Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-1

Date of Response: 2/3/23
Respondent: John Murphy – GZA
James Wieck – GZA

REQUEST:

Ref: Testimony of John C. Murphy and James M. Wieck of GZA GeoEnvironmental, Inc. ("Testimony") on Bates pg. 11, line 11-12

The referenced Testimony states "… expect this monitoring [of wells] and removal processes [of tar-like MGP byproducts] will be in place for many years, as is typical of manufactured gas sites." Please explain what Liberty means by "many years'" to the nearest five-year increment, i.e., twenty to twenty-five years, etc. What is the underlying methodology for full remediation given the specifics of the Gas Holder Site? Does the length of time change if the Gas Holder structure serves as a cap or, in the alternative, is demolished? Please provide supporting sources and documentation.

RESPONSE:

As approved by the New Hampshire Department of Environmental Services (NHDES) in the Site's Remediation Action Plan (RAP), remediation of the Site includes removal of potentially mobile and exposed MGP byproduct source material and management of residual soil and groundwater contamination using and engineered cap, administrative controls, and long-term monitoring. Given the presence of residual soil contamination, the time to full remediation (i.e., meeting New Hampshire soil and groundwater quality standards throughout site and impacted off-site areas) is not known. The results of groundwater quality monitoring indicate that improvements in groundwater quality have occurred in some areas affected by the Site; however, in other locations, a clear improving water quality trend, needed for estimation of the time to full remediation, has not yet developed (see Attachment DOE 4-1 for example contaminant concentration trend plots [Chart 1 – Example Stable Elevated Concentration Trend and Chart 2 – Example Decreasing Concentration Trend]).

Based on extrapolation of current product thickness trends and GZA's experience, we anticipate that the current product recovery program will be completed within five to fifteen years (see Attachment DOE 4-1 for product thickness data; Chart 3). DES may require recovery from

additional locations in the future, which may extend the product recovery program beyond fifteen years.

The effect of the removal of the Gas Holder structure on the length of time to full remediation of the broader Site is anticipated to be limited. This is because whether or not demolition of the Gas Holder structure occurs, as required under the NHDES approved RAP, a cap consisting of either the Gas Holder structure or a constructed low permeability cap in the current footprint of the Gas Holder will be in place that limits infiltration of stormwater and possibility of the leaching of residual contamination to groundwater. and under the RAP residual contamination can remain in place if capped.

Chart 1
Example Stable Elevated Concentration Trend
GEI04-6B
Concord MGP - Gas Steet Site
Concord, New Hampshire
NHDES Site #198904063

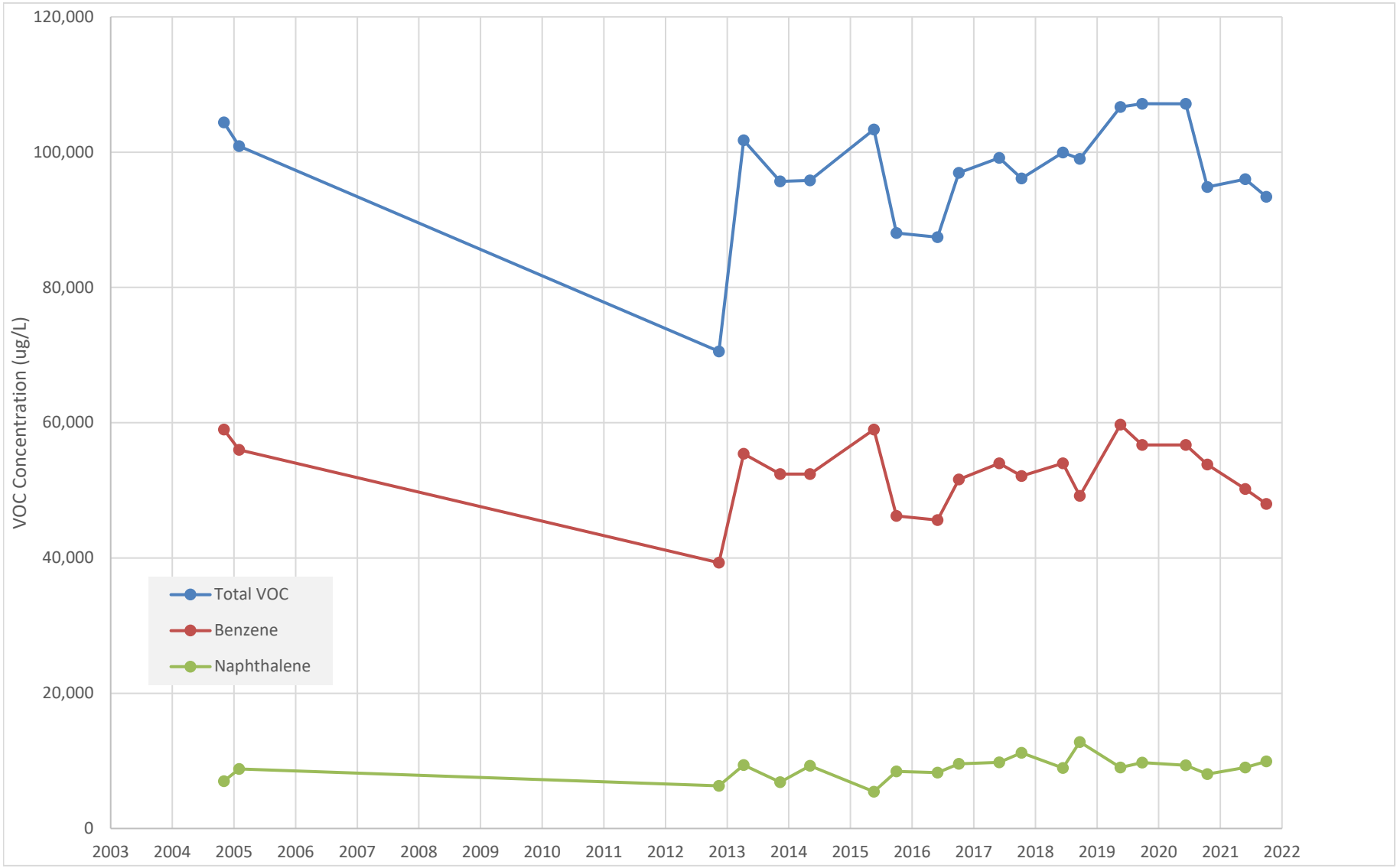
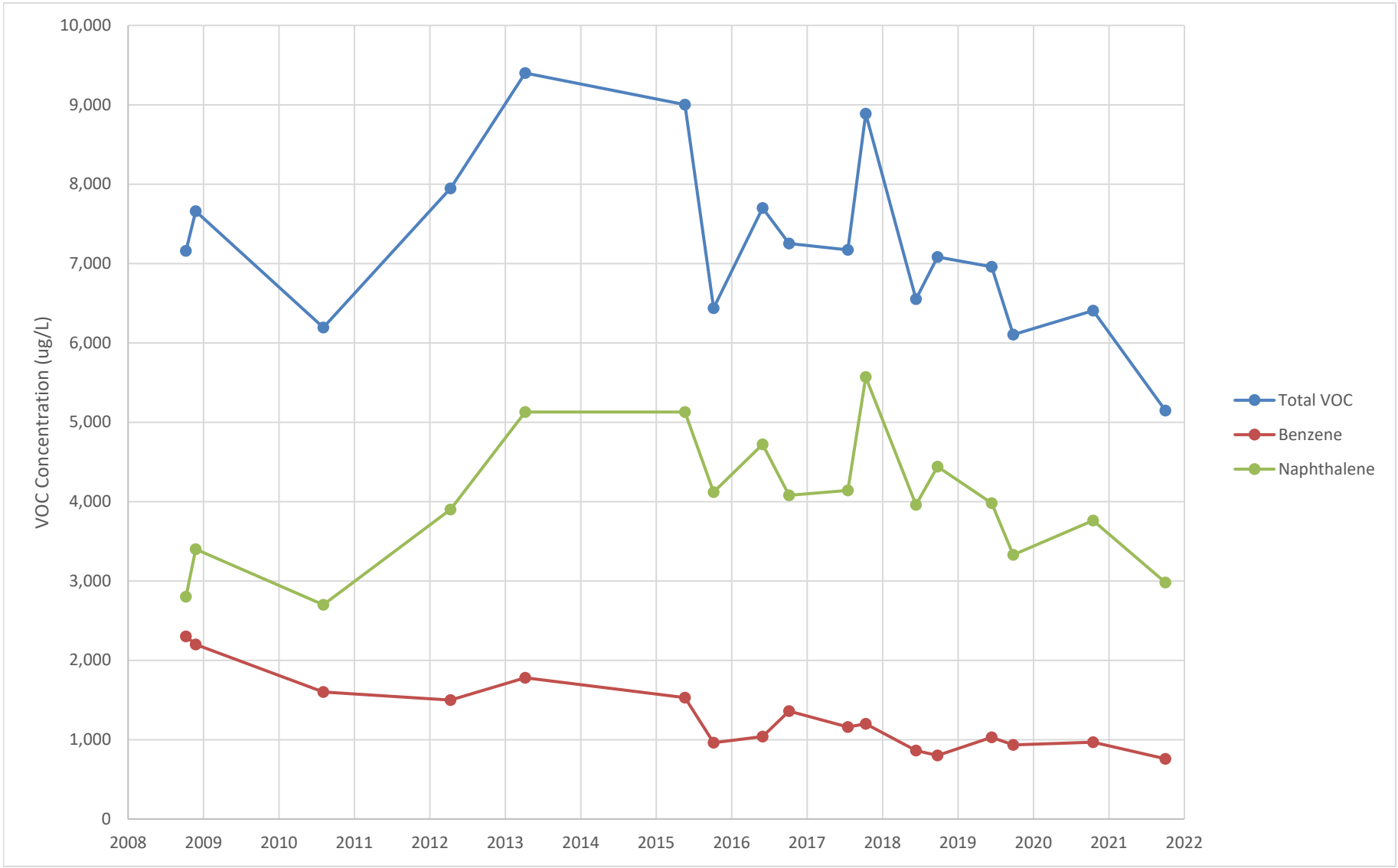


Chart 2
Example Decreasing Concentration Trend
GZ-12D
Concord MGP - Gas Steet Site
Concord, New Hampshire
NHDES Site #198904063



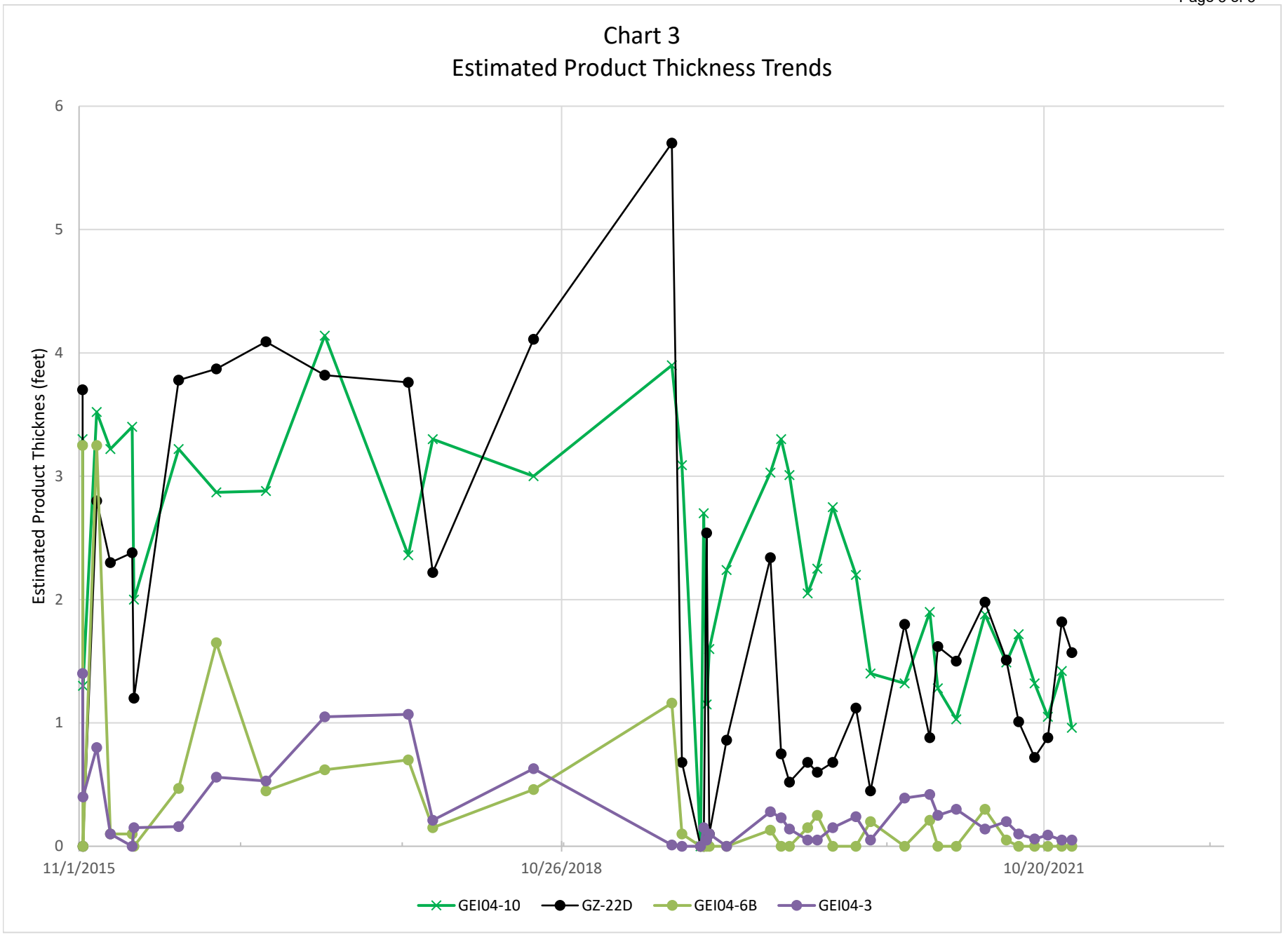


Chart 3
Estimated Product Thickness Trends
Estimated Product Thicknes (feet)
6
5
4
3
2
1
0
11/1/2015
10/26/2018
10/20/2021
GEI04-10
GZ-22D
GEI04-6B
GEI04-3

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-2

Date of Response: 2/3/23
Respondent: John Murphy – GZA
James Wieck – GZA

REQUEST:

Ref: Testimony on Bates p. 11, line 14-15; Liberty's original COG and LDAC filings, filed August 3, 2022 and September 2, 2022 and any supplements, including but not limited to the Company's December 30, 2022 filing. (Liberty's Petition)

The referenced Testimony states that the "cap design and restrictions on excavation" is subject to future use of the Gas Holder Site and is yet to be determined. However, the *Owner's Estimate* (reference at Bates pg. 15, line 8 as Attachment A) identifies $41,875 for required cap construction cost (see Bates pg. 38 of Attachment A). Please explain how the cap design and restrictions on evacuation can be "subject to future use" of the Gas Holder Site and is yet to be determined, while at the same time exact construction costs have been identified.

RESPONSE:

The New Hampshire Department of Environmental Services (NHDES) approved Remedial Action Plan (RAP) for the Site includes the future presence of an engineered cap covering the entire 2.4-acre (104,500 Sq Ft) Site. The Gas House structure currently covers an approximately 88-foot diameter circle (6,082 Sq Ft) and is considered by NHDES to meet the requirement of a cap for that portion of the Site. The estimated cost for required cap construction is related to the construction of the portion of the engineered cap for the Site that would be constructed to replace the cap currently provided by the Gas Holder structure (i.e.,6,082 Sq Ft of the Site). The reference to the cap design being subject to future use is in reference to the cap to be constructed throughout the entire Site beyond the footprint of the structure.

Final Site cap design that would be needed as part of a broader Site redevelopment would need to consider known contaminant distribution, utility placement, site drainage, parking, and other site related constraints. This final Site cap design will require NHDES approval.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-3

Date of Response: 2/3/23
Respondent: Jennifer Goodman – N.H. Preservation Alliance
John Murphy – GZA
James Wieck – GZA

REQUEST:

Ref: Liberty's Petition

What is the *anticipated* future use(s) of the Gas Holder Site and how is any future use(s) tied to Liberty's proposed total approximate $2.4 million cost?

RESPONSE:

NHPA: NHPA plans an incremental redevelopment of the site. The next step after the already-completed emergency stabilization is the rehabilitation of the historic structure which we estimate could cost more than $3 million. A highly competitive $500,000 federal grant has already been secured by the N.H. Preservation Alliance for this work. Other funds are being sought from the Land and Community Heritage Investment Program, N.H. Community Development Finance Authority, and other sources. This project has attracted leaders of civic, cultural, environmental, and business sectors with large portfolios of successful projects. The parties have discussed a 20-year easement related to the federal grant; this durable rehabilitation work can easily last twice or three times that long with basic maintenance. The future use of the Gas Holder site remains undetermined, although the City of Concord's Southern Opportunity Corridor Plan for the area includes the Gasholder property and features the preservation and re-use of buildings of cultural and historic significance. See Attachment DOE 4-3. Liberty's proposed contribution of $2.4 million does not rely on the final development of the site; Liberty's contribution represents a cap on the amount it will contribute to efforts that will meet DES requirements and insure the long-term survival of the gas holder building.

GZA: The future use of the Site has not been determined but could include commercial or industrial use subject to local zoning restrictions. The future use would need to account for additional historic preservation of the Gas Holder structure and must allow for the continued monitoring of the attenuation of Site contaminants and maintenance of an engineered cap

constructed over the entire Site footprint of 104,500 sq-ft to limit infiltration and the potential for contact with residual contamination. The cap could be designed to accommodate a known use that may require subsurface structures and utilities.

Concord, NH
Southern Opportunity Corridor

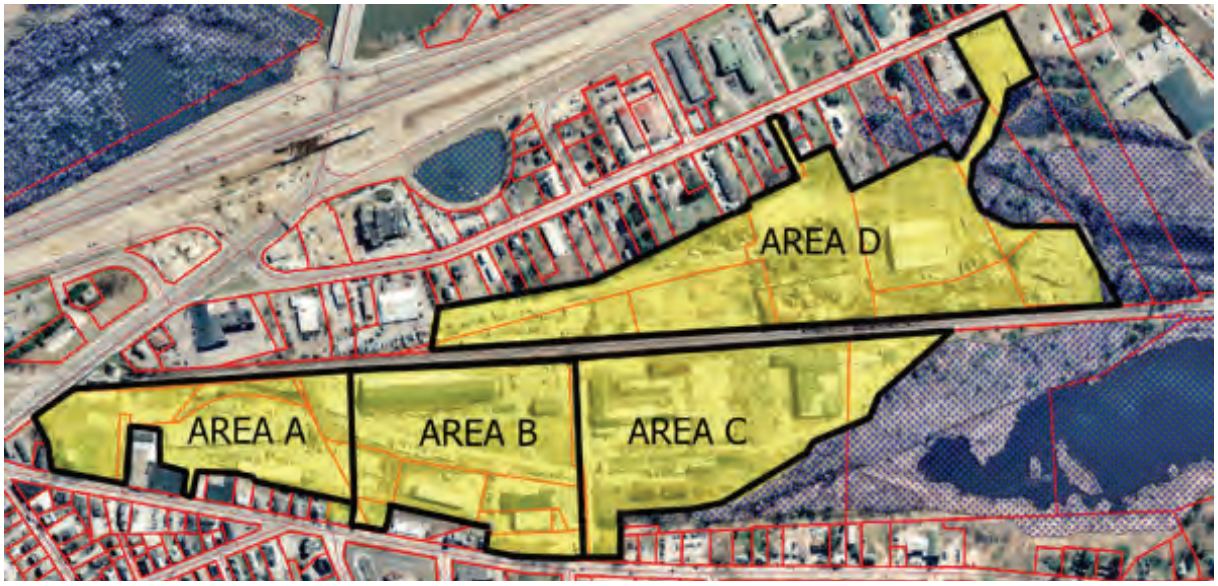
INTRODUCTION

Over the past several years the City has conducted a number of studies that made significant recommendations for the redevelopment of Concord's Opportunity Corridor. This study focuses on the Southern Opportunity Corridor (SOC) to refine past ideas via a Conceptual Master Plan and a presentation of images that could be appropriate for the SOC.

Because there are several parcels involved with different ownership, the envisioned build-out of the SOC could take years or even decades and a lot of patience by City officials, landowners, and developers. The following principles, some outlined in *Getting to Smart Growth II: 100 More Policies for Implementation*, were considered as the Conceptual Plan was prepared and should be considered as any new plans come forward:

- Utilize principles of Smart Growth
- Encourage mixed land uses
- Encourage compact building design
- Create a range of housing opportunities
- Create walkable communities
- Foster distinctive, attractive communities with a strong sense of place
- Preserve or create open space and preserve critical environmental areas
- Provide transportation options
- Encourage community and stakeholder collaboration in development decisions
- Encourage vertical development with retail and/or office on the lower floors and housing above
- Screen the rail line from work/living spaces by earthberms/vegetation; locate parking adjacent to the tracks.

The Southern Opportunity Corridor is comprised of 55± acres of useable land: 20± on the east side of the railroad tracks and 35± on the west side. The Corridor is bounded on the north by the Water Street overpass near Gas Street; on the south by the South End Marsh and I-93; on the west by South Main Street; and the east by five parcels on the east side of the B&M railroad tracks behind and excluding the properties along Hall Street.



CORRIDOR-WIDE CONSIDERATIONS

Railroad Crossing. The Southern Opportunity Corridor is bisected by the active B&M RR line. If the areas on both sides of the tracks are recognized as part of the SOC, a way will have to be developed to facilitate pedestrian movement between the east and west sides. Since it is unlikely that the RR will allow an at-grade crossing, the City should explore the potential for a pedestrian overpass. This could be in the form of a pedestrian bridge originating from the upper floor of a parking structure or a free-standing structure.

Shared Use Pathway. The vision calls for a shared use pathway connecting the SOC with the rest of the city while providing alternative transportation and promoting healthy lifestyles. From the south end of the SOC to the State House is approximately 1.5 miles, a comfortable distance by foot, bicycle, or in-line skates. With the existing bus station located in the northern end of the opportunity corridor and the proposed multimodal transportation center in the central opportunity corridor, people would be able to use this pathway to get to these hubs and then commute to regional destinations without use of their car.

South End Marsh. Conservation of the marsh and adjacent wetlands should be a high priority. This area offers a unique bird watching and wildlife area in an urban setting. With proper access and interpretation, the marsh can become an important amenity and component of the City's open space system. Development plans for adjacent properties should include a perimeter trail, boardwalks, signage, and other features to highlight the beauty and value of the Marsh.

South Main Street Frontage. There are several opportunities to reinforce the street edge along South Main Street and in-fill vacant parcels with new retail, commercial or residential housing. This area presents a variety of challenges due to change in elevation, existing vegetation, and orientation.

Design Guidelines. The city should develop Design Guidelines and Procedures for Design Review that set the standards for all new development and rehabilitation. The guidelines should address Site Planning, Architecture, Signage, Lighting, Landscaping, and Amenities to assure that all development is recognized as part of a coordinated whole while blending into the fabric of the surrounding neighborhoods.

View of South End Marsh, looking north.

AREA A: WATER STREET OVERPASS TO ALLISON STREET

Possible Uses: Medium to high density residential.

Extend Storrs Street south along the RR tracks and under the Water Street Bridge to create another strong access into the SOC**.** This roadway will parallel the tracks on one side and steep slopes on the other for over 1500 feet prior to intersecting with Gas Street. Because of the RR, slope, and bridge underpass, this segment of Storrs Street will not serve as frontage for businesses or residences. However, there is an excellent opportunity to design it as a tree lined boulevard and greenway with a shared use pathway. Depending on the ultimate proposal for this northern sub-area, the boulevard design could extend into the SOC for another several hundred feet.

Create a suitable landscaped setting for the circular Gas House. This historic structure is a landmark in Concord and an important visual reference point in the south end.

Develop the start of a walkable neighborhood with 2-3 story apartments along the Boulevard. Provide space for on-street parallel parking with additional parking in the rear.

Preserve a significant vegetative buffer between the new development and the rear yards of the properties along South Main Street.

Improve the South Main / Allison Street intersection to accommodate the anticipated increase in vehicle trips.

Reinforce the Allison Street entrance into the SOC with mixed use buildings close to the street and on-street parking. Consider live-work units: first floor may be a shop or home office with residential uses on the second/third floors.

An example of the reuse potential of existing buildings.

AREA B: ALLISON STREET TO LANGDON STREET

Possible Uses: Medium to high density residential; mixed use retail and commercial.

Re-use / rehabilitate existing buildings of cultural and historic importance (colored olive green), specifically the large blue building, a 2-story brick building currently being used for offices, and one other unoccupied brick structure.

Treat the historic train shed as a focal point/ anchor in the SOC. The large blue building currently being used for lumber storage and office space was originally a building where trains were repaired. Purportedly, beneath the blue metal cladding is the original brick façade with arched windows. This building is approximately 60,000 s.f. and 35 feet to the roof eaves and approximately 50 feet to the peak.

Create more parking within easy walking distance. Reuse of the train shed will create a demand for more parking than the immediate site can support and still maintain a desirable and realistic mixed-use development. Add parking by building a mixed-use parking structure on South Main/Langdon Streets, or surface parking on the opposite side of the tracks with a pedestrian overpass. The garage could be built into the hill and allow for shops and businesses at the South Main Street level while satisfying the demand for parking on the lower and upper levels.

Preserve existing trees. This area contains many healthy mature trees, specifically around the old train shed. These trees should be preserved or relocated wherever possible.

Establish a strong buffer along the tracks. A buffer of vegetation, earthen berms, and / or parking should be located along the active tracks. Green spaces could also be appropriate with proper protective screening or fencing.

Existing photo looking south. Train Shed is on the left.

Photosimulation of new street featuring mixed-use development, on-street parking, and rehabilitated Train Shed.

Looking north at the old train machine shops and assembly building.

Photosimulation showing potential reuse with a mix of commercial, office, and residential.

Photosimulation showing potential reuse with a mix of commercial, office, and residential.

AREA C: BETWEEN LANGDON STREET AND THE SOUTH END MARSH

Possible Uses: High density residential, office, and commercial in 3-story structures.

Preserve and reuse existing buildings of cultural and historic importance. The long 2-3 story brick buildings adjacent to Langdon Street are worthy of preservation and contain over 46,000 SF of space per floor. These buildings could be considered for commerial/office use or compact residential units with common amenities and green space.

Example of creative reuse of a former RR building.

Circulation systems and parking. High density residential will create a demand for convenient parking. Parking lots should be designed with neckdowns, planting islands every 10 to 15 spaces, and internal walkways to minimize onflicts between pedestrians and vehicles. In addition to standard parking lots, the SOC should incorporate parking courtyards, under-building lots, on-street parking, and parking garages to minimize the visual impact of large numbers of automobiles.

Pedestrian connections. The SOC should feature interconnected pathways throughout, favoring pedestrian movement over vehicular convenience. Sidewalks and crosswalks should be safe direct, and proportional to the intended uses.

