12" 600# Flange	5.00	EACH	8,171.05 /EACH	40,855	316.12 /EACH	1,581	-	42,436
n	16 16" 600# Flange	6.00	EACH	10,054.333 /EACH	60,326	989.33 /EACH	5,936	-	66,262
n	20 20" 600# Flange	2.00	EACH	13,152.69 /EACH	26,305	1,750.67 /EACH	3,501	-	29,807
n	24 24" 600# Flange	1.00	EACH	16,402.86 /EACH	16,403	2,461.33 /EACH	2,461	-	18,864

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Flanges - Standard</b>				<b>282,646</b>		<b>15,031</b>			<b>297,676</b>
	2,577.002 Labor hours									
<b>3.362</b>	<b>Blind Flanges</b>									
	03 3" 600# Blind Flange	8.00	EACH	486.014 /EACH	3,888	118.00 /EACH	944	-	-	4,832
	24 24" 600# Blind Flange	1.00	EACH	3,645.00 /EACH	3,645	1,858.67 /EACH	1,859	-	-	5,504
	<b>Blind Flanges</b>				<b>7,533</b>		<b>2,803</b>			<b>10,336</b>
	68.683 Labor hours									
<b>3.364</b>	<b>Closures</b>									
	06 6" 600# Closure	1.00	EACH	3,037.59 /EACH	3,038	490.00 /EACH	490	-	-	3,528
	08 8" 600# Closure	4.00	EACH	4,100.75 /EACH	16,403	694.00 /EACH	2,776	-	-	19,179
	<b>Closures</b>				<b>19,441</b>		<b>3,266</b>			<b>22,707</b>
	177.25 Labor hours									
<b>3.370</b>	<b>Bolts &amp; Gaskets</b>									
	01 1" 600# Bolt Up	50.00	EACH	109.354 /EACH	5,468	5.23 /EACH	262	-	-	5,729
	02 2" 600# Bolt Up	80.00	EACH	221.742 /EACH	17,739	8.23 /EACH	658	-	-	18,398
	03 3" 600# Bolt Up	30.00	EACH	331.094 /EACH	9,933	11.89 /EACH	357	-	-	10,290
	06 6" 600# Bolt Up	10.00	EACH	662.193 /EACH	6,622	36.76 /EACH	368	-	-	6,990
	08 8" 600# Bolt Up	10.00	EACH	1,324.39 /EACH	13,244	43.70 /EACH	437	-	-	13,681
	12 12" 600# Bolt Up	18.00	EACH	1,874.18 /EACH	33,735	107.50 /EACH	1,935	-	-	35,670
	16 16" 600# Bolt Up	24.00	EACH	2,536.374 /EACH	60,873	192.17 /EACH	4,612	-	-	65,485
	20 20" 600# Bolt Up	10.00	EACH	3,198.57 /EACH	31,986	296.07 /EACH	2,961	-	-	34,946
	24 24" 600# Bolt Up	4.00	EACH	3,860.77 /EACH	15,443	442.51 /EACH	1,770	-	-	17,213
	<b>Bolts &amp; Gaskets</b>				<b>195,043</b>		<b>13,359</b>			<b>208,402</b>
	1,778.29 Labor hours									
	<b>600# ANSI Class</b>				<b>728,995</b>		<b>701,432</b>	<b>0</b>	<b>0</b>	<b>1,430,427</b>
	6,646.57 Labor hours									
<b>3.500</b>	<b>Fittings, B-GR, STD</b>									
<b>3.502</b>	<b>90 Elbows</b>									
	01 1" 90 Elbow Std Gr B	30.00	EACH	880.90 /EACH	26,427	8.40 /EACH	252	-	-	26,679
	02 2" 90 Elbow Std Gr B	30.00	EACH	1,063.15 /EACH	31,894	8.70 /EACH	261	-	-	32,155
	03 3" 90 Elbow Std Gr B	15.00	EACH	1,397.28 /EACH	20,959	9.86 /EACH	148	-	-	21,107
	06 6" 90 Elbow Std Gr B	4.00	EACH	2,278.19 /EACH	9,113	35.00 /EACH	140	-	-	9,253
	08 8" 90 Elbow Std Gr B	10.00	EACH	3,341.32 /EACH	33,413	67.00 /EACH	670	-	-	34,083
	12 12" 90 Elbow Std Gr B	3.00	EACH	5,011.993 /EACH	15,036	199.00 /EACH	597	-	-	15,633
	<b>90 Elbows</b>				<b>136,842</b>		<b>2,068</b>			<b>138,910</b>
	1,247.651 Labor hours									
<b>3.508</b>	<b>Tees</b>									
	01 1" Tee Std Gr B	25.00	EACH	880.89 /EACH	22,022	22.80 /EACH	570	-	-	22,592
	02 2" Tee Std Gr B	10.00	EACH	1,154.294 /EACH	11,543	26.40 /EACH	264	-	-	11,807
	03 3" Tee Std Gr B	10.00	EACH	1,822.542 /EACH	18,225	33.60 /EACH	336	-	-	18,561
	<b>Tees</b>				<b>51,791</b>		<b>1,170</b>			<b>52,961</b>
	472.20 Labor hours									
<b>3.512</b>	<b>Concentric Reducers</b>									
	0201 2" x 1" Conc Red Std Gr B	10.00	EACH	759.402 /EACH	7,594	18.00 /EACH	180	-	-	7,774
	0302 3" x 2" Conc Red Std Gr B	10.00	EACH	1,002.40 /EACH	10,024	16.00 /EACH	160	-	-	10,184
	0804 8" x 4" Conc Red Std Gr B	2.00	EACH	2,673.12 /EACH	5,346	65.00 /EACH	130	-	-	5,476
	1206 12" x 6" Conc Red Std Gr B	6.00	EACH	3,857.72 /EACH	23,146	132.00 /EACH	792	-	-	23,938

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Concentric Reducers</b>			<b>46,111</b>		<b>1,262</b>			<b>47,373</b>
	420.410 Labor hours								
<b>3.514</b>	<b>Caps</b>								
	06 6" Cap Std Gr B	2.00 EACH	3,541.68 /EACH	7,083	21.00 /EACH	42	-	-	7,125
	12 12" Cap Std Gr B	2.00 EACH	4,432.770 /EACH	8,866	79.00 /EACH	158	-	-	9,024
	<b>Caps</b>			<b>15,949</b>		<b>200</b>			<b>16,149</b>
	145.413 Labor hours								
<b>3.518</b>	<b>Reinforced Saddles</b>								
	01 Saddle Std Gr B - 1" Nozzle	10.00 EACH	607.51 /EACH	6,075	300.00 /EACH	3,000	-	-	9,075
	02 Saddle Std Gr B - 2" Nozzle	10.00 EACH	1,215.024 /EACH	12,150	300.00 /EACH	3,000	-	-	15,150
	06 Saddle Std Gr B - 6" Nozzle	1.00 EACH	3,341.29 /EACH	3,341	540.00 /EACH	540	-	-	3,881
	<b>Reinforced Saddles</b>			<b>21,567</b>		<b>6,540</b>			<b>28,107</b>
	196.632 Labor hours								
	<b>Fittings, B-GR, STD</b>			<b>272,259</b>		<b>11,240</b>	<b>0</b>	<b>0</b>	<b>283,499</b>
	2,482.303 Labor hours								
<b>3.650</b>	<b>Fittings, Y-60, STD</b>								
<b>3.652</b>	<b>90 Elbows</b>								
	16 16" 90 Elbow Std Y-60	10.00 EACH	6,439.62 /EACH	64,396	1,195.00 /EACH	11,950	-	-	76,346
	20 20" 90 Elbow Std Y-60	8.00 EACH	7,806.551 /EACH	62,452	1,553.00 /EACH	12,424	-	-	74,876
	24 24" 90 Elbow Std Y-60	3.00 EACH	9,416.47 /EACH	28,249	2,348.00 /EACH	7,044	-	-	35,293
	<b>90 Elbows</b>			<b>155,098</b>		<b>31,418</b>			<b>186,516</b>
	1,414.10 Labor hours								
<b>3.658</b>	<b>Tees</b>								
	16 16" Tee Std Y-60	2.00 EACH	8,201.40 /EACH	16,403	1,464.00 /EACH	2,928	-	-	19,331
	20 20" Tee Std Y-60	2.00 EACH	10,145.51 /EACH	20,291	2,009.00 /EACH	4,018	-	-	24,309
	24 24" Tee Std Y-60	1.00 EACH	12,150.24 /EACH	12,150	2,717.00 /EACH	2,717	-	-	14,867
	<b>Tees</b>			<b>48,844</b>		<b>9,663</b>			<b>58,507</b>
	445.332 Labor hours								
<b>3.660</b>	<b>Reducing Tees</b>								
	1608 16" X 8" Red Tee Std Y-60	3.00 EACH	7,168.653 /EACH	21,506	1,410.00 /EACH	4,230	-	-	25,736
	2012 20" x 12" Red Tee Std Y-60	12.00 EACH	8,991.204 /EACH	107,894	1,954.00 /EACH	23,448	-	-	131,342
	2016 20" x 16" Red Tee Std Y-60	4.00 EACH	9,416.47 /EACH	37,666	1,954.00 /EACH	7,816	-	-	45,482
	2412 24" x 12" Red Tee Std Y-60	4.00 EACH	10,479.62 /EACH	41,918	2,717.00 /EACH	10,868	-	-	52,786
	2420 24" x 20" Red Tee Std Y-60	2.00 EACH	11,694.69 /EACH	23,389	2,717.00 /EACH	5,434	-	-	28,823
	<b>Reducing Tees</b>			<b>232,374</b>		<b>51,796</b>			<b>284,170</b>
	2,118.66 Labor hours								
<b>3.668</b>	<b>Reinforced Saddles</b>								
	01 Saddle Std Y-60 - 1" Nozzle	5.00 EACH	607.52 /EACH	3,038	366.00 /EACH	1,830	-	-	4,868
	02 Saddle Std Y-60 - 2" Nozzle	5.00 EACH	1,184.632 /EACH	5,923	366.00 /EACH	1,830	-	-	7,753
	06 Saddle Std Y-60 - 6" Nozzle	2.00 EACH	3,341.35 /EACH	6,683	696.00 /EACH	1,392	-	-	8,075
	<b>Reinforced Saddles</b>			<b>15,643</b>		<b>5,052</b>			<b>20,695</b>
	142.63 Labor hours								
	<b>Fittings, Y-60, STD</b>			<b>451,960</b>		<b>97,929</b>	<b>0</b>	<b>0</b>	<b>549,889</b>
	4,120.711 Labor hours								

