Environmental Notification Form

CENTECH PARK NORTH
384-386 South Street, Shrewsbury, Massachusetts
Worcester County

Submitted to:
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, 9th Floor, Boston, MA 02114
Attn: MEPA Office

Proponent:
Town of Shrewsbury
100 Maple Ave., Shrewsbury, MA 01545

Prepared by:
BOHLER ENGINEERING
352 Turnpike Road, Southborough, MA 01772

EcoTec, Inc.
102 Grove Street, Worcester, MA 01605

Whitestone Associates, Inc.
352 Turnpike Road, Suite 320
Southborough, MA 01772

November 30, 2018

#W181144
November 30, 2018

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office
110 Cambridge Street, Suite 900
Boston, MA 02114

Re: Environmental Notification Form
Centech Park North
384-386 South Street
Shrewsbury, Massachusetts

Dear Mr. Beaton:

Enclosed please find two (2) copies of the Environmental Notification Form (ENF) for the proposed Centech Park North project located in Shrewsbury. Additionally, a CD is provided with a full copy of the ENF in digital format.

Included in the ENF is a circulation list prepared in accordance with 301 CMR 11.16. Please notice the ENF in the December 5, 2018 Environmental Monitor to commence public review. In accordance with the 2018 Publication Schedule, Comments and Decisions Deadlines, public comments are due on December 26, 2018 with an ENF Decision expected on January 4, 2019.

Additional agencies or persons who would like to review the ENF should contact Michael J. Dryden by telephone at (508) 480-9900 or via e-mail at mdryden@bohlereng.com.

We trust the enclosed information is sufficient to facilitate your review. Should you have any questions or require additional information, please do not hesitate to contact us at (508) 480-9900.

Sincerely,

BOHLER ENGINEERING

Michael J. Dryden, Project Manager

John A. Kucich, P.E.

Cc: ENF Distribution List
Kristen Las, Town of Shrewsbury
Claire O’Neill, MassDevelopment

MEPA Cover Ltr (2018-11-30).docx
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APPENDIX C: SUPPLEMENTAL INFORMATION (BY OTHERS)
➢ “Wetland Resource Evaluation, Allen Farm, South Street, Shrewsbury, MA”, prepared by EcoTec, Inc., dated 10/24/18.

APPENDIX D: LIST OF REQUIRED PERMITS

APPENDIX E: PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

APPENDIX F: CIRCULATION LIST
## Environmental Notification Form

**For Office Use Only**

<table>
<thead>
<tr>
<th>EEA#</th>
<th>MEPA Analyst</th>
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<tbody>
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</tbody>
</table>

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

<table>
<thead>
<tr>
<th>Project Name: Centech Park North</th>
<th>Street Address: 384-386 South Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipality: Shrewsbury</td>
<td>Watershed: Blackstone &amp; Concord (SuAsCo)</td>
</tr>
<tr>
<td>Universal Transverse Mercator Coordinates: 4,683,200 meters N, 278,100 meters E</td>
<td>Latitude: 42° 16' 08.91&quot; N</td>
</tr>
<tr>
<td>Estimated commencement date: Fall 2019</td>
<td>Estimated completion date: Fall 2024</td>
</tr>
<tr>
<td>Project Type: Commercial</td>
<td>Status of project design: 20% complete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proponent: Town of Shrewsbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street Address: 100 Maple Ave.</td>
</tr>
<tr>
<td>Municipality: Shrewsbury</td>
</tr>
<tr>
<td>Name of Contact Person: Michael J. Dryden</td>
</tr>
<tr>
<td>Firm/Agency: Bohler Engineering</td>
</tr>
<tr>
<td>Municipality: Southborough</td>
</tr>
<tr>
<td>Phone: (508) 480-9900</td>
</tr>
</tbody>
</table>

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?

- [ ] Yes  
- [x] No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

- [ ] a Single EIR? (see 301 CMR 11.06(8))
- [ ] a Special Review Procedure? (see 301CMR 11.09)
- [ ] a Waiver of mandatory EIR? (see 301 CMR 11.11)
- [ ] a Phase I Waiver? (see 301 CMR 11.11)

(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

### Land:
- 301 CMR 11.03 (1)(a)(2) – Creation of 10 or more acres of impervious area (EIR)
- 301 CMR 11.03 (1)(b)(1) – Direct alteration of 25 or more acres of land (ENF)

### Transportation:
- 301 CMR 11.03 (6)(a)(6) – Generation of 3,000 or more new ADT on roadways providing access to a single location (EIR)
- 301 CMR 11.03 (6)(a)(7) – Construction of 1,000 or more new parking spaces at a single location (EIR)

Effective January 2011
301CMR 11.03 (6)(b)(13) – Generation of 2,000 or more new ADT on roadways providing access to a single location (ENF)
301CMR 11.03 (6)(b)(14) – Generation of 1,000 or more new ADT on roadways providing access to a single location and construction of 150 or more new parking spaces at a single location (ENF)
301CMR 11.03 (6)(b)(15) – Generation of 300 or more new parking spaces at a single location (ENF)

Which State Agency Permits will the project require?
Highway Access Permit – Massachusetts Department of Transportation (MassDOT, District 3)

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

**Agency: MassDevelopment**
Site Readiness Funding for the Project Grant - $302,000

**Agency: Executive Office of Housing and Economic Development**
MassWorks Infrastructure Grant – 2019 Application

**Agency: Executive Office of Housing and Economic Development**
Chapter 43D Expedited Permitting Grant - $150,000

**Agency: Massachusetts Association of Regional Planning Agencies (MARPA)**
District Local Technical Assistance (DLTA) for CMRPC Planning - $10,000

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**Summary of Project Size & Environmental Impacts**

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LAND</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total site acreage</td>
<td>66.5±</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New acres of land altered</td>
<td></td>
<td>+ 26 ±</td>
<td></td>
</tr>
<tr>
<td>Acres of impervious area</td>
<td>2 ±</td>
<td>+20 ±</td>
<td>22 ±</td>
</tr>
<tr>
<td>Square feet of new bordering vegetated wetlands alteration</td>
<td></td>
<td>+ 4,900±</td>
<td></td>
</tr>
<tr>
<td>Square feet of new other wetland alteration</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Acres of new non-water dependent use of tidelands or waterways</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>STRUCTURES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross square footage</td>
<td>9,000±</td>
<td>+ 441,000±</td>
<td>450,000±</td>
</tr>
<tr>
<td>Number of housing units</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maximum height (feet)</td>
<td>15’ ±</td>
<td>+ 35’ ±</td>
<td>50’ (max.)</td>
</tr>
<tr>
<td><strong>TRANSPORTATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle trips per day*</td>
<td>0</td>
<td>+ 4,384 ±</td>
<td>4,384 ±</td>
</tr>
<tr>
<td>Parking spaces*</td>
<td>50 ±</td>
<td>+ 1,075 ±</td>
<td>1.125 ±</td>
</tr>
<tr>
<td><strong>WASTEWATER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Use (Gallons per day)*</td>
<td>0</td>
<td>+ 33,750± (max.)</td>
<td>33,750± (max.)</td>
</tr>
<tr>
<td>Water withdrawal (GPD)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wastewater generation/treatment* (GPD)</td>
<td>0</td>
<td>+ 33,750± (max.)</td>
<td>33,750± (max.)</td>
</tr>
<tr>
<td>Length of water mains (miles)</td>
<td>0</td>
<td>+ 0.32 ±</td>
<td>0.32 ±</td>
</tr>
<tr>
<td>Length of sewer mains (miles)</td>
<td>0</td>
<td>+ 0.38 ±</td>
<td>0.38 ±</td>
</tr>
<tr>
<td>------------------------------</td>
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</tbody>
</table>

Has this project been filed with MEPA before?
☐ Yes (EEA #__________) ☒No

Has any project on this site been filed with MEPA before?
☐ Yes (EEA #__________) ☒No

* Assumes the conservative build-out of the entire Project at 450,000 GSF of general office space
GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site:______________________________

Existing Site

The project site (the “Site”) is located at 384-386 South Street, identified as Tax Assessor’s Map 42, Parcel 011, consisting of approximately 66.5± acres of land. The Site is bordered by South Street and commercial property (Charles River Lab) to the north, a ground-mounted solar field and residential properties to the west, commercial businesses and Route 20 to the south, and residential dwellings and South Street to the east. A portion of the Site along South Street is currently developed with three (3) vacant buildings and a paved/gravel parking area associated with the prior agricultural use of the property. The remaining portion of the Site consists of undeveloped woodlands with mature tree growth, areas covered by scrub vegetation and secondary tree growth within the former farm fields, and wetland resource areas. The Site has undeveloped frontage along South Street and Route 20, and is separated into two distinct developable areas by a large wetland resource area that generally extends from the southwest edge of the Site to northeast.

The Site is located within the Town’s Flexible Development Overlay District, which contains two Sub-Districts, Sub-Districts A and B located in the north and south portions, respectively. The underlying zoning is Office-Research (O-R). Adjacent parcels to the north and northeast are zoned O-R, while parcels to the east, south, and southwest are Limited-Industrial. Parcels located to the west of the site are zoned Rural “B”.

Wetland resources located on or immediately adjacent to the Site include:
- Bordering Vegetated Wetlands (BVW) – numerous areas containing BVW were field delineated and survey located in September of 2018.
- Intermittent Stream Bank – A total of three (3) intermittent Streams are shown on the USGS map. In all cases, the streams are located internal to the BVW area(s).
- Potential Vernal Pools – Two (2) PVP’s were identified in the western portion of the Site using the Massachusetts Geographical Information System (MassGIS) Online Maps. Refer to the Wetland Map provided in Appendix A. Based on preliminary site investigations, both onsite PVP’s meet vernal pool criteria but have not been certified. A PVP was also observed on the Charles Street Laboratory Site to the north during onsite investigations. Further inspections will be required to determine if this offsite pond meets the criteria to be certified. Early site investigations indicate that a depression within a wetland system in the west-central portion of the site is a potential isolated land subject to flooding (ILSF). Further investigations and calculations will be required to confirm this depression would be regulated as ILSF.

According to the most recent Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA), there are no areas located within the 100-year flood plain on the Site. According to the latest addition of the Massachusetts Natural Heritage Atlas, 14th edition, there are no areas of Priority Habitats or Estimated Habitats located on the Site. Refer to the FEMA and Natural Heritage & Endangered Species Maps provided in Appendix A.

Runoff generated onsite flows overland to on-site wetlands located in the northwest and central portions of the Site. The northwest drainage area is associated with the Blackstone Watershed, and the central drainage area is associated with the SuAsCo (Concord) Watershed. Elevations onsite range from a maximum of 564 feet in the west to 496 feet adjacent to wetlands in the east.
For more information, refer to the Project Maps provided in Appendix A, the Existing Conditions Plan provided in Appendix B, and the “Wetland Resource Evaluation”, prepared by EcoTech and provided in Appendix C.

Site and Project History

The Site, formerly known as the “Allen Property”, was previously used for agricultural purposes and was previously zoned Limited Industrial and Rural “B”. After numerous unsuccessful attempts by the previous owner to market the land for light industrial development, the owners entered into a purchase and sale agreement with a national rental housing developer in 2002. Because much of the property had been assessed as Chapter 61A land, the Town of Shrewsbury was afforded a right of first refusal to match the housing developer’s purchase offer.

In 2002, the Town of Shrewsbury obtained a state grant to implement several of the Town’s 2001 Master Plan commercial and industrial zoning recommendations, which identified the Site as suitable for industrial, office, and research and development uses. In September of 2002, the Town acquired approximately 49-acres by exercising its right of first refusal, and acquired the remaining portion through negotiations with the previous owner. The acquisition was made under the auspices of the Shrewsbury Development Corporation (SDC), which was established in February of 2003.

In 2007, after four years of conceptual site planning, the Town was awarded a Chapter 43D Expedited Permitting planning grant to conduct an independent assessment of the lands potential, explore the impacts of development possibilities, and prepare a plan for the Board of Selectman’s consideration in accordance with the requirements of Chapter 493. A Conceptual Site Development Plan was prepared by Beta Group, Inc. as part of the 2008 “Allen Property Master Plan Report”, which proposed amendments to the Zoning Bylaw to allow more flexible uses to be developed on the Site and ultimately supplement the existing Office-Research district. In 2009, Shrewsbury Town Meeting voted to rezone the property and establish a Flexible Development Overlay District and associated by-law. The goal of the overlay zoning district was to encourage flexible, planned development to provide employment and fiscal benefits to the town, and to establish review and permitting procedures for a Priority Development Site under the provisions of M.G.L. Chapter 43D.

In early 2018, the Town commissioned a second study to evaluate the former Allen Property as a potential site for the proposed Beal Early Childhood Center. The study evaluated and compared the merits of the Site and an alternative site known as the Glavin Center on Lake Street. It was determined that the alternate site was more suitable for the development of the school.

Funding sources for the project include the following:

- $302,000 Site Readiness Program grant from MassDevelopment for engineering and permitting costs;
- $150,000 Chapter 43D expedited permitting grant; and
- $10,000 District Local Technical Assistance (DLTA) grant for CMRPC Planning.

The Town of Shrewsbury will also seek a grant under the 2019 MassWorks Infrastructure Program to fund the cost of initial roadway construction in Sub-District A.
Describe the proposed project and its programmatic and physical elements: _________________

NOTE: The project description should summarize both the project’s direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Proposed Project

Under the proposed Master Plan, approximately 450,000 GSF of mixed commercial space is envisioned, along with associated access roadways, parking and circulation areas, stormwater management systems, and utility infrastructure (the “Project”). At this time, the Project master plan is in early stages of development. The Town of Shrewsbury is currently working with the Central Massachusetts Regional Planning Commission (CMRPC) and its broker to determine the highest and best uses for the property based on current/projected market conditions. The Project is likely to include a mix of commercial uses consistent with those envisioned under the Flexible Development Overlay District. The uses include but are not limited to office, research and development, manufacturing, warehousing/distribution, and similar complimentary uses.

The project Site is bisected by a large wetland resource area which creates two distinct developable areas, Sub-Districts A and B in the north and south, respectively. Sub-District A will gain access from South Street and Sub-District B from Route 20. Sub-District A will consist of a dead-ended subdivision road of approximately 1,000 feet in length, which will provide access and frontage for approximately 275,000 GSF of commercial space in five (5) or more individual building lots. Sub-District B will consist of a dead-ended subdivision road of approximately 800 feet in length, which will provide access and frontage for approximately 175,000 GSF of commercial space in three (3) or more individual building lots.

For flexibility and marketing purposes, the current Master Plan depicts a range of building footprints and building heights. Both Sub-Districts contain a large, four-story building, ranging in size from 120,000 to 160,000 GSF, which are conducive to general office or research and development, while multiple smaller building footprints with 1.5 or two-stories are also incorporated. The smaller buildings range in size from 21,000 sf to 40,000 GSF lending themselves to a variety of “flex” uses.

For the purposes of quantifying impacts such as trip generation, parking, and water/sewer demand, the development program for this ENF filing is conservatively assumed to be entirely office space. However, it is anticipated that the mix of uses will ultimately be less impactful than office. For this reason, the impacts outlined herein should be considered conservatively high. As more is learned about the current market, the Master Plan will be refined to target a more specific mix of uses. Subsequent MEPA filings (i.e. Draft and Final Impact Reports), will reflect these refinements.

The Project will increase the amount of impervious onsite by approximately 20± acres, which will be mitigated by the construction of surface and subsurface infiltration/detention systems. The Project will be serviced by municipal water and sewer systems, and is estimated to generate approximately 33,750 GPD of sewer use and 33,750 GPD potable water demand. New power and gas services are also proposed to the Site. Refuse will be handled by onsite dumpsters that will routinely be emptied by a private waste disposal company. Buildings will incorporate fire suppression sprinkler systems, as required by the Massachusetts State Building Code. Access to the Site from Route 20 as well as utility connections to existing infrastructure within the highway are proposed as part of the development of Sub-District B. The Proponent is committed to working with MassDOT and the Town of Shrewsbury to provide safe and efficient access to the Site and to limit potential impacts caused by construction. Project impacts during construction will be confined within the property boundary and the immediately adjacent roadways for utility connections. Site construction is expected to last approximately 5 years.
Proposed pedestrian infrastructure will include an on-site sidewalk system that connects the proposed buildings with South Street. The sidewalk system will provide a pedestrian connection to area businesses and to the nearby Charles River and UMass office parks. Trip generation estimates for the Project are based on the higher-generating general office land use category. The development is estimated to generate a total of 4,384 vehicle trips on a weekday. The project will also include exterior bicycle racks within the property and will provide a Transportation Management Program (TMP). The Proponent will continue to work with MassDOT and MEPA during the state review process to provide a framework for project mitigation and timelines through a monitoring program. For additional detail and information, refer to the “Transportation Scoping Letter”, prepared by MDM Transportation, provided in Appendix C.

Funding sources for the project include the following:
- $302,000 Site Readiness Program grant from MassDevelopment for engineering and permitting costs;
- $150,000 Chapter 43D expedited permitting grant; and
- $10,000 District Local Technical Assistance (DLTA) grant for CMRPC Planning.

The Town of Shrewsbury will also seek a grant under the 2019 MassWorks Infrastructure Program to fund the cost of initial roadway construction in Sub-District A.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

NOTE: The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.

Alternatives Analysis

No-Built Alternative

The “No-Built” alternative is not an economically viable option for the property. The Town of Shrewsbury purchased the property in 2002 in an effort to increase tax revenue, supply jobs, and promote the growth of the regional economy by supplementing the area with additional office and research and development space. The Town has been making principal and interest payments on the $6.1 million borrowed to purchase the Allen Property since 2012. The Town’s intention for the property is to provide a pad-ready Site that aligns with the Town and SDC’s overall goals and objectives for development.

“2008 Master Plan” (Alternative A)

In 2008, the Site was evaluated for the development of two (2) office/industrial parks located in the North and South portions of the Site. The Conceptual Site Development Plan, provided in Appendix C, consisted of 405,000sf office/research space to the North, and 206,000sf of office/manufacturing space to the South. Due to the intensity of the program, this Alternative would require additional infrastructure improvements and significantly more site work cost premiums when compared to the Preferred Alternative, proposing more overall building area, parking, and impervious coverage, and increased potable water use and sanitary sewer generation. Similar impacts to wetlands are proposed as in the Preferred Alternative, including a wetland crossing to access the western portion of the site, and a waterline crossing to loop water service through the entire project.
“Beal Early Childhood Center” (Alternative B)

The Town commissioned a study in early 2018 to evaluate the Site and another local property for an educational use known as the Beal Early Childhood Center. The Site is zoned Office-Research; however, public and non-profit educational uses are exempt from local zoning under Chapter 40A of the Massachusetts General Law (M.G.L. c. 40A, §3). A comprehensive site suitability analysis was conducted based on a comparative rating system. Categories rated included geographic location, physical and regulatory constraints, encumbrances, and access conditions. Given the preliminary nature of this evaluation, a conceptual development plan and full environmental impact study was not prepared. Based on the comparative results of the study, the Town determined that the alternate site was best suited for the development of the school.