Relationship to Marsh. The existing wetlands consist of thick scrub-shrub vegetation. Views to the South End Marsh from the upper floors of the buildings and the constuction of a perimeter pathway/boardwalk around the marsh could be a genuine amenity to the SOC.

AREA D: BETWEEN LANGDON STREET AND THE SOUTH END MARSH

Possible Uses: Mixed-use technology center or community college campus.

Retain the Train Shed as the focal point for new development. The existing Train Shed is the predominant and most historically significant structure on the east side of the RR tracks. The former train shed is currently part of a scrap metal recycling facility. It may have the potential to become an integral part of the redevelopment concept for the east side of the SOC.

Transistions/neighborhood integration. Future uses should consider potential impacts on the surrounding residential neighborhoods. Buffers should be established to maintain privacy and minimize visual impacts from new uses, increased activity, and expanded parking areas.

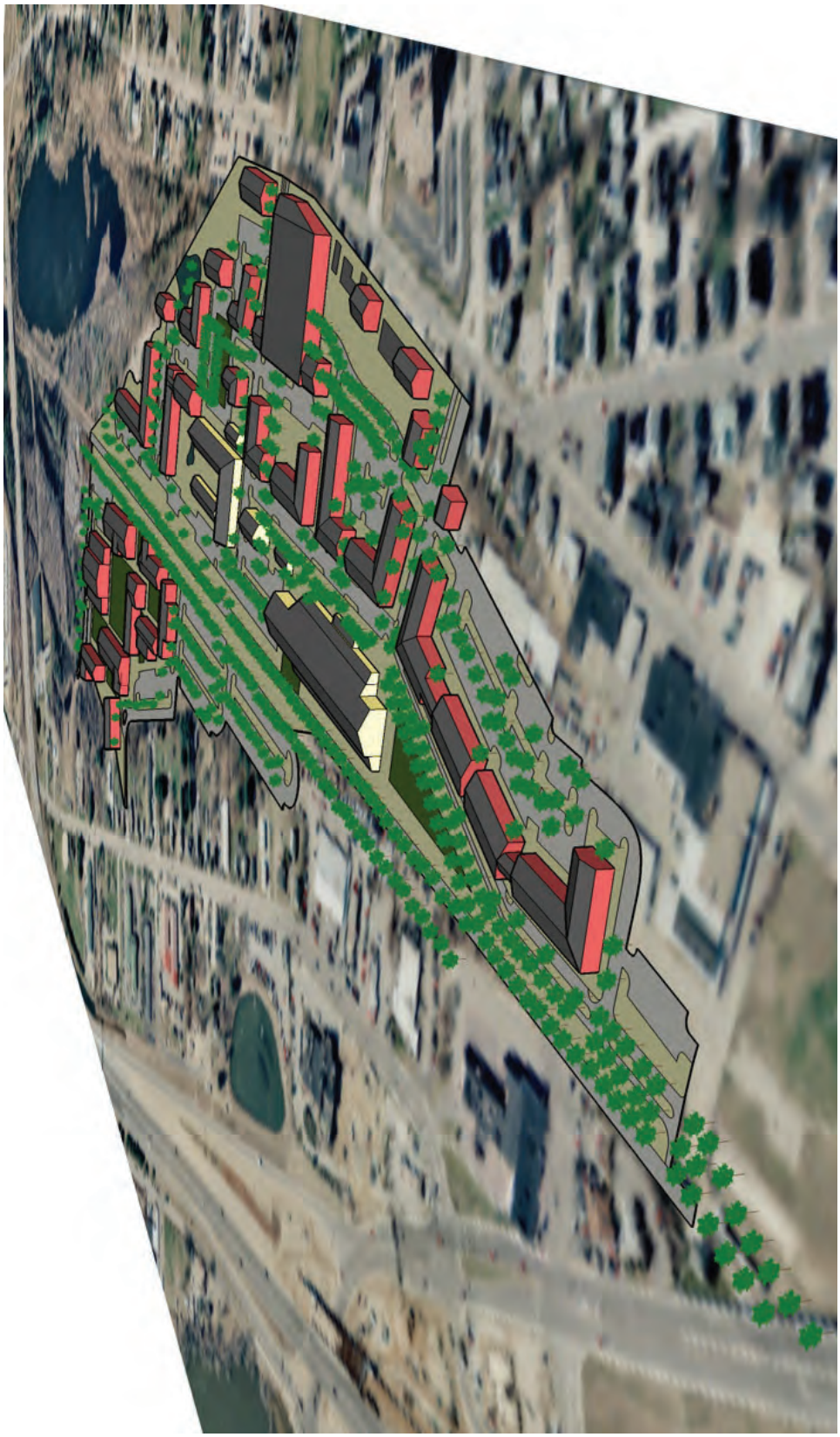
Pedestrian connection to west side of tracks. This type of use could generate a significant demand for east/west pedestrian movement within the SOC. A pedestrian overpass or some other means of connecting the mixed use development on the west side of the tracks should be incorporated into the long-range planning.

Old train shed on east side of the RR tracks.

Interior of an existing structure within the Southern Opportunity Corridor.

Potential uses may include a public market.

Conceptual Master Plan



3D Massing Diagram.


ALLISON STREET
SOUTH STATE
SOUTH MAIN STREET
SANELS
GAS STREET
WATER STREET


HALL STREET
HISTORIC TRAIN SHED
PEDESTRIAN OVERPASS
HISTORIC TRAIN SHED
GAS STREET
SANELS
SOUTH MAIN STREET
SOUTH STATE
ALLISON STREET
PARKING GARAGE 110 SPACES/ FLOOR
LANGDON STREET
SOUTH MAIN STREET

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-4

Date of Response: 2/3/23
Respondent: Luke Sanborn
Jennifer Goodman – N.H. Preservation Alliance

REQUEST:

Ref: Liberty's cover letter dated December 30, 2022 and documents filed therewith; Testimony Attachment A including Appendix A and Appendix B

In the cover letter submitted by Liberty on Dec 30, 2022, Liberty requests to recover an estimated total cost of **$2.4 million** to stabilize the Gas Holder building while the Testimony on Bates pg. 18, line 1, recommends a midpoint figure of **$2,035,549** (i.e., approximately **$2.04 million**) as an estimated demolition cost. Please explain the discrepancy between these figures, and provide the analysis, with illustrative examples of potential costs, that resulted in the higher figures:

a. The NHPA states "We note that $2,379,492 was supported by H&A as a figure accommodating limitations required by Liberty's consultants GZA." Please identify the referenced "limitations."

b. How does Liberty anticipate that additional expenses would be handled in the event the GZA has underestimated costs. *See* Testimony Attachment A, Appendix B. Would Liberty shareholders bear the additional costs?

c. Please provide a copy of the "Scope of Services" and "Report" and "Proposal" provided to GZA (or produced by GZA) and referenced by them in Testimony Attachment A

d. Please confirm that estimated costs do not include legal or permitting costs.

RESPONSE:

The requested cost of $2.4 million considers the opinions of both GZA and Haley & Aldrich. GZA estimated costs for investigation and remediation to be between $1.69 million and $2.38 million. Haley & Aldrich estimated the cost for investigation and remediation to be between $2.38 million and $3.05 million, with the potential to cost as much as $6 million. As noted in GZA's testimony and report there is uncertainty in the work which would be required to

complete the demolition and remediation. Liberty is requesting recovery of a cost estimate represents the common ground of the two environmental professionals. The information basis for the costs is provided below.

The $1.69 million estimate for investigation and remediation by GZA assumes there are no impacts beneath the footprint of the gas holder. Based on the experience of Haley & Aldrich and their understanding of site conditions, it is their opinion that this scenario has a low probability and therefore was not considered by them in the development of their expected range of costs.

The $2.4 million estimate for investigation and remediation by GZA assumes a portion of the soils beneath the holder are impacted such that 788 cubic yards of impacted soil would need to be removed. Haley & Aldrich concurs and considers this a potential remedial scenario and the basis for the lower end of their estimated cost to remediate.

The $3.05 million estimate for the investigation and remediation by Haley & Aldrich is based on removing 5 feet of soil within the entire footprint of the gas holder building, which is 1,232 cubic yards of soil. This source removal scenario is consistent with the previously completed and NHDES approved removal work completed by Liberty on other source structures at the site.

a. Limitations relate to the analysis described immediately above in overview of the $2.4 million estimate. To develop the cost estimate GZA made assumptions to establish the scope of the remedial work, such as the extent of impacted soil and what impacted soil could be removed.

b. Note that Liberty will not actually incur the demolition costs. The demolition estimates are provided to establish the amount that Liberty may contribute toward the stabilization of the gas holder, provided Commission approval. Thus, Liberty will contribute up to what the Commission approves is the appropriate figure. There will not be any “additional expenses.”

   We believe that the Commission’s approval of this estimate will add predictability to the process for customers. The Preservation Alliance also has and will bring additional local, state, and federal financial resources to this project that meet DES requirements while achieving preservation and community development goals. Essentially, the Preservation Alliance is contributing funds to stabilize a structure that is currently part of the cap that is central to the existing RAP approved by NHDES.

c. See Attachment DOE 4-4.c.

d. The estimated costs do not legal, regulatory requirements such as annual reporting, or costs associated with a supplemental RAP. Liberty chose not to include such costs in the demolition estimate. As stated above, the demolition estimate is only to establish a figure that Liberty may contribute toward the stabilization.

Known for excellence.
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CALCULATION OF BASIS OF MAXIMUM OWNER CONTRIBUTION

1888 GAS HOLDER HOUSE DEMOLITION ALTERNATIVE

Manufactured Gas Plant

Concord, New Hampshire

December 27, 2022
File No. 04.0029644.03

PREPARED FOR:

Liberty™

GZA GeoEnvironmental, Inc.
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603-623-3600

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04.0029644.03
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1.0 INTRODUCTION

GZA GeoEnvironmental, Inc. is pleased to present this letter report providing our opinion of probable costs (OPC) for known and potential regulatory required environmental services related to the demolition of the 1888 Holder House at the former Concord Coal Gas Site[1] (Site), should demolition of the structure become necessary. GZA's OPC was prepared to provide a basis for the calculation of the Maximum Owner Contribution to the repair of the Holder House under the Emergency Stabilization License Agreement (Agreement) between The New Hampshire Preservation Alliance (NHPA) and Liberty Utilities (Energy North Natural Gas) Corp. (Liberty Utilities).

Liberty Utilities desires to contribute to the total cost of stabilizing and preserving the Holder House an amount no greater than the aggregate estimated cost of demolishing the Holder House and gas holder, performing an environmental investigation beneath the area currently made inaccessible by the Holder House, removing or managing contamination found beneath the Holder House that would be made accessible by the demolition process, and installing a cap over the Holder House footprint. The work must be consistent with the objectives and remedial alternatives described in the Remedial Action Plan[2] (RAP) prepared for the Site or any RAP amendment required by the New Hampshire Department of Environmental Services (NHDES), and the funds spent on a plan that will ensure the long-term viability of the building's service as a cap as required by the RAP. The Agreement between Liberty Utilities and NHPA outlines a detailed phased stabilization plan, NHDES, and NH Public Utilities Commission approval requirements and further defines use of this OPC in defining the Maximum Owner Contribution. As outlined in the Agreement, during development of the OPC by GZA, Haley & Aldrich of Bedford, New Hampshire was retained jointly by Liberty Utilities and NHPA to review the approach and estimates presented herein.

The tasks included in the OPC described in this letter report were selected to be consistent with the RAP for the Site, which was conditionally approved by the NHDES in their letter[3] dated May 29, 2015, and additional guidance provided by NHDES in their letter[4] dated February 24, 2014. The tasks included in the OPC are consistent with GZA's understanding of Site conditions as described in GZA's conceptual Site model (CSM) and reflect our understanding of historical Site use, Site, and vicinity hydrogeology, and identified potential receptors to manufactured gas plant (MGP) byproduct contamination associated with the Site. A copy of GZA's CSM for the Site is included in the year 2021 annual summary report[5] (ASR) prepared by GZA for the Site, including the results of recent monitoring. GZA's ASR for 2021 is available on the NHDES online OneStop website. General descriptions of the tasks included in this OPC were reviewed by NHDES during a meeting with Liberty Utilities, NHPA, and GZA on Thursday, September 30, 2021. NHDES commented during the meeting[6] that the alternatives presented seemed appropriate based on what was currently known.

---

[1] Site address One Gas Street, Concord, New Hampshire. NHDES Site Number 198904063, Project RSN #1479.

[2] RAP prepared by GZA titled "*Report, Remedial Action Plan, Former Concord MGP Gas Street Site, Concord, New Hampshire, NHDES Site No. 198904063, Project RSN # 1479*," dated April 1, 2015.

[3] Letter by NHDES titled "*Concord – Former Concord Manufactured Gas Plant (MGP) Site, Gas Street, DES Site #198904063, Project #1479, Remedial Action Plan, prepared by GZA GeoEnvironmental, Inc. (GZA), and dated April 1, 2015*."

[4] Letter by NHDES titled "*Concord – Former Concord Coal Gas Site/Manufactured Gas Plant, DES Site #198904063, Project #1479, Letter Regarding Brick Gas Holder House Status, prepared by GZA GeoEnvironmental, Inc., and dated January 29, 2014*."

[5] Report by GZA titled "*Annual Summary Report – Monitoring Year 2021, Former Concord Coal Gas Site, One Gas Street, Concord, New Hampshire, Groundwater Management Permit No. GWP-198904063-C-002, NHDES Site No. 198904063, Project RSN #147*," dated March 1, 2022.

[6] Refer to memorandum by GZA titled "*Meeting Minutes – Concord, Gas St. – 1888 Holder House, Conceptual Investigation and Remediation Scope Discussion*," dated December 6, 2021.

The following sections summarize background information and describe the known and potential tasks on which our OPC is based, including primary assumptions. This letter report and GZA's OPC are subject to the Limitations included in **Appendix A**.

2.0 BACKGROUND

2.1 HOLDER HOUSE HISTORICAL SUMMARY & CONDITION

The vacant, approximately 2.4-acre Site is located at the South Main Street/Gas Street intersection in Concord, New Hampshire. The terrain is generally open with some overgrown brush and a few mature trees and moderately slopes downward from South Main Street in an easterly direction toward existing rail lines. Grassed areas are mowed regularly to maintain a neat appearance. The Site is enclosed by a series of chain-link fences and locked gates to mitigate trespassing. The only structure remaining from the former MGP facility is the Holder House, that stands in the northwest corner of the Site, approximately 15 feet east of South Main Street (**Figure 1**).

The circular Holder House structure was constructed in 1888 and houses an approximately 80-foot-diameter riveted iron plate gas holder (tank) that was once connected to the City of Concord's gas distribution system. The iron plate holder consists of a circular top and sidewall that is approximately 24 feet in height. The holder sits within the approximately 24 feet deep Holder House foundation and is open to the foundation at the bottom. The Holder House is approximately 88 feet in diameter and has 27-foot-high brick masonry walls. The conical roof is constructed using heavy timbers and is covered with slate shingles.

The gasholder was originally designed to travel up and down inside the Holder House as gas was pumped into the holder and then out into the gas distribution network. As such, there were no interior roof or wall supporting elements that would interfere with its operation. Historical drawings depicting the construction of the gas Holder House are included on **Figure 2**. Although not depicted on historical drawings of the 1888 Holder House, a brick central pillar is located within the foundation of the Holder House. The holder was supported by the pillar when the gas pressure within the holder is not sufficient to lift the holder and is currently resting on the pillar.

Reportedly, the gas holder and Holder House are the last surviving, intact holder and holder house of its type in the United States.[7] The Holder House is included in the Library of Congress collection of Historic American Building Survey/Historic American Engineering Record, and during 2018 was included in the National Register of Historic Places.

Stabilization elements anticipated to have been constructed during the 1990s consist of a center platform supported by four-spoke beams that extended to the interior wall line, where they engage the building's foundation. The platform is also supported by the central brick pillar. A shoring system of modular scaffolding was erected from the platform to the roof to partially support the cupola until a permanent solution could be implemented in 2010, the platform and shoring were updated to allow safer access to the cupola for window repairs.

A tree fell onto the north side of the conical roof of the Holder House during a storm in June 2013. Liberty Utilities designed temporary repairs to the roof in 2013 and installed temporary roof repairs in during 2014. A combination interior/exterior shoring system was erected, and temporary repairs were made to the roof to stabilize the structure. Completion of the repairs was technically challenging and costly due to the presence of the holder and

[7] Hatheway, A., W., 2012, Remediation of Former Manufactured Gas Plants and Other Coal-Tar Sites, CRC Press, Boca Raton, FL, p. 444.

lack of a structure within the Holder House from which to access and repair the roof. The overall condition of the roof was observed as part of the repair work, and deterioration of the roof and related critical structural elements due to the passage of time and historic weathering, in addition to the impact by the tree, was identified as a significant impediment to permanent repair.

Since completion of the temporary repairs in 2014, Liberty Utilities and the City have been working to identify a developer that would fully repair the Holder House as part of the future use of the Site, and thereby maintain the barrier function provided by the Holder House. Although several developers have expressed interest and performed preliminary development studies, no development is planned at this time.

In late 2021, a stabilization Agreement between Liberty Utilities and NHPA was finalized, and design, planning, and procurement activities commenced. The first phase of stabilization efforts began when a historic preservation contractor, Yankee Steeplejack Company, Inc., of Harvard, Massachusetts, mobilized to the Site in early March 2022. Stabilization work was well underway at the time this letter report was prepared.

2.2 HOLDER HOUSE FUNCTION

When operating, the foundation of the Holder House contained water, used to create a gas-tight seal, and the holder rose and fell depending on the pressure exerted on the holder by the coal gas. The production of gas at the Site was discontinued in the 1950s and residual MGP byproducts removed from the interior of the Holder House foundation during the 1990s. Relative to the management of historic MGP byproduct contamination at the Site, the Holder House currently provides a physical barrier to the contamination and prevents potential contaminant transport due to the infiltration of precipitation.

As noted by the NHDES in their May 29, 2015, letter approving the RAP, " *we believe that maintaining (restoring) the gas holder building would provide a physical barrier to prevent infiltration of precipitation into the foundation of the structure and deeper subsurface soils. This would limit the amount of MGP-related residual contaminants that could be released to the environment. As indicated in the referenced letter, the Department remains concerned that the roof must be restored to not only provide the environmental protections but also to prevent further deterioration of the roof and building structure*."

The NHDES also noted that "*In the event that the holder structure was to be razed, the potential for infiltration of precipitation into the foundation would be unrestricted. This condition would increase the potential for both dissolved-phase contaminants and NAPL to be released to the environment. In the absence of the physical containment afforded by the gas holder, the Department would likely need to require that the RAP include a remedial element to remove or treat MGP-contaminated soils that may be present beneath the gas holder and would then likely be accessible."*

GZA's and NHDES' opinions regarding the role of the Holder House as a cap relative to the remedial strategy for the Site are also described in GZA's letter[8] dated January 29, 2014, and NHDES's letter[9] dated February 24, 2014.

[8] Letter by GZA titled "*Brick Gas Holder House Status, Former Concord Coal Gas Site/Manufactured Gas Plant (site), One Gas Street, Concord, New Hampshire, DES Site # 198904063, Project RSN # 1479*."

[9] Letter by NHDES titled "*Concord – Former Concord Coal Gas Site/Manufactured Gas Plant, DES Site #198904063, Project #1479, Letter Regarding Brick Gas Holder House Status, prepared by GZA GeoEnvironmental, Inc., and dated January 29, 2014*."

2.3 STATUS OF SITE REMEDIATION

The remedial alternatives selected to address historic MGP byproduct contamination at the Site, as described in the RAP, include:

1. Excavation and inspection of certain subsurface structures to identify and remove readily accessible and potentially mobile MGP byproduct source material.
2. Excavation of known areas of solid tar and tar-saturated soils within the upper 2 feet below ground surface to limit the potential for direct contact with MGP byproduct contamination.
3. Construction of an engineered cap (Cap) to limit the long-term potential for workers to come in direct contact with Site contaminants. Also, designed, to the extent practicable, to limit infiltration of precipitation and the resulting and leaching of contaminants from Site soils to groundwater.
4. Periodic recovery of dense nonaqueous phase liquid (DNAPL), where practicable, from existing monitoring wells.

As documented in GZA's ASR for 2021, known subsurface structures and readily accessible sources of solid tar and tar-saturated soils at the Site have been excavated, and recovery of DNAPL is ongoing. The construction of the Cap remains to be completed along with certain follow-up activities related to work completed during 2020, as described in NHDES' letter[10] dated April 28, 2020.

An important part of the intent of the engineered Cap is to accommodate redevelopment of the Site. Consequently, the design of the Cap has been deferred pending determination of the future use of the Site, so that the Cap can be designed to accommodate the future Site use. Despite efforts by the Liberty Utilities and City of Concord, a developer/future use of the Site has not been identified. Access to the Site remains restricted by chain-link fence and locked gates. The security fence has been recently upgraded and reinforced by Liberty Utilities.

As described in the RAP, the lateral and vertical distribution of MGP byproduct contamination beneath the Site and vicinity and physical constraints related to the historic development of the Site vicinity, including transportation infrastructure, in the absence of potential receptors, make the remediation of residual soil contamination beneath the Site impractical. However, potentially mobile nonaqueous phase liquid (NAPL) represents a source of further contamination of the subsurface and is the focus of the remedial efforts at the Site. The known and potential tasks included in the OPC were selected to be consistent with the overall remedial approach for the Site, which was implemented in consideration of these conditions.

3.0 REQUIRED TASKS (DEMOLITION AND INVESTIGATION)

3.1 HOLDER HOUSE DEMOLITION

The OPC includes the complete demolition and removal of the above-ground elements of the Holder House and capping in place the below-ground portions of the structure. The top of the foundation wall would be left in place and would stand above the ground surface. For this option, GZA worked with Select Demolition, Inc. of

[10] Letter by NHDES titled "*Concord – Former Concord Manufactured Gas Plant (MGP) Site, 1 Gas Street, DES Site #198904063, Project #1479, 2020 Annual Summary Report, as prepared by GZA GeoEnvironmental, Inc., and dated February 19, 2021*."

Salem, New Hampshire and Leighton A. White, Inc. of Milford, New Hampshire to develop a demolition approach that includes the following tasks and assumptions:

- **Demolition Planning** – Preparation of a workplan expanding on the task descriptions included herein for review and approval by the City of Concord and NHDES and obtaining demolition permits (Concord Demolition Review Committee approval required).

- **Mobilization and Site Preparation** – GZA's OPC for this task assumes/includes:

  - Site access through the Gas Street entrance gate.
  - Identified asbestos and hazardous materials removed based on limited hazardous building material assessment[11] by GZA dated March 19, 2021.
  - Standing water in gasholder water removed (assumed 30,000 gallons based on gauging from top of holder) with waste profile based on sampling results included in GZA's 2020 ASR[12].
  - Utilities cut/disconnected within Site limits, including removal of existing Holder House perimeter lighting system. Excludes active gas lines that transect the Site (not connected to Holder House).

- **Demolition of Holder House –** Demolition of the structure of the Holder House above the top of the foundation wall and demolition of the central brick pillar. GZA's OPC for this task assumes/includes:

  - Demolition and holder removal performed using conventional demolition equipment.
  - Demolition performed over two months.
  - Salvage retained by contractor ($10,000 allowance included for preservation of certain building components).

- **Cap Construction and Site Restoration –** Includes construction of an engineered cap throughout the footprint of the Holder House. GZA's OPC for this task assumes/includes:

  - Construction of a minimum 2-foot-thick low permeability soil cap with marker barrier.
  - Restoration will include grading, loam, and seed of disturbed areas.
  - Long-term monitoring of the cap is included with ongoing Site management and is not included in the OPC.

3.2 HOLDER HOUSE FOOTPRINT SUBSURFACE INVESTIGATION

Consistent with the RAP, which includes managing residual soil contamination using administrative controls and an engineered Cap, the required subsurface investigation is focused on the identification of potentially mobile NAPL[13]. The investigation includes the following primary tasks:

[11] Report by GZA titled "*Limited Hazardous Building Materials Assessment, Holder House, 1 Gas Street, Concord, New Hampshire*."

[12] Report by GZA titled "*Annual Summary Report – Monitoring Year 2020, Former Concord Coal Gas Site, One Gas Street, Concord, New Hampshire, Groundwater Management Permit No. GWP-198904063-C-002, NHDES Site No. 198904063, Project RSN #1479*," dated February 19, 2021.

[13] Including dense NAPL (DNAPL) and light NAPL (LNAPL).

- **Site Investigation Workplan** – Preparation of a workplan/RAP addendum expanding on the task descriptions included herein for review and approval by NHDES.
- **Holder House Foundation Condition Assessment** – Observation and documentation of the physical condition of the surface of the Holder House foundation following removal of holder and dewatering of foundation. The objective of this task is to identify and document potential penetrations of the foundation that could have allowed MGP byproducts to move into the subsurface. Potential penetrations may include piping and structural components that extend through the foundation, as well as substantial cracks in the foundation. The assessment will focus on the portion of the foundation that is anticipated to have historically contained liquid (NAPL and or water). The observations will be used to select locations for excavation of test pits and/or drilling of soil borings. GZA's OPC for this task assumes/includes:
  - The observations will be completed by two persons over two 8-hour days on the Site.
  - Entry into the foundation via a ladder utilizing fall protection.
  - Photographic documentation, measurement, and visual characterization of each potential penetration identified.
  - Observations will be sufficient to prepare a plan documenting the conditions for submittal to NHDES.
- **Test Pit Excavation –** Excavation of test pits through the foundation to make visual observations of underlying soils. Test pits will be excavated at locations selected based on the foundation condition assessment using a mini excavator placed in the foundation using a crane. GZA's OPC for this task assumes/includes:
  - Construction of a gravel access/tracking pad for excavator (access from South Main St.).
  - Placement of up to 500 cubic yards of ¾-inch stone fill within the foundation to construct a level working platform for a mini excavator (Includes 10 days of min excavator subcontractor services and two days of crane subcontractor services).
  - The test pits will be completed by two persons over four 8-hour days on Site.
  - Two days of concrete cutting/breaking and crane subcontractor services.
  - A maximum concrete thickness of 12-inches (based on Historical information from similar holder houses).
  - Documentation of the location of the test pits and soil conditions encountered sufficient to prepare a plan documenting the conditions for submittal to NHDES.
- **Foundation Backfill** – The foundation will be backfilled to grade to enable entry into the footprint of the Holder House by a track-mounted drill rig. GZA's OPC for this task assumes/includes:
  - Placement of approximately clean masonry debris and imported fill within the foundation of the Holder House. Fill would be brought to within approximately 2 feet of the current Site grade adjacent to South Main Street to allow for construction of a low-permeability cap as described in **Section 3.1**.
- **Boring and Monitoring Well Construction** – Drilling and construction of seven overburden and three bedrock monitoring wells within the footprint of the Holder House. GZA's OPC for this task assumes/includes:
  - Depth to bedrock, based on existing Site borings, of 35 feet below grade.