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>4.200</b>	<b>Small Valves &amp; Fittings</b>									
<b>4.204</b>	<b>Ball Valves, NPT</b>									
04	1/2" Ball Valve NPT - 4500#	50.00	EACH	261.231 /EACH	13,062	22.64 /EACH	1,132	-	-	14,194
08	1" Ball Valve NPT	50.00	EACH	291.61 /EACH	14,580	55.80 /EACH	2,790	-	-	17,370
	<b>Ball Valves, NPT</b>				<b>27,642</b>		<b>3,922</b>			<b>31,564</b>
	252.023 Labor hours									
<b>4.206</b>	<b>Check Valves, NPT</b>									
08	1" Check Valve NPT	5.00	EACH	291.62 /EACH	1,458	178.52 /EACH	893	-	-	2,351
	<b>Check Valves, NPT</b>				<b>1,458</b>		<b>893</b>			<b>2,351</b>
	13.294 Labor hours									
<b>4.212</b>	<b>Instrument Valves, NPT</b>									
75	3/4" Instrument Valve NPT	50.00	EACH	276.42 /EACH	13,821	150.00 /EACH	7,500	-	-	21,321
	<b>Instrument Valves, NPT</b>				<b>13,821</b>		<b>7,500</b>			<b>21,321</b>
	126.011 Labor hours									
<b>4.216</b>	<b>Plug Valves, NPT</b>									
08	1" Plug Valve NPT	5.00	EACH	291.62 /EACH	1,458	306.600 /EACH	1,533	-	-	2,991
	<b>Plug Valves, NPT</b>				<b>1,458</b>		<b>1,533</b>			<b>2,991</b>
	13.294 Labor hours									
<b>4.218</b>	<b>Relief Valves, NPT</b>									
08	1" Relief NPT	5.00	EACH	291.62 /EACH	1,458			-	-	1,458
	<b>Relief Valves, NPT</b>				<b>1,458</b>					<b>1,458</b>
	13.294 Labor hours									
<b>4.219</b>	<b>Strainer - "Y" Type</b>									
1	1" "Y" Type Strainer A105 Thrd	5.00	ea	303.75 /ea	1,519	62.00 /ea	310	-	-	1,829
	<b>Strainer - "Y" Type</b>				<b>1,519</b>		<b>310</b>			<b>1,829</b>
	13.85 Labor hours									
<b>4.224</b>	<b>Couplings, NPT</b>									
06	3/4" Coupling NPT	30.00	EACH	45.564 /EACH	1,367	0.95 /EACH	29	-	-	1,395
08	1" Coupling NPT	30.00	EACH	54.68 /EACH	1,640	1.48 /EACH	44	-	-	1,685
	<b>Couplings, NPT</b>				<b>3,007</b>		<b>73</b>			<b>3,080</b>
	27.42 Labor hours									
<b>4.230</b>	<b>90 Elbows, NPT</b>									
08	1" 90 Elbow NPT	50.00	EACH	91.124 /EACH	4,556	3.05 /EACH	153	-	-	4,709
	<b>90 Elbows, NPT</b>				<b>4,556</b>		<b>153</b>			<b>4,709</b>
	41.541 Labor hours									
<b>4.232</b>	<b>Tees, NPT</b>									
08	1" Tee NPT	30.00	EACH	121.50 /EACH	3,645	5.14 /EACH	154	-	-	3,799
	<b>Tees, NPT</b>				<b>3,645</b>		<b>154</b>			<b>3,799</b>
	33.233 Labor hours									
<b>4.234</b>	<b>Unions, NPT</b>									
06	3/4" Union NPT	50.00	EACH	121.501 /EACH	6,075	3.33 /EACH	167	-	-	6,242
08	1" Union NPT	50.00	EACH	151.88 /EACH	7,594	5.84 /EACH	292	-	-	7,886

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Unions, NPT</b>				<u>13,669</u>		<u>459</u>			<u>14,128</u>
	124.63 Labor hours									
<b>4.236</b>	<b>Socket Connections</b>									
	08 1" 90 Elbow Socket	100.00	EACH	91.13 /EACH	<u>9,113</u>	13.15 /EACH	<u>1,315</u>	-	-	<u>10,428</u>
	<b>Socket Connections</b>				<u>9,113</u>		<u>1,315</u>			<u>10,428</u>
	83.09 Labor hours									
<b>4.238</b>	<b>O-Lets, NPT x Socket</b>									
	7503 3/4" x 3" Thredolet NPT	30.00	EACH	759.391 /EACH	<u>22,782</u>	2.36 /EACH	<u>71</u>	-	-	<u>22,853</u>
	7506 3/4" x 6" Thredolet NPT	30.00	EACH	759.391 /EACH	<u>22,782</u>	1.93 /EACH	<u>58</u>	-	-	<u>22,840</u>
	<b>O-Lets, NPT x Socket</b>				<u>45,563</u>		<u>129</u>			<u>45,692</u>
	415.422 Labor hours									
<b>4.242</b>	<b>Swage-STD/XS, NPT</b>									
	0201 2 x 1" Swage PE/NPT	15.00	EACH	607.51 /EACH	<u>9,113</u>	20.35 /EACH	<u>305</u>	-	-	<u>9,418</u>
	<b>Swage-STD/XS, NPT</b>				<u>9,113</u>		<u>305</u>			<u>9,418</u>
	83.084 Labor hours									
<b>4.244</b>	<b>NPT Connections</b>									
	06 3/4" Connection NPT	300.00	EACH	115.43 /EACH	<u>34,629</u>	-	-	-	-	<u>34,629</u>
	08 1" Connection NPT	300.00	EACH	145.802 /EACH	<u>43,741</u>	-	-	-	-	<u>43,741</u>
	<b>NPT Connections</b>				<u>78,369</u>					<u>78,369</u>
	714.53 Labor hours									
<b>4.246</b>	<b>Socket Welds</b>									
	08 1" Socket Weld	150.00	EACH	194.41 /EACH	<u>29,161</u>	6.17 /EACH	<u>926</u>	-	-	<u>30,086</u>
	<b>Socket Welds</b>				<u>29,161</u>		<u>926</u>			<u>30,086</u>
	265.871 Labor hours									
<b>4.250</b>	<b>Socket Weld Tee</b>									
	0080 1" Tee 3000# SW A105	30.00	ea	364.511 /ea	<u>10,935</u>	9.85 /ea	<u>296</u>	-	-	<u>11,231</u>
	<b>Socket Weld Tee</b>				<u>10,935</u>		<u>296</u>			<u>11,231</u>
	99.702 Labor hours									
	<b>Small Valves &amp; Fittings</b>				<u>254,488</u>		<u>17,966</u>	<u>0</u>	<u>0</u>	<u>272,453</u>
	2,320.274 Labor hours									
<b>4.300</b>	<b>Miscellaneous Mechanical</b>									
<b>4.304</b>	<b>Startup Fluids</b>									
	10 Lube Oil	1,000.00	GAL	-	-	15.00 /GAL	<u>15,000</u>	-	-	<u>15,000</u>
	<b>Startup Fluids</b>						<u>15,000</u>			<u>15,000</u>
<b>4.306</b>	<b>Adjustable Pipe Supports</b>									
	01 1" Adjustable Pipe Support	30.00	EACH	507.28 /EACH	<u>15,218</u>	72.00 /EACH	<u>2,160</u>	-	-	<u>17,378</u>
	02 2" Adjustable Pipe Support	15.00	EACH	668.264 /EACH	<u>10,024</u>	220.00 /EACH	<u>3,300</u>	-	-	<u>13,324</u>
	03 3" Adjustable Pipe Support	10.00	EACH	789.762 /EACH	<u>7,898</u>	247.05 /EACH	<u>2,471</u>	-	-	<u>10,368</u>
	<b>Adjustable Pipe Supports</b>				<u>33,140</u>		<u>7,931</u>			<u>41,070</u>
	302.151 Labor hours									
<b>4.310</b>	<b>Hydrotesting</b>									
	01 Hydrotest (LS)	10.00	LS	7,290.16 /LS	<u>72,902</u>	-	-	-	-	<u>72,902</u>



Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Hydrotesting</b>				<b>72,902</b>					<b>72,902</b>
	664.68 Labor hours									
<b>4.312</b>	<b>Painting</b>									
	01 Prep & Paint (LS)	5.00	LS	15,471.69 /LS	77,358	-	-	-	-	77,358
	<b>Painting</b>				<b>77,358</b>					<b>77,358</b>
	792.19 Labor hours									
<b>4.314</b>	<b>Contractor Mobilization</b>									
	02 Contractor Move in / out	10.00	LS	3,392.63 /LS	33,926	-	-	-	-	33,926
	<b>Contractor Mobilization</b>				<b>33,926</b>					<b>33,926</b>
	410.77 Labor hours									
<b>4.315</b>	<b>Field Surveys</b>									
----	Geotech Study & Soil Survey	1.00	Ea					-	-	10,000
----	Noise Survey	1.00	Ea					-	-	10,000
----	Emissions Testing	1.00	Ea					-	-	10,000
	<b>Field Surveys</b>									<b>30,000</b>
	<b>Miscellaneous Mechanical</b>				<b>217,326</b>		<b>22,931</b>	<b>0</b>	<b>0</b>	<b>270,257</b>
	2,169.780 Labor hours									
<b>4.400</b>	<b>Instrumentation</b>									
<b>4.401</b>	<b>Station &amp; Unit</b>									
n	5 Station Control Panel w/Prog	1.00	EACH	143,617.90 /EACH	143,618	96,000.00 /EACH	96,000	-	-	239,618
n	20 ESD/BSD Panel (PLC w/Programmi	1.00	EACH	43,887.71 /EACH	43,888	37,000.00 /EACH	37,000	-	-	80,888
	35 PC ( Laptop )	1.00	EACH	928.51 /EACH	929	9,000.00 /EACH	9,000	-	-	9,929
n	37 PC Man-Machine Interface	1.00	EACH	1,238.09 /EACH	1,238	14,000.00 /EACH	14,000	-	-	15,238
	45 MMI Development Keys	1.00	EACH	-	-	9,000.00 /EACH	9,000	-	-	9,000
	50 MMI Runtime Key	1.00	EACH	-	-	4,000.00 /EACH	4,000	-	-	4,000
	55 MMI Connection	1.00	Lot	-	-	-	-	-	-	10,000
	<b>Station &amp; Unit</b>				<b>189,672</b>		<b>169,000</b>			<b>368,672</b>
	1,675.67 Labor hours									
<b>4.404</b>	<b>Fire &amp; Gas Detection</b>									
n	01 Main Fire & Gas Control Panel	1.00	EA	3,448.28 /EA	3,448	29,900.00 /EA	29,900	-	-	33,348
n	07 Large Interface Panel	1.00	EA	2,539.24 /EA	2,539	28,600.00 /EA	28,600	-	-	31,139
n	13 Smoke Detector (Non-Hazardous)	2.00	EA	407.55 /EA	815	234.00 /EA	468	-	-	1,283
n	16 Fire Detector (Networked)	10.00	EA	752.37 /EA	7,524	4,030.00 /EA	40,300	-	-	47,824
n	19 Gas Detector (Networked)	5.00	EA	752.354 /EA	3,762	2,470.00 /EA	12,350	-	-	16,112
	22 Gas Calibration Kit	1.00	EA	-	-	812.50 /EA	813	-	-	813
	25 Open Path Gas Detector	3.00	EA	1,504.74 /EA	4,514	4,095.00 /EA	12,285	-	-	16,799
	28 Aiming Laser	1.00	EA	-	-	1,365.00 /EA	1,365	-	-	1,365
	31 Horns - Supervised	8.00	EA	579.950 /EA	4,640	715.00 /EA	5,720	-	-	10,360
	34 Beacons - Supervise	10.00	EA	579.94 /EA	5,799	299.00 /EA	2,990	-	-	8,789
	37 Network Extenders	6.00	EA	169.25 /EA	1,015	1,612.00 /EA	9,672	-	-	10,687
n	40 ESD/BSD Pushbutton Stations	14.00	EA	407.53 /EA	5,705	598.00 /EA	8,372	-	-	14,077
n	43 Fire & Gas HMI	1.00	EA	-	-	3,380.00 /EA	3,380	-	-	3,380
n	46 Fire & Gas HMI Programming	1.00	EA	-	-	5,460.00 /EA	5,460	-	-	10,460
n	49 Fire & Gas Startup Assistance	10.00	DAY	4,708.12 /DAY	47,081	-	-	-	-	67,081
	<b>Fire &amp; Gas Detection</b>				<b>86,843</b>		<b>161,675</b>			<b>273,518</b>
	351.28 Labor hours									
<b>4.406</b>	<b>Transient Protectors</b>									
	01 Analog/Digital I/O Transient Protector	1.00	EA	112.85 /EA	113	171.60 /EA	172	-	-	284