Preferred Alternative

The Project is limited to this Site and considers no alternate due to the Proponent and SDC’s interests for development of the parcel, as this is Shrewsbury’s last significant parcel of industrial land. It is their objective to develop this site in a way that limits environmental impacts, promotes economic growth, facilitates respectful development, and creates high-quality jobs. The Preferred Alternative appears to be the best use of the property.

The Preferred Alternative proposes 450,000 GSF of development in Sub-District’s A & B. It should be noted that the wetland resource area limits have changed and more notably increased in size since the development of Alternate A; therefore, less developable area is shown onsite resulting in reduced environmental impacts when compared to Alternate A. The Preferred Alternative proposes a similar build-out of the site but on a reduced scale, limiting permitting efforts to the maximum extent practicable and meeting all regulatory requirements.

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

Mitigation Measures

Transportation

Currently, there are no transit or bike facilities within the study area. MassDOT is in the process of planning roadway improvements along Route 20 near the project site which are expected to be designed as a multimodal facility under MassDOT’s Complete Streets guidelines. Based on a preliminary meeting held with MassDOT District 3 staff on October 31, 2018, planning improvements along Route 20 would include adding additional capacity to the system via a four-lane cross-section. The Proponent will work with MassDOT to provide a project that is compatible and cohesive with the long-range improvements planned for the area.

The Project will require a highway access permit for Sub-District B, which will have direct access/egress from Route 20 via a right-in/right-out driveway (subject to MassDOT approval). All work to be completed by the Proponent to support the project will comply with local requirements and to the extent applicable MassDOT requirements within State Highway Layout.

Based on preliminary discussions with MassDOT, it is anticipated that the Project will be required to prepare a Road Safety Audit at the Route 9 intersection with South Street and will be responsible for the implementation of a pedestrian crossing and pedestrian traffic signal phasing at said intersection. To enhance capacity, the Project is will also likely require widening of the South Street southbound approach to Route 20 to provided dedicated turn lanes. Any improvements would be designed to complement
MassDOT’s Route 20 pending improvement initiatives. The Proponent will continue to work with MassDOT and MEPA during the State review process to provide a framework for project mitigation and timelines through a monitoring program.

The Project will include sidewalks along each of the proposed access roadways that will connect with the existing sidewalk along South Street. Exterior bicycle racks will also be proposed onsite. The Project will review the feasibility of providing shuttle service to/from the nearby Grafton Commuter Rail Station that is located along Pine Street approximately 2 miles to the south. The Proponent will implement a Travel Demand Management (TDM) program that encourages ridesharing among tenant employees and on-site amenities that reduce vehicle trips by tenant employees.

Utilities

The existing Site is serviced by a 6-inch sewer stub extending from an 8-inch sewer main that was extended up South Street by the Town in 2012. Other service connections to the site were not observed on record plans or during site investigations. Existing 6- and 12-inch water mains and an 8-inch gas line are available in South Street. An existing 12-inch sewer main, 12-inch water main and 4- and 12-inch gas lines are available in Route 20. 3-phase power is available in both streets. According to discussions with the Town a fiber optic line is available in South Street. Drainage with South Street is collected via a series of catch basins and manholes and discharges to wetlands on the Site. A drainage system was observed in Route 20, but its point of discharge is unknown at this time.

The Project proposes to connect to the existing 12” main in South Street and loop an 8-inch water service through the Site via a wetland crossing which will connect the Subdivision Roadways in Sub-Districts A & B. The Project will implement efficient water use strategies to reduce overall water use onsite.

Sewer, gas, and electric will extend from South Street and Route 20 to service Sub-Districts A & B, respectively. The Project will implement efficient water use strategies to reduce overall sewer discharges. Utility work in South Street and Route 20 will be fully coordinated with the Town and MassDEP (as applicable) to ensure safe and efficient construction practices are conducted.

Stormwater

The Project will increase the amount of impervious area by approximately 20± acres. The resulting increase in runoff will be mitigated by the construction of surface and subsurface infiltration/detention basins. The drainage system will be designed to meet or exceed MassDEP Standards by attenuating runoff rates to less than the pre-development condition, providing treatment and TSS removal prior to infiltration and discharge, and promoting groundwater recharge. Additional Best Management Practices (BMPs), such as deep sump and hooded catch basins, proprietary stormwater quality units, and forebays, will be incorporated into the design to further enhance the systems treatment effectiveness.

Investigations were conducted in early October 2018 by Whitestone Associates, Inc., to understand subsurface conditions onsite. Refer to Appendix C for a detailed summary of findings and design recommendations.

Wetlands

The Site contains a series of intermittent streams, bordering vegetated wetlands (BVW), potential isolated land subject to flooding (ILSF) and potential vernal pools (PVP). The Project proposes work within 100 feet of wetlands onsite as well as direct alteration of BVW, therefore a permit is required to be filed with the Shrewsbury Conservation Commission under the Massachusetts Department of Environmental Protection
(MassDEP) Wetlands Protection Act (WPA). Direct impacts to BVW will be less than 5,000 sf and therefore will not require regulatory action with the Army Corps of Engineers. Wetland replication equal to the area impacted is proposed and will meet the requirements of the WPA for BVW’s (310 CMR 10.55(4)).

Construction

The Project will provide construction period erosion and sedimentation controls as required by the National Pollutant Discharge Elimination System (NPDES) General Construction Permit (CGP). This will include a proposed construction entrance, protection for stormwater inlets, temporary sediment basins, protection around temporary material stock piles, and various other techniques. The total site and project area is greater than one acre. Accordingly, the project will require filing a Notice of Intent (NOI) with the United States Environmental Protection Agency (US EPA). A Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the projects proponent.

An Operation and Maintenance (O&M) Plan for this site will be included with the project Drainage Report. The O&M Plan will outline procedures and time tables for the long-term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer’s recommendations. The O&M will include a list of responsible parties, and the stormwater management system will be maintained by the owner and/or the owner’s representative.

If the project is proposed to be constructed in phases, please describe each phase:

The Project will be built out in two (2) phases. The initial phase will entail the Subdivision Roadway in Sub-District A and construction of the associated parcels. The subsequent phase will involve the Subdivision Roadway and associated parcels located in Sub-District B.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:

Is the project within or adjacent to an Area of Critical Environmental Concern?  
☐ Yes (Specify______________________________ )  ☒ No  

If yes, does the ACEC have an approved Resource Management Plan?  ____ Yes _____ No; If yes, describe how the project complies with this plan.

Will there be stormwater runoff or discharge to the designated ACEC?  ____ Yes _____ No;  
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.  
______________________________________________________

RARE SPECIES:

Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species?  (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)  
☐ Yes (Specify______________________________ )  ☒ No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:

Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?  
☐ Yes (Specify______________________________ )  ☒ No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources?  ☐ Yes (Specify______________________________ )  ☒ No
A review of the Massachusetts Cultural Resource Information System (MACRIS) indicated that there are no historic properties or areas located on or near the Site. A Project Notification Form (PNF) was filed with the Massachusetts Historical Commission (MHC) on November 20, 2018. The Proponent is awaiting a response letter from the MHC to confirm the Site does not meet the criteria of eligibility for listing in the State Register of Historical Places.

WATER RESOURCES:

Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? XYes ___No; if yes, identify the ORW and its location. Two (2) onsite vernal pools appear to meet the criteria to be certified in western and northwestern portions of the site (Refer to GIS Map in Appendix A). One potential vernal pool (PVP) was observed to the north on the Charles River Laboratories site.

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? ___Yes X No; if yes, identify the water body and pollutant(s) causing the impairment:_________________________

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? XYes ___No

Based on Figure 5: Stressed Basin Map, provided in a report entitled, “Stressed Basins in Massachusetts”, prepared by the Commonwealth of Massachusetts Water Resources Commission, dated December 13, 2001, the northwestern portion of the site flows to a Low Stress Basin, and the remainder of the site flows to a Medium Stress Basin. Flows from the northwest portion of the site are associated with the Blackstone Watershed, and the flows from the remainder of the site are associated with the SuAsCo Watershed.

STORMWATER MANAGEMENT:

Generally describe the project’s stormwater impacts and measures that the project will take to comply with the standards found in MassDEP’s Stormwater Management Regulations:___________

There are no stormwater runoff mitigation measures associate with the existing site. The proposed Project will be designed in accordance with the MassDEP Stormwater Standards. Stormwater runoff will be treated for TSS removal with the use of deep sumps and trap hoods and proprietary stormwater quality units prior to any infiltration or outfall. The proposed drainage design will be consistent with maintaining natural drainage flow patterns to the extent practicable, and will utilize BMPs, including surface and subsurface infiltration/detention systems, to promote groundwater recharge and attenuate peak rates of runoff. The Proponent will work with the Town of Shrewsbury to evaluate and mitigate any potential impacts to the existing stormwater infrastructure and to resource areas on and surrounding the Project site.

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? XYes ___No; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):_________________________

Is there an Activity and Use Limitation (AUL) on any portion of the project site? XYes ___No; if yes, describe which portion of the site and how the project will be consistent with the AUL: ________________.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN? XYes ___No; if yes, please describe:____________________________________

A Phase I Environmental Site Assessment was conducted in February 5, 2018 and did not identify any
Recognizable Environmental Concerns. Due to the historic use of a portion of the Site as an orchard, a Potential Environmental Concern is noted due to possible use of lead arsenate pesticides.

**SOLID AND HAZARDOUS WASTE:**

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:

The existing site contains paved/gravel parking areas and three (3) existing vacant buildings. Minimal solid waste will be generated during demolition of the site. Excess materials will be reused or recycled when possible or will otherwise be properly disposed of to a licensed facility per the DEP regulations for Solid Waste Facilities, 301 CMR 16.00.

*(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)*

Will your project disturb asbestos containing materials? Yes ___ No X; if yes, please consult state asbestos requirements at [http://mass.gov/MassDEP/air/asbhom01.htm](http://mass.gov/MassDEP/air/asbhom01.htm)

Describe anti-idling and other measures to limit emissions from construction equipment:

The Proponent will take the following reasonable efforts to minimize impacts associated with Construction efforts:
- Equipment will not needlessly idle on site during construction
- Enclosures or barriers will be provided on small equipment that operates continuously
- Equipment used throughout construction will be maintained properly with particular attention put to proper operation of equipment mufflers

**DESIGNATED WILD AND SCENIC RIVER:**

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No X; if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the “outstandingly remarkable” resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River? Yes ___ No ____; if yes, specify name of river and designation: ___________; if yes, will the project result in any impacts to any of the designated “outstandingly remarkable” resources of the Wild and Scenic River or the stated purposes of a Scenic River. Yes ___ No ____; if yes, describe the potential impacts to one or more of the “outstandingly remarkable” resources or stated purposes and mitigation measures proposed.
ATTACHMENTS:

1. List of all attachments to this document.
2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.
3. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
4. Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.
5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.

Refer to the Appendices section of this document for the attachments listed above.
LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits
A. Does the project meet or exceed any review thresholds related to land (see 301 CMR 11.03(1)
   X Yes ___ No; if yes, specify each threshold:

   (1)(a)(2) – Creation of 10 or more acres of impervious area (EIR)
   (1)(b)(1) – Direct alteration of 25 or more acres of land (ENF)

II. Impacts and Permits
A. Describe, in acres, the current and proposed character of the project site, as follows:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footprint of buildings</td>
<td>0.2±</td>
<td>+3.7±</td>
<td>3.9±</td>
</tr>
<tr>
<td>Internal roadways</td>
<td>0</td>
<td>+1.7±</td>
<td>1.7±</td>
</tr>
<tr>
<td>Parking and other paved areas</td>
<td>1.8±</td>
<td>+14.6±</td>
<td>16.4±</td>
</tr>
<tr>
<td>Other altered areas</td>
<td>0</td>
<td>+6.0±</td>
<td>6.0±</td>
</tr>
<tr>
<td>Undeveloped areas</td>
<td>64.5±</td>
<td>-26.0±</td>
<td>38.5±</td>
</tr>
<tr>
<td><strong>Total: Project Site Acreage</strong></td>
<td>66.5±</td>
<td>0</td>
<td>66.5±</td>
</tr>
</tbody>
</table>

B. Has any part of the project site been in active agricultural use in the last five years?
   ___ Yes X No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
   ___ Yes X No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes X No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction?
   ___ Yes X No; if yes, does the project involve the release or modification of such restriction?
   ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes X No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No X; if yes, describe:

III. Consistency
A. Identify the current municipal comprehensive land use plan
   Title: Town of Shrewsbury Master Plan
   Date: March 3, 2016

B. Describe the project’s consistency with that plan with regard to:
   1) economic development __________________________

The proposed Centech Park North Project is consistent with the Master Plan’s vision for development of the Site located at South Street and Route 20. The development of the Site has
been an economic development priority for over a decade. The SDC and Board of Selectmen hope to attract higher-end office and research tenants to the Site. Residents have voiced strong support for commercial development with better site and architectural design to provide a non-residential tax base to handle the cost of population and school growth. The Project will align with these objectives and will create additional economic opportunity for new businesses in the area.

2) adequacy of infrastructure

The Site has access to water, sewer, gas, and electric services within South Street and Route 20. To accommodate future growth, mainly for commercial and industrial activities, the Town has implemented limitations on existing public water well withdrawals to minimize impacts to the Blackstone River Basin. The Town recently upgraded and extended sewer service in South Street to accommodate the Project. Based on discussions with Town Officials, there are no known capacity issues and future upgrades to utility infrastructure are not anticipated.

3) open space impacts

The proposed Project will meet the minimum open space requirement for the project in accordance with the Town of Shrewsbury Zoning By-Laws. The Site is zoned Office-Research with associated Flexible Development Overlay Sub-Districts (FDOS) A & B, and is consistent with the proposed development.

4) compatibility with adjacent land uses

The proposed Project remains consistent with the adjacent land uses. The Site is surrounded by Office-Research to the north and east, Light Industrial to the south, and Rural “B” to the west. When the Town purchased the Site in 2002, the property was re-zoned from Light Industrial to Office-Research to allow for commercial development and to align with the goals and objectives of the Town for the future build-out. In 2009 the FDOS overlay districts were established to allow more flexibility in the types of uses developed onsite.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)

RPA: ______________________

Title Central Massachusetts Regional Planning Commission (CMRPC) Land Use Priority Plan
Process Summary
Date: December 2014

Title: 495/MetroWest Development Compact Plan & Priority Development and Preservation Base Map
Date: March 2012 & June 12, 2018, respectively

D. Describe the project’s consistency with that plan with regard to:

1) economic development

The Project is consistent with the regional plan. The regional plan and Priority Development and Preservation Base Map identify the Site as a Development Priority Area. The Project will align with the objectives of the regional plan and will create additional economic opportunity for new businesses in the area.

2) adequacy of infrastructure

The Site has access to municipal water and sewer services within South Street and Route 20, as well as gas and electric services. The Town recently upgraded and extended sewer service in South Street to accommodate the Project. Based on discussions with Town Officials, there are no known capacity issues and future upgrades to utility infrastructure are not anticipated.
The Future Land Use Plan within the regional plan indicates the Site within an area of special planning interest associated with Commercial/Office Research, and does not designate it as a Public & Private Open Space/Recreation Land. The vast network of wetland resource areas onsite limits the developable area onsite and will ensure significant wildlife habitats are protected as a result of the future build-out. In addition, the proposed Project will meet the minimum open space for the property as required by the Town of Shrewsbury Zoning By-Laws.

RARE SPECIES SECTION

I. Thresholds / Permits
   A. Will the project meet or exceed any review thresholds related to rare species or habitat (see 301 CMR 11.03(2))? __ Yes X No; if yes, specify, in quantitative terms:

   (NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

   B. Does the project require any state permits related to rare species or habitat? ___ Yes X No

   C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes X No.

       Refer to the NHESP Map in Appendix A.

   D. If you answered "No" to all questions A, B and C, proceed to the Wetlands, Waterways, and Tidelands Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits
   A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

       1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

       2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

   3. Which rare species are known to occur within the Priority or Estimated Habitat?

   4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

   4. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

   B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:
WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits
A. Will the project meet or exceed any review thresholds related to wetlands, waterways, and tidelands (see 301 CMR 11.03(3))? ___ Yes X No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to wetlands, waterways, or tidelands? X Yes ___ No; if yes, specify which permit:

The Project will be required to file a Notice of Intent with the Shrewsbury Conservation Commission.

C. If you answered "No" to both questions A and B, proceed to the Water Supply Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits
A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? X Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes X No; if yes, list the date and MassDEP file number: ______; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes X No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

The Project proposes to impact approximately 4,900± SF of wetland resource areas onsite. A "limited crossing" is proposed to access the western side of Sub-District A. A water service wetland crossing is proposed to loop the water service between Sub-Districts A and B. Small impacts to wetlands are also proposed for roadway and parking area development. Wetland replication equal to the area impacted is proposed and will meet the requirements of the WPA for BVW's (310 CMR 10.55(4)).

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

<table>
<thead>
<tr>
<th>Coastal Wetlands</th>
<th>Area (square feet) or Length (linear feet)</th>
<th>Temporary or Permanent Impact?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Under the Ocean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Designated Port Areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal Beaches</td>
<td></td>
<td></td>
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<tr>
<td>Coastal Dunes</td>
<td></td>
<td></td>
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<tr>
<td>Barrier Beaches</td>
<td></td>
<td></td>
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<tr>
<td>Coastal Banks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocky Intertidal Shores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt Marshes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Under Salt Ponds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Containing Shellfish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish Runs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Subject to Coastal Storm Flowage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Inland Wetlands                       |                                           |                               |
| Bank (lf)                             |                                           |                               |
| Bordering Vegetated Wetlands          | 4,900± SF                                 | 4,900± SF                     |
| Isolated Vegetated Wetlands           |                                           |                               |
| Land under Water                      |                                           |                               |
| Isolated Land Subject to Flooding     |                                           |                               |
Bordering Land Subject to Flooding ___________________ ___________________
Riverfront Area ___________________ _____________________

D. Is any part of the project:
1. proposed as a **limited project**? ___ Yes X No; if yes, what is the area (in sf)?
2. the construction or alteration of a **dam**? ___ Yes X No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes X No
4. dredging or disposal of dredged material? ___ Yes X No; if yes, describe the volume
   of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical
   Environmental Concern (ACEC)**? X Yes ___ No
6. subject to a wetlands restriction order? ___ Yes X No; if yes, identify the area (in sf):
7. located in buffer zones? X Yes ___ No; if yes, how much (in sf): 210,000 ± sf (impervious)

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw? ___ Yes X No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes X No; if 
   yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits
A. Does the project site contain waterways or tidelands (including filled former tidelands) that are
   subject to the Waterways Act, M.G.L.c.91? ___ Yes X No; if yes, is there a current Chapter 91
   License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or
   permit number and provide a copy of the historic map used to determine extent of filled
   tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes X No; if 
   yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent
   use? Current ___ Change ___ Total ___
   If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following:
   Area of filled tidelands on the site:________________________
   Area of filled tidelands covered by buildings:_______________
   For portions of site on filled tidelands, list ground floor uses and area of each use:
   ____________________________
   Does the project include new non-water-dependent uses located over flowed tidelands?
   Yes ___ No ___
   Height of building on filled tidelands____________________

   Also show the following on a site plan: Mean High Water, Mean Low Water, Water-
   dependent Use Zone, location of uses within buildings on tidelands, and interior and
   exterior areas and facilities dedicated for public use, and historic high and historic low
   water marks.