- Overburden borings extend to bedrock (*i.e.*, 35 feet below grade).
- Bedrock borings drilled 15 feet into bedrock.
- Borings and monitoring well construction can be completed in 11 days using a track-mounted drill rig.
- Monitoring wells will be constructed using 2-inch internal diameter PVC screen and riser sections and will be consistent with the requirements of Env-Or 610.04 (Groundwater Monitoring Wells).
- Soil samples will be collected at 5-foot intervals using a 2-foot-long splits spoon soil sampler.
- Visual examination of soil samples.
- Completion of a reference point level elevation survey and location of wells using taped measurements from Site features on the existing Site plan.

- **NAPL Gauging** – Monthly gauging of monitoring wells constructed within the footprint of the Holder House using an oil/water interface probe to identify NAPL. This task also includes collection of two rounds of groundwater samples for laboratory analysis of MGP-related groundwater contaminants. GZA's OPC for this task assumes/includes:

  - Each monthly gauging round can be completed in four hours on Site.
  - Laboratory analysis of samples from five wells during each of two sampling rounds performed coincident with two of the gauging rounds. Each sampling round can be completed in eight hours on Site.
  - Laboratory analysis for volatile organic compounds (VOCs), semi-VOCs, total petroleum hydrocarbons, Resource Conservation and Recovery Act (RCRA), eight metals, and total cyanide.

- **Summary Report** – Preparation of a summary report describing the investigation tasks, including the work performed and results. The report will be prepared to meet, as applicable, the requirements of Env- Or 606.03 (Site Investigation Report).

4.0 POTENTIALLY REQUIRED TASKS (SUBSURFACE REMEDIATION) – NOT CURRENTLY REQUIRED BY NHDES

Consistent with the RAP, which includes managing residual soil contamination using administrative controls and an engineered cap, the potentially required tasks are theoretical and are focused on the potential removal of mobile NAPL from the subsurface if encountered during test pit operations described in **Task 3.2**. The remediation approach included in the OPC has been designed to address the removal of potentially mobile NAPL:

- **Workplan/RAP Addendum** – Preparation of a workplan/RAP addendum expanding on the task descriptions included herein for review and approval by NHDES.

- **Limited Foundation Floor Removal and Soil Excavation** – Prior to backfilling operations, removal of a portion of the floor and limited excavation of impacted soils below the floor slab. To maintain the stability of the roadbed of South Main Street and associated utilities, the permitter foundation wall of the Holder House foundation must remain in place. The theoretical excavation of soil from beneath the foundation assumes that the permitter foundation wall remains in place along with the floor slab at the base of the foundation walls to maintain the stability of the foundation walls. GZA's opinion of probable cost for this task assumes/includes:

- Excavation from the center of the foundation to a radial distance of approximately 20 feet (*i.e.*, a circular area with an area of 1,200 square feet).
- Excavation to a depth of approximately 5 feet within the center of the excavation.
- Excavation of soil using a mini-excavator and skid steer, placed within the foundation using a crane.
- Removal of up to 275 cubic yards of impacted soils using 3,000 lb. soil bags.
- Stockpiling and management of impacted soil on the Site.
- Off-Site transport and disposal of up to 415 Tons of impacted soil to Clean Earth (ESMI), Loudon, New Hampshire.
- Replace excavated soil with compacted structural fill.

Given that no soil quality data are available from beneath the footprint of the Holder House, the extent of excavation that may be needed is not known. Additionally, the depth to bedrock beneath the Holder House is not known and may be as little as five feet. As part of the review conducted by Haley & Aldrich the uncertainty of the soil volume requiring excavation, management, and off-site disposal was reviewed with GZA. Haley & Aldrich calculated a potential excavation soil volume of 788 cubic yards. In consideration of the uncertainty regarding the volume of soil that may be appropriate to excavate, GZA has presented a range of costs in the OPC presented in Appendix B using the above-assumed excavation volume (275 cubic yards) and the Haley & Aldrich excavation volume estimates as the ends of the range for estimating purposes.

GZA acknowledges that Haley & Aldrich subsequently estimated a range of potential cost higher than the range estimated for planning purposes by GZA, as described in their December 20, 2022 memorandum to NHPA. GZA agrees with Haley & Aldrich that actual costs for remediation are uncertain and could be higher than the range estimated by GZA for planning purposes. Consequently, we consider our estimated range to be conservative and appropriate for planning purposes in the absence of data delineating any contamination that may be present within the footprint of the Holder House.

- **NAPL Recovery Well Construction** – Construction of five 4-inch internal diameter NAPL recovery wells. GZA's opinion of probable cost for this task assumes/includes:
  - Well construction following backfilling of the folder to within approximately 2 feet of the final grade to allow for construction of a low-permeability cap as described in **Section 3.1**.
  - Depth to bedrock, based on existing Site borings, of 35 feet below grade.
  - NAPL recovery wells extend to bedrock (i.e., 35 feet below grade).
  - Well construction can be completed in 7 days using a track-mounted drill rig.
- **Product Recovery** – Manual gauging and recovery of NAPL from the product recovery wells; and
  - Monthly gauging and recovery for up to five years.
  - Each monitoring well within the footprint of the Holder House. Monthly gauging and recovery round can be completed in four hours on Site.
  - Disposal of product with existing product recovered from Site.

- Annual reporting would be included within the Annual Summary Report prepared for the Site under the existing Site groundwater Management Permit.

- **Remedial Completion Report** – Preparation of a report summarizing the soil excavation and NAPL product recovery measures implemented at the Site meeting the requirements of Env-Or 606.17 (Remedial Action Implementation Report).

5.0 GENERAL ASSUMPTIONS

GZA's opinions of probable cost for the known Required Tasks described in **Section 2.0** and Potentially Required Tasks described in **Section 3.0** are based on the following general assumptions:

- Permitting and approvals would not require project to meet State or federal historic preservation guidelines requirements or be controlled by federal historic preservation statutes;
- Project management by GZA is included in each task;
- Staffing and travel from GZA's Bedford, New Hampshire office;
- Use of personal protective equipment (PPE) and air quality monitoring under Site-Specific Health and Safety Plans (HASPs);
- All costs presented in the OPC are in 2022 dollars, including all overhead and profit. No provision for cost escalation or adjustment are included; and
- GZA's OPC should be considered a Class 3 Estimate as defined by the American Association of Cost Engineers Cost Estimate Classification System and is subject to limitations included in **Appendix A**.

6.0 OPINION OF PROBABLE COSTS

GZA's OPC for decommissioning and performing related subsurface investigation within the footprint of the 1888 Holder House is $1,128,750 and is detailed in Appendix B.

GZA's OPC for decommissioning and performing related subsurface investigation and remediation of potentially mobile NAPL within the footprint of the 1888 Holder House is between $1,691,606 and $ 2,379,492 as detailed in Appendix B. Some degree of subsurface contamination is likely, but the extent cannot be known based on the available data. Consequently, we recommend using the midpoint of this range ($2,035,549) for planning purposes.

GZA's OPC is based on review of local cost data (contractor quotations) for demolition, excavation, monitoring/recovery well construction, and waste transportation and disposal services; industry cost averages; RSMeans 2022 Cost works Data; and our experience with oversight of demolition, subsurface investigation, and remediation projects. The OPC includes a 25-percent cost contingency for overruns that regularly occur during construction but cannot be ascertained when an operation is being reviewed.

7.0 PREPARER'S STATEMENT AND QUALIFICATIONS

The demolition plan and the associated sections of this OPC has been prepared under the direction of Mr. John C. Murphy, CCM, CHMM. Mr. Murphy is a Certified Construction Manager and Certified Hazardous Materials Manager with over 34 years of experience in remediation, demolition, and facility decommissioning projects throughout the United States; Mr. Murphy is a Senior Principal at GZA, and in this capacity, he is

responsible for overall management and oversight of a variety of projects and personnel. His experience includes construction management, cost estimating, schedule control, and design in the environmental, building, demolition, and heavy construction industries.

The subsurface investigation and remediation sections of this OPC have been prepared under the direction of Mr. James M. Wieck, P.G. Mr. Wieck has over 30 years of experience in hydrogeologic and contaminated Site investigation and remediation and has been involved with the investigation and remediation of the Site since 2009. Mr. Wieck is an Associate Principal at GZA; in this capacity, he is responsible for overall management and oversight of a variety of projects and personnel. Both Mr. Murphy and Mr. Wieck have been involved with the remediation of the Site since 2012, and their resumes are included in **Appendix C**.

James. M. Wieck, P.G.
Associate Principal

John C. Murphy CCM, CHMM
Senior Principal

JMW/JCM:jlb
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Figures


PSS SB/MW 9
NE BLOCK
AINING WALL
PSS SB/MW 8
SS SB/MW 10
BROKEN PAVEMENT AREA
PRESENT ON-SITE
CURRENTLY (TYP.)

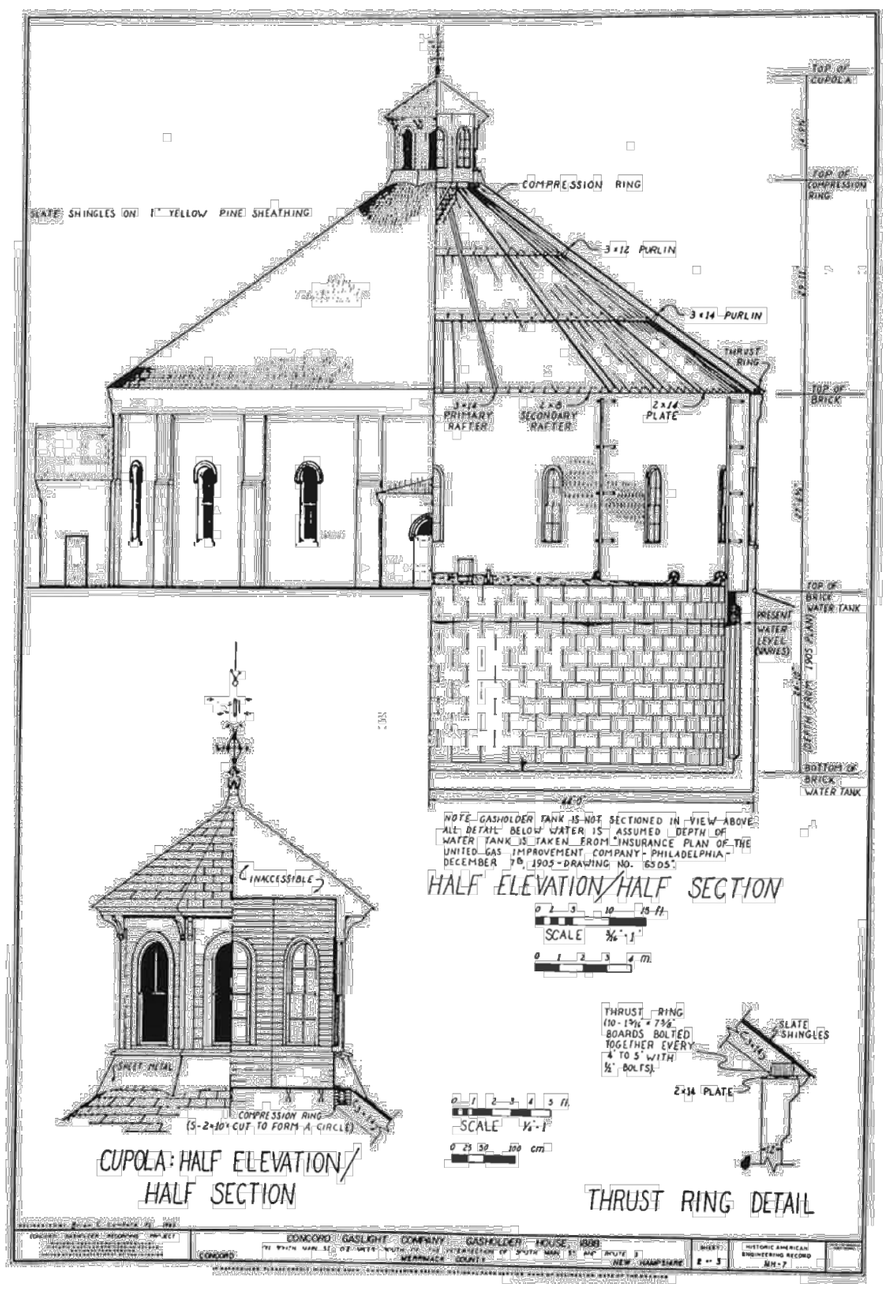

Figure 4. *Elevation and section drawings of 1888 gasholder house.* HAER, drawing by Brian Lombard, 1982.

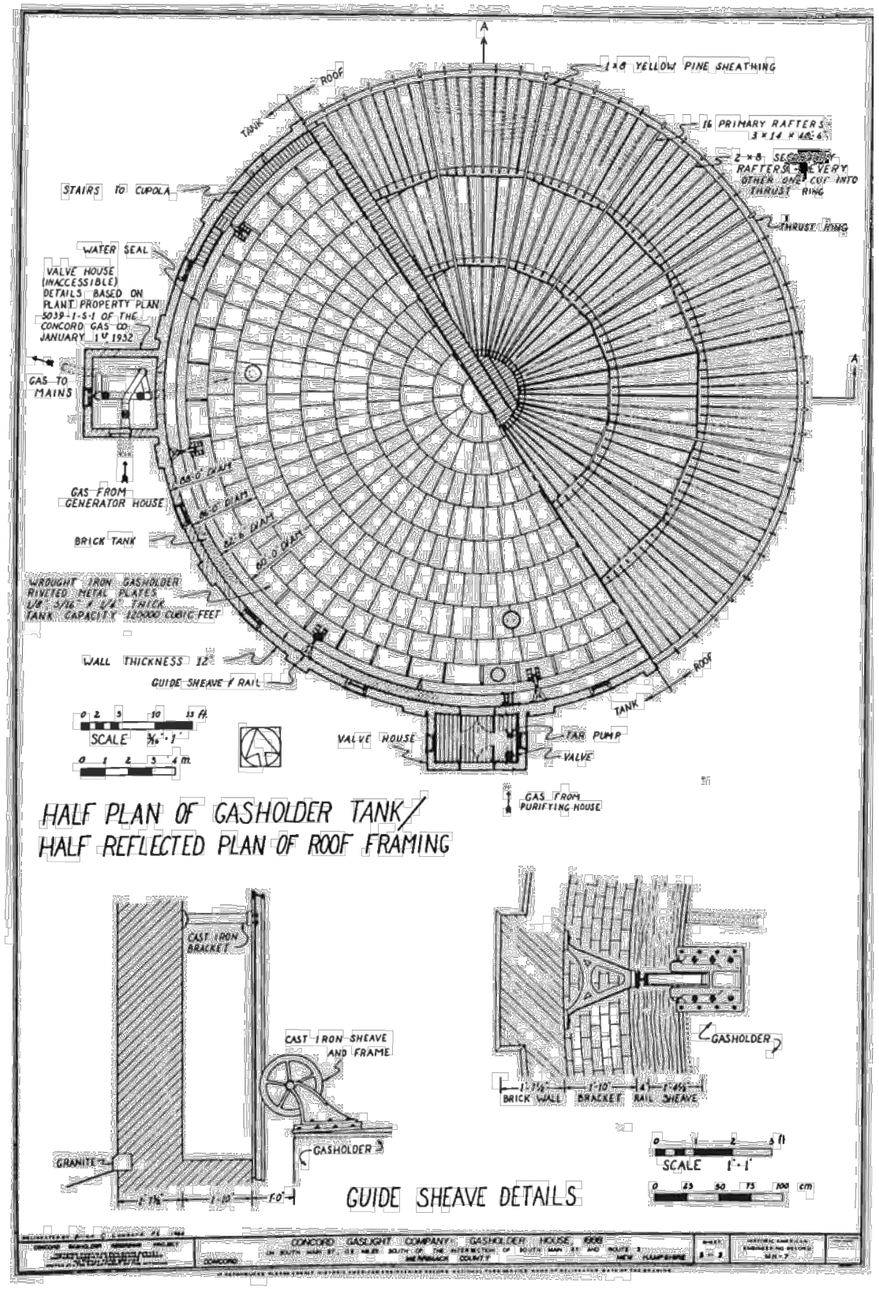

Figure 8. *Roof plan and details of guide sheaves.* HAER, drawing by Brian Lombard, 1982.

GENERAL NOTES

1. DRAWINGS TAKEN FROM "THE CONCORD (NEW HAMPSHIRE) GASHOLDER: LAST SURVIVOR FROM THE GAS-MAKING ERA," BY WILLIAM L. TAYLOR.
2. PHOTOGRAPHS TAKEN BY GZA DURING JUNE 2013.

1888 GAS HOLDER HOUSE DEMOLITION ALTERNATIVE CALCULATION OF BASIS OF MAXIMUM OWNER CONTRIBUTION
GAS STREET SITE
CONCORD, NEW HAMPSHIRE

DES SITE #198904063, PROJECT RSN #1479
HOLDER HOUSE FEATURES

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
5 COMMERCE PARK NORTH, SUITE 201
BEDFORD, NEW HAMPSHIRE 03110
(603) 623-3600

PREPARED FOR: Liberty Utilities

PROJ MGR: JMW	REVIEWED BY: SRL	CHECKED BY: JMW	FIGURE 2
DESIGNED BY: JMW	DRAWN BY: MA	SCALE: NOT TO SCALE	
DATE MARCH 2022	PROJECT NO. 04.0029644.03	REVISION NO.	039 SHEET NO.

Appendix A - Limitations

USE OF REPORT

1. GeoEnvironmental, Inc. (GZA) prepared this Report on behalf of, and for the exclusive use of our Client at the stated time for the stated purpose(s) and location(s) identified in the Report. Use of this Report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, and at the same or a similar property. No warranty, expressed or implied, is made.

BASIS OF OPINION OF COST

4. GZA's opinion of cost is based on limited data which may not be sufficient to identify each and every condition existing at the site which may constitute noncompliance with applicable governmental statutes, rules, and regulations or constitute a release of oil or hazardous materials and/or may require remediation.

5. The costs on which the preliminary opinion of cost is based are limited to those conditions which were described in the Report.

6. Observations described in the Report were made under the conditions stated therein. Where access to portions of a structure or site was unavailable or limited, GZA renders no opinion as to the condition of those portions of the site or structure.

7. The conclusions presented in the Report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.

COST ASSUMPTIONS

8. While the preliminary opinion of cost represents our professional judgment in this matter, actual conditions encountered during remediation may result in higher or lower costs.

9. The preliminary opinion of cost includes only those cost items identified, and should not be assumed to include other costs such as legal, administrative, permitting or others. The preliminary opinion of cost also does not include any costs with respect to third-party claims, fines, penalties, or other charges which may be assessed against any responsible party because of either the existence of present conditions or the future existence or discovery of any such conditions.

10. The Report contains approximate cost opinions for purposes of evaluating alternative remedial programs. These estimates involve approximate quantity evaluations. Actual quantities and unit costs may vary. A preliminary cost opinion of this nature is likely to vary substantially from Contractors' Bid Prices and is not to be considered the equivalent of nor as reliable as Contractors' Bid Prices. Prices for similar work undertaken in the future will be subject to variations

in market pricing, which are not within GZA's control. Detailed quantity and cost estimating should be performed by professional, experienced cost estimators to determine actual cost.

RELIANCE ON INFORMATION PROVIDED BY OTHERS

11. In preparing the Report, GZA may have relied on certain information provided by the Client, state and local officials, and other parties referenced therein available to GZA at the time of the evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

CODES AND REGULATIONS

12. GZA used reasonable care in identifying and interpreting codes and regulations which are relevant to the costs estimated. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

13. Governmental agencies' interpretations, requirements, and enforcement policies vary from region to region, district office to district office, from state to state, and between federal and state agencies. In addition, statutes, rules, standards, and regulations may be legislatively changed and inter-agency and intra-agency policies may be changed from present practices. GZA has used its experience and judgment in making assumptions as to how anticipated changes in regulatory policies may affect remediation costs.

ADDITIONAL SERVICES

14. It is recommended that GZA be retained to provide engineering services during any final design, construction and/or implementation of any remedial measures recommended in this report. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Opinion of Probable Cost

TASK	SUB-TASK Number	Name	Opinion of Probable Cost Required	Required and Potential
Demolition				
	1.1	Work Plan, Mobilization, and Site Preparation	$35,500	$35,500
	1.2	Temporary Facilities and Controls	$31,000	$31,000
	1.3	Erosion and Sedimentation Controls	$11,000	$11,000
	1.4	Asbestos Removal	$39,500	$39,500
	1.5	Hazardous Materials Removal	$4,500	$4,500
	1.6	Dewater Interior of Foundation	$60,000	$85,000
	1.7	Demolition of Holder House to Top of Foundation	$158,000	$158,000
	1.8	Backfill and Restoration	$246,500	$246,500
	1.9	Demobilization	$20,000	$20,000
		Task Contingency (25%)	*$151,500*	*$157,750*
		Demolition Subtotal	***$757,500***	***$788,750***
Cap Construction *Required by NHDES*				
	2.1	Clay Cap Construction	$33,500	$33,500
		Task Contingency (25%)	*$8,375*	*$8,375*
		Cap Construction Subtotal	***$41,875***	***$41,875***
Investigation *Required by NHDES*				
	3.1	Work Plan	$7,500	$7,500
	3.2	Visual Inspection of Foundation	$11,000	$11,000
	3.3	Test Pit Excavation	$60,000	$60,000
	3.4	Work Platform	$39,500	$39,500
	3.5	Boring and Monitoring Well Construction	$93,000	$93,000
	3.6	Groundwater Sampling and NAPL Gauging	$27,500	$27,500
	3.7	Investigation Report	$25,000	$25,000
		Task Contingency (25%)	$65,875	$65,875
		Investigation Subtotal	***$329,375***	***$329,375***
Remediation *May be required by NHDES (Speculative)*				
	4.1	RAP Addendum/Workplan	-	$20,000
	4.2	NAPL Recovery Well Construction	-	$38,000
	4.3	NAPL Gauging and Recovery (*5-Years*)	-	$47,285
	4.4	Annual Report	-	$4,500
	4.5	Excavation	-	$245,000 - $702,036**
	4.6	Soil Stockpiling/Management	-	$7000 - $20,058**
	4.7	Soil Transportation and Disposal	-	$43000- $123,215
	4.8	Remedial Completion Report	-	$20,500
		Task Contingency (25%)	$0	$106,321 -$243,898**
		Remediation Subtotal	***$0***	***$531,606 -$1,219,492****

Clay Cap Construction

Appendix C – Qualifications

RESUME

John C. Murphy, CCM, CHMM

Chief Operating Officer/ Senior Principal

Summary of Experience

Mr. Murphy is a Certified Construction Manager, currently serves as GZA's Chief Operating Officer and leads GZA's Construction Management and Demolition practice. Mr. Murphy's expertise includes pre-design, design, procurement, construction, and post-construction activities on a variety of environmental, energy, building, heavy construction, demolition, and facility closures projects throughout the United States. Mr. Murphy has specialized experience with work sequencing, scheduling, waste minimization, logistics and the management of hazardous materials, asbestos, lead, mold, polychlorinated biphenyls (PCBs) in buildings and site structures. He also has significant experience with site development, remediation and design as well as installation of specialty groundwater and soil treatment systems, containment structures and caps.

Education

B.S., 1988, Mechanical Engineering Technology, Wentworth Institute of Technology
A.S., 1986, Mechanical Design Engineering, Wentworth Institute of Technology

Licenses & Registrations

Certified Construction Manager- #3612
Certified Hazardous Materials Manager, Certificate – #16064
Engineer-in Training – New Hampshire, #3714

Affiliations

- Association of General Contractors
- Construction Management Association of America
- National Demolition Association
- Member, Salvation Army Advisory Board

Areas of Specialization

- Site Remediation
- Construction Management
- Cost Control
- Facility Closures / Demolition
- Building Assessments
- Hazardous Materials Management
- Asbestos, Lead and Mold Management
- Storage Tank Management

Relevant Project Experience

Principal in-Charge, Reclamation Cost Estimate, Milford I & II Windfarm and 345KVA gen tie, SunEdison, Beaver, Utah. GZA was retained to prepare a Reclamation Cost Estimate to meet the requirements of federal Bureau of Land Management (BLM) policy IM-2015-138 regarding financial assurance. The entire Milford I & II Wind Farm development is comprised of 165 WTGs, 4 permanent MET towers, electrical collector lines, electrical transmission lines, a substation, and an Operations and Maintenance building. The development encompasses an area of approximately 40 square miles of public, Utah Schools and Institutional Lands Administration lands, and BLM-managed lands. .

The Wind Farm components that are on BLM-managed lands include: 62 WTGs, 4 permanent MET towers, 88 miles of 346kva electrical collector lines, electrical transmission lines, a substation, and certain access roads. GZA prepared a detailed reclamation cost estimate which included analysis of salvage and long-term monitoring costs.

Principal in-Charge, Decommissioning Plan and Opinion of Probable Costs, Northern Pass Transmission, Confidential Client, New Hampshire. GZA was retained to prepare a Decommissioning Plan and Opinion of Probable Costs for the Northern Pass project which includes a 192-mile transmission line network and over 50 miles of underground conductor installation. Work was performed to support requirements of the New Hampshire Siting and Evaluation Committee and included a detailed cost estimate and an analysis of salvage values for the entire project.

Principal in-Charge, Demolition and Clean-Up of Fire Damaged Battery Storage Building at 30 Mega-watt Windfarm, Confidential Client, Kahuku, Hawaii. Responsible for overall coordination, planning and management of a fixed price demolition and clean-up of a battery storage building that served a 30 Mega-Watt windfarm damaged in a catastrophic fire. The structure consisted of a steel-framed high-bay building with concrete slab which housed approximately 12,000 lead acid batteries in use at the facility. Lead debris was present in the form of hazardous ash, molten lead, and burnt lead batteries plates still remaining in the racks. Prior to on-site demolition and clean-up activities, GZA conducted a pre-demolition asbestos survey,

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developed a Demolition and Clean-Up Work Plan and obtained approval from the regulatory agency, obtained a demolition permit, coordinated subcontractors, characterized waste streams, coordinated recycling and disposal facilities, and established work areas and site controls. Work included segregation, removal, and containerization of hazardous materials and non-hazardous materials remaining in the building as well as complete decontamination and removal of the building structure. The clean-up design was focused on waste minimization and maximizing the percentage of materials suitable for recycling through labor intensive waste segregation. Segregated materials were containerized in accordance with applicable shipping regulations and transported off-site for disposal. Following demolition of the structure, the surface of the slab and surrounding soils were remediated to meet regulatory requirements.

Principal in-Charge, Former Manufactured Gas Plant, Liberty Utilities, Manchester, New Hampshire. Responsible for completion of a supplemental site investigation (SSI), data gap investigations, Initial Response Action (IRA), and historic structure remediation for this former manufactured gas plant (MGP) site. MGP byproducts including light and dense non-aqueous phase liquids (LNAPLs and DNAPLs) are present at the site, and a dissolved-phase volatile organic compound (VOC) plume extends off site. Work also included upgrades and repairs to facility stormwater systems.