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
4.406	<b>Transient Protectors</b>									
	04 Modem Transient Protector	1.00	EA	78.44 /EA	78	319.80 /EA	320	-	-	398
	07 120 VAC Transient Protector	1.00	EA	344.90 /EA	345	214.50 /EA	215	-	-	559
	<b>Transient Protectors</b>				<b>536</b>		<b>706</b>			<b>1,242</b>
	4.74 Labor hours									
4.407	<b>Transmitters</b>									
	01 Temp. Transmitter (HART) w/Sensor & TW	8.00	EA	752.37 /EA	6,019	743.80 /EA	5,950	-	-	11,969
	04 DP Transmitter (HART) w/Manifold	5.00	EA	752.32 /EA	3,762	1,495.00 /EA	7,475	-	-	11,237
	07 Pressure Transmitter (HART) w/Manifold	12.00	EA	752.353 /EA	9,028	1,235.00 /EA	14,820	-	-	23,848
	19 Tri-loop Transmitter	2.00	EA	407.55 /EA	815	611.00 /EA	1,222	-	-	2,037
	25 HART 375 Configurator	1.00	EA	-	-	5,668.00 /EA	5,668	-	-	5,668
	<b>Transmitters</b>				<b>19,624</b>		<b>35,135</b>			<b>54,759</b>
	173.37 Labor hours									
4.408	<b>Transducers</b>									
n	07 RTD w/Thermowell	8.00	EA	470.20 /EA	3,762	292.50 /EA	2,340	-	-	6,102
	<b>Transducers</b>				<b>3,762</b>		<b>2,340</b>			<b>6,102</b>
	33.232 Labor hours									
4.409	<b>Switches</b>									
	04 Pressure Switch	2.00	EA	752.39 /EA	1,505	754.00 /EA	1,508	-	-	3,013
	<b>Switches</b>				<b>1,505</b>		<b>1,508</b>			<b>3,013</b>
	13.294 Labor hours									
4.425	<b>ESD Solenoid Valves</b>									
	04 ESD Solenoid Valve	10.00	EA	815.05 /EA	8,151	932.00 /EA	9,320	-	-	17,471
	<b>ESD Solenoid Valves</b>				<b>8,151</b>		<b>9,320</b>			<b>17,471</b>
	72.01 Labor hours									
4.430	<b>Tubing, SS-316</b>									
	25 3/8" SS Tubing	1,200.00	FT	81.51 /FT	97,806	-	-	-	-	108,318
	28 3/8" NTP to Tube Connector	120.00	EA	97.18 /EA	11,662	-	-	-	-	15,445
	34 3/8" Tubing Tee	20.00	EA	97.184 /EA	1,944	-	-	-	-	2,942
	37 1/2" SS Tubing	800.00	FT	106.584 /FT	85,267	-	-	-	-	95,307
	40 1/2" NTP to Tube Connector	80.00	EA	97.18 /EA	7,774	-	-	-	-	12,117
	46 1/2" Tubing Tee	15.00	EA	97.181 /EA	1,458	-	-	-	-	2,423
	<b>Tubing, SS-316</b>				<b>205,910</b>					<b>236,552</b>
	1,819.13 Labor hours									
	<b>Instrumentation</b>				<b>516,003</b>		<b>379,684</b>	<b>0</b>	<b>0</b>	<b>961,328</b>
	4,142.710 Labor hours									
4.500	<b>Electrical</b>									
4.501	<b>Instrumentation Cable</b>									
	22 Triad 1-8 PR #16 SH.	4,000.00	FT	11.581 /FT	46,322	-	-	-	-	57,534
	<b>Instrumentation Cable</b>				<b>46,322</b>					<b>57,534</b>
	420.960 Labor hours									
4.502	<b>Cable - Control</b>									
	10 1-9/C #14 Cable - PVC Jkt (Belden 27087A)	2,500.00	FT	6.40 /FT	15,997	-	-	-	-	19,885

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Cable - Control</b>			<u>15,997</u>					<u>19,885</u>
	145.38 Labor hours								
<b>4.503</b>	<b>Cable - Communication</b>								
n	04 Optic Cable, 12 Fiber Multimode	1,000.00 FT	3.66 /FT	3,657	-	-	-	-	4,827
	07 Category 5 (Cat-5) Cable	500.00 FT	4.27 /FT	2,134	-	-	-	-	2,195
n	13 DeviceNet Branch Cable (Round)	500.00 FT	3.963 /FT	1,981	-	-	-	-	2,404
	16 ControlNet Cable (RG-6)	500.00 FT	3.66 /FT	<u>1,828</u>	-	-	-	-	<u>1,887</u>
	<b>Cable - Communication</b>			<u>9,600</u>					<u>11,312</u>
	87.24 Labor hours								
<b>4.504</b>	<b>Cable - Power, 600 Volt</b>								
	04 1/C #12/THWN	4,000.00 FT	2.131 /FT	8,526	-	-	-	-	9,150
	10 1/C #8/THWN	1,000.00 FT	2.744 /FT	2,744	-	-	-	-	3,149
	19 1/C #2/XHHW	1,000.00 FT	3.963 /FT	<u>3,963</u>	-	-	-	-	<u>6,164</u>
	<b>Cable - Power, 600 Volt</b>			<u>15,233</u>					<u>18,463</u>
	138.43 Labor hours								
<b>4.507</b>	<b>Cable - Grounding</b>								
	01 1/C #6 Type "CP" Cable	1,000.00 FT	3.353 /FT	3,353	-	-	-	-	4,313
	04 1/C #2 Type "CP" Cable	1,000.00 FT	3.963 /FT	3,963	-	-	-	-	6,319
	10 1/C #4/0 Type "CP" Cable	1,000.00 FT	5.49 /FT	<u>5,485</u>	-	-	-	-	<u>12,847</u>
	<b>Cable - Grounding</b>			<u>12,801</u>					<u>23,479</u>
	116.330 Labor hours								
<b>4.509</b>	<b>Termination - Wire/Cable</b>								
n	01 Terminate #10 - #18	1,200.00 EA	76.19 /EA	91,427	-	-	-	-	91,823
n	04 Terminate #8 - #2	250.00 EA	106.664 /EA	26,666	-	-	-	-	26,848
n	07 Terminate #1 - #4/0	80.00 EA	134.093 /EA	10,727	-	-	-	-	11,097
n	13 Terminate Fiber Optic Cable	20.00 EA	228.56 /EA	4,571	-	-	-	-	4,994
	16 5 KV Stress Cones (3 each)	3.00 EA	1,218.99 /EA	<u>3,657</u>	-	-	-	-	<u>4,707</u>
	<b>Termination - Wire/Cable</b>			<u>137,049</u>					<u>139,470</u>
	1,245.45 Labor hours								
<b>4.520</b>	<b>GRC Conduit</b>								
	07 1" GRC Conduit	1,500.00 FT	15.24 /FT	<u>22,858</u>	-	-	-	-	<u>26,875</u>
	<b>GRC Conduit</b>			<u>22,858</u>					<u>26,875</u>
	207.720 Labor hours								
<b>4.522</b>	<b>PVC Coated GRC Conduit</b>								
	04 1" 40 Mil poly-coated GRC Conduit	2,500.00 FT	16.761 /FT	41,903	-	-	-	-	56,788
	13 2" 40 Mil poly-coated GRC Conduit	250.00 FT	33.523 /FT	<u>8,381</u>	-	-	-	-	<u>11,377</u>
	<b>PVC Coated GRC Conduit</b>			<u>50,284</u>					<u>68,165</u>
	456.960 Labor hours								
<b>4.524</b>	<b>PVC Conduit</b>								
	04 1" PVC Conduit	1,000.00 FT	10.362 /FT	<u>10,362</u>	-	-	-	-	<u>10,770</u>
	<b>PVC Conduit</b>			<u>10,362</u>					<u>10,770</u>
	94.17 Labor hours								
<b>4.526</b>	<b>Conduit &amp; Wire Misc</b>								
	04 Conduit clamp/hanger >1" <2"	100.00 EA	49.371 /EA	4,937	-	-	-	-	5,145
	13 6" Conduit Nipples >1" <2"	100.00 EA	152.38 /EA	15,238	-	-	-	-	16,577
n	25 24" Cable Tray	300.00 FT	60.95 /FT	18,285	-	-	-	-	23,960
n	28 36" Cable Tray	100.00 FT	65.83 /FT	6,583	-	-	-	-	8,715

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	Conduit & Wire Misc				45,042					54,396
	409.33 Labor hours									
4.528	Trenching & Other Serv.									
n	01 Mechanical Trenching - 18" Deep	3,000.00	FT	6.094 /FT	18,282	-	-	-	-	18,282
n	04 Hand Trenching - 18" Deep	100.00	FT	64.00 /FT	6,400	-	-	-	-	6,400
n	07 Mechanical Backfill	3,000.00	FT	12.19 /FT	36,571	-	-	-	-	36,571
n	10 Hydrovacuum Truck - Large	5.00	DAY	-	-	-	-	-	-	19,500
	Trenching & Other Serv.				61,253					80,753
	556.64 Labor hours									
4.530	Conduit Make-up Box Ftgs.									
n	07 1" Condulet, 1-4 Hubs	100.00	EA	158.472 /EA	15,847	-	-	-	-	22,087
n	16 2" Condulet, 1-4 Hubs	20.00	EA	237.703 /EA	4,754	-	-	-	-	9,226
	Conduit Make-up Box Ftgs.				20,601					31,313
	187.22 Labor hours									
4.532	Elbow Fittings									
	04 1" LBY Conduit Elbow Fitting	150.00	EA	76.191 /EA	11,429	-	-	-	-	15,452
	Elbow Fittings				11,429					15,452
	103.86 Labor hours									
4.534	Conduit Seals									
n	07 1" EYS Conduit Seal	150.00	EA	256.00 /EA	38,399	-	-	-	-	42,812
	Conduit Seals				38,399					42,812
	348.96 Labor hours									
4.536	Conduit Unions									
	07 1" UNY Conduit Union	150.00	EA	109.712 /EA	16,457	-	-	-	-	21,279
	Conduit Unions				16,457					21,279
	149.553 Labor hours									
4.539	Sealtite Flex. Connection									
n	07 1" Sealtite Flex Connection	20.00	EA	226.121 /EA	4,522	-	-	-	-	5,326
	Sealtite Flex. Connection				4,522					5,326
	41.10 Labor hours									
4.540	Grounding Equipment									
	01 Packaged Zinc Anode w/50 ft Lead	20.00	EA	365.71 /EA	7,314	-	-	-	-	10,434
	04 Small Ground Box	1.00	EA	548.55 /EA	549	-	-	-	-	1,023
	07 Large Ground Box	1.00	EA	609.40 /EA	609	-	-	-	-	1,175
	10 Cadweld Connection	10.00	EA	335.23 /EA	3,352	-	-	-	-	3,643
	13 Scotchcast Encapsulation Kit	10.00	EA	167.613 /EA	1,676	-	-	-	-	2,690
	16 Grounding Clamp	10.00	EA	85.35 /EA	853	-	-	-	-	1,012
n	19 Auger 12" x 72" hole	20.00	EA	225.52 /EA	4,510	-	-	-	-	4,510
	22 Clamp-On Ground Tester	1.00	EA	-	-	6,084.00 /EA	6,084	-	-	6,084
	25 PCR	1.00	EA	761.92 /EA	762	1,700.00 /EA	1,700	-	-	2,462
----	Deep Well Ground Bed	1.00	EA			60,000.00 /EA	60,000	-	-	60,000
	Grounding Equipment				19,626		67,784			93,033
	178.36 Labor hours									
4.542	Junction Boxes									
	07 36 x 30 Stainless Steel NEMA #4	3.00	EA	640.03 /EA	1,920	-	-	-	-	6,639
	Junction Boxes				1,920					6,639
	17.45 Labor hours									
4.600	Motor Control									

