GRANITE BRIDGE
By New Hampshire. For New Hampshire.

Liberty Utilities

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April 19, 2019

Via Hand Delivery

Melodie Esterberg, PE - Design Services Chief
New Hampshire Department of Transportation
7 Hazen Drive
Concord, NH 03302-7025

Dear Ms. Esterberg:

Liberty Utilities and the Granite Bridge Project Team are pleased to submit the Granite Bridge Preliminary Conceptual Feasibility Study for your review. This submission consists of:

- Ten (10) Copies of the Granite Bridge Preliminary Conceptual Feasibility Study:
  - Study Narrative
  - Summary of anticipated UAM Exception Requests
  - Pipeline 30% design alignment sheets (Half-Scale)
  - Discussion of Cased vs. Uncased Pipeline Crossings
  - Granite Bridge Pipeline Route Alternative Map

- Three (3) Copies of the Pipeline 30% design alignment sheets (Full-Scale)

Liberty Utilities makes this filing pursuant to RSA 162-R:3. The Company looks forward to the Department's acceptance of this study as sufficiently complete, and its subsequent recommendation that "the proposed project route [is] conceptually feasible within the applicable state-owned transportation right-of-way." RSA 162-R:3, I(c). If any additional information is required to render a determination that the report is sufficiently complete for evaluation, please don't hesitate to contact me or Benjamin Martin, PE at 603-391-3973 or benjaminmartin@vhb.com.

Sincerely,

James Sherrod
Senior Project Manager

Enclosures
Cc: Benjamin Martin, PE
John Tirrell, PE

Liberty Utilities

GRANITE BRIDGE

By New Hampshire. For New Hampshire.

Preliminary Conceptual Feasibility Study

Liberty Utilities – Granite Bridge Project

April 17, 2019

TABLE OF CONTENTS

1. OVERVIEW, PURPOSE, AND NEED 3

2. THE GRANITE BRIDGE PROJECT 4

3. ENERGY INFRASTRUCTURE CORRIDOR 5

4. SITE EVALUATION COMMITTEE PROCESS AND NHDOT COORDINATION 6

5. EVALUATION OF ALTERNATIVES 8

6. CORRIDOR DESCRIPTION / EXISTING CONDITIONS 8

7. GENERAL PIPELINE ROUTING APPROACH 9

8. DESCRIPTION OF PIPELINE DESIGN AND MATERIAL 10

9. PIPELINE CONSTRUCTION MEANS AND METHODS 11

10. PIPELINE DESIGN DETAILS 12

Appendix 1 List of Anticipated U.A.M. Exception Requests

Appendix 2 Pipeline 30% Design Alignment Sheets

Appendix 3 Discussion of Cased Versus Uncased Pipeline Crossings

Appendix 4 Granite Bridge Pipeline Route Alternative Analysis Map

1. OVERVIEW, PURPOSE AND NEED

New Hampshire is currently served by four interstate transmission pipelines that provide natural gas to residents and businesses in the state. One system of pipelines enters the state in Newington and exits in Plaistow. These pipelines, the Joint Facilities of Maritimes & Northeast Pipeline and Portland Natural Gas Transmission System ("PNGTS") (hereby referred to as "Joint Facilities"), have capacity available on them due to a recent upgrade on the PNGTS line. The other pipeline is the Tennessee Gas Pipeline Concord Lateral (hereby referred to as "Concord Lateral"), which enters the state in Pelham and ends in Concord. The Concord Lateral provides natural gas service to Liberty Utilities service territory in southern and central New Hampshire. Liberty Utilities' 92,000 customers, located in 31 communities, depend on the Concord Lateral as the sole source for pipeline natural gas.

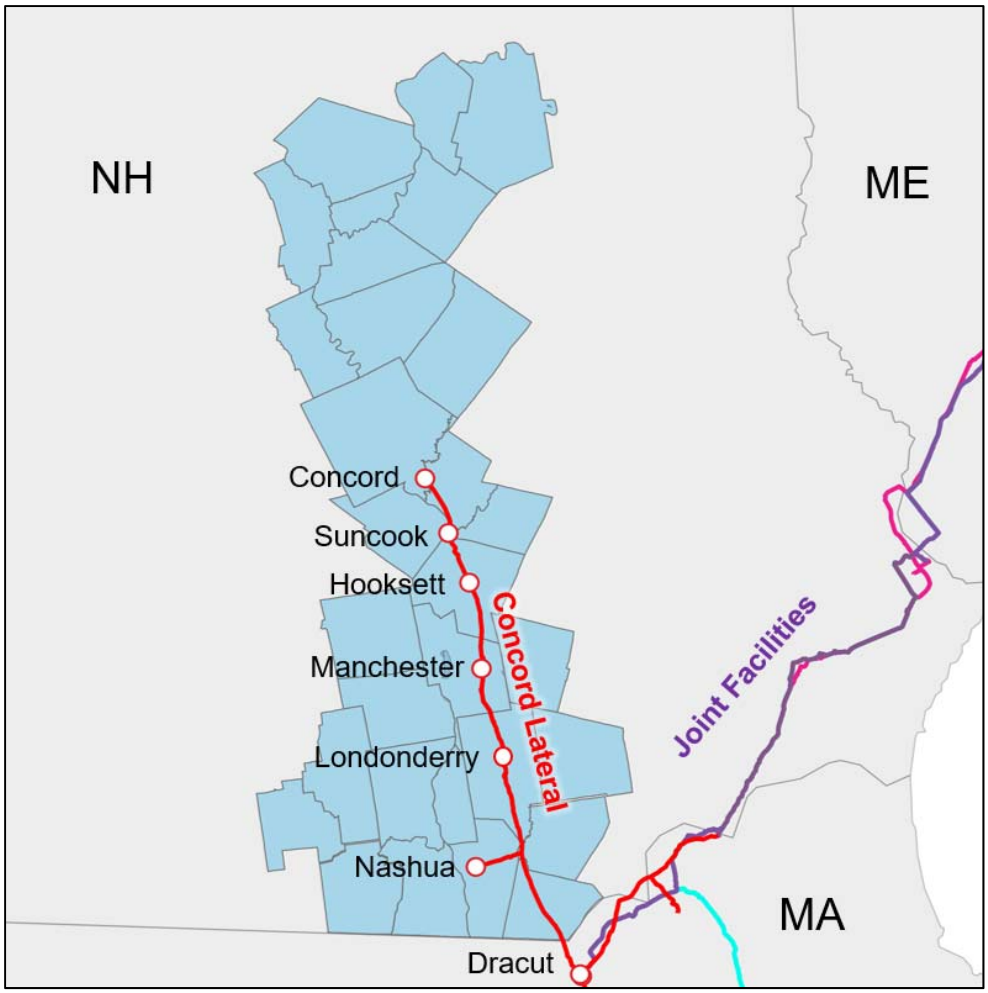


Figure 1: Liberty Utilities - Current Natural Gas Service Area

It is projected that within the next five years, the Concord Lateral's capacity will not be able to support additional natural gas customers in New Hampshire. This threatens to hinder growth, increase heating costs, increase the reliance on other heating fuels, and adversely affect the reliability of service to Liberty's existing customers. The only way for natural gas supply to meet growing demand is to expand the existing natural gas transmission infrastructure, or build new infrastructure to connect to additional supply.

If no action is taken to address the growing natural gas needs of areas served by the Concord Lateral, Liberty Utilities will be forced to impose a moratorium on further natural gas expansion in New

Hampshire. Similar restrictions on new natural gas customer connections have occurred with other New England and New York distribution companies. This moratorium would adversely affect the reliable supply of natural gas to current customers, preclude new customers from utilizing natural gas, and impede economic development in this part of the state.

Liberty Utilities considered several potential supply options to alleviate the current capacity constraint to meet the growing needs of residents and businesses who are seeking a clean and economic heating fuel option.

2. THE GRANITE BRIDGE PROJECT

The Granite Bridge Project ("Granite Bridge" or the "Project") is a local natural gas pipeline and storage project, proposed by Liberty Utilities, which would utilize a designated State Energy Infrastructure Corridor to bring additional natural gas supply to the residents and businesses in southern and central New Hampshire. Granite Bridge would provide long-term access to safe, reliable, clean natural gas to meet the growing needs of Liberty's customers and promote job creation and economic development, while reducing energy costs in New Hampshire.

The Granite Bridge Project consists of two key components: (1) a two billion cubic foot ("Bcf") liquefied natural gas ("LNG") storage facility; and (2) a natural gas transmission line that connects the Joint Facilities and Concord Lateral pipelines.

The proposed Granite Bridge LNG Facility would be located on an approximately 140-acre parcel of land adjacent to New Hampshire Route 101 ("Route 101") in Epping. The facility would provide natural gas price stability and commodity cost savings for customers in New Hampshire. Specifically, the Granite Bridge LNG facility reduces exposure to supply restrictions and price volatility and, as a result, stabilizes energy prices. This is achieved by purchasing natural gas during the off-peak season (summer) when prices are generally lower and storing it in the proposed LNG tank. During peak demand (winter) the stored natural gas is supplied via the Granite Bridge pipeline to meet customer demands. In this way customers benefit by having access to the summer priced LNG storage and avoiding the much higher priced winter period gas supplies. In addition, the location of the LNG tank (i.e., connected to the Granite Bridge Pipeline in Epping) provides Liberty Utilities with access to a supply source should one of its upstream gas supplies experience production or transmission curtailments, further enhancing system reliability.

The proposed Granite Bridge Pipeline consists of approximately 26 miles of 16-inch diameter coated carbon steel pipeline originating at the Joint Facilities Pipeline in Exeter, New Hampshire, and traversing several communities along Route 101 within the New Hampshire Department of Transportation's ("NHDOT") Limited Access Right-of-Way ("LAROW") to connect to the Concord Lateral in Manchester. The Granite Bridge Pipeline would be buried within the NHDOT's LAROW along Route 101 which, in 2016, was designated an Energy Infrastructure Corridor by the NH Legislature (see section 3).

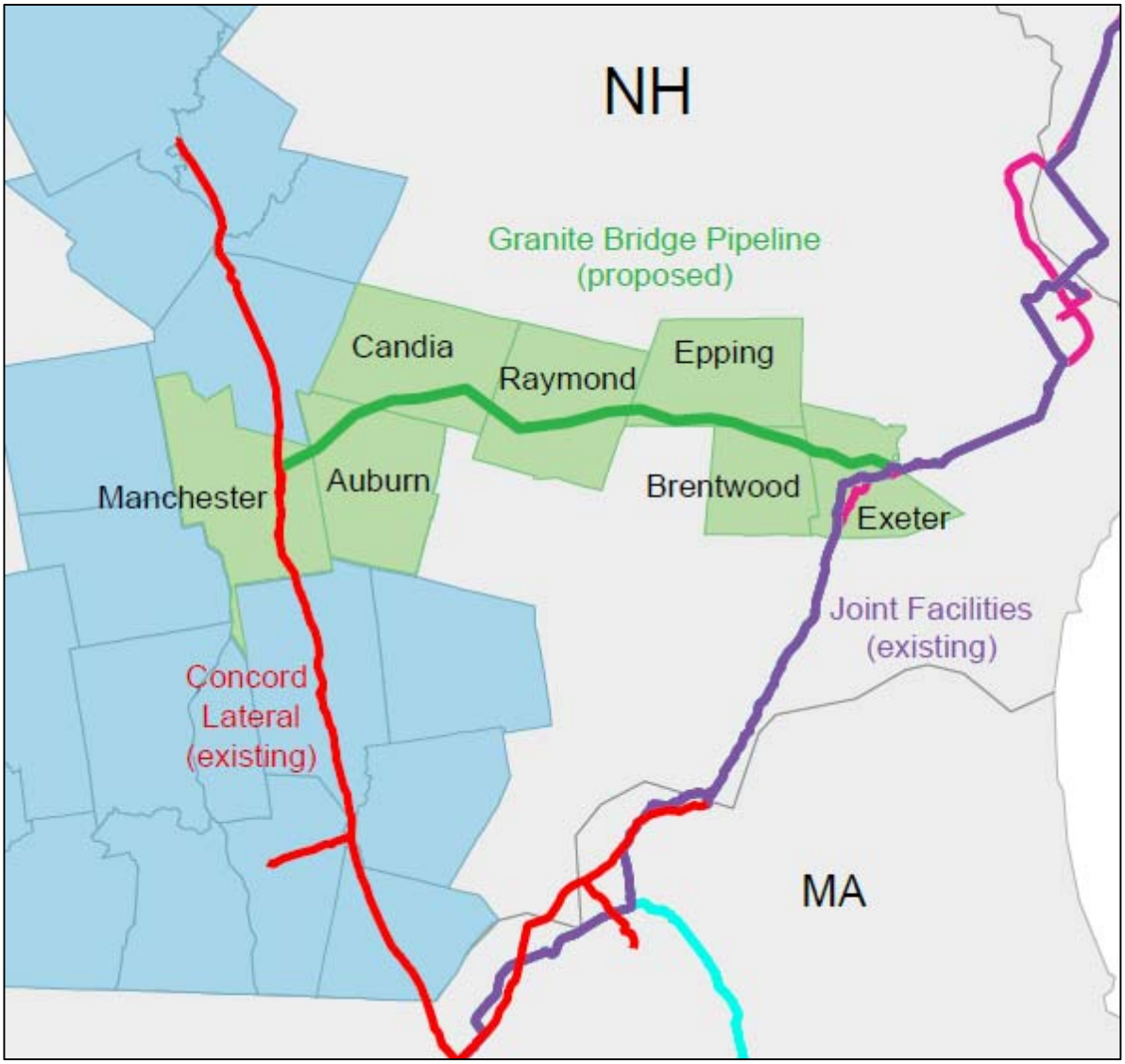


Figure 2: Proposed Granite Bridge Pipeline Map

3. ENERGY INFRASTRUCTURE CORRIDOR

In recent years, there have been several significant energy infrastructure projects proposed in New Hampshire. In an effort to encourage orderly development of energy infrastructure projects and limit private property impacts, the New Hampshire Legislature passed House Bill 626-FN-A in 2016. The bill designated I-89, parts of I-93, I-95, and sections of Route 101 as "Energy Infrastructure Corridors." This designation demonstrates the Legislature's preference for projects to be co-located within these major infrastructure corridors.

The purpose statement of HB 626-FN-A articulated the New Hampshire Legislature's desire to provide an avenue for the development of needed energy infrastructure, while at the same time protecting private property and the state's scenic and natural resources:

> The legislature recognizes that high and volatile energy costs increasingly threaten the competitiveness of New Hampshire's businesses and industries and the financial resources of its electric ratepayers, and that new low-cost sources of energy are needed in order to stabilize and lower wholesale and retail electric rates in New

> Hampshire and New England. At the same time, as the state's citizens have become more aware of the value, to themselves and others, of New Hampshire's scenic natural landscapes, clean air, and unspoiled environment, it has become increasingly difficult to site and develop large-scale above-ground energy transmission lines from lower-cost neighboring regions. Such projects often face unacceptably high development costs, regulatory delays, and public opposition resulting from their potential adverse impacts on the state's most scenic natural landscapes, the value of adjoining and nearby private properties, and the comfort, health, and safety of adjacent homeowners. The general court therefore finds that it may be in the public interest for the state to designate certain "energy infrastructure corridors" along, within, and under major state-owned transportation routes, for the underground collocation of major energy transmission lines necessary to promote balanced economic growth, reduce or mitigate high energy prices, and contribute to a cleaner and more natural environment, while providing the state highway fund with market-based revenues from private energy transmission companies in return for the use of such designated energy infrastructure corridors. The general court intends that the energy infrastructure corridors designated under this act are simply options for the siting of energy infrastructure and nothing in this act shall be construed as limiting the historic accommodation of utilities in all public rights of way.

The Granite Bridge Project would be the first infrastructure project to utilize this new statute by constructing the proposed pipeline within the NHDOT LAROW along Route 101, between Manchester and Exeter. Utilizing this Energy Infrastructure Corridor would reduce private property impacts of the project, minimize the need for Liberty Utilities to acquire easements for the placement of the infrastructure' and help to mitigate environmental and historic resource impacts of the Project (as many areas have been previously disturbed by the construction of the highway).

There are also economic benefits to the state when the Energy Infrastructure Corridor is utilized. The statute requires developers to negotiate with the NHDOT on a value for the use of the state-owned land and provide payment to the state for that use. This fee structure provides revenue to New Hampshire's Highway Fund, which can be used for construction and maintenance of the State's transportation infrastructure.

Finally, locating natural gas infrastructure within a LAROW provides additional safety benefits by reducing the risk of third-party damage to the pipe. Utilities take many steps to avoid third-party damage, including above-ground markers, warning tape, and requirements to call utility locating services (Dig Safe). By constructing infrastructure on limited access state property, areas where unauthorized digging is prohibited, significant protection from third-party damage is realized.

4. SITE EVALUATION COMMITTEE PROCESS AND NHDOT COORDINATION

The New Hampshire Site Evaluation Committee ("SEC") was established in 1990 by the NH State Legislature for the review, approval, monitoring, and enforcement of compliance in the planning, siting, construction, and operation of energy facilities under New Hampshire RSA 162-H. The SEC is a nine-member committee comprised of the heads of various state agencies and two public members. The committee is tasked with the evaluation of energy facilities.

The Granite Bridge Project will be subject to SEC approval and is currently progressing through the early stages of project development to initiate a filling with the SEC. Part of that process is coordinating with NHDOT to determine the feasibility of the pipeline portion of the Project and the use of a designated Energy Infrastructure Corridor.

The Energy Infrastructure Corridor legislation, discussed above, defines a process for Liberty Utilities to solicit feedback on the project from NHDOT as part of the SEC filing process. The following summarizes the general coordination process of the Conceptual Study Phase of the proposal:

1. The Developer, in this case Liberty Utilities, presents the concept to NHDOT as a potential project that will use the Energy Infrastructure Corridor.
2. The Developer submits a Preliminary Conceptual Feasibility Study (proposal) to NHDOT containing project information and preliminary design plans.
3. NHDOT determines, within 30 days, if the Feasibility Study is sufficiently complete to evaluate the proposal (or specifies what is needed for it to be considered sufficiently complete).
4. Once the proposal is accepted as sufficiently complete, the NHDOT will review the proposal for general conformance with department policies to determine if the proposal is feasible and could be permitted.
5. NHDOT provides a report on conceptual feasibility to the SEC, specifying any concerns or issues the committee should consider in its review. This report is provided within 60 days of the determination that the Feasibility Study is sufficiently complete (Step 3, above).

Liberty Utilities and the Granite Bridge Project Team engaged NHDOT early in the design process and have been working closely to develop preliminary pipeline routing. In taking this collaborative approach to the conceptual layout of the pipeline route, the design team has had extensive input and feedback from NHDOT in developing this feasibility study.

To streamline the review, the 26-mile pipeline project was divided into five spreads (described in more detail below). Over the course of several months, each spread was developed to approximately 30% design level and provided to NHDOT. Design Services (Main Office), as well as NHDOT personnel in Maintenance Districts 5 or 6 (depending on the location of the spread) reviewed the design packages and provided feedback to the Granite Bridge Project Team. The Granite Bridge Project Team and NHDOT met several times to review each spread in detail. NHDOT's feedback was integral in advancing the development of the pipeline route and this feasibility study. The revised 30% design plans for all five spreads are included as Appendix 2 to aid in the review of this feasibility study. Some design changes will be captured by future design submissions as noted in the detailed routing table in Section 10.

As Project development advances toward the SEC submission, the Granite Bridge Project Team will continue to coordinate closely with NHDOT to advance the plans to the 70% design level needed for the SEC submission and will also begin the process to determine the value of the right-of-way ("ROW") needed to construct the pipeline and negotiate a fee structure between the NHDOT and Liberty Utilities. Following NHDOT's report on conceptual feasibility to the SEC (step 5 above), the Bureau of Right-of-Way will identify an initial estimate of the range of the fair market value of the use of the state-owned land. This estimate will take into consideration the approximate area of impact, local zoning, land use restrictions, and land value. This range of values will be provided to Liberty Utilities for planning purposes, and to initiate negotiations later in the process.