D. Is the project located on landlocked tidelands? ___ Yes X No; if yes, describe the project’s
   impact on the public’s right to access, use and enjoy jurisdictional tidelands and describe
   measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a
   municipality or by a state or federal agency as a threat to building foundations? ___ Yes X No; if yes, describe the project’s impact on groundwater levels and describe
   measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent and located on landlocked tidelands or waterways or
   tidelands subject to the Waterways Act and subject to a mandatory EIR? ___ Yes X No;
G. Does the project include dredging? ___ Yes X No; if yes, answer the following questions:

What type of dredging? Improvement ___ Maintenance ___ Both ____

What is the proposed dredge volume, in cubic yards (cys) __________

What is the proposed dredge footprint ____ length (ft) ____ width (ft) ____ depth (ft);

Will dredging impact the following resource areas?
   Intertidal     Yes__      No__; if yes, ___ sq ft
   Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft
   Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__; if yes ___ sq ft

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

If no to any of the above, what information or documentation was used to support this determination?

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.

Sediment Characterization

Existing gradation analysis results? __ Yes ___ No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___ Yes _____ No; if yes, provide results.

Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

   Beach Nourishment ____
   Unconfined Ocean Disposal ____
   Confined Disposal:
      Confined Aquatic Disposal (CAD) ____
      Confined Disposal Facility (CDF) ____
   Landfill Reuse in accordance with COMM-97-001 ____
   Shoreline Placement ____
   Upland Material Reuse ____
   In-State landfill disposal ____
   Out-of-state landfill disposal ____

(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:
A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes X No; if yes, describe these effects and the project's consistency with the policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes X No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:
WATER SUPPLY SECTION

I. Thresholds / Permits
A. Will the project meet or exceed any review thresholds related to water supply (see 301 CMR 11.03(4))? ___ Yes ___ No; if yes, specify, in quantitative terms: ±33,750 GPD
B. Does the project require any state permits related to water supply? ___ Yes ___ No; if yes, specify which permit:
C. If you answered "No" to both questions A and B, proceed to the Wastewater Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits
A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

<table>
<thead>
<tr>
<th>Source</th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal or regional water supply</td>
<td>0</td>
<td>+33,750±</td>
<td>33,750±</td>
</tr>
<tr>
<td>Withdrawal from groundwater</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Withdrawal from surface water</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Interbasin transfer</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(Note: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)
B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No
C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. ______________
D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ___ Will the project require an increase in that withdrawal? ___ Yes ___ No; if yes, then how much of an increase (gpd)?
E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe existing and proposed water supply facilities at the project site:

<table>
<thead>
<tr>
<th>Source</th>
<th>Permitted Flow</th>
<th>Existing Avg Daily Flow</th>
<th>Project Flow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity of water supply well(s) (gpd)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity of water treatment plant (gpd)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed? N/A
G. Does the project involve:
   1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
   2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes X No

III. Consistency
Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

The Project will implement efficient water use strategies to reduce overall potable water use onsite.

WASTEWATER SECTION

I. Thresholds / Permits
A. Will the project meet or exceed any review thresholds related to wastewater (see 301 CMR 11.03(5))? X Yes ___ No; if yes, specify, in quantitative terms: +33,750± GPD

B. Does the project require any state permits related to wastewater? ___ Yes X No; if yes, specify which permit:

C. If you answered “No” to both questions A and B, proceed to the Transportation -- Traffic Generation Section. If you answered “Yes” to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits
A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge of sanitary wastewater</td>
<td>0</td>
<td>+ 33,750+</td>
<td>33,750+</td>
</tr>
<tr>
<td>Discharge of industrial wastewater</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>+ 33,750+</td>
<td>33,750+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge to groundwater</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Discharge to outstanding resource water</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Discharge to surface water</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Discharge to municipal or regional wastewater facility</td>
<td>0</td>
<td>+ 33,750+</td>
<td>33,750+</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>+ 33,750+</td>
<td>33,750+</td>
</tr>
</tbody>
</table>

B. Is the existing collection system at or near its capacity? ___ Yes X No; if yes, then describe the measures to be undertaken to accommodate the project’s wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes X No; if yes, then describe the measures to be undertaken to accommodate the project’s wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes X No; if yes, describe as follows:
Wastewater treatment plant capacity (in gallons per day)

<table>
<thead>
<tr>
<th></th>
<th>Permitted</th>
<th>Existing Avg Daily Flow</th>
<th>Project Flow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

*(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)*

The Project will not require an interbasin transfer of wastewater.

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes X No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes X No; if yes, what is the capacity (tons per day):

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

The Project will introduce new watertight sewer mains which will limit infiltration entering the sewer system onsite. Design strategies will be incorporated to promote smarter use of water within the buildings and onsite, and to reduce potable water consumption. By reducing water consumption, the project will reduce wastewater discharges.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

The Project will comply with all applicable state, regional and local plans and policies, as required.

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes X No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:
TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit
   A. Will the project meet or exceed any review thresholds related to traffic generation (see 301 CMR 11.03(6))? X Yes ___ No; if yes, specify, in quantitative terms:
      11.03(6)(a)6: Generation of 3,000 or more new ADT on roadways providing access to a single location.
      11.03(6)(a)7: Construction of 1,000 or more new parking spaces at a single location.
      11.03(6)(b)13: Generation of 2,000 or more new ADT on roadways providing access to a single location.
      11.03(6)(b)14: Generation of 1,000 or more new ADT on roadways providing access to a single location and construction of 150 or more new parking spaces at a single location.
      11.03(6)(b)15: Construction of 300 or more new parking spaces at a single location.
   C. Does the project require any state permits related to state-controlled roadways? X Yes ___ No; if yes, specify which permit:
      The project will require a MassDOT Highway Access Permit
   C. If you answered "No" to both questions A and B, proceed to the Roadways and Other Transportation Facilities Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits
   A. Describe existing and proposed vehicular traffic generated by activities at the project site:
      Number of parking spaces
      | Existing | Change | Total |
      |---------|--------|-------|
      | 50+     | +1,075 | 1,125 |
      Number of vehicle trips per day
      | 0       | +4,384 | 4,384 |
      ITE Land Use Code(s):
      | Proposed: ITE 10th Edition, LUC 710 (General Office Building) applied to 450,000 gsf. |
   B. What is the estimated average daily traffic on roadways serving the site?
      | Roadway | Existing | Change | Total |
      |---------|---------|--------|-------|
      1. Route 9 – East of the South St | 38,714+ | +695   | 39,409+ |
      2. Route 9 – West of the South | 38,323+ | +1,395 | 39,718+ |
      3. Route 20 – East of South St | 24,156+ | +876   | 25,032+ |
      4. Route 20 – West of Centech Blvd | 20,013+ | +1,424 | 21,437+ |
      5. South St – North of Route 9 | 14,182+ | +329   | 14,511+ |
      6. Centech Blvd – South of Route 20 | 5,782+ | +220   | 6,002+ |
   C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:
      The project will require a highway access permit and the southern portion of the Site (175,000 sf) will have direct access/egress from Route 20 via a right-in/right-out driveway (subject to MassDOT approval).
      Based on preliminary discussions with MassDOT, it is anticipated that the project will be required to prepare a Road Safety Audit at the Route 9 intersection with South Street and will be responsible for the implementation of a pedestrian crossing and pedestrian traffic signal phasing at said intersection. To enhance capacity, the project is also likely require widening of the South Street southbound approach to Route 20 to provide dedicated turn lanes. Any improvements would be designed to complement MassDOT’s Route 20 pending improvement initiatives. The Proponent will continue to work with MassDOT and MEPA during the state
review process to provide a framework for project mitigation and timelines through a monitoring program.

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

Currently, there are no transit or bike facilities within the study area. However, MassDOT is in the process of planning roadway improvements along Route 20 which are expected to be designed as a multimodal facility under MassDOT’s Complete Streets guidelines.

The Project will include sidewalks along each of the proposed access roadways that will connect the existing sidewalk along South Street. Exterior bicycle racks will also be proposed onsite. The Project will review the feasibility of providing shuttle service to/from the nearby Grafton Commuter Rail Station that is located along Pine Street approximately 2 miles to the south. The Proponent will implement a Travel Demand Management (TDM) program that encourages ridesharing among tenant employees and on-site amenities that reduce vehicle trips by tenant employees.

F. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes X No; if yes, describe if and how will the project will participate in the TMA:

G. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes X No; if yes, generally describe:

H. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

The project will not penetrate approach airspace of any airports.

III. Consistency
Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

The proposed project is located within the town’s office-research zoning district with a flex-business overlay and will meet all requirements of that district. All work to be completed by the Proponent to support the project will comply with local requirements and to the extent applicable MassDOT requirements within State Highway Layout.

Pedestrian infrastructure proposed as part of the Project will consist of a sidewalk system that connects the development in Sub-District A to South Street. This will provide a pedestrian connection to area businesses and to the nearby Charles River and UMass office parks. A sidewalk will also be proposed along the access road in Sub-District B to connect to the future Route 20 sidewalk if applicable. The Project will also include exterior bicycle racks and will provide a Transportation Management Program (TMP). The Proponent will continue to work with MassDOT and MEPA during the state review process to provide a framework for project mitigation and timelines through a monitoring program.
TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds
   A. Will the project meet or exceed any review thresholds related to roadways or other transportation facilities (see 301 CMR 11.03(6))? ___ Yes X No; if yes, specify, in quantitative terms:

   B. Does the project require any state permits related to roadways or other transportation facilities? ___ Yes X No; if yes, specify which permit:

   C. If you answered "No" to both questions A and B, proceed to the Energy Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts
   A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

   B. Will the project involve any
      1. Alteration of bank or terrain (in linear feet)? __________
      2. Cutting of living public shade trees (number)? __________
      3. Elimination of stone wall (in linear feet)? __________

III. Consistency
     Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

ENERGY SECTION

I. Thresholds / Permits
   A. Will the project meet or exceed any review thresholds related to energy (see 301 CMR 11.03(7))? ___ Yes X No; if yes, specify, in quantitative terms:

   B. Does the project require any state permits related to energy? ___ Yes X No; if yes, specify which permit:

   C. If you answered "No" to both questions A and B, proceed to the Air Quality Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits
   A. Describe existing and proposed energy generation and transmission facilities at the project site:

      | Existing | Change | Total |
      |----------|--------|-------|
      | Capacity of electric generating facility (megawatts) | | |
      | Length of fuel line (in miles) | | |
      | Length of transmission lines (in miles) | | |
      | Capacity of transmission lines (in kilovolts) | | |

   B. If the project involves construction or expansion of an electric generating facility, what are:
      1. the facility's current and proposed fuel source(s)?
      2. the facility's current and proposed cooling source(s)?
C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds
A. Will the project meet or exceed any review thresholds related to air quality (see 301 CMR 11.03(8))? ___ Yes X No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to air quality? ___ Yes X No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Solid and Hazardous Waste Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits
A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

<table>
<thead>
<tr>
<th>Emission Type</th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile organic compounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxides of nitrogen</td>
<td></td>
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<td></td>
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<tr>
<td>Lead</td>
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<tr>
<td>Any hazardous air pollutant</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency
A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:
SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits
   A. Will the project meet or exceed any review thresholds related to solid or hazardous waste (see 301 CMR 11.03(9))? ___ Yes X No; if yes, specify, in quantitative terms:

   B. Does the project require any state permits related to solid and hazardous waste? ___ Yes X No; if yes, specify which permit:

   C. If you answered "No" to both questions A and B, proceed to the Historical and Archaeological Resources Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits
   A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment, processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

   B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Change</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
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</tr>
<tr>
<td>Recycling</td>
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<td></td>
<td></td>
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<tr>
<td>Treatment</td>
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<td></td>
</tr>
<tr>
<td>Disposal</td>
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<td></td>
</tr>
</tbody>
</table>

   C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

   D. If the project involves demolition, do any buildings to be demolished contain asbestos? ___ Yes ___ No

   E. Describe the project’s other solid and hazardous waste impacts (including indirect impacts):

III. Consistency
   Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:
HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts
A. Have you consulted with the Massachusetts Historical Commission? ____ Yes X No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes X No; if yes, attach correspondence

A review of the Massachusetts Cultural Resource Information System (MACRIS) indicated that there are no historic properties or areas located on or near the Site.

A Project Notification Form (PNF) was filed with the Massachusetts Historical Commission (MHC) on November 20, 2018. The Proponent is awaiting a response letter from the MHC to confirm the Site does not meet the criteria of eligibility for listing in the State Register of Historical Places.

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ____ Yes X No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ____ Yes ___ No; if yes, please describe:

See response above in Section A.

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ____Yes X No; if yes, does the project involve the destruction of all or any part of such archaeological site? ____ Yes ___ No; if yes, please describe:

See response above in Section A.

D. If you answered "No" to all parts of both questions A, B and C, proceed to the Attachments and Certifications Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts
Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

III. Consistency
Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:
CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name) Worcester Telegram & Gazette (Date) 11/30/18

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

<table>
<thead>
<tr>
<th>Date</th>
<th>Signature of Responsible Officer or Proponent</th>
<th>Date</th>
<th>Signature of person preparing ENF (if different from above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/27/18</td>
<td>John I. Lebeaux</td>
<td>11/30/18</td>
<td>Michael J. Dryden</td>
</tr>
</tbody>
</table>

Name (print or type)                                    | Name (print or type)                                    |
---           | ---                                  |
John I. Lebeaux | Michael J. Dryden                      |

Town of Shrewsbury-Board of Selectmen Bohler Engineering
Firm/Agency
100 Maple Avenue 352 Turnpike Road
Street
Shrewsbury, MA 01545 Southborough, MA 01772
Municipality/State/Zip
508-841-8504 508-480-9900
Phone Phone
APPENDIX A: PROJECT MAPS

➢ USGS Site Location Map
➢ Existing Conditions Map
➢ Town of Shrewsbury Zoning Map
➢ Town of Shrewsbury Flexible Development Overlay District Map
➢ Areas of Critical Concern Map
➢ Natural Heritage & Endangered Species (NHESP) Map
➢ Wetland Map
➢ Watershed Map
➢ FEM A Flood Insurance Rate (FIRM) Map
➢ Natural Resources Conservation Service (NRCS) Soil Map
AERIAL EXHIBIT
FOR
CENTECH PARK NORTH

MAP #42, LOT #11
384-386 SOUTH STREET
TOWN OF SHREWSBURY
WORCESTER COUNTY, MASSACHUSETTS

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**Legend**

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

<table>
<thead>
<tr>
<th>SPECIAL FLOOD HAZARD AREAS</th>
<th>OTHER AREAS OF FLOOD HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Base Flood Elevation (BFE)</td>
<td>Without Base Flood Elevation (BFE)</td>
</tr>
<tr>
<td>Zone A, C, AE, AF</td>
<td>Zone X</td>
</tr>
<tr>
<td>With BFE or Depth</td>
<td>Future Conditions 1% Annual Chance Flood Hazard</td>
</tr>
<tr>
<td>Zone A99, AO, AH, VE, AR</td>
<td>Zone X</td>
</tr>
<tr>
<td>Regulatory Floodway</td>
<td>Area with Reduced Flood Risk due to Levee. See Notes.</td>
</tr>
<tr>
<td>0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile</td>
<td>Area with Flood Risk due to Levee</td>
</tr>
<tr>
<td>Zone X</td>
<td>Zone D</td>
</tr>
</tbody>
</table>

**OTHER AREAS**

- Area of Minimal Flood Hazard
- Area of Undetermined Flood Hazard
- Area of Minimal Flood Hazard

**GENERAL STRUCTURES**

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**

- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**

- Digital Data Available
- No Digital Data Available
- Unmapped

This pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA’s standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA’s basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/9/2018 at 1:26:05 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.
The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale. Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 
Coordinate System: Web Mercator (EPSG:3857)
Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 13, Sep 11, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
## Map Unit Legend

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>71A</td>
<td>Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony</td>
<td>18.3</td>
<td>9.7%</td>
</tr>
<tr>
<td>71B</td>
<td>Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony</td>
<td>2.2</td>
<td>1.1%</td>
</tr>
<tr>
<td>72A</td>
<td>Whitman loam, 0 to 3 percent slopes</td>
<td>14.2</td>
<td>7.6%</td>
</tr>
<tr>
<td>102C</td>
<td>Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes</td>
<td>2.7</td>
<td>1.5%</td>
</tr>
<tr>
<td>102D</td>
<td>Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes</td>
<td>2.6</td>
<td>1.4%</td>
</tr>
<tr>
<td>305B</td>
<td>Paxton fine sandy loam, 3 to 8 percent slopes</td>
<td>72.4</td>
<td>38.4%</td>
</tr>
<tr>
<td>305C</td>
<td>Paxton fine sandy loam, 8 to 15 percent slopes</td>
<td>2.7</td>
<td>1.4%</td>
</tr>
<tr>
<td>306B</td>
<td>Paxton fine sandy loam, 0 to 8 percent slopes, very stony</td>
<td>35.0</td>
<td>18.6%</td>
</tr>
<tr>
<td>306C</td>
<td>Paxton fine sandy loam, 8 to 15 percent slopes, very stony</td>
<td>2.7</td>
<td>1.4%</td>
</tr>
<tr>
<td>307C</td>
<td>Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony</td>
<td>1.6</td>
<td>0.9%</td>
</tr>
<tr>
<td>310A</td>
<td>Woodbridge fine sandy loam, 0 to 3 percent slopes</td>
<td>0.7</td>
<td>0.4%</td>
</tr>
<tr>
<td>310B</td>
<td>Woodbridge fine sandy loam, 3 to 8 percent slopes</td>
<td>16.0</td>
<td>8.5%</td>
</tr>
<tr>
<td>310C</td>
<td>Woodbridge fine sandy loam, 8 to 15 percent slopes</td>
<td>3.1</td>
<td>1.6%</td>
</tr>
<tr>
<td>311B</td>
<td>Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony</td>
<td>8.1</td>
<td>4.3%</td>
</tr>
<tr>
<td>312B</td>
<td>Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony</td>
<td>4.7</td>
<td>2.5%</td>
</tr>
<tr>
<td>651</td>
<td>Udorthents, smoothed</td>
<td>1.2</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td><strong>188.3</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
APPENDIX B: EXISTING AND PROPOSED CONDITIONS PLANS
APPENDIX C: SUPPLEMENTAL INFORMATION (BY OTHERS)


➢ “Wetland Resource Evaluation, Allen Farm, South Street, Shrewsbury, MA”, prepared by EcoTec, Inc., dated 10/24/18.