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
4.600	<b>Motor Control</b>									
	04 Combination Starters - Size 2 (Ckt Bkr/480VAC/3O/NEMA1)	12.00	EA	533.31 /EA	6,400	4,478.50 /EA	53,742	-	-	60,142
n	19 MCC - Size 2 (Ckt Bkr/480VAC/3O/NEMA1)	12.00	EA	975.21 /EA	11,702	6,532.50 /EA	78,390	-	-	90,092
	<b>Motor Control</b>				<b>18,102</b>		<b>132,132</b>			<b>150,234</b>
	164.51 Labor hours									
4.610	<b>Power Distribution</b>									
n	07 1000 Amp - 480 Volt Fused Switch - SS	1.00	EA	792.29 /EA	792	11,505.00 /EA	11,505	-	-	12,297
n	16 400 Amp - Power Panel - 42 Pole - Main Bkr	1.00	EA	1,474.98 /EA	1,475	18,850.00 /EA	18,850	-	-	20,325
n	28 Surge Protector 408 VAC 3-Phase	1.00	EA	426.74 /EA	427	1,631.50 /EA	1,632	-	-	2,058
	<b>Power Distribution</b>				<b>2,694</b>		<b>31,987</b>			<b>34,681</b>
	24.482 Labor hours									
4.620	<b>Transformers</b>									
	07 150 KVA 480-120/208 Dry-Type NEMA 3R	1.00	EA	1,295.28 /EA	1,295	5,330.00 /EA	5,330	-	-	6,625
	10 500 KVA 4160/480 Oil-Filled Transformer	1.00	EA	2,285.75 /EA	2,286	10,140.00 /EA	10,140	-	-	12,426
	13 Concrete Transformer Pad	2.00	EA	700.90 /EA	1,402	175.50 /EA	351	-	-	1,753
	<b>Transformers</b>				<b>4,983</b>		<b>15,821</b>			<b>20,804</b>
	45.282 Labor hours									
4.630	<b>Lighting</b>									
n	01 30 ft Breakover Pole/3 Prong Bullhorn/Winch	4.00	EA	2,072.33 /EA	8,289	2,392.00 /EA	9,568	-	-	17,857
	04 400W HID Highbay	10.00	EA	335.24 /EA	3,352	195.00 /EA	1,950	-	-	5,302
	07 400W HID Flood Light	6.00	EA	380.96 /EA	2,286	162.50 /EA	975	-	-	3,261
n	10 100W Incandescent (Div 1)	8.00	EA	542.50 /EA	4,340	764.40 /EA	6,115	-	-	10,455
	13 4-40W Flourescent Fixture	8.00	EA	259.024 /EA	2,072	113.82 /EA	911	-	-	2,983
	16 LED Emergency Exit Light Fixture	12.00	EA	204.19 /EA	2,450	329.86 /EA	3,958	-	-	6,409
	19 480V Lightning Contacter (Includes Photocells)	1.00	EA	335.18 /EA	335	280.37 /EA	280	-	-	616
	<b>Lighting</b>				<b>23,125</b>		<b>23,757</b>			<b>46,883</b>
	210.151 Labor hours									
4.640	<b>UPS Systems</b>									
	04 3 KVA N+1 Single Phase UPS	1.00	EA	701.06 /EA	701	17,620.20 /EA	17,620	-	-	18,321
	10 20 KVA 3-Phase UPS w/Aux Bat Cabinet	1.00	EA	975.17 /EA	975	22,594.00 /EA	22,594	-	-	23,569
	<b>UPS Systems</b>				<b>1,676</b>		<b>40,214</b>			<b>41,890</b>
	15.233 Labor hours									
4.650	<b>Generators</b>									
n	34 350 KW Natural Gas Generator	1.00	EA	38,094.20 /EA	38,094	236,600.00 /EA	236,600	-	-	274,694
	<b>Generators</b>				<b>38,094</b>		<b>236,600</b>			<b>274,694</b>
	346.19 Labor hours									
4.660	<b>Mobilization Electrical</b>									
	07 Mobilization (Large Job) >6 Persons	1.00	EA	36,570.47 /EA	36,570	-	-	-	-	36,57

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>4.700</b>	<b>Automation Systems</b>								
<b>4.701</b>	<b>Control Logix PLC</b>								
n	101 17 Slot Card Cage	1.00 EA	-	-	518.38 /EA	518	-	-	1,447
	102 Control Logix Power Supply	1.00 EA	-	-	904.88 /EA	905	-	-	2,023
	111 Ethernet Communication Card	1.00 EA	-	-	2,068.63 /EA	2,069	-	-	4,169
	112 Control Net Communication Card	1.00 EA	-	-	1,781.25 /EA	1,781	-	-	3,572
	113 Device Net Communication Card	1.00 EA	-	-	1,503.13 /EA	1,503	-	-	3,081
	114 4-Port HART Communication Card	1.00 EA	-	-	2,390.63 /EA	2,391	-	-	4,901
	115 Modbus TCP/IP Communication Card	1.00 EA	-	-	1,722.50 /EA	1,723	-	-	4,590
	116 3-Port Serial Communication Card	1.00 EA	-	-	2,332.50 /EA	2,333	-	-	4,665
n	130 32 Pt Digital Input Card	2.00 EA	-	-	643.50 /EA	1,287	-	-	3,274
n	133 32 Pt Digital Output Card	2.00 EA	-	-	961.88 /EA	1,924	-	-	4,201
n	139 16 Pt 4-20ma Input Card	1.00 EA	-	-	1,908.75 /EA	1,909	-	-	4,139
n	145 8 Pt 4-20ma Output Card	1.00 EA	-	-	1,319.50 /EA	1,320	-	-	2,730
n	155 6 Pt RTD Input Card	2.00 EA	-	-	1,723.13 /EA	3,446	-	-	9,337
	<b>Control Logix PLC</b>					<b>23,107</b>			<b>52,130</b>
<b>4.707</b>	<b>Computers/Hardware</b>								
n	101 Configuration Laptop	1.00 EA	-	-	1,953.25 /EA	1,953	-	-	3,907
n	111 Desktop Client PC/Monitor	1.00 EA	-	-	4,215.00 /EA	4,215	-	-	6,698
n	112 Div 2 Client PC/Monitor	1.00 EA	-	-	9,568.00 /EA	9,568	-	-	19,136
	121 HMI Server	1.00 EA	-	-	7,771.88 /EA	7,772	-	-	18,654
	122 Domain Server	1.00 EA	-	-	6,703.13 /EA	6,703	-	-	16,037
	123 M-Health SQL Server	1.00 EA	-	-	7,771.88 /EA	7,772	-	-	18,654
	131 8-Port KVM Switch	1.00 EA	-	-	1,816.75 /EA	1,817	-	-	3,669
n	132 72" Server rack	1.00 EA	-	-	7,181.25 /EA	7,181	-	-	14,861
	<b>Computers/Hardware</b>					<b>46,981</b>			<b>101,616</b>
<b>4.709</b>	<b>Software</b>								
n	101 RSVIEW SE Client	1.00 EA	-	-	3,612.38 /EA	3,612	-	-	7,225
n	107 RSVIEW Studio	1.00 EA	-	-	3,776.25 /EA	3,776	-	-	7,553
n	110 RSLINX Enterprise	1.00 EA	-	-	1,311.38 /EA	1,311	-	-	2,623
n	113 RSLOGIX 5000 Pro	1.00 EA	-	-	10,509.38 /EA	10,509	-	-	21,019
n	116 RSSQL (M-Health)	1.00 EA	-	-	7,865.00 /EA	7,865	-	-	15,730
n	119 SRS Bizware	1.00 EA	-	-	10,509.38 /EA	10,509	-	-	21,019
n	122 On-screen Keyboard	1.00 EA	-	-	112.13 /EA	112	-	-	224
n	125 Kepware OPC Driver	1.00 EA	-	-	1,490.63 /EA	1,491	-	-	2,981
n	128 iSNMP Basic Software	1.00 EA	-	-	1,291.880 /EA	1,292	-	-	2,584
	<b>Software</b>					<b>40,478</b>			<b>80,957</b>
<b>4.711</b>	<b>Panels &amp; Accessories</b>								
n	102 Large PLC Panel	1.00 EA	18,285.240 /EA	18,285	16,250.00 /EA	16,250	-	-	51,598
n	111 20 A Power supply	2.00 EA	-	-	768.75 /EA	1,538	-	-	3,152
n	118 24 Vdc Power Distribution	1.00 EA	-	-	281.40 /EA	281	-	-	575
	<b>Panels &amp; Accessories</b>			<b>18,285</b>		<b>18,069</b>			<b>55,325</b>
	166.17 Labor hours								
<b>4.713</b>	<b>Fiber Optic Systems</b>								
n	101 72 fiber rack-mt Patch Pnl	1.00 EA	1,219.02 /EA	1,219	632.13 /EA	632	-	-	2,515
	112 1 Pt Media Changer	1.00 EA	152.300 /EA	152	593.13 /EA	593	-	-	1,368
	<b>Fiber Optic Systems</b>			<b>1,371</b>		<b>1,225</b>			<b>3,883</b>
	12.462 Labor hours								
<b>4.715</b>	<b>Communications</b>								
	01 4-Port KVM Sw w/Keyboard & Monitor	1.00 EA	-	-	2,730.00 /EA	2,730	-	-	5,460

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>4.715</b>	<b>Communications</b>									
n	04 Router for T1 Line	1.00	EA	2,498.90 /EA	2,499	9,230.00 /EA	9,230	-	-	20,959
n	07 VOIP Telephone	1.00	EA	30.59 /EA	31	725.40 /EA	725	-	-	1,481
n	10 12-Port Ethernet Sw w/Fiber Ports	1.00	EA	426.74 /EA	427	2,730.00 /EA	2,730	-	-	5,887
	16 4-Port Terminal Server	1.00	EA	670.58 /EA	671	2,795.00 /EA	2,795	-	-	6,261
	19 Dial-up Modem	1.00	EA	335.18 /EA	335	669.50 /EA	670	-	-	1,674
n	31 72 Fiber Patch Panel	1.00	EA	396.25 /EA	396	569.40 /EA	569	-	-	1,535
n	34 Media Converter Rack	1.00	EA	396.25 /EA	396	720.20 /EA	720	-	-	1,837
n	37 Media Converter, Fiber to Copper	1.00	EA	158.46 /EA	158	418.60 /EA	419	-	-	996
	40 Vsat Dish & Controller Kit	1.00	EA	2,042.01 /EA	2,042	3,711.50 /EA	3,712	-	-	9,465
	<b>Communications</b>				<b>6,955</b>		<b>24,300</b>			<b>55,554</b>
	63.204 Labor hours									
<b>4.717</b>	<b>System Integration</b>									
n	102 Station Panel App Develop	1.00	LS	-	-			-	-	40,000
n	103 HMI App Development	1.00	LS	-	-			-	-	40,000
n	111 Integrator Project Management	160.00	HR	304.642 /HR	48,743			-	-	80,743
n	112 Startup & Commission	160.00	HR	304.642 /HR	48,743			-	-	80,743
n	113 Training	80.00	HR	304.642 /HR	24,371			-	-	40,371
n	118 FRD & Documentation	160.00	LS	-	-			-	-	20,000
n	119 FAT Test	40.00	HR	304.642 /HR	12,186			-	-	20,186
n	120 Integrator Site Visit	40.00	HR	304.642 /HR	12,186			-	-	20,186
	<b>System Integration</b>				<b>146,228</b>					<b>342,228</b>
	1,329.35 Labor hours									
	<b>Automation Systems</b>				<b>172,840</b>		<b>154,160</b>	<b>0</b>	<b>0</b>	<b>691,693</b>
	1,571.180 Labor hours									
<b>5.000</b>	<b>Civil</b>									
<b>5.075</b>	<b>Wells &amp; Septic Systems</b>									
----	Rural Water Connection	1.00	Ea	41,542.22 /Ea	41,542	5,000.00 /Ea	5,000	-	-	46,542
----	Restroom Facilities	1.00	Ea	27,694.82 / Ea	27,695	5,000.00 / Ea	5,000	-	-	32,695
----	Septic Tank and Leach Field	1.00	Ea	55,389.62 / Ea	55,390	5,000.00 / Ea	5,000	-	-	60,390
	<b>Wells &amp; Septic Systems</b>				<b>124,627</b>		<b>15,000</b>			<b>139,627</b>
<b>5.100</b>	<b>Dirt &amp; Gravel Work</b>									
	02 Clear & Grub - Sta Site	4.00	ACRE	7,423.913 /ACRE	29,696	-	-	-	-	29,696
	03 Grading - Sta Site	1.00	lot	61,865.74 /lot	61,866	-	-	-	-	61,866
	05 Cut & Fill - Sta Site	4,000.00	cy	21.654 /cy	86,615	-	-	-	-	86,615
	14 Excavation - Heavy Equipment	2.00	LS	17,303.150 /LS	34,606	-	-	-	-	34,606
	20 Backfill - Heavy Equipment	2.00	LS	17,303.150 /LS	34,606	-	-	-	-	34,606
n	29 Excavate & Backfill-Large Dia.	700.00	cuyd	329.65 /cuyd	230,752	-	-	-	-	230,752
	41 Crushed Stone Northern Region	500.00	Cy	253.651 /Cy	126,826	-	-	-	-	126,826
	<b>Dirt &amp; Gravel Work</b>				<b>604,967</b>					<b>604,967</b>
	7,115.585 Labor hours									
<b>5.105</b>	<b>Site Roadways</b>									
	3 Aggregate Base	400.00	cuyd	24.93 /cuyd	9,970	-	-	-	-	18,370
	10 18" CMP Driveway Culvert	40.00	FEET	470.924 /FEET	18,837	-	-	-	-	18,837
	<b>Site Roadways</b>				<b>28,807</b>					<b>37,207</b>
	221.56 Labor hours									
<b>5.210</b>	<b>Piers/Piling &amp; Anch. Blk.</b>									
	03 Underground Pipe Support Block	40.00	CY	1,858.00 /CY	74,320	-	-	-	-	81,320
	04 Concrete - Pipe Piers	40.00	CY	1,752.711 /CY	70,108	-	-	-	-	76,508