Technical Principal, Public Service of New Hampshire, Natural Resources and Construction Support for Transmission Line Projects in New Hampshire. Responsible for providing constructability review to support ongoing natural resources data collection, wetlands and shoreland permitting, environmental compliance monitoring, agency negotiations and resolution, and wetland mitigation and restoration design and implementation oversight.

Principal in-Charge, Demolition Planning and Procurement, North Campus Academic Center Project, Dartmouth College, Dartmouth, New Hampshire. Responsible for overall coordination and management of pre-design, assessment, final design and procurement for the demolition of the Gilman building and Dana building including the Gilman/Dana Connector and portions of the Gilman/Remsen Connector located on College Street at the North Campus of Dartmouth College. The project includes a 62,740 square-foot Gilman building, 27,100-square-foot Dana building, a 700-square-foot Dana-Gilman connector, a 1,110-square-foot Dana-Remsen connector, concrete and gravel sidewalks, paved parking, and landscaped areas. Work included full facility assessment, project sequencing demolition plan and specification development and management of procurement process on behalf of Dartmouth College.

Principal in-Charge, Former Manufactured Gas Plant, Liberty Utilities, Concord, New Hampshire. Responsible for completion of a supplemental site investigation (SSI), data gap investigations, Initial Response Action (IRA), and historic structure maintenance activities for this former manufactured gas plant (MGP) site. MGP byproducts including light and dense non-aqueous phase liquids (LNAPLs and DNAPLs) are present at the site, and a dissolved-phase volatile organic compound (VOC) plume extends off site.

Work included the completion of subsurface investigations to delineate dissolved-phase and DNAPL contamination, as well as the evaluation and summary of work performed by others that included storm water sampling, subsurface explorations, groundwater sampling, and an evaluation of subsurface MGP structures. GZA developed work plans for an IRA to remove liquid and sludge contained within the subsurface structures, and completed a soil vapor migration study. GZA also developed a 3-dimensional numerical model of site vicinity stratigraphy and DNAPL. The model provided insight into the distribution and historic movement of DNAPL within the subsurface.

Principal in-Charge, Siding and Roofing Removal and Confidential Client, Avanel, New Jersey. Responsible for overall coordination and management of pre-design, assessment, final design, and procurement for the removal and replacement of asbestos siding and roofing coated with PCB paint at an operating industrial facility that produces food grade sodium silicate based products. Paint containing PCBs at varying concentrations had previously been identified on approximately 250,000 square feet of asbestos (transite) siding and roofing throughout the facility. As Construction Manager as Agent, GZA designed and implemented a remedial strategy to comply with a state mandated source removal of PCBs from the paint on the siding.

Principal in-Charge, Demolition Planning and Procurement, PQ Corporation, Plant 1 Demolition. Responsible for providing comprehensive engineering and construction management services to PQ Corporation at one of its active manufacturing Sites in

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New Jersey as the company complies with Industrial Site Recovery Act (ISRA) and New Jersey Department of Environmental Protection (NJDEP) requirements. As part of the ISRA process, PQ Corporation decided to demolish the portion of the plant no longer in use. GZA provided pre-demolition asbestos-containing material (ACM), PCB, lead paint, and hazardous material surveys of the Plant 1 buildings. GZA developed technical specifications to address the abatement of ACM, PCBs, and hazardous materials, the planned approach for demolition of site structures, utilities, and site work required to meet the needs of PQ. GZA prepared a Soil Erosion and Sediment Control Plan and prepared a PCB Work Plan. GZA was retained as Construction Management as Agent to manage the demolition and Site restoration Project.

Principal in Charge, Building Demolition and Renovation, Former Dorr Woolen Mill Complex, Newport, New Hampshire. Mr. Murphy was responsible for environmental permitting, design, local plan approval and demolition activities associated with the complete demolition and removal of 250,000 square feet of the 300,000-square-foot Former Dorr Woolen Mill Complex located in Newport, New Hampshire. Approximately 50,000 square feet of the facility were separated from the demolished portion of the facility and renovated for re-occupancy by the current owner. The work was performed on a firm fixed price basis with an accelerated schedule. Work included performing a demolition level asbestos and hazardous materials survey and development of a demolition design plan to address utility capping and rerouting, abatement and demolition phasing, and renovation coordination activities to facilitate relocation of existing on-site personnel from the buildings being demolished to the newly renovated space. GZA presented its demolition and renovation plans to the Town of Newport Planning board and secured all Town approvals for the project. In addition, GZA secured wetland, shoreland protection, alteration of terrain, and construction stormwater permits for the project.

Work included removal and characterization of hazardous materials remaining in the buildings, removal of asbestos-containing materials, and demolition and processing of all building materials. GZA performed inventory and management of salvageable materials within all buildings. Following demolition, the former basement and foundation areas were backfilled with recycled crushed brick and concrete from the buildings as well as imported fill, graded, and compacted. All disturbed areas were final graded, loamed, and seeded. Work also included closure of an existing raceway below the facility which was formerly used to convey water from the adjacent Sugar River through the facility for process operations.

Technical Principal, Former MGP, Pawtucket, Rhode Island. Responsible providing constructability review and support to complete design and construction management services for the decommissioning and demolition (D&D) of Gas Holders Nos. 7 and 8 at the former Tidewater MGP facility located in Pawtucket, Rhode Island. The location of the gas holders was adjacent to sensitive receptors including an apartment complex, charter school, and private residences. Gas Holders Nos. 7 and 8 measured approximately 130 and 175 feet in diameter, respectively and were both 30 feet in height. The approximate gas storage capacity of Holder Nos. 7 and 8 was 1,000,000 and 3,000,000 cubic feet, respectively.

D&D activities included evaluation of treatment and discharge options for accumulated stormwater in the gas holders; preparation of D&D design plans and specifications; contractor procurement; permitting; storm water removal, treatment, and discharge; implementation of perimeter air monitoring system; and construction management of abatement and demolition of the gas holders.

The Tidewater gas holder D&D project was completed within an aggressive schedule and on budget with no change orders.

Principal in- Charge, Construction of GE Aviation Welcome Center and Site Entrance, Hooksett, New Hampshire. Responsible for design-build construction of the new Site entrance and construction of a new GE Hooksett Welcome Center. The new Site entrance and Welcome Center was constructed at the location of an existing secondary access drive to the main facility. The location of the secondary access drive was redesigned to accommodate the Welcome Center and is the new main entrance into the facility and the check-in/out of employees and visitors upon arrival and departure. The new Site entrance includes a 3-lane entrance with a 90-foot automated slide gate and a 2-lane exit with a 45-foot automated slide gate. The ADA compliant Welcome Center building includes a guard station, waiting area, bathroom, telecommunication closet, and a utility room. Sidewalks around the Welcome Center are equipped with an automated snowmelt system. GZA performed as Construction Manager at Risk for all phases of the project including permitting, civil design, building design, earthwork, utilities, footings and foundation, building

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structure, interior and exterior finishes, building and Site electrical, mechanical, fire alarm, sprinkler system, fencing and slide gates, and demolition of the former guard shack.

Principal-in -Charge, Facility Upgrades, G&K Services, Manchester, New Hampshire. Responsible for overall management of a design-build contract to install two Ellis VOC stripper/washer-extractors at G&K's Manchester, New Hampshire towel wash plant. To support the new VOC stripper/washer-extractor installation, numerous infrastructure upgrades were required not only to support the new washers, but also to increase the efficiency and productivity of the entire washing process. Infrastructure upgrades included retrofitting the existing drain system including existing wastewater trenches; construction of a floor sump in the concrete slab; installation of shaker screen, 75 BHP steam generating boiler, heat exchanger, stack economizer, soap system, and chemical totes with automated level controls; building structure renovations; earthwork, foundation, and installation of a new hazardous materials storage building; and installation and/or relocation of electrical, network, compressed air, hot and cold water, natural gas, high pressure steam, wastewater, and condensate return lines. As part of our design work, GZA provided G&K with building renovation, mechanical, and electrical engineered plans for all systems supporting the towel wash plant upgrades and obtained permits, authorizations, and approvals for completion of the work. A requirement of our contract for construction services was an aggressive schedule and detailed work sequencing that included no impact to facility operations. Completion of all building structural renovations, mechanical piping and connections, electrical conduit, wiring and connections, and new equipment rigging and installation were performed with essentially no interruption to the facility with required shut-down connections performed outside of the facilities normal working hours (nights and weekends).

Principal in Charge, Demolition and Soil & Groundwater Remediation, Former Sanmina Facility, Derry, New Hampshire. Responsible for the relocation of an existing groundwater treatment system consisting of 3 bedrock and 12 overburden extraction wells including installation of new underground piping and conduit and construction of a new treatment building. Completed demolition activities associated with complete demolition of an existing approximately 126,000-square-foot, 2-story former plating facility. Work included removal and characterization of hazardous materials remaining in the buildings, removal of asbestos-containing materials, and demolition and processing of all building materials including removal of foundations and footings. Following demolition, the former basement and foundation areas were backfilled with imported fill, graded, and compacted. Work also included the excavation and disposal of approximately 1,300 tons of contaminated concrete and 3,500 tons of contaminated soil.

Principal in Charge, Building Demolition, The Salvation Army, Dorchester, Massachusetts. Responsible for design and demolition activities associated with the complete demolition and removal of an existing 21,000-square-foot, 1-story industrial building; 9,500-square-foot, 1-story industrial building; and six multi-family, apartment buildings located in an urban setting. Work included removal and characterization of hazardous materials remaining in the buildings, removal of asbestos-containing materials, and demolition and processing of all buildings including removal of foundations and footings. Following demolition, former basement and foundation areas were backfilled with imported fill, graded, and compacted. Work also included excavation, removal and disposal of three underground solvent and gasoline tanks and one No. 6 oil tank located in a below grade vault. Contaminated soil associated with releases from the tanks was excavated and disposed of off-site. Approximately 180 tons of lead-impacted soil were also excavated and disposed of offsite.

Project Manager/Estimator, Facility Closures, Defense Fuel Supply Center (DFSP-Newington, DFSP-Casco Bay, and DFSP-Searsport). Responsible for the development of fixed price costs for competitively bid facility closure programs for three military bulk fuel storage and transportation facilities managed by the Department of Defense and located in the Northeastern United States. GZA was awarded the contract as best value to the government. DFSP-Newington includes a marine fuel pier, a multi-acre bulk fuel storage terminal consisting of six underground storage tanks with a total capacity of approximately 15.4 million gallons, and a 3-mile-long pipeline system to Pease Air Force Base. DFSP-Casco Bay includes a marine fuel pier, a 67-acre bulk fuel storage terminal consisting of 14 aboveground fixed-roof storage tanks with a total capacity of approximately 39.5 million gallons, and a 12-mile-long pipeline system to Brunswick Naval Air Station. DFSP-Searsport includes a marine fuel pier, a 52-acre bulk fuel storage

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terminal consisting of nine aboveground fixed-roof storage tanks with a total capacity of approximately 37.8 million gallons, and a 200-mile-long pipeline system to Bangor Air National Guard Facility and Loring Air Force Base.

Principal in Charge, Building Demolition, The Salvation Army, Utica, New York. Due to a structural failure of the roof on a 100,000-square-foot warehouse, GZA was retained to perform overall Demolition of the warehouse and adjacent 3-story former residence building. Work included performing a demolition level asbestos and hazardous materials survey and subsequent abatement of identified materials. Given the extended period of time that had elapsed since the roof collapse, abatement of significant amounts of pigeon guano was required to protect worker health & safety during site activities. Upon completion of abatement activities, a complex building separation was performed where the building tied into an occupied adjacent structure and the entire building was demolished. Site work included removal of all utilities. The site was graded and left in a "parking lot" ready condition.

Principal in Charge, Environmental Services, The Salvation Army, Various Locations. Mr. Murphy is responsible for overall coordination of investigation and remedial work at all client-owned facilities in the Northeast. Facilities range from single-family residences to multi-story commercial buildings to 100-acre summer camps. GZA performed environmental inspections at over 2,300 facilities and ranked environmental risk based on our observations of lead, asbestos, tanks and water intrusion issues. An Internet based application was developed by GZA that catalogued our visits, findings and rankings. At the completion of the studies, GZA Identified 125 "priority" sites that required immediate action. As follow-on to our initial study, GZA was tasked with remediation at these priority sites. This work involves generation of work plans, bid administration and construction management at these sites. To date work has involved asbestos, lead, mold, aboveground and underground storage tank removal, water intrusion, and contaminated soils. In addition to abatement and remediation, GZA is responsible for restoration of disturbed building or Site surfaces.

Principal in Charge, Beede Waste Oil Superfund Site, Plaistow, New Hampshire. Responsible for cost estimating and management of this fixed price competitively bid remedial action. Work included installation of two separate vacuum enhanced dual phase extraction systems capable of removal groundwater and light non-aqueous phase liquid (LNAPL) from 143 extraction well locations. Approximately 1 mile of heat fused aboveground polypropylene piping was installed to transport LNAPL and groundwater from three-separate on-site plume locations to the treatment systems. In addition, an existing interceptor trench was extended to capture LNAPL migrating into Kelly Brook at the down gradient edge of the Site. This remedial action is considered a Non Time Critical Removal Action (NTCRA) by EPA and is designed to contain the existing on-site plumes and stop off-site migration to adjacent surface water.

Professional Development

US Army Corps of Engineers, Construction Quality Management for Contractors

Remediation of Hazardous Waste Sites, Center for Professional Advancement

Construction Dewatering, Northeastern University

OSHA 29 CFR 1910.120 (e)(3) HAZWOPER Initial Training (40 Hours)

OSHA 29 CFR 1910.120 (e)(8) HAZWOPER Refresher Training (8 Hours/Annual)

OSHA 29 CFR 1910.120 (e)(4) HAZWOPER Management and Supervisor Training (8 Hours)

Factory-Certified, Level B Safety Equipment, North

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James M. Wieck, P.G.

Associate Principal, Hydrogeologist

Summary of Experience

Mr. Wieck has completed numerous environmental hydrogeologic projects including investigation and remediation at facilities with complex historical usage and hydrogeologic settings, as well as water supply investigations and permitting. He has experience in evaluating site hydrogeologic and contaminant conditions, numerical and analytical simulation of hydrogeology, aquifer testing/analyses, and water supply development and protection. Mr. Wieck has over 28 years of experience with the New Hampshire groundwater and surface water protection rules and has prepared numerous milestone documents including site investigation (SI) reports, remedial action plans (RAPs), and applications for groundwater management and discharge permits. Mr. Wieck has experience working with industry, municipalities, institutions, and utilities including the nuclear power industry to assist in meeting their regulatory requirements. Recent work includes investigation and remediation of emerging contaminants including 1,4-dioxane and per- and poly-fluoroalkyl substances (PFAS).

Education

B.S., 1988, Geology,
Salem State University
M.S., 1993, Hydrology,
University of New Hampshire

Licenses & Registrations

Professional Geologist – 2003, New Hampshire, #678

Affiliations

- National Ground Water Association

Areas of Specialization

- Hydrology
- Hydrogeology
- Hydrogeologic Modeling
- Initial Site Characterizations
- Site Investigations
- Remedial Design
- Remedial Action Plans
- Remedial Action Implementation
- Groundwater Management Zone Permitting
- Groundwater Permit Monitoring

Relevant Project Experience

Project Manager, Former Manufactured Gas Plant, Concord, New Hampshire. Responsible for completion of a supplemental SI, data gap investigations, Initial Response Action (IRA), RAP preparation and implementation, and historic structure maintenance activities for this former manufactured gas plant (MGP) site. MGP byproducts including light and dense non-aqueous phase liquids (LNAPLs and DNAPLs) are present at the site, and a dissolved-phase volatile organic compound (VOC) plume extends off site. Mr. Wieck has overseen the groundwater monitoring for the site since 2009.

Work included the completion of subsurface investigations to delineate dissolved-phase and DNAPL contamination, as well as the evaluation and summary of work performed by others that included storm water sampling, subsurface explorations, groundwater sampling, and an evaluation of subsurface MGP structures. Mr. Wieck developed work plans to remove liquid and sludge contained within the subsurface structures and completed a soil vapor migration study. Mr. Wieck also developed a 3-dimensional numerical model of site vicinity stratigraphy and DNAPL. The model provided insight into the distribution and historic movement of DNAPL within the subsurface.

Project Manager, Former Manufactured Gas Plant, Manchester, New Hampshire. Responsible for completion of a remedial feasibility study and remedial action plan (RAP) for this former MGP. The project included review of existing site information including the results of DNAPL and LNAPL mobility and recoverability studies. The information was used to evaluate the feasibility of selected remedial alternatives with the objective of controlling the movement of DNAPL and recovering LNAPL and DNAPL. Mr. Wieck developed a three-dimensional numerical model of site and site vicinity stratigraphy and DNAPL. The model provided insight into the potential sources distribution and historic movement of DNAPL within the subsurface.

Remedial alternatives evaluated include excavation, in-situ treatment and stabilization, product removal, and barrier methods. The RAP includes a combination of source

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remediation and product recovery. Other work includes Groundwater Management Permit- (GMP-) related sampling and implementation of the RAP.

Senior Project Manager, Hydrogeologic Site Investigation and Remediation, Hanover, New Hampshire. This on-going remedial project included evaluation of 1,4-dioxane transport in overburden and fractured bedrock groundwater systems from a former medical research waste disposal facility. Waste included scintillation fluids used in radiological research that contained 1,4-dioxane. 1,4-dioxane was detected following remediation and closure of the facility relative to radiological waste. The investigation phase of the project included multiple phases of groundwater monitoring well installation and testing to evaluate the transport of 1,4-dioxane, including evaluation of potential transport to private water supply wells downgradient of the former facility.

Bedrock mapping and surficial and borehole geophysical methods were used in the evaluation of the bedrock fracture fabric to identify potential preferential directions of groundwater flow and 1,4-dioxane transport. Water supply sampling has included sampling of over 140 private water supply wells, surface water, and community and public water supplies. Delineation of the source and extent of dissolved phase transport supported the design of a groundwater remedial system and issuance of a groundwater management permit. Radionuclide sampling and analysis was also performed in consideration of the historical waste disposal at the site.

The groundwater remedial system was constructed in a remote location and includes extraction of groundwater from overburden and fractured bedrock, and treatment using an ion exchange resin. Steam regeneration of the resin is performed on site, with condensate treated using granular activated carbon. Excavation of laboratory waste including evaluation of 1,4-dioxane and radionuclides was performed.

Mr. Wieck was GZA's project manager and is the lead hydrogeologist, responsible for work plan preparation and implementation, data evaluation, and remedial design and construction. An important portion of Mr. Wieck's work was communication of technical information to residents regarding the properties of 1,4-dioxane and the investigation and remediation activities.

Project Manager, Industrial Facility, Derry, New Hampshire. Comprehensive environmental services including SI, remedial design and construction, building abatement, and operation of a remedial system of for a hydrogeologically and environmentally complex site. Responsibilities include: investigation and evaluation of chlorinated solvents, metals, 1,4-dioxane and inorganic parameters in overburden and fractured bedrock; and oversight of source remediation and building demolition activities. Recent sampling indicates the presence of PFAS. Delineation PFAS is ongoing along with the integration of its remediation with the existing remedial system.

The project included removal of approximately 200 buried containers and associated contaminated soil; design, construction and operation of a groundwater extraction well field consisting of bedrock and overburden groundwater wells; design and construction of a groundwater treatment system; industrial discharge permit-related effluent monitoring and reporting; demolition of the site manufacturing facility; remediation of overburden source areas; and GMP-related sampling and reporting.

Senior Project Manager, Hydrogeologic Site Investigation and Remediation, Confidential Client. This on-going project includes the remedial investigation of a former tannery for contaminants including PFAS used in the finishing of leather. The investigation focused on identification of tannery wastes and delineation of PFAS in overburden groundwater, surface water, and sediment. On-going remedial activities related to PFAS are focused on controlling PFAS transport in a multi-unit overburden groundwater system including prevention of transport to an adjacent river. The hydrogeologic setting is complicated by the presence of a dam on the adjacent river. The remedial system incudes groundwater extraction and treatment using granular activated carbon (GAC). Mr. Wieck's responsibilities include development of investigation work plans; technical support during work plan implementation; data evaluation; and design of the groundwater extraction components of the remedial system.

Senior Project Manager, Hydrogeologic Site Investigation and Remediation, Brentwood, New Hampshire This on-going project includes a phased site SI of a fire training drill yard. The SI is focused on evaluating the extent of PFAS contamination in soil, groundwater, and surface water. The SI also includes the sampling of private and community water supply wells, and the sampling

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of groundwater monitoring wells related to a wastewater spray irrigation field associated with a groundwater discharge permit on an adjacent property. A supplemental SI work plan has been prepared and is being implemented including installation of multilevel well couplets to evaluate vertical transport of PFAS, and the evaluation of leaching of PFAS to groundwater. Mr. Wieck's responsibilities include development of SI and supplemental SI work plans, technical support and review; and management of the spray irrigation and supplemental SI projects.

Project Manager, Radial Collector Well, Hooksett, New Hampshire. Providing permitting and hydrogeologic evaluation services including the preparation of a Large Groundwater Withdrawal permit for this first of its kind municipal water supply project in New Hampshire. The Radial Collector Well (RCW) includes an approximately 70-foot-deep, 16-foot-diameter vertical caisson constructed on shore, and six horizontal laterals constructed in a fan-like pattern beneath the bed of the Merrimack River. The laterals have an average length of approximately 207 feet.

Groundwater and induced infiltration from the Merrimack River are drawn into the laterals and pumped out of the caisson. The RCW was constructed to supply the City of Manchester, New Hampshire with up to 7.2 million gallons of water per day (MGD). As part of the large groundwater withdrawal permitting, Mr. Wieck was responsible for the design and implementation of the withdrawal testing program, and evaluation of the potential influence of the withdrawal on groundwater flow necessary to ensure that there are no unplanned adverse impacts due to the withdrawal. Withdrawal test data were used to prepare a Final Report which was approved by the New Hampshire Department of Environmental Services including approval of the requested 7.2 MGD withdrawal. Mr. Wieck is currently managing a project to develop a surface water source protection plan for the RCW.

Senior Project Manager, Hydrogeologic Site Investigation and Remediation, Amhurst, New Hampshire This project included completion of the initial phase of a SI at an industrial site related to the release of PFAS compounds. Potential air dispersion and groundwater discharge sources were preliminarily evaluated. Soil samples were collected within the vicinity of the site from soils accessible to sensitive receptors and agricultural properties to evaluate PFAS concentrations at these locations. Site hydrogeology and PFAS concentrations within groundwater were preliminarily evaluated. A work plan for completion of the SI is currently being prepared. Mr. Wieck was responsible for development of the preliminary investigation work plan and provided technical support and review of the work. Mr. Weick is currently responsible for the preparation of the work plan for the final phase of the SI.

Project Manager, Brownfields Site Investigation, Durham, New Hampshire. Performed a multi-phased hydrogeologic site investigation and prepared a Remedial Action Plan (RAP) for an abandoned former dry-cleaning supply facility located on a lot surrounded by the University of New Hampshire Durham campus. The objective of the investigation was delineation of tetrachloroethene soil and groundwater contamination and evaluation of potential sources of soil and groundwater contamination. Investigations included bedrock fracture fabric evaluations; installation of multilevel bedrock and overburden monitoring wells; very low frequency (VLF) and borehole geophysical surveys; water supply well, groundwater, and surface water sampling; review of land usage; bedrock borehole zone sampling; bench and field scale testing of enhanced reductive dehalogenation; and the evaluation of hydrogeologic data.

Work also included the preparation of Quality Assurance Project Plans (QAPPs) and addenda for United State Environmental Protection Agency (EPA) review and approval. The majority of work on this project was conducted for the State of New Hampshire Office of State Planning under an EPA Brownfields grant. A RAP was developed focused on facilitating redevelopment. Other projects have included: evaluation of potential migration of VOCs to a municipal swimming pool; site building demolition and capping; water quality and soil vapor intrusion monitoring; environmental and geotechnical services related to rehabilitation of a box culvert that transects the site; and Groundwater Management Permit (GMP)-related monitoring.

Project Manager, Brownfields Site Investigation, Tilton, New Hampshire. Planned and conducted a hydrogeologic site investigation at a town owned former mill complex located adjacent to the Winnipesaukee River. Work on this project was conducted for the NHDES under an EPA Brownfields grant. The work was focused on identifying sources of soil and groundwater contamination based on site usage information. Areas of historic solvent and petroleum usage were identified and investigated. Soil quality was evaluated for selected metals to address tanning activities and ash from lead paint released when the former mill was burnt. Soils containing lead and barium at concentrations exceeding applicable standards were identified and remedial

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approaches to manage the soil contamination developed to facilitate redevelopment of the site as a public park. Work on this project also included the preparation of a Master QAPP and a site-specific addendum for EPA review and approval.

Senior Project Manager, Former Wastewater Treatment Facility, Salem, New Hampshire. Provided hydrogeologic data evaluation support for investigation and remediation of a TCE source at a former wastewater treatment facility. Support included interpretation of geologic data and development of a 3-dimensional numerical models of groundwater flow and TCE transport and transformation within multiple glacial geologic deposits. The model included steady state and transient boundary conditions and was used to evaluate remedial alternatives for the site, as well as the effects of potential site redevelopment scenarios on TCE transport. More recent work included preparation of a RAP, implementation of a zero valent iron and biotic enhanced reductive dehalogenation pilot study, and completion of a high resolution characterization of the source area.

Senior Project Manager, Industrial Facility, Jubail Industrial Complex, Saudi Arabia. Project management and hydrogeologic data evaluation support for remediation of a chlorinated volatile organic compound source at a major chemical manufacturing industrial facility. A simplified model of groundwater flow and transport was developed to evaluate potential remedial alternatives and design an in-situ reductive dehalogenation treatment cell. The treatment cell included injection, circulation, and a subsequent downgradient transport of a remedial additive selected to enhance reductive dehalogenation of chlorinated solvents. The project included the construction and pilot testing of the treatment cell. DNAPL was encountered during the pilot testing. Recent work has included the design of a DNAPL recovery system and evaluation of recovery data.

Project Manager, Industrial Facility, Newmarket, New Hampshire. Project included design/construction of a remedial system for a former mill facility with fuel oil within a tidally influenced multi-layered groundwater system. Project involved evaluation of previous hydrogeologic studies and collection of additional information leading to the selection of a remedial technology aimed at product recovery and soil remediation, the preparation of a RAP and application for GMP, and oversight of remedial system construction. The proposed remedial system included the use of passive free product recovery and natural attenuation of site contaminants based on a low estimated risk to human health and the environment. Subsequent phases of work included investigations to facilitate the development of the site under the NHDES Brownfields program, and subsurface investigations that confirmed the presence of Manufactured Gas Plant (MGP)-related contamination at the site. Portions of the work on this project were conducted for the State of New Hampshire Office of State Planning under an EPA Brownfields grant.