Once the Project application is submitted to the SEC, and has been accepted, additional coordination with NHDOT will continue as part of the SEC process, as the NHDOT is a member of the SEC. The SEC with NHDOT will evaluate the submitted design for determination of conformance with NHDOT policies, including the Utility Accommodation Manual ("UAM"), to provide comments regarding the Project proposal, policy issues and any other concerns. NHDOT will provide a progress report to Liberty Utilities and the SEC as to whether an Excavation/Encroachment Permit can be issued along with any noted conditions to be met prior to issuing the permit. This progress report will be submitted within 150 days (5 months) of acceptance of the Project application by the SEC.

As the SEC process advances, NHDOT will continue to review the design for conformance and ultimately provide a final recommendation to SEC as to whether permits can be issued. At the conclusion of the process, the NHDOT Bureau of Right-of-Way will negotiate with Liberty Utilities a fair

market value for the use of state land in the Energy Infrastructure Corridor, which will be subject to approval from the Long-Range Capital Planning and Utilization Committee.

5. EVALUATION OF ALTERNATIVES

Liberty Utilities evaluated several project alternatives that could provide additional natural gas supplies to its customers. Project options included expansion of the Concord Lateral, expansion of existing LNG and propane storage facilities, and construction of a new natural gas transmission line. Expansion of the Concord Lateral would, at a minimum, require new facilities including pipeline looping and pipeline replacement with a larger diameter pipe to provide increased capacity. Capital cost estimates from the Concord Lateral's owner were prohibitive, precluding selection of this project option. Liberty Utilities' existing LNG and propane storage facilities are unable to be expanded to support increased capacity at their current locations in Nashua, Manchester, Concord, and Tilton. As a result, Liberty Utilities selected the construction of a new natural gas transmission line to connect supply from the Joint Facilities pipeline to distribution served by the Concord Lateral pipeline.

Liberty Utilities selected a pipeline route along Route 101 with the passage of House Bill 626-FN-A in 2016 that established an energy infrastructure corridor that could accommodate the proposed project. The Route 101 LAROW also offered the highest level of protection from third party damage to the pipeline. However, as part of Liberty Utilities' due diligence process, six other pipeline routes were identified to determine if another route could provide a less impacting or more cost-effective alternative. Routes were developed by evaluating available east to west routes along state road ROWs, recreational trail ROWs, railroad ROWs, and transmission ROWs. Four of the six alternative routes were not advanced for further evaluation because the routes were significantly longer, required acquisition of easements from private landowners, or required extensive use of the Route 101 ROW. Two of the six alternative routes and the Route 101 route were selected for further evaluation.

The three routes selected for further analysis were the Route 101 preferred route, the Route 27 alternative, and the Rockingham Recreational Trail alternative. The three selected alternatives represented the three most direct west to east routes that could feasibly and safely be constructed and did not require permanent easement rights from numerous abutters. See Appendix 4 for a figure depicting the routes described above.

Several criteria were selected to evaluate the suitability of the three pipeline route alternatives, including safety, impact on abutters, land use impacts, environmental and cultural resources, and cost. Based on the review of the various criteria, the Route 101 route offered the greatest protection from third party damage, abutted the fewest number of developed properties, did not impact town centers or commercial districts, and is the most direct route. The Route 27 alternative offered the least protection from third party damage, abutted the largest number of developed properties and contaminated sites, but caused the least impact to streams and wetlands. The Rockingham Recreational Trail alternative offered a moderate level of protection from third party damage, abutted a large number of developed properties relative to the Route 101 route, required the greatest amount of impact to wetlands and streams, and was the longest route.

The route evaluation did not produce an alternative that was superior to the Route 101 corridor in most of the evaluated criteria. Therefore, Liberty Utilities is confident that the Route 101 LAROW is the best route for the proposed transmission gas line.

6. CORRIDOR DESCRIPTION / EXISTING CONDITIONS

The Granite Bridge Pipeline route utilizes the Route 101 corridor. From west to east, the route begins in Manchester where the Concord Lateral intersects Route 101, and traverses through the communities of Auburn, Candia, Raymond, Epping, Brentwood, and ending in Exeter where it connects to the Joint Facilities. The route follows rolling topography through open and wooded areas in the NHDOT

LAROW, consisting of rock ledges, wetlands, and wooded upland. Much of the highway was built through shallow granite bedrock and glacial till.

Route 101 between Manchester and Exeter consists of a four-lane divided highway with limited access (entry and exit from interchanges only). The highway was constructed through a series of contracts over several decades beginning in the 1960s. Significant new LAROW was established as part of the highway construction, with widths varying from 200 to 500 feet. As part of Project development, the Granite Bridge Project Team has been surveying the proposed pipeline route and using highway record plans and survey records to verify the LAROW along the corridor.

New Hampshire Certified Wetland Scientists conducted natural resource assessments within the LAROW along the corridor between March 2018 and March 2019. Two-hundred and thirty-two wetlands, seventeen vernal pools, twenty-three perennial streams, and thirteen intermittent streams were identified within the LAROW between Manchester and Exeter. Wetlands within the LAROW include palustrine forested ("PFO"), palustrine scrub-shrub ("PSS"), and palustrine emergent ("PEM") wetlands. However, most of the wetlands delineated for this project are located within the existing ROW of Route 101, and exhibit characteristics (sharp PFO/PEM boundaries within a wetland) typical of maintained highway ROWs due to tree clearing and regular mowing. Those wetlands located closest to the Route 101 pavement edge tend to have emergent cover types due to regular mowing, and those located along the ROW boundaries tend to have forested or scrub-shrub cover types.

Major wetland and open water systems are present near the proposed Project or will be crossed by the pipeline. In Manchester and Auburn, the Project is located within the Massabesic Lake Watershed. The LAROW contains three delineated streams in Manchester and two delineated streams in Auburn that are tributaries to Massabesic Lake, including Maples Falls Brook that conveys water from the Tower Hill Pond drinking water reservoir to the lake. In Candia, Abe Emerson Marsh is adjacent to Route 101. The marsh is approximately 100 acres of permanently conserved wetlands and uplands protected by the Audubon Society of New Hampshire. A segment of the Lamprey River that is designated as wild and scenic crosses the LAROW in Raymond and in Epping. The Piscassic River also crosses the LAROW in Epping. The Lamprey and Piscassic Rivers are fourth order streams subject to the Shoreland Water Quality Protection Act and Waters of the State subject to Public Utility Commission licensing. In Brentwood, the LAROW is adjacent to the Deer Hill Wildlife Management Area ("WMA") that was developed as wetland mitigation for the Route 101 highway construction. The land consists of approximately 330 acres of open water wetlands and uplands protected by the NH Fish and Game Department ("NHFG"). Similarly, Conner Farm WMA is adjacent to the Route 101 Corridor in Exeter. NHFG protects approximately 220 acres of wetlands and uplands in this area. This WMA includes portions of the Little River and Bloody Brook and associated wetlands that are considered prime wetlands in Exeter. The Exeter Town Forest also extends across the LAROW and includes a delineated unnamed perennial stream. The design team has taken these major surface waters and wetland systems into consideration during the design of the Project.

7. GENERAL PIPELINE ROUTING APPROACH

The pipeline design has been developed with several factors driving the location of the pipeline. Safety is the primary concern, both during the construction and operation of the pipeline. The Project team has considered safety elements for the traveling public, abutting property owners, and the contractors throughout the design of the pipeline. Work areas specified by the design are generally outside of the roadway clear zone or would be established with appropriate work zone traffic control measures. The Project team will develop a Traffic Management Plan as part of the final design development that will outline measures for Liberty Utilities and its contractors to minimize the effect on the traveling public.

The pipeline routing has also been influenced by environmental factors. The pipeline has been routed around or under (using trenchless installation techniques) sensitive environmental features such as

significant wetlands, perennial streams, and vernal pools where possible and practical. Additional details of environmental routing factors are detailed in section 10.

Cost and constructability are also important factors considered during the design process. Ensuring that the pipeline location allows for optimal construction efficiency is important, as ultimately Liberty Utilities' customers will pay for the proposed infrastructure. Temporary construction workspace, as well as reasonable construction access, are critical elements to making construction cost effective. NHDOT has stated a preference that construction access directly from Route 101 should only be considered if other access options are not feasible. If direct access to Route 101 is needed, then the Granite Bridge Project Team will need to demonstrate that access from public/local roads, or via easements granted by abutters through private property is not practical, feasible. or able to be obtained. Most of the construction workspace along Route 101 will be accessed from crossing roads. Liberty Utilities is working to secure private property rights at a limited number of locations to ease constructability and minimize the need to access the work zone from Route 101. These easements would improve efficiency of construction and reduce disruption along the ROW but are not required to move forward with the Project.

Another factor for pipeline routing is compliance with the NHDOT Utility Accommodation Manual (UAM). The UAM describes measures to minimize the effect of utility installations on existing NHDOT infrastructure. Accordingly, the pipeline's standard alignment has been routed as close to the edge of the ROW as possible. Earlier designs called to offset the centerline of the pipe at 10 feet from the edge of the established LAROW. Following additional coordination with NHDOT, this offset distance was increased to 15 feet to allow for more space to accommodate the segregation of limited reuse soils ("LRS") from other excavated materials. LRS are generally defined as disturbed topsoil and organic materials that must be reused within the project corridor or follow special protocol before removing the materials from the corridor. Liberty Utilities will develop a soil management plan that describes methodologies to segregate and properly reuse (or spoil) LRS within the Project corridor as specified by NHDOT policy.

In some cases, Liberty Utilities will be requesting exceptions from the requirements of the UAM. These anticipated UAM Exception Requests are summarized and tabulated in Appendix 1 and generally fall into one of three categories:

1. Uncased crossings under roads – Consistent with current industry standards and given the conservative design approach of this pipeline (minimum 4-foot burial depth and larger pipe wall thickness), uncased crossings are safer than cased crossings. This rationale is presented in greater depth in Appendix 3.
2. Routing deviations from the edge of the LAROW – In some areas it is prudent to shift the pipeline route away from the LAROW to reduce impacts to sensitive environmental areas, to balance abutter impacts, or for constructability factors.
3. Construction access from the LAROW - The Granite Bridge Project Team is making every effort to establish construction access points from local roads and easements granted from abutting property, but in some cases, access is only possible from Route 101. In these instances, Liberty Utilities will develop traffic control plans consistent with NHDOT policies and Manual of Uniform Traffic Control Devices ("MUTCD") guidelines. Further, appropriate coordination with local law enforcement and emergency responders will be detailed in the Traffic Management Plan.

8. DESCRIPTION OF PIPELINE DESIGN AND MATERIAL

The design of the Granite Bridge Pipeline is primarily governed by the following codes:

1. 49 CFR Part 192, "Transportation of Natural and Other Gases by Pipeline;"

2. American Society of Mechanical Engineering code ASME B31.8, “Gas Transmission and Distribution Code;” and
3. New Hampshire Code of Administrative Rules, PUC 500.

These codes provide the rules for the design, operation, and maintenance for natural gas pipelines and related facilities. Pipelines are designed to different safety classes based on population density in proximity to the proposed infrastructure. Liberty Utilities is designing, and proposes to construct, the Granite Bridge Pipeline to satisfy the Federal Pipeline Code Class 4 safety standards, which is the highest possible standard and usually reserved for densely populated urban areas. As part of Liberty Utilities’ commitment to safety, it has opted to construct the Granite Bridge to the highest safety standards.

The pipeline itself is proposed to be high-yield carbon steel pipe (American Petroleum Institute, 5L line pipe, Grade X-65) that is electric resistance welded with a ½”-thick wall. All pipe joints are to be welded in accordance with API 1104 welding code, and all welds will be 100% circumferentially x-rayed as a quality control measure. The pipeline will be buried at a minimum 4-foot depth. Pipeline coatings will vary depending on soil conditions, but is anticipated to consist of Pritec coating, Power Crete epoxy coating, or concrete coating to control buoyancy.

The design includes remote actuated valve stations spaced so that any portion of the pipeline is no greater than 2.5 miles from a valve station. This is among the design features dictated by the Federal Pipeline Code for a Class 4 pipeline design.

9. PIPELINE CONSTRUCTION MEANS AND METHODS

Construction process for the pipeline generally begins with survey to determine the extents of the LAROW and establish the baseline route for the pipe. Once controls have been established, the route is cleared, grubbed, and rough graded to establish the temporary construction workspace.

Once survey control has been established for the route, trenching operations commence. The pipe segments are strung along the open trench. Field bending is completed before welding the pipes into a continuous segment. Girth welds are x-rayed and coated before the pipe is lowered into the trench. The trench is backfilled, and the surface is regraded to match adjacent grades and topsoil is seeded and stabilized as needed. Once construction is complete, the pipeline is tested to 150% of its maximum allowed operating pressure and commissioned.

Pipeline construction can be an open cut trench or trenchless. Open cutting can generally be categorized into three methods. The first, cross-country pipeline construction, means several distinct crews construct the pipeline in a long assembly line spread out over several miles. This construction methodology generally requires a wide work area of 100 feet or more, and long stretches of open and available space. When less space is available, the contractor will employ “drag section” construction methodology where multiple lengths of pipe are welded together and placed into the trench before it is backfilled. Finally, “stove pipe” methodology is used when space is very limited, such as urban areas or restricted workspaces. This method performs each installation step on one piece of pipe at a time, and the trench is backfilled at the end of each day. It is the most time consuming and costly method of open cut pipe installation. The Granite Bridge Pipeline project will be a modified approach that will use a combination of all three construction methods, depending on the amount of workspace that is available within the LAROW to complete the pipeline installation.

When trenching is not possible due to the need to avoid impacts to sensitive environmental areas or existing infrastructure, the pipeline can be installed using trenchless methods such as a horizontal directional drill (“HDD”) or jack-and-bore. Details of construction methodology for the Granite Bridge Pipeline route are noted below in section 10.

Liberty Utilities will develop a soil management plan that describes methodologies to segregate and properly reuse (or spoil) LRS within the Project corridor as specified by NHDOT policy.

10. PIPELINE DESIGN DETAILS

As noted previously, at the outset of conceptual design the overall Project length was divided into five sections, or "spreads," to break the design and review process into packages that can be developed and reviewed incrementally. It is anticipated that the construction of the pipeline will be as a single contract, and the spread designations are simply dividing the Project into manageable pieces and providing a reference system for the corridor. A location map is provided in Appendix 2.

Spread 1, which includes Manchester and Auburn, runs from the proposed Concord Lateral meter station in Manchester to the east side of Tower Hill Road in Auburn and follows the north side of the LAROW corridor.

Spread 2 picks up from the east side of Tower Hill Road in Auburn and the route follows the north side of the Route 101 LAROW to Chester Road in Candia. At Chester Road, the pipeline crosses from the north side of the LAROW to the south side of the LAROW to avoid two large wetlands. The route follows the south side of the LAROW to Depot Road in Candia where it crosses back to the north side of the Route 101 corridor. Spread 2 ends on the northeast side of Depot Road at the Candia/Raymond town line.

Spread 3 starts at the Candia/ Raymond town line and follows the north side of the Route 101 LAROW. On the east side of Exit 5, Spread 3 crosses from the north side of the ROW to the south side in order to connect with the proposed LNG facility piping in Spread 4. Spread 3 ends at the Raymond/Epping town line.

Spread 4 starts at the Raymond/Epping town line and runs on the south side of the 101 LAROW. It ends at the east side of the Exit 8 (North Road) interchange. Significant features of this spread include an HDD of the Lamprey River and the piping connections to the proposed LNG Facility in Epping.

Spread 5 starts at the east side of North Road (Exit 8) and runs on the south side of the Route 101 LAROW. Spread 5 ends at the Joint Facilities Meter Station in Exeter. Significant features on Spread 5 include a long directional drill under Exit 10 and the Pan Am Railroad.

The table below provides details of the 30% design. Please note the stationing is approximate as the five spreads are being combined into one continuous design.

Spread 1 – Manchester and Auburn				
Approximate From Station	**Approximate To Station**	**Construction Method**	**Remarks**	**Construction Access**
0+00	1+00	direct burial	Exiting Meter station property and crossing under Kinder Morgan/Concord Lateral transmission lines.	From LaGrange St. Manchester
1+00	30+50	direct burial	at edge of ROW, shallow ledge, side slope	From LaGrange St. Manchester
30+50	54+00	direct burial	Pipeline is routed on highway side of sound barrier wall sufficient distance from the wall as to not affect the wall foundations.	From LaGrange and NH 28 Bypass
54+00	57+80	direct burial	At edge of ROW, some wetlands.	From NH 28 Bypass
57+80	58+50	direct burial	Pipeline is routed away from the edge of ROW to avoid culvert headwall.	From NH 28 Bypass
58+50	67+00	direct burial	Pipeline is routed at the edge of the LA ROW.	From NH 28 Bypass
67+00	72+70	HDD	Horizontal Directional Drill to avoid shallow rock and utilities in NH 28 Bypass.	From NH 28 Bypass
72+70	87+50	direct burial	Pipe routing transitions to edge of ROW. Adjacent to Sparrow Lane, the pipe is routed between the guardrail and wooden fence. The pipe shall be installed below any drainage structure in this section.	From NH 28 Bypass
87+50	102+25	HDD	This section of the pipeline poses the most difficult construction due to narrow ROW and limited workspace. Liberty has revised the plan to be HDD per DOT request and to eliminate traffic disruptions and improve constructability.	Sparrow Lane and King St.
102+25	125+00	direct burial	The section will require direct burial in restricted workspace. The pipeline is routed closer to the guardrails and away from residential houses.	King St. and Hooksett Road
125+00	133+00	direct burial	Pipeline routing follows the edge of the ROW through alternating wetlands and upland forest.	King St. and Hooksett Road
133+00	134+00	direct burial	Pipeline is offset from edge of ROW about 10 ft. to avoid culvert headwall.	King St. and Hooksett Road
134+00	146+00	direct burial	Pipeline routing follows the edge of the ROW through alternating wetlands and upland forest.	King St. and Hooksett Road

Spread 1 – Manchester and Auburn				
146+00	153+00	direct burial	Pipeline has been re-routed to the edge of ROW per DOT comment and to improve constructability.	King St. and Hooksett Road
153+00	166+25	direct burial	Pipeline routing follows the edge of the ROW through alternating wetlands and upland forest.	King St. and Hooksett Road
166+25	168+00	Jack and Bore	Under Hookset Road.	Hookset Road
168+00	195+70	direct burial	Pipeline is routed at the edge of ROW through uplands and occasional wetlands.	Hookset Road and Tower Hill Road temporary construction bridge.
195+70	200+39	HDD	Liberty's current design is for a horizontal directional drill under Maple Falls Brook to avoid construction and environmental issues associated with crossing Maple Falls Brook.	Temporary construction bridge and Tower Hill Road

Spread 2 – Auburn and Candia				
Approximate From Station	**Approximate To Station**	**Construction Method**	**Remarks**	**Construction Access**
200+39	206+20	HDD	Liberty's current design is for a horizontal directional drill under Maple Falls Brook to avoid construction and environmental issues associated with crossing Maple Falls Brook.	Tower Hill Road, Old Mill Road, and Chester Turnpike
206+20	251+40	Direct burial	Pipe is routed at edge of ROW through varied wetlands and forest.	Tower Hill Road, Old Mill Road, and Chester Turnpike
251+40	252+60	Jack and bore	Under Chester Turnpike.	Chester Turnpike
252+60	255+60	Direct burial	Routing currently is approx. 30 ft. from edge of ROW to preserve trees for abutting resident. Permanent valve site shall be located on the east side of Chester Turnpike.	Chester Turnpike
255+60	276+00	Direct burial	Pipe is routed at edge of ROW through varied wetlands and forest.	Chester Turnpike and Flint Rd.
276+00	296+50	Direct burial	Pipe is routed at the edge of ROW through woodland and wetlands.	Flint Road and Old Candia Rd.
296+50	298+00	Jack and bore	Plans have been revised for Jack and bore per DOT request.	Old Candia Rd.
298+00	336+60	Direct burial	Pipe is routed at the edge of the ROW, primarily through wetlands.	Old Candia Rd. and DOT Maintenance Yard.
336+60	339+30	Jack and bore	Under Exit 3 On and Off Ramps.	DOT Maintenance Yard and Old Candia Rd.
339+30	381+75	Direct burial	Pipe is routed at the edge of ROW through varied woodland and wetlands.	Chester Road and access to be determined near Exit 3.
381+75	385+50	Direct burial	Pipe routing is proposed to be open cut in Chester Rd., sufficient distance to not affect bridge abutments.	Chester Road.
385+50	405+30	Direct burial	Pipe routing at edge of ROW through varied woodland and wetlands.	Chester Road.
405+30	412+30	HDD	Horizontal direction drill is proposed for the vernal pool.	Chester Road and old Patten Hill Road.
412+30	419+70	Direct burial	Pipe routing at edge of ROW through varied woodland and wetlands.	old Patten Hill Rd.
419+70	421+50	Jack and bore	Under Patten Hill Rd. Overpass.	Patten Hill Rd. ROW

Spread 2 – Auburn and Candia				
421+50	431+00	Direct burial	Pipeline is routed away from edge of ROW, closer to shoulder due to proximity of residential property.	Patten Hill Rd. ROW
431+00	493+75	Direct burial	Pipeline is routed at edge of ROW. Terrain includes some challenging side-slope, boulders, and ledge.	Patten Hill Rd. ROW Access to Route 101 EB shall be required for construction vehicles to exit the construction workspace.
493+75	500+90	HDD	Under vernal pool and Depot Rd. Overpass.	Depot Rd ROW. From the west, access from Route 101 EB shall be required for construction vehicles.
500+90	501+70	Direct burial	This site includes a permanent valve site and a very deep jacking pit.	From Depot Rd. ROW
501+70	503+90	Jack and bore	Under Route 101.	From Depot Rd. ROW on both the north and south side of Route 101.
503+90	508+18	Direct burial	Primarily wetlands under Eversource power lines.	Depot Rd ROW.