November 19, 2018

Mr. Lionel Lucien
Manager, Public/Private Development Unit Office of Transportation Planning
10 Park Plaza Room 4150
Boston, MA 02116

Re: Transportation Scoping Letter – Proposed Centech Park North
Route 20 at South Street, Shrewsbury, Massachusetts

Dear Mr. Lucien,

On behalf of the Town of Shrewsbury (the Proponent), MDM has prepared this Transportation Scoping Letter (TSL) to outline the technical assumptions and key transportation matters that will be addressed in a Transportation Impact and Access Study (TIAS) for the above-referenced Project.

Proposed Development

The Site comprises approximately 66.5± acres bounded by Route 20 to the south and South Street to the east in Shrewsbury, Massachusetts. The location of the site relative to adjacent roadways is shown in Figure 1. The property includes 3 vacant structures associated with former agricultural use, a paved parking area and undeveloped land. Site access/egress currently includes two full access/egress driveways along South Street.

A Master Plan is being advanced for the property under which a total yield of approximately 450,000 sf of commercial space at the property is envisioned with up to 275,000± sf of commercial space buildings being developed via a full access driveway along South Street (Sub-District A) and up to 175,000± sf of commercial space buildings being developed with right-in/right out access via a driveway along Route 20 (Sub-District B). The full buildout of approximately 450,000 sf is the subject of the forthcoming ENF filing. Anticipated land uses may include a range of business uses including research and development, warehouse/distribution, light industrial and office. The Proponent is currently applying for a MassWorks grant to construct a development roadway with access at South Street and associated infrastructure.
TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: November 2018
Dwg No. 1001 LTR02 TSL.dwg
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Study Area Network & Analysis Periods

The TIAS will evaluate transportation characteristics of roadways and intersections that provide a primary means of access to the site, and that are likely to sustain a measurable level of traffic impact from the development. MDM proposes the study area includes the following intersections, which represent locations at which additional project traffic for approximately 450,000 sf development represent increases of 5 percent or more over existing traffic volumes:

- Route 9 (Boston Turnpike) at South Street (Signalized)
- Route 20 (Hartford Turnpike) at South Street/Green Street (Signalized)
- Route 20 (Hartford Turnpike) at Centech Boulevard/Cherry Street (Signalized)
- South Street at Charles River Labs/Umass Campus Access Road (Unsignalized)
- Proposed Site Driveway at South Street
- Proposed Site Driveway at Route 20 (Hartford Turnpike)

Traffic-volume data used in the TIAS will include counts obtained by mechanical and manual methods in October 2018. Automatic traffic recorder counts (ATRs) were conducted along South Street and Route 20 while manual turning movement counts (TMCs) were conducted at the study intersections. Traffic data were collected during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods. These hours represent the combination of busiest activity periods of the site and adjacent roadway network. Permanent count station data (see Attachments) for the area indicate that October is an above-average month; however, as a conservative measure, no seasonal adjustments are applied. Existing traffic volumes for proposed study area intersections are presented in Figure 2 and Figure 3.

Trip Generation

Future Build condition traffic volumes are developed by estimating the number of peak-hour trips expected to be generated by the proposed development and distributing this additional traffic onto the local roadway network. These future development-related trips are added to future No-Build traffic volumes to evaluate future traffic operations with the proposed development in place. The methodology utilized to estimate the future trip-generation characteristics of the proposed approximate 450,000 sf development are summarized below; initial trip estimates are also provided for the 275,000 sf buildout associated with the MassWorks grant for reference.
Transportation Scoping Letter
Shrewsbury, Massachusetts

Figure 3
2018 Existing Condition
Weekday Evening Peak Hour
Traffic Volumes

NOTES:
NEGL. = Negligible
S = Signaiized Intersection

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: November 2018
Dwg No. 1001 LTR02 TSL.dwg
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In accordance with EEA/MassDOT guidelines, the traffic generated by the proposed development was estimated using trip rates published in ITE’s *Trip Generation* (10th Edition) for relevant Land Use Codes (LUCs) that include General Office (LUC 710) and Research and Development (LUC 760). Since no specific tenant information is available at this time, for planning purposes the higher of the two LUC trip estimates is selected as the basis for ENF filing and analysis to present a conservative assessment. Results comparing trip generation for general office and R&D land use categories are summarized in Table 1 (proposed approximate 450,000 sf development) and Table 2 (MassWorks Grant). The Attachments contain the relevant ITE Trip Generation 10th Edition worksheets.

**TABLE 1**
TRIP-GENERATION COMPARISON (Master Plan)

<table>
<thead>
<tr>
<th></th>
<th>SITE TRIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Office</td>
</tr>
<tr>
<td></td>
<td>(450 ksf)&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Peak Hour/Direction</strong></td>
<td></td>
</tr>
<tr>
<td>Weekday Morning Peak Hour:</td>
<td></td>
</tr>
<tr>
<td>Entering</td>
<td>449</td>
</tr>
<tr>
<td>Exiting</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>522</td>
</tr>
<tr>
<td>Weekday Evening Peak Hour:</td>
<td></td>
</tr>
<tr>
<td>Entering</td>
<td>83</td>
</tr>
<tr>
<td>Exiting</td>
<td>435</td>
</tr>
<tr>
<td>Total</td>
<td>518</td>
</tr>
<tr>
<td>Weekday Daily (24 hours)</td>
<td>4,384</td>
</tr>
</tbody>
</table>


<sup>1</sup>ITE LUC 710 – General Office applied to 450,000± gsf.

<sup>2</sup>ITE LUC 760 – R&D Office applied to 450,000± gsf.
TABLE 2
TRIP-GENERATION COMPARISON (MassWorks Grant)

<table>
<thead>
<tr>
<th>Peak Hour/Direction</th>
<th>SITE TRIPS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Office</td>
<td>R&amp;D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(275 ksf)1</td>
<td>(275 ksf)2</td>
<td></td>
</tr>
<tr>
<td>Weekday Morning Peak Hour:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entering</td>
<td>274</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Exiting</td>
<td>45</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>319</td>
<td>253</td>
<td></td>
</tr>
<tr>
<td>Weekday Evening Peak Hour:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entering</td>
<td>51</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Exiting</td>
<td>265</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>316</td>
<td>298</td>
<td></td>
</tr>
<tr>
<td>Weekday Daily (24 hours)</td>
<td>2,678</td>
<td>3,018</td>
<td></td>
</tr>
</tbody>
</table>

1ITE LUC 710 – General Office applied to 275,000± gsf
2ITE LUC 760 – R&D Office applied to 275± gsf

As summarized in Table 1, under the Master Plan scenario, an approximate 450,000 sf development program assuming the higher-generating general office land use category is estimated to generate approximately 522 vehicle trips during the weekday morning peak hour (449 entering and 73 exiting) and 518 vehicle trips during the weekday evening peak hour (83 entering and 435 exiting). On a daily basis, the development is estimated to generate approximately 4,384 vehicle trips on a weekday.

Under the MassWorks Grant which will be used to construct a development roadway with access at South Street and associated infrastructure, the proposed approximate 275,000 sf development assuming the higher-generating general office land use category is estimated to generate approximately 319 vehicle trips during the weekday morning peak hour (274 entering and 45 exiting) and 316 vehicle trips during the weekday evening peak hour (51 entering and 265 exiting). On a daily basis, the development is estimated to generate approximately 2,678 vehicle trips on a weekday.

Trip generation estimates presented above are based on the anticipated maximum development programming for the Site and will be further refined during the MEPA process as more definitive Site layout plans are developed.
Trip Distribution

The directional distribution of development-generated trips on the roadway network is a function of a number of variables including employee place of residence, existing travel patterns along area roadways, and the efficiency of these roadways leading to the site. Journey to Work data published by the US Census, existing travel patterns in the area including the adjacent Charles River and UMass Campuses, driveway restrictions, and area roadway infrastructure will serve as the primary basis for determining the employee trip distribution pattern for the proposed Site. Preliminary trip distribution calculations for the Site are summarized in Table 3 with supporting worksheets provided in the Attachments.

TABLE 3
TRIP-DISTRIBUTION PATTERNS

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>Office Uses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enter</td>
<td>Exit</td>
<td></td>
</tr>
<tr>
<td>Route 20 (East)</td>
<td>25%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Route 20 (West)</td>
<td>15%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Route 9 (East)</td>
<td>5%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Route 9 (West)</td>
<td>40%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>South Street (North)</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Cherry Street (North)</td>
<td>NEGL</td>
<td>NEGL</td>
<td></td>
</tr>
<tr>
<td>Green Street (South)</td>
<td>NEGL</td>
<td>NEGL.</td>
<td></td>
</tr>
<tr>
<td>Centech Boulevard (South)</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

1Existing travel patterns and Journey to Work Census 2010 data for workers within Shrewsbury.

Application of the above trip distribution patterns to projected trips for the approximate 450,000 sf development scenario result in relative trip increases identified in Figure 4 and Figure 5.

Mode Split

There are currently no available transit options in the immediate vicinity of the Site and no mode share adjustments are proposed. The existing pedestrian system serving the study area is limited and the existing network of sidewalks and crosswalks will be documented in the study. There are no formal bicycle accommodations within the study area. The TIAS will document currently available pedestrian and bicycle accommodations and volumes.
Figure 4

Site Generated Trips
Weekday Morning Peak Hour
Traffic Volumes
Figure 5

Site Generated Trips
Weekday Evening Peak Hour
Traffic Volumes
Background Growth

Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

Nearby permanent count station data published by MassDOT indicates a -0.65 percent per year growth rate. For purposes of this evaluation, a 0.5-percent compounded annual growth rate is proposed (3.6 percent increase over a 7-year horizon). This growth rate is higher than historic rates and is also expected to account for any small fluctuation in hourly traffic as may occur from time to time in the study area and traffic associated with other potential small developments or vacancies in the area. MassDOT permanent count station data and background growth calculations are provided in the Attachments.

Based on a review of MEPA files, consultation with the Town of Shrewsbury planning department, and consultation with Grafton and Northborough planning staff there are several vacancies and site-specific projects in the study area that may also modestly increase traffic at the study intersections as follows:

- **The Pointe at Hills Farm.** The residential project is currently permitted to include 280 apartment units to be located along Route 20 in Shrewsbury between the two Stoney Hill Road connections. The site-specific trip tracings were obtained from the TIAS prepared by Tetra Tech in November 2015. Trips for this project will be included in the future No-Build traffic volume networks.

- **Charles River Laboratories.** The Charles River building at 334 South Street in Shrewsbury includes 412,000± sf of R&D space which is currently half vacant based on discussions with the Town. To account for the full occupancy of the building, trips will be added based on the existing trip generation rates and distribution patterns for the building. Trips for this project will be included in the future No-Build traffic volume networks.

- **University of Massachusetts Office.** The UMass buildings at 333 South Street in Shrewsbury include 664,000± sf of Office/R&D space which is currently ¼ vacant based on discussions with the Town. To account for the full occupancy of the buildings, trips will be added based on the existing trip generation rates and distribution patterns for the buildings. Trips for this project will be included in the future No-Build traffic volume networks.

- **UPS Grafton.** UPS is in discussions with the Town of Grafton to develop a 900,000± sf facility within Centech Park location on Centennial Drive. The project is preliminary and no formal site plans or filings have occurred, therefore, trips for this project will not be included in the future No-Build traffic volume networks.
In summary, to account for future traffic growth in the study area future No-Build traffic volumes will be developed by increasing the existing (2018) volumes by approximately 3.6 percent (0.5 percent compounded annually over 7 years) and adding trips associated with the proposed Point at Hills Farm project as well as vacancies for Charles River Laboratories and UMass both located along South Street.

**Long Range Route 20 Improvements**

Based on a preliminary meeting held with MassDOT District 3 staff on Wednesday October 31, 2018, MassDOT is currently planning improvements along Route 20 in the study area which would include adding additional capacity to the system with improvements to include a four lane cross-section. The Proponent will work will MassDOT to provide a project that is compatible and cohesive with the long range improvements planned for the area.

**Conclusions**

Based on the preliminary information presented in this TSL, we respectfully request your feedback on the TIAS scope. If you have any questions or need additional information to review the TSL, please contact me at 508-303-0370 x104 or via e-mail.

Sincerely,

Robert J. Michaud, P.E.
Managing Principal

Cc: J. Robida, MassDOT District 3
    K. Las, Town of Shrewsbury
    File
ATTACHMENTS

- Seasonal/ Yearly Growth Data
- Trip Generation
- Trip Distribution Calculations
  - Existing Patterns
  - Charles River Patterns
  - UMass Patterns
  - Journey to Work Data
Seasonal Data/ Yearly Growth
## SECTION I - CONTINUOUS COUNTING STATION MONTHLY AVERAGE DAILY TRAFFIC

<table>
<thead>
<tr>
<th>YR</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
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<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>YEAR</th>
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<tr>
<td>07</td>
<td>47,505</td>
<td>47,283</td>
<td>49,268</td>
<td>49,136</td>
<td>50,000</td>
<td>52,000</td>
<td>53,000</td>
<td>52,322</td>
<td>49,031</td>
<td>50,571</td>
<td>49,662</td>
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<td>46,112</td>
<td>47,829</td>
<td>48,816</td>
<td>50,518</td>
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<td>47,490</td>
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<td>49,049</td>
<td>49,474</td>
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<td>47,056</td>
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<td>48,663</td>
<td>47,379</td>
<td>47,664</td>
<td>47,628</td>
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<td>11</td>
<td>43,244</td>
<td>46,150</td>
<td>48,016</td>
<td>48,943</td>
<td>49,781</td>
<td>50,525</td>
<td>46,812</td>
<td>48,234</td>
<td>48,825</td>
<td>49,198</td>
<td>49,151</td>
<td>49,888</td>
<td>48,231</td>
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<tr>
<td>12</td>
<td>46,381</td>
<td>46,883</td>
<td>48,606</td>
<td>48,662</td>
<td>50,126</td>
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<td>49,941</td>
<td>48,882</td>
<td>50,056</td>
<td>50,015</td>
<td>47,600</td>
<td>48,791</td>
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<tr>
<td>13</td>
<td>46,393</td>
<td>46,220</td>
<td>47,421</td>
<td>49,359</td>
<td>50,657</td>
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<td>49,797</td>
<td>49,223</td>
<td>49,935</td>
<td>50,021</td>
<td>49,651</td>
<td>48,441</td>
<td>48,562</td>
</tr>
</tbody>
</table>

**Seasonal Adjustment Factor** (to average month)

|     | 1.07 | 1.04 | 1.01 | 0.99 | 0.97 | 0.98 | 0.99 | 0.99 | 0.98 | 0.98 | 1.01 |

**Growth** -0.65%

Average Yearly Growth Calculated -0.7%
Yearly Growth Factor Used 0.5%

**ITALICS = ESTIMATED DATA**

MADT
Trip Generation
Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 275

**AVERAGE WEEKDAY DAILY**

\[ T = 9.74 \times (X) \]
\[ T = 9.74 \times 275 \]
\[ T = 2678.50 \]

Vehicle trips: 2,678 with 50% entering and 50% exiting.

**WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

\[ T = 1.16 \times (X) \]
\[ T = 1.16 \times 275 \]
\[ T = 319.00 \]

Vehicle trips: 319 with 86% entering and 14% exiting.

**WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

\[ T = 1.15 \times (X) \]
\[ T = 1.15 \times 275 \]
\[ T = 316.25 \]

Vehicle trips: 316 with 16% entering and 84% exiting.

**SATURDAY DAILY**

\[ T = 2.21 \times (X) \]
\[ T = 2.21 \times 275 \]
\[ T = 607.75 \]

Vehicle trips: 608 with 50% entering and 50% exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

\[ T = 0.53 \times (X) \]
\[ T = 0.53 \times 275 \]
\[ T = 145.75 \]

Vehicle trips: 146 with 54% entering and 46% exiting.
Average Vehicle Trips Ends vs: 1,000 sf gross floor area
Independent Variable (X): 275

AVERAGE WEEKDAY DAILY
\[ T = 10.23(X) + 204.68 \]
\[ T = 10.23 \quad 275 \quad + \quad (204.68) \]
\[ T = 3017.93 \]
\[ T = 3,018 \quad \text{vehicle trips} \]
\[ \text{with 50\% (1,509 vpd) entering and 50\% (1,509 vpd) exiting.} \]

WEEKDAY MORNING PEAK HOUR OF GENERATOR
\[ \ln T = 0.88 \ln (X) + 0.59 \]
\[ \ln T = 0.88 \ln \quad 275 \quad + \quad (0.59) \]
\[ \ln T = 5.53 \]
\[ T = 252.84 \]
\[ T = 253 \quad \text{vehicle trips} \]
\[ \text{with 83\% (210 vph) entering and 17\% (43 vph) exiting.} \]

WEEKDAY EVENING PEAK HOUR OF GENERATOR
\[ T = 1.04 * (X) + 12.86 \]
\[ T = 1.04 * \quad 275 \quad + \quad 12.86 \]
\[ T = 298.86 \]
\[ T = 298 \quad \text{vehicle trips} \]
\[ \text{with 16\% (48 vpd) entering and 84\% (250 vpd) exiting.} \]

SATURDAY DAILY
\[ T = 1.25 * (X) + 112.04 \]
\[ T = 1.25 * \quad 275 \quad + \quad 112.04 \]
\[ T = 455.79 \]
\[ T = 456 \quad \text{vehicle trips} \]
\[ \text{with 50\% (228 vpd) entering and 50\% (228 vpd) exiting.} \]

SATURDAY MIDDAY PEAK HOUR OF GENERATOR
\[ T = 0.15 * (X) + 12.67 \]
\[ T = 0.15 * \quad 275 \quad + \quad 12.67 \]
\[ T = 53.92 \]
\[ T = 54 \quad \text{vehicle trips} \]
\[ \text{with 50\% (27 vpd) entering and 50\% (27 vpd) exiting.} \]
Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 450

**AVERAGE WEEKDAY DAILY**

\[ T = 9.74 \times (X) \]

\[ T = 9.74 \times 450 \]

\[ T = 4383.00 \]

\[ T = 4384 \text{ vehicle trips} \]

with 50\% (2,192 vpd) entering and 50\% (2,192 vpd) exiting.

**WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

\[ T = 1.16 \times (X) \]

\[ T = 1.16 \times 450 \]

\[ T = 522.00 \]

\[ T = 522 \text{ vehicle trips} \]

with 86\% (449 vph) entering and 14\% (73 vph) exiting.

**WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

\[ T = 1.15 \times (X) \]

\[ T = 1.15 \times 450 \]

\[ T = 517.50 \]

\[ T = 518 \text{ vehicle trips} \]

with 16\% (83 vph) entering and 84\% (435 vph) exiting.

**SATURDAY DAILY**

\[ T = 2.21 \times (X) \]

\[ T = 2.21 \times 450 \]

\[ T = 994.50 \]

\[ T = 994 \text{ vehicle trips} \]

with 50\% (497 vpd) entering and 50\% (497 vpd) exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

\[ T = 0.53 \times (X) \]

\[ T = 0.53 \times 450 \]

\[ T = 238.50 \]

\[ T = 239 \text{ vehicle trips} \]

with 54\% (129 vph) entering and 46\% (110 vph) exiting.
Average Vehicle Trips Ends vs: 1,000 sf gross floor area
Independent Variable (X): 450

**Average Weekday Daily**

\[ T = 10.23(X) + 204.68 \]
\[ T = 10.23 \times 450 + (204.68) \]
\[ T = 4808.18 \]

T = 4,808 vehicle trips
with 50% (2,404 vpd) entering and 50% (2,404 vpd) exiting.

**Weekday Morning Peak Hour Of Generator**

\[ \ln T = 0.88 \ln (X) + 0.59 \]
\[ \ln T = 0.88 \ln 450 + (0.59) \]
\[ \ln T = 5.97 \]
\[ T = 390.00 \]

T = 390 vehicle trips
with 83% (324 vph) entering and 17% (66 vph) exiting.

**Weekday Evening Peak Hour Of Generator**

\[ T = 1.04 * (X) + 12.86 \]
\[ T = 1.04 * 450 + 12.86 \]
\[ T = 480.86 \]

T = 480 vehicle trips
with 16% (77 vpd) entering and 84% (403 vpd) exiting.

**Saturday Daily**

\[ T = 1.25 * (X) + 112.04 \]
\[ T = 1.25 * 450 + 112.04 \]
\[ T = 674.54 \]

T = 674 vehicle trips
with 50% (337 vpd) entering and 50% (337 vpd) exiting.

**Saturday Midday Peak Hour Of Generator**

\[ T = 0.15 * (X) + 12.67 \]
\[ T = 0.15 * 450 + 12.67 \]
\[ T = 80.17 \]

T = 80 vehicle trips
with 50% (40 vpd) entering and 50% (40 vpd) exiting.
- Trip Distribution Calculations
  - Existing Patterns
  - Charles River Patterns
  - UMass Patterns
  - Journey to Work Data
ATTACHMENT

TRIP-DISTRIBUTION SUMMARY

The directional distribution of development-generated trips on the roadway network is a function of a number of variables including employee place of residence, existing travel patterns along area roadways, and the efficiency of these roadways leading to the site. Journey to Work data published by the US Census, existing travel patterns in the area including the adjacent Charles River and UMass Campuses, driveway restrictions, and area roadway infrastructure will serve as the primary basis for determining the employee trip distribution pattern for the proposed Site. The preliminary average distribution is as follows

TRIP-DISTRIBUTION PATTERNS – UNADJUSTED

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>Office Uses</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Enter</td>
</tr>
<tr>
<td>Route 20 (East)</td>
<td>25%</td>
</tr>
<tr>
<td>Route 20 (West)</td>
<td>15%</td>
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<tr>
<td>Route 9 (East)</td>
<td>5%</td>
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<tr>
<td>Route 9 (West)</td>
<td>40%</td>
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<tr>
<td>South Street (North)</td>
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<td>Cherry Street (North)</td>
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<tr>
<td>Green Street (South)</td>
<td>NEGL.</td>
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<tr>
<td>Centech Boulevard (South)</td>
<td>5%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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</tbody>
</table>

1Existing travel patterns and Journey to Work Census 2010 data for workers within Shrewsbury.

A preliminary review of area infrastructure indicates the general use of Route 20 from the east for inbound trips and a 50/50 split between Route 20 and Route 9 to the east for outbound trips. Likewise, the inbound trips are expected to use Route 9 from the west and South Street from the north for 50% of the inbound trips with a shift of 35% of the exiting trips re-allocated to Route 20 and Route 140 based on area infrastructure at the Route 9 and South Street intersection and anticipated capacity along Route 20 under future conditions. Accordingly, the resulting trip distribution pattern for entering and exiting trips is shown below.
### TRIP-DISTRIBUTION PATTERNS – ADJUSTED FOR AREA INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>Office Uses¹</th>
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<tbody>
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<tr>
<td>Route 20 (East)</td>
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<td>Route 20 (West)</td>
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<td><strong>TOTAL</strong></td>
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</table>

¹Existing travel patterns and Journey to Work Census 2010 data for workers within Shrewsbury with adjustments for area infrastructure.
Trip Distribution Calculations
  - Existing Patterns
- Trip Distribution Calculations
  - Charles River Patterns
Trip Distribution Calculations
  □ UMass Patterns
Trip Distribution Calculations
  - Journey to Work Data
<table>
<thead>
<tr>
<th>Workplace Town</th>
<th>Residence Town</th>
<th>Residence State</th>
<th>All Workers</th>
<th>% of Total Rounded</th>
<th>Route 9 From West</th>
<th>Route 9 From East</th>
<th>Route 20 From West</th>
<th>Route 20 From East</th>
<th>Centrtech Blvd From South</th>
<th>Green Street From South</th>
<th>Cherry Street From North</th>
<th>South Street From North</th>
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</table>
October 24, 2018

Michael Dryden
Bohler Engineering
352 Turnpike Road
Southboro, MA 01772

RE: Wetland Resource Evaluation, Allen Farm, South Street, Shrewsbury, MA

Dear Mike:

On August 30, 31 & September 26, 2018, EcoTec, Inc. inspected the above-referenced property for the presence of wetland resources as defined by: (1) the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, § 40; the “Act”) and its implementing regulations (310 CMR 10.00 et seq.; the “Regulations”); and (2) the U.S. Clean Water Act (i.e., Section 404 and 401 wetlands). Arthur Allen, CPSS, CWS and Scott Morrison, PWS conducted the inspections.

The subject site consists of a 60-acre parcel located between the south side of South Street and the west side of Route 20. The upland portions of the site consist of a paved parking lot, two dilapidated farm structures, overgrown fields and woodlands. The wetland resources observed on the site are described below.

Methodology

The site was inspected, and areas suspected to qualify as wetland resources were identified. The boundary of Bordering Vegetated Wetlands or, in the absence of Bordering Vegetated Wetlands, Bank was delineated in the field in accordance with the definitions set forth in the regulations at 310 CMR 10.55(2)(c) and 310 CMR 10.54(2). Section 10.55(2)(c) states that “The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.” Section 10.54(2)(c) states that “The upper boundary of Bank is the first observable break in the slope or the mean annual flood level, whichever is lower.” The methodology used to delineate Bordering Vegetated Wetlands is further described in: (1) the BVW Policy “BVW: Bordering Vegetated Wetlands Delineation Criteria and Methodology,” issued March 1, 1995; and (2) “Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook,” produced by the Massachusetts Department of Environmental Protection, dated March 1995. The plant taxonomy used in this
report is based on the *National List of Plant Species that Occur in Wetlands: Massachusetts* (Fish and Wildlife Service, U.S. Department of the Interior, 1988). Federal wetlands were presumed to have boundaries conterminous with the delineated Bordering Vegetated Wetlands and Bank. Two sets of DEP Bordering Vegetated Wetland Delineation Field Data Forms completed for observation plots located in the wetlands and uplands near flags AA-8 and AB-5 are attached. The table below provides the Flag Numbers, Flag Type, and Wetland Types and Locations for the delineated wetland resources.

<table>
<thead>
<tr>
<th>Flag Numbers</th>
<th>Flag Type</th>
<th>Wetland Types and Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA-1.6 to AA-87</td>
<td>Blue Flags</td>
<td>Boundary of Bordering Vegetated Wetlands located in the southeasterly portion of the site that is associated with mapped and unmapped intermittent streams.</td>
</tr>
<tr>
<td>AB-1 to AB-44</td>
<td>Blue Flags</td>
<td>Boundary of Bordering Vegetated Wetlands located in the northwesterly portion of the site that is associated with a mapped intermittent stream.</td>
</tr>
<tr>
<td>AC-1 to AC-69</td>
<td>Blue Flags</td>
<td>Boundary of Bordering Vegetated Wetlands located in the westerly portion of the site that is associated with a mapped intermittent stream.</td>
</tr>
<tr>
<td>(AC-1 connects to BA-116)</td>
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<td>BA-1.1 to BA-116</td>
<td>Blue Flags</td>
<td>Boundary of Bordering Vegetated Wetlands located in the north-central portion of the site that is associated with mapped and unmapped intermittent streams.</td>
</tr>
<tr>
<td>(BA-116 connects to AC-1)</td>
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</table>

**Findings**

Wetlands AA, AB & AC consist of contiguous, wooded and shrub swamps and marshes, located in the central portion of the site, that are associated with two mapped and one unmapped intermittent streams. Wetland AB consists of a wooded/shrub swamp, located in the northwesterly portion of the site, that is associated with a mapped intermittent stream. Plant species observed include red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), gray birch (*Betula populifolia*), swamp tupelo (*Nyssa sylvatica*), and American elm (*Ulmus americana*) trees and/or saplings; poison ivy (*Toxicodendron radicans*) climbing woody vines; highbush blueberry (*Vaccinium corymbosum*), common winterberry (*Ilex verticillata*), arrowwood (*Viburnum dentatum*), withe-rod (*Viburnum cassinoides*), northern spicebush (*Lindera benzoin*), swamp rose (*Rosa palustris*), speckled alder (*Alnus rugosa*), silky dogwood (*Cornus amomum*), maleberry (*Lyonia ligustrina*), fetter-bush (*Leucothoe racemosa*), glossy buckthorn (*Rhamnus frangula*), sweet pepper-bush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), and American elderberry (*Sambucus canadensis*) shrubs; and sheep-laurel (*Kalmia angustifolia*), bristly blackberry (*Rubus hispidus*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), sensitive fern (*Onoclea sensibilis*), subarctic lady fern (*Athyrium filix-femina*), marsh fern (*Thelypteris thelypteroides*), Massachusetts fern (*Thelypteris simulata*),
spinulose woodfern (*Dryopteris spinulosa*), skunk-cabbage (*Symplocarpus foetidus*), swamp Jack-in-the-pulpit (*Arisaema triphyllum*), Alaska goldthread (*Coptis trifolia*), spotted touch-me-not (*Impatiens capensis*), shining clubmoss (*Lycopodium lucidulum*), and sphagnum moss (*Sphagnum sp.*). ground cover. Evidence of wetland hydrology, including hydric soils, high groundwater, saturated soils, pore linings, evidence of flooding, and drainage patterns, was observed within the delineated wetlands. These vegetated wetlands border intermittent streams; accordingly, the vegetated wetlands would be regulated as Bordering Vegetated Wetlands and the intermittent streams would be regulated as Bank under the Act. A 100-foot Buffer Zone extends horizontally outward from the edge of Bordering Vegetated Wetlands and Bank under the Act.

Bordering Land Subject to Flooding is an area that floods due to a rise in floodwaters from a bordering waterway or water body. Where flood studies have been completed, the boundary of Bordering Land Subject to Flooding is based upon flood profile data prepared by the National Flood Insurance Program. Section 10.57(2)(a)3. states that “The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm.” The project engineer should evaluate the most recent National Flood Insurance Program flood profile data to determine if Bordering Land Subject to Flooding occurs on the site. Bordering Land Subject to Flooding would occur in areas where the 100-year flood elevation is located outside of or upgradient of the delineated Bordering Vegetated Wetlands or Bank boundary. Bordering Land Subject to Flooding does not have a Buffer Zone under the Act.

The Massachusetts Rivers Protection Act amended the Act to establish an additional wetland resource area: Riverfront Area. Based upon a review of the current USGS Map (attached) and observations made during the site inspection, three streams that are shown as intermittent on the USGS Map are located within the delineated wetlands. The watershed area for the largest stream complex at the site was determined to be 0.24 square miles, which is less than 0.5 square miles (see attached StreamStats watershed calculations). As such, the streams would be designated intermittent under the Massachusetts Wetlands Protection Act regulations. Furthermore, based upon a review of the current USGS Map and observations made during the site inspection, there are no other mapped or unmapped streams located within 200 feet of the site. Accordingly, Riverfront Area would not occur on the site. Riverfront Area does not have a Buffer Zone under the Act.

The Regulations require that no project may be permitted that will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures set forth at 310 CMR 10.59. Based upon a review of the *Massachusetts Natural Heritage Atlas*, 14th edition, Priority Habitats and Estimated Habitats from the NHESP Interactive Viewer, valid from August 1, 2017, and Certified Vernal Pools from MassGIS, there are no Estimated Habitats [for use with the Act and Regulations (310 CMR 10.00 et seq.)], Priority Habitats [for use with Massachusetts Endangered Species Act (M.G.L. Ch. 131A; “MESA”) and MESA Regulations (321
CMR 10.00 et seq.), or Certified Vernal Pools on or in the immediate vicinity of the site. A copy of this map is attached.

The reader should be aware that the regulatory authority for determining wetland jurisdiction rests with local, state, and federal authorities. A brief description of my experience and qualifications is attached. If you have any questions, please feel free to contact me at any time.

Cordially,
ECOTEC, INC.

Arthur Allen, CWS, CPSS
Vice President

Attachments (6, 13 pages)

AA/NOI/ShrewsburySouthCentechNorth Wet Report
Arthur Allen is the Vice President of EcoTec, Inc. and has been a senior environmental scientist there since 1995. His work with EcoTec has involved wetland delineation, wildlife habitat evaluation, environmental permitting (federal, state and local), environmental monitoring, expert testimony, peer reviews, contaminated site assessment and the description, mapping and interpretation of soils. His clients have included private landowners, developers, major corporations and regulatory agencies. Prior to joining EcoTec, Mr. Allen mapped and interpreted soils in Franklin County, MA for the U.S.D.A. Natural Resources Conservation Service (formerly Soil Conservation Service) and was a research soil scientist at Harvard University’s Harvard Forest. Since 1994, Mr. Allen has assisted the Massachusetts Department of Environmental Protection and the Massachusetts Association of Conservation Commissions as an instructor in the interpretation of soils for wetland delineation and for the Title V Soil Evaluator program.

Mr. Allen has a civil service rating as a soil scientist, an undergraduate degree in Natural Resource Studies and a graduate certificate in Soil Studies. His work on the Franklin County soil survey involved interpretation of landscape-soil-water relationships, classifying soils and drainage, and determining use and limitation of the soil units that he delineated. As a soil scientist at the Harvard Forest, Mr. Allen was involved in identifying the legacies of historical land-use in modern soil and vegetation at a number of study sites across southern New England. He has a working knowledge of the chemical and physical properties of soil and water and how these properties interact with the plants that grow on a given site. While at Harvard Forest he authored and presented several papers describing his research results which were later published. In addition to his aforementioned experience, Mr. Allen was previously employed by the Trustees of Reservations as a land manager and by the Town of North Andover, MA as a conservation commission intern.

Education:
1993-Graduate Certificate in Soil Studies, University of New Hampshire
1982-Bachelor of Science in Natural Resource Studies, University of Massachusetts

Professional Affiliations:
Certified Professional Soil Scientist (ARCPACS CPSS #22529)
New Hampshire Certified Wetland Scientist (#19)
Registered Professional Soil Scientist – Society of Soil Scientists of SNE [Board Member (2000-2006)]
Certified Erosion, Sediment & Stormwater Inspector (#965)
Massachusetts Approved Soil Evaluator (#13764)
New England Hydric Soils Technical Committee member
Massachusetts Association of Conservation Commissions member
Society of Wetland Scientists member

Refereed Publications:
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/29/2018 at 3:55:24 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.
StreamStats Report

Region ID: MA
Workspace ID: MA2018082200852750000
Clicked Point (Latitude, Longitude): 42.27016, -71.66712
Time: 2018-08-29 16:08:20 -0400

384-386 South Street, Shrewsbury MA

Basin Characteristics

<table>
<thead>
<tr>
<th>Parameter Code</th>
<th>Parameter Description</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRNAREA</td>
<td>Area that drains to a point on a stream</td>
<td>0.24</td>
<td>square miles</td>
</tr>
<tr>
<td>BSDLDEM250</td>
<td>Mean basin slope computed from 1:250K DEM</td>
<td>2.241</td>
<td>percent</td>
</tr>
<tr>
<td>DRFTPERSTR</td>
<td>Area of stratified drift per unit of stream length</td>
<td>0</td>
<td>square mile per mile</td>
</tr>
<tr>
<td>MAREGION</td>
<td>Region of Massachusetts 0 for Eastern 1 for Western</td>
<td>0</td>
<td>dimensionless</td>
</tr>
</tbody>
</table>

Low-Flow Statistics Parameters

<table>
<thead>
<tr>
<th>Parameter Code</th>
<th>Parameter Name</th>
<th>Value</th>
<th>Units</th>
<th>Min Limit</th>
<th>Max Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRNAREA</td>
<td>Drainage Area</td>
<td>0.24</td>
<td>square miles</td>
<td>1.61</td>
<td>149</td>
</tr>
<tr>
<td>BSDLDEM250</td>
<td>Mean Basin Slope from 250K DEM</td>
<td>2.241</td>
<td>percent</td>
<td>0.32</td>
<td>24.6</td>
</tr>
<tr>
<td>DRFTPERSTR</td>
<td>Stratified Drift per Stream Length</td>
<td>0</td>
<td>square mile per mile</td>
<td>0</td>
<td>1.29</td>
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<td>Massachusetts Region</td>
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<td>dimensionless</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Low-Flow Statistics Citations


One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Low-Flow Statistics Flow Report

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Day 2 Year Low Flow</td>
<td>0.00596</td>
<td>ft^3/s</td>
</tr>
<tr>
<td>7 Day 10 Year Low Flow</td>
<td>0.00151</td>
<td>ft^3/s</td>
</tr>
</tbody>
</table>
### Section I. Vegetation