Project Manager, Brownfields Site Investigation, New Boston, New Hampshire. Performed a hydrogeologic site investigation at an abandoned property formerly occupied by a propane and oil sales and service operation and a garage that serviced heavy equipment. Work on this project was conducted for the NHDES under an EPA Brownfields grant and focused on identifying sources of soil and groundwater contamination based on site usage information. Groundwater quality was used as an indicator of unidentified areas of soil contamination. Solid waste disposal areas were delineated and characterized. Recommendations for management of the limited soil contamination identified by the work and solid waste were developed to facilitate redevelopment of the site by potential developers. GZA's work also included the preparation of a Master QAPP and a site-specific addendum for EPA review and approval.

Project Manager, Brownfields Site Investigation, Claremont, New Hampshire. Performed a hydrogeologic site investigation at two of the former Monadnock Mills buildings and the site of a demolished mill building located adjacent to the Sugar River. Work on this project was conducted for the NHDES under an EPA Brownfields grant. The work focused on identifying sources of soil and groundwater contamination based on site usage information. Areas of historic solvent and petroleum usage were identified and investigated. Soil and groundwater quality was evaluated for solvents, petroleum products, and metals to address historic site use. A RAP was prepared based on the investigation that includes the use of administrative controls to limit exposure to future site occupants. Work also included the preparation of a site-specific QAPP addendum to our Master QAPP. Subsequent work included development of an activity and use restriction and construction oversight.

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James M. Wieck, P.G.

Associate Principal, Hydrogeologist

Senior Project Manager, Spring Water Source Investigation and Development, Alton, New Hampshire. Performed a hydrogeologic evaluation in support of the development of a bedrock spring water source. Site geology included a thin layer of glacial till deposits overlying fractured metamorphic bedrock. The evaluation included several phases of subsurface exploration and testing, including bedrock mapping and geophysical surveys, installation of bedrock groundwater extraction and monitoring wells, installation of overburden monitoring wells and surface water gauging stations, pumping tests, construction and monitoring of weirs, and a metrological station. Pumping tests included the monitoring of numerous residential water supply wells within the area for potential adverse impacts. The investigation was performed to support the development of the spring water source including meeting the requirements of the State of New Hampshire permitting process for Large Withdrawals of groundwater. GZA successfully obtained a Large Withdrawal Permit and spring water certification for this project.

Project Manager, Residential Drinking Water Evaluation, Derry, New Hampshire. Performed a hydrogeologic investigation to identify the source of a volatile organic compound contaminating numerous private bedrock water supply wells. Investigations included: a bedrock fracture fabric evaluation; installation of groundwater monitoring wells and bedrock sentry wells; water supply well, monitoring well, and surface water sampling and analyses; review of land usage; and geophysical surveys. The project was conducted in several phases and included extensive communications with municipal, State, and federal officials and property owners, and presentation of results at a locally televised Town Council meeting.

Senior Project Manager, Hydrogeologic Assessments, Pilgrim Station, Plymouth, Massachusetts, and Arkansas Nuclear One, Russellville, Arkansas. Managed hydrogeologic assessments of two active nuclear power facilities in support of the client's Groundwater Protection Initiative. The objectives of these projects focused on assessing potential radionuclide pathways to the ground from impacted, and potentially impacted, plant systems. For each facility, the project included a site field reconnaissance, engineering systems review; review of as-built plant drawings, review and analysis of regional and local hydrogeological information and development of a Site Conceptual Model. Based on our assessment, options for future permanent monitoring well locations were developed for each facility.

Senior Project Manager, Hydrogeologic Assessment, Vermont Yankee Nuclear Power Station, Vernon, Vermont and Palisades Nuclear Plant, Covert, Michigan. Provided site review and technical review and support in the completion of hydrogeologic assessments of active nuclear power facility in support of the client's Groundwater Protection Initiative. The objectives of the projects focused on assessing potential radionuclide pathways to the ground from impacted, and potentially impacted, plant systems. The projects included a site field reconnaissance, engineering systems review; review of as-built plant drawings, review and analysis of regional and local hydrogeological information and development of a Site Conceptual Model. Based on our assessment, options for future permanent monitoring well locations were developed for each facility.

For the Vermont Yankee Power Station Mr. Wieck also provided technical guidance and oversight of the development of a 3-dimensional numerical groundwater flow model using Groundwater Modeling Systems software to simulate groundwater flow on local watershed and site scales. The project included modeling of a complex subsurface geology, numerous anthropogenic features, and complex hydraulic boundary conditions.

Project Manager, Site Investigation, Community and Residential Water Supply Well Evaluation, Windham, New Hampshire. Conducted on-site and off-site investigations at an active gasoline station. The project involved evaluation of potential sources of M*t*BE groundwater contamination within fractured bedrock. The project included evaluation of fracture connectivity and contaminant transport from the site to off-site community and residential water supply wells. Typical gasoline-related compounds were not detected and the source of the M*t*BE was eventually attributed to a vapor phase release from the UST system. Off-site well installation, bedrock fracture fabric analysis, bedrock pump testing, bedrock packer zone sampling, and monitoring for natural attenuation indicator parameters were performed. Bedrock pump testing included monitoring and evaluating water level response in community and residential water supply wells. Monitored natural attenuation combined with operation of three point-of-entry groundwater treatment systems at affected off-site locations was selected as the remedial approach.

RESUME

James M. Wieck, P.G.

Associate Principal, Hydrogeologist

Project Manager, Industrial Facility, Hooksett, New Hampshire. Investigation of a hydrogeologically complex site with cVOC and metals groundwater contamination. Responsibilities included work plan development, oversight of field activities including soil gas surveys; microwell, overburden and bedrock boring and monitoring well installation programs; and a groundwater sampling program including compliance with the requirements of an existing groundwater management permit. Potential impacts to off-site groundwater supply wells were also evaluated. Planned and oversaw an off-site hydrogeologic investigation to delineate the extent of site-related groundwater and surface water contamination and evaluate the potential for natural attenuation of contaminants. A RAP and application for GMP utilizing natural attenuation as the remedial alternative for the site were prepared. Activities included the preparation and presentation of numerous presentations for municipal and state officials and affected individuals.

Project Manager, Industrial Facility, Bristol, New Hampshire. Hydrogeologic investigation to evaluate performance of an existing groundwater remedial system to improve capture and reduce time to closure associated with chlorinated aliphatic and petroleum hydrocarbons. Project objectives also include remediation of vadose zone soil contamination and remediation of soils contained within concrete and polyethylene soil enclosures. Design, construction, and operation of supplemental and replacement groundwater extraction wells, and soil vapor extraction systems have been performed. Remedial technologies include groundwater extraction and treatment using air stripping and carbon, and soil vapor extraction for vadose zone, and soil enclosure for VOC-contaminated soils. Use of bioremediation via reductive dehalogenation was evaluated for the site. Other activities include permit-related water quality monitoring and reporting, permit application preparation, and technical assistance associated with the operation and maintenance of the groundwater remedial system by the site owner.

Senior Project Manager, Hydrogeologic Data Review, Dover, New Hampshire. Performed a review and evaluation of existing hydrogeologic data to evaluate MtBE transport to a public water supply well. The source of the MtBE and other VOCs was an automobile recycling facility. Site geology included a sand and gravel aquifer, silt and clay deposits, and glacial till. Data evaluation included development of a 3-dimensional numerical model of site conditions using the ModFlow and ModPath computer codes. Model development and post-processing of data were performed using Groundwater Modeling System (GMS) software. Results of the model were used to evaluate the potential future impacts to the well. Remedial alternatives were developed based on the results of the evaluation to limit potential impacts to the water supply well.

GMS software was used to prepare 3-dimensional models of major bedrock fracture zones for presentation to local and State officials during public hearings.

Project Manager, Spring Water Source Investigation and Development, Peterborough, New Hampshire. Performed a hydrogeologic evaluation of a sand and gravel aquifer to develop a spring water source. Hydrogeologic investigations included groundwater monitoring well and pumping well installation, aquifer testing/analysis, hydrogeologic mapping, groundwater quality analyses, and water supply pumping well design. The purpose of the project was to develop a spring water source with a flow rate of up to 200 gallons per minute. Aquifer analysis included the use of numerical simulation of groundwater flow to evaluate the capture zone of the proposed withdrawal. Aquifer modeling and numerical simulation was performed using the 3-dimensional finite difference computer code known as ModFlow, and GMS pre- and post-processing software. The project was complicated by a Superfund groundwater contamination site within the site vicinity. Capture zone analyses were conducted to evaluate the potential for contamination of the spring water source.

Recent work has included long-term technical support and oversight of system modifications related to ozonation and chlorination disinfection systems.

Project Manager, Industrial Facility, Nashua, New Hampshire. Prepared a RAP and GMP Application for multiple fuel oil-contaminated areas and a chromium-contaminated area. Responsibilities have included the design and oversight of water quality monitoring programs and milestone regulatory documents including RAPs for the petroleum and chromium areas and a Groundwater Management Permit application for the petroleum areas. Work has included conducting remedial options evaluations that included the evaluation of biochemical fixation of chromium using indigenous soil bacteria. Recent work also

RESUME

James M. Wieck, P.G.

Associate Principal, Hydrogeologist

included implementation of the RAP for the chromium area which included excavation of shallow and "hot spot" contaminated soils from beneath an existing building and construction of an engineered cap as part of an activity and use restriction.

Project Manager, Former Dry Cleaners, Keene, New Hampshire. Responsibilities included oversight of remedial system operation and groundwater quality monitoring/reporting at a chlorinated solvent contaminated site. Work includes the evaluation of a previously installed soil vapor extraction and air sparging groundwater remedial system, supplemental delineation of an off-site chlorinated solvent plume, and monitoring of indoor air quality within an on-site retail mall located adjacent to the groundwater remedial system. Work included evaluation of off-site transport. The evaluation of the remedial soil vapor extraction/air sparging remedial system supported termination of operation of the system and transition of the site to remediation by monitored natural attenuation.

Project Manager, Industrial Facility, Keene, New Hampshire. Responsibilities included evaluation of an existing 3-dimensional finite difference groundwater flow model relative to new hydrogeologic and aquifer test data and the evaluation of historical water quality data. The objective of the project was to refine the existing model into a predictive tool used during the long-term implementation of a groundwater recovery and treatment system. Site contaminants include chlorinated aliphatic and petroleum hydrocarbon compounds. The results of this study were used to support termination of active remediation at the site with remediation by natural attenuation being used to remediate limited residual groundwater contamination.

Publications

Schaffner, I.R., Wieck, J.M., Lamb, S.R., Wright, C.F., and Pickering, E.W., 1997, Microbial enumeration screening method for evaluating intrinsic bioremediation, in press for proceedings, The Fourth International Symposium on In-Situ and On-Site Bioremediation, Battelle Memorial Institute

Schaffner, I.R., Wieck, J.M., Wright, C.F., Katz, M.D, and Pickering, E.W., Microbial enumeration and laboratory-scale microcosm studies in assessing enhanced bioremediation potential of petroleum hydrocarbons, in press for proceedings, 11th Annual Conference on Contaminated Soils, University of Massachusetts at Amherst (Paper in peer review for Journal of Soil Contamination)

Schaffner, I.R., Hawkins, E.F., and Wieck, J.M., 1996, Screening study of intrinsic bioremediation of chlorinated aliphatic hydrocarbons at a site in southern New Hampshire, in proceedings, The Tenth National Outdoor Action Conference on Aquifer Remediation, Ground Water Monitoring, & Geophysical Methods: National Ground Water Association, p. 339-353 (Peer reviewed by NGWA)

Schaffner, I.R., Hawkins, E.F., and Wieck, J.M., 1996, A look at degradation of CAHs, Soil & Groundwater Cleanup, Group III Communications, Inc., p. 20-31

Wieck, J.M., Person, M., and L. Strayer, December 1995, A Finite Element Method for Simulating Fault Block Motion and Hydrothermal Fluid Flow within Rifting Basins, Water Resources Research, Vol. 31, No. 12, pp. 3241-3258.

Person, M., Toupin, D., Wieck, J., Eadington, P., Warner, D., 1993, Hydrologic Constraints on Petroleum Generation within the Cooper & Eromanga Basins, Australia: I Mathematical Modeling (abstract), Submitted to Geofluids International Conference on Fluid Evolution, Migration, and Interaction in Rocks, Torquay, England.

Wieck, J.M., 1993, Effects of Fault Block Motion on Hydrothermal Fluid Flow within Continental Rift Basins, M.A. thesis, University of New Hampshire.

GZA GeoEnvironmental, Inc.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23 | Date of Response: 2/3/23
Request No. DOE 4-5 | Respondent: Luke Sanborn

REQUEST:

Ref: Liberty's responses to DOE Data Requests DR 1-7

As required by the Department of Energy (DOE) instruction provided with DOE data requests, please provide updated responses to all requests made in DOE DR Set 1–7, including but not limited to whether Liberty conducted a benefit-cost analysis of entering into the agreement with New Hampshire Preservation Alliance (NHPA) to stabilize the Gas Holder house of the Concord MPG and manage the relevant construction in lieu of demolition.

RESPONSE:

The only updates to the responses to DOE 1-7 are as follows:

a. Please also provide the rate impacts on MPG in the LDAC for both scenarios, i.e., demolition and preservation/construction.

   Original response: "Rate impacts of the preservation/construction option (which is capped at the cost of demolition) cannot be prepared until the owner's estimate is complete."

   Revised response: The rate impact for the current costs that were contributed to the 2022 stabilization work is provided in the original filing and has not changed.

   The rate impact for demolition would be the impact of recovering the $2.4 million over 7 years. The rate impact cannot be determined with precision because the Company has not yet incurred the full $2.4 million in costs (it has incurred $486,596). Had the Company demolished the gas holder in 2022 and had the actual costs matched the $2.4 million estimate, then the rate impact would be approximately five times the proposed LDAC rate increase for the gas holder costs in this filing, which is approximately five times the current costs ($486,596 x 5 = $2,432,980).

   The rate impact for contributing $2.4 million toward stabilization of the gas holder also cannot be calculated because the Company has not spent $2.4 million, the Company does not know when, if ever, it will contribute up to the $2.4 million because the next phase of

the gas holder project is currently unknown. If the company had contributed the full $2.4 million toward the gas holder stabilization in 2022, the rate impact would be exactly the same as if the Company had incurred $2.4 million in demolition and remediation costs. Neither event has yet occurred, so the rate impacts cannot be calculated with precision.

b. No change.

In addition to the original response, Liberty notes that, if the Commission approves recovery of the $486,596 in costs incurred in 2022, customers will only be paying for those costs, and not the full $2.4 million. That is because the Company has only incurred $486,596 to date. Absent the 2022 stabilization work, the Company would have demolished the building and incurred the actual demolition and remediation costs, whether $2.4 million as estimated or a different figure if the actual costs differed. Therefore, customers are now benefitting from lower rates than if the demolition had occurred. Given that the stabilization work will keep the gas holder standing for many years, even if no further development of the gas holder site occurs, customers will continue to benefit from the delayed – and possibly avoided – demolition and remediation costs.

c. No change.

d. No change.

e. No change.

f. No change.

g. No change.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-6

Date of Response: 2/3/23
Respondent: Luke Sanborn
Jennifer Goodman – N.H. Preservation Alliance

REQUEST:

Ref: Liberty's Petition

Please explain whether the Phase I Stabilization and Phase II Stabilization costs identified to preserve the Gas Holder building will be sufficient to preserve the building for the next twenty-five, fifty- and/or one- hundred years. If there are additional Phases, please describe the phases, quantify expenses, and explain who will pay for those expenses. If by Liberty, please indicate if expenses will be born by rate-payers or shareholders or both. Who will pay for standard maintenance and/or ancillary expenses? Please expand upon any supplemented answer to DOE DR 1-7 with regard to whether risk of cost arising from maintenance and/or ancillary expenses should be assigned to rate-payers rather than shareholders.

RESPONSE:

The Phase II rehabilitation work will last 40-60 years and easily much longer if the building is well-maintained. The 1888 Gasholder stood for more than hundred years prior to the damage to the roof caused by a falling tree. Our goal is to ensure that the property's future business model and investment underwrites maintenance and future capital projects.

The Preservation Alliance does not anticipate future phases aside from costs related to the future development of the southern corridor of the City of Concord or a future developer. These costs would be the responsibility of parties other than Liberty. The Preservation Alliance is not in a position to address any future requirements that may exist with respect to Liberty's obligations related to contamination of the site. However, under the current RAP approved by NHDES, Liberty is responsible for the maintenance of the Gas Holder as part of the approved CAP.

Standard maintenance, which is expected to be minimal, will be borne by Liberty. It is appropriate for customers to bear the costs of standard maintenance and ancillary expenses

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23 | Date of Response: 2/3/23
Request No. DOE 4-7 | Respondent: Luke Sanborn

REQUEST:

Ref: September 22, 2021, Transcript of Prehearing Conference at pg. 22 in Dkt. No. DG 21-130

Please identify and provide copies of any and all documents, including but not limited to email(s), and any other information relevant to whether, in Liberty's opinion, the Public Utilities Commission (PUC) and/or PUC Staff approved Liberty's participation in remediation of the Gas Holder structure as opposed to Liberty demolishing the structure and remediating the contamination found beneath the footprint on or before January 1, 2022.

RESPONSE:

To the best of Liberty's knowledge, there are no such documents.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23
Request No. DOE 4-8

Date of Response: 2/3/23
Respondent: Jennifer Goodman – N.H. Preservation Alliance

REQUEST:

Ref: NHPA letter dated December 30, 2022

Please provide supporting documentation or confirmation that the Gas Holder is "considered the last of its kind in the nation." Please provide the NHPA's analysis that shows that "preservation and redevelopment of the Gasholder's property hold strong, catalytic community development potential for the southern gateway..."

RESPONSE:

The National Register of Historic Places nomination that was accepted by the National Park Service is the best source. Here is an excerpt below:
Full nomination here: http://www.concordnh.gov/DocumentCenter/View/9460/Concord-Gasholder-House-NR-and-Photos?bidId=

From Statement of Significance: The Concord Gas Light Company Gasholder House is significant at the national level under Criterion C in the area of Engineering as the last remaining example of a gasholder house in the United States that retains its gasholder. Concord Gas Light Company (chartered 1850), suppliers of illuminating gas to the City of Concord, New Hampshire, installed the Gasholder House in 1887–1888 during one of several late-nineteenth-century improvements to its facility on South Main Street. The structure was designed and erected by Deily & Fowler of Laurel Iron Works, Philadelphia—a nationally recognized firm in the field of gasholder design and fabrication. During the second half of the nineteenth century, coal gas was an important fuel for municipal and industrial illumination, as well as domestic purposes, and therefore played a significant role in the growth of American cities and industry. In this period, gasholder houses were emblematic of urban progress generally and the coal gas industry in particular, and, as one of the larger buildings or structures on a city's skyline, often came to have landmark status in a community. In Concord, the introduction of coal gas coincided with a dramatic period of physical and economic expansion, as well as the community's incorporation as a city.

Docket No. DG 22-045 Request No. DOE 4-8

The Gasholder House is located in South Concord, a residential and industrial area with strong associations to the late nineteenth-century development of the City as a manufacturing and transportation hub. In the period 1900–1950, coal gas manufacturing and distribution facilities became obsolete as electricity and natural gas emerged as viable competitors. Concord Gas Light Co. discontinued use of the Gasholder House in 1952 when it switched to the sale of natural gas. Wholesale demolition of disused coal gas plants and their iconic gasholders has occurred across the country, and currently, only a handful of gasholder buildings or gasholders survive. The Gasholder House is now the only known gasholder house in the country that retains its metal gasholder. It is demonstrative of typical late nineteenth-century gasholder house and gasholder design and retains all the essential physical features required to convey its engineering significance.

This finding was central to a report prepared for the City of Concord's Ad-hoc Gasholder Committee by a real estate and planning consulting group, ADG LLG. It was completed in January 2021. A copy of that Report is provided as Attachment DOE 4-8.

Preservation and Redevelopment Feasibility Options for the Concord Gasholder Concord NH

for the

City of Concord Ad-hoc Gasholder Committee

Submitted by

ADG LLC

January 4, 2021

Table of Contents

Executive Summary

At committee meetings and public forums during the course of this explorative study, **stakeholders have expressed a strong preference for preservation,** rather than loss, of the historic Concord Gasholder building in Concord, NH, noting its future is being determined in the 60th anniversary year of the loss of Concord's Victorian-era railroad station. Preservation investment in the Gasholder will rescue a last-of-its-kind national landmark and save an important—and visually arresting—icon of Concord's industrial history, while offering community and economic development opportunities.

It has become clear that preserving and redeveloping this distinctive, round, brick building is the best approach to pursue—and that it will be best achieved in phases that are both incremental and aspirational.

However, immediate action and investment is needed to prevent accelerated deterioration or total loss. This will provide the necessary time to secure interim and/or long-term owner/developer(s) and to access funding and financing from private and public sources. With an approach that celebrates the property as an iconic landmark with unique traits, the building's restoration and the property's development can be a catalyst for adding value and amenities to the city's southern gateway.

Summary findings and recommendations

The building is on the National Register of Historic Places and is the last of the fourteen known gasholders in the U.S. with its inner workings intact. Once it has been stabilized, **a historic preservation approach is the best solution for the building**. This approach would repair the building and add an unobtrusive support system that offers 1) the chance to retain what's most unique about the building, 2) unlocks access to certain preservation funds and incentives, and 3) readies the building for additional commercial or institutional investment. The preservation approach keeps the possibility of re-use open as it keeps the interior space open (free of structural framing).

The 2.4 acre property can offer **a vibrant experience** with a restored landmark and creative interpretation and access for the Gasholder and its now-lost auxiliary structures. Additional development on the site gives it more feasibility and viability. A 5,000-10,000 square-foot structure fits on the southeastern part of the lot. Restaurant, special event, and recreation-related uses on the property are possibilities when considering market and constraints; hotel, housing and other uses seem less likely.

The redevelopment of the Gasholder property is most successful, and has the best return on investment for any private and public sector investors, if it is **part of a broader preservation and revitalization approach for the southern gateway of Concord**.

A Vision

Imagine the Gasholder's neighborhood with a cachet that attracts housing and additional businesses such as S&W Sports and Evo Rock+Fitness and offers access to future trails along the river and a bus/rail transportation center. Picture meeting spaces, food trucks and scooter rentals, as well as a gateway to Downtown, the City parks, the marsh preserve and adjoining neighborhoods.

Imagine a restored Gasholder that people can enjoy with 24/7 access through actual and creatively-designed "windows" and engaging interpretation of how the site and building worked for Concord's residents and industrial growth. Restored gas lamps along the sidewalks and innovative exterior art-lighting that can be seen from Interstate 93, welcoming visitors to Downtown. Picture compatible, next-generation-type use in the building and/or on the property related to recreation, arts, history, energy, and innovation.

The area's proximity to downtown, existing city parks, significant natural resources, and two interstate exits could encourage this "smart, sustainable" mixed-use neighborhood that could generate jobs, housing, community vitality, as well as significant new property tax revenues

Our **recommended three-phase approach** improves opportunities for success and reduces risk for the parties. It features an initial investment by Liberty Utilities, then later a City of Concord commitment during an Opportunity Bridge Phase. This tees up full restoration and redevelopment of the Gasholder and its site as well as other investments in the surrounding area. Key concepts for supporting and accelerating progress for the Gasholder and surrounding area include committing adequate project development resources to this venture over the next two years, and making the project a priority for City incentives like a Tax Increment Financing (TIF) District and grant support.

Redevelopment is most feasible with a mix of private and public investment. A new or expanded TIF district can, over time, generate City revenues sufficient to invest in initial and broader-scale improvements as well as private fundraising, grants and private investment.

In terms of environmental issues, the **Gasholder currently serves as a cap on contaminants** created during its industrial history. Demolition of the building would create additional assessment and likely additional clean-up work and costs, according to the owner's consultant and state agency information. Future preservation and redevelopment of the property must minimize ground disturbance to lessen costs associated with the management of existing contaminants.

This project will benefit greatly from adopting prior plans for the area, as well as both the sophistication of City staff and a commitment from the community and civic leaders.

Redeveloping the building offers benefits to both Liberty Utilities and the City of Concord. A working group led by the City and Liberty with other stakeholders should draft a Memorandum of Understanding (MOU) that addresses short-term stabilization needs, ownership/management options and concepts for next phases.

This report was prepared for an ad-hoc committee formed by Concord's Mayor, Jim Bouley, and City Council in response to news that the property's owner, Liberty Utilities, planned to secure a demolition permit for the building.

The ADG Gasholder team included ADG principals Stuart Arnett and Patrick McDermott as well as landscape architect Mitchell Rasor, David Versel of the Versel Group and Jackie Barton of Birchwood Planning. www.ADG.com

ADG wishes to thank the many participants that assisted in this work, including members of the public, the Ad-hoc Committee, city and state professional staff, Liberty Utilities, and the New Hampshire Preservation Alliance. www.nhpreservation.org

The project was funded, in large part, by the Concord City Council with an additional grant from the New Hampshire Preservation Alliance made possible with support from the Land and Community Heritage Investment Program.

Recommended Next Steps:
Incremental Investment with Aspirational Community Development Goals

Immediate Action Phase
Liberty Utilities facilitates emergency repairs that keeps cap on environmental issues, saves the building through a preservation approach and leaves open commercial and institutional investment opportunities.

- $400,000+ repair costs based on Structures North report (Attachment J) borne by Liberty Utilities
- Liberty's contribution to total project based on estimated demolition and remediation costs determined in consultation with the NH PUC
- Liberty Utilities aided by appropriate project management and construction expertise
- Work starts as soon as possible

City of Concord, Liberty Utilities and other stakeholders create a Memorandum of Understanding to work out specific terms for Opportunity Bridge Phase, including short and long-term issues, ownership/management model and ways to accelerate positive activity.

- Phase will likely run 1/8/21-6/30/21

Opportunity Bridge Phase
To secure public and private redevelopment investment, City of Concord, Liberty Utilities and other stakeholders need to determine and create a short-term ownership/management structure to best meet those goals. Then:

- Owner/manager works to secure private developer for Gasholder and/or new building on site.
- Owner/manager seeks community development grant/resources, and philanthropic interest. City makes project a priority for support through TIF creation/expansion and other incentives and grants and connects project development to other area investments as appropriate.
- Owner/manager, in concert with City as appropriate, seeks funding sources, such as the Land and Community Heritage Investment Program, Save America's Treasures Program, Community Development Finance Authority, New Markets Tax Credits and Federal Historic Preservation Tax Credits, in addition to private investment and private fundraising. Based on Structures North report, restoration estimate including the emergency stabilization phase is approximately $3 million (likely more for commercial use, but that would be borne by new end user, if applicable).
- City, Liberty and others as appropriate invest in cost of development of this phase including dedicated personnel and consultants as needed. Cost TBD.
- Phase will likely run 4/1/21-12/31/22 based on schedule of grants, permitting and other development factors.

Restoration and Redevelopment Phase

- New 5,000-10,000 sq. ft. structure constructed on Gasholder site to add value and tax base. TIF revenues are equal to or greater than required to service the TIF debt.
- Gasholder restoration is underway.
- Commercial and mixed-use taxable development continues.