Spread 3 – Raymond				
Approximate From Station	**Approximate To Station**	**Construction Method**	**Remarks**	**Construction Access**
505+59	577+75	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Depot Rd. ROW, and Sargent Rd.
577+75	579+50	Jack and bore	Under Green Rd. overpass.	Sargent Rd. and Green Rd. ROW.
579+50	592+00	Direct burial	Pipeline is routed away from edge of ROW to increase distance from two residential homes.	Green Rd. ROW and Gile Rd.
592+00	644+00	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Green Rd. ROW and Gile Rd.
644+00	658+50	Direct burial	Pipeline is routed away from edge of ROW to increase distance from two residential homes and to avoid a farm pond.	Gile Rd. and Old Batchelder Rd.
658+50	672+15	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Old Batchelder Rd.
672+15	673+85	Jack and bore	Old Manchester Rd. overpass.	Old Batchelder Rd. and Old Manchester Rd.
673+85	690+00	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Old Manchester Rd. and Main St.
690+00	692+00	Direct burial	Pipeline is routed away from edge of ROW to avoid vernal pool.	Old Manchester Rd. and Main St.
692+00	699+00	Direct burial	Pipeline is routed at the edge of the ROW through varied woodlands.	Old Manchester Rd. and Main St.
699+00	707+00	Direct burial	Pipeline is routed away from edge of ROW to avoid vernal pools.	Old Manchester Rd. and Main St.
707+00	720+00	Direct burial	Pipeline is routed at the edge of the ROW through varied woodlands.	Old Manchester Rd. and Main St.
720+00	723+50	Direct burial	Pipeline is routed away from edge of ROW to avoid a vernal pool.	Old Manchester Rd. and Main St.
723+50	727+50	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Main St.
727+50	728+50	Direct burial	Open cut Main St. valve site to be located on the west side of Main St.	Main St.
728+50	750+50	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Main St.

Spread 3 – Raymond				
750+50	773+75	HDD	Current plans show two HDDs, however these will be combined into one HDD under the Lamprey River, NH Routes 102 and 107 (Freetown Rd.), and westbound on-ramp and westbound off ramp. This HDD will require more temporary workspace east of Exit 5 to fabricate and lay out the pullback string.	Main St. and westbound off ramp or Freetown Rd.
773+75	775+25	Direct burial	Shoulder of westbound off-ramp.	Westbound off-ramp or Freetown Rd.
775+25	778+25	Jack and bore	Under Route 101.	Westbound off-ramp or Freetown Rd. and eastbound on-ramp.
778+25	798+00	Direct burial	Pipeline is routed at the edge of the ROW through varied woodland and wetlands.	Eastbound on ramp and old Prescott Rd.
798+00	804+00	Direct burial	Pipeline is routed away from edge of ROW to avoid proximity to abutting residence.	Old Prescott Rd.
804+00	805+50	Jack and bore	Under Prescott Rd. Overpass.	Old Prescott Rd. and Route 101 eastbound.
805+50	808+75	Direct burial	Pipeline is routed away from edge of ROW to irregular ROW line.	Route 101 eastbound.
808+75	812+95	Direct burial	Pipeline is routed at the edge of the ROW through varied woodlands.	Route 101 eastbound.

Spread 4 – Epping				
Approximate From Station	**Approximate To Station**	**Construction Method**	**Remarks**	**Construction Access**
812+43	813+60	Direct burial	Workspace of HDD.	Prescott Rd.
813+60	834+40	HDD	Under Lamprey River, vernal pool and up side slope.	LNG Plant Property via Whitham Rd.
834+40	865+50	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	LNG Plant Property via Whitham Rd.
865+50	865+50	Direct burial	Pipe exits the LA ROW to DOT Non-LA ROW parcel.	LNG Plant Property via Whitham Rd.
865+50	888+25	Direct burial	Pipe is routed in existing road that will be improved for LNG Plant. This is a DOT owned parcel not part of the LA ROW.	Whitham Rd.
888+25	893+00	Direct burial	Pipe is routed back into the LA ROW at the back edge of the ROW.	Whitham Rd.
893+00	896+20	Direct burial	Pipe is route around a vernal pool and is not at the edge of the ROW, in order to cross Beede Rd. and maintain distance from culverts in Beede Rd.	Whitham Rd.
896+20	898+00	Jack and bore	Under Beede Rd.	Beede Rd. and Whitham Rd.
898+00	905+50	Direct burial	Pipe is routed to transition to the edge of ROW at station 905+50.	Beede Rd.
905+50	946+00	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	Beede Rd. and Shirkin Rd.
946+00	951+00	Direct burial	Pipe is routed away from edge of ROW approx. 10 ft. to avoid an existing well at Station 949+40.	Shirkin Rd. and Martin Rd.
951+00	978+20	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	Shirkin Rd. and Martin Rd.
978+20	980+15	Jack and bore	Under Martin Rd. overpass. Detail will be developed to clarify distance to DOT structures.	Martin Rd. ROW on west side of overpass.
980+15	991+25	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	Martin Rd. ROW and Route 125. Potentially Brickyard Square.
991+25	998+00	Direct burial	Pipe is routed at edge of ROW, but also occupies the location of the Rockingham Recreational Trail, which will require temporary accommodations during construction.	Martin Rd. ROW and Route 125. Potentially Brickyard Square.

Spread 4 – Epping				
998+00	1012+00	Direct burial	Pipe is routed at edge of ROW.	Route 125
1012+00	1014+20	Jack and bore	Under Route 125.	Route 125 east and west.
1014+20	1019+40	Direct burial	Pipe is routed at edge of ROW.	Route 125
1019+40	1022+40	Direct burial	Pipe is routed away from edge of ROW to avoid a vernal pool.	Route 125
1022+40	1037+23	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	Route 125
1037+23	1049+03	HDD	Under Piscassic River. Direct burial will be evaluated as an alternative in this area.	Route 125 and Route 101 eastbound
1049+03	1070+50	Direct burial	Pipe is routed at edge of ROW. Note workspace is constrained in this area due to wetlands and weigh station.	Route 101 eastbound and weigh station.
1070+50	1114+00	Direct burial	Pipe is routed at the edge of the ROW through varied woodlands and wetlands.	Route 101 eastbound.
1114+00	1115+60	Direct burial	Pipe is currently routed away from edge of ROW to avoid engineered wetlands. Per request from DOT, routing will be revised to be closer to the edge of ROW.	Route 101 eastbound.
1115+60	1134+67	HDD	Under Exit 8 eastbound on and off ramps and North Rd. This HDD has been combined with the overpass HDD to minimize ROW access requirements.	Route 101 eastbound and eastbound on-ramp.
1134+67	1135+93	Direct burial	End of Spread 4	Route 101 eastbound onramp

Spread 5 – Epping, Brentwood and Exeter				
Approximate From Station	**Approximate To Station**	**Construction Method**	**Remarks**	**Construction Access**
1138+18	1160+40	Direct burial	Pipeline is not routed at the edge of ROW because the edge of ROW is deep in the wetlands and to avoid installation on side slope.	From Exit 8 eastbound on-ramp
1160+40	1189+20	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	From Exit 8 eastbound and potentially from "Deer Hill" State game lands.
1189+20	1189+57	Direct burial	Pipeline is offset to achieve a straight routing for the HDD. Alternatively, direct burial is being considered which would allow the routing to follow the edge of ROW up to Little River.	Potentially from "Deer Hill" state game lands.
1189+57	1196+08	HDD	An alternate routing is being considered which would allow the routing to follow the edge of ROW more closely.	Potentially from "Deer Hill" state game lands and Pine Rd.
1196+08	1198+02	Direct burial	Pipe routing is not at the edge due to HDD alignment and to avoid power poles at the edge of Pine Rd.	Pine Rd.
1198+02	1198+37	Direct burial	Open cut of Pine Rd.	Pine Rd.
1198+37	1214+16	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Pine Rd.
1214+16	1224+61	HDD	Alternatively, direct burial is being considered for this Little River crossing.	Pine Rd. and Connor Farm Rd.
1224+61	1247+00	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Connor Farm Rd.
1247+00	1262+00	Direct burial	Pipeline is routed at the edge of ROW through clear ROW abutting Connor Farm conservation lands.	Connor Farm Rd.
1262+00	1274+91	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Connor Farm Rd.
1274+91	1281+19	HDD	Alternatively, direct burial is being considered for this Bloody Brook crossing.	Connor Farm Rd. and Epping Rd.
1281+19	1292+65	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Connor Farm Rd. and Epping Rd.
1292+65	1303+41	Direct burial	Pipeline is routed in Old Route 101 at edge of LA ROW.	Epping Rd.

Spread 5 – Epping, Brentwood and Exeter				
1303+41	1305+65	Jack and bore	Under NH 27 Epping Rd. overpass.	Epping Rd. and Cronin Rd.
1305+65	1349+20	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Cronin Rd.
1349+20	1356+00	Direct burial	Pipeline is route away from the edge of ROW into drainage swale due to two vernal pools on the edge of ROW.	Cronin Rd. and Route 101 eastbound.
1356+00	1372+72	Direct burial	Pipeline is routed at the edge of ROW through woodlands and wetlands.	Cronin Rd. and Route 101 eastbound.
1372+72	1392+72	HDD	This HDD crosses deep below the Exit 10 eastbound off-ramp, the Route 85 Overpass, and the eastbound on-ramp, and Pan Am Railroad.	Route 101 eastbound and Exeter Water Treatment Facility.

Appendix 1

List of Anticipated U.A.M. Exception Requests

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
1	4 to 6	30+50	54+00	Pipeline is not routed at edge of ROW.	Topography behind the sound wall (steep downward slope) does not allow pipe installation between the sound wall and the edge of ROW.
1	7	57+80	58+50	Pipeline is not routed at edge of ROW.	Stone headwall is approximately 5 ft from the edge of ROW, pipeline will cross to south and maintain required clearance from 48" RCP.
1	8	67+00	72+70	Pipeline is not routed at edge of ROW.	HDD cannot be installed close to edge of ROW because of the drilling rig's space requirements.
1	8	69+50	70+50	Pipeline is not in a casing under a State Road (Route 28A bypass).	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
1	12	100+00	103+40	Pipeline is not routed at edge of ROW.	Due to irregular edge of ROW at this intersection, the pipeline is routed in the most direct path.
1	12 to 14	103+90	125+00	Pipeline is not routed at edge of ROW.	Liberty Utilities wants to be sensitive to the concerns of abutting residential homes in this area.
1	15	132+90	133+75	Pipeline is not routed at edge of ROW.	The pipeline is routed in towards the roadway to avoid a stone headwall. Pipeline will maintain required clearance from the 48" RCP.
1	19	165+40	167+85	Pipeline is not routed at edge of ROW.	The pipeline is routed in a straight line; however, the edge of the LA ROW is irregular at Exit 2.
1	19	166+50	167+50	Pipeline is not in a casing under Hookset Rd., which is under NH DOT jurisdiction.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
1	22	195+50	200+39	Pipeline is not routed at edge of ROW.	HDD cannot be installed close to edge of ROW because of the drilling rig's space requirements and due to the irregular shape of the ROW at Tower Hill Road.
2	1	200+39	207+10	Pipeline is not routed at edge of ROW.	HDD cannot be installed close to edge of ROW because of the drilling rig's space requirements and due to the irregular shape of the ROW

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
2	6	251+40	252+60	Pipeline is not in a casing and runs close to the overpass wing walls (Chester Turnpike).	Exact distance from wing walls will be detailed in the 70% plans. Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
2	6 to 7	251+50	255+70	Pipeline is not routed at edge of ROW.	Pipeline has been routed approximately 30 ft. from the edge of the LA ROW to address specific request of the abutter to retain screening trees.
2	10	286+70	287+10	Pipeline is not routed at edge of ROW.	Pipeline has been routed to avoid a stone headwall.
2	11	296+50	298+00	Pipe in not in a casing under Old Candia Rd., which is under NH DOT jurisdiction.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3. Note this crossing shall be redesigned as a Jack and bore per NH DOT request.
2	15 to 16	336+60	339+30	Pipeline is not in a casing and is under Exit 3 on and off ramps.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
2	20 to 21	381+75	385+50	Pipeline is not in a casing and is within 25 ft. of Chester Road bridge abutments.	A detail plan shall be prepared to show that the direct-buried pipe in this area shall maintain sufficient distance from the bridge abutments and footings.
2	23 to 24	404+50	412+90	Pipeline is not routed at edge of ROW.	The pipe is routed to allow the HDD drilling equipment to set up on a constructible location. This HDD shall be relocated to be within 20 ft. of the edge of ROW in the 70% issue.
2	24 to 25	419+70	421+50	Pipeline is not in a casing and passes under Patten Hill Road in the LA ROW.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
2	25 to 26	421+50	431+00	Pipeline is not routed at edge of ROW.	Liberty Utilities wants to be sensitive to the concerns of abutting horse farm and residential house.

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
2	32	485+00	490+00	Construction access from NH Route 101.	Due to being remote and inaccessible from side roads, construction access off and on Route 101 eastbound is requested to allow access for pipeline construction and HDD pullback site.
2	32 to 33	493+30	501+00	Pipeline is not routed at edge of ROW.	Due to side slope on the ROW, the pipe is routed to allow the HDD drilling equipment to set up on a constructible location.
2	33	499+50	501+00	Pipeline is not in a casing and passes under Depot Road in the LA ROW.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
2	33 to 34	501+70	503+90	Pipeline is not in a casing and passes under Route 101.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
3	9 to 10	577+75	579+50	Pipeline is not routed at edge of ROW.	Jack and bore in this location requires a certain distance from the edge of ROW for the jacking machine and pits. This crossing may be modified to be closer to the edge of ROW and away from DOT structures.
3	10 to 11	579+50	592+00	Pipeline is not routed at edge of ROW.	Liberty Utilities wants to be sensitive to the concerns of two abutting residential houses.
3	18 to 19	644+00	658+50	Pipeline is not routed at edge of ROW.	Liberty Utilities wants to be sensitive to the concerns of abutting residential houses.
3	21	672+15	673+85	Pipeline is not in a casing and passes under Old Manchester Road (Exit 4).	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
3	23	690+00	692+00	Pipeline is not routed at edge of ROW.	Pipe is routed towards the roadway to avoid a vernal pool. Liberty shall evaluate alternate methods such as HDD, which may pose other risks such as inadvertent releases.
3	24 to 25	699+00	707+00	Pipeline is not routed at edge of ROW.	Pipe is routed towards the roadway to avoid two vernal pools. Liberty shall evaluate alternate methods such as HDD, which may pose other risks such as inadvertent releases.

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
3	27	720+00	723+50	Pipeline is not routed at edge of ROW.	Pipe is routed towards the roadway to avoid a vernal pool. Liberty shall evaluate alternate methods such as HDD, which may pose other risks such as inadvertent releases.
3	30 to 32	745+40	758+50	Pipeline is not routed at edge of ROW.	The pipe is routed to allow the HDD drilling equipment to set up on a constructible location.
3	32	758+00	760+50	Pipeline is not in a casing under Route 102 and 107.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
3	32 to 33	766+00	773+00	Pipeline is not in a casing under Route 101 on and off ramps (Exit 5).	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
3	34	775+25	778+25	Pipeline is not in a casing and passes under Route 101.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure.
3	34 to 35	778+00	783+00	Construction access from Route 101 on ramp.	Due to being remote from side roads, construction access off NH 101 eastbound on-ramp is requested to allow access for pipeline construction.
3	37	798+00	804+00	Pipeline is not routed at edge of ROW.	Liberty Utilities wants to the sensitive to the concerns of abutting residential house and to keep the pipe routing in a straight line with the irregular LA ROW line.
3	37	804+00	805+50	Pipeline is not in a casing and passes under Prescott Rd overpass.	Liberty shall develop a detailed plan identifying distances from bridge structures. Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
3	38	805+50	808+75	Pipeline is not routed at edge of ROW.	Pipe is not routed at the edge of the LA ROW due to irregular ROW line.
4	2 to 3	823+80	834+40	Pipeline is not routed at edge of ROW.	The pipeline is routed in a straight line because it is part on an HDD, however the edge of the LA ROW is irregular in this area.

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
4	5 to 6	854+40	856+40	Pipeline is not routed at edge of ROW.	The pipeline transitions to the edge of the ROW as quickly as practical with construction considerations.
4	10	893+00	905+50	Pipeline is not routed at edge of ROW.	The pipeline is routed to avoid a vernal pool and then into a Jack and bore under Beede Road. The routing follows a straight line to the edge of ROW at Station 905+50.
4	10	896+20	898+00	Pipeline is not in a casing and passes under Beede Road (Exit 6) in the LA ROW.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
4	16	946+00	951+00	Pipeline is not routed at edge of ROW.	The pipeline is routed in a curve to avoid being too close to an existing well.
4	20	978+20	980+15	Pipeline is not in a casing and passes under Martin Rd. overpass.	Liberty shall develop a detailed plan identifying distances from bridge structures (approx. 7 ft. from cantilevered wing wall). Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Refer to Appendix 3.
4	24	1012+00	1014+20	Pipeline is not in a casing and passes under Route 125.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
4	24 to 25	1019+40	1022+40	Pipeline is not routed at edge of ROW.	The pipeline is routed towards the roadway to avoid a vernal pool. Liberty shall evaluate alternate methods such as HDD, which may pose other risks such as inadvertent releases.
4	28	1050+00	1053+00	Construction access from Route 101 eastbound.	Due to being remote from side roads, construction access off Route 101 eastbound is requested to allow access for pipeline construction and east side of Piscassic HDD site. Liberty is actively pursuing access from state and private property to avoid this exception request.