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Piers/Piling &amp; Anch. Blk.</b>				<b>144,428</b>					<b>157,828</b>
	1,581.01 Labor hours									
<b>5.220</b>	<b>Foundations - Equipment</b>									
	04 Compressor Foundation	80.00	CY	2,260.57 /CY	180,845	-	-	-	-	194,845
	05 Scrubber Foundation	10.00	CY	3,259.92 /CY	32,599	-	-	-	-	34,349
c03f	Misc. Equipment Foundations	10.00	CY	3,096.67 /CY	30,967	-	-	-	-	32,717
c03f	Misc. Equipment Foundations	10.00	CY	3,096.67 /CY	30,967	-	-	-	-	32,717
c03f	Tank Farm	20.00	CY	3,096.664 /CY	61,933	-	-	-	-	65,433
	<b>Foundations - Equipment</b>				<b>337,311</b>					<b>360,061</b>
	3,606.77 Labor hours									
<b>5.230</b>	<b>Foundations - Buildings</b>									
c03f	Comp Building Foundation	70.00	Cy	2,477.34 /Cy	173,413	-	-	-	-	185,663
c03f	Aux Building Foundations	60.00	Cy	2,477.332 /Cy	148,640	-	-	-	-	159,140
	<b>Foundations - Buildings</b>				<b>322,053</b>					<b>344,803</b>
	3,525.411 Labor hours									
<b>5.310</b>	<b>Fencing &amp; Guardrails</b>									
f06c	6' Chain Link Fence	2,000.00	FEET	-	-	-	-	-	-	60,000
gr06	4' High Guard Rail	50.00	FEET					-	-	2,500
	<b>Fencing &amp; Guardrails</b>									<b>62,500</b>
<b>5.340</b>	<b>Gates</b>									
g01w	Walk Gates	4.00	FEET	-	-	-	-	-	-	300
g02w	Drive Gates	1.00	FEET	-	-	-	-	-	-	30
	<b>Gates</b>									<b>330</b>
<b>5.400</b>	<b>Buildings</b>									
n	110 Comprssr Bldg	3,000.00	SF	122.68 /SF	368,039	130.00 /SF	390,000	-	-	758,039
n	122 Aux/Control Bldg, In Place Avg/SF	1,600.00	SF	121.17 /SF	193,864	156.25 /SF	250,000	-	-	443,864
	<b>Buildings</b>				<b>561,903</b>		<b>640,000</b>			<b>1,201,903</b>
	5,729.65 Labor hours									
<b>5.500</b>	<b>Structural Steel</b>									
n	50 Comp Suppts, Walkways, Ladders	3.00	LS	71,160.78 /LS	213,482	-	-	-	-	262,982
	<b>Structural Steel</b>				<b>213,482</b>					<b>262,982</b>
	1,940.043 Labor hours									
	<b>Civil</b>				<b>2,337,579</b>		<b>655,000</b>	<b>0</b>	<b>0</b>	<b>3,172,209</b>
	23,720.025 Labor hours									
<b>6.000</b>	<b>Cut, Bevel, and Weld</b>									
<b>6.002</b>	<b>Cut &amp; Bevel</b>									
	01 1" Cut & Bevel	7.00	EACH	96.223 /EACH	674	-	-	-	-	674
	02 2" Cut & Bevel	14.00	EACH	126.593 /EACH	1,772	-	-	-	-	1,772
	03 3" Cut & Bevel	10.00	EACH	189.90 /EACH	1,899	-	-	-	-	1,899
	06 6" Cut & Bevel	5.00	EACH	379.80 /EACH	1,899	-	-	-	-	1,899
	08 8" Cut & Bevel	5.00	EACH	506.46 /EACH	2,532	-	-	-	-	2,532
	12 12" Cut & Bevel	5.00	EACH	759.622 /EACH	3,798	-	-	-	-	3,798
	16 16" Cut & Bevel	10.00	EACH	1,012.82 /EACH	10,128	-	-	-	-	10,128
	20 20" Cut & Bevel	15.00	EACH	1,164.681 /EACH	17,470	-	-	-	-	17,470
	24 24" Cut & Bevel	10.00	EACH	1,519.254 /EACH	15,193	-	-	-	-	15,193



Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Cut &amp; Bevel</b>			<u>55,365</u>					<u>55,365</u>
	504.79 Labor hours								
<b>6.004</b>	<b>Butt Weld</b>								
01	1" Butt Weld	10.00	EACH	567.111 /EACH		-	-	-	5,671
02	2" Butt Weld	14.00	EACH	603.564 /EACH		-	-	-	8,450
03	3" Butt Weld	7.00	EACH	905.343 /EACH		-	-	-	6,337
06	6" Butt Weld	5.00	EACH	1,810.69 /EACH		-	-	-	9,053
08	8" Butt Weld	5.00	EACH	2,414.254 /EACH		-	-	-	12,071
12	12" Butt Weld	5.00	EACH	3,621.392 /EACH		-	-	-	18,107
16	16" Butt Weld	10.00	EACH	4,828.52 /EACH		-	-	-	48,285
20	20" Butt Weld	15.00	EACH	6,347.30 /EACH		-	-	-	95,209
24	24" Butt Weld	5.00	EACH	7,242.784 /EACH		-	-	-	36,214
	<b>Butt Weld</b>			<u>239,399</u>					<u>239,399</u>
	2,182.701 Labor hours								
	<b>Cut, Bevel, and Weld</b>			<u>294,764</u>		<u>0</u>	<u>0</u>	<u>0</u>	<u>294,764</u>
	2,687.49 Labor hours								
<b>7.000</b>	<b>Rental Equipment</b>								
<b>7.001</b>	<b>Rental Equip. - USA</b>								
0006	Welder - 8 Pack 300 AMP.- Wks	10.00	wks	-	-	-	6,000	-	6,000
0020	Compressor - 300 cfm - Mths	5.00	mths	-	-	-	30,000	-	30,000
0036	Hydraulic Crane - 20 ton - Wks	10.00	wks	-	-	-	22,000	-	22,000
0051	Truck Crane - 140 ton - Wks	2.00	wks	-	-	-	18,000	-	18,000
0096	Gen Set 100 kw - Wks	20.00	wks	-	-	-	30,000	-	30,000
0111	Crawler Excavtr 1.5 cy - Wks	12.00	wks	-	-	-	50,400	-	50,400
0126	Vibratory Roller - Wks	12.00	wks	-	-	-	14,400	-	14,400
0130	Hydro/Vac Trencher	15.00	Day	-	-	-	15,000	-	15,000
0200	Parts Trailer - Day	150.00	Day	-	-	-	52,500	-	52,500
	<b>Rental Equip. - USA</b>						<u>238,300</u>		<u>238,300</u>
	1,320.00 Equipment hours								
	<b>Rental Equipment</b>			<u>0</u>	<u>0</u>	<u>238,300</u>	<u>0</u>	<u>238,300</u>	
	1,320.00 Equipment hours								

## Estimate Totals

Description	Amount	Totals	Hours	Rate	Cost Basis	Cost per Unit	Percent of Total
Labor	7,438,458		68,028.625	ch			38.15%
Material	5,628,285						28.86%
Subcontract	884,382						4.54%
Equipment	238,300		1,320.000	ch			1.22%
Other							
	<u>14,189,425</u>	<u>14,189,425</u>					<u>72.77</u>
MATERIALS					O		
Materials - See Above					O		
-Freight	253,273			4.500 %	C		1.30%
-Sales Tax	450,263			8.000 %	C		2.31%
ENVIRONMENTAL					O		
-Company Labor	10,000				L		0.05%
-Contract Labor	75,000				L		0.38%
-General	25,000				L		0.13%
-Environmental Monitor					L		
-Permits/Auth	5,000				L		0.03%
CONSTRUCTION SUPPORT					O		
-Company & Contract Labor	130,000				L		0.67%
-X-Ray (NDT)	120,000				L		0.62%
-Survey	25,000				L		0.13%
-3rd Party Inspection	675,000				L		3.46%
-Test	40,000				L		0.21%
DISTRICT LABOR AND EQUIPMENT					O		
Company Labor	150,000				L		0.77%
ENGINEERING					O		
-Company Labor	300,000				L		1.54%
-Contract Labor	750,000				L		3.85%
CONTRACT INSTALLATION					O		
Contract Labor - See Above					O		
ROW					O		
-Matls-Construction Damages	25,000				L		0.13%
-Matls-Land-Fee Property	150,000				L		0.77%
-Matls-Land-Easements	5,000				L		0.03%
-Matls-Acquisition Costs	5,000				L		0.03%
-Company Labor	5,000				L		0.03%
-Contract Labor	50,000				L		0.26%
-Lease					L		
-General					L		
OTHER					O		
-Gas Loss					L		
-Quality Inspection					L		
-General					L		
	<u>3,248,536</u>	<u>17,437,961</u>					<u>16.66</u>
Construction Overhead	610,329			3.500 %	T		3.13%
As-Builts Overhead					T		
Software Overhead					T		
AFUDC	<u>523,139</u>			3.000 %	T		<u>2.68%</u>
	<u>1,133,468</u>	<u>18,571,429</u>					<u>5.81</u>
CONTINGENCY	928,571			5.000 %	T		4.76%
	<u>928,571</u>	<u>19,500,000</u>					<u>4.76</u>
<b>Total</b>		<b>19,500,000</b>					