Details of Feasibility Concepts for Phased Approach

Need for Emergency Stabilization:
There is a need for immediate action to secure the property's future potential. The building is at imminent risk of irreversible deterioration and total loss due to localized damage. Overall, however, it is relatively sound and salvageable.

There is no inexpensive, "blue-tarp" winterization fix that works. To reasonably assure there is no irreversible damage, approximately $400,000 needs to be invested *soon* according to Structures North (December, 2020) to minimize winter (snow load) and non-winter (water infiltration) damage. This investment serves as an important component of a full restoration plan, which preserves the historic value of the building and leaves open the possibility of re-use. See full report Attachment J.

Benefits of Design by Structures North
The design to preserve the building as recommended by Structures North adds an unobtrusive structural system that 1) offers the chance to retain what's most unique about the building; 2) unlocks access to certain preservation funds and incentives; 3) readies it for additional commercial or institutional investment; and 4) keeps the possibility of re-use open as it keeps the interior space open (free of structural framing).

The Structures North $3 million restoration (after stabilization) estimate is less than a preliminary monument and stabilization concept suggested by GZA GeoEngineering in an earlier report (July 2020). Additionally, the GZA estimate was based on work that would reduce the building's preservation values and its ability to meet national preservation standards and, thus, reduce or limit grant funding and commercial tax credit eligibility.

Potential for Institutional or Commercial Use of Gasholder
A stand-alone redevelopment of the site as a historic attraction would be expensive and need up-front subsidies and innovative revenue streams to be a success.

While interest has been expressed in reusing the Gasholder for commercial purposes, there are serious limitations to consider:

- Keeping the one-of-a kind mechanisms in-place and preserved greatly limits the interior for reuses like a restaurant, and greatly increases the costs of an already expensive industrial-to-commercial conversion.
- Commercial redevelopments increase the clean-up thresholds, both from a permitting perspective and from the general public's willingness to enter a brownfield building with less than total remediation, especially as a food service or office facility.
- Residential redevelopment is not considered feasible in this type of brownfield redevelopment.

Adding Value to Site With Additional Development

Even though the inside of the building has limited redevelopment potential, its exterior and 2.4-acre parcel have potential for a multi-use, private (taxable) anchor building. A 5,000-10,000 square foot structure fits well on the southeastern part of the lot. Restaurant, special event, and recreation-related uses are possibilities when considering market and constraints; hotel, housing and other uses seem less likely. See Appendix H for analysis of uses relative to market conditions. Adding a commercial building adds value to the property but likely falls short of generating enough revenue by itself to cover restoring and operating the Gasholder.

Future preservation and redevelopment of the property must minimize ground disturbance to lessen costs associated with managing existing contaminants. The site has several limiting factors, including the capped brownfield, the slopes, limited sight lines for traffic entering onto Main Street, the adjacent railroad tracks, and rights-of-way.

Opportunities Associated with an Iconic Structure

The Gasholder is an icon; it is authentic; it is Concord's version of Chicago's Water Tower or Boston's Citgo sign. Such beloved architectural landmarks brand a city and can stimulate nearby redevelopment and economic activity. See Attachments F and H for ideas about interpretation, access and redevelopment.

Benefits of Phased Approach to Redevelopment

The redevelopment of the Gasholder property will be most successful—and have the best return on investment for any private and public sector investors—if it is part of a phased preservation and revitalization approach that links this project to additional enhancements on the property and in the southern gateway area of Concord. See Attachment G.

The new building on the site – as well as a stabilized and showcased Gasholder building—could provide an authentic and highly visible amenity to build around. It can serve as a gateway to the southern section of Main Street, an anchor to the redeveloped Main Street, a magnet for cars off-ramping from the interstate into the city, and an amenity for the many residents in the area.

Related Management and Financial Considerations

The recommended three-phase approach offers the best opportunities for success and reduces risk for the parties.

Liberty Utilities representatives have stated their interest in contributing the cost of demolition and remediation to a redevelopment project and are best-positioned to make initial investment in the property. The Gasholder currently serves as a cap to contaminants created during its industrial history. Demolition of the building would create additional assessment and likely additional clean-up work and costs, according to the owner's consultant and state agency information.

The City, Liberty Utilities and other stakeholders need to explore the best management and ownership structures to address short- and long-term issues. Consider possibilities including two years of ownership by Liberty Utilities with a development entity as an exit strategy, short-term or longer-term ownership by the City with long-term leases, a new subsidiary or third party, and other options. Lease payments could be structured to help cover maintenance costs. Stewardship agreements or easements may be used to guard private or public investment in the restoration and public access.

Redevelopment is the most feasible with a mix of private and public investment. Possible sources include the Land and Community Heritage Investment Program, Save America's Treasures Program, Community Development Finance Authority, New Markets Tax Credits and Federal Historic Preservation Tax Credits.

The expansion or establishment of a TIF district can generate City revenues sufficient to invest in initial and broader-scale improvements to leverage private fundraising, grants and private investment with and without use of incentives. By adopting a TIF soon– before any bonding – the feasibility of additional commercial interest can be tested in the real marketplace. Captured funds can then either be used in the district or be returned to the general fund. Waiting to adopt a district lessens the readiness of the area for redevelopment and forfeits captured funds – however minimal – from being used within the district or for the gasholder site.

In a phased approach, an expanded or new TIF district can generate new revenues to fund any public investment in the project area and to promote opportunities in the surrounding area. No TIF funds would be committed without these new revenues from redevelopment identified.

This project benefits greatly from revisiting the adopted prior plans for the area. Additional assets are the sophistication of City staff with similar redevelopments, a community-minded utility-owner, and the expressed commitment from the community and civic leaders.

While there are challenges to success, the property's proximity to downtown, existing city parks, significant natural resources, and two interstate exits could encourage the development of a "smart, sustainable" mixed-use neighborhood that generates jobs, housing, community vitality, as well as significant new property tax revenues. The demolition or collapse of the Gasholder building makes the innovative redevelopment of this area less interesting - less "cool" - for a future residential, commercial, sustainable, and amenity-rich neighborhood. The technology and innovation of this 1888 fossil-energy innovation will be of interest to the current and future advocates of green, fossil-free energy, such as the suggested solar farm adjacent to the south marsh.

It can be a win-win for every stakeholder, and a great place to live, work, play and visit.

Preservation and Redevelopment Feasibility Options
Additional Background

A. Report Purpose and Guiding Principles for Redevelopment
B. ADG Scope and Approach
C. List of Members of City of Concord's Ad-hoc Gasholder Committee
D. National Register Nomination Excerpt and Link and Additional Information on Historic Significance
E. Redevelopment Options; includes link to GZA Environmental Report issues by City of Concord and Liberty Utilities, July 2020
F. Examples of Vibrant Interpretation/Access and Industrial Structures as Part of Brand Redevelopment
G. Local Efficient District, Catalyst Concept Site Plans and Link to 2006 Master Plan for the Southern Opportunity Corridor Excerpt
H. Market Options Worksheet, Site Plan with Added Building and Gasholder Building Models
I. Gasholder Remedial Action Plan, N.H. Department of Environmental Services, 2015
J. Report by Structures North, December 2020

Attachment A: Report Purpose and Guiding Principles

This report was prepared for an ad-hoc committee formed by Concord's Mayor Jim Bouley in response to news that the owner of the Gasholder, Liberty Utilities, would file for a demolition permit for the building in December, 2020. Working under contract with the NH Preservation Alliance, which is providing support to the Committee, ADG was contracted in October 2020 to help the City determine what to do – if anything – about the possibility of the Gasholder building being demolished.

Factors including time, money, pandemic limitations, and market changes were all taken into consideration, as was a set of Guiding Principles adopted by the Committee at the outset of this effort.

The specific deliverables are possible redevelopment options, with explanation and recommendations, to be presented to the Committee for its consideration before its report to the City Council. While the primary audience for this report is the Committee, its findings will be shared with the public and future developers or investors.

Given the short-time frame for this report, it relies heavily upon previous work, especially in the technical areas, as well as on selected public records, similar situations elsewhere for envisioning concepts for redevelopment, third-party expert opinion, and concept level planning.

We appreciate the opportunity to assist in this very worthwhile effort, and hope that this work will help those responsible make more informed and better decisions.

ADG LLC

Concord, NH

December 2020

Guiding Principles for the Gasholder Redevelopment

Reviewed with Ad-hoc Committee in September, 2020 and used to shape report:

- Investment that preserves this iconic symbol of Concord's industrial growth, considered the last of its kind in the country. Listed on National Register for Historic Places in 2018.
    - Some public access to building or site preferred over none -- and likely on limited basis.
    - Auxiliary interpretation/documentation could help take place of physical access.
    - Retention of historic interior structure strongly preferred.
- Investment that improves historic character, aesthetics and economic strength of the City's southern gateway/corridor.
    - Creates visible symbol of entrance into downtown from the south.
    - Becomes a catalyst for further development in this section of the city.
    - Addresses environmental contaminants through containment and/or clean-up.
- Investment that helps meet other master plan goals such as
    - Uses that complement other land uses in immediate vicinity.
    - Considers whole site and not just structure.
    - Considers policy priorities beyond historic preservation such as housing, public open space, and others.
- Investment that preferably has neutral or positive impact on municipal services and revenues.
    - Understood that certain municipal investments may take several years to see positive return.

Attachment B: ADG Scope and Approach

Discovery Process

The following sources of information were reviewed for this report:

- GZA engineering report (issued July, 2020) with three Options, including a structural report and a demolition estimate.
- A report from Structures North (December, 2020) an engineering company contracted by the NH Preservation Alliance for an estimate of various costs for the building to be preserved in a manner that better accommodates historic preservation values
- Select NH Public Utility Commission public records
- Select NH Department of Environmental Services records
- City of Concord plans, including the 2006 redevelopment plan for the South Opportunity Corridor
- City Tax Rate and Tax Assessing records
- Local market reports on demand for residential and commercial properties, and knowledge of private and public funding tools
- Two virtual meetings of the Task Force with comments by Task Force members, invited expert guests and the public, and their incorporated suggestions
- Two NH Preservation Alliance-hosted virtual meetings, which were well attended and in one that ADG presented initial thoughts and concepts, and incorporated subsequent suggestions
- Research on similar sites elsewhere provided by three other consulting firms, each with experience in similar redevelopments situations
- Many on-line and off-line conversations, correspondences and discussions concerning city, utility, permitting, redevelopment, real estate, marketing, engineering, legal, neighborhood and general interests regarding the site. ADG is grateful for the assistance from these many sources in providing helpful information in an understandable and timely fashion.

Questions Considered That Affected the Redevelopment Feasibility Options Presented Utilizing ADG's 360 Opportunity Assessment Factors of *Money, Market, People* and *Place*

Money (Sources and Uses, or Costs and Revenues):

A. Costs:

- How much is required, and when?
- Who pays?
- How is a cost justified by either the city or the utility?
- How is any authorized expenditure commenced and overseen?
- What are the on-going costs?

B. Revenues:

- What are the possible Revenue sources; one-time and on-going?
- How might they be realized and increased?
- What are the possible investment sources?

Market:

- What is the current and projected market for landmark/educational redevelopments?
- What is the market for Historic-based redevelopments?
- What is the local market for mixed-use development that include residential, commercial, and public uses? Will the current over-heated residential demand continue? Post-COVID considerations?
- How well served is the area for local "3rd place" amenities?
- How can this site be leveraged to:
- Enhance other City assets, including downtown, Main Street, City parks, natural resource areas, public and commuter transit, and branding?
- Catalyze the long-planned South Opportunity Corridor development?

Who (or what entity) will own and operate any redevelopment, while ensuring historic, community and environmental requirements?

People:

- What are the owner's interests and plans?
- Why should either the utility or the city act?
- How will other key entities – such as the NH PUC and NH-DES – respond?
- What are the interests of the adjacent property-owners and neighborhoods?
- Who else is interested, and what do they know and think about the options?

Place:

- To safely remain as an effective brownfields' "cap", and as a possible future redevelopment, is rehab work necessary?
- As is, does the building have any use?
- As Stage 1 stabilized, does the building have use?
- Does the fully stabilized building have serious potential for commercial (taxable) redevelopment that meets historic standards?
- What does the 2.4 acres site with capped brownfield allow?
- Are there additional covenants or similar restriction to consider?
- What are the possible effects of demolition or further development upon:
    - Permitting, permits and agreements
    - Area redevelopment
    - Neighborhood traffic, services, amenities, property values
    - Tax revenues and demand for services
    - Public acceptance and consistency with each entity's Mission?

Attachment C: Members of City of Concord's Ad-hoc Gasholder Committee

Mayor Jim Bouley and City Council created an ad-hoc committee after learning of Liberty Utilities' plans to secure a demolition permit for the Gasholder.

City Councilors:
Byron Champlin, chair
Jennifer Kretovic (also serves on Concord Heritage Commission)
Linda Kenison
Brent Todd
Robert Werner

Additional committee members with business, preservation, real estate and design expertise:
Jon Chorlian, developer
Liz Durfee Hengen, historic preservation consultant
Huck Montgomery, Liberty Utilities
Frank Lemay, Milestone Engineering and Construction
Bill Norton, Norton Asset Management
Tim Sink, Concord Chamber of Commerce
Benjamin Wilson, N.H. Division of Historical Resources

The N.H. Preservation Alliance, the statewide historic preservation organization, is supporting the effort. ADG, LLC was hired to provide analysis and conceptual feasibility options.

Attachment D: National Register Nomination Excerpt and Link and Additional Information on Significance

The Concord Gasholder is listed on the National Register of Historic Places thanks to the efforts of the Concord Heritage Commission. Here is an excerpt below (paragraph breaks added). Full nomination here.

From Statement of Significance:
The Concord Gas Light Company Gasholder House is significant at the national level under Criterion C in the area of Engineering as the last remaining example of a gasholder house in the United States that retains its gasholder. Concord Gas Light Company (chartered 1850), suppliers of illuminating gas to the City of Concord, New Hampshire, installed the Gasholder House in 1887–1888 during one of several late-nineteenth-century improvements to its facility on South Main Street. The structure was designed and erected by Deily & Fowler of Laurel Iron Works, Philadelphia—a nationally recognized firm in the field of gasholder design and fabrication. During the second half of the nineteenth century, coal gas was an important fuel for municipal and industrial illumination, as well as domestic purposes, and therefore played a significant role in the growth of American cities and industry. In this period, gasholder houses were emblematic of urban progress generally and the coal gas industry in particular, and, as one of the larger buildings or structures on a city's skyline, often came to have landmark status in a community. In Concord, the introduction of coal gas coincided with a dramatic period of physical and economic expansion, as well as the community's incorporation as a city.

The Gasholder House is located in South Concord, a residential and industrial area with strong associations to the late nineteenth century development of the City as a manufacturing and transportation hub. In the period 1900–1950, coal gas manufacturing and distribution facilities became obsolete as electricity and natural gas emerged as viable competitors. Concord Gas Light Co. discontinued use of the Gasholder House in 1952 when it switched to the sale of natural gas. Wholesale demolition of disused coal gas plants and their iconic gasholders has occurred across the country, and currently only a handful of gasholder buildings or gasholders survive. The Gasholder House is now the only known gasholder house in the country that retains its metal gasholder. It is demonstrative of typical late nineteenth-century gasholder house and gasholder design and retains all the essential physical features required to convey its engineering significance. The period of significance for the Concord Gas Light Company Gasholder House begins and ends in 1888, when the structure was completed and entered active use as a gasholder.

Additional Information on Historic Significance and Protections

At an October 29, 2020 presentation that was part of this feasibility study, state historic preservation officer Benjamin Wilson, preservation consultant Liz Durfee Hengen, retired state architectural historian Jim Garvin and National Park Service historian Roger Reed described the gasholder as an icon of Concord's history of industry and innovation, its last-of-its-kind national status, and how people and organizations across the U.S. who understand this kind of place want to see it saved.

Garvin discussed how gas revolutionized the way people lived and industry grew. Hengen showcased the multitude of diverse industries that propelled Concord's growth in the late 19th and early 20th centuries and their dependency on manufactured gas, though virtually none of these factories survive. She noted that, in the 60th anniversary year of the loss of Concord's railroad station, she and many others hope we will not see the same fate for the gasholder.

A video recording of the program on the history and significance of the landmark is here.

The building and its accompanying 2.4 acres are listed on the National Register of Historic Places (thanks to the Concord Heritage Commission) and may well be worthy of (even higher) National Historic Landmark status. Neither designation prohibits demolition, but they do afford recognition and access to some resources. Similarly, Concord's demolition delay ordinance would allow time to explore alternatives to demolition but would not prevent it.

Attachment E: Redevelopment Options Worksheet

ADG analyzed the options analyzed by GZA GeoEnvironmental in their report issued in July 2020, guiding principles set forth by the committee, market conditions, and explored three conceptual redevelopment Models-Options:

1. **Monument/landmark** with an educational element.
2. The Monument/landmark and **a commercial new building** being erected on site
3. The Monument/landmark and the commercial building as **Catalyst,** designed to initiate and catalyze a redevelopment of the areas around and adjacent to the site, by offering a unique theme and authentic asset. The site would act as the "hub" of a "hub and spoke" redevelopment scenario.

ADG's recommended option is the third Option, the Gasholder site as Catalyst.

The Monument/Landmark – as stand-alone redevelopment – would require substantial capital and operating subsidies. It then becomes competition for other institutions seeking charitable contributions and grants, and the visitor market for museums with a narrow market is poor and - post covid – projected to get worse.

The **Monument/Landmark plus a commercial building** is less of a subsidy requirement for the site, but the stand-alone value of the small area available here (10,000sf max footprint, maximum 2 floors, limited parking, train noise, vagrancy issues), the off-street location, the availability of other underutilized commercial properties near-by, and dead-end location would probably not attract a standalone, commercial development that would generate significant property tax revenues.

The **Catalyst Option**: Monument/Landmark and commercial buildings themed around the Gasholder building and history. Utilize the building's outside and the site commercially as a food and meeting place, e-scooter, bike-rental, and downtown walkway trailhead, to be the gateway to a:

a) Redeveloped mixed-use "walk, live, play" 40+ acre neighborhood
b) An adjoining natural resource park and solar farm
c) A commuter and pedestrian transit hub
d) A "3rd space" destination for the near-by residents and a
e) Destination for interstate off-ramp visitors

The area's proximity to downtown, existing city parks, significant natural resources, and two interstate exits could encourage this "smart, sustainable" mixed-use neighborhood that could generate jobs, housing, community vitality, as well as significant new property tax revenues.

The existence of an authentic "logo" to provide a theme for the area is not a guarantee that it will happen; there are many impediments to success. There are examples where similar post-industrial sites have attracted investment and people; some examples are included in this report.

The technology and innovation of this 1888 fossil-energy innovation will be of interest to the current and future advocates of green, fossil-free energy, such as solar, which is included in the Catalyst concepts.

Conversely, the demolition or collapse of the Gasholder building makes the innovative redevelopment of this area less interesting - less “cool” - for a future residential, commercial, sustainable, and amenity rich neighborhood.

Attachment F: Examples of Vibrant Interpretation/Access and Iconic/Industrial Structures as Part of Brand Redevelopment

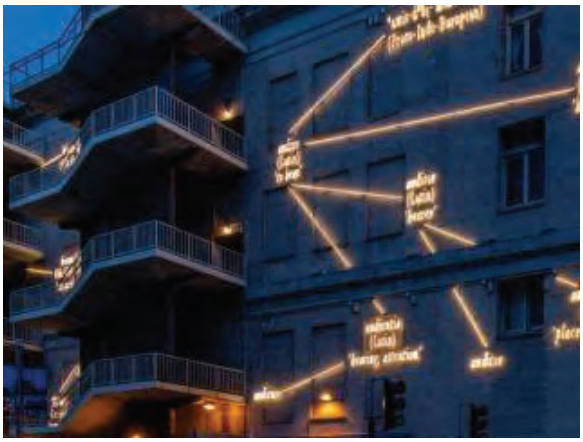
Examples from around the state, country and the world offer ideas for how to add 24/7 access and interpretation to the site.

This former mill in Mansfield, NJ has windows linking viewers to the water power that once fueled it. Photo: Realtor.com.

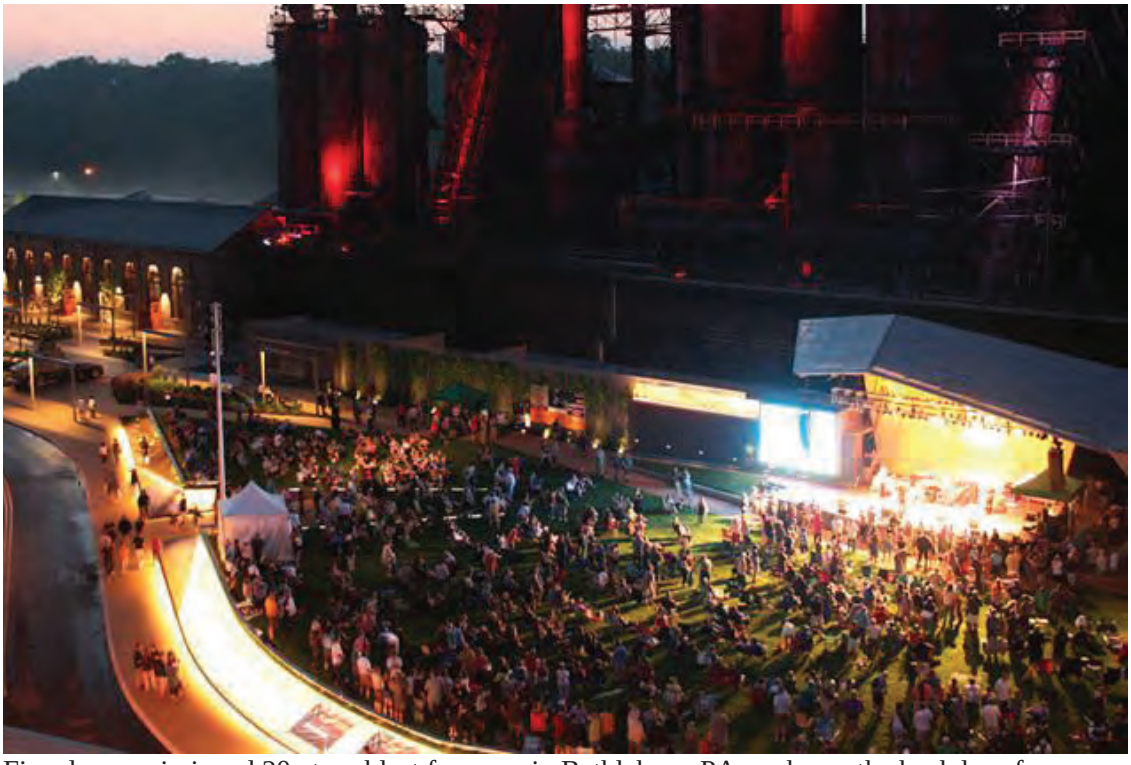
Common Man Restaurant in Claremont, NH has a design treatment to allow visual access to water to help interpret its industrial past as well.

This Philadelphia visitor destination features sculptural depiction of lost structures as well as “windows” to archeological evidence and interpretation. Photo: Pinterest/Google.

Examples of exterior lighting that adds vibrancy and interpretation to a site.



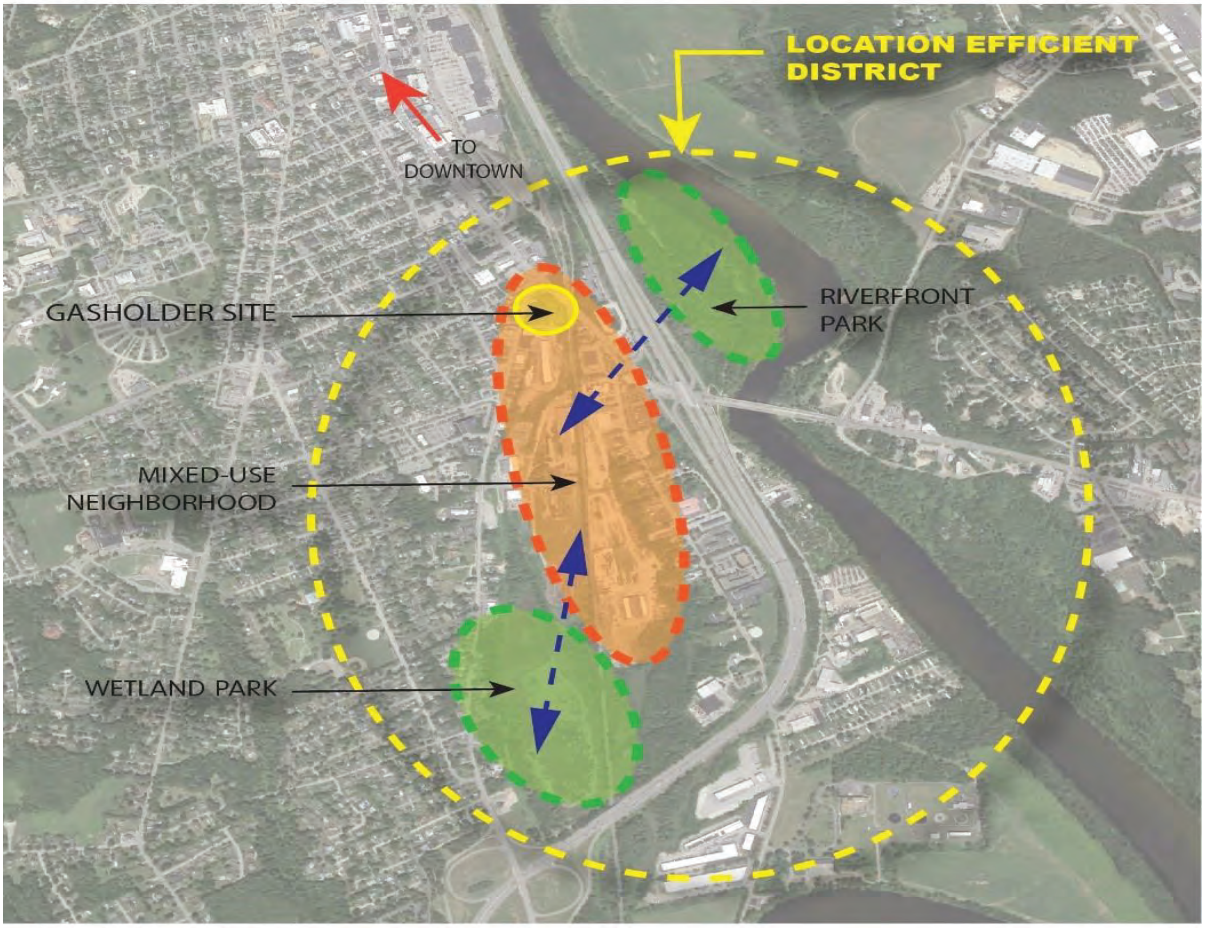
The 19.1-acre Seattle Gas Works Park revived a former coal gasification site and features recreational and other uses.