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
4	36 to 38	1115+60	1134+67	Pipeline is not routed at edge of ROW.	The pipeline is routed the most direct route through the Exit 8 Interchange. The routing has been be modified per DOT comments, to be closer to the edge of the ROW at least from Station 114+50 to 1120+00.
4	35	1109+00	1114+00	Construction access from Route 101 eastbound.	Due to being remote from side roads, construction access off Route 101 eastbound is requested to allow access for pipeline construction and west side of Exit 8 HDD site. Liberty is actively pursuing access from state and private property to avoid this exception request.
4	36	1120+00	1122+00	Pipeline is not in a casing and passes under the Exit 8 off ramp.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
4	36 and 37	1125+00	1131+00	Pipeline is not in a casing and passes under the Exit 8 off tamp, on ramp, and North Road.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.
5	1	1138+00	1141+00	Construction access from Route 101 Exit 8 eastbound on ramp.	Due to being remote from side roads, construction access off Route 101 eastbound on-ramp is requested to allow access for pipeline construction east of Exit 8.
5	1 to 3	1138+18	1160+50	Pipeline is not routed at edge of ROW.	Edge of the LA ROW is irregular near Exit 8; from 1156+00 to 1160+50, the routing avoids a steep downslope at the edge of the LA ROW.
5	7	1189+00	1199+00	Pipeline is not routed at edge of ROW.	The pipeline is routed in the center of the work space to facility the HDD equipment. Liberty is likely to change the design to direct burial in the 70% issue, which will allow installation at the edge of ROW. Near Pine Road, the routing avoids telephone poles.
5	20	1303+41	1305+65	Pipeline is not in a casing and passes under the Route 27.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. Note the pipeline is greater than 25 ft. from any bridge structure. Refer to Appendix 3.

Spread	Alignment Sheet	Approximate From Station	Approximate To Station	Exception	Reason for Exception
5	20	1303+41	1305+65	Pipeline does not cross Route 27 at right angles.	Liberty's routing is avoiding certain wetlands and aligns with the edge of the LA ROW line.
5	25 to 26	1349+20	1356+00	Pipeline is not routed at edge of ROW.	Pipe is routed towards the roadway to avoid a vernal pool. Liberty shall evaluate alternate methods such as HDD, which may pose other risks such as inadvertent releases.
5	28	1367+00	1372+00	Construction access from Route 101 eastbound.	Due to being remote from side roads, construction access off Route 101 eastbound is requested to allow access for pipeline construction and HDD pullback west of Exit 10.
5	28 to 30	1374+00	1389+00	Pipeline is not routed at edge of ROW.	The pipeline route HDD follows a straight line while the LA ROW widens for Exit 10 on and off ramps, etc.
5	29 to 30	1376+00	1388+00	Pipeline is not in a casing and passes under the eastbound off ramp, NH Route 85, and the eastbound on-ramp.	Liberty shall provide documentation why a casing can actually reduce the safety and reliability of the pipe, and the additional safety measures in the 16" pipeline material specification. The drawings will detail the exact distance of the pipe from the Route 85 wing walls. Refer to Appendix 3.

Appendix 2

Spread 1-5 Pipeline Alignment Sheets (Under Separate Cover)

Appendix 3

Review of Technical Literature
Cased Versus Uncased Pipeline Crossings

BACKGROUND

The NHDOT Utility Accommodation Manual (UAM), October 2017, Notes in Section IX Pipelines A.1. *a) "Encasement Is mandatory of bridge approaches, freeway, interchange ramps and rail crossings*".

As noted in *Section 7 – General Pipeline Routing Approach* of the Feasibility Study, Liberty Utilities is requesting permission to install an uncased pipeline for crossings under NH Route 101. The current design calls to cross under the highway 3 times, but also crosses under numerous side streets and interchange ramps. This appendix discusses the technical issues and the pros and cons of utilizing uncased pipeline.

PRO'S AND CON'S OF CASED PIPELINES

CASING PRO'S

Historic (1880s - 1950s) perspective for the need/desire of casing around a carrier pipe.

- With the discovery of crude oil and the desire to transport it quickly and economically to market, many pipelines began to be installed. These early lines were of generally small diameter, up to 8 inches, were of wrought iron or steel and were joined together by threads into collars or other mechanical couplings. Two other important considerations were that these lines were laid bare and as a regular matter pumped crude oil that contained water and sediments from the production well. With the last items fostering external and internal corrosion, poor joint connections and the lack of environmental sensitivity that we have today, pipeline leaks were commonplace.
- Because of the propensity of pipelines to leak, both pipeliners and railroaders wanted casings for railroad crossings. However, they had different reasons, the pipeliners felt that casings would provide an easy way to replace, at low cost, a leaky unsatisfactory crossing and the railroaders wanted protection from the leaky pipeline washing out their roadbed.
- Another matter of concern was that a train would impose a load on a pipe installed underneath the roadbed and possibly crush it. A casing would prohibit this unknown load from being transferred to the pipe. This may be called a factor of ignorance, i.e. if you don't know what it is, eliminate it or make it substantially stronger. The industry have better tools now and have found some cases where structures had been constructed with double-digit safety factors to account for this factor. As the years went by, pipe sizes became larger and the joining became more effective with the advent of acetylene welding. These liquid pipelines began to carry refined petroleum products as well as crude oil.

4. Modern Era Liquid Pipelines (post 1950s) – The following have substantially reduced the likelihood and/or minimize pipeline leaks:

- Invention of insulating protective coatings & cathodic protection systems.
- Improved pipe-making and non-destructive testing methods.
- Electric welding and radiographic inspection of pipe joints.
- Required hydrotesting of pipelines to 150% of their maximum operating pressure.
- Internal inspection devices (smart pigs).
- Ability to determine stresses effecting a pipeline in railroad or highway crossing situations.
- The extreme cost of a leak and its subsequent cleanup.
- Probably the single most important factor in the safety of modern pipelines is the use of coatings and cathodic protection systems on steel pipes. Without protection steel pipe will eventually go to a lower potential state by corroding to iron oxide, rust. The first step in a protection scheme is to insulate the pipe from the ground with a protective coating. If you

could be certain that the coating is and will remain perfect, you don't have to do any more. However, the coating has or will develop small imperfections. To combat the coating imperfections, a direct current electrical charge or voltage is put on the pipe making it the cathode and the surrounding ground an anode. This is done so that the direction of electron flow is to the pipe instead of away from it. This potential difference between the pipe and the ground is constantly maintained by a series of anodes or rectifiers and is regularly tested along the pipeline.

CASING CONS

In the modern era of high-pressure transmission pipelines, the industry has found casings to be the cause of many problems and not the solution once thought. A large percentage of pipeline maintenance budgets are spent each year repairing pipelines at casings. Problems attendant with casings:

- Natural earth movements caused by freeze/thaw, heating/cooling and wetting/drying, settlement due to construction of the crossing along with liquid temperature cycles within the pipeline and superimposed load cycles from trains, cause the pipe and casing to move differentially. These movements over time, despite the best efforts to insulate them from each other, often cause the pipe and casing to touch one another causing a short. This short ground the cathodic protection system and eliminates the protection, allowing the pipe to corrode. In extreme cases this differential movement can cause significant stress on the carrier pipe at the casing end. Shorts are intermittent, may be in the middle of a crossing, and are difficult to excavate.
- In many cases a pipeline casing is sealed at each end to prevent groundwater infiltration or flow. When equipped with required vents, the casing will contain water after a period because the pipeline will be relatively cold and will condense moisture from the air. This presents a problem of atmospheric corrosion which the cathodic protection will not contend with.
- The reason that the cathodic protection system is ineffective within a casing is that the metal casing pipe shields the carrier pipe from the protecting cathodic protection current. Also because of the casing, determining what the status of the pipeline within the casing is difficult to conclude without running a smart pig, which may or may not be possible due to the pipeline's design.

CODE AND INDUSTRY BEST PRACTICE

The purpose of the discussion below is to provide insight into current pipeline code as well as industry best practices in support of Liberty Utilities' request for an exception to NHDOT requirements for cased crossings under roadways.

ASME B31.8, Gas Transmission and Distribution pipe Systems - ASME B31.8 is the primary code for the design of the Granite Bridge Pipeline. The Granite Bridge Pipeline is being designed as a class 4 facility and observing the most stringent design factor of 0.4. Table 841.114B of the ASME code notes that for class 4 pipelines, pipelines crossing under roads and highway and public streets have the same design factor of 0.4, whether they are cased or uncased. Meaning a cased pipeline does not contribute to the safety factor.

NACE RP0200 Steel Cased Pipeline Practice - The National Association of Corrosion Engineers (NACE) Recommended Practice RP0200, Section 3.1.1 states: "Unless prohibited by regulation or right-of-way agreement, consideration should be given to adding supplementary carrier pipe wall thickness or burial depth, in lieu of casing". Note the Granite Bridge pipeline provides both supplementary carrier pipe wall and burial depth.

AREMA Manual for Railway Engineering - The American Railway Engineering and Maintenance-of-Way Association's (AREMA) Design Code "Manual for Railway Engineering" Section 5.2.3 provides the

specification of uncased carrier pipe under railroads. Table 1-5-3 specifies a minimum wall thickness of 0.250 inches for a 16" 60,000 psi yield pipe operating at less 1,000 psi, which is significantly less than the 0.5" thickness specified for the Granite Bridge pipeline.

Statistical Analysis of External Corrosion Anomaly Data Of Cased Pipe Segments - This report was prepared for The INGAA Foundation, Inc. by Southwest Research Institute in 2007. It is a comparison of scheduled or immediate responses/mile vs. number of repairs from an Interstate Natural Gas Association of America (INGAA) study and the US Pipeline and Hazardous Materials Safety Administration (PHMSA) database. The report concludes that cased pipe segments could be less safe than uncased segments based on the following:

- Analysis of US Office of Pipeline Safety (OPS) 1988 report data and analysis of new data provided for this study, however, show that shorted casings are more susceptible to corrosion than non-shorted casings.
- When a metallic short is present, any cathodic protection benefit could be eliminated.
- Depression of cathodic protection current resulting in elevated corrosion of the carrier pipe upstream and downstream of the casing ends can occur when a metallic short or electrolytic coupling exists between the casing and the carrier pipe.

The Case Against Casings – At the 1999 AREMA conference, Mr. George Fox presented the findings of his paper "The Case Against Casings". The following is an exert:

"Prior to 1993, the AREMA Manual recommended that all pipelines carrying flammable gas and flammable liquids under the track to be encased in a larger steel pipe. This casing requirement was somewhat unique to the railroad industry. Except for the State of New York, no other state or federal regulatory agency required casings. No other professional organization such as the ASCE, ASME, or API required casings.

Naturally, the pipeline industry questioned the necessity of casings under railroads. In 1985, the Gas Research Institute solicited Cornell University to conduct a study to determine alternatives to casing pipes. Although the research was funded by the Gas Research Institute, members of AREMA and American Petroleum Institute participated in the study.

The Cornell research included comprehensive fully three-dimensional finite element modeling (FEM), followed by parametric reduction into simplified design formulas and design curves. The Cornell FEM results did not compare well with the most widely used design methods developed by Spangler in l956 and l964. In order to verify the Cornell design methods, full-scale field tests were performed by AAR at the Transportation Test Center at Pueblo."

"The design procedure was then utilized to draft a revision of Chapter l, Part 5 of the AREMA Manual to reflect, as an acceptable alternative, the use of uncased pipelines under railroads provided that wall thickness and burial depth met stated conservative minimums. Those changes were printed in the l993 manual."

THE PIPELINE INDUSTRY'S POSITION ON CASINGS

On modern pipelines, casings cause problems without solving any. Further, issues that arise from cased pipeline generally have great effect on both the owner of the pipeline and the owner of the facility where the casing is used. 7 years and millions of dollars in research has been invested to develop updated design criterion for uncased pipeline under transportation facilities.

Professional Societies such as American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), American Petroleum Institute (API) and Governmental Agencies such as the U.S.D.O.T Office of Pipeline Safety have adopted the updated design criterion, allowing uncased crossings of transportation facilities.

The American Petroleum Institute published a report for the US Department of Transportation entitled “Analysis of DOT Reportable Incidents for Hazardous Liquid Pipelines, 1986 through 1996”. Report No 1158 is dated January 7, l999. According to the report, the leading cause of pipeline incidents is “third-party” damage, (i.e. incidents where excavation results in a leak or rupture of a buried pipeline) which accounted for 19.9 percent of all incidents. The next most common cause is “external corrosion” which accounts for a nearly identical 19.4% of all incidents.

While a casing will provide some mechanical protection against third party damage, the degree of protection is marginal considering the ripping force of excavators. There are more practical ways of achieving this protection without the problems inherent to casings. In many soil conditions, deeper burial is a practical method to reduce the risk of third-party damage. Modern directional drilling techniques can economically achieve greater installation depths without interruption to transportation facilities.

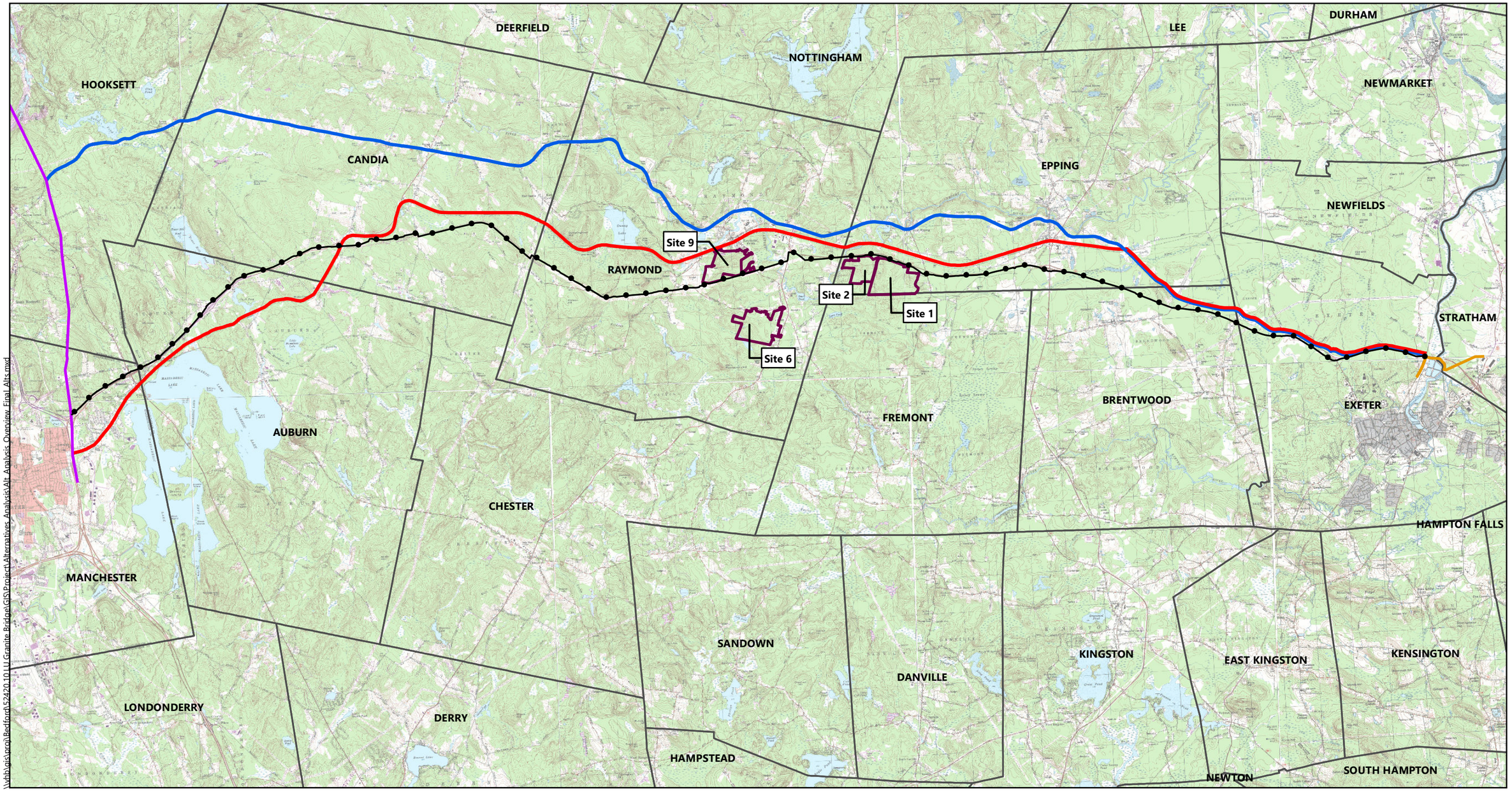
The second leading cause of pipeline incidents is external corrosion. A casing pipe increases the risk of corrosion by defeating cathodic protection and exposing the carrier pipe to atmospheric corrosion. Therefore, elimination of the casing pipe will actually reduce the potential development of a leak caused by external corrosion. Through significant reduction of the effects of these two categories, third party damage and corrosion, arises the potential to reduce incidents by nearly 40%.

The perceived added factor of safety provided by a casing pipe does not outweigh the negative effects that a casing has on the overall reliability of the carrier pipe. In addition to modern cathodic protection systems and deeper burial, the pipeline industry has been successful in reduction of incidents through public awareness programs, underground utility “One Call” programs and more frequent markings for pipelines.

Appendix 4

Granite Bridge Pipeline
Route Alternative Analysis Map

vhb January 10, 2019 | **FIGURE 1**



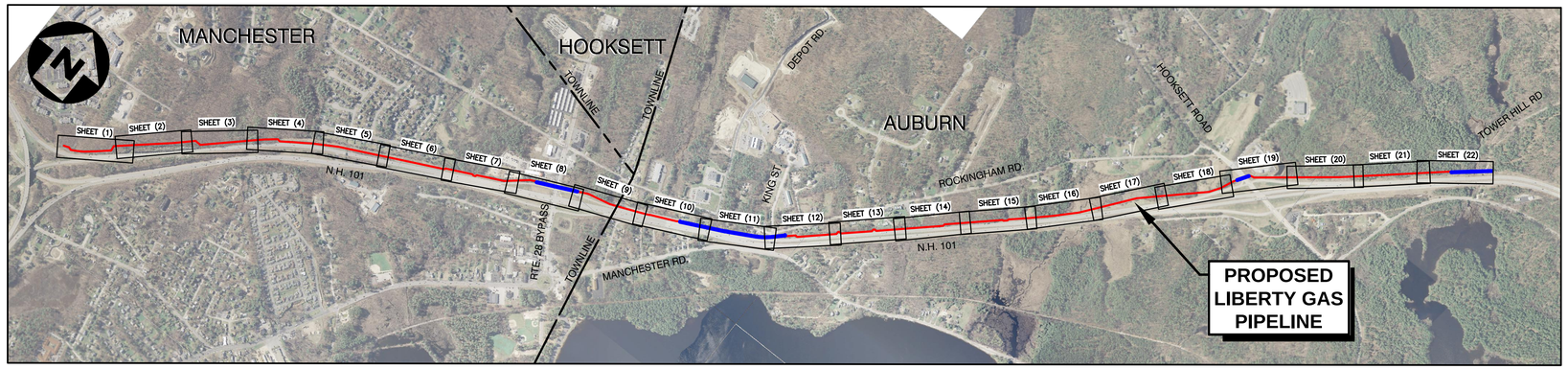
\\vhb\vais\proj\Bedford\52820.10\Granite Bridge\GIS\Project\Alternatives Analysis\Alt Analysis Overview_Final Alts.mxd

Granite Bridge Project | Exeter to Manchester, NH

Alternative Analysis Figure

Source Info: VHB, NHGranit

GRANITE BRIDGE PIPELINE
SPREAD 1
LIBERTY UTILITIES
MANCHESTER & AUBURN, NEW HAMPSHIRE



GAS LEGEND
- PROPOSED GAS PIPELINE ROUTE
- PROPOSED GAS PIPELINE HDD/PUSH

ENVIROMENTAL LEGEND
- WETLAND AREA
- EDGE OF WETLAND (ALL TYPES)
- CONSTRUCTION FENCE
- VERNAL POOL

SURVEY LEGEND
- MARITIMES & NORTHEAST PIPELINE
- APPROX. PROPERTY LINE
- LA ROW
- ROW LINE DIGITIZED
- CHAIN LINK FENCE
- GUARDRAIL
- OVERHEAD WIRE
- SEWER LINE
- DRAIN LINE
- GAS LINE
- WATER LINE
- UG. ELEC. LINE (FROM HWY MAP)
- UG. GAS LINE (FROM HWY MAP)
- UG. DRAIN LINE (FROM HWY MAP)
- UG. SANIT. LINE (FROM HWY MAP)
- UG. TELE./FIBER LINE (FROM HWY MAP)
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE
- TREE LINE
- SHRUB LINE
- EDGE OF WATER
- EXISTING CURB
- RETAINING WALL
- CONCRETE
- RIP RAP
- UTILITY POLE
- UTILITY POLE & GUY WIRE
- UTILITY POLE W/ LIGHT
- LIGHT POLE
- LIGHT POLE (ONE ARM)
- LIGHT POLE (TWO ARMS)
- ELECTRIC METER
- SIGN
- SIGN (TWO POSTS)
- BOUND FOUND
- CATCH BASIN
- DRAIN MANHOLE
- TELEPHONE MANHOLE
- FLARED END SECTION
- HAND HOLE
- BORING LOCATION
- CONIFEROUS TREE
- DECIDUOUS TREE

DRAWING INDEX

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-CV-01	1	E	Cover Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-CV-01	2	E	Index Map Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	1	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	2	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	3	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB19	4	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	5	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-20	16	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-20	22	E	Spread 1 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	1	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	2	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	3	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	4	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	5	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	6	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-TR-01	1	E	Standard Traffic Control Plan	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-CA-01	1	E	Construction Access Plan	30% Preliminary	6/22/2018

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PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT

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APPROVAL			
BID			
CONSTR.			