#### A. Sample layer and plant species
(Enter largest to smallest % cover by layer)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Species/Misc.</th>
<th>Percent Cover (or basal area)</th>
<th>Percent Dominance</th>
<th>Dominant Plant?</th>
<th>Wetland Indicator Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>red oak Quercus rubra</td>
<td>20</td>
<td>20.0</td>
<td>YES</td>
<td>FACU-</td>
</tr>
<tr>
<td></td>
<td>red maple Acer rubrum</td>
<td>80</td>
<td>80.0</td>
<td>YES</td>
<td>FAC *</td>
</tr>
<tr>
<td>Sapling</td>
<td>shagbark hickory Carya ovata</td>
<td>10</td>
<td>100.0</td>
<td>YES</td>
<td>FACU-</td>
</tr>
<tr>
<td>Shrub</td>
<td>white oak Quercus alba</td>
<td>20</td>
<td>40.0</td>
<td>YES</td>
<td>FACU-</td>
</tr>
<tr>
<td></td>
<td>white/red spruce Picea glauca/rubens</td>
<td>10</td>
<td>20.0</td>
<td>YES</td>
<td>FACU</td>
</tr>
<tr>
<td></td>
<td>black cherry Prunus serotina</td>
<td>10</td>
<td>20.0</td>
<td>YES</td>
<td>FACU</td>
</tr>
<tr>
<td></td>
<td>lowbush blueberry Vaccinium angustifolium</td>
<td>10</td>
<td>20.0</td>
<td>YES</td>
<td>FACU</td>
</tr>
<tr>
<td>Ground</td>
<td>sheep laurel Kalmia angustifolia</td>
<td>5</td>
<td>33.3</td>
<td>YES</td>
<td>FAC *</td>
</tr>
<tr>
<td></td>
<td>bracken fern Pteridium aquilinum</td>
<td>5</td>
<td>33.3</td>
<td>YES</td>
<td>FACU</td>
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<tr>
<td></td>
<td>canada mayflower Maianthemum canadense</td>
<td>5</td>
<td>33.3</td>
<td>YES</td>
<td>FAC-</td>
</tr>
</tbody>
</table>

#### Vegetation Conclusions

- **Number of dominant wetland indicator plants**: 2
- **Number of dominant non-wetland indicator plants**: 8

**Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants?**

**No**
DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant: [ ]
Prepared by: EcoTec, Inc
Project Location: South St, Shrewsbury
DEP File #: [ ]

Section II. Indicators of Hydrology

Number: TPU
Transect # AB-5
Date of Delin: 8/31/2018

1. Soil Survey

Is there a published soil survey for this site? [ ]
- title/date
- map number
- soil type mapped
- hydric soil inclusions

Are field observations consistent with soil survey? [ ]

Remarks: [ ]

2. Soil Description

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (inches)</th>
<th>Matrix Color</th>
<th>Mottle Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf Litter</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>2-0</td>
<td>10YR 3/2</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0-6</td>
<td>10YR 5/6</td>
<td></td>
</tr>
<tr>
<td>Bw</td>
<td>6-14</td>
<td>10YR 5/6</td>
<td></td>
</tr>
</tbody>
</table>

Remarks: stony fine sandy loam

3. Other

Conclusion: Is the soil hydric? No

Other Indicators of hydrology (check all that apply):

- Site Inundated
- Depth to free water in observation hole
- Depth to soil saturation in observation hole
- Water marks
- Drift lines
- Sediment Deposits
- Drainage patterns in BVWs
- Oxidized rhizospheres
- Water stained leaves
- Recorded data (stream, lake, or tidal gauge; aerial photo; other):
- Other:

Vegetation and Hydrology Conclusion

Number of wetland indicator plants ≥ number of non-wetland indicator plants
- Yes [ ]
- No [ ]

Wetland hydrology present:
- Hydric soil present
- Other indicators of hydrology present
- Sample Location is in a BVW
- Yes [ ]
- No [ ]
### Section I. Vegetation

<table>
<thead>
<tr>
<th>Layer</th>
<th>Species</th>
<th>Percent Cover (or basal area)</th>
<th>Percent Dominance</th>
<th>Dominant Plant?</th>
<th>Wetland Indicator Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapling</td>
<td>red maple</td>
<td>80</td>
<td>80.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td></td>
<td>eastern red cedar</td>
<td>20</td>
<td>20.0</td>
<td>YES</td>
<td>FACU</td>
</tr>
<tr>
<td>Shrub</td>
<td>panicled dogwood</td>
<td>30</td>
<td>60.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td></td>
<td>Northern arrow-wood</td>
<td>20</td>
<td>40.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>Ground</td>
<td>poison ivy</td>
<td>5</td>
<td>50.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td></td>
<td>yellow sedge</td>
<td>5</td>
<td>50.0</td>
<td>YES</td>
<td>OBL</td>
</tr>
<tr>
<td>Vine</td>
<td>Asiatic bittersweet</td>
<td>10</td>
<td>100.0</td>
<td>YES</td>
<td>NL</td>
</tr>
</tbody>
</table>

### Vegetation Conclusions

- Number of dominant wetland indicator plants: 5
- Number of dominant non-wetland indicator plants: 2
- Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants? **YES**
DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant
Preparing by: EcoTec, Inc
Project Location: South St, Shrewbury
DEP File #

Section II. Indicators of Hydrology
Number: TPW Transect # AA-8 Date of Delin: 8/30/2018

1. Soil Survey
Is there a published soil survey for this site?
- title/date
- map number
- soil type mapped
- hydric soil inclusions

Are field observations consistent with soil survey?

Remarks:

2. Soil Description

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (inches)</th>
<th>Matrix Color</th>
<th>Mottle Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-12</td>
<td>10YR2/2</td>
<td></td>
</tr>
<tr>
<td>Bg</td>
<td>12-15</td>
<td>10YR5/2</td>
<td>10% 7.5YR4/6</td>
</tr>
</tbody>
</table>

3. Other

Remarks: Stony loams

Vegetation and Hydrology Conclusion

Number of wetland indicator plants ≥ number of non-wetland indicator plants

Wetland hydrology present:
- Hydric soil present
- Other indicators of hydrology present

Sample Location is in a BVW

Conclusion: Is the soil hydric? Yes

Other Indicators of hydrology (check all that apply):
- Site Inundated
- Depth to free water in observation hole
- Depth to soil saturation in observation hole
- Water marks
- Drift lines
- Sediment Deposits
- Drainage patterns in BVWs
- Oxidized rhizospheres
- Water stained leaves
- Recorded data (stream, lake, or tidal gauge; aerial photo; other):
- Other:
<table>
<thead>
<tr>
<th>Layer</th>
<th>Species</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Percent Cover or Basal Area</th>
<th>Percent Dominance</th>
<th>Dominant Plant?</th>
<th>Wetland Indicator Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>red maple</td>
<td>Acer rubrum</td>
<td></td>
<td>100</td>
<td>100.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>Sapling</td>
<td>red maple</td>
<td>Acer rubrum</td>
<td></td>
<td>10</td>
<td>50.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td></td>
<td>gray birch</td>
<td>Betula populifolia</td>
<td></td>
<td>10</td>
<td>50.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>Shrub</td>
<td>swamp azalea</td>
<td>Rhododendron viscosum</td>
<td></td>
<td>20</td>
<td>50.0</td>
<td>YES</td>
<td>OBL</td>
</tr>
<tr>
<td></td>
<td>highbush blueberry</td>
<td>Vaccinium corymbosum</td>
<td></td>
<td>10</td>
<td>25.0</td>
<td>YES</td>
<td>FACW-</td>
</tr>
<tr>
<td></td>
<td>sweet pepperbush</td>
<td>Clethra alnifolia</td>
<td></td>
<td>10</td>
<td>25.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>Ground</td>
<td>sensitive fern</td>
<td>Onoclea sensibilis</td>
<td></td>
<td>20</td>
<td>80.0</td>
<td>YES</td>
<td>FACW</td>
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<tr>
<td></td>
<td>horsetail</td>
<td>Equisetum sp.</td>
<td></td>
<td>5</td>
<td>20.0</td>
<td>YES</td>
<td>FAC</td>
</tr>
</tbody>
</table>

**Vegetation Conclusions**

- Number of dominant wetland indicator plants: 8
- Number of dominant non-wetland indicator plants: 0
- Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants? YES
### Section II. Indicators of Hydrology

**Observation Plot Number:** TPW

**Date of Delin:** 8/31/2018

#### 1. Soil Survey

- **Is there a published soil survey for this site?** 
  - [ ] Yes
  - [ ] No

  **Title/Date**
  - 

  **Map Number**
  - 

  **Soil Type Mapped**
  - 

  **Hydric Soil Inclusions**
  - 

- **Are field observations consistent with soil survey?** 
  - Yes
  - No

**Remarks:**

#### 2. Soil Description

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (inches)</th>
<th>Matrix Color</th>
<th>Mottle Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf Litter</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>3-0</td>
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<td></td>
</tr>
<tr>
<td>A</td>
<td>0-12</td>
<td>10YR2/1</td>
<td></td>
</tr>
<tr>
<td>B₆</td>
<td>12-16</td>
<td>10YR5/2</td>
<td>10% 10YR 4/6</td>
</tr>
</tbody>
</table>

**Remarks:** stony fine sandy loams

#### 3. Other

**Remarks:**

**Conclusion: Is the soil hydric?** Yes

**Vegetation and Hydrology Conclusion**

- **Number of wetland indicator plants ≥ number of non-wetland indicator plants**
  - Yes
  - No

- **Wetland hydrology present:**
  - Hydric soil present
  - Other indicators of hydrology present

- **Sample Location is in a BVW**
  - Yes
  - No
## Section I. Vegetation

### A. Sample layer and plant species

<table>
<thead>
<tr>
<th>Layer</th>
<th>Plant Species</th>
<th>Percent Cover (or basal area)</th>
<th>Percent Dominance</th>
<th>Dominant Plant?</th>
<th>Wetland Indicator Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapling</td>
<td>common buckthorn</td>
<td>60</td>
<td>66.7</td>
<td>YES</td>
<td>FAC*</td>
</tr>
<tr>
<td></td>
<td>red maple</td>
<td>10</td>
<td>11.1</td>
<td>NO</td>
<td>FAC*</td>
</tr>
<tr>
<td></td>
<td>eastern red cedar</td>
<td>10</td>
<td>11.1</td>
<td>NO</td>
<td>FACU</td>
</tr>
<tr>
<td></td>
<td>basswood</td>
<td>10</td>
<td>11.1</td>
<td>NO</td>
<td>FACU</td>
</tr>
<tr>
<td>Shrub</td>
<td>panicled dogwood</td>
<td>10</td>
<td>100.0</td>
<td>YES</td>
<td>FAC*</td>
</tr>
<tr>
<td>Ground</td>
<td>multi-flora rose</td>
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<td>25.0</td>
<td>YES</td>
<td>FACU</td>
</tr>
<tr>
<td></td>
<td>Pennsylvania/upland sedge</td>
<td>5</td>
<td>25.0</td>
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<td>NL</td>
</tr>
<tr>
<td></td>
<td>poison ivy</td>
<td>10</td>
<td>50.0</td>
<td>YES</td>
<td>FAC*</td>
</tr>
<tr>
<td>Vine</td>
<td>asiatic bittersweet</td>
<td>30</td>
<td>100.0</td>
<td></td>
<td>NL</td>
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</tbody>
</table>

**Vegetation Conclusions**

- Number of dominant wetland indicator plants: 3
- Number of dominant non-wetland indicator plants: 3
- Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants? YES
### DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

**Section II. Indicators of Hydrology**

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Prepared by: EcoTec, Inc</th>
<th>Project Location: South St, Shrewsbury</th>
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<tr>
<td></td>
<td></td>
<td>Transect # AA-8</td>
<td>8/30/2018</td>
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#### 1. Soil Survey

Is there a published soil survey for this site?
- [ ] Site Inundated
- [ ] Depth to free water in observation hole
- [ ] Depth to soil saturation in observation hole
- [ ] Water marks
- [ ] Drift lines
- [ ] Sediment Deposits
- [ ] Drainage patterns in BVWs
- [ ] Oxidized rhizospheres
- [ ] Water stained leaves
- [ ] Recorded data (stream, lake, or tidal gauge; aerial photo; other):

Are field observations consistent with soil survey?

Remarks:

#### 2. Soil Description

<table>
<thead>
<tr>
<th>Horizon</th>
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<th>Matrix Color</th>
<th>Mottle Color</th>
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<tr>
<td>A</td>
<td>0-10</td>
<td>10YR3/2</td>
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<tr>
<td>Bw</td>
<td>10-15</td>
<td>10YR5/4</td>
<td>5% 7.5YR4/6</td>
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</table>

Remarks: very stony fine sandy loams

#### Vegetation and Hydrology Conclusion

Number of wetland indicator plants ≥ number of non-wetland indicator plants

Wetland hydrology present:
- [ ] Hydric soil present
- [ ] Other indicators of hydrology present

Sample Location is in a BVW

**Conclusion: Is the soil hydric?**

No
REPORT OF GEOTECHNICAL INVESTIGATION

PROPOSED RETAINING WALL AND ROADWAY
CENTECH PARK NORTH
MAP 42, LOT 11
SHREWSBURY, WORCESTER COUNTY, MASSACHUSETTS

Prepared for:

BOHLER ENGINEERING MA, LLC
352 Turnpike Road
Suite 300
Southborough, Massachusetts 01772

Prepared by:

WHITESTONE ASSOCIATES, INC.
352 Turnpike Road
Suite 320
Southborough, Massachusetts 01772

Whitestone Project No.: GM1815882.000
November 12, 2018

Richard W.M. McLaren, P.E.
Senior Consultant

Ryan R. Roy, P.E.
Principal, New England Region

Other Office Locations:

WARREN, NJ   CHALFONT, PA   ROCKY HILL, CT   WALL, NJ   STERLING, VA   EVERGREEN, CO
November 12, 2018

via email

BOHLER ENGINEERING MA, LLC
352 Turnpike Road
Suite 105
Southborough, Massachusetts 01772

Attention: Matthew Smith, P.E.
Principal, New England

Regarding: GEOTECHNICAL INVESTIGATION
PROPOSED RETAINING WALL AND ROADWAY
CENTECH PARK NORTH
MAP 42, LOT 11
SHREWSBURY, WORCESTER COUNTY, MASSACHUSETTS
WHITESTONE PROJECT NO.: GM1815882.000

Dear Mr. Smith:

Whitestone Associates, Inc. (Whitestone) is pleased to submit the attached Report of Geotechnical Investigation for the above-referenced project. The report presents the results of Whitestone’s site visit and subsurface exploration, and includes design recommendations for the proposed foundations, pavement, and related earthwork associated with the proposed retaining wall and roadway.

Whitestone appreciates the opportunity to be of continued service to Bohler Engineering MA, LLC. Please contact us with any questions or comments regarding the enclosed report.

Sincerely,

WHITESTONE ASSOCIATES, INC.

Richard W.M. McLaren, P.E.  Ryan R. Roy, P.E.
Senior Consultant  Principal, New England Region

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WARREN, NJ  908.668.7777  
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EVERGREEN, CO  303.670.6906
# REPORT OF

**GEOTECHNICAL INVESTIGATION**

**PROPOSED RETAINING WALL AND ROADWAY**

CenTech Park North

Map 42, Lot 11

Shrewsbury, Worcester County, Massachusetts

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## Section 1.0 Summary of Findings

Section 1.0 provides an overview of the findings and conclusions of the geotechnical investigation.

## Section 2.0 Introduction

Section 2.0 introduces the report and includes sections on authorization, purpose, and scope.

### Section 2.1 Authorization

Details the authorization for the investigation.

### Section 2.2 Purpose

Outlines the purpose of the investigation.

### Section 2.3 Scope

Describes the scope of the investigation.

## Section 3.0 Site Description

Section 3.0 provides a detailed description of the site, including location, existing conditions, site geology, and proposed construction.

### Section 3.1 Location and Description

Provides a description of the site location.

### Section 3.2 Existing Conditions

Details the existing conditions at the site.

### Section 3.3 Site Geology

Describes the geology of the site.

### Section 3.4 Proposed Construction

Provides details on the proposed construction.

## Section 3.0 Subsurface Conditions

Section 3.0 covers the subsurface conditions at the site, including soil conditions and groundwater.

### Section 4.1 Subsurface Soil Conditions

Details the subsurface soil conditions.

### Section 4.2 Groundwater

Provides information on the groundwater conditions.

## Section 4.0 Conclusions and Recommendations

Section 4.0 includes conclusions and recommendations for the site development.

### Section 5.1 General

Summarizes the general findings and recommendations.

### Section 5.2 Site Preparation and Earthwork

Details the site preparation and earthwork considerations.

### Section 5.3 Structural Fill and Backfill

Provides information on structural fill and backfill.

### Section 5.4 Groundwater Control

Describes the groundwater control measures.

### Section 5.5 Foundations

Details the foundation design and construction.

### Section 5.6 Pavement Design Criteria

Provides criteria for pavement design.

### Section 5.7 Retaining Walls/Lateral Earth Pressures

Details the retaining walls and lateral earth pressures considerations.

### Section 5.8 Seismic and Liquefaction Considerations

Describes seismic and liquefaction considerations.

### Section 5.9 Excavations

Provides information on excavation practices.

### Section 5.10 Supplemental Post Investigation Services

Details supplemental post-investigation services.

## Section 5.0 General Comments

Section 5.0 provides general comments and conclusions.

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**Whitestone Associates, Inc.**

1815882 ROGi Shrewsbury MA
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(Continued)

FIGURES

FIGURE 1  Boring Location Plan

APPENDICES

APPENDIX A  Records of Subsurface Exploration
APPENDIX B  Supplemental Information (USCS, Terms & Symbols)
SECTION 1.0
Summary of Findings

Whitestone has completed an exploration and evaluation of the subsurface conditions for the proposed retaining wall and roadway located at CenTech Park North, southwest of the intersection of South Street and Hartford Turnpike, in the Town of Shrewsbury, Worcester County, Massachusetts. The Town of Shrewsbury intends to develop the 60-acre CenTech Park property. Based on discussions with Bohler Engineering MA, LLC (Bohler) and an October 5, 2018 Boring Location Plan, the proposed development will include construction of a retaining wall and 2,400 lineal feet of roadway. New stormwater management facilities are proposed, but not included in this study.

The geotechnical investigation included performing a reconnaissance of the project site, advancing eight soil borings, and collecting soil samples for characterization. Site subsurface conditions consisted of topsoil/forest mat overlying intermittent existing fill, which is underlain by glacial till, which is in turn underlain by shallow bedrock. Bedrock outcrops were noted at various locations along the proposed roadway alignment. Groundwater was encountered in one of the soil borings at a depth of 3.5 feet below ground surface (fbgs) during the exploration.

The results of the investigation indicate that the proposed retaining wall may bear on the natural glacial till or structural fill placed on the glacial till, or bear on the weathered or competent bedrock or crushed stone placed on the bedrock. Additionally, the site conditions support the use of typical pavement sections using standard State of Massachusetts Department of Transportation (MassDOT) specified materials.