Five decommissioned 20-story blast furnaces in Bethlehem, PA, make up the backdrop for SteelStacks, which includes commercial space, an outdoor concert stage, and a casino amidst an extensive and picturesque complex of historic blast furnace equipment.

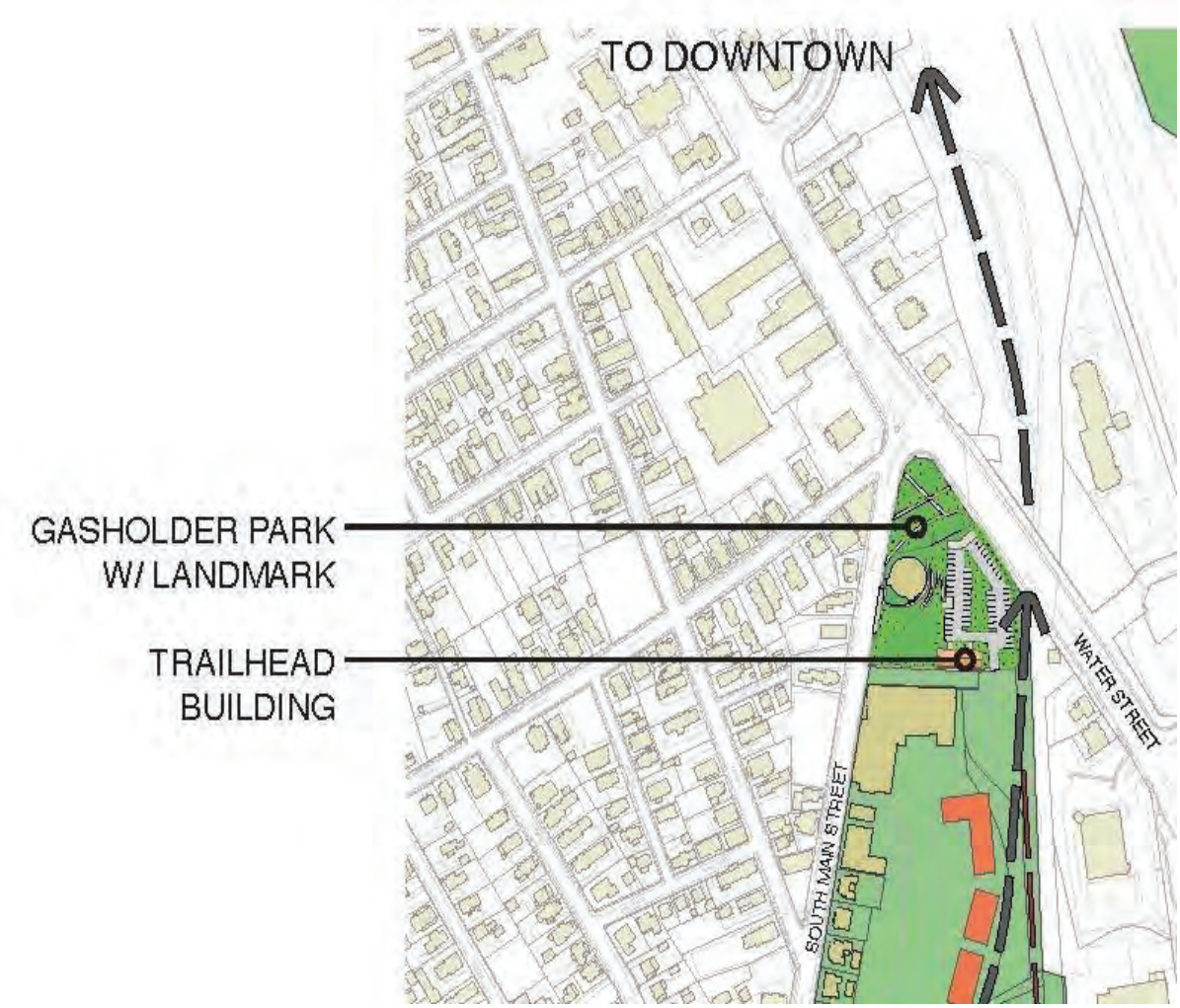
Attachment G: Local Efficient District, Catalyst Redevelopment Site Plans and Link to 2006 Master Plan for the Southern Opportunity Corridor Excerpt

The Gasholder property benefits from its site in what's considered a local efficient district, with close proximity to downtown, mixed-use neighborhoods and natural and recreational assets.



Catalyst Scenario Site Plan

This site plan uses the City of Concord's 2006 Southern Opportunity Corridor Redevelopment Plan as a starting point. Buildings are depicted in orange. Note trails, pedestrian-bikeways, and solar farm ideas as environmental buffer to marsh area. Closer looks of sections of plan follow.



Gasholder Preservation and Redevelopment Feasibility Options, January 4, 2021

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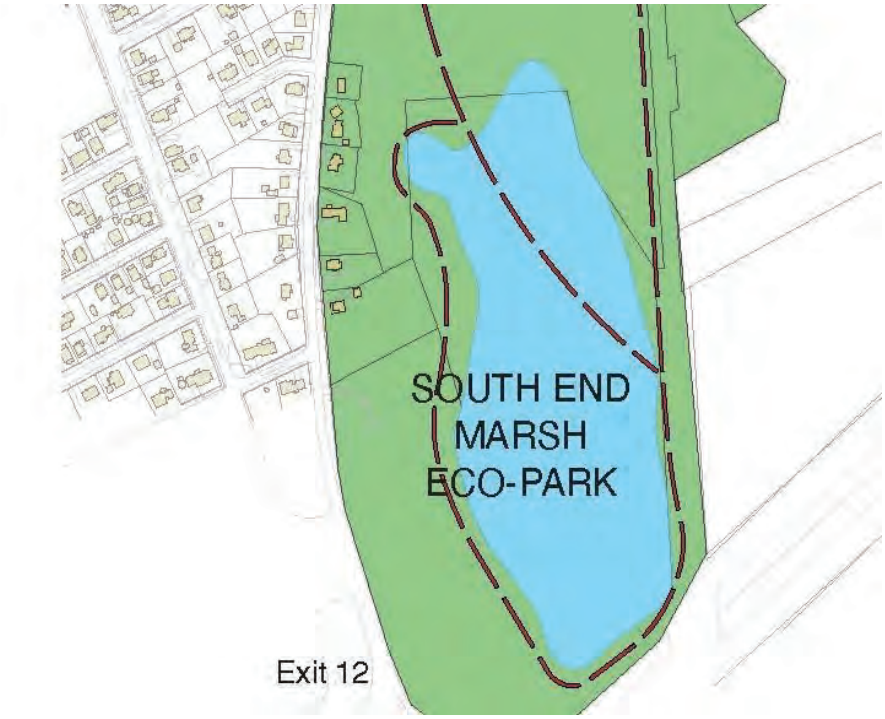
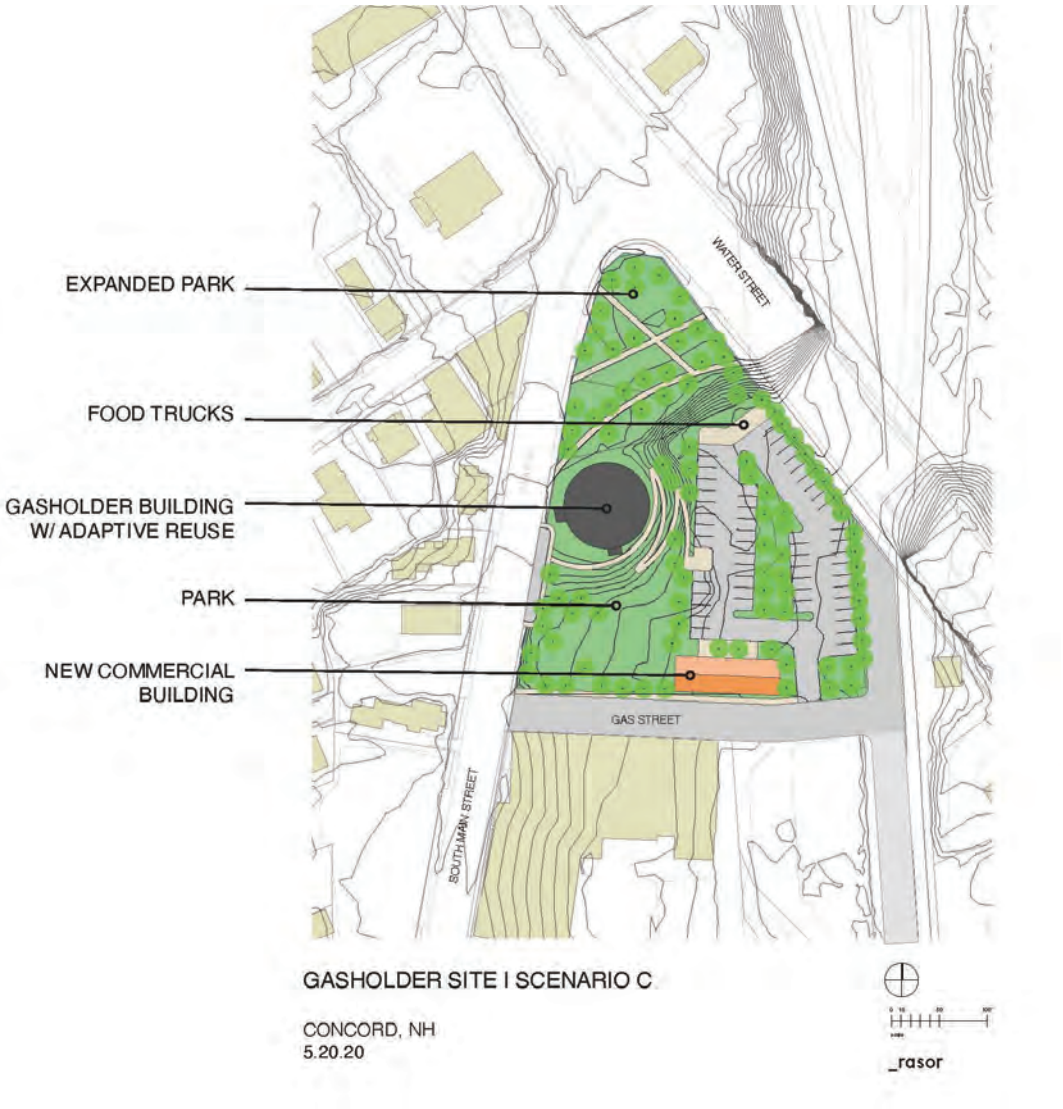


Attachment H: Market Options Worksheet, Site Plan with Additional Structure and Gasholder Building Models

	CONCLUSIONS		CRITERIA							
	OVERALL COMMENTS	*Compatibility for Site*	*Neighborhood Impact*	*Market Supportability*	*Social Needs and Inclusion*	*Historic Preservation*	*Employment Opportunities*	*Environmental Considerations*	*Cost/Level of Risk*	*Potential Catalytic Effects*
Conference/Special Event	Excellent opportunity to activate building with sustainable use that engages community, but may face short-term market challenges.	HIGH	Can present "best face" to neighborhood, keep exterior largely intact while improving property	Event business is in crisis, but strong longer-term potential	Activation of outdoor space can be huge boost to entire neighborhood	Potential to leave building and Gasholder infrastructure intact, minimal alteration to exterior	Direct impact for event/ catering business, good amenity for broader business community	Potentially limits disturbance of capped site	Minimal alteration to building, but will need kitchen, bathrooms, and other interior improvements	Potential complementary use with restaurant, maker space, retail, etc.
Restaurant/Drinking Establishment	Srong potential to attract destination business that catalyzes revitalization of neighborhood and activate outdoor space.	HIGH	Maximizes access to community	Very strong residential base and appeal to regional market	Activation of outdoor space can be huge boost to entire neighborhood, especially if family oriented	Exterior could stay intact, but significant interior upgrades are needed	Good job opportunities, though many are lower paying	Potentially limits disturbance of capped site	Minimal alteration to building, but will need kitchen, bathrooms, building systems, and life safety improvements	Anchor business that can drive revitalization of whole South End. Best way to activate outdoor space
Distillery/Brewery/ Maker Space	Good opportunity to attract entrepreneurs, create jobs, and provide complementary use to retail, dining, and event spaces.	HIGH	Opportunities for programming to engage with public	Very strong opportunities for a variety of related uses	Activation of outdoor space can be huge boost to entire neighborhood	Exterior could stay intact, but significant interior upgrades are needed	Strong entrepreneurship opportunities, creation of higher-skilled jobs	Potentially limits disturbance of capped site	Shell cost is fairly low, but tenant fit-out could be expensive	Potential complementary use with restaurant, conference, retail, etc.
Housing	Strong market support and positive impact to community, but would disturb building and site and makes the site exclusive to residents.	MEDIUM	Adds people to neighborhood, increasing spending power	Very strong, high demand for housing in Concord	Makes it an exclusive property, limits community access to it	Would need significant added footprint for multifamily, extra parking	Limited, only construction and property management	Need to disturb more of the property, could cause issues	High due to need for modifications to building, but low risk due to stronger market	Adds people and life to site, but makes it exclusive to residents
Retail	Strong potential, but would require unique users and may not be compatible with the needs of the community.	MEDIUM	Depending on exact users, could draw significant activity from neighborhood	Potentially strong due to unique nature of space and proximity to revitalized downtown	Depends on goods and services; could either add to inclusion or take away from it	Potential to leave building and Gasholder infrastructure intact, minimal alteration to exterior	Potential for one of a kind "showroom" space for unique retail businesses, especially local manufacturers	Potentially limits disturbance of capped site	Shell cost is fairly low, but tenant fit-out could be expensive	Depends on type of business and if it draws a regional clientele
Cultural Use	Potential for stong impact to community, but very expensive and risky to launch and operate.	MEDIUM	Potentially very strong, can create enormous pride and value	Very difficult to launch and sustain cultural facilities in this environment	Activation of outdoor space can be huge boost to entire neighborhood	Very compatible use of building, user will be most sensitive to preservation of building	Limited	Potentially limits disturbance of capped site	Very high risk of financial failure, will need ongoing funding support	Depending on programming, can spur additional activity
Hotel/Lodging	Would require significant disturbance to building and site, may not be market supportable, and adds little to the neighborhood.	LOW	Minimal	Business travel market is in crisis, may not be supportable	Makes it an exclusive property, limits community access to it	Would need significant added footprint for hotel, inn would have less impact	Good job opportunities, though many are lower paying	Need to disturb more of the property, could cause issues	High due to need for modifications to building, high risk due to market	Minimal
Office	Opportunity to attract jobs to unique space, but market outlook is weak and would have very limited positive impact on the community.	LOW	Minimal	Office market is uncertain, demand may stay low for several years	Makes it an exclusive property, limits community access to it	Would need to make major modifications to building, would need to add significant parking	Could attract new business, but not significant	Need to disturb more of the property, could cause issues	High due to need for modifications to building, high risk due to market	Minimal
Health Care/School	Would create good job opportunity, but would require major alterations to building and site and is not ideal for the community.	LOW	Limited to students and patients	Potentially strong demand for certain types of uses	Makes it an exclusive property, limits community access to it	Potentially very invasive to building, negative impacts to integrity of building	Good opportunity to create jobs in education and health care sectors	Need to disturb more of the property, could cause issues	Very expensive to retrofit for these uses, unlikely to find funding sources	Minimal

Site Plan with Additional Building -- Two Versions

Gasholder Preservation and Redevelopment Feasibility Options, January 4, 2021



Concord Gasholder Building Models

Jackie Barton, 10-13-2020

Monument/Park Enhancement

In this approach, the community will protect the building, preserving it for future use and ensuring it is secure and structurally intact. Periodic access could be granted depending on safety assessment. The surrounding 2+ acres would be improved as parkland. Ownership could be a public entity, a nonprofit, a land bank/trust, or similar organization. Examples of successful projects that incorporate historic structures into park sites without active use include the following:

- Kings Cross Gasholder Park (UK) utilizes creative lighting effects in a pocket park to make an 1850s cast iron gasholder frame structure the main experience of this space. “During the day the park sees local families, visitors on the King’s Cross Heritage Trail and Central Saint Martins’ students stepping away from the bustle of the city. This is the perfect place to relax and watch the narrow boats at St Pancras Lock. The circular lawn is also a great play space for local families as well as the children who attend the new school in the neighbouring Plimsoll Building.” o https://www.architectmagazine.com/technology/lighting/gasholder-park-kings-crosslondon_o
    - o https://www.kingscross.co.uk/gasholder-park
- One applicable example is St. Dunstan’s in the East (London, UK): https://www.atlasobscura.com/places/the-ruins-of-st-dunstan-in-the-east-london-england o A small park site in an urban setting o Draws tourists and photographers as well as park-seekers o Site is valued for its history and historic integrity
- Another particularly interesting example is the Seattle Gas Works park, which can be viewed on a continuum from a passive inclusion of historic structures to a deeper investment in the site. This 19.1-acre park on the site of a former coal gasification site is a signature site for Seattle’s parks: https://parkways.seattle.gov/2018/10/05/gas-works-park-play-area-opens/
- Though they are run as a site, some of the uses and passive stabilization is applicable from Sloss
  Furnaces (AL): https://www.slossfurnaces.com/
    - o Former iron furnaces o Open as a museum and venue, photography site
- The Bethlehem Steel Blast Furnaces and Hoover Mason Trestle (PA) use the trestle as a viewing walkway for the blast furnaces to explore the site's history. They are the backdrop

for the Levitt Pavilion, which is a grassy amphitheater. Good lighting of the blast furnaces makes them interesting to see day or night.

  - http://hoovermason.com/
    https://levitt.org/bethlehem

- Bulow Plantation Ruins State Park (FL) offers examples of how ruins can enhance a larger park experience: https://www.floridastateparks.org/parks-and-trails/bulow-plantation-ruins-historicstate-park
- Five decommissioned 20-story blast furnaces in Bethlehem, PA, make up the backdrop for **SteelStacks**, which includes commercial space, an outdoor concert stage, and a casino amidst an extensive and picturesque complex of historic blast furnace equipment. The artifacts were able to be saved in this case because of the commercial development and its revenue. Steelstacks is 9.5 acres and attracts 1.5 million visitors per year. https://www.steelstacks.org/about/what-issteelstacks/
- The Troy Gas Light Company (NY) is used today for storage, a garage and "occasional music and arts presentations," according to Wikipedia. https://en.wikipedia.org/wiki/Troy_Gas_Light_Company.

Attachment I: Gasholder Remedial Action Plan, N.H. Department of Environmental Services, 2015

Link to copy of document is here.

Attachment J: Structures North Report, December 2020 follows with its own page numbering.

Structures North
CONSULTING ENGINEERS, INC.

60 Washington St, Suite 401
Salem, Massachusetts 01970-3517
P.O. Box 01971-8560
T 978.745.6817 | F 978.745.6067
www.structures-north.com

21 December 2020

Jennifer Goodman
Executive Director
N.H. Preservation Alliance
7 Eagle Square
Concord, NH 03301

Reference: Concord Gasholder House Evaluation

Dear Jennifer:

On December 2, 2020 I visited the disused Concord Gasholder House on Gas Street to perform an evaluation of the structure and to look at ways that it might be saved. The following is a summary of my observations and my findings.

STRUCTURE DESCRIPTION

According to the NPS HEAR drawings that we were forwarded, the Concord Gasholder House is a 27-foot tall by 88-foot diameter above-grade brick bunker structure with a 27-foot high self-supporting conical roof, enclosing what is believed to be the last intact gasholder in North America. Set on the side of a hill, the above grade structure rests upon the rim of a 25-foot deep by 88-foot reservoir that was once filled with water and out of which the inverted gas containment tank raised and lowered depending upon supply. The perimeter bunker wall is 12" thick mass masonry with sixteen 8" x 44" nominal brick pilasters distributed about the exterior.

The roof is framed with sixteen 3" x 14" principal rafters that ascend from the tops of the pilasters to a compression ring at the top of cone, on which rests a wooden cupola. The sides of the cone are framed with three tiers of 2" x 8" common rafters that are supported by

wooden purlins that span between the principal rafters. The upper purlins are 3" x 12" and the lower purlins are 3" x 14". The compression ring at the top of the cone measures 10" x 10" and is made up of multiple wood plies. The tension ring at the bottom of the cone is approximately 12" wide by 8" tall and is made up of 10 interwoven laminations of wood.

STRUCTURAL THEORY

The gasholder house superstructure is composed of three primary elements: (1) The circular brick bunker (2) the conical wooden roof and (3) the wooden cupola.

Bunker Wall

The bunker is basically a circular brick wall with punched window openings that takes the vertical roof loads and brings them to the ground. The bunker wall is stiffened by the 16 brick pilasters and the corbeled cornice that runs around the exterior. The bottom ends of the principal rafters land over the pilasters and the guide rails for the movable inverted tank are attached to the pilasters on the inside.

Conical Roof Structure and Cupola

In the most basic sense, one could think of the roof as a large teepee that bears on the top of the circular bunker wall. The supporting ribs or the teepee would be the principal rafters, which all lean on each other at the top, and want to spread out at the bottom. This concept, however, is a bit deceptive, as the principal rafters are in this case not strong enough in bending to span from the base to the apex and hold up the the conical roof. Instead, I believe that the roof actually functions more like a stacked segmental dome, which is not dependent on the principal rafters for primary support, rather, its stacked components support themselves.

The first step in construction would have been laying the circular tension ring atop the bunker walls and then building falsework up the center of the cone to support the compression ring at the top. The sixteen single piece, principal rafters would then have been erected to span between the tension ring and the apex of the roof where this was installed a compression ring that left an open oculus below the cupola. The intent of the principal rafters were to

provide a geometric form about which the cone would be erected, and to help the cone retain its shape under unbalanced loading.

Next, the first ring of purlins would have been installed between the principal rafters- these are at about the third point up the roof. Common rafters would then have been installed between the base tension ring and the ring of purlins, and then covered over with sheathing boards. At this point, the lower third of the roof would have now functioned like a truncated dome, with the tension ring at the bottom resisting the outward thrust and the purlin ring resisting the inward.

In similar manner, the second ring of purlins would have been installed along with rafters and sheathing between them and the first purlin ring. At this point the second course of roof construction would be supporting itself between the first and second purlin ring, with the inward thrust going into the second ring and the outward thrust actually passing through the first purlin ring and first rafter course into the tension ring at the bottom.

The third course of roof construction would have been constructed in similar fashion but with the compression ring at the very top of the cone taking the inward thrust.

Following the construction of the cone, the cupola would have then been constructed on top.

Calculated Loads and Stresses

We ran some approximate load calculations to test the “coursed dome” theory described above, considering the weights of component materials and anticipated snow loads. We found the following:

The tension load in the tension ring is approximately 90,000 lbs, resulting in tension average tension stress of about 1,400 psi, which is reasonable for design stress for the type of high grade lumber material that would have been used for this application.

The compression loads in the first and second purlin rings came out to about 30,000 lb. and 10,000 lb., resulting in compressive stresses of 700 psi and 260 psi, respectively. These stress levels are within an acceptable range. Because of their segmental geometries, the purlins also experience bending stresses between the principal rafters, where the segmental forces are resolved. Checking these for bending, the first and second rings of purlins have

bending stresses of 1,800 and 860, respectively. Unfortunately, the stresses on the lower purlins are higher than they should be, and may not have been properly accounted for in the original design, whereas the upper purlins are OK. *The first ring of purlins should be reinforced for bending.*

I also checked the common rafters in bending and the stresses came to about 1,200 psi, which is on the high side of reasonable.

We have not analyzed the principal rafters since these are theoretically unloaded elements, except for unbalanced loading, which would be resisted by a combination of the rafters and the existing sheathing, the analysis of which is beyond the initial scope of this investigation. *Based upon observed conditions, as noted below, it is likely that the more complex analysis will determine that the principal rafters and sheathing are technically insufficient under unbalanced conditions and will need to be reinforced.*

NOTED STRUCTURAL CONDITIONS

During my investigation I note the following conditions:

Cone Structure

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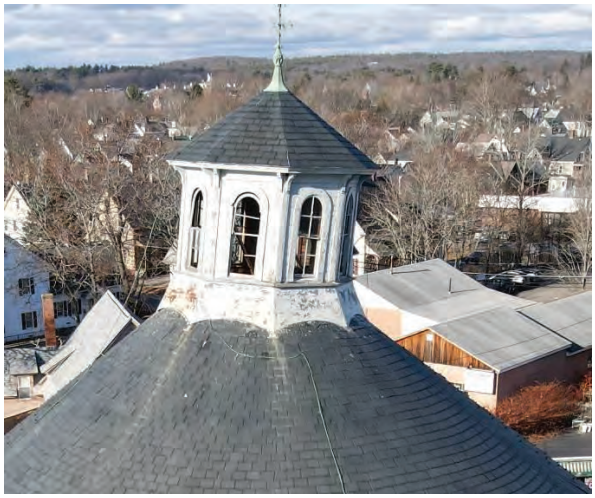
The most obvious damage that has occurred involves the impact site where a large tree crashed through the roof in the northern portion of the structure. The impact damage was addressed by Preservation Timber Framing who patched the hole and erected staging to help support the surrounding roof structure and reinforce staging to support the apex of the roof. Although this has been helpful to stop further water ingress and localized collapse, one can still see the wider ranging effects of the event in the significant sag that has occurred in the surrounding portion of the roof.

The sag has put significant bending stresses in the principal rafters. In addition, many of the common rafters in the area are bent in the horizontal direction due to lateral shifting of the structure in response to this event. *The principal rafters should be stiffened and the roof sheathing improved in order to arrest this deformation*.

Unfortunately, the tension ring has materially failed due to wood rot fungus and is essentially severed, shifting all of the tie action to whatever reserve capacity is achieved with the sheathing boards and roof purlins.

Tilting Cupola

The cupola is leaning toward the west. According to an 80+-year old mother of a good friend who grew up in Concord, she remembers having marveled over the cupola's tilt in her youth. The theory that this was caused by the hurricane of 1938 may have some validity, given the timeframe.



Bunker Wall

The bunker wall is in generally intact condition except for the north end. There are scattered areas where the mortar joints are eroded *and in need of cutting and repointing with a compatible mortar.*

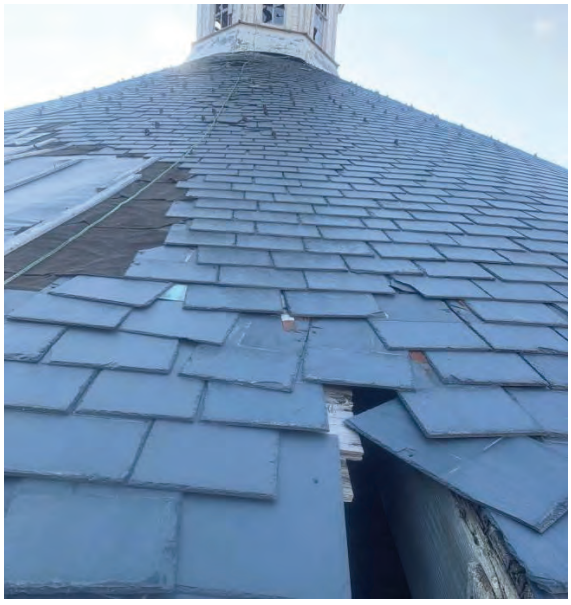
Other than for the tree impacted north portion of the bunker wall, typically all of the brickwork except for the top 4 to 6 courses is in materially good, well-bonded condition. The top courses on the west and part of the south portions of the structure appear to have undergone repeated freezing and thawing cycles under wet conditions and are lifting and separating and need to be incrementally taken apart and rebounded back together.