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LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
COVER SHEET
SPREAD 1 – SHEET 1
–

ENGR: J. TIRRELL | DSGN: MJK
DATE: 05/30/2018 | SCALE: 1"=1000'
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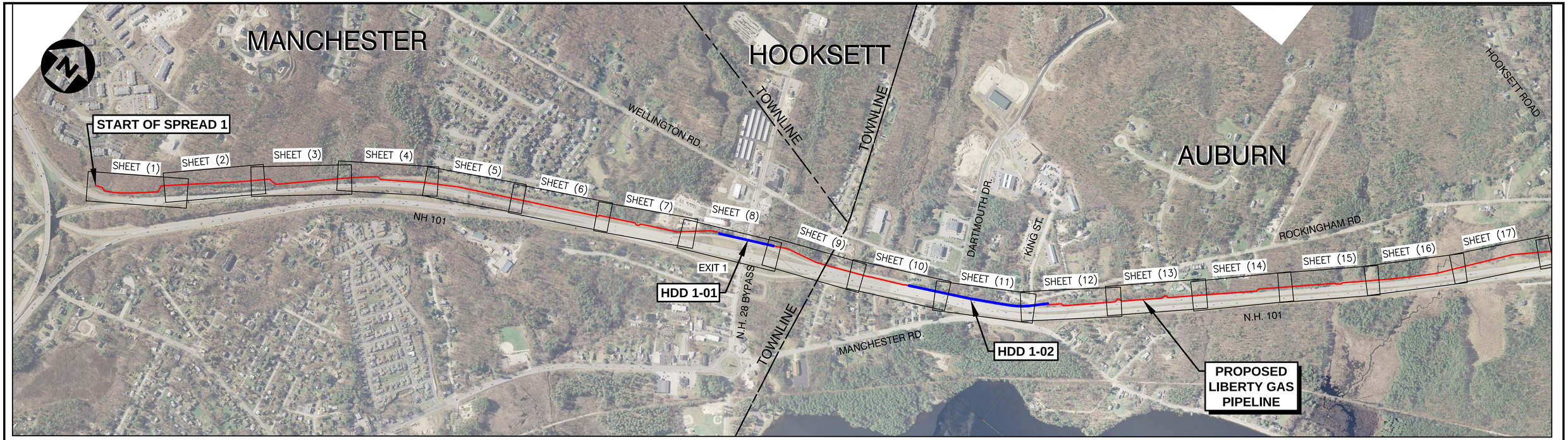

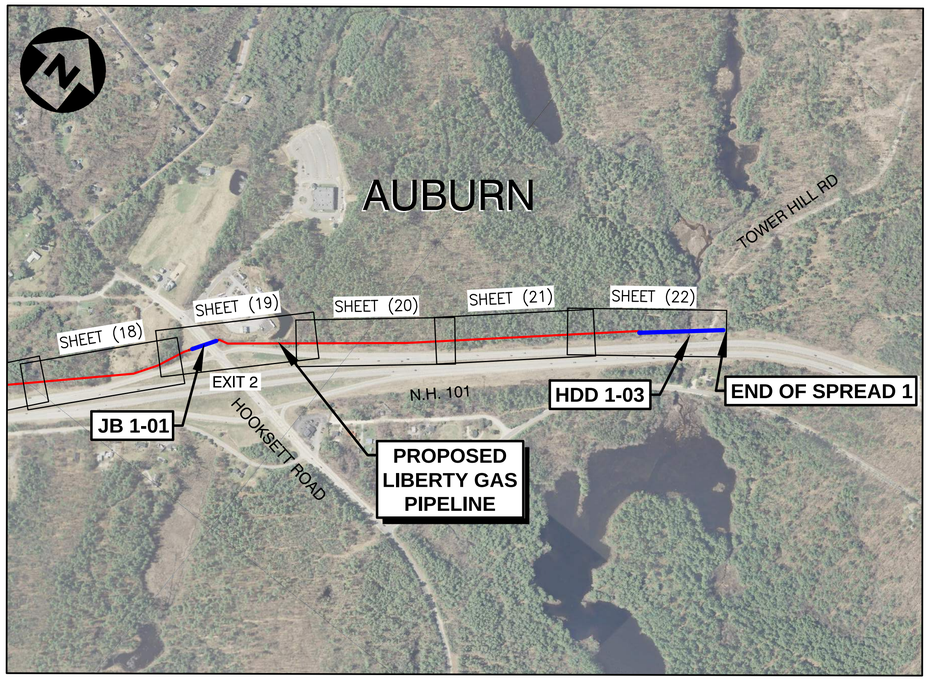

30% PRELIMINARY

ABBREVIATIONS:
JB = JACK AND BORE
HDD = HORIZONTAL DIRECTIONAL DRILL
TGP = TENNESSEE GAS PIPELINE

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PROJ ENGR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
ENGR	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
OPR	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
CONST	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT

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LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
INDEX MAP SHEET
SPREAD 1 – SHEET 2
–

ENGR: J. TIRRELL | DSGN: MJK
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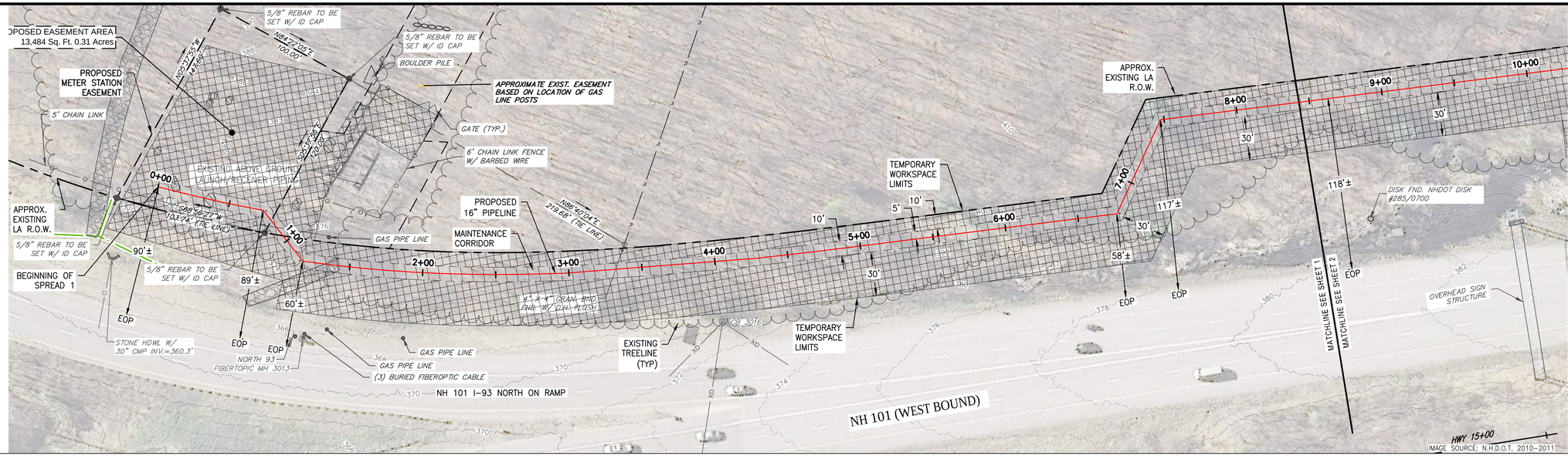
PLAN (PIPELINE STATIONING)



0 40 80
SCALE IN FEET

LOCATION	MANCHESTER, HILLSBOROUGH COUNTY, NEW HAMPSHIRE
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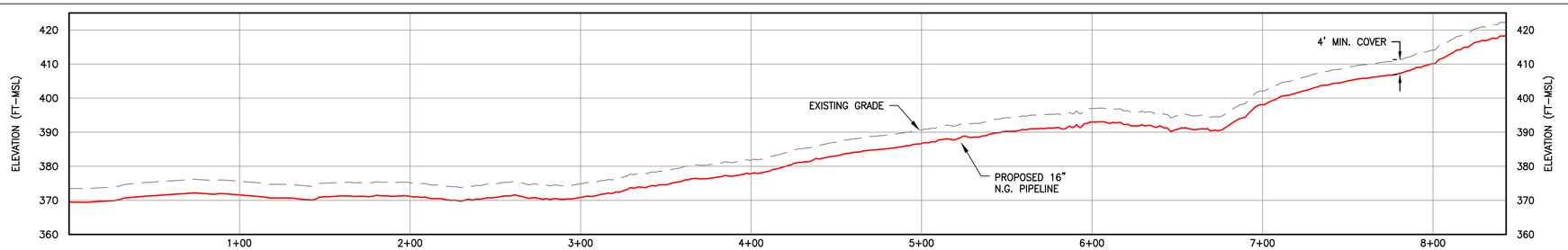
WETLAND I.D.s	
REF. DWG. NO	

CROSSING ITEMS (PIPELINE STATIONING)

PROFILE (PIPELINE STATIONING)



0 40 80
HORIZ. SCALE IN FEET
0 20 40
VERT. SCALE IN FEET

MATERIAL

PIPELINE SCHEMATIC
- PIPE INSTALLED BY OPEN CUT
- PIPE INSTALLED BY BORE
- SOILS BOUNDRY
- SEGMENTABLE FITTING
- BORE ENTRY/EXIT
- PIPELINE MARKER
- VALVE
- IMPRESSED CURRENT TEST STATION

BILL OF MATERIALS

NO.	DESCRIPTION	QTY.
1	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 30 mils POWERCRETE COATING	
2	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 10/40 PRITEC COATING	
3	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 2" THICK CONCRETE COATING	
4	PIPELINE MARKER	
5	IMPRESSED CURRENT TEST STATION	

GENERAL NOTES:
1. ALL EXISTING UTILITIES AND THEIR RESPECTIVE LOCATIONS DEPICTED ON THESE PLANS SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR MUST VERIFY THE EXTENT OF ALL UTILITIES WITHIN THE PROJECT AREA, AS WELL AS THEIR SPECIFIC LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.
2. QUANTITIES LISTED ARE BASED ON HORIZONTAL LENGTH.
3. DESIGN SPECIFICATIONS: CLASS 4 DESIGN USING 0.4 DESIGN FACTOR /ANSI 600/950 PSIG MAOP
4. REFERENCE (ALL SHEETS): FOR FULL LIST OF DRAWING REFERENCES FOR BASE MAP INFORMATION, SEE COVER SHEET.
5. PIPELINE MARKERS MUST BE INSTALLED ON BOTH SIDES OF ROAD AND RAILROAD CROSSINGS, AT EACH LINE CROSSING, AND OTHER LOCATIONS SHOWN IN PROJECT SCOPE OF WORK OR PROJECT CONSTRUCTION DRAWINGS. LINE MARKER PLACEMENT TO BE DETERMINED DURING CLEAN UP OPERATIONS AND NOTED ON AS-BUILT DRAWINGS, PER SUBMITTED REDLINES FROM CONSTRUCTION.
6. ANY SURVEY MONUMENT IMPACTED BY CONSTRUCTION SHALL BE LOCATED PRIOR TO IMPACT AND RESET BY A N.H. LICENSED LAND SURVEYOR UNDER THE SUPERVISION OF N.H. DOT BUREAU OF RIGHT-OF-WAY.
7. VACUUM EXCAVATE TO IDENTIFY UTILITY DEPTHS PRIOR TO EXCAVATION.

30% PRELIMINARY

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HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT

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PRELIM.	BM	AB	9/30/18
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CONSTR.			

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LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
ALIGNMENT SHEETS
CITY OF MANCHESTER, HILLSBOROUGH COUNTY, STATE OF N.H.
SPREAD 1 - SHEET 1

ENGR: J. TIRRELL | DSGN: MJK
DATE: 05/30/2018 | SCALE: AS-NOTED
LIBERTY-GB-(19).DWG | E

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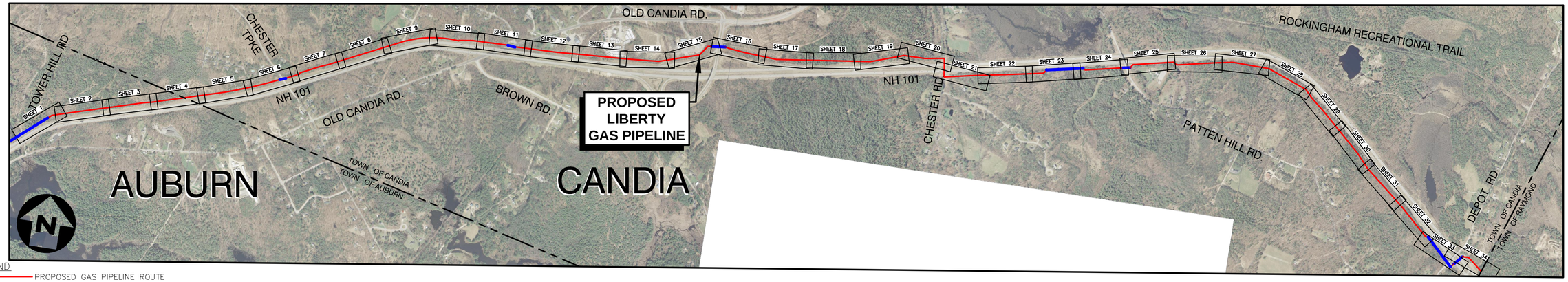
GRANITE BRIDGE PIPELINE
SPREAD 2
LIBERTY UTILITIES
AUBURN & CANDIA, NEW HAMPSHIRE



GAS LEGEND
- PROPOSED GAS PIPELINE ROUTE
- PROPOSED GAS PIPELINE HDD/PUSH

ENVIROMENTAL LEGEND
- WETLAND AREA
- EDGE OF WETLAND (ALL TYPES)
- NON JURISDICTIONAL DRAINAGE
- CONSTRUCTION FENCE
- VERNAL POOL

SURVEY LEGEND
- MARITIMES & NORTHEAST PIPELINE
- APPROX. PROPERTY LINE
- LA ROW
- ROW LINE DIGITIZED
- CHAIN LINK FENCE
- GUARDRAIL
- OVERHEAD WIRE
- SEWER LINE
- DRAIN LINE
- GAS LINE
- WATER LINE
- UG. ELEC. LINE (FROM HWY MAP)
- UG. GAS LINE (FROM HWY MAP)
- UG. DRAIN LINE (FROM HWY MAP)
- UG. SANIT. LINE (FROM HWY MAP)
- UG. TELE./FIBER LINE (FROM HWY MAP)
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE
- TREE LINE
- SHRUB LINE
- EDGE OF WATER
- EXISTING CURB
- RETAINING WALL
- CONCRETE
- RIP RAP
- UTILITY POLE
- UTILITY POLE & GUY WIRE
- UTILITY POLE W/ LIGHT
- LIGHT POLE
- LIGHT POLE (ONE ARM)
- LIGHT POLE (TWO ARMS)
- ELECTRIC METER
- SIGN
- SIGN (TWO POSTS)
- BOUND FOUND
- CATCH BASIN
- TELEPHONE MANHOLE
- DRAIN MANHOLE
- FLARED END SECTION
- HAND HOLE
- BORING LOCATION
- CONIFEROUS TREE
- DECIDUOUS TREE

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_13068\ liberty-gb-cv-02.dwg PLOT DATE/TIME: 03/27/19 10:23 PLOT BY: MICHAEL KELLY

DRAWING INDEX

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-CV-02	1	E	Cover Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-CV-02	2	E	Index Map Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	1	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	2	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	3	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB19	4	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	5	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	6	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	7	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	8	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	9	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-19	10	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	11	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	12	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	13	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	14	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	15	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	16	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	17	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	18	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	19	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	20	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	21	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	22	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	23	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	24	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	25	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	26	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	27	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	28	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018

DRAWING INDEX

PRELIMINARY	CIVIL	LIBERTY-GB-20	29	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	30	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	31	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-20	33	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-20	34	E	Spread 2 Alignment Sheet	30% Preliminary	10/1/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	1	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	2	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	3	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	4	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	5	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	6	E	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-TR-02	1	E	Standard Traffic Control Plan	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-CA-02	1	E	Construction Access Plan	30% Preliminary	6/22/2018

30% PRELIMINARY

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REVIEWED BY:	DATE	REV	DESCRIPTION	BY	APP'D
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT

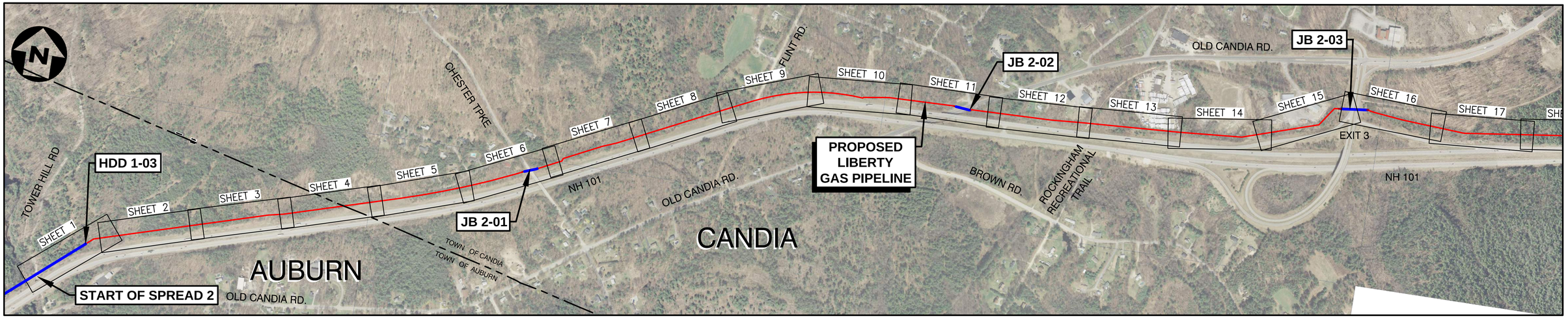
RELEASED ONLY FOR:

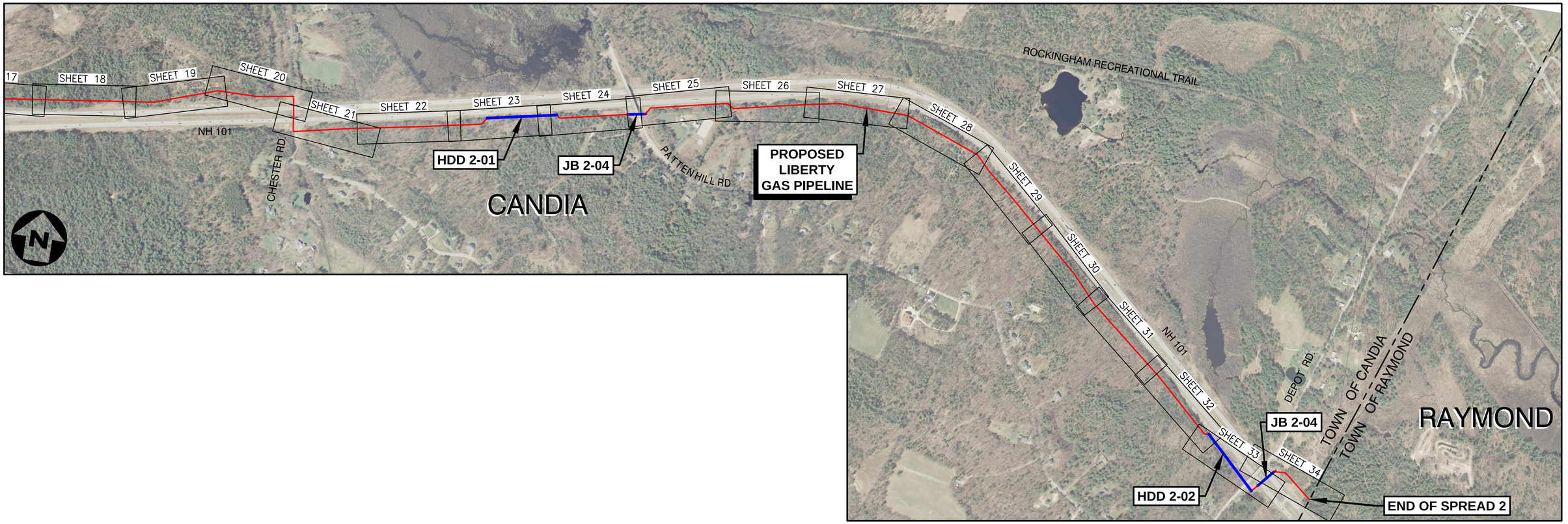
	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

Liberty Utilities WWW.LIBERTYUTILITIES.COM
15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
COVER SHEET
SPREAD 2
–

ENGR: J. TIRRELL | DSGN: MJK
DATE: 05/30/2018 | SCALE: 1"=1000'
LIBERTY-GB-CV-02.DWG | E





ABBREVIATIONS:
JB = JACK AND BORE
HDD = HORIZONTAL DIRECTIONAL DRILL
TGP = TENNESSEE GAS PIPELINE

30% PRELIMINARY

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REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
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CONSTR.			