**Sherco Xcel**  
**NBPL Interconnect**

<b>Project name</b>	NBPL Interconnect
<b>Estimator</b>	Pipeline Expansion
<b>Labor rate table</b>	IL,MI,MN,WI
<b>Equipment rate table</b>	DOMESTIC
<b>Estimate Level</b>	B
<b>Estimate +/-</b>	15 %
<b>Revision #</b>	1
<b>Revision Date</b>	9/18/2020
<b>State</b>	Minnesota
<b>Notes</b>	<p>Scope:</p> <p>Interconnect will be a single run consisting of a 12" V250 control valve, ultrasonic meter and T-strainer. The interconnect will tie-in to the 135 mile, 20" lateral</p> <p>Comparables:</p> <p>- 01105737: Hazel NBPL Interconnect (This 2015 Northern Border built interconnect was used to determine the premium Northern Border charges for their interconnects)</p> <p>- 01122823: Bakersfield Oasis Interconnect (This estimate was used as a baseline I/C cost)</p> <p>-02098584: Fasken Interconnect (This 2013 NNG built interconnect was used to determine the premium Northern Border charges for their interconnects)</p> <p>Northern obtained a cost September 2018 for an unrelated 4" interconnect from NBPL quoted at \$3.34m. This further supports the large premium charged by NBPL</p> <p>Assumptions:</p> <p>- 12" interconnect sufficient for assumed flow requirements</p> <p>- Interconnect built by Northern Border</p>
<b>Report format</b>	Sorted by 'Group phase/Phase' 'Detail' summary

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
1.100	P/L Material								
1.199	Misc Pipeline Materials								
99	12' Interconnect (Comparable Northern build)	1.00 Is	0.00	0	0.00	0	-	1,203,847	1,203,847
99	Northern Border Interconnect premium	1.00 Is	0.00	0	0.00	0	-	1,450,745	1,450,745
	Misc Pipeline Materials							2,654,592	2,654,592
	P/L Material			0		0	0	2,654,592	2,654,592

## Estimate Totals

Description	Amount	Totals	Rate
Labor			
Material			
Subcontract			
Equipment			
Other	<u>2,654,592</u>		
	2,654,592	2,654,592	
LABOR			
Labor - See Above			
Labor Tax			
MATERIALS			
Materials - See Above			
Freight and Sales Tax			12.500 %
Contractor Escalation			
ENVIRONMENTAL			
General Expense			
Permits/Auth.			
Construction Monitoring			
CONSTRUCTION SUPPORT			
Company Labor			
Contract Labor			
X-Ray (NDT)			
Survey			
3rd Party Inspection			
Test			
DISTRICT LABOR AND EQUIPMENT			
Company Labor			
ENGINEERING			
Company Labor (Engr)			
Contract Labor (Design)			
As-Builts			
CONTRACT INSTALLATION			
Contract Labor - See Above			
ROW			
Real Property Purchase			
Right-of Way			
Damages, Services, & Other			
OTHER			
Other General			
Gas Loss			
Quality Inspection			
		2,654,592	
CONTINGENCY	<u>132,730</u>		5.000 %
	132,730	2,787,322	
ESCALATION	<u>44,597</u>		1.600 %
	44,597	2,831,919	
OVERHEAD	<u>99,117</u>		3.500 %
	99,117	2,931,036	
AFUDC	<u>58,621</u>		2.000 %
	58,621	2,989,657	
<b>Total</b>		<b>2,989,657</b>	

**Sherco Xcel  
Meter Station**

<b>Project name</b>	Sherco Meter Station
<b>Estimator</b>	Pipeline Expansion
<b>Labor rate table</b>	IL,MI,MN,WI
<b>Equipment rate table</b>	DOMESTIC
<b>Estimate Level</b>	B
<b>Estimate +/-</b>	15 %
<b>Revision #</b>	1
<b>Revision Date</b>	9/18/2020
<b>State</b>	Minnesota
<b>Notes</b>	<p>Scope:</p> <p>Regulated delivery station will consist of 12" piping with two 6" V260A control valves and a single run 16" ultrasonic meter with EFM. The meter station will tie-in at the Sherco facility.</p> <p>Design Conditions:</p> <p>Scenario 1:</p> <ul style="list-style-type: none"><li>- Min Inlet: 660 psig</li><li>- Delivery Pressure: 560 psig</li><li>- Max Flow: 156,000 Mcfh</li></ul> <p>Scenario 2:</p> <ul style="list-style-type: none"><li>- Min Inlet: 865 psig</li><li>- Delivery Pressure: 765 psig</li><li>- Max Flow: 180,000 Mcfh</li></ul> <p>Comparables:</p> <ul style="list-style-type: none"><li>- 01115962: Oasis Waha I/C Meter Upgrade</li><li>- 01105737: Hazel NBPL Interconnect</li><li>- 01122823: Bakersfield Oasis Interconnect</li><li>- 01137435: SSC Yard Mods</li></ul> <p>Assumptions:</p> <ul style="list-style-type: none"><li>- No ROW required. TBS will be built on existing Sherco facility</li><li>- No lateral is included to get from TBS to Sherco tie-in</li><li>- 12" piping sufficient for flow requirements of both Scenarios.</li></ul>
<b>Report format</b>	Sorted by 'Group phase/Phase' 'Detail' summary

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>2.700</b>	<b>Process Piping</b>									
<b>2.704</b>	<b>Pipe XS, Gr B</b>									
10	10" Station Pipe .500wt Gr B	65.00	FEET	129.261 /FEET	8,402	74.00 /FEET	4,810	-	-	13,212
12	12" Station Pipe .500wt Gr B	100.00	FEET	152.763 /FEET	15,276	108.04 /FEET	10,804	-	-	26,080
20	20" Station Pipe .500wt Gr B	200.00	FEET	246.771 /FEET	49,354	83.00 /FEET	16,600	-	-	65,954
	<b>Pipe XS, Gr B</b>				<b>73,032</b>		<b>32,214</b>			<b>105,246</b>
	621.50 Labor hours									
	<b>Process Piping</b>				<b>73,032</b>		<b>32,214</b>	<b>0</b>	<b>0</b>	<b>105,246</b>
	621.50 Labor hours									
<b>3.100</b>	<b>150# ANSI Class</b>									
<b>3.118</b>	<b>Control Valves</b>									
fv12	6" Fisher V260A	2.00	EACH	14,999.98 /EACH	30,000	75,000.00 /EACH	150,000	-	-	180,000
	<b>Control Valves</b>				<b>30,000</b>		<b>150,000</b>			<b>180,000</b>
	255.30 Labor hours									
	<b>150# ANSI Class</b>				<b>30,000</b>		<b>150,000</b>	<b>0</b>	<b>0</b>	<b>180,000</b>
	255.30 Labor hours									
<b>3.300</b>	<b>600# ANSI Class</b>									
<b>3.316</b>	<b>Ultrasonic Flow Meters</b>									
n	0210 16" Spool 2 path UltraSonic Me	1.00	EACH	1,880.16 /EACH	1,880	160,000.00 /EACH	160,000	-	-	161,880
	<b>Ultrasonic Flow Meters</b>				<b>1,880</b>		<b>160,000</b>			<b>161,880</b>
	16.00 Labor hours									
<b>3.320</b>	<b>Ball Valves - Flange End</b>									
10	10" 600# Ball Valve FE	3.00	EACH	1,621.64 /EACH	4,865	10,000.00 /EACH	30,000	-	-	34,865
20	20" 600# Ball Valve FE	1.00	EACH	3,055.26 /EACH	3,055	20,000.00 /EACH	20,000	-	-	23,055
	<b>Ball Valves - Flange End</b>				<b>7,920</b>		<b>50,000</b>			<b>57,920</b>
	67.400 Labor hours									
<b>3.322</b>	<b>Ball Valves - Weld End</b>									
20	20" 600# Ball Valve WE	1.00	EACH	4,112.850 /EACH	4,113	20,000.00 /EACH	20,000	-	-	24,113
	<b>Ball Valves - Weld End</b>				<b>4,113</b>		<b>20,000</b>			<b>24,113</b>
	35.00 Labor hours									
<b>3.323</b>	<b>Ball Valves - Flg x WE</b>									
20	20" 600# Ball Valve Flg x WE	3.00	EACH	2,820.24 /EACH	8,461	20,000.00 /EACH	60,000	-	-	68,461
	<b>Ball Valves - Flg x WE</b>				<b>8,461</b>		<b>60,000</b>			<b>68,461</b>
	72.000 Labor hours									
<b>3.327</b>	<b>Plug Valves - Flg x WE</b>									
10	10" 600# Plug Valve Flg x WE	8.00	EACH	1,927.164 /EACH	15,417	7,376.27 /EACH	59,010	-	-	74,427





Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
<b>4.200</b>	<b>Small Valves &amp; Fittings</b>									
<b>4.214</b>	<b>Needle Valves, NPT</b>									
08	1" Needle Valve NPT	4.00	EACH	112.81 /EACH	451	121.00 /EACH	484	-	-	935
	<b>Needle Valves, NPT</b>				<b>451</b>		<b>484</b>			<b>935</b>
	3.84 Labor hours									
<b>4.216</b>	<b>Plug Valves, NPT</b>									
08	1" Plug Valve NPT	16.00	EACH	112.81 /EACH	1,805	315.00 /EACH	5,040	-	-	6,845
	<b>Plug Valves, NPT</b>				<b>1,805</b>		<b>5,040</b>			<b>6,845</b>
	15.36 Labor hours									
<b>4.220</b>	<b>Plugs, NPT</b>									
08	1" Plug NPT	16.00	EACH	25.853 /EACH	414	2.81 /EACH	45	-	-	459
	<b>Plugs, NPT</b>				<b>414</b>		<b>45</b>			<b>459</b>
	3.52 Labor hours									
<b>4.224</b>	<b>Couplings, NPT</b>									
08	1" Coupling NPT	16.00	EACH	21.152 /EACH	338	1.48 /EACH	24	-	-	362
	<b>Couplings, NPT</b>				<b>338</b>		<b>24</b>			<b>362</b>
	2.88 Labor hours									
<b>4.240</b>	<b>Nipples, NPT x BBE</b>									
1003	1" x 3" Nipple STD B-GR NPT	16.00	EACH	58.76 /EACH	940	2.55 /EACH	41	-	-	981
	<b>Nipples, NPT x BBE</b>				<b>940</b>		<b>41</b>			<b>981</b>
	8.00 Labor hours									
	<b>Small Valves &amp; Fittings</b>				<b>3,948</b>		<b>5,633</b>	<b>0</b>	<b>0</b>	<b>9,582</b>
	33.60 Labor hours									
<b>4.300</b>	<b>Miscellaneous Mechanical</b>									
<b>4.306</b>	<b>Adjustable Pipe Supports</b>									
12	12" Adjustable Pipe Support	6.00	EACH	716.812 /EACH	4,301	276.470 /EACH	1,659	-	-	5,960
20	20" Adjustable Pipe Support	2.00	EACH	1,022.34 /EACH	2,045	450.00 /EACH	900	-	-	2,945
	<b>Adjustable Pipe Supports</b>				<b>6,346</b>		<b>2,559</b>			<b>8,904</b>
	54.00 Labor hours									
<b>4.310</b>	<b>Hydrotesting</b>									
01	Hydrotest (LS)	1.00	LS	15,000.03 /LS	15,000	-	-	-	-	15,000
	<b>Hydrotesting</b>				<b>15,000</b>					<b>15,000</b>
	127.65 Labor hours									
<b>4.312</b>	<b>Painting</b>									
01	Prep & Paint (LS)	1.00	LS	11,499.97 /LS	11,500	-	-	-	-	11,500
	<b>Painting</b>				<b>11,500</b>					<b>11,500</b>
	106.66 Labor hours									
<b>4.314</b>	<b>Contractor Mobilization</b>									
02	Contractor Move in / out	1.00	LS	50,000.00 /LS	50,000	-	-	-	-	50,000