The above summary is intended to provide an overview of the geotechnical findings and recommendations and is not fully developed. Greater detail is presented in the following sections. The entire report must be read for comprehensive understanding of the information contained herein.
SECTION 2.0
Introduction

2.1  AUTHORIZATION

Mr. Michael J. Dryden, Project Manager for Bohler, issued authorization to Whitestone to perform a geotechnical investigation on this site relevant to the construction of a proposed retaining wall and roadway at CenTech Park North in the Town of Shrewsbury, Worcester County, Massachusetts. The geotechnical investigation was performed in general accordance with Whitestone’s revised proposal dated June 14, 2018.

2.2  PURPOSE

The purpose of this exploration and analysis was to:

► ascertain the various soil profile components at test locations;
► estimate the engineering characteristics of the proposed foundation bearing and subgrade materials;
► provide geotechnical criteria for use by the design engineers in preparing the foundation and pavement design;
► provide lateral earth parameters for retaining wall design;
► provide recommendations for required earthwork and subgrade preparation;
► record groundwater and/or bedrock levels (if encountered) at the time of the investigation and discuss the potential impact on the proposed construction; and
► recommend additional investigation and/or analysis, if warranted.

2.3  SCOPE

The scope of the exploration and analysis included the subsurface exploration, field testing and sampling, and a geotechnical engineering analysis and evaluation of the subsurface materials. This Report of Geotechnical Investigation is limited to addressing the site conditions related to the physical support of the proposed construction.

Field exploration of the project site was conducted by means of eight soil borings, identified as B-1 through B-8, which were advanced with an all terrain vehicle (ATV) mounted CME-55 drill rig equipped with hollow stem augers. The soil borings were advanced to termination depths that ranged from approximately 3.3 fbgs to 6.5 fbgs. Soil borings were backfilled with excavated soils generated from the investigation. Test locations are shown on the Boring Location Plan included as Figure 1.
Test locations were based on project information provided to Whitestone at the time of the investigation, including the *Boring Location Plan* from Bohler. The subsurface tests were conducted in the presence of a Whitestone representative, who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. Test locations were established and marked in the field by others prior to Whitestone mobilizing to the site.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D1586. The Standard Penetration Resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthwork and foundations.

Groundwater level observations, where encountered, were recorded during and immediately following the completion of the field operations prior to backfilling the borings. Seasonal variations, temperature effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.
SECTION 3.0
Site Description

3.1 LOCATION AND DESCRIPTION

The subject property is located southwest of South Street in Shrewsbury, Worcester County, Massachusetts, Latitude 42.2692 North, Longitude 71.6931 West. The property, which is identified further as Map 42, Lot 11, is undeveloped. The proposed retaining wall and roadway will extend to the southwest from South Street.

The site is irregularly shaped, bounded to the northeast by South Street and in other directions by undeveloped, wooded land. Access to the site is from South Street. The site of the proposed construction is shown on the Boring Location Plan included as Figure 1.

3.2 EXISTING CONDITIONS

Existing Development: At the time of Whitestone’s investigation, the subject site was undeveloped and wooded.

Topography: Based on a review of the USGS 7.5 Minute Series Shrewsbury Quadrangle, Massachusetts (2018), the Boring Location Plan by Bohler, and Whitestone’s visual observations, the site slopes down to the southeast from about 525 feet above National American Vertical Datum of 1988 (NAVD) to 510 feet above NAVD.

Utilities: The site is not serviced by underground utilities. The utility information contained in this report is presented for general discussion only and is not intended for construction purposes.

Site Drainage: Surface run-off generally consists of flow to the southeast towards the wetlands area adjacent to the site.

3.3 SITE GEOLOGY

From a review of the Surficial Geologic Map of the Shrewsbury Quadrangle, Worcester County, Massachusetts (1969), the site is underlain by glacial till. The Geologic Map of Massachusetts (1983), prepared by U.S. Geological Survey, indicates that the subject property is underlain by Ordovician or Proterozoic Z-aged Nashoba Formation, consisting of schist and gneiss, with minor calc-silicate rock, amphibolite, and marble, part of the Nashoba Zone.
3.4 PROPOSED CONSTRUCTION

The Town of Shrewsbury intends to develop the 60-acre CenTech Park property. Based on the aforementioned Boring Location Plan, the proposed development will include construction of a retaining wall and 2,400 lineal feet of roadway. New stormwater management facilities are proposed, but not included in this study.

Whitestone anticipates the proposed retaining wall will be a mechanically stabilized earth (MSE) wall, up to about 10 feet in height, with masonry block facing and the retained earth reinforced with geogrid.

The scope of Whitestone’s investigation and the professional advice contained in this report were generated based on the project details and loading noted herein. Revisions or additions to the design details enumerated in this report should be brought to the attention of Whitestone for additional evaluation as warranted.
SECTION 3.0
Subsurface Conditions

Details of the subsurface materials encountered are presented on the Records of Subsurface Exploration in Appendix A of this report. The subsurface soil conditions encountered in the test locations consisted of the following generalized strata in order of increasing depth.

4.1 SUBSURFACE SOIL CONDITIONS

Surface Cover Materials: The explorations encountered three inches to eight inches of topsoil or three inches to four inches of forest mat at the ground surface.

Existing Fill (intermittent): Beneath the surface cover materials, boring B-1, which is at the northeast end of the roadway alignment, encountered existing fill, consisting of brown, medium dense, poorly graded sand with gravel. The SPT N-value recorded within the existing fill was 18 blows per foot (bpf). A six-inch thick layer of former topsoil was encountered under the existing fill.

Glacial Till: Beneath the surface cover materials or existing fill, the borings encountered natural glacial till, consisting of brown, medium dense to very dense (surficially very loose to loose), silty sand with gravel (USCS: SM). SPT N-values recorded within the glacial till were variable, ranging from two bpf to 82 bpf.

Apparent Bedrock: The explorations encountered refusal on probable bedrock at depths ranging from 3.3 fbgs to 6.5 fbgs. Refusal materials were not sampled through rock coring efforts. Rock coring techniques would be required to further characterize the nature and extent of the refusal materials. Bedrock outcrops were noted at various locations along the roadway alignment.

4.2 GROUNDWATER

Static groundwater was encountered in one of the soil borings (B-7) at a depth of 3.5 fbgs during the exploration. However, static and perched/trapped water conditions generally will fluctuate seasonally and following periods of precipitation.
SECTION 4.0
Conclusions and Recommendations

5.1 GENERAL

The results of the investigation indicate that the proposed retaining wall may bear on the natural glacial till or structural fill placed on the glacial till, or bear on the weathered or competent bedrock or crushed stone placed on the bedrock. The site conditions support the use of typical pavement sections using standard MassDOT-specified materials.

5.2 SITE PREPARATION AND EARTHWORK

Surface Cover Stripping: Prior to stripping operations, utilities should be identified and secured. The organic material to be stripped should be removed from within and at least five feet beyond the limits of the proposed retaining wall and pavement areas. The contractor should be required to perform earthwork in accordance with the recommendations in this report, including backfilling any excavation with structural fill. Fill or backfill placed within areas requiring structural support should be placed as structural fill in accordance with Section 5.2, 5.3, and 5.10 of this report.

Excavation Difficulties: Shallow bedrock and cobbles and boulders typically encountered in glacial till may present excavation difficulties at marginal depths below the ground surface during proposed site excavations. Excavation difficulties will be affected by excavation size and depth. The speed and ease of excavation also will depend on the type of equipment used, the skill of the operator, and the geological structure of the bedrock, such as spacing between discontinuities and planes of weakness. Whitestone expects that the upper one foot to two feet of weathered bedrock may be removable with standard heavy excavation equipment. However, pneumatic hammers would likely be required to remove more resistant bedrock. Consideration could be given to blasting, depending on the depth of any excavation into the bedrock.

Surface Preparation/Proofrolling: Before placing fill or granular subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton vibratory roller. The surface should then be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets that may require removal and replacement, or further evaluation. Proofrolling should be performed after a suitable period of dry weather to reduce the likelihood of degrading an otherwise stable subgrade. Fill or backfill should be placed and compacted in accordance with Section 5.3.

Bedrock Subgrade Preparation: Bedrock slopes should not be steeper than 4:1 (horizontal:vertical). Bedrock steeper than 4:1 (horizontal:vertical) should be stepped. Loose bedrock should be removed from the subgrade prior to placement of crushed stone. Bedrock fractures and joints should be tight. Bedrock
joints, fractures, or fissures greater than 0.25-inch in width should be filled with lean concrete. Only minus 0.75-inch crushed stone should be placed directly over the bedrock. Structural fill (sand and gravel) should not be placed directly on the bedrock surface to reduce the likelihood of migration of fines into the bedrock.

**Weather Performance Criteria:** Every effort should be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations and prepared subgrades to rainfall. Accordingly, excavation and fill placement procedures should be performed during favorable weather conditions. Overexcavation of wet or disturbed soils and replacement with controlled structural fill per Section 5.3 of this report may be required prior to resuming work on subgrade soils.

**Subgrade Protection and Maintenance:** The site soils may degrade if exposed to inclement weather, freeze-thaw cycles, or repeated construction traffic. However, if properly protected and maintained as recommended herein, the site soils will provide adequate support for the proposed construction. The site contractors should employ appropriate means and methods to protect the subgrade including, but not limited to the following:

- sealing exposed subgrade soils on a daily basis with a smooth drum roller operated in static mode;
- regrading the site as needed to maintain positive drainage away from open earthwork construction areas and to prevent standing water;
- removing wet surficial soils immediately; and
- limiting exposure to construction traffic and precipitation especially following inclement weather and subgrade thawing.

**5.3 STRUCTURAL FILL AND BACKFILL**

**Imported Fill Material:** Imported material placed as structural fill or backfill to raise elevations or restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and up to 15 percent, by weight, of material finer than a #200 sieve. Imported material should be free of silt, clay, organics, and deleterious material. Imported material should be approved by a qualified geotechnical engineer prior to delivery to the site.

**On-Site Material Reuse:** Whitestone anticipates that portions of the natural glacial till and the existing fill materials will be structurally suitable for selective reuse as fill/backfill material, provided that soil moisture contents are controlled within three percent of optimum moisture level, particles larger than three inches in diameter are either removed or crushed, and objectionable portions, such as organics, are segregated. Reuse of the glacial till and existing fill materials will be contingent on careful review in the field by the owner's geotechnical engineer by visual observation during construction as recommended herein.

**Compaction and Placement Requirements:** Fill and backfill should be placed in maximum eight-inch thick loose lifts and compacted using a vibratory drum roller during mass grading activities or a small
hand-held vibratory compactor within excavations. Structural fill and backfill should be compacted to at least 95 percent of the maximum dry density within three percent of the optimum moisture content, as determined by ASTM D1557 (Modified Proctor).

**Structural Fill Testing:** A sample of the imported fill material or on-site material proposed for reuse as structural fill or backfill should be submitted to the owner’s geotechnical engineer for analysis and approval at least one week prior to its use. The placement of fill and backfill should be monitored by a qualified engineering technician, so that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed, so that the specified compaction is achieved throughout the height of the fill or backfill.

### 5.4 GROUNDWATER CONTROL

Static groundwater was encountered within one of the soil borings during this investigation at a depth that may impact foundation construction and excavation for utilities. Water perched on the bedrock surface may be encountered during construction. As such, construction phase dewatering may consist of removing surface water runoff, infiltrating water, or trapped water. Whitestone anticipates that construction phase dewatering, if required, will include installing temporary sump pits and pumps within trenches and excavations.

Proper grading and drainage should be incorporated into the site design and construction phase grading to discourage ponding of surface runoff. Every effort should be made to maintain drainage of surface runoff away from construction areas by grading. The contractor should limit exposure of excavations and prepared subgrades to rainfall. Overexcavation of wet soils and replacement with controlled structural fill per Section 5.3 of this report may be required prior to resuming work on disturbed subgrade soils.

### 5.5 FOUNDATIONS

**Shallow Foundations:** Whitestone considers that the proposed retaining wall may bear on the natural glacial till or structural fill placed on the glacial till, or bear on the weathered or competent bedrock or crushed stone placed on the bedrock, provided these materials are properly evaluated, placed and compacted in accordance with Sections 5.2, 5.3, and 5.10 of this report. Sand and gravel fill should not be placed directly on the bedrock surface to reduce the likelihood of fine soils migrating into cracks and crevices in the bedrock. Following in-trench compaction of foundation subgrades, foundations bearing within these materials may be designed to impart a maximum net allowable bearing pressure of 5,000 pounds per square foot.

All footing excavation bottoms should be compacted in place by hand-operated compaction equipment in the presence of the geotechnical engineer to densify isolated loose zones and soil disturbed by excavation. Regardless of loading conditions, proposed foundations should be sized no less than a minimum width of 24 inches.
Footings should be designed such that the maximum toe pressure due to the combined effect of vertical loads (including soil weight) and overturning moment does not exceed the recommended maximum allowable bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete footing. Side friction should be neglected when proportioning the footings; lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction (ultimate) against sliding of 0.4 is recommended for use in the design of the foundations bearing within the site soils or imported structural fill.

**Foundation Inspection:** Whitestone recommends that the suitability of the bearing soils along new footing bottoms be reviewed by a geotechnical engineer prior to constructing the footings. Special attention should be given to any areas of the site underlain by soft/loose conditions. In the event that isolated areas of unsuitable materials are encountered in footing excavations, overexcavation and replacement of the materials or deeper foundation embedment may be necessary to provide a suitable footing subgrade. Overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation.

**Settlement:** Whitestone estimates post construction settlements of new retaining wall foundations will be on the order of less than one inch, if the recommendations outlined in this report are properly implemented. Differential settlements of new foundations should be less than one half inch along a horizontal distance of 50 feet.

**Frost Coverage:** Footings subject to frost action should be placed at least 48 inches below adjacent exterior grades, in accordance with the Commonwealth of Massachusetts *State Building Code (Ninth Edition)*, to provide protection from frost penetration.

**Foundation Inspection:** Whitestone recommends that the suitability of the bearing soils along footing bottoms be reviewed by a Whitestone geotechnical engineer prior to placing concrete for the footings. Special attention should be given to areas of the site underlain by any soft/loose conditions. Following review by the owner’s geotechnical engineer, the exposed soil subgrade may be compacted.

## 5.6 PAVEMENT DESIGN CRITERIA

**General:** Whitestone anticipates that the properly inspected and approved glacial till or existing fill, and/or compacted structural fill or backfill placed to raise or restore design elevations, will be suitable for support of the proposed pavements, provided these materials are properly evaluated, compacted, and proofrolled in accordance with Sections 5.2, 5.3, and 5.10 of this report during favorable weather conditions.
**Design Criteria:** A California Bearing Ratio value of 8.0 has been assigned to the properly prepared subgrade soils for pavement design purposes. This value was correlated with pertinent soil support values and assumed traffic loading to prepare a flexible pavement design per the AASHTO *Guide for the Design of Pavement Structures*.

Design traffic loading was assumed based on typical volumes for similar roadways and correlated with 18-kip equivalent single axle loads (ESAL) for a 20-year life. Estimated maximum pavement loading of 150,000 ESALs was used.

**Pavement Sections:** Pavement components should meet material specifications from MassDOT *Standard Specifications* specified below. The recommended flexible pavement section is tabulated below:

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<td>MassDOT M3.11.03 Table A “Binder Course”</td>
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<tr>
<td>Granular Subbase</td>
<td>MassDOT M2.01.7 Dense-graded Crushed Stone for Sub-Base</td>
<td>12.0</td>
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</tbody>
</table>

**Additional Design Considerations:** The pavement section thickness design presented in this report is based on the design parameters detailed herein and is contingent on proper construction, inspection, and maintenance. Additional pavement thickness may be required by local code. The design is contingent on achieving the minimum soil support value in the field. To accomplish this requirement, subgrade soil and supporting fill or backfill should be placed, compacted, and evaluated in accordance with Sections 5.2, 5.3, and 5.10 of this report. Proper drainage should be provided for the pavement structure, including appropriate grading and surface water control, and an edge drain on the uphill side of the roadway.

The performance of the pavement also will depend on the quality of materials and workmanship. Whitestone recommends that MassDOT standards for materials, workmanship, and maintenance be applied to this site. Project specifications should include verifying that the installed asphaltic concrete material composition is within tolerance for the specified materials and that the percentage of air voids of the installed pavement is within specified ranges for the respective materials.

**5.7 RETAINING WALLS/LATERAL EARTH PRESSURES**

**General:** The following parameters may be used for design of the proposed site retaining wall, any below-grade walls, and other structures reliant on granular materials to provide adequate drainage.

**Lateral Earth Pressures:** Any retaining/below-grade walls should be capable of withstanding active and at-rest earth pressures. With an active earth pressure coefficient ($K_a$) of 0.33 and assuming a level
backfill and an assumed maximum backfill soil unit weight of 140 pounds per cubic foot (pcf), an equivalent fluid pressure of 46 psf per foot of wall height should be used in design of retaining/below-grade walls which are free to rotate.

Retaining/below-grade walls and wall corners that are restrained from lateral movement should be designed using at-rest earth pressures. A coefficient of at-rest earth pressure ($K_o$) of 0.50, for a level backfill, is recommended for retaining/below-grade walls designed to resist at-rest earth pressures, which assume no lateral movement. With an assumed maximum total unit weight of backfill of approximately 140 pcf, an equivalent fluid pressure of 70 pounds per square foot per foot of wall height should be used in design of restrained retaining/below-grade wall and wall corners. A coefficient of friction of 0.4 against sliding can be used for concrete on the existing site soils. Additional lateral earth pressures from a sloped backfill or any temporary or long term surcharge loads also should be included in the design. Retaining wall design should include a global stability analysis.

**Backfill Criteria:** Whitestone recommends that granular soils be used to backfill behind retaining walls. The granular backfill materials should consist of clean, relatively well graded sand or gravel. Whitestone recommends that backfill directly behind walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone of influence measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

Positive drainage should be provided at the base of the below-grade walls. Where wall drainage is not provided, the wall should be designed to withstand full hydrostatic pressure.

Whitestone should be notified if any other retaining structures or design considerations requiring lateral earth pressure estimations are proposed. Specific recommendations for temporary retaining structures are beyond Whitestone’s scope of services.

### 5.8 SEISMIC AND LIQUEFACTION CONSIDERATIONS

The subsurface conditions are most consistent with a Site Class C, as defined by the Commonwealth of Massachusetts *State Building Code (Ninth Edition)*. The site soils are not susceptible to earthquake induced liquefaction.

### 5.9 EXCAVATIONS

The existing fill materials and natural glacial till encountered during this investigation typically are, at a minimum, consistent with Type C Soil Conditions, as defined by 29 CFR Part 1926 (OSHA), which require a maximum unbraced excavation angle of 1.5:1 (horizontal:vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA), so that safe excavation methods and/or shoring and bracing requirements are implemented.
bedrock may be excavated at an angle of 1:6 (horizontal:vertical). A steeper excavation angle in the bedrock may be feasible, if the exposed bedrock is reviewed by a professional engineer or geologist.