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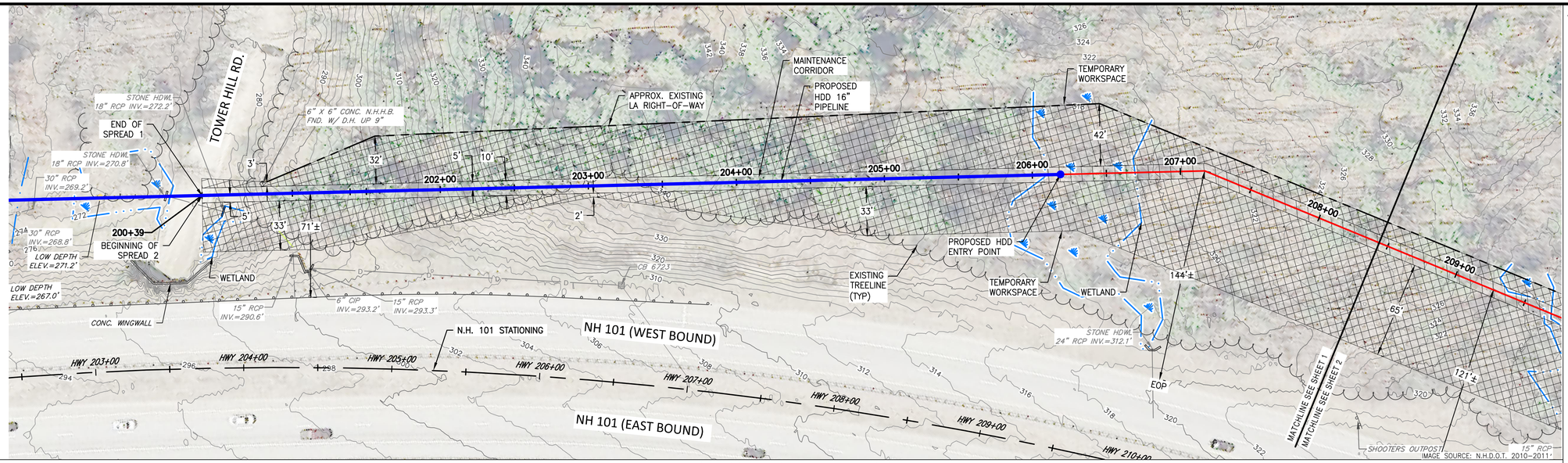
15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
INDEX MAP SHEET
SPREAD 2
–

ENGR: J. TIRRELL	DSGN: MJK
DATE: 05/30/2018	SCALE: 1"=500'
LIBERTY-GB-CV-02.DWG	E

FILE PATH: C:\Users\vmkelly\appdata\local\temp\AcPublish_13068\ liberty-gb-cv-02.dwg PLOT DATE/TIME: 03/27/19 08:42 PLOT BY: MICHAEL KELLY

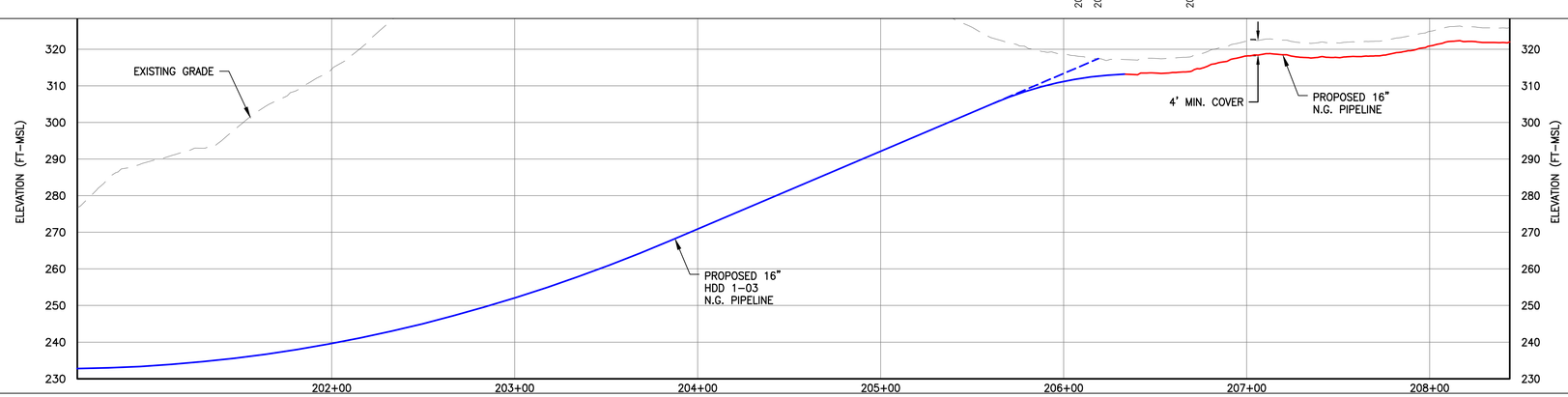
PLAN (PIPELINE STATIONING)



LOCATION	AUBURN, ROCKINGHAM COUNTY, NEW HAMPSHIRE
N.H. 101 STATIONING	HWY 204+00 · HWY 205+00 · HWY 206+00 · HWY 207+00 · HWY 208+00 · HWY 209+00 · HWY 210+00 · HWY 211+00
WETLAND I.D.s	
REF. DWG. NO	

CROSSING ITEMS (PIPELINE STATIONING)

PROFILE (PIPELINE STATIONING)



MATERIAL

PIPELINE SCHEMATIC
- PIPE INSTALLED BY OPEN CUT
- PIPE INSTALLED BY BORE
- SOILS BOUNDRY
- SEGMENTABLE FITTING
- BORE ENTRY/EXIT
- PIPELINE MARKER
- VALVE
- IMPRESSED CURRENT TEST STATION

BILL OF MATERIALS

NO.	DESCRIPTION	QTY.
1	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 30 mils POWERCRETE COATING	
2	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 10/40 PRITEC COATING	
3	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 2" THICK CONCRETE COATING	
4	PIPELINE MARKER	
5	IMPRESSED CURRENT TEST STATION	

GENERAL NOTES:
1. ALL EXISTING UTILITIES AND THEIR RESPECTIVE LOCATIONS DEPICTED ON THESE PLANS SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR MUST VERIFY THE EXTENT OF ALL UTILITIES WITHIN THE PROJECT AREA, AS WELL AS THEIR SPECIFIC LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.
2. QUANTITIES LISTED ARE BASED ON HORIZONTAL LENGTH.
3. DESIGN SPECIFICATIONS: CLASS 4 DESIGN USING 0.4 DESIGN FACTOR /ANSI 600/950 PSIG MAOP
4. REFERENCE (ALL SHEETS): FOR FULL LIST OF DRAWING REFERENCES FOR BASE MAP INFORMATION, SEE COVER SHEET.
5. PIPELINE MARKERS MUST BE INSTALLED ON BOTH SIDES OF ROAD AND RAILROAD CROSSINGS, AT EACH LINE CROSSING, AND OTHER LOCATIONS SHOWN IN PROJECT SCOPE OF WORK OR PROJECT CONSTRUCTION DRAWINGS. LINE MARKER PLACEMENT TO BE DETERMINED DURING CLEAN UP OPERATIONS AND NOTED ON AS-BUILT DRAWINGS, PER SUBMITTED REDLINES FROM CONSTRUCTION.
6. ANY SURVEY MONUMENT IMPACTED BY CONSTRUCTION SHALL BE LOCATED PRIOR TO IMPACT AND RESET BY A N.H. LICENSED LAND SURVEYOR UNDER THE SUPERVISION OF N.H. DOT BUREAU OF RIGHT-OF-WAY.
7. VACUUM EXCAVATE TO IDENTIFY UTILITY DEPTHS PRIOR TO EXCAVATION.

30% PRELIMINARY

SPREAD - 2

REVIEWED BY:	NO.	DATE	DESCRIPTION	BY	APP'D
PROJ ENGR					
ENGR					
OPR	E	3/18/19	ALIGNMENT UPDATES 30%	MJK	JPT
CONST	D	2/28/19	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
HS&E	C	12/27/18	EXPANDED WORK AREAS	MJK	JPT
	B	9/17/18	DOT REVIEW	PPS	JPT
	A	9/0718	LIBERTY REVIEW	PPS	JPT

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

Liberty Utilities
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15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
ALIGNMENT SHEETS
TOWN OF AUBURN, ROCKINGHAM COUNTY, STATE OF N.H.
SPREAD 2 - SHEET 1

ENGR: J. TIRRELL | DSGN: MJK
DATE: 05/30/2018 | SCALE: AS-NOTED
LIBERTY-GB-(21).DWG | E

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DOUCET SURVEY INC. WWW.DOUCETSURVEY.COM
CHI WWW.CHIENGINEERING.COM

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_13068\liberty-gb-(21).dwg PLOT DATE/TIME: 03/27/19 14:00 PLOT BY: MICHAEL KELLY

GRANITE BRIDGE PIPELINE
SPREAD 3
LIBERTY UTILITIES
RAYMOND, NEW HAMPSHIRE

GAS LEGEND
- PROPOSED GAS PIPELINE ROUTE
- PROPOSED GAS PIPELINE HDD/PUSH

ENVIROMENTAL LEGEND
- WETLAND AREA
- EDGE OF WETLAND (ALL TYPES)
- CONSTRUCTION FENCE
- VERNAL POOL

SURVEY LEGEND
- MARITIMES & NORTHEAST PIPELINE
- APPROX. PROPERTY LINE
- LA ROW
- ROW LINE DIGITIZED
- CHAIN LINK FENCE
- GUARDRAIL
- OVERHEAD WIRE
- SEWER LINE
- DRAIN LINE
- GAS LINE
- WATER LINE
- UG. ELEC. LINE (FROM HWY MAP)
- UG. GAS LINE (FROM HWY MAP)
- UG. DRAIN LINE (FROM HWY MAP)
- UG. SANIT. LINE (FROM HWY MAP)
- UG. TELE./FIBER LINE (FROM HWY MAP)
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE
- TREE LINE
- SHRUB LINE
- EDGE OF WATER
- EXISTING CURB
- RETAINING WALL
- CONCRETE
- RIP RAP
- UTILITY POLE
- UTILITY POLE & GUY WIRE
- UTILITY POLE W/ LIGHT
- LIGHT POLE
- LIGHT POLE (ONE ARM)
- LIGHT POLE (TWO ARMS)
- ELECTRIC METER
- SIGN
- SIGN (TWO POSTS)
- BOUND FOUND
- CATCH BASIN
- DRAIN MANHOLE
- FLARED END SECTION
- HAND HOLE
- BORING LOCATION
- CONIFEROUS TREE
- DECIDUOUS TREE

DRAWING INDEX

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-CV-03	1	D	Cover Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-CV-03	2	D	Index Map Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	1	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	2	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	3	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	4	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	5	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	6	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	7	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	8	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	9	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-6	10	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	11	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	12	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	13	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	14	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	15	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-7	17	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-7	18	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-7	20	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	21	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	22	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	23	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	24	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	25	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	26	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	27	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	28	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	29	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-8	30	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	31	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	32	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	33	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	34	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	34A	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018

DRAWING INDEX (CON'T)

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
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PRELIMINARY	CIVIL	LIBERTY-GB-9	37	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-9	38	D	Spread 3 Alignment Sheet	30% Preliminary	7/14/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	1	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	2	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	3	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	4	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	5	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	6	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-TR-01	1	D	Standard Traffic Control Plan	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-CA-03	1	D	Construction Access Plan	30% Preliminary	6/22/2018

30% PRELIMINARY

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REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

Liberty Utilities WWW.LIBERTYUTILITIES.COM 15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
COVER SHEET
SPREAD 3
–

ENGR: J. TIRRELL | DSGN: PPS
DATE: 05/30/2018 | SCALE: 1"=1000'
LIBERTY-GB-CV-03.DWG | D

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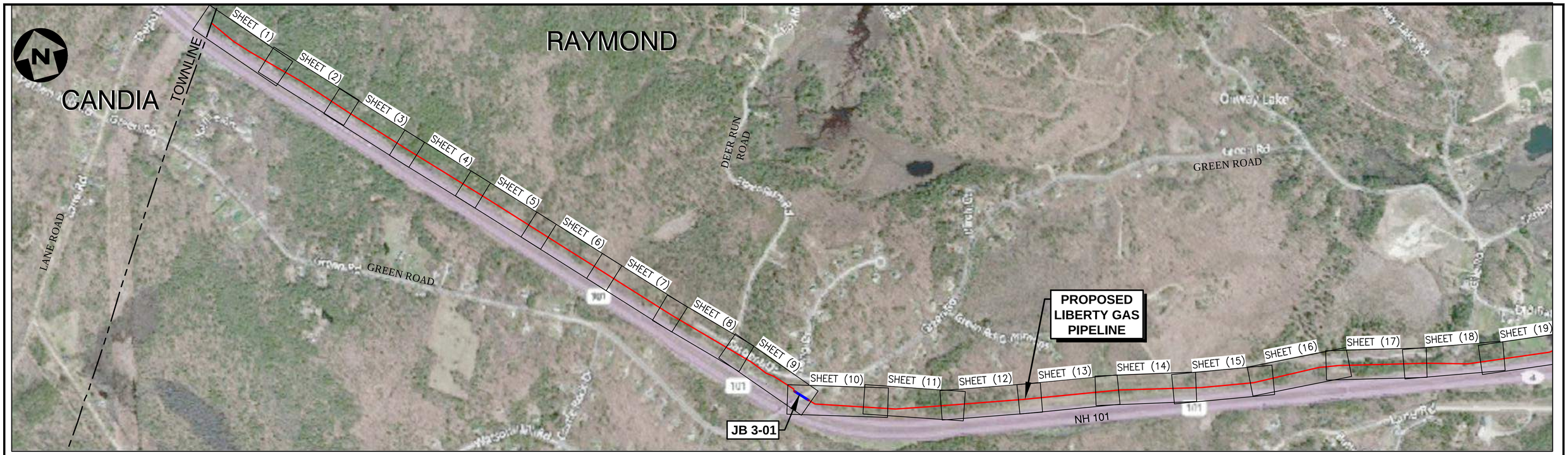

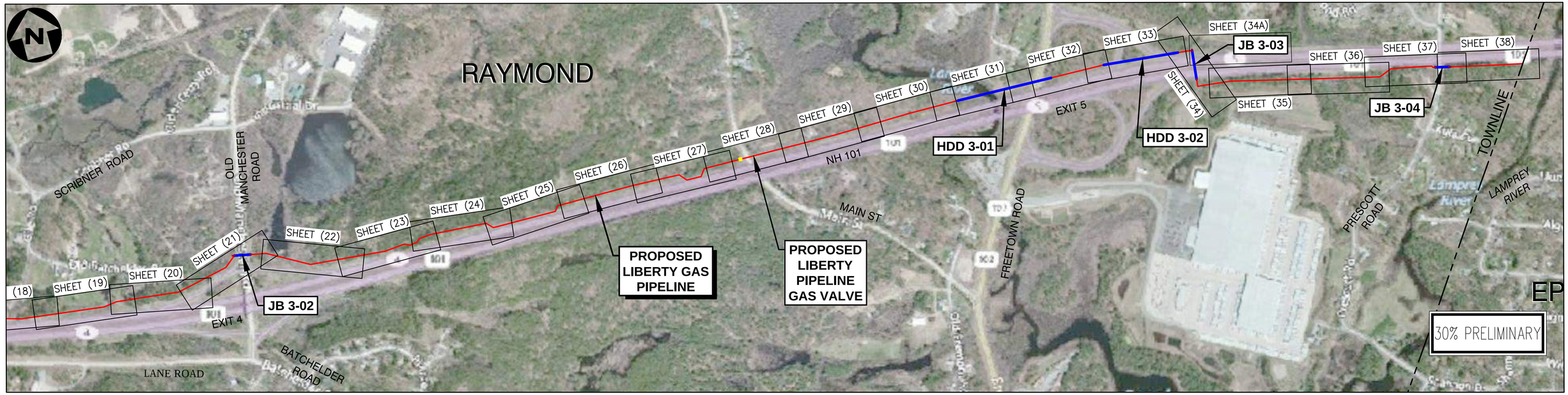

ABBREVIATIONS:
JB = JACK AND BORE
HDD = HORIZONTAL DIRECTIONAL DRILL
TGP = TENNESSEE GAS PIPELINE

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WWW.VHB.COM

GOLDER
WWW.GOLDER.COM

DOUCET SURVEY INC
WWW.DOUCETSURVEY.COM

CHI
WWW.CHIENGINEERING.COM

REVIEWED BY:	DATE	REV	DESCRIPTION	BY	APP'D
PROJ ENGR					
ENGR					
OPR	02/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/21/18	C	EXPANDED WORK AREAS	MJK	JPT
HS&E	06/28/18	B	DOT REVIEW	PPS	JPT
	06/22/18	A	LIBERTY REVIEW	PPS	JPT