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Contractor Mobilization</b>				50,000					50,000
	438.943 Labor hours									
	<b>Miscellaneous Mechanical</b>				82,846		2,559	0	0	85,404
	727.251 Labor hours									
<b>4.400</b>	<b>Instrumentation</b>									
<b>4.405</b>	<b>Flow Computer/RTU</b>									
n	01 Fisher ROC 809	1.00	EA	399.85 /EA	400	7,350.00 /EA	7,350	-	-	7,750
	13 RTU to Laptop Cable	1.00	EA	-	-	124.00 /EA	124	-	-	124
	<b>Flow Computer/RTU</b>				400		7,474			7,874
	3.20 Labor hours									
<b>4.406</b>	<b>FlowComputer/RTU</b>									
	01 Analog/Digital I/O Transient Protector	7.00	EA	44.983 /EA	315	145.00 /EA	1,015	-	-	1,330
	04 Modem Transient Protector	1.00	EA	31.24 /EA	31	258.00 /EA	258	-	-	289
	07 120 VAC Transient Protector	1.00	EA	137.45 /EA	137	173.00 /EA	173	-	-	310
	<b>FlowComputer/RTU</b>				484		1,446			1,930
	3.87 Labor hours									
<b>4.407</b>	<b>Transmitters</b>									
	01 Temp. Transmitter (HART) w/Sensor & TW	1.00	EA	299.88 /EA	300	604.00 /EA	604	-	-	904
	07 Pressure Transmitter (HART) w/Manifold	1.00	EA	299.88 /EA	300	1,250.00 /EA	1,250	-	-	1,550
	19 Tri-loop Transmitter	1.00	EA	162.44 /EA	162	494.00 /EA	494	-	-	656
	<b>Transmitters</b>				762		2,348			3,110
	6.10 Labor hours									
<b>4.416</b>	<b>Controllers (PID)</b>									
n	01 Electronic 1-loop	1.00	EA	262.40 /EA	262	446.00 /EA	446	-	-	708
	<b>Controllers (PID)</b>				262		446			708
	2.10 Labor hours									
	<b>Instrumentation</b>				1,908		11,714	0	0	13,622
	15.27 Labor hours									
<b>4.500</b>	<b>Electrical</b>									
<b>4.502</b>	<b>Cable - Control</b>									
	01 1/C #14 Cable THWN	500.00	FT	0.73 /FT	365	-	-	-	-	405
	04 1/C #16 Cable THWN	500.00	FT	0.851 /FT	425	-	-	-	-	466
	<b>Cable - Control</b>				790					872
	6.50 Labor hours									
<b>4.504</b>	<b>Cable - Power, 600 Volt</b>									
	04 1/C #12/THWN	1,000.00	FT	0.851 /FT	851	-	-	-	-	977
	13 1/C #6/XHHW	300.00	FT	1.34 /FT	401	-	-	-	-	620
	<b>Cable - Power, 600 Volt</b>				1,252					1,597
	10.30 Labor hours									
<b>4.507</b>	<b>Cable - Grounding</b>									
	01 1/C #6 Type "CP" Cable	100.00	FT	1.34 /FT	134	-	-	-	-	211
	04 1/C #2 Type "CP" Cable	200.00	FT	1.58 /FT	316	-	-	-	-	697

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Cable - Grounding</b>				<u>450</u>					<u>908</u>
	3.70 Labor hours									
<b>4.509</b>	<b>Termination - Wire/Cable</b>									
n	01 Terminate #10 - #18	150.00	EA	30.383 /EA	4,557	-	-	-	-	4,596
n	04 Terminate #8 - #2	16.00	EA	42.54 /EA	681	-	-	-	-	690
	<b>Termination - Wire/Cable</b>				<u>5,238</u>					<u>5,286</u>
	43.10 Labor hours									
<b>4.520</b>	<b>GRC Conduit</b>									
	07 1" GRC Conduit	200.00	FT	6.08 /FT	1,215	-	-	-	-	1,648
	<b>GRC Conduit</b>				<u>1,215</u>					<u>1,648</u>
	10.00 Labor hours									
<b>4.522</b>	<b>PVC Coated GRC Conduit</b>									
	04 1" 40 Mil poly-coated GRC Conduit	300.00	FT	6.684 /FT	2,005	-	-	-	-	3,448
	<b>PVC Coated GRC Conduit</b>				<u>2,005</u>					<u>3,448</u>
	16.50 Labor hours									
<b>4.524</b>	<b>PVC Conduit</b>									
	04 1" PVC Conduit	100.00	FT	4.132 /FT	413	-	-	-	-	446
	<b>PVC Conduit</b>				<u>413</u>					<u>446</u>
	3.40 Labor hours									
<b>4.526</b>	<b>Conduit &amp; Wire Misc</b>									
	10 6" Conduit Nipples <1"	12.00	EA	41.93 /EA	503	-	-	-	-	563
	<b>Conduit &amp; Wire Misc</b>				<u>503</u>					<u>563</u>
	4.14 Labor hours									
<b>4.528</b>	<b>Trenching &amp; Other Serv.</b>									
n	04 Hand Trenching - 18" Deep	200.00	FT	25.522 /FT	5,104	-	-	-	-	5,104
n	07 Mechanical Backfill	80.00	FT	4.861 /FT	389	-	-	-	-	389
n	10 Hydrovacuum Truck - Large	10.00	DAY	-	-	-	-	-	-	39,000
	13 Backfill Soil (tested & hauled)	4.00	CYD	-	-	-	-	-	-	508
	<b>Trenching &amp; Other Serv.</b>				<u>5,493</u>					<u>45,001</u>
	45.20 Labor hours									
<b>4.530</b>	<b>Conduit Make-up Box Ftg.</b>									
n	07 1" Condulet, 1-4 Hubs	30.00	EA	63.20 /EA	1,896	-	-	-	-	3,408
	<b>Conduit Make-up Box Ftg.</b>				<u>1,896</u>					<u>3,408</u>
	15.60 Labor hours									
<b>4.532</b>	<b>Elbow Fittings</b>									
	04 1" LBY Conduit Elbow Fitting	30.00	EA	30.383 /EA	911	-	-	-	-	1,561
	<b>Elbow Fittings</b>				<u>911</u>					<u>1,561</u>
	7.50 Labor hours									
<b>4.534</b>	<b>Conduit Seals</b>									
n	07 1" EYS Conduit Seal	20.00	EA	102.09 /EA	2,042	-	-	-	-	2,517
	<b>Conduit Seals</b>				<u>2,042</u>					<u>2,517</u>
	16.80 Labor hours									
<b>4.536</b>	<b>Conduit Unions</b>									
	07 1" UNY Conduit Union	20.00	EA	43.751 /EA	875	-	-	-	-	1,394

Item	Description	Takeoff Qty		Labor		Material		Equipment	Other	Total
				Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	<b>Conduit Unions</b>				<u>875</u>					<u>1,394</u>
	7.20 Labor hours									
4.539	<b>Sealtite Flex. Connection</b>									
n	07 1" Sealtite Flex Connection	7.00	EA	90.18 /EA	<u>631</u>	-	-	-	-	<u>913</u>
	<b>Sealtite Flex. Connection</b>				<u>631</u>					<u>913</u>
	5.194 Labor hours									
4.540	<b>Grounding Equipment</b>									
	01 Packaged Zinc Anode w/50 ft Lead	4.00	EA	145.84 /EA	583	-	-	-	-	1,087
	04 Small Ground Box	2.00	EA	218.76 /EA	438	-	-	-	-	1,204
	10 Cadweld Connection	6.00	EA	133.683 /EA	802	-	-	-	-	943
	16 Grounding Clamp	2.00	EA	34.03 /EA	68	-	-	-	-	94
n	19 Auger 12" x 72" hole	4.00	EA	89.933 /EA	360	-	-	-	-	360
	25 PCR	1.00	EA	303.83 /EA	<u>304</u>	1,973.00 /EA	<u>1,973</u>	-	-	<u>2,277</u>
	<b>Grounding Equipment</b>				<u>2,555</u>		<u>1,973</u>			<u>5,965</u>
	21.02 Labor hours									
4.542	<b>Junction Boxes</b>									
	01 16 x 16 Stainless Steel NEMA #4	2.00	EA	121.53 /EA	243	1,100.00 /EA	2,200	-	-	3,462
	04 24 x 30 Stainless Steel NEMA #4	1.00	EA	206.60 /EA	<u>207</u>	1,800.00 /EA	<u>1,800</u>	-	-	<u>2,852</u>
	<b>Junction Boxes</b>				<u>450</u>		<u>4,000</u>			<u>6,313</u>
	3.70 Labor hours									
4.660	<b>Power Transmission Lines</b>									
	01 Mobilization (Small Job) 2 Persons	1.00	EA	5,000.03 /EA	5,000	-	-	-	-	5,000
	01 Connecting Utility Phone and Power	1.00	EA	3,499.97 /EA	<u>3,500</u>	-	-	-	-	<u>3,500</u>
	<b>Power Transmission Lines</b>				<u>8,500</u>					<u>8,500</u>
	69.941 Labor hours									
	<b>Electrical</b>				<u>35,219</u>		<u>5,973</u>	<u>0</u>	<u>0</u>	<u>90,340</u>
	289.80 Labor hours									
4.700	<b>Automation Systems</b>									
4.717	<b>System Integration</b>									
n	112 Startup & Commission	24.00	HR	110.00 /HR	<u>2,640</u>	-	-	-	-	<u>2,640</u>
	<b>System Integration</b>				<u>2,640</u>					<u>2,640</u>
	24.00 Labor hours									
	<b>Automation Systems</b>				<u>2,640</u>		<u>0</u>	<u>0</u>	<u>0</u>	<u>2,640</u>
	24.00 Labor hours									
5.000	<b>Civil</b>									
5.210	<b>Piers/Piling &amp; Anch. Blk.</b>									
	04 Concrete - Pipe Piers	7.50	CY	697.70 /CY	<u>5,233</u>	-	-	-	-	<u>6,433</u>
	<b>Piers/Piling &amp; Anch. Blk.</b>				<u>5,233</u>					<u>6,433</u>
	51.96 Labor hours									
5.310	<b>Fencing &amp; Guardrails</b>									
f08c	8' Chain Link Fence	300.00	FEET	-	-	-	-	-	-	10,500

Item	Description	Takeoff Qty	Labor		Material		Equipment	Other	Total
			Unit Cost	Amount	Unit Cost	Amount	Amount	Amount	Amount
	Fencing & Guardrails								10,500
5.340	Gates								
g01w	Walk Gates	8.00	FEET	-	-	-	-	-	600
g02w	Drive Gates	32.00	FEET	-	-	-	-	-	960
	Gates								1,560
5.400	Buildings								
	200 EFM Building	1.00	EACH	10,000.00 /EACH	10,000	85,000.00 /EACH	85,000	-	95,000
ss 1	8x10x7 Eq Sunshade Open Sides	2.00	EACH	1,298.160 /EACH	2,596	15,000.00 /EACH	30,000	-	32,596
	Buildings				12,596		115,000		127,596
	24.00 Labor hours								
	Civil				17,829		115,000	0	146,089
	75.96 Labor hours								

## Estimate Totals

Description	Amount	Totals	Rate
Labor	477,888		
Material	733,958		
Subcontract	62,408		
Equipment			
Other			
	<u>1,274,254</u>	<u>1,274,254</u>	
LABOR			
Labor - See Above			
Labor Tax			
MATERIALS			
Materials - See Above			
Freight and Sales Tax	91,745		12.500 %
Contractor Escalation			
ENVIRONMENTAL			
General Expense	15,000		
Permits/Auth.	5,000		
Construction Monitoring	45,000		
CONSTRUCTION SUPPORT			
Company Labor	15,000		
Contract Labor			
X-Ray (NDT)	15,000		
Survey	5,000		
3rd Party Inspection	150,000		
Test			
DISTRICT LABOR AND EQUIPMENT			
Company Labor	20,000		
ENGINEERING			
Company Labor (Engr)	25,000		
Contract Labor (Design)	35,000		
As-Builts	5,000		
CONTRACT INSTALLATION			
Contract Labor - See Above			
ROW			
Real Property Purchase			
Right-of Way			
Damages, Services, & Other			
OTHER			
Other General			
Gas Loss			
Quality Inspection			
	<u>426,745</u>	<u>1,700,999</u>	
CONTINGENCY	<u>85,050</u>		5.000 %
	<u>85,050</u>	<u>1,786,049</u>	
ESCALATION	<u>28,577</u>		1.600 %
	<u>28,577</u>	<u>1,814,626</u>	
OVERHEAD	<u>63,512</u>		3.500 %
	<u>63,512</u>	<u>1,878,138</u>	
AFUDC	<u>37,563</u>		2.000 %
	<u>37,563</u>	<u>1,915,701</u>	
<b>Total</b>		<b>1,915,701</b>	