5.10 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Inspection and Monitoring: The owner’s geotechnical engineer with specific knowledge of the site subsurface conditions and design intent should perform inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be performed to check that the existing surface cover materials are properly removed, any encountered underground structures are properly backfilled, and suitable materials, used for controlled fill, are properly placed and compacted over suitable subgrade soils. The proofrolling of all subgrades prior to foundation and pavement support should be witnessed and documented by the owner’s geotechnical engineer.
SECTION 5.0
General Comments

Supplemental recommendations may be required upon finalization of construction plans or if significant changes are made in the characteristics or location of the proposed structure. Soil/rock bearing conditions should be checked at the appropriate time for consistency with those conditions encountered during Whitestone’s geotechnical investigation.

The recommendations presented herein should be utilized by a qualified engineer in preparing the project plans and specifications. The engineer should consider these recommendations as minimum physical standards, which may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the sole use of Bohler Engineering MA, LLC for the specific project detailed and should not be used by any third party. These recommendations are relevant to the design phase and should not be substituted for construction specifications.

The possibility exists that conditions between borings may differ from those at specific test locations, and conditions may not be as anticipated by the designers or contractors. In addition, the construction process may alter soil and rock conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered.

Whitestone assumes that a qualified contractor will be employed to perform the construction work, and that the contractor will be required to exercise care to ensure excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

Whitestone recommends that the services of the geotechnical engineer be engaged to test and evaluate the soils in the footing excavations prior to concreting in order to determine that the soils will support the bearing pressures. Monitoring and testing also should be performed to check that suitable materials are used for controlled fills and that they are properly placed and compacted over suitable subgrade soils.

The exploration and analysis of the foundation conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the foundation design. The recommendations submitted for the proposed construction are based on the available soil information and the design details furnished by Bohler Engineering MA, LLC. Deviations from the noted subsurface conditions encountered during construction should be brought to the attention of the geotechnical engineer.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties, express or implied, are made.
FIGURE 1
Boring Location Plan
APPENDIX A
Records of Subsurface Exploration
**Project:** Proposed Centech Park North Roadway  
**Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts  
**Client:** Bohler Engineering MA, LLC  
**WAI Project No.:** GM1815882.000  

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<td>HSA / SPT</td>
<td>Contractor:</td>
<td>PG</td>
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<td>Equipment:</td>
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**RECORD OF SUBSURFACE EXPLORATION**  
**Boring No.:** B-1  
**Record of Boring:** 1815882 Shrewsbury MA - Logs 11/9/2018

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**STRATA**  
**DESCRIPTION OF MATERIALS (Classification)**  
**REMARKS**

- **EXISTING FILL**: Brown, Medium Dense, Poorly Graded Sand with Gravel (FILL)
- **Boring Log B-1 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 6.0 Feet Below Ground Surface.**

**NOTES:** bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched
### RECORD OF SUBSURFACE EXPLORATION

**Project:** Proposed Centech Park North Roadway  
**WAI Project No.:** GM1815882.000

**Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts  
**Client:** Bohler Engineering MA, LLC

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<td>Drill / Test Method</td>
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**Date Started:** 10/9/2018  
**Water Depth | Elevation:**  (feet bgs) | (feet NAVD88)

**Date Completed:** 10/9/2018  
**Cave-In Depth | Elevation:**  (feet bgs) | (feet NAVD88)

**Logged By:** DC  
**Contractor:** PG  
**Equipment:** CME-55

**Equipment:** CME-55  
**Drill / Test Method:** HSA / SPT  
**Contractor:** PG

---

**SAMPLE INFORMATION**

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**STRATA**

- **TS:** 5" Topsoil
- **GLACIAL TILL:** Brown, Medium Dense, Silty Sand with Gravel, Cobbles (SM)

**REMARKS**

- Boring Log B-2 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 3.3 Feet Below Ground Surface.

---

**NOTES:** bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

---

**RECORD OF SUBSURFACE EXPLORATION**

1815882 Shrewsbury MA - Logs 11/9/2018
**Project:** Proposed Centech Park North Roadway  
**Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts  
**Client:** Bohler Engineering MA, LLC  
**WAI Project No.:** GM1815882.000  
**Date Started:** 10/9/2018  
**Date Completed:** 10/9/2018  
**Contractor:** PG  
**Equipment:** CME-55  
**Drill / Test Method:** HSA / SPT  
**Logged By:** DC  

### Sample Information

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#### Stratification

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- Offset 10 Feet to SW - Auger Refusal at 4 Feet

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<td>GLACIAL TILL</td>
<td>As Above, Very Dense (SM)</td>
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- Boring Log B-3 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 4.0 Feet Below Ground Surface.

### Notes:
- bgs = below ground surface
- msl = mean sea level
- NA = Not Applicable
- NE = Not Encountered
- NS = Not Surveyed
- P = Perched
## RECORD OF SUBSURFACE EXPLORATION

### Project Information
- **Project:** Proposed Centech Park North Roadway
- **Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts
- **Client:** Bohler Engineering MA, LLC
- **WAI Project No.:** GM1815882.000

### Surface Elevation
- **Surface Elevation:** ± NS feet above NAVD88
- **Termination Depth:** 4.5 feet bgs

### Proposed Location
- **Proposed Location:** Retaining Wall

### Drill / Test Method
- **Drill / Test Method:** HSA / SPT

### Date Details
- **Date Started:** 10/9/2018
- **Date Completed:** 10/9/2018

### Equipment
- **Equipment:** CME-55

### Water Depth
- **Water Depth | Elevation:** (feet bgs) | (feet NAVD88)

### Cave-In Depth
- **Cave-In Depth | Elevation:** (feet bgs) | (feet NAVD88)

### During
- **During:** -- --

### At Completion
- **At Completion:** -- --

### 24 Hours
- **24 Hours:** -- --

### Log Data

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### Description of Materials
- **STRATA:**
  - **TS:** 5" Topsoil
  - **GLACIAL TILL:** Brown, Loose, Silty Sand with Gravel (SM)
  - **As Above, Dense (SM):**

### Remarks
- **RECORD OF Boring No.:** B-4
- **Boring Log B-4 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 4.5 Feet Below Ground Surface.**

### Notes
- bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

---

**RECORD OF SUBSURFACE EXPLORATION**

1815882 Shrewsbury MA - Logs 11/9/2018
# RECORD OF SUBSURFACE EXPLORATION

## Boring No.: B-5

### Project Information
- **Project:** Proposed Centech Park North Roadway
- **Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts
- **Client:** Bohler Engineering MA, LLC
- **WAI Project No.:** GM1815882.000

### Subsurface Exploration Details
- **Surface Elevation:** ± NS feet above NAVD88
- **Termination Depth:** 6.5 feet bgs
- **Proposed Location:** Retaining Wall
- **Drill / Test Method:** HSA / SPT
- **Date Started:** 10/9/2018
- **Date Completed:** 10/9/2018
- **Logged By:** DC
- **Contractor:** PG
- **Equipment:** CME-55
- **Water Depth:**
  - **Elevation:** (feet bgs) / (feet NAVD88)
- **Cave-In Depth:**
  - **Elevation:** (feet bgs) / (feet NAVD88)
- **Equipment:**
  - **24 Hours:**
  - **Remarks:**

### Sample Information

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### Strata Description

- **TS:** 7" Topsoil
- **Brown, Loose, Silty Sand with Gravel (SM)**
- **GLACIAL TILL:** As Above, Medium Dense (SM)
- **As Above, Very Dense (SM)**

### Remarks
- Boring Log B-5 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 6.5 Feet Below Ground Surface.

---

**NOTES:** bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

---

**RECORD OF SUBSURFACE EXPLORATION**

1815882 Shrewsbury MA - Logs 11/9/2018
Boring No.: B-6

**RECORD OF SUBSURFACE EXPLORATION**

**Project:** Proposed Centech Park North Roadway  
**Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts  
**Client:** Bohler Engineering MA, LLC  
**WAI Project No.:** GM1815882.000

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**STRATA**  
- S-1: Brown, Very Loose, Silty Sand with Gravel (SM)  
- S-2: As Above, Medium Dense (SM)

**DESCRIPTION OF MATERIALS (Classification)**

**REMARKS:** Boring Log E-6 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 4.5 Feet Below Ground Surface.

--

**NOTES:** bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched
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**Project:** Proposed Centech Park North Roadway  
**Location:** South Street and Hartford Turnpike, Shrewsbury, Worcester, Massachusetts  
**Client:** Bohler Engineering MA, LLC  
**WAI Project No.:** GM1815882.000

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**STRATA**

- **TS** 4" Forest Mat
- **GLACIAL TILL** Brown, Dense, Silty Sand with Gravel (SM)  
- **As Above, Medium Dense (SM)**

**REMARKS:** Boring Log B-8 Terminated Upon Auger Refusal on Probable Bedrock at a Depth of 5.0 Feet Below Ground Surface.

**NOTES:** bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

**SITE CONDITIONS**

- **Surface Elevation:** ± NS feet above NAVD88
- **Termination Depth:** 5.0 feet bgs
- **Proposed Location:** Retaining Wall
- **Drill / Test Method:** HSA / SPT
- **Equipment:** CME-55
- **Date Started:** 10/9/2018
- **Date Completed:** 10/9/2018
- **Logged By:** DC
- **Contractor:** PG
- **At Completion:** --

**RECORD OF SUBSURFACE EXPLORATION**

**SAMPLE INFORMATION**

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**Water Depth | Elevation**

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**Cave-In Depth | Elevation**

<table>
<thead>
<tr>
<th>Cave-In Depth</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**24 Hours**

- **Equipment:** CME-55

**24 Hours**

- **Date Started:** 10/9/2018
- **Date Completed:** 10/9/2018
- **Logged By:** DC
- **Contractor:** PG
- **At Completion:** --

**RECORD OF SUBSURFACE EXPLORATION**

**1815882 Shrewsbury MA - Logs 11/9/2018**
APPENDIX B
Supplemental Information
(USCS, Terms and Symbols)
## UNIFIED SOIL CLASSIFICATION SYSTEM

### SOIL CLASSIFICATION CHART

<table>
<thead>
<tr>
<th>MAJOR DIVISIONS</th>
<th>LETTER SYMBOL</th>
<th>TYPICAL DESCRIPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL AND GRAVELLY SOILS</td>
<td>GW</td>
<td>WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES</td>
</tr>
<tr>
<td>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE</td>
<td>GP</td>
<td>POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES</td>
</tr>
<tr>
<td>SAND AND SANDY SOILS</td>
<td>GM</td>
<td>SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES</td>
</tr>
<tr>
<td>MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE</td>
<td>GC</td>
<td>CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES</td>
</tr>
<tr>
<td>CLEAN SAND (LITTLE OR NO FINES)</td>
<td>SW</td>
<td>WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES</td>
</tr>
<tr>
<td>SANDS WITH FINES (APPRECIALE AMOUNT OF FINES)</td>
<td>SP</td>
<td>POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES</td>
</tr>
<tr>
<td>CLEAN GRAVELS (LITTLE OR NO FINES)</td>
<td>SM</td>
<td>SILTY SANDS, SAND-SILT MIXTURES</td>
</tr>
<tr>
<td>GRAVELS WITH FINES (APPRECIALE AMOUNT OF FINES)</td>
<td>SC</td>
<td>CLAYEY SANDS, SAND-CLAY MIXTURES</td>
</tr>
<tr>
<td>INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY</td>
<td>ML</td>
<td></td>
</tr>
<tr>
<td>INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td>ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY</td>
<td>OL</td>
<td></td>
</tr>
<tr>
<td>INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS</td>
<td>MH</td>
<td></td>
</tr>
<tr>
<td>INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS</td>
<td>CH</td>
<td></td>
</tr>
<tr>
<td>ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS</td>
<td>OH</td>
<td></td>
</tr>
<tr>
<td>PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS</td>
<td>PT</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

### GRADATION

<table>
<thead>
<tr>
<th>% FINER BY WEIGHT</th>
<th>RELATIVE DENSITY</th>
<th>RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACE .......... 1% TO 10%</td>
<td>LOOSE............. 0% TO 40%</td>
<td>VERY SOFT ...... LESS THAN 250</td>
</tr>
<tr>
<td>LITTLE......... 10% TO 20%</td>
<td>MEDIUM DENSE..... 40% TO 70%</td>
<td>SOFT............... 250 TO 500</td>
</tr>
<tr>
<td>SOME........... 20% TO 35%</td>
<td>DENSE............ 70% TO 90%</td>
<td>MEDIUM............ 500 TO 1000</td>
</tr>
<tr>
<td>AND............ 35% TO 50%</td>
<td>VERY DENSE....... 90% TO 100%</td>
<td>STIFF............... 1000 TO 2000</td>
</tr>
</tbody>
</table>

*VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

---

**Other Office Locations:**

- **Warren, NJ:** 908.668.7777
- **Chalfont, PA:** 215.712.2700
- **Rocky Hill, CT:** 860.726.7889
- **Wall, NJ:** 732.592.2101
- **Sterling, VA:** 703.464.5858
- **Evergreen, CO:** 303.670.6905
SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
Pl: Plasticity index, %.
δd: Natural dry density, PCF.
▽: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ¾” I.D., 2” O.D., except where noted.
ST: Shelby Tube - 3” O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

<table>
<thead>
<tr>
<th>Term (Non-Cohesive Soils)</th>
<th>Standard Penetration Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>0-4</td>
</tr>
<tr>
<td>Loose</td>
<td>4-10</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>10-30</td>
</tr>
<tr>
<td>Dense</td>
<td>30-50</td>
</tr>
<tr>
<td>Very Dense</td>
<td>Over 50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term (Cohesive Soils)</th>
<th>Qu (TSF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>0 - 0.25</td>
</tr>
<tr>
<td>Soft</td>
<td>0.25 - 0.50</td>
</tr>
<tr>
<td>Firm (Medium)</td>
<td>0.50 - 1.00</td>
</tr>
<tr>
<td>Stiff</td>
<td>1.00 - 2.00</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>2.00 - 4.00</td>
</tr>
<tr>
<td>Hard</td>
<td>4.00+</td>
</tr>
</tbody>
</table>

PARTICLE SIZE

<table>
<thead>
<tr>
<th>Particle Type</th>
<th>Size</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulders</td>
<td>8 in.+</td>
<td>Coarse Sand</td>
</tr>
<tr>
<td>Cobbles</td>
<td>8 in.-3 in.</td>
<td>Medium Sand</td>
</tr>
<tr>
<td>Gravel</td>
<td>3 in.-5mm</td>
<td>Fine Sand</td>
</tr>
</tbody>
</table>

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APPENDIX D: LIST OF REQUIRED PERMITS
LIST OF REQUIRED PERMITS

LOCAL PERMITS

Preliminary and Definitive Subdivision – Shrewsbury Planning Board

Site Plan Approval – Shrewsbury Planning Board

Special Permits (Potentially Required) – Shrewsbury Planning Board

Order of Conditions – Shrewsbury Conservation Commission

STATE PERMITS

Highway Access Permit - Massachusetts Department of Transportation

FEDERAL PERMITS

Construction General Permit (CGP): National Pollutant Discharge Elimination System (NPDES)
APPENDIX E: PUBLIC NOTICE OF ENVIRONMENTAL REVIEW
A. PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Centech Park North
LOCATION: 384-386 South Street, Shrewsbury, MA

PROPOSENT: Town of Shrewsbury

The undersigned is submitting an Environmental Notification Form ("ENF") to the Secretary of Energy & Environmental Affairs on or before November 30, 2018 (date)

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA", M.G.L. c. 30, s.s. 61-621). Copies of the ENF may be obtained from:
Bohler Engineering, Attn: Michael J. Dryden
352 Turnpike Road
Southborough MA 01772
(508) 480-9900: mdryden@bohlereng.com
(Name, address, phone number of proponent or proponent’s agent)

Copies of the ENF are also being sent to the Conservation Commission and Planning Board of Shrewsbury, (Municipality) where they may be inspected.

The Secretary of Energy & Environmental Affairs will publish notice of the ENF in the Environmental Monitor, will receive public comments on the project for 20 days, and will then decide, within ten days, if an environmental Impact Report is needed. A site visit and consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit or consultation session, should write to the Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Attention: MEPA Office, referencing the above project.

By Town of Shrewsbury (Proponent)
CIRCULATION LIST

SECRETARY MATTHEW A. BEATON
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
ATTENTION: MEPA OFFICE
100 CAMBRIDGE STREET, SUITE 900 (9TH FLOOR)
BOSTON, MA 02114

DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMISSIONER’S OFFICE
ATTENTION: MEPA COORDINATOR
ONE WINTER STREET
BOSTON, MA 02108

DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTRAL REGIONAL OFFICE
ATTENTION: MEPA COORDINATOR
8 NEW BOND STREET
WORCESTER, MA 01608

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
ATTENTION: MEPA COORDINATOR
250 WASHINGTON STREET
BOSTON, MA 02108

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PUBLIC/PRIVATE DEVELOPMENT UNIT
TEN PARK PLAZA #4150
BOSTON, MA 02116

MASSDOT HIGHWAY DEPARTMENT – DISTRICT 3
ATTENTION: MEPA COORDINATOR
403 BELMONT STREET
WORCESTER, MA 01604

MASSACHUSETTS HISTORICAL COMMISSION
THE MA ARCHIVES BUILDING
220 MORRISSEY BOULEVARD
BOSTON, MA 02125

ENERGY FACILITIES SITING BOARD
ATTENTION: MEPA COORDINATOR
ONE SOUTH STATION
BOSTON, MA 02110
MASSACHUSETTS DIVISION OF ENERGY RESOURCES
ATTENTION: MEPA COORDINATOR
100 CAMBRIDGE STREET, SUITE 1020 (10TH FLOOR)
BOSTON, MA 02114

CENTRAL MASS REGIONAL PLANNING COMMISSION
2 WASHINGTON SQUARE
UNION STATION – 2ND FLOOR
WORCESTER, MA 01604

SHREWSBURY BOARD OF SELECTMAN
100 MAPLE AVENUE
SHREWSBURY, MA 01545

SHREWSBURY PLANNING BOARD
100 MAPLE AVENUE
SHREWSBURY, MA 01545

SHREWSBURY CONSERVATION COMMISSION
100 MAPLE AVENUE
SHREWSBURY, MA 01545

SHREWSBURY BOARD OF HEALTH
100 MAPLE AVENUE
SHREWSBURY, MA 01545

SHREWSBURY PUBLIC LIBRARY
609 MAIN STREET
SHREWSBURY, MA 01545