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

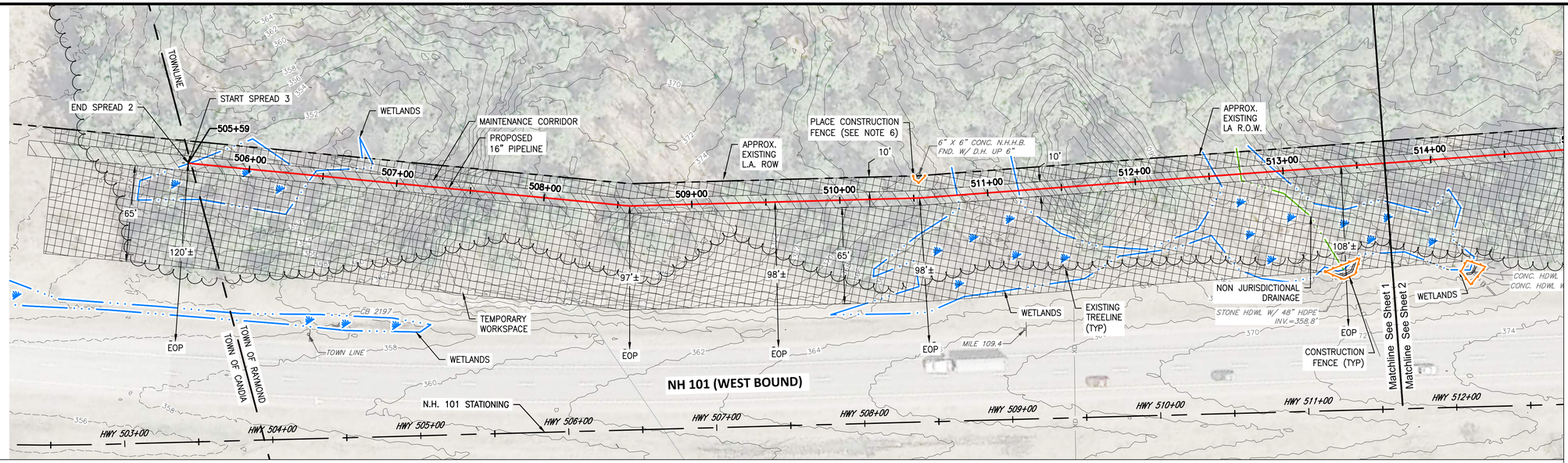
Liberty Utilities
WWW.LIBERTYUTILITIES.COM
15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY–GRANITE BRIDGE PIPELINE PROJECT
INDEX MAP SHEET
SPREAD 3
–

ENGR: J. TIRRELL | DSGN: PPS
DATE: 05/30/2018 | SCALE: 1"=500'
LIBERTY–GB–CV–03.DWG | D

FILE PATH: C:\Users\vnkelly\appdata\local\temp\AcPublish_12600\ liberty-gb-cv-03.dwg PLOT DATE/TIME: 02/06/19 09:42 PLOT BY: MICHAEL KELLY

PLAN (PIPELINE STATIONING)

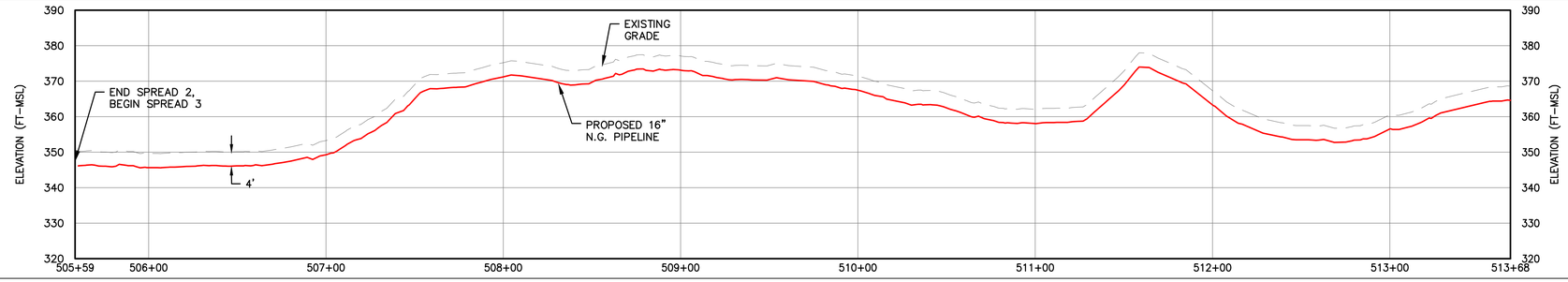


LOCATION	CANDIA, ROCKINGHAM COUNTY, NEW HAMPSHIRE — RAYMOND, ROCKINGHAM COUNTY, NEW HAMPSHIRE
N.H. 101 STATIONING	HWY 504+00 · HWY 505+00 · HWY 506+00 · HWY 507+00 · HWY 508+00 · HWY 509+00 · HWY 510+00 · HWY 511+00
REF. DWG. NO	

CROSSING ITEMS (PIPELINE STATIONING)

506+43 WETLANDS
510+79 WETLANDS
511+21 WETLANDS
512+55 WETLANDS
512+71 NON JURISDICTIONAL DRAINAGE
512+95 WETLANDS

PROFILE (PIPELINE STATIONING)



MATERIAL

PIPELINE SCHEMATIC
- PIPE INSTALLED BY OPEN CUT
- PIPE INSTALLED BY BORE
- SOILS BOUNDRY
- SEGMENTABLE FITTING
- BORE ENTRY/EXIT
- PIPELINE MARKER
- VALVE
- IMPRESSED CURRENT TEST STATION

BILL OF MATERIALS

NO.	DESCRIPTION	QTY.
1	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 30 mils POWERCRETE COATING	
2	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 10/40 PRITEC COATING	
3	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 2" THICK CONCRETE COATING	
4	PIPELINE MARKER	
5	IMPRESSED CURRENT TEST STATION	

GENERAL NOTES:
1. ALL EXISTING UTILITIES AND THEIR RESPECTIVE LOCATIONS DEPICTED ON THESE PLANS SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR MUST VERIFY THE EXTENT OF ALL UTILITIES WITHIN THE PROJECT AREA, AS WELL AS THEIR SPECIFIC LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.
2. QUANTITIES LISTED ARE BASED ON HORIZONTAL LENGTH.
3. DESIGN SPECIFICATIONS: CLASS 4 DESIGN USING 0.4 DESIGN FACTOR /ANSI 600/950 PSIG MAOP
4. REFERENCE (ALL SHEETS): FOR FULL LIST OF DRAWING REFERENCES FOR BASE MAP INFORMATION, SEE COVER SHEET.
5. PIPELINE MARKERS MUST BE INSTALLED ON BOTH SIDES OF ROAD AND RAILROAD CROSSINGS, AT EACH LINE CROSSING, AND OTHER LOCATIONS SHOWN IN PROJECT SCOPE OF WORK OR PROJECT CONSTRUCTION DRAWINGS. LINE MARKER PLACEMENT TO BE DETERMINED DURING CLEAN UP OPERATIONS AND NOTED ON AS-BUILT DRAWINGS, PER SUBMITTED REDLINES FROM CONSTRUCTION.
6. ANY SURVEY MONUMENT IMPACTED BY CONSTRUCTION SHALL BE LOCATED PRIOR TO IMPACT AND RESET BY A N.H. LICENSED LAND SURVEYOR UNDER THE SUPERVISION OF N.H. DOT BUREAU OF RIGHT-OF-WAY.

30% PRELIMINARY

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DOUCET SURVEY INC WWW.DOUCETSURVEY.COM
CHI WWW.CHIENGINEERING.COM

REVIEWED BY:	DATE	REV	DESCRIPTION	BY	APP'D
PROJ ENGR	02/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
ENGR	12/21/18	C	ENLARGED WORK AREAS	MJK	JPT
OPR	07/20/18	B	DOT REVIEW	MJK	JPT
CONST	07/13/18	A	LIBERTY REVIEW	MJK	JPT
HS&E					

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.			
APPROVAL			
BID			
CONSTR.			

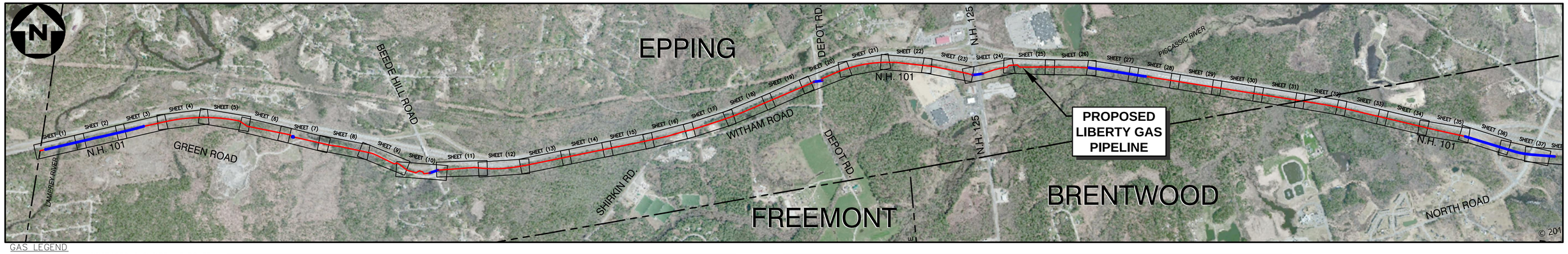
Liberty Utilities WWW.LIBERTYUTILITIES.COM 15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
ALIGNMENT SHEETS
TOWN OF RAYMOND, ROCKINGHAM COUNTY, STATE OF N.H.
SPREAD 3 - SHEET 1

ENGR: J. TIRRELL | DSGN: PPS
DATE: 05/30/2018 | SCALE: AS NOTED
LIBERTY-GB-(6).DWG | D

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_12600\liberty-gb-(6).dwg PLOT DATE/TIME: 02/06/19 09:46 PLOT BY: MICHAEL KELLY

GRANITE BRIDGE PIPELINE
SPREAD 4
LIBERTY UTILITIES
EPPING, NEW HAMPSHIRE



GAS LEGEND

- PROPOSED GAS PIPELINE ROUTE
- PROPOSED GAS PIPELINE HDD/PUSH

ENVIROMENTAL LEGEND

- WETLAND AREA
- EDGE OF WETLAND (ALL TYPES)
- CONSTRUCTION FENCE
- VERNAL POOL

SURVEY LEGEND

- MARITIMES & NORTHEAST PIPELINE
- APPROX. PROPERTY LINE
- LA ROW
- ROW LINE DIGITIZED
- CHAIN LINK FENCE
- GUARDRAIL
- OVERHEAD WIRE
- SEWER LINE
- DRAIN LINE
- GAS LINE
- WATER LINE
- UG. ELEC. LINE (FROM HWY MAP)
- UG. GAS LINE (FROM HWY MAP)
- UG. DRAIN LINE (FROM HWY MAP)
- UG. SANIT. LINE (FROM HWY MAP)
- UG. TELE./FIBER LINE (FROM HWY MAP)
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE
- TREE LINE
- SHRUB LINE
- EDGE OF WATER
- EXISTING CURB
- RETAINING WALL
- CONCRETE
- RIP RAP
- UTILITY POLE
- UTILITY POLE & GUY WIRE
- UTILITY POLE W/ LIGHT
- LIGHT POLE
- LIGHT POLE (ONE ARM)
- LIGHT POLE (TWO ARMS)
- ELECTRIC METER
- SIGN
- SIGN (TWO POSTS)
- BOUND FOUND
- CATCH BASIN
- DRAIN MANHOLE
- FLARED END SECTION
- HAND HOLE
- BORING LOCATION
- CONIFEROUS TREE
- DECIDUOUS TREE

DRAWING INDEX

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-CV-04	1	E	Cover Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-CV-04	2	E	Index Map Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	1	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	2	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	3	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	4	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	5	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	6	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	7	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	8	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	9	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-10	10	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-11	11	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-11	12	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-11	13	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-11	14	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-11	15	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-12	22	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-12	25	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-12	26	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-12	30	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-13	31	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
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PRELIMINARY	CIVIL	LIBERTY-GB-13	33	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-13	34	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-13	35	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018

DRAWING INDEX (CON'T)

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-GB-13	36	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-13	37	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-13	38	E	Spread 4 Alignment Sheet	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	1	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	2	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	3	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	4	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	5	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	6	E	Standard Construction Details	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-TR-01	1	E	Standard Traffic Control Plan	30% Preliminary	9/5/2018
PRELIMINARY	CIVIL	LIBERTY-GB-CA-04	1	E	Construction Access Plan	30% Preliminary	9/5/2018

30% PRELIMINARY

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REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
HS&E	9/0718	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

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PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

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15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
COVER SHEET
SPREAD 4 - SHEET 1

ENGR: J. TIRRELL | DSGN: PPS
DATE: 05/30/2018 | SCALE: 1"=1000'
LIBERTY-GB-CV-04.DWG | E

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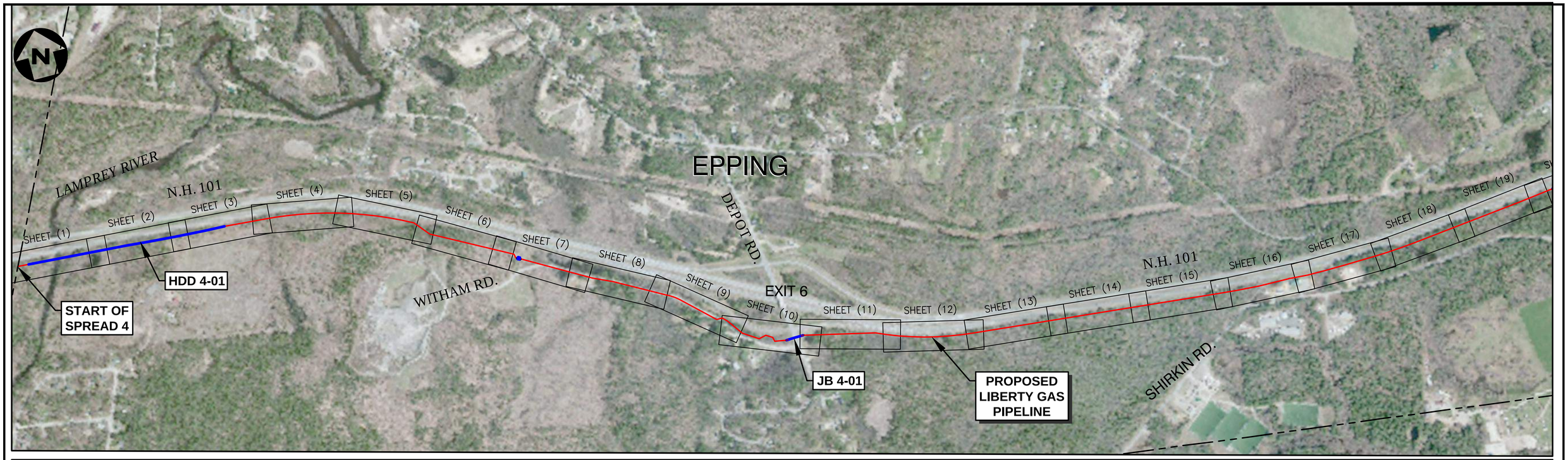

ABBREVIATIONS:
JB = JACK AND BORE
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REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
CONST	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
HS&E	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
	9/0718	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

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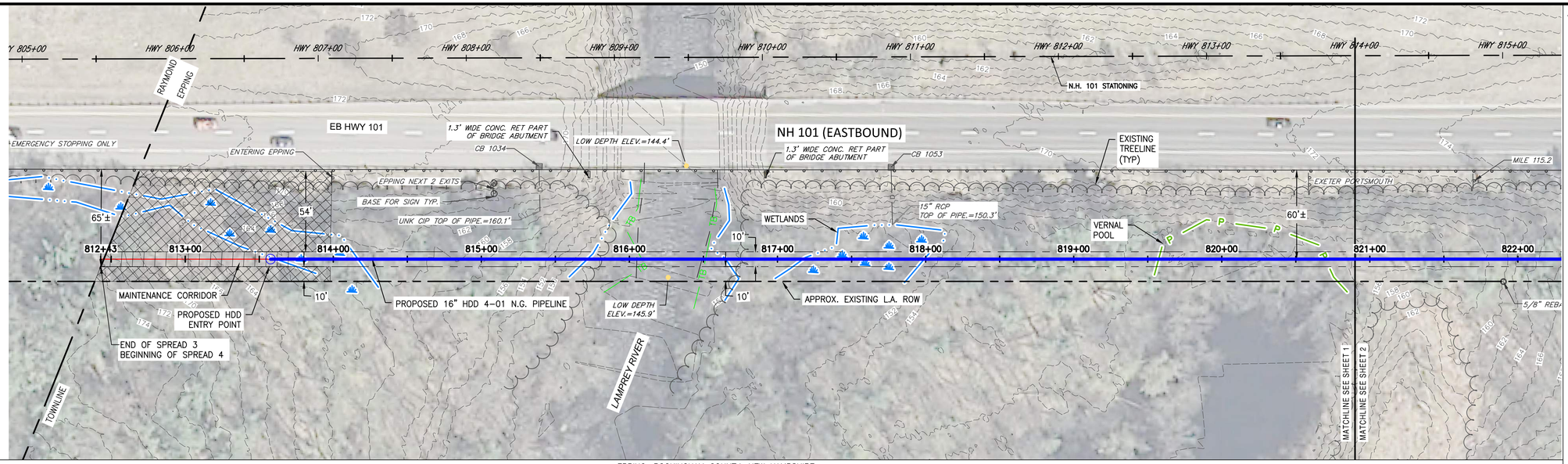
LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
INDEX MAP SHEET
SPREAD 4 – SHEET 2
–

ENGR: J. TIRRELL	DSGN: PPS
DATE: 05/30/2018	SCALE: 1"=500'
LIBERTY-GB-CV-04.DWG	E

FILE PATH: H:\LIBE\18014.00 Granite Bridge Pipeline Design\Civil\Production Dwgs\ liberty-gb-cv-04.dwg PLOT DATE/TIME: 03/18/19 07:32 PLOT BY: MICHAEL KELLY

PLAN (PIPELINE STATIONING)

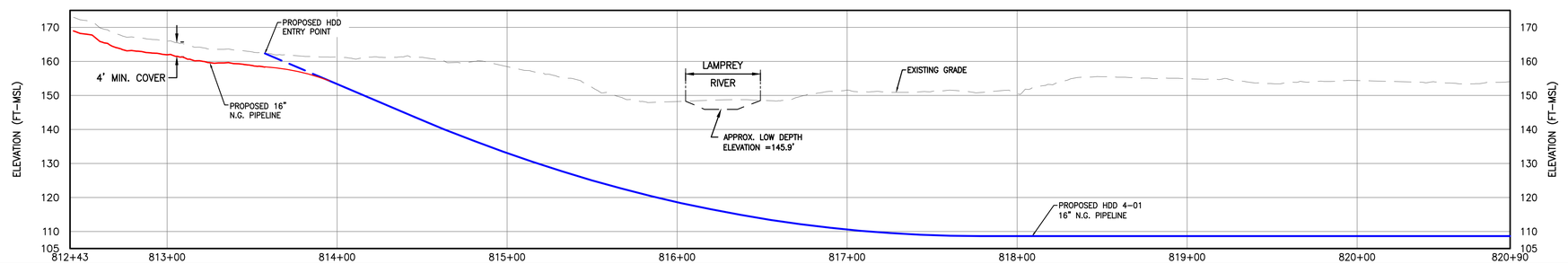


LOCATION	EPPING, ROCKINGHAM COUNTY, NEW HAMPSHIRE
N.H. 101 STATIONING	HWY 805+00 · HWY 806+00 · HWY 807+00 · HWY 808+00 · HWY 809+00 · HWY 810+00 · HWY 811+00 · HWY 812+00 · HWY 813+00 · HWY 814+00
REF. DWG. NO	

CROSSING ITEMS (PIPELINE STATIONING)

812+43 TOWN LINE
813+58 HDD ENTRANCE
813+61 WETLANDS
814+17 WETLANDS
815+72 WETLANDS
816+05 EDGE OF WATER
816+49 EDGE OF WATER
816+65 WETLANDS
817+17 WETLANDS
817+99 WETLANDS
819+57 VERNAL POOL
820+70 VERNAL POOL

PROFILE (PIPELINE STATIONING)



0 40 80
HORIZ. SCALE IN FEET
0 20 40
VERT. SCALE IN FEET

MATERIAL

PIPELINE SCHEMATIC
- PIPE INSTALLED BY OPEN CUT
- PIPE INSTALLED BY BORE
- SOILS BOUNDRY
- SEGMENTABLE FITTING
- BORE ENTRY/EXIT
- PIPELINE MARKER
- VALVE
- IMPRESSED CURRENT TEST STATION

BILL OF MATERIALS

NO.	DESCRIPTION	QTY.
1	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 30 mils POWERCRETE COATING	
2	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 10/40 PRITEC COATING	
3	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 -16 mils FBE	
	AND 2" THICK CONCRETE COATING	
4	PIPELINE MARKER	
5	IMPRESSED CURRENT TEST STATION	

GENERAL NOTES:
1. ALL EXISTING UTILITIES AND THEIR RESPECTIVE LOCATIONS DEPICTED ON THESE PLANS SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR MUST VERIFY THE EXTENT OF ALL UTILITIES WITHIN THE PROJECT AREA, AS WELL AS THEIR SPECIFIC LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.
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6. ANY SURVEY MONUMENT IMPACTED BY CONSTRUCTION SHALL BE LOCATED PRIOR TO IMPACT AND RESET BY A N.H. LICENSED LAND SURVEYOR UNDER THE SUPERVISION OF N.H. DOT BUREAU OF RIGHT-OF-WAY.
7. VACUUM EXCAVATE TO IDENTIFY UTILITY DEPTHS PRIOR TO EXCAVATION.