At the north portion of the wall, the tree damage has allowed water to rain in for several years. This water infiltration not only caused the tension ring in this area to rot away but the eave to shift outward, dragging the bunker wall's cornice with it. In addition, the uninhibited rainwater appears to have soaked deeply into the brickwork and caused the masonry assembly to materially degrade through repeated freezing and thawing cycles.

The result is an approximate 80 foot long by 4 foot deep section of brickwork that has broken into loose fragments that are bent outward and remain loosely perched on the intact portions of the wall below. *All this will need to be reconstructed*.

Slate Roof

While the roof slates themselves appear to be in materially good condition, there are areas where slate are loose, missing or are creased or folded. Also, one can see numerous points of light from the interior, where the roof has been breached. *The slating should be removed and reapplied*.



RECOMMENDATIONS

Based upon the observed conditions and upon our analysis, we have the following recommendations, which are also summarized graphically on our Concord Gasholder House Stabilization Schematic. We see the work taking place in two phases.

Phase 1/ Emergency Stabilization

The purpose of this initial emergency work is to eliminate the possibility of immediate collapse. This work would also be focused on preserving the unique and historic elements of the gasholder house that define its significance while meeting the intent of the Secretary of the Interior's Standards for Historic Preservation. Work would consist of the following in the following order:

E1- Add wooden dunnage restraints to the failed masonry by carefully drilling through it and installing threaded steel rods to between vertical 4x4s on each side of the masonry to tightly clamp them together. This will require safe access via the existing staging on the exterior and interior, and some additional access beyond the staging using ropes and ladders. Drilling would be done with a coring bit so as not to vibrate or disturb the brickwork as it is being done.

E2- Extend the existing staging and remove the existing roof eave cornice along an 80 foot length to expose the existing laminated wood tension ring. At each end mount a fabricated steel drag strut made of a bent heavy duty galvanized steel angle with thick plates at each end. These would be lag screwed or bolted onto the face of the tension ring.

E3- Between the opposing ends of the drag struts run two large diameter wire rope ties terminated against the end plates with threaded rods. Tighten the wire ropes to a tension of 75,000 lb using a torque wrench in order to take load out of the failed portion of the tension ring by bypassing it.

E4- Remove all of the slate from the roof and stockpile it on site. Removal will save about 60 to 70 percent of the existing Munson black slate, which is no longer manufactured and has significant salvage value.

E5- Temporarily cover the existing roof with two layers of 30 lb felt. Install a wooden cover for the hole at the top of the cone where the cupola has been removed. (Phase 2)

The above work should be done as soon as possible but without snow on the roof, making it dependent upon an at least partially mild winter. Restoration of the tension ring at the bottom of the cone, bracing of the falling masonry, and reduction in weight should get the structure through the coming season and is a necessary first stage in what will hopefully be a multi-step, multi-phase effort to stabilize and restore this last-of-its-kind historic structure.

As long as after the completion of each effort the structure is maintained in a weather-tight and structurally secure condition, a multi-step, multi-phase approach may take as long as fundraising might require without further jeopardizing structure.

Phase 2/ Cone Stabilization

The purpose of this work is to bring the cone up to a serviceable state of good repair.

C1- Remove the temporary roof protection and inspect the existing sheathing, replacing damaged boards and creating access points for work below by temporarily removing others.

C2- Brace, cut free and remove the cupola with a large crane and land it on the property for repair.

C3 Into the hole left by the cupola, insert rectangular galvanized steel tube shape rafter scabs into the interior via crane. These would be used to help strengthen and realign the 16 principal rafters and would be fabricated to their approximate geometries. They would have clips along their lengths to press-fit against the bottoms of the rafters and the bottom ends would be fastened to the inner face of the bunker wall and the tops would protrude out of the open hole a the top. Fastenings would be made from above via the holes made by sheathing board removal. Once these have been installed, the extended tops of the scabs on the low side of the hole would be jacked upward (and the high side slowly lowered) using the existing staging tower in an effort to realign then toward a common elevation. When they are reasonably close to vertical alignment, a field-adjustable node connection would be installed to create a common apex, which is lacking in the original design.

C4- Bring PSL manufactured timbers into the interior via the grade level entrance and rope up into position against the bottoms of the lower purlins as scabs to reinforce them. Hoisting and fastening would be done via board removal the holes made in the roof.

C5- Inspect the roof framing and make as many miscellaneous framing repairs as possible via roped access from removed sheathing board holes.

C6- Reinstall the removed sheathing boards and cover the existing roof in plywood, and then with rolled roofing. Because of the roof's conical geometry, the plywood would need to be oriented vertically with sides cut in a trapezoidal manner and laid in ascending courses.

C7- Cut off the failed plies of the ring and splice in new plies by bolting them in place. These will resist more compression than tension due to the tightening of the wire ropes.

C8- Remove the remaining cornice around the base of the cone and install two high capacity wire rope ties around the remainder of the tension ring with intermediate turnbuckles for tightening. The ends of the wire ropes would be terminated into the unused ends of drag struts that were installed under item E2, and the entire loop would be tensioned to up to 75,000 lb.

C9- Reinstall and/or recreate the wood trimmed cornice to conceal the wire rope.

C10- Reinstall the cupola on a new, leveled base atop the compression ring. The cupola itself should be restored while on the ground.

C11- Re-slate the roof. Because of the 30% to 40% loss from removal, either find replacement Monson black slate, which will be difficult, or sell the salvaged Monson slate and purchase new, dark gray slate or similarly appearing synthetic material for a uniform appearance.

Ideally this work should ideally take place in the spring of 2021, however the slating work could be delayed until funds become available.

Phase 2/ Bunker Wall Stabilization

The purpose of this work is to bring the bunker wall up to a serviceable state of good repair.

B1- Incrementally dismantle and reconstruct failed brickwork to the original planes and geometry, using as many of the original bricks as possible.

B2- Remove the temporary roof protection and inspect the existing sheathing, replacing damaged boards and creating access points for work below by temporarily removing others.

This work should take place in the late spring and summer of 2021.

Thank you for the opportunity to investigate this lovely and historic landmark. I must say that I have been impressed with the amount of familiarity and interest that so many of my colleagues have in this last of a kind structure and the prospect that it can be preserved. We are all fans and I am personally excited to be part of this effort.

Please contact me if you have any questions or concerns.

Respectfully Yours,

John M. Wathne, PE, President
Structures North Consulting Engineers, Inc.

Concord Gasholder House Stabilization **12-21-2020**
COST ESTIMATE **Structures North Consulting Engineeers, Inc.**

ITEM	QUANTITY	RATE	UNIT	LOG. FACT.	TOTAL
EMERGENCY WORK (WINTER 2020/21)					
Expand Staging to Eave	1	$10,000	LS	1.1	$11,000
DBL Wire Rope Tie Link	48	$100	/ LF	2	$9,600
Drag Strut Assemblies	2	$20,000	/ EA	2	$80,000
Temporary Bricwork Dunnage	400	$100	/ SF	1.5	$60,000
Cornice Removal + Prep	90	$50	/ LF	1.5	$6,750
Slate Removal/ Temp Protect	8,700	$12	/ SF	1.2	$125,280
Subtotal/ Emergency =					$292,630
SUGESTED DESIGN CONTINGENCY @25% =					$73,158
A/E FEES @ 12.5% =					$45,723
SUGGESTED EMERGENCY PHASE PROJECT BUDGET =					**$411,511**
CONE AND BUNKER STABILIZATION (2021)					
Remove Cupola	1	$30,000	LS	1.5	$45,000
Plywood Cover Roof + Felt	8,700	$18	/ SF	2	$313,200
Sheathing Repair	8,700	$5	/ SF	1.5	$65,250
Galv HSS Rafter Scabs	960	$120	/ LF	4	$460,800
PSL Purlin Scabs	194	$50	/ LF	4	$38,800
Tens Ring Dutchman Splice	1	$10,000	LS	2	$20,000
Misc Framing Repairs	1	$50,000	LS	4	$200,000
Apex Node Connection	1	$50,000	LS	2	$100,000
Re-Set Cupola	1	$40,000	LS	2	$80,000
New Slate Roof (Incl Flash)*	8,700	$20	/ SF	1.5	$261,000

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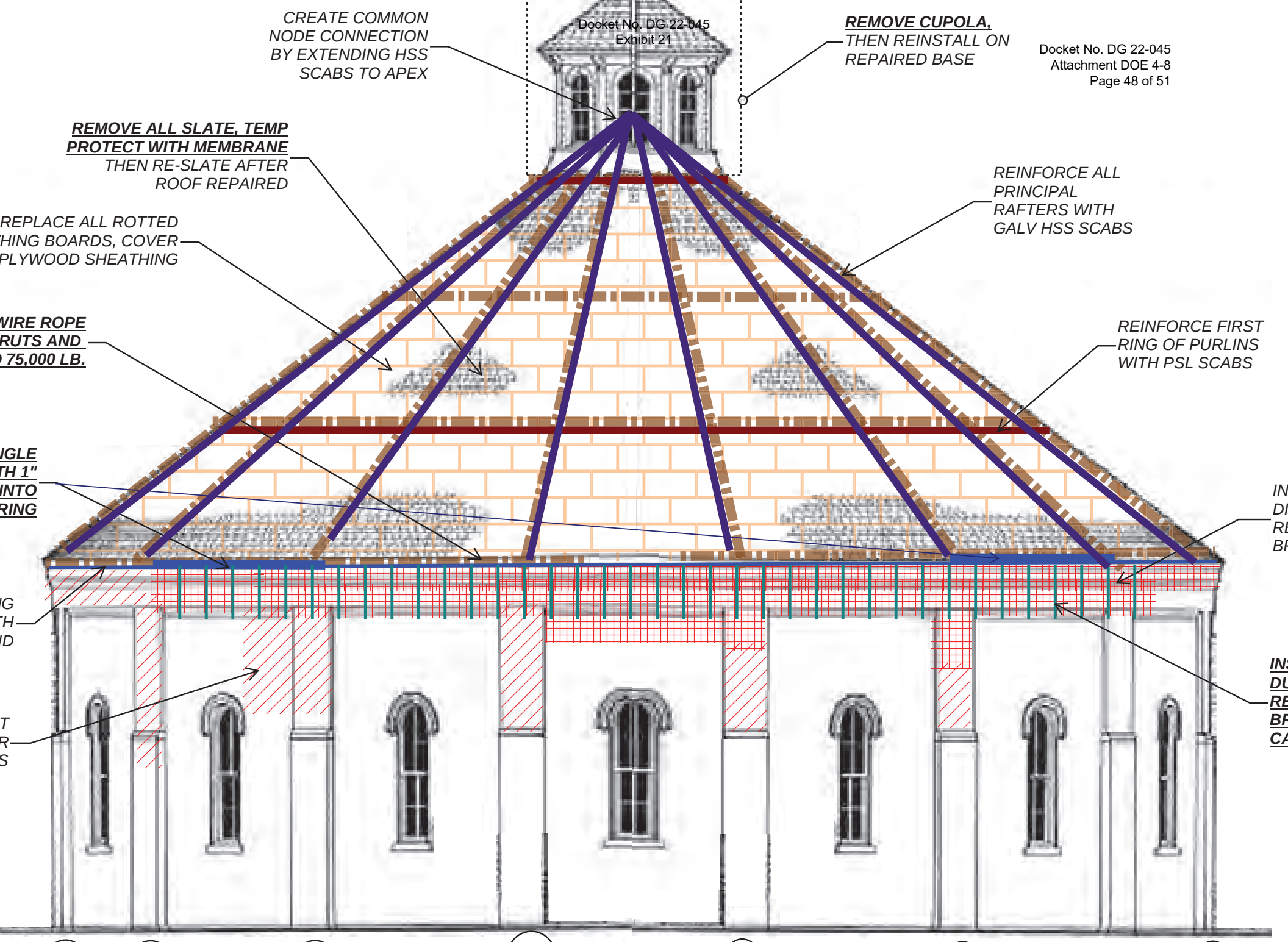
Concord Gasholder House Stabilization **12-21-2020**
COST ESTIMATE **Structures North Consulting Engineeers, Inc.**

Extend Staging All Around	1	$35,000 LS	1.1	$38,500
Cornice Removal + Prep	166	$50 / LF	1.5	$12,450
DBL Wire Rope Tie Assist	256	$100 / LF	2	$51,200
Rebuild Cornice	256	$75 / LF	1.5	$28,800
Brick Masonry Reconstruct	750	$120 / CF	2	$180,000
Cutting and Pointing	1,000	$60 / SF	1.5	$90,000
Subtotal/ Cone and Bunker Wall =				$1,985,000
SUGESTED DESIGN CONTINGENCY @25% =				496,250
A/E FEES @ 7.5% =				186,094
SUGGESTED CONE AND BUNKER TRUCTURAL PROJECT BUDGET =				**$2,667,344**
GRAND TOTAL =				**3,078,855**

* Please note that a less expensive and lighter weight material might be considered in lieu of slate if it will allow the project to move forward.



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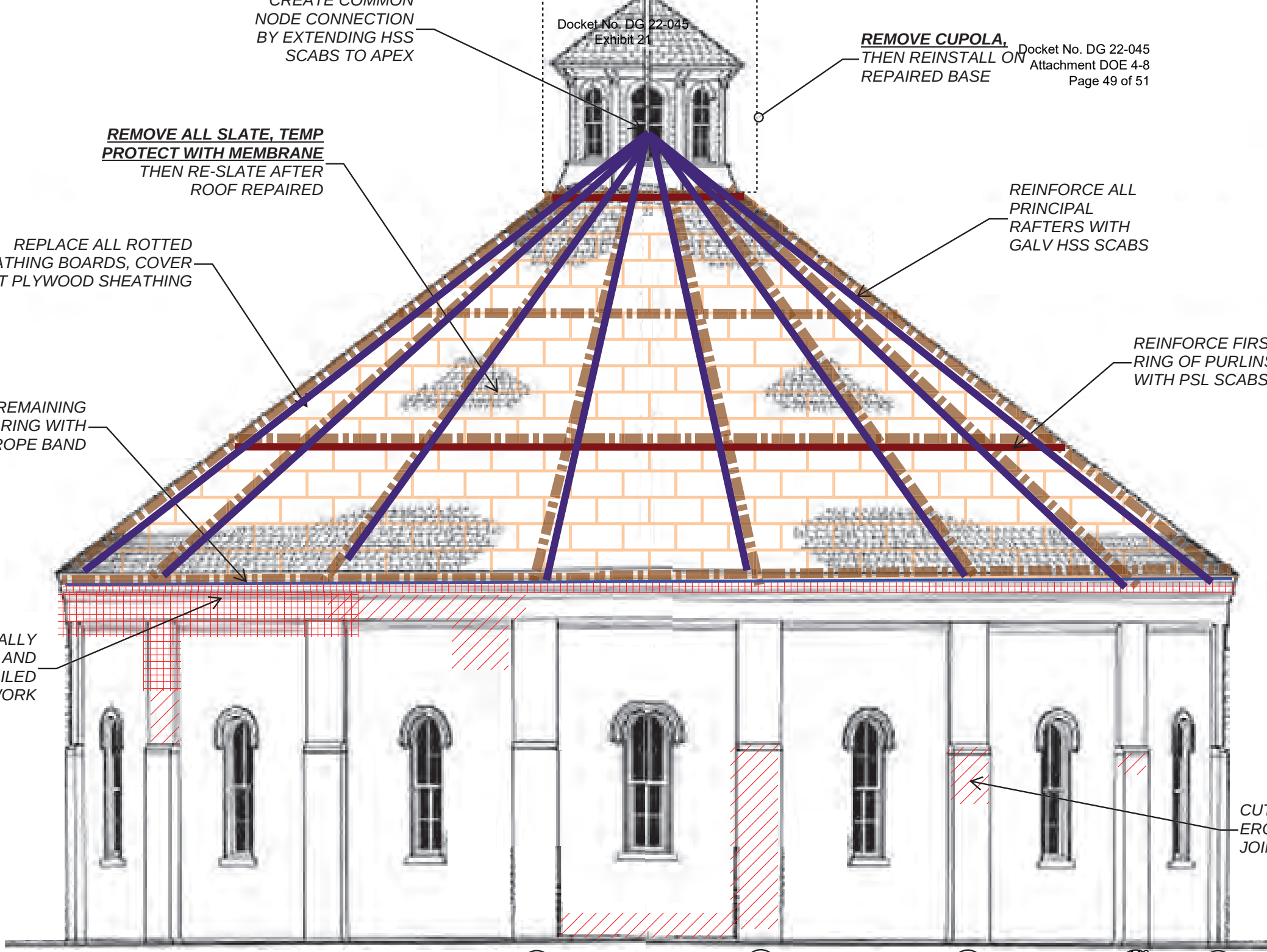
CONCORD NH GASHOLDER HOUSE STABILIZATAION


CREATE COMMON NODE CONNECTION BY EXTENDING HSS SCABS TO APEX
REMOVE CUPOLA, THEN REINSTALL ON REPAIRED BASE
REMOVE ALL SLATE, TEMP PROTECT WITH MEMBRANE THEN RE-SLATE AFTER ROOF REPAIRED
REINFORCE ALL PRINCIPAL RAFTERS WITH GALV HSS SCABS
REPLACE ALL ROTTED HEATHING BOARDS, COVER P/T PLYWOOD SHEATHING
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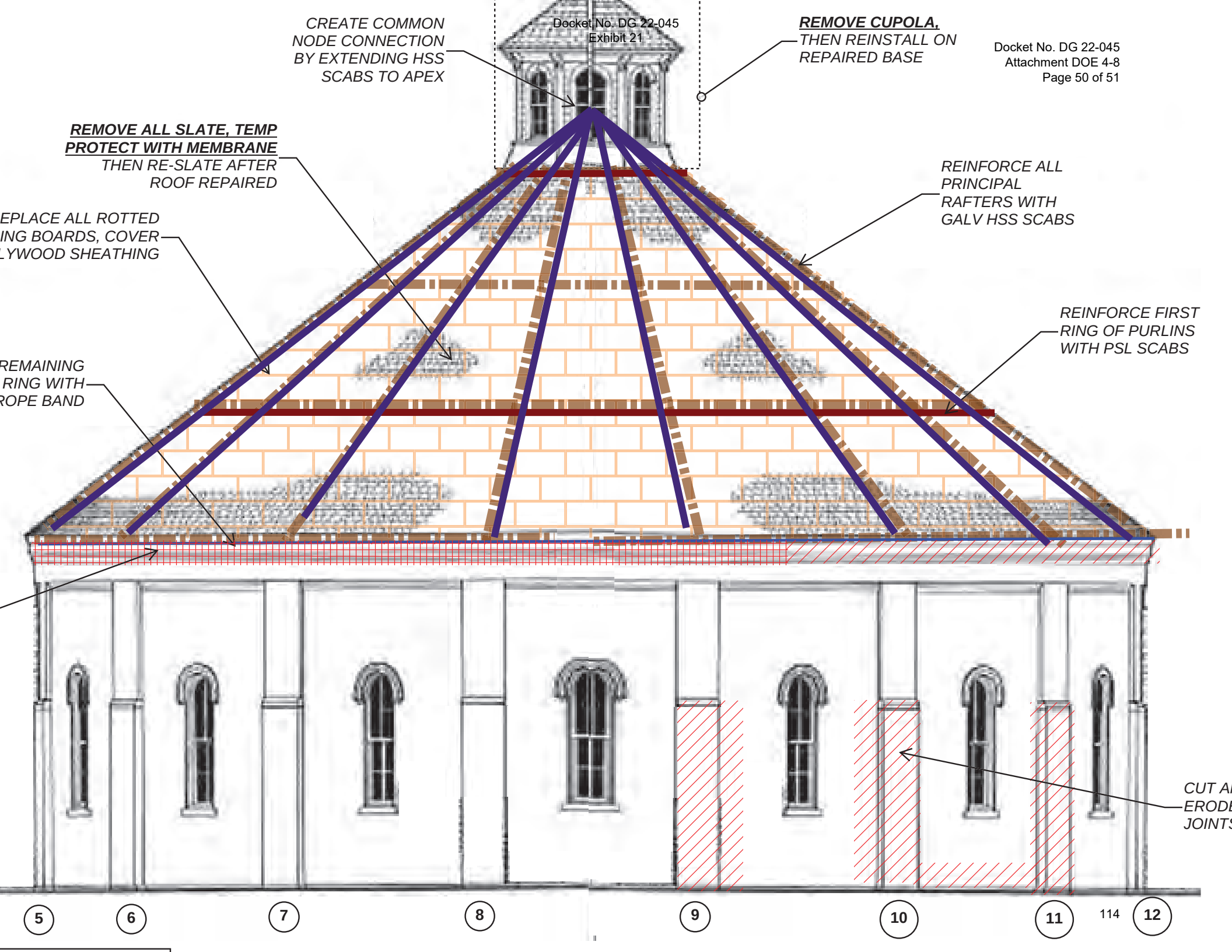
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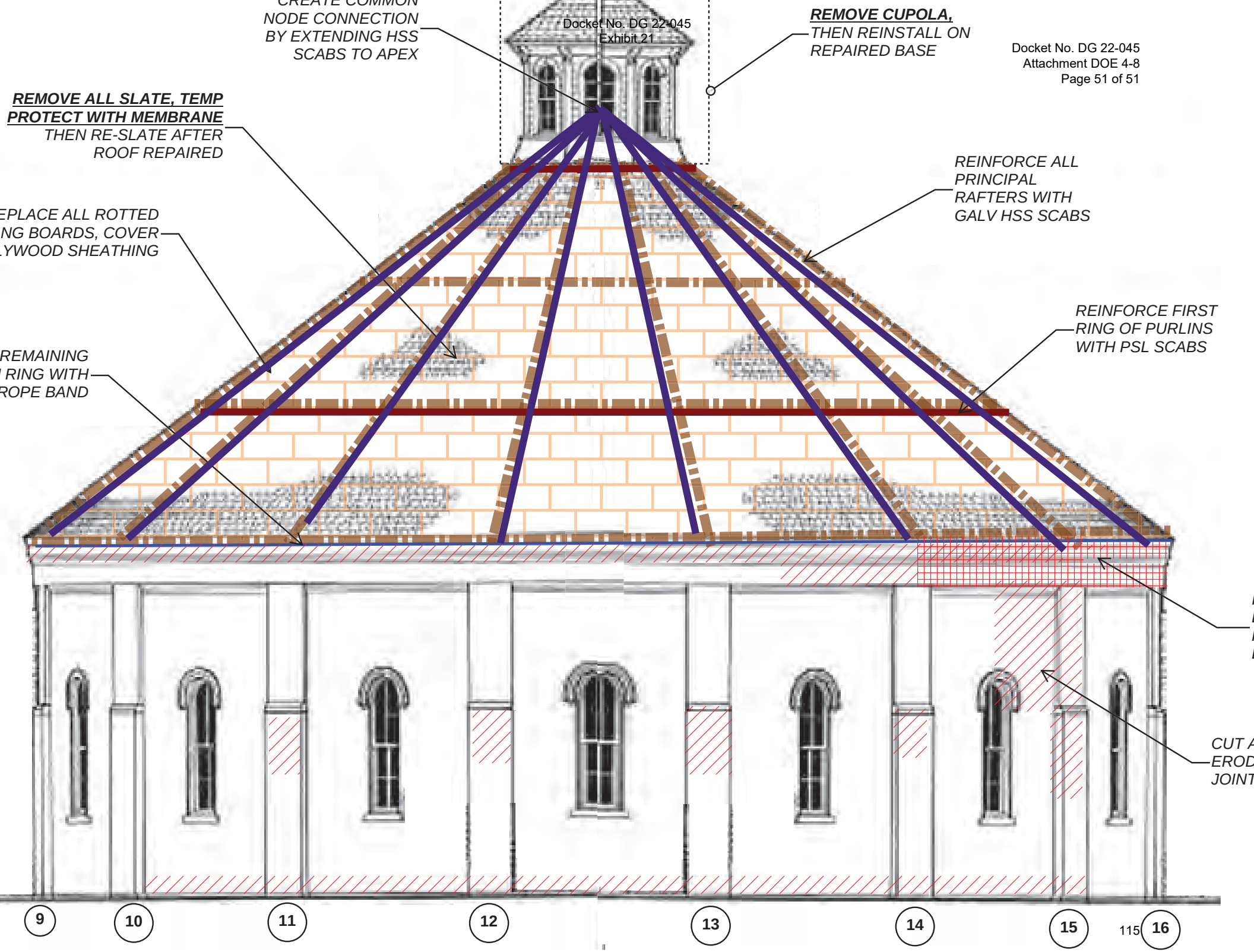

CONCORD NH CAPITOL HILL HOUSE STABILIZATION

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23 | Date of Response: 2/3/23
Request No. DOE 4-9 | Respondent: Luke Sanborn

REQUEST:

Ref: NHPA Letter dated December 30, 2022

Please provide a copy of the "*amended* Remedial Action Plan, investigation and mitigation" (emphasis added) and explain DES's role in that plan. In "the event of demolition" subsequent to Phase I and/or Phase II of the stabilization plan, how would demolition costs and remediation of the underlying footprint be handled? What entities would be responsible for costs (please provide it by percentage, if any)? What would be the total costs?

RESPONSE:

A copy of the plan is provided as Attachment DOE 4-9.

Since demolition of the Gas Holder "subsequent to Phase I and/or Phase II" will likely not occur for decades provided the building is maintained, it is unknown how the costs would be handled; therefore, the entities responsible for costs and total costs are unknown.

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty

DG 22-045

Winter 2022–2023 and Summer 2023 Cost of Gas
(RDAF and Gas Holder)

Department of Energy Data Requests - Set 4

Date Request Received: 1/20/23 | Date of Response: 2/3/23
Request No. DOE 4-10 | Respondent: Luke Sanborn

REQUEST:

Ref: Emergency Stabilization License Agreement ("Agreement") between the NHPA and Liberty; Haley & Aldrich Inc. Memorandum

The Haley & Aldrich Memo states "In accordance with the Stabilization License Agreement (Agreement) between the [NHPA] and Liberty Utilities, the probable costs to demolish and remediate the Gasholder building [a/k/a the Gas Holder structure] may be applied to the repair and preservation of the historical structure, should demolition be avoided."

a. Does Liberty agree with this statement? If not, please explain why not?

b. Does Liberty understand, consistent with the referenced Agreement, that "probable costs" are those costs as estimated at present, (i.e., approximately $2.4 million)? If not, please explain why not.

RESPONSE:

a. The Stabilization Agreement speaks for itself, but this statement seems generally accurate.

b. Yes.