## Appendix C

### Comparable Project Details

### Comparable Project Details

Owner/Operator			Project Location & Details				Actual Costs				Actual Costs (2020\$)		Noramalized Actual Costs (2020\$)			
													20-inch		24-inch	
No.	Project Name	Pipeline Operator Name	Year	State(s)	Miles	Dia. (In.)	Total Cost \$m	Total Cost \$/mi	Labor Cost \$m	Labor Cost \$/mi	Total Cost \$/in*mi	Labor Cost \$/in*mi	Total Cost \$/mi	Labor Cost \$/mi	Total Cost \$/mi	Labor Cost \$/mi
1	Southeast Market Expansion	Gulf South Pipeline Company	2014	AL, MS	42	30	193.4	2.76	112.8	1.61	107,221	64,110	2,144,420	1,282,195	2,573,304	1,538,634
					28	24										
					70	27.6										
2	Ft. Lupton to Cherokee	Xcel Energy	2014	CO	34	24	110	3.24			145,993		2,919,860		3,503,832	
3	West Side Expansion Project	National Fuel Gas Supply Company	2015	PA	23	24	69.8	3.03	42.2	1.83	138,163	85,507	2,763,260	1,710,145	3,315,912	2,052,174
4	Virginia Southside Expansion Project	Transcontinental Gas Pipeline	2015	NC, NJ, VA	98	24	245.5	2.51	124.2	1.27	113,344	59,056	2,266,880	1,181,122	2,720,256	1,417,347
5	Carty Lateral Project	Gas Transmission Northwest	2016	OR	24.3	20	54.5	2.24	28.4	1.17	123,428	66,667	2,468,560	1,333,333	2,962,272	1,600,000
6	Western Kentucky Lateral Project	Texas Gas Transmission, LLC	2016	KY	22.5	24	66.1	2.94	45.8	2.04	137,716	96,852	2,754,320	1,937,037	3,305,184	2,324,444
7	West Central Lateral	We Energies	2016	WI	40.2	16	70	1.74			122,489		2,449,780		2,939,736	
8	Rochester Lateral	Northern Natural Gas	2019	MN	12.5	16	41.6	3.33	25.9	2.07	211,326	131,513	4,226,520	2,630,260	5,071,824	3,156,312
9	Rockford to Buffalo Lateral	Northern Natural Gas	2019	MN	10.1	24	48.2	4.77	27.5	2.72	202,087	115,387	4,041,740	2,307,740	4,850,088	2,769,288
Average Comparable Project					37.18	22.18	99.90	2.69	58.1	1.56	144,641	88,442	2,892,816	1,768,833	3,471,379	2,122,600
Northern's Estimate					134.50	20	387.6	2.88	208.3	1.55	144,104	77,417	2,882,080	1,548,340		
					134.50	24	458.5	3.41	257.8	1.92	142,053	79,883			3,409,272	1,917,192

• Normalized total project costs averaged \$2.89m per mile for 20-inch and \$3.47m per mile for 24-inch. Northern estimated \$2.88m per mile for 20-inch and \$3.41m per mile for 24-inch pipeline lateral costs.

• Normalized labor costs averaged \$1.77m per mile for 20-inch and \$2.12m per mile for 24-inch. Northern estimated \$1.55m per mile for 20-inch and \$1.92m per mile for 24-inch.

• Reference page 12 of this document for additional information on these comparable projects.



Comparable Compressor Station Project Details								
Owner/Operator			Project Location		Actual Costs (\$m)	2020 Costs (\$m)	Cost (\$/hp)	Project Details
No.	Project Name	Pipeline Operator Name	Year	State(s)				
1	Rock Springs Expansion	Transcontinental Gas Pipeline	2015	MD, PA	28.4	31.5	7,875	4000 hp electric compressor
2	LP Keys Energy	Dominion Cove Point LNG	2015	MD, VA	29.6	32.8	5,466	6000 hp electric compressor
3	Homer Compressor Station <sup>2</sup>	Northern Natural Gas	2014	NE	33.5	37.7	3,968	Four 2375 hp CAT compressors.
4	St. Charles Parish Expansion	Gulf South Pipeline	2017	LA	39.0	42.0	8,400	Two 2500 hp CAT compressors.
5	West Side Expansion and Modernization	National Fuel Gas Supply	2015	PA	11.2	12.4	3,352	3,550 hp compressor at existing facility.
6	Majorsville Compressor 3	Rover Pipeline	2017	WV	11.9	12.8	3,521	3550 hp reciprocating compressor at existing facility.
Average (new station)							6,427 <sup>3</sup>	
Average (additional unit)							3,437	
Northern's Estimate (full redundancy)						26.5	7,464	Two 1,775 hp CAT compressor (\$7.0m included for second unit).
Northern's Estimate (additional unit)						7.0		See risk section for more details.
Northern's Estimate (single unit)						19.5		One 1,775 hp CAT compressor.

<sup>2</sup> Note that this project captures the savings from Northern's experienced engineering resources and vast compressor station experiences. Compressor stations designed by third-party engineering are likely to incur significantly higher costs. Additionally, this project benefited from a favorable installation bid that led to lower than average costs for Northern compressor stations.

<sup>3</sup> Numbers 5 and 6 were omitted in the average, but shown for comparison when installing a new unit at an existing station.

## Appendix D

### Global Insight Escalation Rates Excerpt

### Cost Trends of Compressor Station Construction<sup>4</sup>

Based on Historical Actual Trends										Forecast of Future Annual Trends					
2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
1.5	2.1	1.4	2.0	1.4	1.2	1.7	3.7	2.8	1.1	0.7	1.5	2.0	2.3	2.2	2.1

### Cost Trends of Pipeline Construction<sup>4</sup>

Based on Historical Actual Trends										Forecast of Future Annual Trends					
2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
3.2	2.6	-1.5	6.8	-1.8	-2.0	5.2	7.3	2.3	-0.6	-0.3	3.1	2.8	2.3	2.7	3.1

<sup>4</sup> Second Quarter 2020 Publication. IHS Global Insight provides a comprehensive economic analysis of the pipeline construction industry through a combination of expertise, models, data and software within a common analytical framework. Global Insight is recognized as the most consistently accurate forecasting company in the world, with over 3,800 clients and revenues in excess of \$95.0m. Rates for years 2011-2019 are based on actual market trends, whereas 2020-2026 are forecasted.

## Appendix E

### Engineering and Inspection Details

Engineering and Inspection Comparison										
Project	Year	Diameter	Length (miles)	Total Project Cost	Combined Engineering & Inspection	Percentage	Engineering	Percentage	Inspection	Percentage
Dalton Expansion	2017	16, 20, 24, 30	111.2	\$468,809,578.00	\$49,208,080.00	10.50%				
Virginia Southside	2015	24	98	\$245,451,509.00	\$20,351,784.00	8.29%				
Phase VIII Expansion	2011	20, 24, 30, 36, 42	483.2	\$2,484,429,302.00	\$233,526,728.00	9.40%				
Raton 2010 Expansion	2009	16	118.6	\$92,459,090.00	\$6,691,668.00	7.24%				
FL SE Conn	2016	30, 36	126	\$494,603,409.00			\$11,975,591.00	2.42%		
Bison Pipeline	2011	30	302	\$645,900,000.00			\$38,500,000.00	5.96%		
Average			206.5			8.86% <sup>5</sup>		4.19% <sup>6</sup>		4.67% <sup>7</sup>
Greenfield Line		20	134.5	\$387,640,959.00	\$27,871,384.00	7.19% <sup>8</sup>	\$13,141,028.00	3.39% <sup>8</sup>	\$14,730,356.00	3.80% <sup>8</sup>
		24	134.5	\$458,546,672.00	\$30,975,750.00	6.76% <sup>8</sup>	\$14,455,350.00	\$3.15% <sup>8</sup>	\$16,520,400.00	3.60% <sup>8</sup>

Reference page 16 of this document for additional information on engineering and inspection.

<sup>5</sup> The average percentage of combined cost was derived from the four projects that submitted combined engineering and inspection costs.

<sup>6</sup> The average percentage of engineering cost was derived from the two projects that only submitted engineering costs.

<sup>7</sup> The average percentage of inspection cost was extrapolated from the difference in average combined cost and average engineering cost.

<sup>8</sup> Northern analyzed costs for engineering and inspection; costs are very similar to comparable projects researched.

## Appendix F

### Compressor Operations and Maintenance Cost

[illegible]

## Appendix G

### Environmental Impacts



Environmental Factor	Unit	Proposed NBPL Project
<b>Total length</b>	Miles	134.5
New pipeline	Miles	134.5
Loop/Extension pipeline	Miles	0
<b>Total compressor stations</b>		1
Upgraded	Number	0
New	Number	1
Construction ROW <sup>9</sup>	Acres	1,629.8
<b>Total wetlands crossed<sup>10</sup></b>	Miles	6.7
Emergent wetlands	Miles	4.7
Forested/Scrub-shrub wetlands	Miles	1.2
Riverine wetlands	Mile	0.8
Wetland complexes crossed	Number	261
<b>Total waterbodies crossings<sup>11</sup></b>	Number	87
Perennial waterbodies	Number	21
Intermittent waterbodies	Number	27
Public waters	Number	31
Impaired waters	Number	17
<b>Land Use<sup>12</sup></b>		
Developed, high and medium intensity	Acres	1.8
Developed, low and open space	Acres	57.7
Forested land	Acres	36.5
Federal land	Number	1 (BLM parcel)
Tribal-owned land/reservations crossed	Number	0
Federal species with potential to occur	Number	2
Critical habitats for federal species	Number	0
Birds of Conservation Concern	Number	21
MDNR-owned land crossed	Number	3 (MDNR state wildlife management areas)
MDNR state-listed species element occurrences within one mile of proposed centerline	Number	68
MDNR forest stand inventory	Number	4
MDNR sites of biodiversity significance	Number	12
MDNR native plant communities	Number	8
MDNR native prairies	Number	2
MDNR snowmobile trails/hiking trail	Number	6
MDNR state park	Number	1 (Lake Maria State Park)
MDNR wellhead protection areas	Number	1
MDNR Wild and Scenic River	Number	1 (Mississippi River)

<sup>9</sup> Based on 100-foot wide construction corridor

<sup>10</sup> Based on National Wetland Inventory Data

<sup>11</sup> Based on National Hydrograph Data

<sup>12</sup> Based on National Land Cover Database 2016

<b>Environmental Factor</b>	<b>Unit</b>	<b>Proposed NBPL Project</b>
MDNR Wildlife Management area – land cover	Number	8
Conservation easements crossed from MDNR	Number	17 (RIM and CRP)
Regionally Significant Ecological Areas (1 and 2)	Number	13
Conservation easements crossed from PADUS	Number	9 (WRP and BWSR)
County parks	Number	3
NRHP properties within 100 feet of centerline	Number	0
Levees crossed	Number	0
Rusty patched bumble bee high or low potential zones	Number	0
Bedrock within 60 inches of ground surface	Miles	0
FEMA Floodplains crossed (Zones A and AE)	Number	9
Quarries within 0.25 mile	Number	1
“Difficult” waterbody crossing areas (oxbows, poor set ups)	Number	6
Railroads crossed (estimated)	Number	8