30% PRELIMINARY

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GOLDER WWW.GOLDER.COM
DOUCET SURVEY INC. WWW.DOUCETSURVEY.COM
CHI WWW.CHIENGINEERING.COM

REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
CONST	2/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
HS&E	12/27/18	C	EXPANDED WORK AREAS	MJK	JPT
	9/17/18	B	DOT REVIEW	PPS	JPT
	9/0718	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

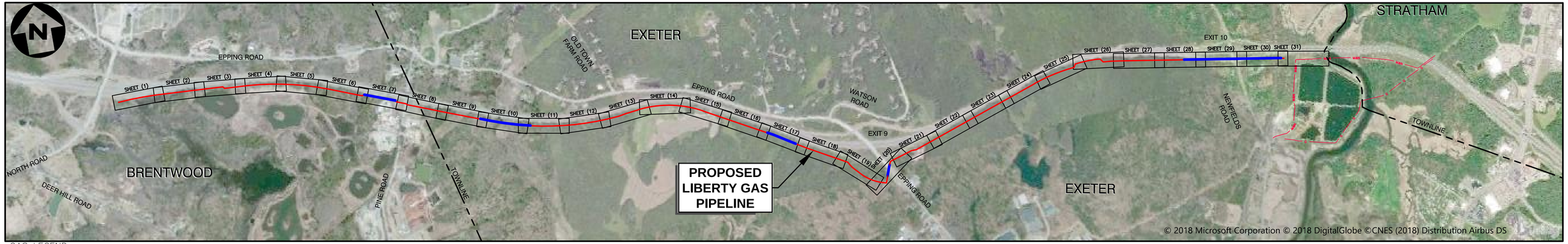
Liberty Utilities WWW.LIBERTYUTILITIES.COM 15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
ALIGNMENT SHEETS
TOWN OF EPPING, ROCKINGHAM COUNTY, STATE OF N.H.
SPREAD 4 - SHEET 1

ENGR: J. TIRRELL | DSGN: MJK
DATE: 05/30/2018 | SCALE: AS-NOTED
LIBERTY-GB-(10).DWG | E

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_15236\ liberty-gb-(10).dwg PLOT DATE/TIME: 03/18/19 09:55 PLOT BY: MICHAEL KELLY

GRANITE BRIDGE PIPELINE
SPREAD 5
LIBERTY UTILITIES
STRATHAM, EXETER & BRENTWOOD, NEW HAMPSHIRE



GAS LEGEND
- PROPOSED GAS PIPELINE ROUTE
- PROPOSED GAS PIPELINE HDD/PUSH

ENVIROMENTAL LEGEND
- WETLAND AREA
- EDGE OF WETLAND (ALL TYPES)
- CONSTRUCTION FENCE
- VERNAL POOL

SURVEY LEGEND
- MARITIMES & NORTHEAST PIPELINE
- APPROX. PROPERTY LINE
- LA ROW
- ROW LINE DIGITIZED
- CHAIN LINK FENCE
- GUARDRAIL
- OVERHEAD WIRE
- SEWER LINE
- DRAIN LINE
- GAS LINE
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- UG. ELEC. LINE (FROM HWY MAP)
- UG. GAS LINE (FROM HWY MAP)
- UG. DRAIN LINE (FROM HWY MAP)
- UG. SANIT. LINE (FROM HWY MAP)
- UG. TELE./FIBER LINE (FROM HWY MAP)
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE
- TREE LINE
- SHRUB LINE
- EDGE OF WATER
- EXISTING CURB
- RETAINING WALL
- CONCRETE
- RIP RAP
- UTILITY POLE
- UTILITY POLE & GUY WIRE
- UTILITY POLE W/ LIGHT
- LIGHT POLE
- LIGHT POLE (ONE ARM)
- LIGHT POLE (TWO ARMS)
- ELECTRIC METER
- SIGN
- SIGN (TWO POSTS)
- BOUND FOUND
- CATCH BASIN
- DRAIN MANHOLE
- FLARED END SECTION
- HAND HOLE
- BORING LOCATION
- CONIFEROUS TREE
- DECIDUOUS TREE

DRAWING INDEX

ISSUE STATUS	SET TYPE	DRAWING NO.	SHT	REV	DESCRIPTION	COMMENTS	DATE
PRELIMINARY	CIVIL	LIBERTY-CV-05	1	D	Cover Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-CV-05	2	D	Index Map Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	1	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	2	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	3	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	4	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	5	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	6	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	7	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	8	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	9	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	10	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-14	11	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	12	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	13	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	14	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	15	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	16	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	17	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	18	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	19	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-15	20	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	21	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	22	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	23	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	24	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	25	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	26	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	27	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	28	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	29	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-16	30	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-17	31	D	Spread 5 Alignment Sheet	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	1	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	2	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	3	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	4	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	5	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-DE-01	6	D	Standard Construction Details	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-TR-01	1	D	Traffic Control Plan	30% Preliminary	6/22/2018
PRELIMINARY	CIVIL	LIBERTY-GB-CA-05	1	D	Construction Access Plan	30% Preliminary	6/22/2018

30% PRELIMINARY

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REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR	3/18/19	E	ALIGNMENT UPDATES 30%	MJK	JPT
	02/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
CONST	12/20/18	C	EXPANDED WORK AREAS	MJK	JPT
	08/02/18	B	DOT REVIEW	PPS	JPT
HS&E	06/07/18	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:

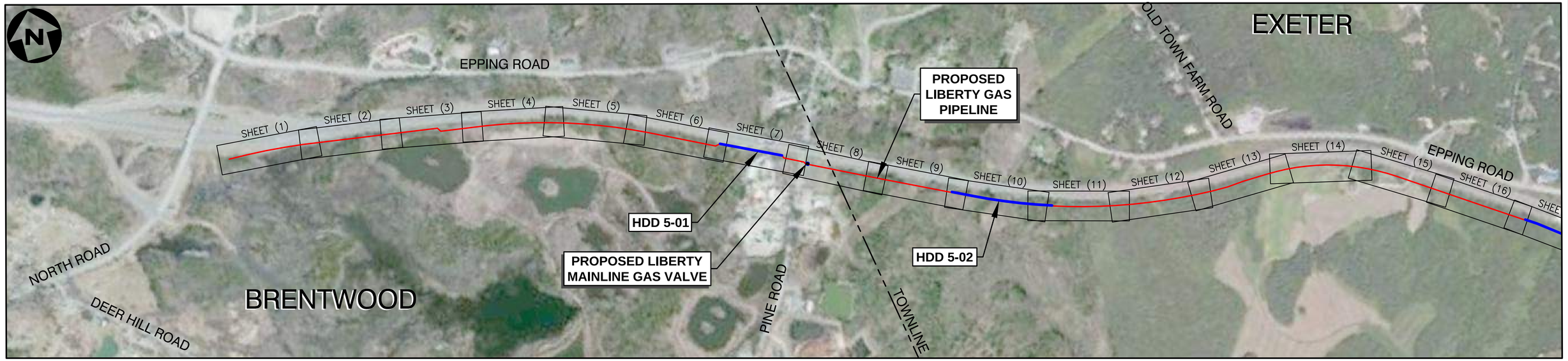
	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

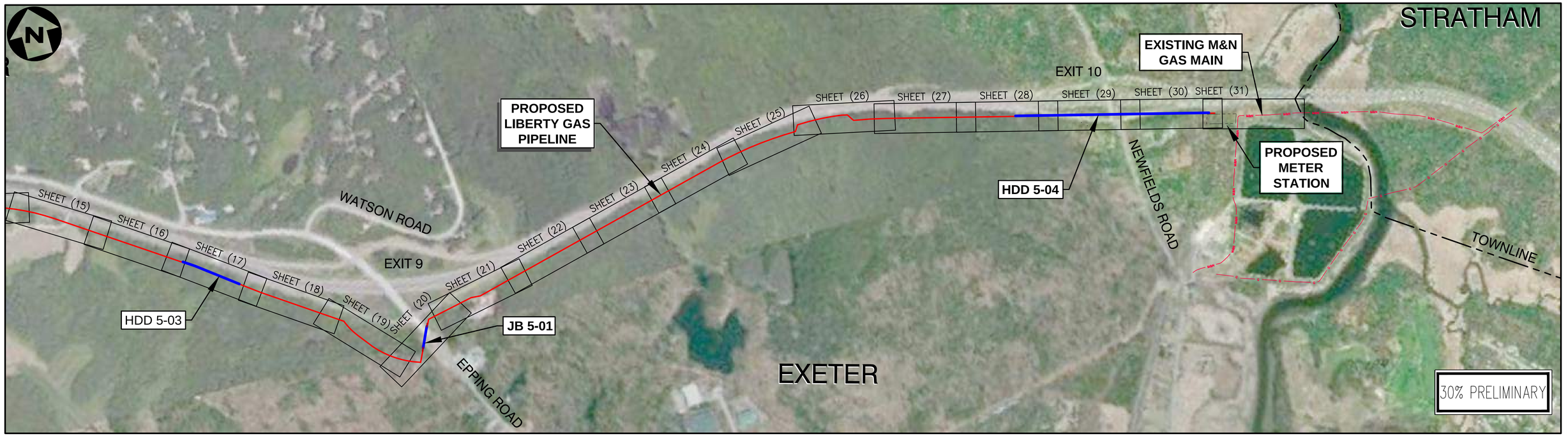
Liberty Utilities WWW.LIBERTYUTILITIES.COM 15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY-GRANITE BRIDGE PIPELINE PROJECT
COVER SHEET
SPREAD 5
–

ENGR: J. TIRRELL | DSGN: PPS
DATE: 05/30/2018 | SCALE: 1000'=1"
LIBERTY-GB-CV-05.DWG | D

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_13068\ liberty-gb-cv-05.dwg PLOT DATE/TIME: 03/27/19 10:29 PLOT BY: MICHAEL KELLY





ABBREVIATIONS:
JB = JACK AND BORE
HDD = HORIZONTAL DIRECTIONAL DRILL
TGP = TENNESSEE GAS PIPELINE

vhb WWW.VHB.COM
GOLDER WWW.GOLDER.COM
DOUCET SURVEY INC WWW.DOUCETSURVEY.COM
CHI WWW.CHIENGINEERING.COM

REVIEWED BY:					
PROJ ENGR					
ENGR					
OPR					
CONST	02/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
HS&E	12/20/18	C	EXPANDED WORK AREAS	MJK	JPT
	06/28/18	B	DOT REVIEW	PPS	JPT
	06/22/18	A	LIBERTY REVIEW	PPS	JPT
	DATE	REV	DESCRIPTION	BY	APP'D

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.	BM	AB	9/30/18
APPROVAL			
BID			
CONSTR.			

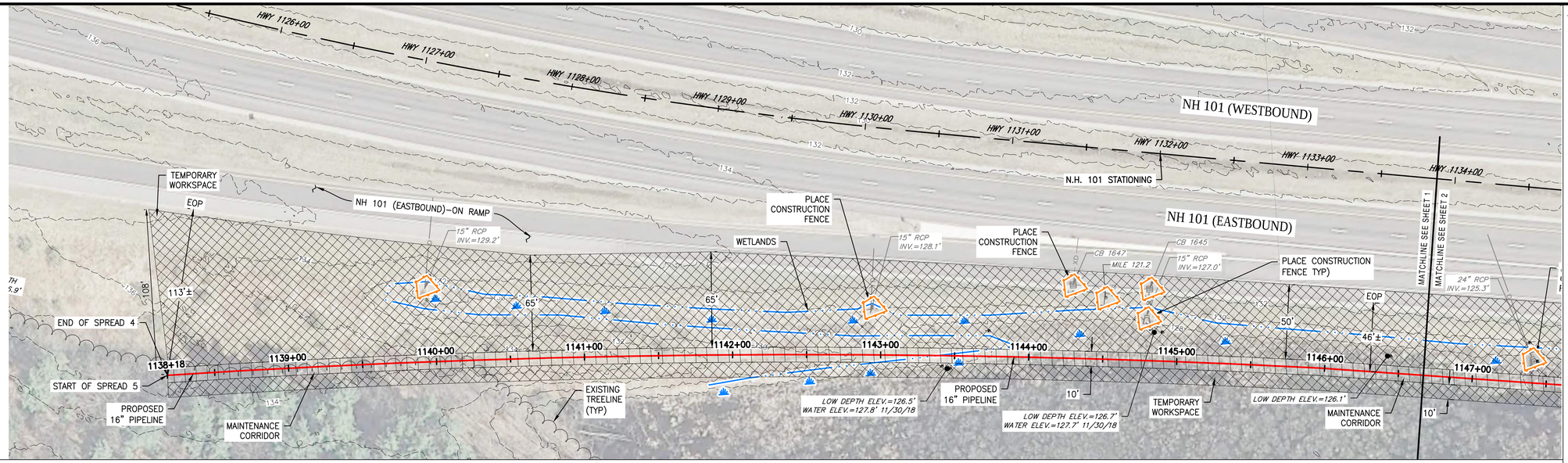
Liberty Utilities WWW.LIBERTYUTILITIES.COM
15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY–GRANITE BRIDGE PIPELINE PROJECT
INDEX MAP SHEET
SPREAD 5
–

ENGR: J. TIRRELL	DSGN: PPS
DATE: 05/30/2018	SCALE: 1"=500'
LIBERTY–GB–CV–05.DWG	D

FILE PATH: H:\LIBE\18014.00 Granite Bridge Pipeline Design\Civil\Production Dwgs\ liberty-gb-cv-05.dwg PLOT DATE/TIME: 02/06/19 10:56 PLOT BY: MICHAEL KELLY

PLAN (PIPELINE STATIONING)

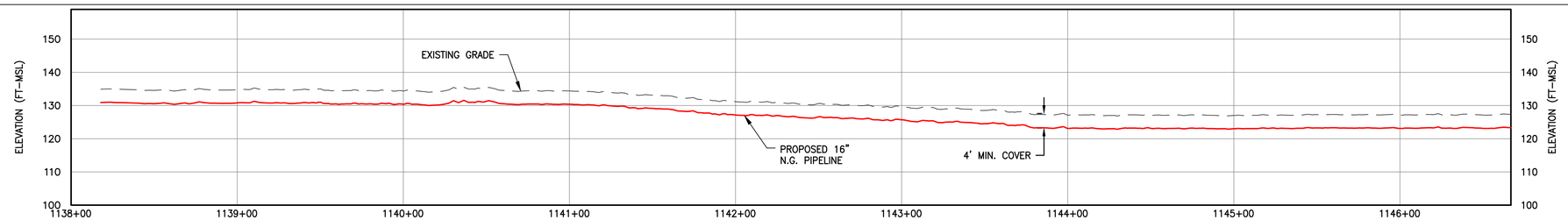


LOCATION	BRENTWOOD, ROCKINGHAM COUNTY, NEW HAMPSHIRE
N.H. 101 STATIONING	HWY 1126+00 · HWY 1127+00 · HWY1128+00 · HWY 1129+00 · HWY 1130+00 · HWY 1131+00 · HWY 1132+00 · HWY 1133+00
REF. DWG. NO	

CROSSING ITEMS (PIPELINE STATIONING)

1143+39 WETLANDS

PROFILE (PIPELINE STATIONING)



MATERIAL

PIPELINE SCHEMATIC
- PIPE INSTALLED BY OPEN CUT
- PIPE INSTALLED BY BORE
- SOILS BOUNDRY
- SEGMENTABLE FITTING
- BORE ENTRY/EXIT
- PIPELINE MARKER
- VALVE
- IMPRESSED CURRENT TEST STATION

BILL OF MATERIALS

NO.	DESCRIPTION	QTY.
1	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 –16 mils FBE	
	AND 30 mils POWERCRETE COATING	
2	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 10/40 PRITEC COATING	
3	16" NOM., 16.0" x 0.500" WT, X65 ERW, w/ 14 –16 mils FBE	
	AND 2" THICK CONCRETE COATING	
4	PIPELINE MARKER	
5	IMPRESSED CURRENT TEST STATION	

GENERAL NOTES:
1. ALL EXISTING UTILITIES AND THEIR RESPECTIVE LOCATIONS DEPICTED ON THESE PLANS SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR MUST VERIFY THE EXTENT OF ALL UTILITIES WITHIN THE PROJECT AREA, AS WELL AS THEIR SPECIFIC LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.
2. QUANTITIES LISTED ARE BASED ON HORIZONTAL LENGTH.
3. DESIGN SPECIFICATIONS: CLASS 4 DESIGN USING 0.4 DESIGN FACTOR /ANSI 600/950 PSIG MAOP
4. REFERENCE (ALL SHEETS): FOR FULL LIST OF DRAWING REFERENCES FOR BASE MAP INFORMATION, SEE COVER SHEET.
5. PIPELINE MARKERS MUST BE INSTALLED ON BOTH SIDES OF ROAD AND RAILROAD CROSSINGS, AT EACH LINE CROSSING, AND OTHER LOCATIONS SHOWN IN PROJECT SCOPE OF WORK OR PROJECT CONSTRUCTION DRAWINGS. LINE MARKER PLACEMENT TO BE DETERMINED DURING CLEAN UP OPERATIONS AND NOTED ON AS–BUILT DRAWINGS, PER SUBMITTED REDLINES FROM CONSTRUCTION.
6. ANY SURVEY MONUMENT IMPACTED BY CONSTRUCTION SHALL BE LOCATED PRIOR TO IMPACT AND RESET BY A N.H. LICENSED LAND SURVEYOR UNDER THE SUPERVISION OF N.H. DOT BUREAU OF RIGHT–OF–WAY.

30% PRELIMINARY

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REVIEWED BY:	DATE	REV	DESCRIPTION	BY	APP'D
PROJ ENGR	02/28/19	D	ADDRESS NHDOT COMMENTS 1/2/19	MJK	JPT
ENGR	12/20/18	C	EXPANDED WORK AREAS	MJK	JPT
OPR	06/28/18	B	DOT REVIEW	PPS	JPT
CONST	06/22/18	A	LIBERTY REVIEW	PPS	JPT
HS&E					

RELEASED ONLY FOR:

	PROJ. ENGR.	FAC. ENGR.	DATE
PRELIM.			
APPROVAL			
BID			
CONSTR.			

Liberty Utilities
WWW.LIBERTYUTILITIES.COM
15 BUTTRICK RD, LONDONDERRY, NH

LIBERTY–GRANITE BRIDGE PIPELINE PROJECT
ALIGNMENT SHEETS
TOWN OF BRENTWOOD, ROCKINGHAM COUNTY, STATE OF N.H.
SPREAD 5 – SHEET 1

ENGR: J. TIRRELL	DSGN: MJK
DATE: 05/30/2018	SCALE: AS–NOTED
LIBERTY–GB–(14).DWG	D

FILE PATH: C:\Users\mkelly\appdata\local\temp\AcPublish_12600\ liberty–gb–(14).dwg PLOT DATE/TIME: 02/06/19 11:15 PLOT BY: MICHAEL KELLY